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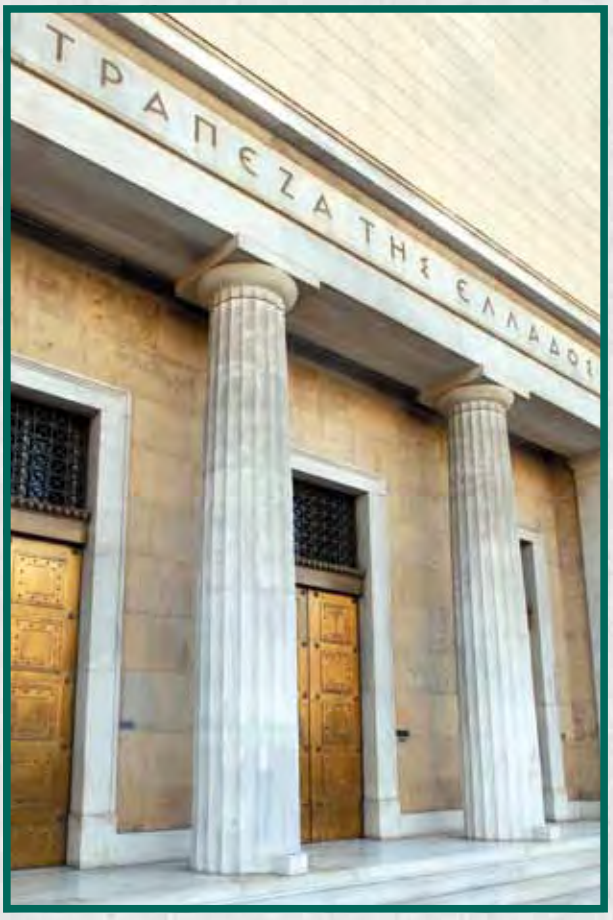

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CONTENTS

NUMERICAL FISCAL RULES IN PRACTICE*

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The international financial crisis caused a serious deterioration in the fiscal position of almost all advanced economies and a debt crisis in "peripheral" countries of the euro area. In an effort to support their financial systems, developed countries took up hefty liabilities, which led to a large increase in annual deficits and the fast accumulation of debt to unprecedented levels in periods of peace. The fiscal position of several developed countries both inside and outside the European Union remains precarious, and achieving a sound and sustainable fiscal position is a crucial challenge facing the countries in question. Against this background, there has been a renewed focus on strengthening the institutional framework of budgetary policy and adopting numerical fiscal rules for the governance of public finances.[1]

Obviously, the Greek sovereign debt crisis did not result from the credit support measures; rather, it was caused by the re-evaluation of credit risk by markets following the global financial crisis, combined with Greece's chronic fiscal imbalances, which in the past three decades led to the accumulation of very high government debt. Imbalances resulted, among other things, from the complete lack of even a rudimentary budgetary framework, which would ensure fiscal sustainability in Greece.[2]

According to a survey by the International Monetary Fund (IMF), in 1990 fiscal rules were used in only seven countries. In 2009, 80 countries had fiscal rules in place, either national or supranational, including EU Member States (i.e. 77 out of 80 countries had national fiscal rules). According to the survey, there is a clear upward trend in the use of numerical fiscal rules and the establishment of independent bodies responsible for assessing the preparation and execution of budgets, as well as the overall fiscal policy.[3]

Since the 1990s, the Bank of Greece has repeatedly recommended[4] the introduction of national fiscal rules,[5] the establishment of an independent authority to review the government budget and the fiscal policy pursued, as well as the adoption of budgeting methods, procedures and practices that help contain public spending and ensure fiscal sustainability. Today more than ever, it is imperative to adopt such measures aimed at strengthening the institutional fiscal framework.[6] The introduction of national fiscal rules and other measures in Greece should boost fiscal discipline and deficit reduction and could help the country regain its

* The views expressed in this article do not necessarily reflect those of the Bank of Greece. The author would like to thank the Legal Department of the Bank of Greece for the information provided about constitutional provisions in European Union countries, as well as Heather Gibson for her constructive comments. The author assumes full responsibility for any errors or omissions.

1 For example, the OECD's recent country surveys (OECD, *Economic Surveys:* Germany 2010, Finland 2010, Norway 2010, Czech Republic 2010, Austria 2010, etc.), as well as Economic Outlook reports, (OECD, 2010, pp. 256-260), present and analyse numerical fiscal rules and other institutions (e.g. independent "fiscal councils") applied in many countries. The International Monetary Fund has also shown renewed interest on the subject. See e.g. Cottarelli *et al.* (2009); and Garcia *et al.* (2011). Lastly, the proposals of the European Commission and the Van Rompuy Task Force require "[...] *a commitment on the part of the euro area countries to swiftly enhance their national budgetary frameworks*". See the article entitled "The reform of economic governance in the euro area – essential elements", ECB, *Monthly Bulletin,* March 2011.

2 According to a relevant European Commission survey, Greece is one of the three European Union countries that had not established a national numerical fiscal rule up until 2010. Law 3871/2010 provides for the introduction of numerical limits for spending, but the relevant provision has not been put into effect yet. Moreover, in Greece there is no independent body to assess the budget, nor are there any practices and procedures to govern budgeting, in order to contain spending. See European Commission (2009), p. 88. See also Bank of Greece (2007), pp. 213-216.

3 Cottarelli et al. (2009), pp. 7-14.

4 In the past few years, the Bank of Greece has repeatedly underlined the need to adopt such rules in Greece. See (i) *Annual Report 1999*, p. 31; (ii) *Annual Report 2001*, pp. 52-53; (iii) *Annual Report 2003*, pp. 70-71, for a detailed discussion on numerical fiscal rules and certain preconditions in order to contain expenditure and fiscal deficits; (iv) *Annual Report 2004*, p. 65; (v) *Annual Report 2006*, pp. 213-216; (vi) *Monetary Policy – Interim Report 2008*, p. 19; (vii) *Monetary Policy 2008-2009*; (vii) *Monetary Policy 2009-2010*; and (viii) *Monetary Policy 2010-2011.*

5 I.e. fiscal rules that will complement and reinforce the respective provisions of the Maastricht Treaty on deficit and debt. According to a recent European Commission document, "... effective application of the EMU budgetary framework can not be expected to derive only from provisions laid down at EU level". See European Commission, ECFIN – C4/ 28 October 2010, p. 2.

6 See e.g. Rapanos and Kaplanoglou (2010), pp. 17.

credibility, which is now standing at very low levels. In any case, the new "Euro Plus Pact" provides for more stringent fiscal rules.

I RULES ON GOVERNMENT EXPENDITURE

For various reasons, any fiscal adjustment effort in Greece should begin with and focus on containing primary expenditure. First, both international and Greek experience[7] has shown that fiscal consolidation can only be sustainable when it focuses on rationalising primary expenditure, while a fiscal adjustment that relies on higher taxes or lower interest payments can easily be reversed. This is consistent with a recent OECD survey, which suggests that spending restraint, notably with respect to government consumption and transfers, is more likely to generate lasting fiscal consolidation and better economic performance.[8]

Second, with particular regard to Greece, the past four decades saw a failure to contain primary expenditure. Even during the major fiscal adjustment of 1994-1999, primary expenditure continued to rise.[9] As far as the current adjustment effort is concerned, 2010 was the only year in which ordinary budget primary expenditure fell by 10.9%, compared with one year earlier, and for 2011 an increase of 1.9% is projected in the budget.

Third, given the fierce tax competition within the European Union, a country like Greece, which has low competitiveness, has limited scope for continuous increases in the tax burden. Besides, the tax measures taken over the past twelve months seem to have left little room for further tax increases. Obviously, every possible effort must be made to curb tax evasion and collect tax arrears. This is necessary not only for reducing the deficits, but also for restoring tax fairness.

Fourth, tax revenue is much more sensitive to cyclical developments than expenditure. Therefore, maintaining a stable fiscal position (e.g. close to balance) would require frequent changes to tax rates and/or tax bases, which however is not practical. Instead, changes to expenditure are easier in practice. As noted by the OECD, expenditure rules are less affected by the economic cycle.[10]

Fifth, a stable tax environment has been shown to minimise distortions and other adverse effects of taxes on the economy, particularly on economic growth.[11]

Lastly, political authorities across the world are under constant pressure by various interest groups to increase certain expenditure categories. Rules limiting a priori the possibility of increases in primary spending make it difficult to accommodate such requests, possibly even discouraging their submission.

Therefore, it is proposed to establish by law a binding ceiling on primary expenditure. In order to be effective, this ceiling should apply to almost all general government primary expenditure and must have been set *well in advance of the annual budget process*. It should impose a constraint on total primary expenditure, rather than respective limits on individual expenditure categories (such limits can be determined at a much later stage). This constraint should be of a "macroeconomic nature", applying to total expenditure and not determining individual spending categories or the budget structure. An expenditure ceiling put in place long before the start of the annual budget process and of the relevant negotiations between the Ministry of Finance and the other ministries *would define a priori the context in which the budget will be formulated and should stabilise expectations*.

Similar fiscal rules (ceilings) on government expenditure are already in place in several countries. In Sweden, an expenditure ceiling

7 The large fiscal adjustment (deficit was reduced by more than 10 percentage points of GDP) in 1994-1999 was based on higher revenue and lower interest payments, while primary expenditure continued to rise. This is why the progress achieved until 2000 was reversed afterwards. See Manessiotis and Reischauer (2001), p. 142.
8 Guichard et al. (2007), p. 7.
9 See footnote 7 above.
10 OECD (2010), p. 258.
11 Kopits (2001).

was introduced in 1997 and has ever since been a key aspect of the country's institutional fiscal framework. It is estimated to have been a very effective tool for stabilising the public finances.[12] Additionally, the medium-term character of the expenditure ceiling has helped establish a longer-term approach to public finances and brought about a better understanding of their dynamics.

Sweden's primary expenditure ceiling is set three years ahead for fiscal year t+3 (on a rolling basis). Thus, the expenditure ceiling for 2013 was set in 2010 (the ceiling for 2012 had been set in 2009, etc.). Finland and the Netherlands define four-year expenditure ceilings corresponding to the term of the government. Thus, each new government defines (at the beginning of its term) the expenditure ceiling to apply during its four years in office.

The case of Sweden is more relevant to Greece, as it implies lower forecasting uncertainty (with a horizon of three years instead of four years) and, more importantly, because *the ceiling is not necessarily set by the government that will be expected to comply with it.*

Which categories of expenditure should be included in the ceiling?

An effective expenditure ceiling has to be comprehensive, i.e. it must cover all primary expenditure of general government, without exceptions: the more expenditure categories it includes, the harder it is to circumvent.[13] Only interest expenditure may be exempted, as it is not subject to the discretion of the government. Therefore, almost all countries exclude interest payments from the ceiling.[14] By contrast, other expenditure (which is often considered "inelastic" in Greece) should not be excluded. The inelasticity of expenditure (other than interest payments) depends on the time horizon. In the medium term, almost all expenditure can be contained.

The only controversial category of primary expenditure refers to cyclically sensitive items, such as unemployment benefits (which are, however, less volatile in Greece than in other countries). Both the inclusion and exemption of these items have pros and cons. Since there is a broad consensus in the literature that there should be no constraints on the operation of automatic stabilisers, expenditure (e.g. for unemployment benefits) can be expected to fluctuate significantly in response to the economic cycle. *The question is thus essentially the choice between a countercyclical fiscal policy (involving higher expenditure) and long-term fiscal sustainability.*

Lastly, the ceiling should somehow take into consideration the impact of inflation on government expenditure. An appropriate adjustment mechanism should take into account the nature, level and volatility of inflation. In the Netherlands and Finland, the four-year ceilings on primary expenditure are determined (at the beginning of the period) in real terms, and converted into nominal terms each year, depending on inflation forecasts. By contrast, in Sweden, the three-year ceilings are set in nominal terms.[15]

Establishing a ceiling in practice[16]

A realistic expenditure ceiling must take into consideration the prevailing fiscal and macroeconomic conditions and prospects, as well as the fiscal targets sought to be achieved. Namely, a clear relationship should be established between primary expenditure under the ceiling, revenue, and the targeted deficit or debt.

An expenditure ceiling Δ_{t+n} for the year $t+n$, consistent with a forecast for revenue E_{t+n} for the same year and a targeted fiscal balance (or a change in debt) D_{t+n} for the year $t+n$ is expressed:

12 According to an IMF study, the adoption of numerical fiscal rules by Sweden and Finland was the main element behind the fiscal adjustment efforts following the fiscal and banking crisis (in these two countries) at the beginning of the 1990s. See Cottarelli et al. (2009), p. 17.
13 OECD (2010), p. 258. Even the so called "tax expenditure" should be included under the expenditure ceiling.
14 Ljungman (2008), p. 7.
15 Ljungman, ibid., pp. 13-15.
16 Ljungman, ibid., pp. 17-19.

$$\Delta_{t+n}=\Delta E_{t+n}+\Delta \Phi_{t+n}-D_{t+n}-\Delta^{\varepsilon.o.}_{t+n}$$

where $\Delta \Phi_{t+n}$ is additional revenue from future tax measures until the year $t+n$, which are not included in the revenue forecast (ΔE_{t+n}) and $\Delta^{\varepsilon.o.}_{t+n}$ is expenditure outside the ceiling ($\varepsilon.o.$) (Ljungman 2008, pp. 17-19). For instance, if interest expenditure (outside the ceiling) is €17 billion (year $t+n$), estimated revenue is €60 billion, and expected additional revenue from tax reforms is €12 billion, then in order to achieve a €2 billion surplus, the expenditure ceiling should be set at €53 billion as follows:

$$\Delta_{t+n}=60+12-2-17$$

$$\Delta_{t+n}=53 \text{ billion}$$

If the target is to achieve a budgetary position close to balance, then:

$$\Delta_{t+n}=60+12-0-17=55 \text{ billion}$$

Obviously, the more accurate the revenue forecasts, the more effective the rule.

Alternatively, the expenditure ceiling could be set in terms of a constant annual rate of change, say p. Assuming that GDP also grows at a constant rate g, then the p/g ratio will also be constant. However, expenditure as a percentage of GDP would decline continuously if p<g and would increase constantly if p>g (if p=g, then G/GDP is constant). The variable p may be adjustable and adaptable (according to the t+n rule), depending on GDP growth forecasts (g), so that expenditure as a percentage of GDP may decline (alternatively, it might be possible to use the growth rate of potential GDP). This rule has two desirable characteristics: it is very simple and it facilitates forecasting the future level of government expenditure.

2 RULES ON GOVERNMENT DEBT

Rules on government debt may take different forms, and sometimes have an indirect, albeit significant, effect on the debt-to-GDP ratio. According to the European Commission, in 2009 thirteen EU Member States had established rules on government debt, which varied considerably[17] across countries. In any case, the probability to stabilise the debt-to-GDP ratio rises when fiscal consolidation focuses on cutting government expenditure.[18]

Due to its debt problems, Greece should immediately adopt a rule to reduce[19] the debt-to-GDP ratio to sustainable levels (e.g. 50-60% of GDP), as well as a "debt brake" to contain the debt ratio at such reduced level. Furthermore, according to the "Euro Plus Pact", all countries are required to establish a national debt rule, in addition to the reference value of 60% of GDP provided for in the Maastricht Treaty. Some countries have already adopted "debt brakes".

In the case of **Poland**, a debt rule is incorporated in the national Constitution, stating that the debt-to-GDP ratio cannot exceed 60% of GDP. Moreover, when the debt ratio stands between 50% and 55%, authorities are required by law to take precautionary measures in order to reduce it. Harder efforts to reduce the debt ratio are required if debt exceeds 55% of GDP and are further intensified if debt exceeds 60% of GDP.

Hungary is preparing to adopt a debt rule, similar to that of Poland. Taking measures is imperative if debt exceeds 50% of GDP and efforts escalate as the debt-to-GDP ratio increases.

As regards **Switzerland**,[20] although the relevant constitutional reform aims at containing the debt-to-GDP ratio, the debt rule is indirect and essentially comprises an expenditure ceiling and provides for cyclically adjusted balanced budgets. In particular, the rule specifies a one-year-ahead *ex ante* ceiling on expenditure equal to forecast revenues (net of one-off

17 European Commission (2006), pp. 184-188.
18 Guichard et al. (2007), pp. 15-16.
19 Recently Greece committed to reduce its debt by 1/20 each year.
20 Cottarelli et al. (2009), p. 39.

items), adjusted by a factor[21] reflecting the cyclical position of the economy. In essence, this helps establish an expenditure ceiling which is in line with a balanced budget in cyclically adjusted terms. If *ex post* results (after calculating real GDP) show that actual expenditure deviates from budgeted expenditure (due to poor GDP projections), the expenditure overrun is recorded in a "notional account". If the negative balance on this account approaches 6% of expenditure, authorities are required by law to take measures to reduce the balance within three years. This rule helped stabilise the debt ratio until the beginning of the current crisis.

The German debt rule, which is also embedded in the Constitution, is explicit at first glance, as it sets an annual borrowing limit of 0.35% of GDP. In essence, though, it is indirect and quite similar to that of Switzerland. Specifically, the structural deficit of the German federal budget cannot exceed 0.35% of GDP, while the individual federal states need to balance their cyclically adjusted budgets.[22] If the structural deficit *ex post* exceeds 0.35% of GDP, the additional amount is stored in a "notional account". If the balance of this account exceeds 1.5% of GDP, then, in accordance with the Constitution, the government is required to take fiscal consolidation measures. It should be noted that the relevant ordinary law, which specifies further details, is more stringent than the constitutional provisions, as it envisages the adoption of measures if the balance exceeds 1.0% of GDP[23] (rather than 1.5% provided for in the Constitution).

In the United States, the Congress determines, in absolute terms, a ceiling on borrowing by the federal government, currently set at $14,300 billion.[24] Recently, as the federal debt came close to the legal limit, the White House is seeking to raise that limit. However, numerous Senators and Representatives have submitted proposals that any further increase in the debt ceiling should be accompanied by significant cuts in government expenditure.

The main difference between debt rules of Poland and Hungary, on the one hand, and Switzerland and Germany, on the other, is that the latter take explicitly into account the cyclical position of the economy, thus not hindering the operation of automatic stabilisers. This is so because the limit applies to the structural component of the deficit, rather than its cyclical component.

3 CONCLUSIONS

1. In the past twenty years, the number of countries applying (national) numerical fiscal rules in order to ensure fiscal sustainability increased sharply to 80, according to the IMF, while the number of rules per country also increased from 1.5 to 2.5 rules on average.

2. Despite its serious structural fiscal problems, Greece has not yet adopted any national numerical fiscal rules (other than the supranational rules provided for in the Stability and Growth Pact, which, however, failed to avert the sovereign debt crisis). It is true that Law 3871, which was passed in the summer of 2010, envisages the adoption of a national numerical rule for expenditure. However, this provision was not implemented in the 2011 budget, and it is unclear when it will be. Moreover, given that the ceiling on expenditure growth is to be determined by the Minister of Finance, this may not be the best solution for Greece, although judgment should be reserved until this rule is implemented in practice.

3. In the context of creating an appropriate fiscal institutional framework to ensure the sustainability of public finances in Greece, this analysis underlines the need to adopt numerical rules for primary expenditure and government debt. Even if these rules come into effect at a later time, when the sovereign

21 The cyclical factor is determined as the ratio of trend real GDP to expected real GDP.
22 Cottarelli et al. (2009), p. 40.
23 Ibid., p. 40.
24 *Financial Times*, 4 February 2011, p. 5.

debt crisis is over, it is advisable to legislate them now. The debt rule in Germany will not come into full effect before 2016; nevertheless it was enshrined in the country's constitution in 2009.

4. These rules could deal with the main problems facing public finances in Greece in the past four decades, namely the continuous increase in primary expenditure (and successive overruns in budgeted expenditure) and the failure to reduce the debt-to-GDP ratio. Even when conditions were particularly favourable for reducing the debt-to-GDP ratio (low interest rates, strong GDP growth, primary surpluses or low primary deficits, and privatisation proceeds), Greece only managed to stabilise the debt ratio, albeit at very high levels.

5. Finally, it should be noted that fiscal rules limit unexpected increases in deficits (due to expenditure overruns) and ensure a stable tax environment, which contributes to strong economic growth in the long run.

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TAX EVASION IN GREECE: AN OVERVIEW*

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Tax evasion is one of the key challenges facing the Greek authorities in their efforts to achieve fiscal consolidation. While its negative impact on government revenue is well-understood by the public at large, its other economic implications and social repercussions are less clear. This paper summarises the reasons that make tax evasion a major social problem and describes issues related to its definition and measurement. It then goes on to analyse the recently released 2009 dataset of tax returns[1] as further evidence of the size and incidence of tax evasion in Greece. The paper concludes with some policy recommendations that are likely to improve the efficiency of tax imposition and collection.

The implications of tax evasion

Tax evasion is a complex phenomenon and is structural in nature, as it reduces the efficiency of the economy and increases social inequality,[2] by distorting the allocation and redistribution of resources both in the short and in the long run. In greater detail, taxation and, by extension, tax evasion affect disposable personal income, thus also affecting, over a longer horizon, the structure of the economy, including labour supply and demand decisions across occupations and sectors, the intetemporal allocation of income between consumption and saving, prices, import volumes and growth, income outflows, etc. At the same time, tax evasion hampers the redistributive role of progressive taxation, thereby increasing the tax burden on honest taxpayers and compromising the equal treatment of similar incomes. Moreover, to the extent that it deprives the public sector of funds that could have been used to finance government expenditure, it drives up government borrowing requirements, limits the scope for public investment, reduces the quality and quantity of publicly provided goods, and hampers the functioning of a welfare state. In the light of the above, it becomes clear that the cost of individual tax evasion is both directly and indirectly diffused across society, to the detriment of those who regularly fulfil their tax obligations.

The definition and measurement of tax evasion

The definition and measurement of tax evasion are subject to theoretical and practical constraints, originating in the complexity of the economy, the tax framework and the tax collection mechanism. In market analyses, as well as in articles appearing in the press, the concept of "tax evasion" is very often confused with that of the "informal economy", which can be misleading.[3] It is important to stress that these two concepts do not necessarily coincide (see Chart 1), although tax evasion does relate in part to the informal economy (defined as the economic activity that is not recorded in the national accounts, although it should be). Tax evasion may occur in the context of any type of economic activity, whether recorded or unrecorded, current or non-current (such as in the case of the real estate transfer tax and the capital transfer tax).[4] Generally, tax evasion can be defined as the illegal practice of wilfully concealing income and other taxable items and of avoiding paying tax (VAT, other withholding taxes, duties, levies, contributions, etc). The complexity of the phenomenon is clearly demonstrated by its many different manifestations – involving direct or indirect taxes, legal or natural persons, any taxation scheme (tax brackets, separate taxation, imputed taxation), type of tax and occupational group (wage/salary earners, professionals, traders, manufacturers,

* The views expressed in the paper are those of the author and do not necessarily reflect those of the Bank of Greece. Acknowledgments to Vasilios Manesiotis, Maria Flevotomou, Heather Gibson and Helen Koltsida for their valuable comments.

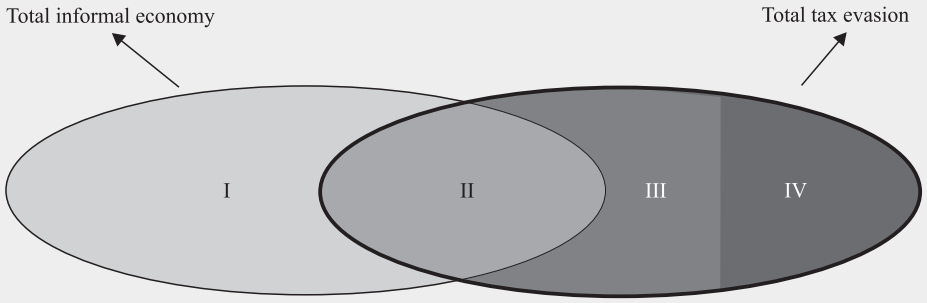
1 Available at: http://www.gsis.gr/statistiko_deltio/statistiko deltio_2009/statdeltio2009.html.

2 See Matsaganis and Flevotomou (2010).

3 Also, "tax evasion" should not be confused with "tax avoidance", which is not against the law.

4 See Manesiotis (1990) for a detailed discussion of the relationship between tax evasion and the informal economy.

Chart 1 Tax evasion and the informal economy



I: Area I represents cases where economic activity is not recorded, but the corresponding incomes/indirect taxes are reported/paid to the Public Revenue Service. Informal economy (+)/tax evasion (-).
II: Area II represents cases where economic activity is not recorded and the corresponding incomes/indirect taxes are not reported/paid to the Public Revenue Service. Informal economy (+)/tax evasion (+).
III: Area III represents cases where value added is recorded in the national accounts, but the corresponding incomes/indirect taxes are not reported/paid to the Public Revenue Service. Examples include agricultural production, construction activity, etc. Tax evasion (+)/Informal economy (-).
IV: Area IV represents tax evasion not related to current economic activity. Examples include evasion of transfer payment, inheritance, donation and parental gift taxes and road duties. Tax evasion (+)/Informal Economy (-).

Source: Kalivianakis et al. (1993).

etc.). Therefore, measuring tax evasion is a daunting task and is often subject to *a priori* assumptions.

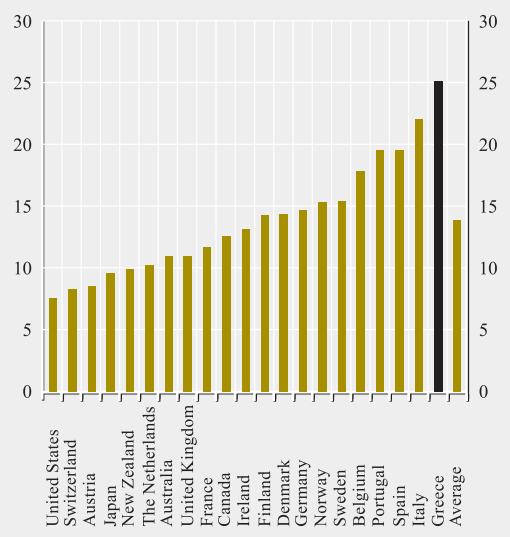
Given the link between tax evasion and the informal economy, a considerable body of papers have focused in the past decades on the study of the phenomenon of informal economy. In Greece, informal economy has been estimated to average, over time and across studies, 30% of GDP.[5] Compared with other OECD countries, it is estimated that the country has one of the highest shares of informal economy in recent years, possibly translating into greater tax evasion (see Chart 2).[6] Part of the problem is undeclared work, which is thought to be quite substantial (around 25% of all controlled employees),[7] reflecting, among other things, a bilateral arrangement between employer and employee not to declare employment so that both can avoid costly social security contributions.[8]

The size of tax evasion in Greece had been formerly estimated at around 4% of GDP.[9] This figure had been produced using different methodologies for direct taxes (a Cobb-Douglas type revenue function) and indirect taxes due to large differences between the two categories, and had also taken account of tax evasion related to the informal sector. A more recent study of personal income tax estimated income underreporting for the entire taxpayer population at 10%, resulting in revenue losses of 26% (because of progressive taxation).[10] According to the same study, tax evasion tended to be higher among: (i) the self-employed (professionals,[11] farmers), with a weighted average income underreporting of around 33%, implying a U-shaped distribution;

5 See Pavlopoulos (1987), Vavouras et al. (1990), Negreponti-Delivani (1991), Kanellopoulos et al. (1995), Tatsos (2001), Ernste and Schneider (1998), Schneider and Klinglmair (2004) and European Commission (2009).
6 See Schneider et al. (2010). Also see the updated tables for the period 1989-2009 available at: http://www.econ.jku.at/members/Schneider/files/publications/ShadowEconomy21OECD_2009.pdf.
7 See the Labour Inspectorate press release "SEPE-EYPEA activity statistics 2010: undeclared work" (January 2011) – in Greek. Also see European Commission (2009) for indirect measurement methods for undeclared work.
8 Other factors related to undeclared work include existence of a minimum wage, employment of underage individuals and employment of foreigners, etc.
9 See Kalivianakis et al. (1993).
10 See footnote 2.
11 In this paper, the term "professionals" refers to persons whose main source of income is independent professional activities, trading, manufacturing activities and construction.

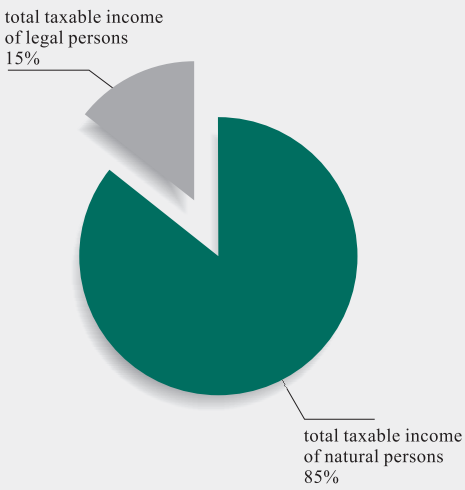
Chart 2 Size of the shadow economy in 21 OECD countries in 2009

(percentage of GDP)



Source: Provisional estimates by Professor F. Schneider, University of Linz, April 2009. Available at: http://www.econ.jku.at/members/Schneider/files/publications/ShadowEconomy 21OECD_2009.pdf.

Chart 3 Total taxable income



Source: Bank of Greece calculations based on data published in the Ministry of Finance Bulletin "Tax Statistics 2009".

(ii) the top- and low-income groups; and (iii) in rural areas relative to urban areas. The methodology used compared income reported on individual tax returns with income reported in the Household Budget Survey. Subsequently, a tax-benefit model was used to estimate the size and distribution of undeclared income.[12]

Tax statistics 2009

The analysis of tax information —mainly personal income tax data— can also provide evidence of the size of tax evasion. The bulletin "Tax Statistics 2009", published in December 2010 by the General Secretariat of Information Systems of the Ministry of Finance, includes, in addition to personal income tax data, information and data on income (profit) tax on legal persons,[13] VAT data, as well as data on fines and capital taxes (inheritance, donation and parental gift taxes, and capital transfer or capital accumulation taxes).

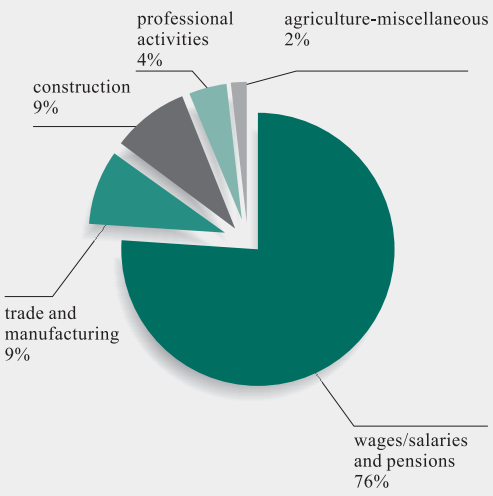
According to these data, the total income earned in 2008 was €115.1 billion. Of this amount, €98.4 billion (or 85%) represented the taxable income of natural persons and the remaining €16.7 billion (or 15%) the taxable income of legal persons (see Chart 3). The declared income[14] of natural persons was €98.1 billion. The distribution of declared personal income by source of income shows that the overwhelming proportion of this amount (76%) was accounted for by income from wages/salaries and pensions. The other

12 Tax-benefit microsimulation models evaluate the fiscal and redistributive impact of public policy by calculating benefit entitlements and tax liabilities for a representative sample of a country's population. The model used in the study in question was the EUROMOD model of cross-national microsimulation (see http://www.iser.essex.ac.uk/research/euromod).

13 "Legal persons" include mainly sociétés anonymes, limited liability companies, general partnerships, limited partnerships and joint ventures. By contrast, "sole proprietors" are natural persons.

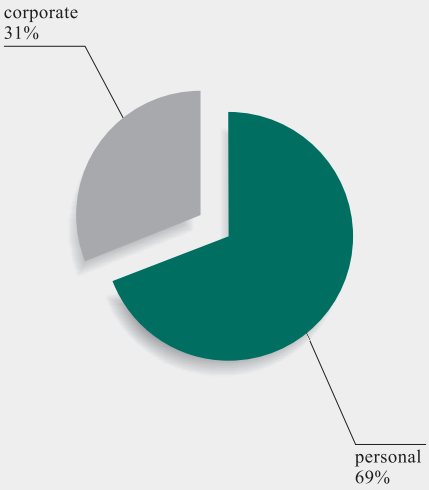
14 "Declared income" (in relation to natural persons): a taxpayer's income as reported to the tax authorities. This typically coincides with "gross taxable income" (which represents the amount of "potentially taxable" income). If, however, it is lower by at least 20% than income imputed on the basis of living expenditure and asset acquisition expenditure, such imputed income is used instead in the computation of taxable income. "(Net) taxable income" is the amount of income minus tax exemptions and deductions. For instance, donations, life insurance premiums, interest payments, family expenditure with supporting receipts and mandatory social security contributions are all fully or partially deductible from gross taxable income. The result is used to calculate the tax due, net of the amounts specified in the provisions in force in connection with any tax credit (medical expenses, principal residence rent payments, tuition fees, alimony payments, etc.).

Chart 4 Declared personal income by source of income



Source: Bank of Greece calculations based on data published in the Ministry of Finance Bulletin "Tax Statistics 2009".

Chart 5 Total tax burden



Source: Bank of Greece calculations based on data published in the Ministry of Finance Bulletin "Tax Statistics 2009".

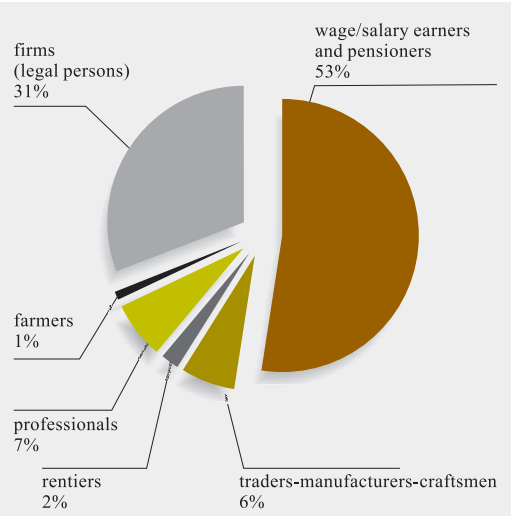
sources of income made a far lesser contribution to total declared income: trade-manufacturing (9%); construction (9%); professional activities (4%); agriculture, securities and income from abroad (2%) – see Chart 4. The observation that income from wages and salaries accounted for the bulk of declared income in 2009 was found to also hold true at the level of individual regions and prefectures.

The total tax burden on legal and natural persons was €13.1 billion in 2009. Of this amount, €9.1 billion (or 69%) was related to personal income tax, while the remaining €4 billion (or 31%) was accounted for by corporate income tax (see Chart 5). Looking at the total tax burden by "occupational status" of the tax liable person —or by "occupational group", as is the term used in the mentioned bulletin— 52.59% of the total (personal and corporate) tax burden was incurred by wage/salary earners and pensioners, with only 16.62% being borne by the rest of taxpayers. This latter figure can be roughly broken down as follows: professionals (6.81%); traders-manufacturers-craftsmen (6.32%); rentiers (2.33%); and farmers (1.16%) – see Chart 6.[15] Legal persons bore the remaining 30.79% of the total tax burden, a 4 percentage point decrease from 2008. In short, half the total tax burden in Greece was borne by wage/salary earners and pensioners, while much smaller shares were observed for the other occupational groups and for legal persons. Removing legal persons from the calculation of total tax so that it only reflects the burden on natural persons increases the relative tax burden borne by wage/salary earners and pensioners in 2009 to 76%, roughly the level it stood in 2008.

The breakdown by *taxable income bracket of individual taxpayers* provides further evidence of the size and incidence of tax evasion – here the classification per occupational status is done per person, not per tax return, in which case the main source of income of the tax liable person would play the most important role.

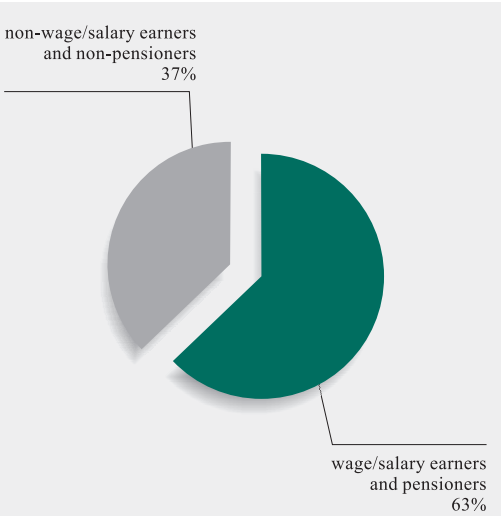
15 The weights used in the calculation of these percentages were the share of each occupational group in total tax, as derived from the income tax returns of the tax liable persons, and of their children and spouses. Given that classification of tax returns by occupational group is based on the occupational status of the tax liable person, rather than on the individual occupational status of the taxpayer, these percentages may only be considered as proxies. Tax brackets and other criteria are in practice applied at the individual level depending on the occupational status of each taxpayer.

Chart 6 Distribution of total tax burden



Source: Bank of Greece calculations based on data published in the Ministry of Finance Bulletin "Tax Statistics 2009".

Chart 7 Taxpayers by main income source



Source: Bank of Greece calculations based on data published in the Ministry of Finance Bulletin "Tax Statistics 2009".

According to this breakdown, from a total of 8 million taxpayers, 5 million (or 63%) were taxed as "wage/salary earners and pensioners", and the remaining 3 million (or 37%) were taxed as "non-wage/salary earners and non-pensioners" (see Chart 7). The average annual income declared by wage/salary earners and pensioners was €14,913, more than double the income declared by non-wage/salary earners and non-pensioners (€6,354 million). From a total of 5 million of wage/salary earners and pensioners, 2.8 million (or 53%) reported a personal income below the tax-free threshold of €12,000, while 0.2% reported zero income (see Chart 8). From a total of 3 million of non-wage/salary earners and non-pensioners, 2.5 million (or 83%) reported a personal income of less than €10,000, and 47% zero income. The tax-free threshold for non-wage/salary earners in 2009 was €10,500. Hence, 64% of all taxpayers declared an income below the applicable tax-free threshold, and 17% zero income. Also, some 85% of taxpayers reported an income below the per capita GDP of Greece (2008: €21,000). It should be noted that these figures had increased compared with the previous year. A personal annual income of more than €900,000 was reported by a mere 33 people in the category "wage/salary earners", plus another 27 in the remaining categories, while a personal annual income of more than €100,000 was reported by 18,942 persons (0.23%) out of a total number of 8,342,160 tax filers.

Even when taking into consideration the factors that could potentially justify low incomes, it is still difficult to explain on the basis of the Greek economic reality how 8 in 10 non-wage/salary earners can have a "real" income of less than €10,000 per year and how 3 in 5 taxpayers pay no tax at all.[16]

Turning to *legal persons*, from a total of 221,363 firms filing a tax return in 2009, 97,037 (or 44%) reported zero profits, while the vast majority (209,311 firms, or 95%) reported tax-

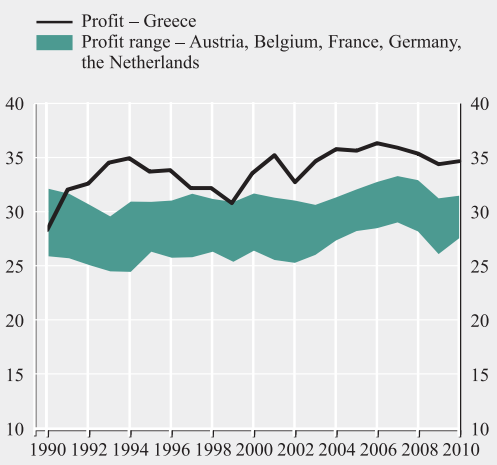
16 A recent study by the Centre of Planning and Economic Research, in which tax-income elasticities are estimated, found that generally high-income taxpayers tend to hide incomes, irrespective of the occupational group they belong to. It is the self-employed, however, who have the greatest flexibility in their reporting decisions as they can easily alter their work schedules or remuneration arrangements, shifting even to the underground economy. See Kaditi and Nitsi (2011).

Chart 8 Proportion of taxpayers who are below the tax-free threshold or declare zero income

Source: Bank of Greece calculations based on data published in the Ministry of Finance Bulletin "Tax Statistics 2009".

Chart 9 Firms' profits

(as a percentage of GDP)



Source: IMF (2010).

able profits of less than €120,000. Total profits declared in 2009 declined by 14% year-on-year to €16.7 billion, translating into a reduction in the share of firms in the distribution of tax burdens. Taxable profits per firm averaged €75,485, against €90,895 a year earlier. Despite a downward trend between 2006 and 2009, the ratio of corporate profits-to-GDP remained significantly higher in Greece compared with other euro area countries, including Austria, Belgium, Germany, France and the Netherlands (see Chart 9).[17]

Moreover, the tax statistics for 2009 demonstrate a number of serious weaknesses inherent in both direct and indirect tax collection. Previous years' VAT was assessed at €7 billion (first-time assessments plus assessments of unaudited tax cases), of which only €558 million (or 8%) was collected. Likewise, of the €1 billion in assessed fines in 2009, only €26 million (or 3%) was collected. In several cases, failure to collect the assessed taxes or fines is due to a backlog of tax cases pending in courts. Cases such as these are typically complex and time-consuming. Revenue from taxes on inheritance, donations and parental gifts amounted to €606 million, of which only around 45% was collected, whereas €609 million in revenue from capital transfer and capital accumulation taxes was collected almost in full.

Policy recommendations

These statistical data, along with available empirical estimates of tax evasion and the informal economy, indicate that tax evasion is indeed a real, chronic and extensive problem in Greece, as repeatedly suggested by various national and international organisations. The complexity of the country's tax system and the

17 See International Monetary Fund (2010).

structure of the economy (featuring a relatively large number of self-employed individuals)[18] tend to increase the scope for tax evasion and the forms of commission of the offence.[19] Adding to the problem are a number of organisational and other weaknesses in tax collection and audits. For instance, according to estimates by the Ministry of Finance, Greece has the lowest tax revenue-to-GDP ratio in the EU, approximately 5 points below average, although the country's tax rates are close to or higher than (in the case of indirect taxes) the EU average rates.[20] Besides income tax evasion, evasion of other (non-income) taxes like road duties, which is significant in Greece, must also be taken into account.

In view of the above, it is reasonable to conclude that, to effectively counter the complex phenomenon of tax evasion, a broad policy package needs to be put in place. This should be organised around three main objectives: (a) simplifying tax legislation and rationalising the regulatory framework; (b) overhauling and mobilising tax administration; and (c) strengthening tax morale and incentives for compliance.[21]

(a) Simplifying tax legislation and rationalising the regulatory framework

Simplifying tax legislation to ensure a flexible and rational regulatory framework and reduce the need for explanatory circulars is a key precondition for the effective design and implementation of tax policy. For one, taxes having low yields and high costs (assessment costs, collection costs, etc.) should be reviewed, as was the case of some 1,600 previously existing taxes collected on behalf of third parties, whose administrative costs were disproportionately high (around 40%) compared with expected yields.[22] At the same time, it is equally important that the 980 tax exemptions currently in force, as well as the taxable income determination methodology, are reviewed. For instance, income averaging and taxation under the tax bracket system could be considered for professionals in art, entertainment, sports, stock brokerage, etc. who are currently taxed under special regimes as they present large variations in annual income.

The existence of a plethora of tax systems and the constant revision of related legislation can *de facto* cause confusion, increasing the scope for exceptions, special provisions, irregularities and omissions in the implementation of tax policy. Moreover, lack of communication between tax and judicial authorities, extremely time-consuming tax dispute resolution procedures (typically lasting up to 10 years) and mild penalties —often easily convertible into fines— have all been identified to act as disincentives for tax compliance, and thus to exacerbate the problem of moral hazard in taxpayer behaviour. Therefore, strengthening the penal component of the dispute resolution process by speeding up the administration of tax justice and imposing heavier and promptly enforceable criminal penalties has to be a priority of any strategy aiming to combat tax evasion.

(b) Overhauling and mobilising tax administration

Moreover, a key pillar of the fight against tax evasion is the overhaul and mobilisation of tax administration, including at auditing and collection level. For audits to be effective, the first requirement is that it must be possible to cross-check and monitor information over time through a centralised integrated information system. One such electronic platform is the Integrated Information System of Controlling Services (ELENXIS) of the Ministry of Finance. As a first step, ELENXIS allows cross-checks and

18 The European Commission (2010) estimates the share of self-employment in total employment in Greece to be almost double the EU-27 average. In 2010, this share reached 30%.
19 Examples of various methods of tax evasion can be found in Kalivianakis *et al.* (1993). Tax evasion through the use of secret offshore bank accounts or the establishment of complex corporate structures in tax havens has reportedly been significant in recent years.
20 See the speech given on 25 February 2011 by the Minister of Finance George Papakonstantinou to the Greek Parliament's Committee of Economic Affairs during the discussion of the draft law on "Combating of tax evasion, staffing of the auditing agencies, and other provisions within the competence of the Ministry of Finance".
21 For a detailed discussion of policy proposals to tackle tax evasion, see Bank of Greece, *Monetary Policy-Interim Report 2010*, special feature "Tax evasion and tax administration".
22 See Balfousias (1998).

risk-based audits of tax information. To ensure, however, a systematic electronic monitoring of the entire range of a taxpayer's assets and liabilities vis-à-vis the state, and consumer spending, it would be useful to connect various bodies and services, including Ktimatologio SA (Hellenic Cadastre), the Ministry of Transport and insurance companies, directly to the system, and strengthen cooperation with foreign authorities. This would also facilitate the introduction and widespread use of a "single personal identification number" for each citizen —to be modelled on the social security number in place in many developed countries— which in turn would allow comprehensive treatment of the tax affairs of the individual.

Second, it is crucial to eliminate tax corruption[23] and reduce personal contact between tax auditors/collectors and taxpayers. Measures likely to contribute to this effect include: (a) dismissal from service, permanent disqualification for re-employment in the broader public sector and immediate prosecution (instead of transfer to another service, as has been the case so far) of auditors/collectors who accept bribes, (b) complete separation of audit and collection services and monitoring of their activities by an independent entity, (c) cutting the number of local public revenue offices and at the same time increasing the powers of central services, and (d) full computerisation of core operations like taxpayer registration and monitoring of filing of tax returns.

Other measures that might be considered are real-time payment of VAT (i.e. as the transaction takes place) and/or payment of professionals' (doctors', lawyers', electricians', etc.) fees through a private accounting company acting as a provider of billing services and exclusively by a bank, irrespective of the amount.

(c) Strengthening tax morale and incentives for compliance

In view of the ills associated with the phenomenon of tax evasion in Greece, creating a tax consciousness has been a long-standing challenge, although not an impossible one. Besides the announcement of the anti-evasion policy and the government's commitment to strictly implement the law, transparency in the use of collected revenue and a gradual improvement of publicly provided goods will also be required to prove that such revenue is actually used in the best interests of citizens, in line with the idea of reciprocity which lies at the heart of the social contract between taxpayers and the state. Moreover, according to the prevailing strand of literature and other empirical studies, the most important determinant of tax behaviour is the probability of being detected and punished.[24] In other words, the higher the probability, in taxpayers' opinion, that tax evasion will be discovered and that penalties will be imposed promptly, the greater their compliance. Of course, this presupposes that fines and other penalties are imposed by auditors in a fair and transparent manner. Tax officers can contribute to improving taxpayers' understanding of the tax framework and the various options available, so long as such tax counselling is provided in a legal and regulated manner. This, in turn, should help strengthen voluntary tax compliance, freeing up administrative resources that could be used to target specific groups representing a high risk of tax evasion or having a history of non-compliance. Finally, given the current public feeling of extensive tax evasion and unfair taxpayer treatment, the prosecution and punishment of big tax evaders as a means of setting an example and delivering social justice should also have a significant multiplying effect.

Conclusions

This paper provides a brief overview of the problem of tax evasion in Greece, highlighting its serious fiscal, social and economic impli-

23 See Annual Report of General Inspector of Public Administration, various years – in Greek.

24 See Allingham and Sandmo (1972) and Kleven *et al.* (2010). According to the typical approach proposed by Allingham and Sandmo (op. cit.), the three key determinants of tax evasion are: the (marginal) tax rate, the probability of being detected and punished and the size of the penalty imposed.

cations. In view of the multifaceted nature of the problem and its deeper endemic causes, anti-evasion efforts must be collective, systematic and multi-sided, along the following three axes: simplifying legislation, improving tax collection and audits, and strengthening tax morale. Considerable efforts have been undertaken by the Greek authorities in recent years to establish an efficient tax framework,[25] capable of yielding the anticipated revenue and of ensuring a transparent and equitable distribution of the tax burden. However, law enforcement and effective tax collection have actually proved to be quite challenging in the face of serious institutional and organisational weaknesses and political and socioeconomic distortions. Cracking down on tax evasion will therefore require greater resolve, as well as radical changes at many levels. Moreover, it is essential that a systematic and coherent effort is made at every stage of the taxation process, from the design of tax policy and the audit of tax subjects to the imposition of criminal penalties and the creation of a sound tax consciousness.

25 See Law 3943/31.3.2011 (Government Gazette A 66) on "Combating tax evasion, staffing of the auditing agencies, and other provisions within the competence of the Ministry of Finance", Law 3888/4.10.2010 (Government Gazette A 175) on "Voluntary closure of tax disputes, settlement of overdue debts, provisions on effective punishment of tax evasion, and other provisions", and Law 3842/23.4.2010 (Government Gazette A 58) on "Restoring tax equity, addressing tax evasion, and other provisions".

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THE USEFULNESS OF STRESS TESTING EXERCISES FOR ASSESSING THE SOUNDNESS OF THE BANKING SYSTEM*

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I INTRODUCTION

The Committee of European Banking Supervisors (CEBS), which was renamed to European Banking Authority (EBA) as from 1 January 2011, was assigned by the ECOFIN Council[1] to organise and conduct in the first half of 2010 a second EU-wide stress testing exercise,[2] in close cooperation with the European Central Bank (ECB), the European Commission and the EU national supervisory authorities. The stress test was conducted on a sample of 91 banks in 20 Member States that represent 65% of the EU banking sector in terms of total assets. The sample also included six Greek banks, which account for 90% of the Greek banking system's assets. The exercise received wide publicity and was thoroughly reported in the press, while its objective was to assist market participants and competent authorities in drawing conclusions on the soundness of banks and their capacity to absorb shocks on markets, as well as to assess the overall resilience of the banking system to potential adverse changes in the economic activity.

Nevertheless, it should be noted that the Greek banking system was stress-tested for the first time in 2005, when the International Monetary Fund (IMF) developed a Financial Sector Assessment Program (FSAP), which had two main components: (i) an assessment of compliance with core principles for banking supervision, and (ii) a stress testing exercise. Although the scenarios applied in that exercise[3] could be characterised as mild compared with the subsequent financial crisis, its conclusions were rather robust, as they showed that the Greek banking system was adequately capitalised to absorb any internal or external shocks. This was also corroborated both by the EU-wide stress testing exercise conducted by the EBA and by the performance of Greek banks so far.

A similar exercise was also conducted by the US Federal Reserve,[4] with a view to assessing the soundness of the 19 largest US bank holding companies and to distributing accordingly the amounts of government financial assistance, under the Supervisory Capital Assessment Program (SCAP). The SCAP was a stress test exercise conducted by the supervisory agencies in May 2009, aiming at assessing the capital adequacy of large banks and at determining whether additional capital is required. This capital, if needed, should be raised either in the market or through the issuance of mandatory convertible preferred shares under the U.S. Treasury's Capital Assistance Program.

The objective of the present study is two-fold: first, to discuss the notion and the usefulness of stress testing exercises, and second, to analyse and compare the stress tests conducted by the Fed with the EU-wide exercise carried out by the EBA. This will contribute to the understanding of the stress tests' nature and facilitate all interested parties in following and correctly interpreting the repeated round of stress tests that the EBA is conducting.[5]

* The views expressed in this study are personal and do not necessarily reflect those of the Bank of Greece.

1 See Council of the European Union, Economic and Financial Affairs, Press release, Brussels, 2 December 2009, http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ecofin/111706.pdf.

2 The first EU-wide stress testing exercise was conducted in 2009 and its results were forwarded to the ECOFIN Council in October 2009 but were not disclosed. Conversely, the ECOFIN Council decided to disclose the results of the 2010 stress test. See http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/115346.pdf.

3 See Kalfaoglou (2006).

4 See Board of Governors of the Federal Reserve System (2009a) and (2009b).

5 See "The European Banking Authority up and running and preparing new EU-wide stress test", 13 January 2011, http://www.eba.europa.eu/News-Communications/Latest-news/The-European-Banking-Authority-up-and-running-and-.aspx and EBA, "2011 EU-Wide Stress Test: Methodological Note", 18.3.2011.

2 BANKING RISKS

Banks provide two kinds of services: brokerage and asset transformation. Brokerage services can be defined as those mechanisms set up by a bank to facilitate the execution of transactions, whereby the bank acts solely as a broker for a commission. As the bank does not assume any financial position, the risks it faces are not financial but non-financial, e.g. operational risk. The second function refers to asset transformation, which is the ability to convert (transform) the financial characteristics of assets and liabilities, such as maturity transformation, size transformation, currency transformation, liquidity transformation, etc. This means that banks are able to offer highly liquid products (e.g. sight deposits payable on demand) and to invest their reserves in less liquid investments. Similarly, they can accept deposits in a currency and invest in another. However, asset transformation results to mismatches between assets and liabilities, which generate a position that, in turn, entails the financial risks facing a bank. Thus, risk taking is intertwined with the functioning of a bank, and hence the definition of banking as the art of managing risks.

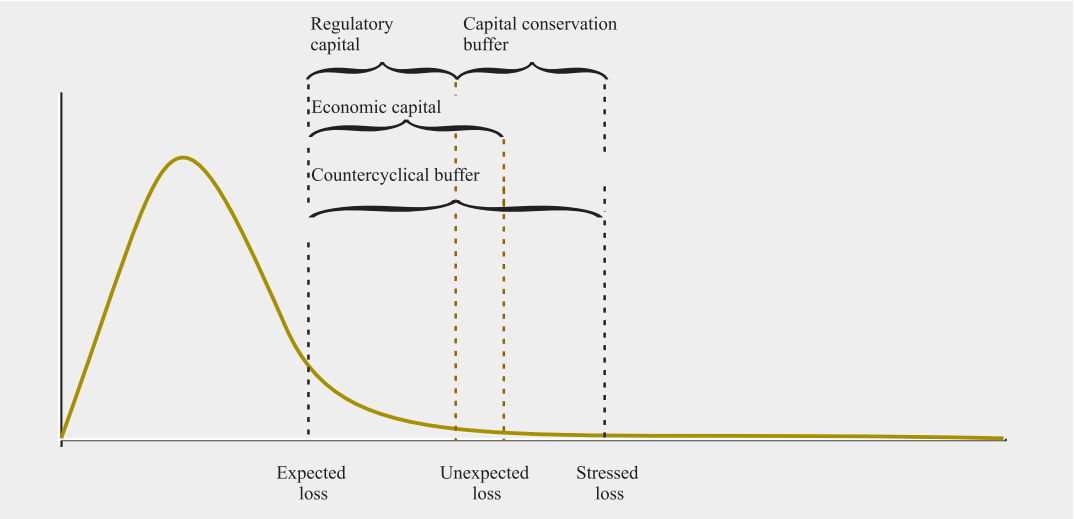
Banking risks may be categorised in several ways. In academic literature various classifications have been developed, depending on the assumptions and the objective of the study. The significance of any risk depends on the business model of the bank and the external environment in which it operates. For instance, market risk is more important for investment banks but in general has become more significant ever since banks started building considerable trading book positions. Credit risk has always been important, due to its linkage with the main function of a bank, i.e. the granting of loans, and its importance is amplified especially in times of financial distress. Operational risk was almost unknown until recently when it was found out that it lay behind the collapse of historic banks (e.g. Barings) and thus, some of its components (such as fraud risk) have gained importance amid the financial crisis. As regards liquidity risk, the pre-crisis view that ample liquidity does not entail any risks proved to be erroneous, as it led to a relaxation of credit standards, while the various market innovations that have emerged brought about parameters not adequately understandable (e.g. securitisation).

First of all, the discussion will focus on credit and market risks which were the object of both the EU-wide stress test and the respective stress testing exercise in the United States. The remainder of this study will explore liquidity risk, which will be analysed in line with the stress testing exercise conducted in the first half of 2011.

Credit risk is defined as the risk of loss due to default by a bank's borrowers. Although a bank's total assets are also exposed to credit risk, the analysis focuses mainly on its lending portfolio. Moreover, a bank may face credit risk variations, such as country risk, i.e. the risk of loss due to a bank's exposures towards a country either directly (direct investment) or indirectly (cross-border exposure). In the light of the above, country risk can be broken down into the following components: political risk, sovereign risk, exchange rate risk, transfer risk, as well as second-round risks. Sovereign risk reflects the potential risk of loss in the event that the central government of the host country defaults on its obligations or restructures its debt.

Credit risk can be described as the combined result of three individual risks, i.e. default risk, exposure risk and recovery risk. Default risk arises when borrowers fail to meet their contractual obligations, which typically leads to loan restructuring. Exposure risk is related to the total amount exposed to credit risk. As regards loan portfolios, the amount is represented by the nominal value of credit. The measurement becomes complex in the case of off-balance sheet items, with the most common practice consisting in calculating credit equivalent value. Recovery risk is related to the proportion of the debt that a bank would receive

Chart 1 Loss distribution and bank capital



in final satisfaction of the claims on a defaulted credit. Recovery rate depends on the value of collateral and/or guarantees, as well as on the seniority of the bank's debt.

As a result, on the basis of the aforementioned components, credit risk can be described by assessing of the following three parameters:

- Probability of Default (PD), referring to the probability of a borrower or a group of borrowers defaulting on their obligations vis-à-vis the bank. It is expressed in percentage terms.

- Loss Given Default (LGD), referring to the loss incurred by a bank due to a debtor's default, expressed as a percentage of total exposure.

- Exposure at Default (EAD), referring to the total value that a bank is exposed to at the time of default, expressed as a sum denominated in the portfolio currency.

Having assessed all of the above parameters, banks establish provisions to cover any expected losses EL_p due to debtors' default as follows:

$$EL_p = \sum_i EL = \sum_i (EAD_i \times PD_i \times LGD_i)$$

Expected loss is the average loss a bank expects to sustain in a normal financial environment. As it is "expected", it is not considered as a bank risk but it is part of its cost, since the bank can take appropriate measures to remedy expected losses. These measures include pricing and provisioning. In the first case, interest rate margins increase in order to compensate for the expected loss, while in the second case the bank's profitability is affected.

The estimation of expected loss is based on the bank's historical experience. Nevertheless, it is likely that the next period will be more unfavourable than the parameter estimation period and losses will be higher. In this case, we refer to unexpected loss, which is embedded in banking risk and needs to be covered by the so-called "economic capital". Unexpected loss is derived by statistical estimation, i.e. as a multiple of the expected loss, depending on risk factor movements and on the risk tolerance degree. Furthermore, if economic conditions are very adverse, the ensuing loss is defined as "stressed loss". All of the above can be illustrated with a simplified chart (Chart 1).

Nevertheless, the above representation of loss distribution is idealistic. In fact, no widely

accepted model for the determination of loss distribution and the level of economic capital has been developed so far, nor are there any techniques to incorporate changes in historical relations during periods of crisis, with the most important being data correlation. However, the main argument against the use of the economic capital framework is the unwillingness of decision-makers to take corrective action in line with this framework. Therefore, for the time being, the economic capital framework is not suitable for incorporating stressed loss and consequently, the stress test results focus on expected rather than unexpected losses.

In the light of the above, an adverse or exceptional change in any of those three risk factors (PD_i, LGD_i, EAD_i) would generate a stressed loss SL_p and this differential $SL_p–EL_p$ should be covered by capital.[6] This is the purpose of stress testing, namely to determine whether the capital base continues to cover the stressed loss and whether it still exceeds regulatory minimum capital requirements.

For the estimation of credit risk parameters, a rating system should be developed. This credit risk modelling can be achieved with credit rating systems for corporate portfolios or credit scoring systems for retail portfolios. Credit scoring systems are distinguished in two large categories: application scoring models, which take into account data collected during the application process for the granting of credit products, as well as behavioural scoring models, which are based on existing customers and take account of information about their creditworthiness or payment behaviour.

Furthermore, by exploring the rationale behind the design of these models, we distinguish them into the following two categories: a) models in which causality is derived by the application of statistical techniques, and b) those in which causality stems from economic theory. The most commonly used models in the first category are discriminant analysis and logistic regression, while the second category comprises options-based structural models at the microeconomic level and intensity-based models that consider default as a random, exogenous event and attempt to model the time or the intensity of an eventual default, regardless of its causes.

Market risk is defined as the potential loss on the valuation of assets included in a bank's trading book due to changes in market prices. Changes in prices include movements in interest rates, exchange rates, stock (or index) prices and commodity prices. The trading book comprises positions in financial instruments and commodities held for trading or for hedging the risks inherent in other assets of the trading book. The financial instruments that are usually included in a trading book are bonds and other debt securities, positions in foreign currency, shares, positions in commodities, mutual funds, as well as derivatives having any of the above instruments as their underlying assets.

The key components of market risk[7] are general position risk and specific position risk. General position risk refers to changes in a financial instrument's valuation due to changes in its market price, whereas specific position risk refers to changes in a financial instrument's valuation due to changes in the risk borne by its issuer. Another important factor of market risk, which at this point is not approached from a supervisory perspective, is market liquidity risk, i.e. the risk that a financial instrument cannot be liquidated without suffering significant losses in its market price, and is approximated by the market bid-ask spread.

As a result, changes in the value (ΔV_i) of each asset i of the trading book can be expressed as a function of adverse changes in one of the

6 Part of the differential can be covered by operational profits (if any), provisions, a decline in assets, deleveraging, etc. over the time horizon of the stress test.

7 Market risk in terms of supervision is defined in a broader sense than the usual definition provided by banks' Asset Management Departments. It comprises five components: position risk, foreign exchange risk, counterparty risk, settlement risk and large exposure risk from trading book. This study discusses only position risk, as this component was stress-tested by the EU-wide exercise.

main risk factors. Thus, if shock (S_j) for j = {interest rates, exchange rates, share prices, commodity prices}, then:

$$(\Delta V_i) = f(S_j)$$

where the valuation function f varies according to j. In the event that the underlying assets are interest rates, e.g. bonds, the equation will be as follows:

$$(\Delta V_i) = PV - PV(S_j)$$

i.e. the difference of the current bond value before $[PV]$ and after the shock $[PV(S_j)]$.

Market risk modelling is easier than credit risk modeling. Typically a valuation model or VaR model is used. Valuation models take into account the modified duration in respect of interest rate instruments, the beta coefficient in respect of equity products, and the delta and gamma coefficients in respect of option derivatives, while foreign exchange instruments are linear. As regards the VaR model, it illustrates the maximum potential loss that a bank expects to sustain within a given period of time at a given level of probability. The time period and the probability depend on the planning period and the degree of risk tolerance. For supervisory purposes the period is determined at 10 days and the level of confidence at 99%, whereas historical data covering at least 250 days must be used.

After determining the implications for each risk separately, the issue of risk aggregation arises. There are two alternative methods: (i) by simply adding up the individual components and (ii) by taking account of a potential interdependence between the two risks.

The interdependence issue lies in that different types of risk must be merged into a single number. From a more technical perspective, this means that marginal loss distributions of different risks must be merged into a single distribution. However, these distributions may differ substantially between them or vary in terms of time span.

The interaction between credit risk and market risk has been corroborated by several studies. Jarrow and Turnbull (2000)[8] report on that matter: "Economic theory tells us that market and credit risk are intrinsically related to each other and, more importantly, they are not separable. If the market value of the firm's assets unexpectedly changes —generating market risk— this affects the probability of default – generating credit risk. Conversely, if the probability of default unexpectedly changes —generating credit risk— this affects the market value of the firm – generating market risk". The Basel Committee, acknowledging the importance of the interaction of credit and market risks, issued a working paper,[9] concluding that a considerable underestimation or overestimation of total risk may occur, depending on the degree of both diversification and compounding effects. The criticality of the issue led the EBA to release a consultation paper,[10] mentioning the following:

Guideline 2: In order to adequately manage concentration risk, institutions should have an integrated approach for looking at all aspects of concentration risk within and across risk categories (intra- and inter-risk concentration).

Liquidity risk can be defined as the failure of a credit institution to raise, at a reasonable cost, the funds required to implement its business planning, meet its obligations and continue its operation. Its obligations may arise either from the liability side, as its inability to service its liabilities that fall due and/or as an unforeseen withdrawal of deposits, or from the asset side, as an unexpected utilisation by customers of committed credit lines and/or its inability to unwind a position without significantly lowering market prices. It is clear that liquidity risk components are a combination of endogenous factors (e.g. investment policy) and customer behavioural factors (e.g. depositor behaviour towards market strains). We

8 See Jarrow and Turnbull (2000).
9 See BCBS (2009).
10 See CEBS (2010c).

can distinguish four risk factors: (1) the concentration of funding sources; (2) the level of core deposits; (3) the level of unused credit lines; and (4) the marketability of assets (market liquidity).

The above analysis is a "traditional" approach to liquidity risk. However, innovations in the financial instruments market have shed light to additional risk factors that are in certain cases indiscernible. For instance, the widely used practice of generating loans, creating securities backed by these loans (securitisation) and then distributing them to investors on the market ("originate and distribute" model) highlighted a new perspective in banks' liquidity.

All liquidity risk factors can be quantified but, unlike other risks, there is currently no way to estimate the impact on a bank's regulatory capital. This means that it is necessary to determine the objective of both analysing and stress-testing liquidity risk. As a rule, the analysis focuses on the ensuing liquidity gap, as well as on the impact on liquidity ratios when a risk factor is subject to an exceptional change.

Liquidity gap depends upon the asset/liability maturity mismatch. Inflows and outflows are estimated at different time periods,[11] as a result of exceptional changes in risk factors, while the liquidity gap, either positive or negative, is calculated as the differential between inflows and outflows. Liquidity gap is then compared with the liquidity buffer, which reflects the additional available liquidity in times of distress.[12] It consists of liquid assets and other readily marketable assets on money and capital markets, without price discounts. The purpose of a stress-test exercise is to determine the coverage of liquidity gap.

Liquidity ratios may be simple analytical ratios (e.g. loan-to-deposit) or more composite regulatory ratios such as those defined in Bank of Greece Governor's Act 2614/7.4.2009 (liquidity coverage ratio and mismatch ratio) or the two new liquidity ratios (liquidity coverage ratio and net stable funding ratio), which have been recently proposed —but not yet endorsed— by the Basel Committee.[13] An unexpected shift in any of the risk factors changes the ratio's nominator and/or denominator and the analysis focuses on whether the ratio continues to move within the predetermined limits.

It is clear that liquidity risk analysis may have significant elements of subjectivity, which led the EBA to suggest the following in its consultation document on stress testing:[14]

Liquidity risk 9. The results of the stress tests should be used as an input for adjusting and improving liquidity risk management.

3 A QUANTIFIED APPROACH TO RISK MANAGEMENT

The brief analysis of risks and their interdependence clearly reveals the revolutionary developments of the last 15 years in the field of finance and banking with regard to the quantification of financial decisions. Several banks have developed financial and econometric models, such as those described above, in order to assess and understand their risks. These models have gained reliability because they provide a uniform framework for the identification, measurement, monitoring and management of risks. However, at the same time they created an illusion of safety, since in many cases it was disregarded that these models are actually a simplification of reality which, despite their increasing complexity and computing power, are still quite elementary to capture all aspects of risks. The failure of models to forecast the current crisis urged Alan Greenspan to write[15] that it is impossible to have the perfect model of risk, mainly because of the rational behaviour hypothesis. All of the

11 As regards liquidity risk, the critical time span is 1-30 days and is referred to as the survival period.
12 See CEBS (2009).
13 See BCBS (2010).
14 See CEBS (2010c).
15 Alan Greenspan, "We will never have a perfect model of risk", *Financial Times*, 16.3.2008.

conventional models assume that participants in the market respond rationally without incorporating notions of "animal spirits", as Kaynes put it, that prevail during periods of exceptional changes. Akerlof and Shiller (2009)[16] have recently attempted to decipher this notion and determine its components. Conventional economic theory assumes that participants in the market act in a rational way and personal perceptions, passions and feelings do not influence the process of forging economic events, which depend on risk factors and government decisions. Irrational choices, non-economic motives and sentiments (animal spirits) have not been put under the microscope of risk analysis. Nevertheless, in many cases, and particularly under extraordinary conditions when risk factors reach extreme values, all of the above features lead to additional uncertainty. Sometimes this uncertainty strengthens the creation of economic events but sometimes it may lead to paralysis. Conventional risk management does not take into account all of the above.

Within this framework, stress testing exercises have evolved. They are a risk management tool stemming from financial decision modelling, attempting to answer the question of what would happen, should certain exceptional but plausible risks materialise. This question arises from the innate human need to anticipate future, and particularly unfavourable, events. We all conduct stress-test exercises in our personal lives. For instance, haven't we all contemplated our reaction to a potential job loss? Similarly, banks wish to plan their response to potential shocks in their economic environment or, more technically, to the different positions of the economic cycle. In order to answer all these questions, risk modelling techniques were applied to quantify the results. This is not wrong in principle, but first of all an answer should be given to whether models continue to be effective in times of stress. As already mentioned above, economic behaviour changes in times of stress. Typically, models are based on a pattern of growth that includes both periods of recovery and periods of recession, but the dynamics of each period varies in line with the drivers of each situation. As a result, even if the perfect model did exist, it would most probably not be useful in periods of stress when risk factors undergo exceptional changes.

4 STRESS TESTING

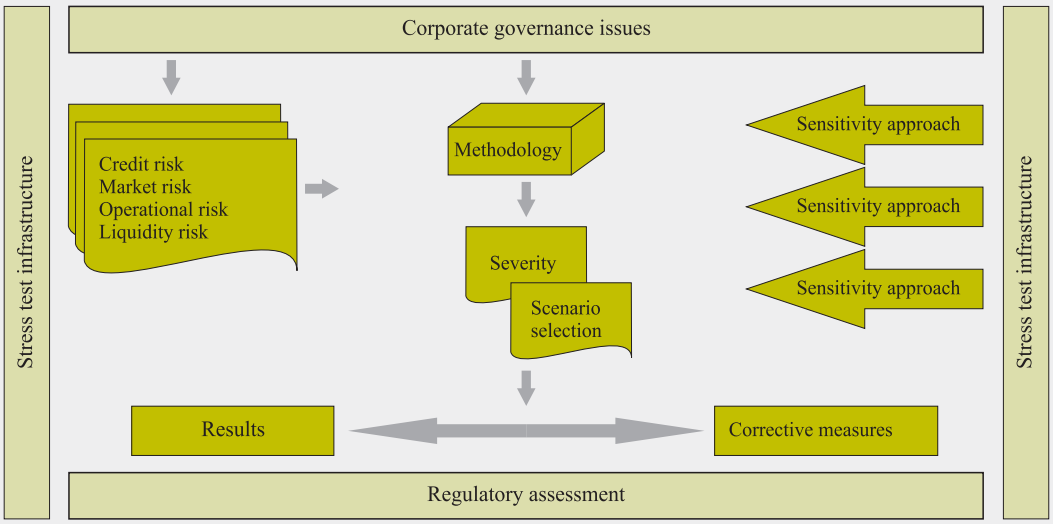
Stress testing seeks to find out what could happen to individual banks and/or the financial system as a whole, when and if specific exceptional but plausible risk scenarios should occur. Its unquestionable usefulness prompted the EBA to develop a framework for conducting a stress testing exercise efficiently.[17] This framework is illustrated in Chart 2 and is broken down into five areas of analysis: (1) corporate governance; (2) methodology; (3) scenarios; (4) implications; and (5) corrective action.

(1) *Corporate governance issues* play a key role in the success of a stress testing exercise. The senior management of each bank is responsible for conducting the stress test and should be able to understand the main assumptions, approve scenarios, make sure that the stress test covers the entire bank, adopt a reporting system and take corrective measures in view of the implications. The stress test should form part of an ongoing risk management programme and rely upon adequate infrastructures, while its hypotheses, reporting lines and effectiveness must be reviewed on a regular basis.

(2) As regards *methodological issues*, in conducting a stress test, a bank has to choose among two alternative techniques: the sensitivity approach and the scenario approach. The sensitivity approach assumes a change in a specific risk factor, e.g. a 30% decline in the share price index, without specifying the cause of the change and irrespective of other risk factors, and the impact of this change is quantified. The scenario approach considers several

16 See Akerlof and Shiller (2009).
17 See CEBS (2010b).

Chart 2 The EBA stress testing framework



Source : CEBS (2010b): "Guidelines on stress testing", GL32, 26 August 2010.

underlying risk factors, with an emphasis on their concurrent emergence, that are associated with a specific portfolio, e.g. changes in the loan portfolio due to simultaneous strains on interest rates and real estate prices, or a specific event which has a horizontal effect on the bank, e.g. changes in interest rates which may affect the corporate portfolio, the retail portfolio and the asset/liability relation.

The sensitivity approach has advantage over the scenario approach due to its easy implementation but it fails to fully reflect reality, as a shock is rarely limited to just one risk factor. Conversely, the scenario approach may be more realistic but is more difficult to apply, as an intercorrelation model of risk factors is required. Under both approaches, shocks may be based on historical experience or may be hypothetical, reflecting theoretical future risks.

(3) With respect to the *severity of scenarios*, no unbiased answer can be provided.[18] The stress test assumes adverse but plausible scenarios. But what does "*adverse but plausible scenarios*" really mean? The answer is biased depending on the analyst's sense of harshness. Daily experience might provide us with an answer, though not satisfactory enough, as some quantification is warranted. In many cases, the adverse and plausible scenario is determined by a regulatory guideline. Namely, as regards the automotive industry, the safety of a car is determined by its performance in specific crash tests. The same applies to the launch of a new pharmaceutical product. As regards the financial sector, the stress testing exercise is a relatively new tool. It was used by the International Monetary Fund (IMF) under its Financial Sector Assessment Program (FSAP), but it was not incorporated in the decision-making process of supervisory authorities and banks. The recent financial crisis acted as a catalyst for an attitude change, as it became clear that the stress test is a powerful risk management tool. The latest example of a successful stress testing exercise implementation was Ireland,[19] where the determination of capital

18 See Isogai (2009).
19 See Central Bank of Ireland, "The Financial Measures Program Report", 31.3.2011.

requirements for distressed banks was based on a stress testing exercise, which was welcome by the markets. Naturally, supervisory authorities did not remain passive but they started, instead, to investigate the severity of scenarios. The EBA reports that:[20]

Guideline 10. Stress testing should be based on exceptional but plausible events. The stress testing program should cover a range of scenarios with different severities including scenarios which reflect a severe economic downturn.

It is widely accepted that the degree of severity depends on the use of the outcomes of a stress test. In order to estimate capital adequacy, a mild recession scenario is needed, whereas when the objective of the stress test is long-term capital planning, a more adverse scenario is warranted. In general, stress tests should include alternative scenarios to ensure that the information they provide is significant. The quantification of the probability of a scenario materialising can usually be defined as "once every n years". The parameter n is difficult to determine and "once every 25 years" is often used, which coincides with an executive officer's professional life. Nevertheless, adverse but plausible scenarios "once every 100 years or more" could be used.

Besides, the degree of severity of a scenario depends on the specific portfolio on which it applies. A scenario may be adverse for one bank and mild for another. For instance, as regards a bank whose core business is credit to shipping, a plain recession scenario may not be satisfactory, since the business cycle of the shipping industry is known to give deeper and lagged recessions.

(4) Each bank must assess the *impact* of a stress test on its assets, liabilities, profit and loss accounts, and ultimately its regulatory capital. This, of course, implies an estimation of the expected loss using a wide range of scenarios.

(5) Each bank must develop a *corrective action* plan in respect of the stress test results to remain functional and solvent. Corrective measures may include, among other things, risk mitigation techniques, a comprehensive limit system, funding sources modifications, capital requirements planning, contingency planning and business continuity plans.

Three basic steps are required for the completion of a stress test:

Step 1: determining macroeconomic scenarios.

Step 2: converting scenarios into risk parameters.

Step 3: assessing the impact on a bank-by-bank basis.

Typically, steps (1) and (2) are known as "top-down approach", while step (3) constitutes the "bottom-up approach"; both approaches are illustrated in Chart 3. Let us investigate each one of these steps separately.

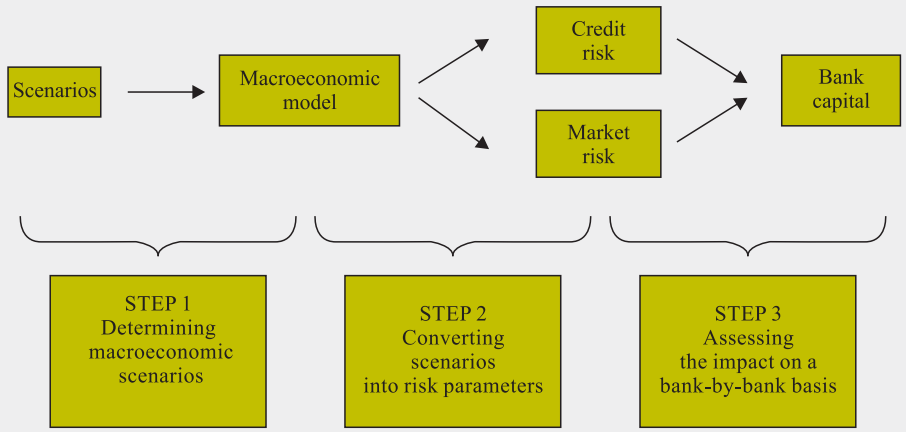
5 DETERMINING MACROECONOMIC EFFECTS (MACRO STRESS TESTING)

The first two steps, *Step 1* and *Step 2*, in designing a stress test determine the effects of the macroeconomic environment over the planning horizon of the exercise. Step 1 is related to the development of macroeconomic scenarios, whereas Step 2 refers to their conversion into risk parameters. In international literature this framework is generally referred to as macro stress testing.

There has been a growing literature on macro stress testing,[21] particularly in the context of the current crisis.[22] In designing a macro stress testing model, the first factor that has to be taken into account is the purpose of the model. If the model is used for financial stability, its purpose is to identify common vulnerabilities

20 See CEBS (2010b).
21 See Drehmann (2009).
22 See Rodrigo and Drehmann (2009).

Chart 3 A typical macro stress testing model



which could affect the system as a whole. By contrast, if the model is used for risk management purposes, its objective is to identify vulnerabilities observed in specific banks or groups of banks. Summer (2007)[23] identifies three differentiation factors between these two approaches. First, stability assessment models examine the financial system as a whole and therefore, the interaction between banks has gradually become more important. Second, financial stability has several parameters and thus, it is difficult to decide on the component(s) that should be parameterised. Third, the design of a stability assessment model is more complex, as it must also include the behavioural patterns of households and non-financial corporations.

$$Y = b_0 + b_1X_1 + b_2X_2 + \ldots + b_nX_n$$

A typical model for the estimation of macroeconomic effects (Chart 3) has the following simple linear form:

where Y= microeconomic risk variable
X_i = macroeconomic variables
b_i = elasticities

The definition of independent macroeconomic variables is case-specific. All models encompass typical macroeconomic variables, such as GDP growth, inflation or interest rates, while in some cases other variables are employed, i.e. the unemployment rate (especially when the main focus of the analysis is the retail portfolio), real estate price indicators (in the case of large exposures to this sector) or world trade indicators (when analysis refers to an open economy).

Furthermore, a decision must be taken as regards the dependent variable Y. On the basis of credit risk analysis, the dependent variable is one of the three credit risk parameters *(PD_i, LGD_i, EAD_i)*. As a rule, in alternative macroeconomic scenarios the probability of default (PD) is used as an approximation of bank customers' creditworthiness. However, in this case, comparability issues between the estimates of different banks, as well as lack of historical data may arise.

23 See Summer (2007).

Table 1 Credit risk model

	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$	$\hat{\beta}_4$
Estimates	0.0825	-0.682	0.149	0.269
p-values	0.000	0.006	0.235	0.000
Adjusted R^2	0.67			

Alternatively, the dependent variable may be an approximation of asset quality or a group of financial soundness indicators. Usually, the first approximation is preferred,[24] using non-performing loans (NPLs) or provisions as the dependent variable. However, NPLs and provisions are based on historical data and thus cannot provide forward-looking estimations. Moreover, provisions do not always reflect reality, since the time at which a credit event is recorded does not necessarily coincide with the time it actually occurred, and are often used for profit smoothing.

Almost all supervisory authorities have developed macroeconomic stress testing models and in fact, an overview is provided in Foglia (2009), as well as in the presentations of the workshop organised by the Central Bank of the Czech Republic.[25] The Bank of Greece has developed a similar model, starting from 2004 under the FSAP, and this model is set forth in Appendix 1 of Kalfaoglou (2006). Since then several modifications and improvements have been made,[26] while in a workshop hosted by the Bank of Greece in November 2009, as regards the total of banks which are active in Greece, the following credit risk model was presented:

$$NPL_{it}=\beta_1 NPL_{it-1}+\beta_2 RGDP_t+\beta_3 RLR_{it-1}+\beta_4 U_{t-1}+e_{it}$$

where NPL = non-performing loans by more than 3 months (compared with total loans)
$RGDP$ = real GDP (on a semiannual basis)
RLR = real lending rates to non-financial corporations
U = unemployment rate

The results are set out in Table 1.

These models are static and represent the first generation of macroeconomic stress testing models. The challenge is to capture all strains experienced by banks under stressed conditions. Banks are coming under direct pressure from the macroeconomic environment and under indirect pressure from the behaviour of households and non-financial corporations. As a result, a comprehensive stress testing system is illustrated in Chart 4.[27]

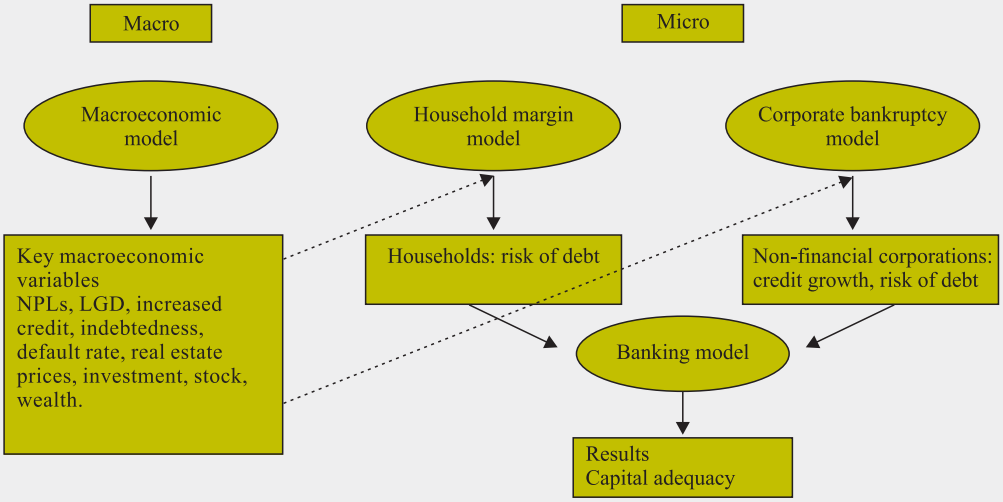
The system is recursive, as the models for the sectors of households and non-financial corporations capture the effects from macroeconomic shock scenarios, thus allowing for an identification of possible credit risks. Data, such as the level of household and corporate debt, debt servicing ability and unserviced debt, are key to financial stability, especially if they are grouped to provide an approximation of the estimated total debt which may not be serviced.

6 BANKS' CAPITAL ADEQUACY

As Step 3 in conducting a stress test is considered the impact assessment for each bank separately and in particular the assessment of the impact on Tier 1 capital, as well as on the capital adequacy ratio (CAR). Prior to the exam-

24 As regards the second approximation, see Sorge and Virolainen (2006).
25 CNB Workshop on Advances in Stress Testing, Prague, 18 November 2009.
26 See Louzis *et al.* (2010).
27 See Andersen *et al.* (2008).

Chart 4 Macroeconomic simulation: the latest approach



Source : Andersen H, T. Berge, E. Bernhardsen, Ki-G. Lindquist and B.H. Vatne (2008): "A suite-of-models approach to stress-testing financial stability", Norges Bank Financial Stability, Staff memo 2008/2.

ination of the quantification method, the capital adequacy framework of banks will be discussed to ensure a better understanding of the stress test's repercussions.

Overall, we can distinguish between three different types of capital:

- Equity capital: own funds of a credit institution, as reported in its balance sheet and calculated according to international accounting rules and principles.

- Regulatory capital: own funds required by regulatory standards. Regulatory standards are basically similar to accounting standards, albeit with some important differences. For instance, a supervisory authority may recognise, conditionally, debt liabilities as part of capital, which however is contrary to accounting standards.

- Risk capital or economic capital: the amount of capital required to absorb any unexpected losses arising from the risks facing a bank.

The main focus of stress tests is usually the impact on regulatory capital. For a financial asset to be included in regulatory capital, it must fulfill certain criteria:

- *Permanence and availability*, i.e. the capital provided by the underlying financial asset must be permanent and available when needed. This means that the issuer should not have any obligation (contractual or not) to buy back prior to due date (e.g. early redemption clause), but even in this case, the clause should not provide a strong incentive for early redemption; that is, it should not be callable before 5 years.

- *Flexibility*, i.e. the issuer of the financial instrument must have the possibility to cancel payments (interest or dividend payments) on the basis of the current financial conditions, e.g. the distribution of dividends should be left at the issuer's discretion.

- *Loss absorption*, i.e. the ability to absorb any unexpected losses, so that a bank continues functioning (on a going concern basis) or sur-

vives financial shocks (on a gone concern basis).

The quality of a financial instrument depends on how well it meets the above mentioned criteria and is suggestive of the quality of capital. Thus, regulatory capital is classified into Tier 1, Tier 2 and Tier 3 capital. Each category is in turn divided into upper and lower capital. It is obvious that Tier 1 capital best meets the specified criteria and comprises[28] shareholders' equity, disclosed reserves and non-cumulative preference shares.[29] Tier 2 or supplementary capital comprises cumulative preference shares and subordinated loans.[30] Tier 3 capital, used to meet a bank's market risks, consists of short-term subordinated loans. The sum of the individual capital categories, less certain capital items and under specific restrictions, makes up a bank's total regulatory capital.

However, the dominant question is whether this capital is sufficient, i.e. whether the bank is adequately capitalised. Capital adequacy is a measure of the bank's assumed risks. Thus, the Capital Adequacy Ratio (CAR) is calculated as follows:

$$CAR = \frac{RC}{Credit\_risk + Market\_risk + Operational\_risk} \geq 8\%$$

where:
CAR: capital adequacy ratio
RC: total regulatory capital
Credit risk: credit risk proxy
Market risk: market risk proxy
Operational risk: operational risk proxy

Therefore, a bank's capital adequacy depends on the assumed credit, market and operational risks. The Basel II framework determines the evaluation methodology of risks and sets the CAR ≥ 8%.

But in some cases, particularly during distressed periods, Tier 2 capital is not effective, as it cannot absorb losses at a satisfactory degree. As a result, the analysis focuses solely on Tier 1 capital and the Tier 1 ratio is calculated as follows:

$$Tier\_1\_ratio = \frac{Tier\_1\_capital}{Credit\_risk + Market\_risk + Operational\_risk} \geq 4\%$$

Under the current regulatory framework, Tier 1 ratio ≥ 4%, whereas the Bank of Greece recommended a Tier 1 ratio ≥ 8% as part of the measures to address the crisis. During the EU-wide stress testing exercise, after taking also into account the impact from financial shocks, the Tier 1 ratio was determined at ≥ 6%, expressly stating that this is not a new regulatory rule but serves only as a benchmark for the purposes of the exercise.

The capital requirements framework is currently being amended by Basel III. The financial crisis broke out at the beginning of an effort to implement a new regulatory framework for capital requirements, which is better known as Basel II. In this sense, the Basel II framework was not tested in terms of its ability to mitigate the impact of a crisis. At the same time however, the lessons learnt from the crisis shed light on some evident weaknesses of the framework[31] and changes have been initiated in the field of banking supervision and more specifically, in the Basel II framework. It is clear that Basel II underrated certain serious risks and overrated banks' capacity to effectively manage risks. Table 2 shows the new framework which is now being forged, as announced by the Basel Committee on 12.9.2010.[32]

28 The analysis is not exhaustive and the examples are provided only for illustrative purposes. A detailed description is included in Bank of Greece Governor's Act 2587/17.8.2007.

29 Preference shares can either be cumulative or non-cumulative. As regards cumulative preference shares, the shareholder is entitled to the current dividend, as well as to all previous dividends that the bank has failed to distribute for some reason.

30 Subordinated loans, which have a lower priority than other debt should a bank go into liquidation, rank after senior debt and just before common stock.

31 A number of working groups were set up to examine the causes of the crisis and to submit reform proposals, namely:
- The de Larosière Group (25.2.2009), High level group on financial supervision in EU.
- Group of Thirty (15.1.2009), "Financial Reform: A framework for financial stability".
- Center for Financial Studies (2.2009), New Financial Order: Recommendations by the Issing Committee.
- The Squam lake report (2010), Fixing the financial system.

32 See BSBC, "Group of Governors and Head of Supervision announces higher global minimum standards", Press release, 12.9.2010.

Table 2 New suggested minimum capital requirements (Basel III)

	Core Tier 1 ratio	Tier I ratio	Capital adequacy ratio (CAR)
Regulatory minimum	4.5%	6%	8.0%
Conservation buffer	2.5%		
Regulatory minimum plus conservation buffer	7.0%	8.5%	10.5%
Countercyclical buffer	0 - 2.5%		

The new framework introduces a new level of capital, core Tier 1 capital (common equity and other types of capital with high loss-absorption capacity), and sets a minimum standard of 4.5%. Moreover, the Tier 1 ratio is raised to 6%, while the CAR remains at 8%. Furthermore, a capital conservation buffer consisting of core Tier 1 capital has been established and will exceed the minimum standard by 2.5%. The capital conservation buffer aims at creating an additional buffer that will enable banks to absorb losses in periods of financial crisis. A counter-cyclical capital buffer ranging between 0% and 2.5% of equity capital is also envisaged to be implemented at a national level. Additional capital buffers will be established with a view to achieving the overall macroprudential objective, i.e. shielding the banking system against accumulated risks. Lastly, it should be noted that a transitional period of 8 years is envisaged and all of the above proposals are expected to be fully implemented by 1.1.2019.

7 THE THREE STEPS OF IMPLEMENTATION

Having specified the equation of macroeconomic simulation,

$$Y = b_0 + b_1X_1 + b_2X_2 + \ldots + b_nX_n$$

as well as the calculation method of the regulatory Tier 1 ratio

$$Tier\_1\_ratio = \frac{Tier\_1\_capital}{Credit\_risk + Market\_risk + Operational\_risk}$$

we can now examine the 3-step implementation procedure.

Step 1

The first step concerns the forecasting of independent macroeconomic variables. Forecasting is *per se* a dubious process and it is even more so, due to the uncertainty prevailing in the macroeconomic environment. Macroeconomic forecasts are usually expressed within a range of values, which in stress testing is translated into alternative scenarios, e.g. a baseline scenario and an adverse scenario. Of course, one should bear in mind that scenario generation is based on the assumption that both data generation process and the behaviour of market participants towards macroeconomic phenomena and structural changes remain unchanged.

Taking account of the above, forecasting can use the structural macroeconomic models developed by most central banks. As a rule, these models fail to associate the real sector of the economy with the financial sector and are therefore used only in forecasting macroeconomic aggregates. For lack of macroeconomic models, statistical techniques may be employed, with the VAR (Vector Autoregressive) technique being the most widely used amongst them. Lately, DSGE (Dynamic Stochastic General Equilibrium)[33] models were used for the forecasting of variables.

33 See Jokivuolle *et al.* (2007).

Step 2

The second step concerns the estimation of the dependent variable Y based on the scenarios generated in Step 1. In other words, the equation must be estimated, using times series or cross-sectional data, and elasticities b_i must be calculated. Then, changes in the dependent variable arise from multiplying elasticities to changes in independent variables. The analysis is based on the assumption that historical relationships remain unchanged in a more adverse environment. Nevertheless, it has been observed that this does not apply to all cases, particularly with regard to co-variances of variables.

Step 3

After having discussed in brief the concept of bank capital adequacy, we are able to determine the impact of a stress test exercise on a bank's capital base. We assume that at a given time t an unexpected shock S occurs in one or more risk factors and the impact per risk factor is $I_{t,S}$. Total impact is the sum of individual impacts and its effect on the Tier 1 ratio (Tier1_ratio) is calculated as follows:

$$I_t = I_{t,credit} + I_{t,market} + \ldots$$

$$Tier1\_ratio_t = \frac{[Tier1_{t-1} - I_t]}{[Risk_{t-1} - I_t]}$$

where *Tier1* = Core or Tier 1 capital,
Tier1_ratio = Tier 1 ratio,
Risk = quantified approximation of risks.

It should be noted that the impact is neither a forecast nor an expected outcome but simply the result of a "what if" exercise that was conducted on the basis of macroeconomic scenarios.

8 COMPARATIVE ANALYSIS

Comparing these two exercises warrants great caution. They may have many features in common but their objective is not identical. The objective of the EU-wide exercise mainly focused on providing information about the soundness of both the banking system and the stress-tested banks, whereas the US exercise placed emphasis on banks' capital needs. The latter aimed at determining the amount of capital that the US administration should contribute, while in Europe the exercise was conducted following the support measures taken by the Member States. There is a huge difference about how the results of a stress test should be treated.

If the exercise is considered as a complementary risk management tool, it will provide information which, combined with additional information from other systems, will help improve perception and knowledge about potential risks, as well as risk tolerance. In this case, the results of a stress test do not necessarily call for the coverage of losses from adverse scenarios with additional capital, but a bank might also take alternative risk management measures. This is the rationale behind the EU-wide stress testing exercise,[34] where it is emphasised that a bank that failed this test is by no means insolvent, since it meets the regulatory minimum. The results must be taken into account before the adoption of any corrective measures which do not necessarily comprise an immediate capital increase. Besides, they should be included in the assessment of vulnerabilities, risks and weaknesses, with the aim of taking corrective measures. All banks below or close to the benchmark must draw up a restructuring plan, which should not exclude a potential recapitalisation. Furthermore, these banks will be more closely monitored and special emphasis will be placed on the supervisory review process of Pillar 2 of the Capital Requirements Directive.

If the exercise is considered as a capital enhancement tool, its impact is automatically translated into capital deficit, which must be covered immediately. In other words, there is no possibility of alternative corrective action.

34 See CEBS: "Q&A: 2010 EU-wide stress testing exercise".

That was the philosophy of the SCAP that was conducted by the US Federal Reserve and its purpose was to assess the need of the participating banks for additional capital.[35]

Furthermore, the methodology that was selected for the stress test at the European level was the sensitivity approach, focusing on credit risk, market risk and sovereign risk, i.e. the risk entailed in the exposure to EU sovereign debt, while operational risk was indirectly taken into account through an estimated change in operational profit. The US SCAP used a similar methodology but sovereign risk was treated in a different way. In the United States, the debt security portfolio underwent a typical process of credit risk stress testing, while in Europe bonds issued by EU Member States were given a preferential treatment. It should be noted that held-to-maturity (HTM) bonds do not entail any credit risk and therefore, they were excluded from the exercise. Government bonds held in a bank's trading book were considered to entail market risk and a valuation haircut was applied for the purposes of the exercise. This difference may be due to the fact that the US stress test was conducted in April 2009, before the intensification of the euro area debt crisis.

Nevertheless, the valuation haircut issue triggered a debate and regulators were strongly criticised.[36] The CEBS in its press release[37] clarified the details of the assumptions and stated that on-balance sheet exposures, as well as potential provisions, were considered, and long and short positions were offset while risk hedging tools (credit derivatives or interest-rate swaps) were not taken into account. The simulation for the calculation of haircuts was effected on the 5-year government bond of individual Member States and led to valuation haircuts of 23.1%, 14% and 12.8% for 2011 as regards Greece, Portugal and Ireland respectively.

After having discussed the broader framework of both exercises and identified the specifics of each exercise for a correct interpretation of their results, we will examine the implementation methodology of the three aforementioned steps.

Step 1

The stress testing exercise was conducted on a consolidated basis, using 2009 figures for the EU-wide exercise and 2008 figures for the US SCAP, over a time horizon of two years. As regards the risks included in the stress test, two scenarios were developed: the baseline scenario and the adverse scenario. The baseline scenario is based upon the European Commission forecasts that were available at the beginning of the stress test in March 2010. According to these forecasts, a slight recovery of the EU-27 economy was anticipated with the GDP rising by 1.0% in 2010 and by 1.7% in 2011, coupled with elevated unemployment rate and overall stable inflation. The US Fed exercise was based upon the average of the projections published by three professional forecasters, i.e. a 2.0% decline in GDP for 2009 and a 2.1% rise in 2010, with elevated unemployment and a plunge in house prices.

The "more adverse" scenario performed under the US Fed exercise was based on the forecast error of three professional forecasters, as well as on their estimations about current uncertainty. This led to a projected decline of 3.3% in GDP for 2009 and a rise of 0.5% for 2010. Under the EU-wide exercise, the adverse scenario has three main features: a global shock in confidence, a more EU-specific shock in the interest rate curve and a separate shock in long-term interest rates per Member State, on the basis of the 10-year bond spread, with a view to capturing concerns about possible fiscal problems in EU Member States. On aggregate, the adverse scenario implies a difference of approximately 3% from the European Com-

35 The note made by the Board of Governors of the Federal Reserve System (2009a) is clear: "...the purpose of the SCAP is to assess the size of the capital needs".
36 David Enrich, "Europe's Bank Stress Tests Minimized Debt Risk", *The Wall Street Journal*, 7.9.2010.
37 CEBS: "CEBS Statement on the disclosure of sovereign exposures in the context of the 2010 EU-wide stress testing exercise", 8.9.2010.

mission forecasts, thus projecting a zero increase in GDP for 2010 and a 0.4% decrease in 2011.

The above data refer to averages derived from the breakdown of data by country. As regards Greece, the baseline scenario incorporates a decline of 4.1% in GDP for 2010 and of 2.6% for 2011, whereas the decline under the adverse scenario is 4.6% and 4.3% respectively. It is obvious that the scenarios that apply to Greece differ considerably from those applying to the other Member States, which implies that the economic cycle frequency is different in Greece than in the rest of Europe.

According to the latest Eurostat estimates, the rate of change in real GDP in the European Union (EU-27) was +1.8% in 2010 and is expected to reach +1.7% in 2011. Thus, the assumptions of a slight recovery under the baseline scenario and of a double-dip recession under the adverse scenario did not materialise. With regard to the United States, the corresponding rates of change in GDP are -2.6% in 2009 and +2.9% in 2010, while the estimates for Greece are -4.6% in 2010 and -3.0% in 2011. It is noteworthy that as regards the European Union as a whole, the macroeconomic scenario was stringent while it was considerably milder with respect to the US. In the case of Greece, reality proved to be even harsher than the adverse scenario of the exercise and this should be borne in mind when analysing the results (see Table 3).

Step 2

In the EU, the estimates for PD and LGD, under the baseline and the adverse scenarios, were calculated at the national level for five key portfolios of banking books (interbank, government bonds, corporate loans, consumer credit and housing loans) in two stages. At the first stage, regression for each portfolio separately was calculated, using as dependent variables their corresponding PD and LGD and as independent variables GDP, unemployment and long-term interest rates, from 1991 to end-2009. Time series for individual PD and LGD were not available and thus were "constructed" using:

- Moody's KMV for exposures to financial institutions,[38]
- CDS spreads for exposures to sovereign debt,
- the ECB Monetary and Financial Institutions (MFI) database on write-offs for other exposures,
- Moody's LossCalc for LGD.[39]

At the second stage, elasticities were multiplied to estimated changes in macroeconomic variables (baseline and adverse scenarios) by country and by portfolio, while for PD estimation, the PD levels that were estimated by the banks themselves at the end of 2009 were used as starting values.

Two comments can be made on the above-mentioned methodology. The first comment concerns model risk[40] that is inherent in the whole process, as dependent variables were not directly observable and were "constructed", thus increasing the bias of estimations. The second comment concerns the estimates of banks themselves about the PD variable for 2009, on which the estimates for 2010 and 2011 were based. With respect to Greece, the Bank of Greece was responsible for monitoring the quality of estimates but it should be noted that there are sufficient historical data about the PD and LGD parameters only for the two banks which are applying the IRB method in line with Basel II and whose internal risk management models have been validated by the Bank of Greece.

The US stress test did not incorporate any analytical estimations of PD and LGD and instead,

38 It refers to a structural credit risk model (KMV) that relies upon the options theory and is supported by Moody's, which in many cases releases the results. It is usually used as a benchmark for results.

39 It refers to a credit risk model focusing on the LGD variable, which has been developed and is supported by Moody's.

40 Model risk refers to the probability of risk mismeasurement either due to inadequate or unsuitable data or due to a wrong specification of the model.

the loss rate was directly employed. There are no detailed published data and the US Federal Reserve mentioned that for the calculation of the loss rate several methods were applied, such as the analysis of historical loss rate or quantative methods linking banks' return with macroeconomic variables. It should also be noted that these rates are indicative and banks are encouraged to estimate their own variables. Besides, each bank should be capable of justifying any estimation that differs from that of the Fed.

As regards market risk, both stress tests focused on the trading book exposures and scenarios were constructed in line with macroeconomic projections. For the EU-wide exercise, specific scenarios were designed concerning:

- each primary risk factor separately (interest rates, exchange rates, stock prices and commodity prices),

- the specific risk of financial instruments with a widening of credit derivative spreads,

- market liquidity risk with a doubling and a quadrupling of the bid/ask spread,

- positions in mutual funds and hedge funds.

Both under the scenarios of primary risk factors and under the scenarios of individual market risk components, the impact was estimated as a valuation loss for each respective position.

Step 3

The EU-wide stress testing exercise, as well as the US Federal Reserve stress test aimed at determining the capital adequacy of banks, albeit with some differences as detailed above. Nevertheless, the first test focused on Tier 1 capital adequacy, while the second one focused on the most important component of Tier 1 capital, i.e. Tier 1 common equity, which has a high loss absorption capacity. The notion of Tier 1 common equity has not yet been institutionalised in the EU from a regulatory point of view and is one of the Basel III proposals. Therefore, the analysis does not only focus on the amount of capital but also on its composition. Common equity is the first element of the capital structure to absorb losses and its adequacy lowers the risk of insolvency under stress.

Under the more adverse scenario, the 19 banks that participated in the US stress test recorded in the 2009-10 period total losses of $599.2 billion, of which $455 billion came from loan portfolios, mainly housing and consumer credit. The estimated loss rate on total loans stands at 9.1% for the 2009-10 period. If account is taken of loan-loss provisions, write-downs/write-offs, expected profits, sale of assets, restructuring of the existing capital base (e.g. issuance of new hybrid securities) etc., an additional capital of $75 billion is required. This amount concerns 10 out of the 19 participating banks, since for the remaining credit institutions the capital ratios still lie above the desired levels even after the scenario implementation. It should be noted that in the case of these 10 banks the required capital to achieve the targeted rate refers almost entirely to common equity, whereas if the Tier 1 ratio were used, capital adequacy would not be impaired.

As regards the EU-wide exercise, for the estimation of total impact, the impacts for each one of the two risks were summed up and the impact on the Tier 1 ratio was evaluated. According to the aforementioned methodology, cumulative losses for the 2009-10 period came to €566 billion, of which €473 billion refer to credit risk, €65 billion to market risk and €28 billion to sovereign risk. Additional capital requirements amounted to €3.1 billion at the European level.

On the basis of this methodology and under the adverse scenario, the performance of Greek banks participating in the stress test is shown in Table 3.

Table 3 Tier I ratio in 2011 under the adverse scenario

National Bank of Greece	7.4%
EFG-Eurobank	8.2%
Alpha Bank	8.9%
Piraeus Bank	6.0%
ATEbank	4.4%
Hellenic Postbank	8.4%

As already stressed above, a bank that fails the test is by no means insolvent, as it meets the regulatory capital requirements. Banks close to the regulatory minimum should develop a plan of corrective measures.

For a correct interpretation of the results, it is worth noting the banking support measures adopted by several EU governments, including the Greek government.[41] Capital injections, in the form of Tier 1 capital, have been taken into account in the final results. At the European level, 31 out of the 91 stress-tested banks have received government aid totalling €236 billion. This should not imply that banks which exceeded the threshold value can automatically embark on an exit strategy, as the stress test is only one of the parameters for such a decision. On the other hand, those banks that were below the threshold value should not rely on a direct government support, since this would undermine the level playing field within the EU. In Greece, banks can resort to the support of the Hellenic Financial Stability Fund, which has been endowed with a €10 billion capital.

9 CONCLUSION

It is generally believed that the eruption and the intensification of the current economic and financial crisis are due to the opacity of banks. Supervisory authorities, in their effort to address the crisis and separate the wheat from the chaff, promoted stress testing as a complementary tool for risk management and/or financial stability, and hoped that by publishing the stress test results, the issue of the soundness of banks, and of the banking system as a whole, would be viewed in its right proportion.

Overall, stress testing can be analysed in terms of usefulness, on the one hand, as a risk management tool contributing to micro-prudential supervision and, on the other hand, as a financial stability tool promoting banks' macro-prudential supervision. Furthermore, it can serve as a countercyclical policy tool to mitigate the effects from the different phases of the economic cycle. If the exercise helps detect *ex ante* the vulnerabilities of the banking sector and as long as the economy has not yet embarked on a downward path, these weaknesses can be remedied by additional capital buffers. Capital buffers can be used during economic downturns when the banking system will be coming under more strain. This idea was first introduced in the review of the capital adequacy framework (Basel III), which envisages a countercyclical buffer of 0%-2.5%, as stressed below:[42]

"The purpose of the countercyclical buffer is to achieve the broader macro-prudential goal of protecting the banking sector from periods of excess aggregate credit growth. For any given country, this buffer will only be in effect when there is excess credit growth that is resulting in a system-wide build-up of risk. The countercyclical buffer, when in effect, would be introduced as an extension of the conservation buffer range".

Thus, only few could contest that stress testing is a valuable tool which can be used by a bank in its risk management strategy or by a supervisory authority in its approach to financial stability, but is no panacea.[43] Until now, the most common practice was to conduct a stress test either at the bank level or at the national bank-

41 ECB, "Measures taken by euro area governments in support of the financial sector", *Monthly Bulletin*, April 2010.
42 BSBC, "Group of Governors and Head of Supervision announces higher global minimum standards", Press release, 12.9.2010.
43 FitchRatings, "EU Bank Stress Tests Round 2. Promising Aspects, But No Panacea", 23.3.2011

ing system level. The EU-wide stress test was the first cross-border exercise to be conducted, comprising many different banking systems and banks. Although it was strongly criticised for the mildness of its scenarios, the intransparent methodology, the preferential treatment of EU government bonds, etc., the positive aspect of the stress test lies in that it received wide publicity beyond the closed community of financial experts. Equally important is the comment made by Credit Suisse[44] which reckoned that the exercise reached a satisfactory level of integration and that for the first time the interested parties enjoy a tool that they can modify as they see fit in order to conduct the desirable stress test in a desired way. It is probably no coincidence that the stress test was repeated within less than a year at the European level.

44 Credit Suisse, "European banks: stress reliever", 23 July 2010.

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ON-THE-JOB TRAINING IN GREECE: A BRIEF OVERVIEW[1]

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1 INTRODUCTION

Large companies active in Greece identify the poor quality of Greek vocational education as one of the factors impacting negatively on productivity.[2] More specifically, as regards tourism, which is a vital sector for the Greek economy, the limited extent to which companies invest in training and employee development adversely affects the country's competitiveness.[3]

The literature on continuing training suggests (see, for example, Pischke, 2001) that skills obtained in the formal education system or via apprenticeships quickly become obsolete. Employers, however, do not seem to acknowledge that the process of education does not end with graduation from the formal education system or with the completion of an apprenticeship and underinvest in on-the-job training. In practice, this view leads to low competitiveness and is inconsistent with the demographic and economic facts that population ageing, technological progress and globalisation have created. Since training at any stage or level possesses features of a public good, the issue is important both from an economic policy and from an education policy perspective.

This paper documents the extent of on-the-job training in Greece and investigates the causes and consequences of its limited role. The study does not look into the issue of life-long learning or vocational training in the formal education system more generally.[4]

The data used herein are derived from two sources. The first source is the *2005 Annual Continuing Vocational Training Survey (CVTS)*, based on a sample of businesses from most sectors of economic activity and carried out across all European Union (EU) Member States on the basis of a more or less harmonised questionnaire. In Greece, the survey was conducted by the Hellenic Statistical Authority (ELSTAT). The sample of 3,110 companies used is derived through single-stage stratified sampling with the firm being the final sampling unit.[5] The population from which the sample was drawn is the ELSTAT company registry put together from administrative data sources (Social Security Fund – IKA, Ministry of Finance Information Processing Centre – KEPYO). The second source is the *Adult Education Survey (AES)*, conducted by ELSTAT in the last quarter of 2007 using a random sample of 6,510 individuals aged between 25 and 64.[6]

On-the-job training (OJT) is here defined as continuing[7] training related to the work performed and is not limited to in-house training.[8] The training is addressed to employees (not apprentices), is planned in advance and is financed, at least in part, by the enterprise. This definition obviously underestimates the extent of OJT, a significant part of which is probably conducted without having been prearranged (informal training). Informal training is, however, difficult to document.[9] Initial voca-

1 The article reflects the views of the author and not necessarily those of the Bank of Greece. The author would like to thank the Hellenic Statistical Authority (ELSTAT) for supplying the data and in particular S. Zachariou (ELSTAT) for the clarifications provided, as well as H. Gibson, C. Kanellopoulos, C. Lagopoulos, G. Manolas and G. Symigiannis for their useful comments. The usual disclaimer applies.

2 Replies to a small-scale field survey conducted by the Bank of Greece. For details, see *Monetary Policy 2009-2010*, March 2010, pp. 42-43.

3 World Economic Forum (2011), *The Travel & Tourism Competitiveness Report*, pp. 202-203.

4 Kanellopoulos and Papakonstantinou (2005), Efstratoglou (2009) and OECD (2010) investigate the impact of vocational training on the probability of finding a job and on wages in Greece.

5 All firms with over 1,000 employees are included in the sample.

6 ELSTAT has supplied us with the grossing-up factors for the *Adult Education Survey* but not for the *Annual Continuing Vocational Training Survey*.

7 Training is defined as *continuing* because it is addressed to employees with an ongoing work relationship with the firm, in contrast with *initial* training which is addressed to trainees.

8 Initial and continuing vocational trainings are in general classified as non-formal education (see, for example, Article 2 of Law 3879/2010 concerning "Development of life-long learning and other policies").

9 There is evidence (see, for example, Lowenstein and Spletzer, 2000) that the incidence of formal training positively correlates with the incidence of informal training. Weiss (1994), however, supports the view that informal training impacts on productivity only in the first few months of employment in a new job.

tional training (IVT), addressed to trainees, is only discussed here briefly.

The extent of training is measured by (i) the **provision or otherwise** of OJT (incidence), (ii) the **duration** (hours) of training, (iii) the **participation rate** and (iv) the **cost** of OJT.

The results suggest that despite the positive association between OJT, productivity and innovation, companies active in Greece are not in general willing to invest in training. The structure of economic activity and the small size of Greek firms explain part of this training deficiency. The low level of productivity and competitiveness of the Greek economy could also, however, be due to the absence of OJT. Lack of OJT contributes to preserving the current composition of economic activity and prevents the introduction of innovative production and organisation processes condemning companies to a standstill.[10] Economic theory refers to additional potential explanations for underinvestment in OJT such as the fear that trained staff will be poached by companies who have not incurred the cost of training. Such explanations are not, however, applicable in the case of Greece.

The paper begins (Section 2) by summarising the predictions of economic theory on the decisions of companies and employees to invest in human capital. The next section (Section 3) outlines workplace training policies in Greece. Section 4 documents the main facts regarding the extent of OJT in Greece and in EU countries. Section 5 presents estimates of the relationship between OJT, productivity and innovation. Finally, Section 6 summarises and concludes.

2 ECONOMIC THEORY ON THE INCIDENCE AND TYPES OF ON-THE-JOB TRAINING

Economic theory on OJT has developed around two main questions: first, what explains the market failure of OJT provision. Second, which policy measures could enhance training supply. A comprehensive discussion on these issues can be found in Stevens (1999), upon which a large part of this section relies. The theory starts with Pigou (1912) and Becker (1962), who attribute limited training provision to the inability of employers to allocate part of the training cost to employees. More specifically, Becker distinguishes two types of training: *general training* which leads to general purpose skills and *specific training* which leads to skills useful only in some businesses. Under perfect competition in the labour market, the employer cannot share the cost of training with the employee since, if the employee is paid less than her marginal product of labour, she will quit. Besides, the employer cannot exclusively cover the cost of training since she cannot be certain that the employee will stay with the firm following the provision of training, i.e. when her productivity will have increased. It is thus possible that the employer does not recoup the benefit from training despite having paid for it. Employee turnover is higher, the more general the training provided. In the event of company-specific training, it is easier for the wage to be less than the marginal product, as no market for these skills exists. Becker thus predicts that employees assume the cost of general training (directly or indirectly via a lower wage).[11] Stevens in a series of articles (1994, 1996, 1999, 2001) questions whether firm-specific skills exist and supports the view that most skills are transferable, thus creating disincentives for businesses to provide training.

The fact that employees are credit-constrained (due to lack of resources, and because credit markets are incomplete and do not lend for human capital enhancement) also contributes to training underinvestment.

Acemoglu and Pischke (1998), however, on the back of data from Germany where companies provide general training, argue that labour markets are not perfectly competitive, thus creating conditions compatible with employer-

10 See Finegold and Soskice (1988) and Redding (1996).
11 This can only happen if an employee is paid at a wage higher than the minimum (see Acemoglu and Pischke, 2003).

funded general training. Acemoglu and Pischke assume that employers can prevent quits by paying higher-productivity employees more than the market wage.[12] This argument could also explain cross-sectional and cross-country differences in the provision of training. In sectors with high employee turnover, businesses have no incentive for training (see Blinder and Krueger, 1996). Furthermore, cross-country differences (for example between the US and Germany) in the extent of training in the same sectors could be attributed to the fact that in some countries (e.g. Germany) hirings and quits entail a larger cost and, therefore, businesses provide training in order to reduce labour turnover.

Under the hypothesis that skills are transferable between firms operating in the same sector, sector size becomes a key determinant of the degree of training. According to one view (see, for example, Acemoglu and Pischke, 1999; Gersbach and Schmutzler, 2006), in industries with highly concentrated firms make more profits and are thus more likely to train. On the other hand, Bassanini and Brunello (2010) argue that the likelihood of training and competition intensity are positively correlated; competition leads firms to train in order to increase productivity and lower costs. Another view gaining ground in the literature is that of complementarity between innovation and training. The idea was initially put forward by Finegold and Soskice (1988) and was later developed by Redding (1996). Finegold and Soskice (1988) express the view that the UK was trapped in a low-skills equilibrium, with firms of low production abilities generating poor quality products. They attribute these interrelationships between innovation, productivity and training to political and economic institutional factors (e.g. the organisation of production, industrial relations, the political system, etc.), including the education and training system. Redding (1996) puts forward an endogenous growth model in which the association between employees' skills and the quality of products is explained by a positive correlation between the existence of qualified personnel and innovation. In the Redding model both the rate at which skills develop and R&D expenditure impact on long-term growth prospects.

Most OECD countries follow policies to counteract the training deficit in their countries (see Chapter 5 in OECD, 2003, for a concise presentation). Policies can take the form of a mandatory contribution (calculated on the basis of either profits or the wage bill), the revenues from which are then allocated across businesses implementing training programmes (Belgium, France, Greece, Italy, Korea and Spain apply such policies). Alternatively, in other countries training courses are either directly subsidised from general tax revenues or organised at the industry level by manpower employment agencies. While the mandatory contribution, which is in turn redistributed, helps to deal with the reluctance of businesses to train, this could potentially lead to bad use of resources if training courses are not efficient. Thus, the literature recommends the use of targeted measures in dealing with the training deficit.

3 INCENTIVES FOR ON-THE-JOB TRAINING IN GREECE

The above suggest that economic and education policies can impact on the extent of OJT and its quality. In Greece, OJT is encouraged in a number of ways: first, by subsidising the cost of training courses;[13] second, by providing some tax relief – reducing the taxable income of companies by more than the amount spent on training; and third, by rebating to companies providing OJT their contributions for training purposes.

However, subsidised vocational training courses in Greece are mainly addressed to the

12 The salary is lower than the marginal product but higher than the market rate.

13 Details of the programmes subsidised by the Greek Manpower Employment Agency (OAED) are published in the Government Gazette.

unemployed and not to private sector employees.[14] Indicatively, as mentioned by Efstratoglou (2004), between 2001 and 2003 out of the 104 thousand individuals participating in CVT courses, none were employed in the private sector. Between 2004 and 2006 out of the 192 thousand individuals, 26% were employed in the private sector.

The payment and rebate of the contribution work as follows: private sector employers registered with the main pension fund IKA pay a so-called training contribution equal to 0.45% of their wage bill.[15] This contribution is rebated to employers in full in order to fund training courses.[16] Businesses which do not train within a given year may claim rebates for two consecutive years in the following year. For small businesses, employing 1-25 employees, since the amount of the rebate falls short of the amount required to organise in-house training, courses are organised for a group of companies locally.[17] By construction, the rebate scheme implies that businesses which do not train subsidise those that do. This would also be the case if training were subsidised out of general tax revenues, but it is remarkable that most businesses do not wish to benefit from training, despite having explicitly paid for at least part of it.[18] In 2007, out of the funds collected through the training contribution, around 25% was rebated to businesses for training, 13% was spent on training programmes of small enterprises, while a very small amount (0.2%) was spent on training the self-employed. The remainder (and the largest part) was spent on the training of unemployed individuals.[19]

Training courses can be organised either by the firm itself or by third-party organisations (e.g. Universities, public educational organisations, private education establishments, private businesses with main activity other than education, employers' associations, Chambers of Commerce, the Manpower Employment Agency – OAED, etc.). Third-party organisations receiving public funds to organise and implement on-the-job training programmes form part of the National Network of Life-Long Learning Framework under Law 3879/2010.

For companies to receive the training contribution rebate, OJT courses must meet certain formal requirements set by the Manpower Employment Agency – OAED. As regards programmes organised within the firm, the requirements set by OAED concern the qualifications of trainers,[20] as well as the type, the duration and the average hourly cost of funded programmes.[21] For programmes organised outside the firm, the bodies in charge, through vocational training centres, must be certified by the National Accreditation Centre for Continuing Vocational Training (EKEPIS). More recently, the Ministry of Education, Life-long Learning and Religious Affairs in the context of Law 3879/2010 on the "Development of life-long learning and other provisions" set up the National Organisation for Accreditation of Qualifications and Vocational Guidance (EOPPEP) to contribute to the accreditation of qualifications provided through the non-formal education system. EOPPEP is in charge of referencing the qualification levels in Greece to those in the European Qualifications Framework (EQF) and will also serve as a quality assurance body.

14 These structures are also used for training public sector employees.
15 The rate was introduced with the 1998 National General Collective Labour Agreement. Initially, the contribution was set at 0.2% of labour costs (on which contributions are calculated), effective as from 1994; however, this rate was later increased to 0.45% (Article 14 of Law 2224/1994 and Article 10 of Law 2336/1995). The revenues from these contributions are placed in a special account managed by the Manpower Employment Agency (OAED) and are used to subsidise training.
16 Administrative expenses of OAED for the monitoring of such courses are covered by an amount equal to 10% of the contribution for training. The reimbursement of the training contribution to companies is not considered as revenue and is exempt from any tax liability (par. 5 of Article 1 of Law 2434/96, as replaced by par. 6 of Article 15 of Law 3762/2009).
17 For 2011 the amount stood at EUR 25 million and was distributed to prefectures on the basis of their population. For the prefecture of Attica this amount stood at EUR 5.5 million.
18 This is also clear from data presented further on.
19 http://www.gsee.gr/userfiles/file/2007_NEWS_KEIMENA/2007_04_12_laek.pdf.
20 Trainers must be registered either with OAED or with the National Centre for Qualification of Life-Long Learning.
21 For example, long-distance courses are not covered, the maximum duration of training per trainee is set at 100 hours per year and the average hourly cost of courses organised by third parties cannot exceed 33 hours per trainee.

Table 1 Employees' views on aspects of life-long learning (LLL) (% of employees agreeing with each statement)

	Absolutely agree	Agree up to a point	Neither agree nor disagree	Disagree	DK/NA	Total
The objective of LLL is to reduce the probability of becoming unemployed	37.6	32.9	17.8	7.6	4.1	100.0
The objective of LLL is to improve one's career prospects	50.0	33.9	9.5	2.8	3.8	100.0
Non-formal education and training must be provided by employers	38.9	33.2	17.5	5.8	4.6	100.0
Skills to improve career prospects cannot be obtained in a classroom	36.7	29.9	15.8	13.0	4.6	100.0

Source: ELSTAT, *Adult Education Survey (AES)* (Question 180 – percentages have been grossed up to the population).

Businesses wishing to implement a training programme submit their proposal to OAED which checks whether prerequisites are met without, nevertheless, restricting the field of training. OAED also monitors the execution of the programme. OAED, however, does not set any efficiency targets, despite findings in the literature (see Eddington and Eddington, 2010) that efficiency targets constitute an important determinant in reducing wastage.

As for the provision of *initial vocational training*, OAED organises apprenticeship programmes for the students of Vocational Training Schools. OAED operates 51 training schools where each year 12 thousand graduates of at least the first year of upper high school, aged 16-23, study. Courses last 4 semesters and include internships in businesses for 4-6 days per week. Students are paid 70% of the minimum wage (i.e. EUR 23.1 per day in the first semester of 2011) for the length of the initial training period. Businesses receive a daily subsidy for each apprentice.[22] The subsidy was doubled from EUR 6 to EUR 12 from 1 January 2011 to encourage apprenticeships.

According to OAED, apprenticeship programmes have a positive impact on transition from schooling to employment: around 70% of apprentices find a job following the expiration of such programmes.[23]

4 ON-THE-JOB TRAINING IN GREECE AND IN OTHER EU COUNTRIES: EXTENT, CONTENT AND TYPE

Employees acknowledge the value of constantly enriching their knowledge and improving their skills, as suggested by the evidence presented in Table 1.[24] The majority adopts a positive stance towards continuous education as a means for improving one's career prospects, while a significant percentage considers employees' training to be employers' responsibility.

Despite the above, there is a deficit of OJT, as mentioned in the Introduction and documented in this section. Only a limited percentage of firms provide OJT. In firms that provide training, however, the percentage of employees participating in training is not negligible. The participation of employees in OJT programmes differs by age and educational level. Businesses that provide OJT do so on a regular basis (e.g. annually). The likelihood of OJT is higher in sectors in which average tenure is relatively long. OJT is usually organised via external courses of general content and short duration. The cost of OJT is moderate and more than half the firms providing training received a sub-

22 The subsidy can also be paid directly to the student.
23 See http://epas.oaed.gr/main.php?cat=1&menu_id=4.
24 The data refer rather to the broader concept of life-long learning.

sidy to this effect. In comparison to other EU countries, the incidence of OJT is lower in Greece; nevertheless, the participation of employees in OJT is not much lower.

On-the-job training in Greek firms

I. Extent: incidence, participation rate and duration

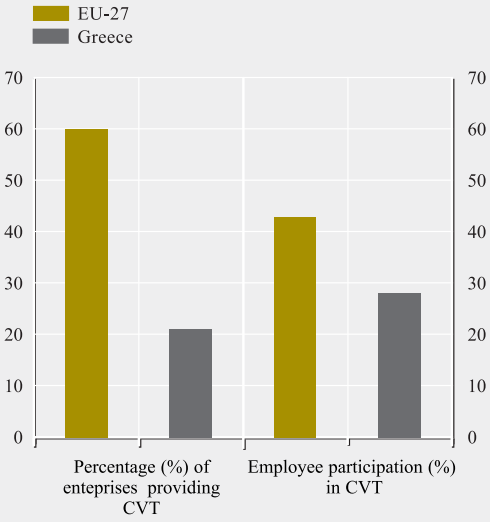
(a) OJT incidence

In 2005 around 21% of Greek firms (employing over 10 individuals) provided some kind of pre-arranged OJT (see Chart 1).[25] OJT incidence varies with firm size, as indicated in the first column of Table 2 which presents the marginal effects from estimating a probit model of OJT incidence. The positive association between the probability of training and firm size is attributable (see, *inter alia,* Goux and Zamora, 2001) to (i) the ability of large enterprises to replace those on training during their absence, and (ii) their easier access to training funds.

In addition, OJT incidence varies across sectors (see col. 2 of Table 2). OJT incidence is lower in sectors with high employee turnover (e.g. hotels and restaurants, construction), while in financial services, where tenure is longer and the introduction of new technologies ongoing, the percentage of firms providing training is high. The relatively high percentage of training in firms active in distribution trade is probably related to technological upgrades. OJT incidence in distribution trade exceeds national averages in most EU-27 countries (see Table A2). The hypothesis that OJT and employee tenure are associated cannot be rejected; replacing industry dummies with a variable to measure employee turnover (the percentage of employees in each sector with a tenure shorter than 3 months), this variable takes on a negative coefficient (results are not illustrated in Table 2), while coefficients on the other variables are not affected.

Furthermore, column 3 of Table 2 suggests a positive association between OJT and innovation. Firms reporting the introduction of new products/services/methods in 2005 (23% of firms) appear to have a higher probability of training their staff. Causality, however, could also run the other way, although the sign would still be the same since firms that perform on-the-job training are more likely to innovate.[26] Finally, the results in column 4 of Table 2 imply that firms providing OJT once are very likely to do so systematically.

Chart 1 Extent of Continuing Vocational Training (CVT) - percentage of enterprises providing CVT and employee participation in training in these enterprises (2005)



Source: Eurostat, *Continuing Vocational Training Survey-CVTS3.*

(b) Participation rate in OJT programmes

Among firms providing OJT the participation rate of employees is close to 30% (see Chart 1). This rate varies between 11% in the construc-

25 The ELSTAT survey uses the term Continuing Vocational Training (CVT) rather than On-the-Job Training (OJT). ELSTAT defines CVT as "...pre-arranged training that was at least partially funded by the organisation, addressed to employees having a contractual relationship with the firm. Informal training and initial vocational training addressed to apprentices and trainees are excluded". As a result, the two terms are used interchangeably herein.

26 The conditional (on firm size and sector of economic activity) association between OJT in 2004 and innovation in 2005 is positive and quite high: firms providing OJT in 2004 were by 20 percentage points more likely to innovate in 2005.

Table 2 Probit results – dependent variable CVT provision[1,2]

(marginal effects)

Variables	(1) Only firm size	(2) Add sector of economic activity	(3) Add innovation	(4) Add incidence of CVT in the previous year
Firm size				
10-49 employees		Reference group		
50-99 employees	0.193*** [0.027]	0.199*** [0.028]	0.194*** [0.028]	0.103*** [0.031]
100-249 employees	0.315*** [0.029]	0.323*** [0.029]	0.300*** [0.029]	0.149*** [0.035]
250-499 employees	0.493*** [0.033]	0.499*** [0.033]	0.470*** [0.035]	0.202*** [0.051]
500-999 employees	0.597*** [0.036]	0.598*** [0.037]	0.566*** [0.045]	0.306*** [0.069]
1,000+ employees	0.688*** [0.025]	0.683*** [0.027]	0.666*** [0.035]	0.422*** [0.093]
Sector of economic activity				
Manufacturing		Reference group		
Mining-quarrying		0.066 [0.055]	0.076 [0.056]	0.043 [0.053]
Electricity, gas, water supply		0.070 [0.067]	0.136* [0.071]	0.088 [0.076]
Construction		-0.063* [0.036]	-0.029 [0.039]	-0.017 [0.042]
Trade		0.086*** [0.024]	0.088*** [0.024]	0.056** [0.028]
Hotels and restaurants		-0.095*** [0.029]	-0.090*** [0.029]	-0.043 [0.036]
Transport		0.001 [0.036]	0.010 [0.038]	0.009 [0.042]
Post and telecommunications		0.092 [0.069]	0.099 [0.072]	0.019 [0.072]
Financial intermediation		0.359*** [0.060]	0.359*** [0.060]	0.206** [0.081]
Business activities		0.113** [0.049]	0.130*** [0.048]	0.049 [0.049]
Services n.e.c.		0.018 [0.061]	0.041 [0.063]	0.031 [0.077]
Other features of the firm				
Introduction of new products/methods/services			0.257*** [0.022]	0.187*** [0.026]
CVT in the previous year				0.697*** [0.019]
Number of observations	3,110	3,110	3,110	3,110
Observed probability[3]	0.285	0.285	0.285	0.285
Estimated probability	0.269	0.266	0.259	0.240
Pseudo- R^2	0.138	0.157	0.197	0.449

1 The dependent variable is derived from the replies to questions B1 and B2 in the ELSTAT *2005 Annual Continuing Vocational Training Survey in Enterprises*. The dependent variable takes the value 1, if at least one employee in the firm participated in continuing vocational training (CVT) in 2005 and the value 0 if no employee participated in CVT in the same year.
2 Standard errors corrected for heteroscedasticity in parentheses. Statistical significance at 1%, 5% και 10% indicated by ***, ** and * respectively.
3 The observed probability reported here has not been grossed up to the population, contrary to the probabilities reported in the appendix tables presenting cross-country evidence.

tion sector and 45% in financial services (see Table A4). In contrast with OJT incidence, the percentage of participants is higher in smaller enterprises (see Table A3), perhaps because small units are more homogeneous in occupational structure.[27]

(c) Duration of OJT programmes

The average time spent in training is 25 hours per year (i.e. just over 3 days) with little variation across firm sizes or sectors of economic activity.[28] However, this average value is influenced by high outlier observations. The median duration value is 6 hours lower, or around 19 hours per year (i.e. about 2.4 days per year).[29] The above imply that the length of training programmes is much shorter than the limit set by the OAED subsidy.

II. Characteristics of participants in OJT

The probability of participating in training programmes is not uniform. As far as OJT is concerned, this is probably a result of employers' choices, since the participation in the relevant programmes, in contrast with life-long learning programmes outside the workplace, is mandatory.

The *CVTS* only collects data on distribution by gender and age of participants in the companies surveyed.[30] The data suggest that there is no difference in participation by gender. The age distribution of participants however suggests that younger individuals participate in training programmes to a larger extent. More detailed information on the demographic and productivity characteristics of participants is provided in the *Adult Education Survey (AES)*. The *AES* confirms findings in the literature (see *inter alia* Bassanini *et al.,* 2007; Blundell, Dearden and Meghir, 2006; Asplund, 2005; Kanellopoulos and Papakonstantinou, 2005) which suggest that the probability of participating in OJT is associated negatively with age and positively with the educational level of the participant (see col. 1 of Table 3). Given that such training is in-house and that, as already mentioned, participation is probably not optional for employees, it is likely that age and educational level influence employers' decisions. The result regarding age is explained by the fact that firms can reap more benefits from training younger individuals. However, while age has a negative impact on the participation of individuals of both genders, it is statistically significant only for women. A particularly low educational level (primary school certificate) impacts negatively on training participation only for men. The negative impact of a post-graduate classification on training participation is not statistically significant.[31] For women, on the other hand, the educational level does not appear to have an impact on training participation. Participation by sector confirms in general the results in Table 2: participation is highest in financial services and lowest in construction. The results also suggest that those employed with fixed-term contracts have a lower chance of OJT.

III. Types of OJT, training subjects and the extent of initial vocational training

(a) Types of OJT

The *CVTS* distinguishes between "Training courses" and "Other types of training" (e.g. individualised training at the workplace, job rotation, conference attendance). Most companies follow both types of training.

Training courses are distinguished according to whether they have been organised by the com-

27 It is also possible that in small firms the need to avoid discrimination is more compelling.
28 The time spent in training, according to CVT data, is much less than that reported in OAED-funded individual company programmes. Consistent data for other countries are not readily available; however, Bartel (1995) reports that at the beginning of the 1990s in US firms the average time spent in training was 4 days per year.
29 It should be noted that the (arithmetic) average is derived from Eurostat data, while the median is derived from individual-level data. While the data from Eurostat cannot be replicated from individual-level data, the gap between mean and median is also confirmed by individual-level data.
30 Information on the nationality and the presence of staff with special needs is not detailed enough to use.
31 The impact of age and training of employees on educational activities outside the firm is generally more clear-cut (see, for example, Bassanini *et al.*, 2007).

Table 3 Probit results – dependent variable employee participation in CVT [1,2]

(marginal effects)

Variables	(1) Basic specification	(2) Men only	(3) Women only
Demographic features			
Age	-0.001** [0.000]	-0.001 [0.000]	-0.002* [0.001]
Gender (men=1)	-0.007 [0.009]		
Greek nationality	0.037*** [0.007]	0.028*** [0.008]	0.052** [0.010]
Highest education level attained			
Upper secondary	Reference group		
PhD or post-graduate studies	-0.004 [0.025]	-0.025 [0.010]	0.087 [0.098]
Tertiary education	-0.012 [0.011]	-0.015 [0.011]	-0.013 [0.023]
Higher vocational school	0.012 [0.012]	0.012 [0.014]	0.010 [0.023]
Lower secondary	-0.015 [0.010]	-0.009 [0.011]	-0.026 [0.020]
Primary school	-0.023** [0.009]	-0.023** [0.009]	-0.022 [0.021]
Firm size			
1-10 employees	Reference group		
11-19 employees	0.053*** [0.018]	0.037** [0.018]	0.082*** [0.038]
20-49 employees	0.095*** [0.033]	0.087*** [0.040]	0.122*** [0.056]
50+ employees	0.088*** [0.025]	0.065*** [0.024]	0.142*** [0.062]
Sector of economic activity			
Trade	Reference group		
Mining-quarrying	0.105 [0.078]	0.092 [0.072]	
Manufacturing	-0.011 [0.009]	-0.012 [0.010]	-0.012 [0.019]
Electricity, gas, water supply	-0.025** [0.013]		0.032 [0.082]
Construction	-0.024 [0.011]	-0.023* [0.011]	
Hotels and restaurants	-0.004 [0.015]	-0.008 [0.016]	0.005 [0.033]
Transport. storage and communication	-0.004 [0.013]	-0.008 [0.012]	0.007 [0.036]
Financial intermediation	0.153*** [0.056]	0.150*** [0.070]	0.172*** [0.097]
Real estate, renting and business activities	-0.007 [0.012]	-0.002 [0.016]	-0.019 [0.020]
Other services	0.006 [0.023]	0.019 [0.033]	-0.010 [0.031]
Other features of job			
Fixed-term contract	-0.028** [0.008]	-0.032** [0.006]	-0.025 [0.019]
Number of observations	2,684	1,743	894
Observed probability	0.0616	0.0557	0.0761
Estimated probability	0.0366	0.0310	0.0471
Pseudo-R^2	0.154	0.159	0.166

1 The dependent variable is derived from the replies of employees to Question 54 of the ELSTAT *Adult Education Survey (AES)*. The dependent variable takes the value 1 if the employee states that in the course of the last 12 months he/she has received training at the workplace.
2 See Note 2 of Table 2.

Table 4 Distribution of CVT hours by training field [1]

Training field	%
Accounting, finance, management and administration, and office work	17.9
Computer science and computer use	17.5
Engineering, production and construction	16.2
Sales and marketing	16.1
Environment protection, professional health and safety	6.6
Languages: foreign and mother tongue	5.6
Personal development and working life	3.8
Personal services, transport services, etc.	2.1
Other training subjects	14.2
Total	100.0

Source: ELSTAT, 2005 *Annual Continuing Vocational Survey in Enterprises* (Question C6).
1 The distribution is based on the total number of hours of CVT in all firms providing CVT.

pany itself or by third parties. More than half the companies (56.5%) offering training programmes do so only through externally organised courses, about a third (30.1%) provide both externally and internally organised courses, while the remainder (13.4%) provides only internally organised courses.

From the *Other types of training*, the most common is conference attendance, followed by individualised in-house training within standard working hours.

The distinctions reported above are of relevance because they provide an indication for the skills which are obtained through training programmes. Externally organised programmes, offered by most companies, pertain to the acquisition of general and transferable skills. This is a conclusion also reached from information on the content of training programmes.

(b) Content of vocational training programmes

Table 4 presents the distribution of training hours by subject. The most popular training subjects are those related to the "production process" itself (e.g. accounting, engineering, construction, etc.), the use of computers, marketing and sales techniques.[32]

(c) The extent of initial vocational training

Incidence of initial vocational training (IVT) —defined as training addressed to apprentices, of at least 6 months and ensuring a certificate of attendance— is even lower than that of OJT; less than 5% of businesses provide IVT.

IV. The cost of OJT

According to CVTS 2005 data, businesses offering any kind of vocational training report that the two aspects of economic policy that affect the company's training strategy are subsidy of the cost of training and accreditation of the training provided. Publicly funded advisory programmes aimed at identifying training needs, procedures to ensure trainers' qualification standards, as well as tax relief on training expenditure have less of an impact on a firm's training policy.

32 The distribution of training hours by subject is closely correlated with the distribution of training incidence by subject.

The average (median) cost per participant in OJT courses amounts to EUR 475. This cost, not taking into account the opportunity cost of the time spent in training, corresponds to around 0.5% of a firm's total labour costs. A significant percentage of firms offering OJT (56.8%) receive some kind of subsidy. The subsidy covers over half of the training cost for 3/4 of the firms, while most of the subsidised firms report that the subsidy shaped their decision to offer OJT. However, around 1/4 of total firms believe that the potential receipt of a subsidy had no influence on their decision and, furthermore, they report that they receive no subsidy whatsoever.

Ideally, in order to find out how the cost of training is allocated between employers and employees, data are required on wages and salaries, as well as on the non-observable skills of all employees. In the absence of such data, we restrict ourselves here to data from the AES which show that the salaries of participants in OJT are *ceteris paribus* (conditional on demographic and productive features) higher than non-participants' by 7%.[33] This result could be taken to suggest that employers are burdened with the cost of training rather than employees; nevertheless, it is not possible to safely conclude this since we have no data on non-observable skills.

V. Certification and evaluation of OJT

According to AES data, approximately 1/4 of the employees who followed a job-related training course received some kind of certificate of attendance. This share is much lower than that receiving a certificate of attendance in non-job related training (60%). However, around 56% of firms (see Table 5) report that they (always or frequently) evaluate the impact of training programmes on the professional performance of *employees*, while some 43% of firms assess the impact of OJT on *business* performance.

The above is suggestive of the asymmetry of information that exists between the current and the future employer who cannot know the extent and quality of OJT, since a lot of training courses are not certified.

On-the-job training in European Union (EU) countries

Chart 1 and Table A1 suggest that the share of companies in Greece providing OJT is not only lower than the EU-27 average but is the lowest across the EU-27. Data, which are not detailed here, show that this gap appears not only for OJT courses but also for other forms of training (conference attendance, job rotation, individualised training at the workplace). A gap is also noticeable with respect to employee participation in companies providing training in Greece, compared with the EU-27 average (see Chart 1 and Table A3). Given the positive correlation between firm size and incidence of training provision, as presented in Table 2, it is possible that the lower incidence of OJT training of companies located in Greece is due to the significantly higher percentage of small firms in the Greek economy. However, the gap between the Greek and the EU-27 average can be observed in every size class (see Table A1). For instance, if the distribution of businesses by size in Greece was similar to that in the Czech Republic but the percentage of firms in Greece providing OJT in each size class remained unchanged, then the overall OJT provision would come to 25.6% (against 21%), i.e. still considerably lower than the EU-27 average.[34]

Furthermore, the gap between the Greek and the EU-27 average cannot be entirely due to the composition of economic activity in Greece (lower shares of manufacturing and electricity, gas and water supply, where training is in general more prevalent, against a higher share of hotels and restaurants, where lower training rates are observed).[35] This is evidenced (see

33 The difference is statistically significant.
34 Data for the distribution of firms by size class are from the OECD, *Structural and Demographic Business Statistics 2009* (2010). The data for the distribution of value added by sector of economic activity are national accounts data from Eurostat.
35 Spearman's rank correlation coefficient between training incidence by sector in Greece and in other EU countries is high and statistically significant for most pairs of countries.

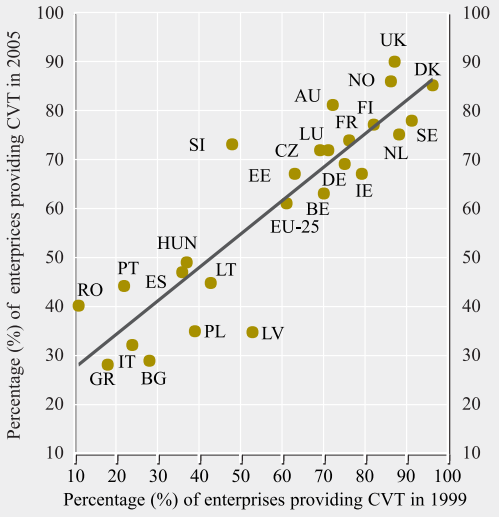
Table 5 Assessment of training courses

(% of enterprises)

Method of evaluation	Frequency				
	Always	Often	Occasionally	Never	Total
Following the training event, the enterprise measures participants' satisfaction with the training	25.8	25.8	27.9	20.5	100.0
Following the training event, the enterprise assesses whether participants acquired the targeted skills	20.9	28.5	28.0	22.6	100.0
Following the training event, the enterprise assesses participants' occupational behaviour and/or performance	22.6	33.4	28.7	15.3	100.0
Use of indicators to evaluate the impact of training on company performance	15.8	27.7	30.6	25.9	100.0

Source: ELSTAT, *2005 Annual Continuing Vocational Survey in Enterprises* (Question D4).

Chart 2 Percentage of enterprises providing CVT in 1999 and 2005[1]



Source: Eurostat, *Continuing Vocational Training Surveys - CVTS2* and *CVTS3*.
1 The regression specification is $CVT_{05}=20.4+0.68CVT_{99}$ ($R^2=0.80$).

Table A2) by the size of the gap against Greece in all sectors. More specifically, if the composition of economic activity in Greece corresponded to the average of the EU-27, then the gap would narrow but would not be eliminated. In this case, around 30% of companies would provide OJT, relative to 21% at present.

The persistence in the supply of on-the-job training, which was indicated by the results in Table 2, is corroborated by Chart 2, showing the association between the rate of companies providing OJT in 1999 in each of the 26 countries and the corresponding rates for 2005.

5 ON-THE-JOB TRAINING AND PRODUCTIVITY

Over 43% of companies providing OJT assess the impact of training on business performance, as already mentioned in the previous section. The assessment is conducted with the use of suitable indicators such as delivery and production times (see Table 5). Given that around 60% of companies proceeding to this evaluation provide OJT on a regular basis (in the three consecutive years 2004-6), one could assume that they probably regard the impact of training positively.

The relationship between OJT and productivity is being explored both directly and indirectly through the impact of training on wages. While the impact of training on wages is an indicator of its impact on productivity only under certain assumptions (perfect competition in the labour market – see Dearden *et al.*, 2006, for a discussion), most available evidence is on the indirect channel. The direct channel,

Table 6 Studies on the association of CVT with productivity

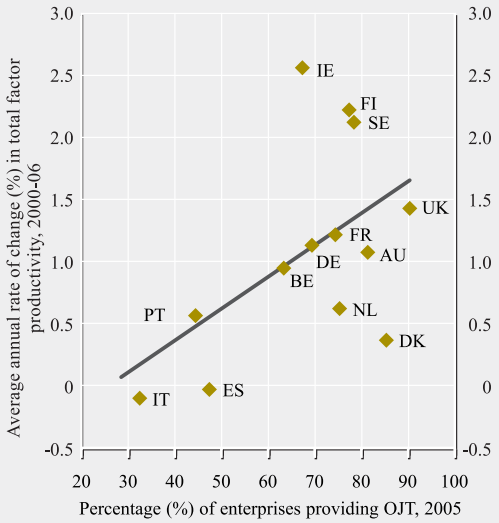
Authors	Methodology – Data	Results
Industry-level data		
Conti (2005)	The relationship between CVT (percentage of firms) and productivity and CVT and earnings in Italy (1996-99) is estimated using industry panel data.	CVT appears to be positively associated both with productivity and earnings. The association with productivity appears robust to alternative econometric specifications.
Dearden, Reed, Van Reenen (2006)	The relationship between CVT (employee participation) and productivity and CVT and average wages in the UK (1983-96) is estimated using industry panel data.	An increase in the percentage of employees participating in CVT by one percentage point leads to an increase of 0.6% in hourly productivity. In comparison, the impact of CVT on earnings is weaker.
Firm-level data		
Bartel (1995)	Data on productivity, participation in CVT courses and duration of these courses for a large US manufacturing firm over the period 1986-90.	Employees are selected into training by employers based on their ability (increased participation rate amongst the most able). Supervisors assess that CVT has a positive impact on performance.
Lynch and Black (1995)	Productivity, CVT incidence and CVT participation rate by training field and level of employees' education. Firm-level data for US firms.	CVT incidence is higher in firms that have invested more in physical capital or have hired workers with higher average education. Positive association between CVT participation and productivity.
Barrett and O' Connell (2001)	Survey data from enterprises in Ireland during 1993-95 are used to estimate the productivity impact of training by type (general, specific).	General CVT appears to have a stronger positive impact on productivity than specific CVT. A possible explanation is the different reaction of employees.

Sources: Individual articles - full citations can be found in the references.

selected articles of which are summarised in Table 6, finds a positive impact of training on productivity at the aggregate, industry and firm level. The evidence presented in Chart 3 corroborates the existence of a positive association between on-the-job training and productivity performance at the macro level. Countries with a higher share of firms offering on-the-job training exhibit a higher annual growth rate of multi-factor productivity. A rise of 10 percentage points in the share of firms offering OJT increases the annual growth rate of multi-factor productivity by 0.25 percentage point.[36] As expected, OJT alone is not an exhaustive explanation of cross-country differences in productivity growth, with R&D expenditures also providing clues. On the basis of the information presented in Chart 3 and data on R&D expenditure (see Table A9), we can distinguish 4 groups of countries. The first group includes countries with extensive OJT and high R&D expenditures (e.g. Finland and Sweden) located above the regression line on the right-hand side of the Chart. The second group comprises countries with extensive OJT but lower R&D expenditures (e.g. Denmark and the UK) located under the regression line on the right-hand side of the Chart. The third group includes countries that, despite limited OJT and R&D expenditures, have a good productivity performance (Ireland), while the last group includes countries (Italy, Portugal, Spain) that have a poor record of OJT, R&D and productivity growth. There is also a strong

36 Greece is not included amongst the countries in Chart 3, due to lack of OECD data on total factor productivity (TFP) change. However, despite the fact that the estimated rate of change in TFP during the period of investigation is high (see, for example, Albani *et al.*, 2010; Nicolitsas, 2005), the observation for Greece would constitute an outlier and would not be consistent with the positive association described.

Chart 3 Average annual rate of change in total factor productivity (2000-2006) and percentage of enterprises providing CVT (2005)[1]



Sources: Eurostat, *Continuing Vocational Training Survey - CVST3* for the percentage of enterprises providing CVT and OECD, Productivity Database for the rate of change in total factor productivity. For Belgium and Portugal, productivity refers to the periods 2000-04 and 2000-05, respectively.
1 $Productivity_{00\text{-}06}$=-0.64+0.0256$CVT_{05}$ (R^2=0.28).

negative association between OJT and the percentage of employees who have completed primary school only. Since this variable is strongly linked to OJT, it does not have additional explanatory power in the regression of Chart 3.

The positive association between OJT and productivity is verified at the sectoral level. Table 7 illustrates the point using data from two-digit (according to NACE rev.1) sectors in Greek manufacturing. The first column shows the correlation between the logarithm of labour productivity in each sector for 2006 and the extent of OJT for the previous year, conditioning on both the level of investment and the percentage of employees with tertiary education in the sector for 2005. The results suggest a statistically significant association between job training and labour productivity. The direction of causation is, however, not clear (see, for example, Zwick 2006), as it is firms/sectors with high productivity that also have more resources to spend on training. The use of OJT data for the previous year may not completely eliminate endogeneity, since OJT is autocorrelated. In an effort to deal with the issue, the present study instruments OJT in year (t-1) using as instruments the extent of training two years earlier, as well as the percentage of firms in each sector receiving a training subsidy one year earlier. The results in column 2 of Table 7 show that both the significance and the size of the coefficient on the OJT variable are retained.

Moreover, the data, although not presented in Table 7, show that there is an association between OJT and innovation. If the extent of innovation in the sector —proxied by the percentage of firms introducing new products/methods/services in 2005— is also included in the regression, then OJT is no longer statistically significant. The positive association between innovation and OJT is, however, illustrated in the last column of Table 6 where the dependent variable is the proportion of firms in each sector having introduced new products/methods/services in 2005. The regression also includes the inverse of the number of firms in the sector (1/N) in order to control for the market structure of the sector (the larger the number of companies in the sector, the lower the inverse and the more intense the competition). This variable is, however, not significant.

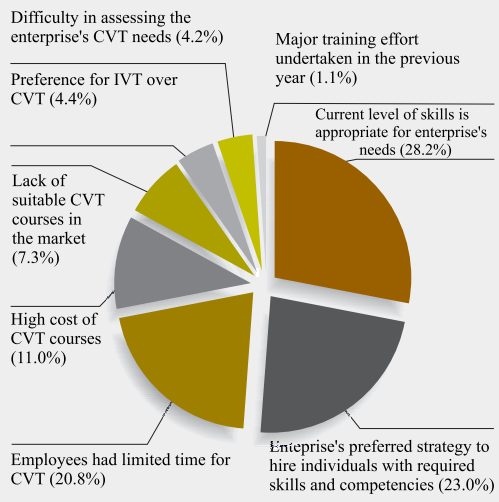
The view that companies do not proceed with OJT if they are not planning to upgrade their product is corroborated by the reasoning provided by businesses. Chart 4 presents the reasons which shaped businesses' decision not to provide OJT. The high percentage of companies reporting that the existing skills of the personnel are adequate for the company's current needs suggests a limited interest in development and innovation. An analysis of variance results implies that in general the replies of companies do not differ by company size but they differ by sector of economic activity.

Table 7 Productivity, innovation and CVT in manufacturing[1]

	(1)	(2)	(3)
	$\ln(Y/L)_{06}$	$\ln(Y/L)_{06}$	$Innovation^{4}_{06}$
	OLS[2]	IV[3]	
CVT_{05}	1.260*** (0.372)	1.548*** (0.388)	
CVT_{04}			3.022*** (0.807)
(1/N)			3.665 (4.716)
Innovation	6.482*** (1.030)	6.352*** (0.998)	-1.770*** (0.209)
Number of observations	21	21	21
R^2	0.489	0.480	–

1 The dependent variable in the first two columns is the log of value added per employee in each of the 21 two-digit (NACE Rev.1) manufacturing sectors. The source of the data is the ELSTAT *Annual Industrial Survey*. In the third column the dependent variable is the percentage of enterprises which introduced new products/methods/services in 2005.
2 In the first two columns the right-hand side variables include the logarithm of the level of capital investment in 2006 and the percentage of employees who have completed tertiary education in 2004.
3 Two instrumental variables are used: the percentage of firms in each sector providing CVT in 2004 and the percentage of firms in each sector having received a training subsidy in 2005.
4 The specification in the last column is estimated through GLM since the dependent variable is a percentage.

Chart 4 Reasons for not providing CVT (% of enterprises)[1]



Source: ELSTAT, 2005, *Annual Continuing Vocational Training Survey in Enterprises* (Question E1).
1 Firms were asked to report the three most important reasons influencing their decision for the non-provision of CVT. Percentages have been adjusted to add to 100.

6 SUMMARY AND CONCLUSIONS

OJT shares, to some extent, features of a public good and quite a few economies exhibit a training deficit. This deficit is stark in the Greek economy, with only 21% of businesses that employ more than 10 persons providing OJT, compared with 60% in the EU-27. Training incidence varies by company size —large enterprises are more likely to provide training— and by sector of economic activity – the probability of training is higher in financial services and lower in hotels/restaurants and the construction sector. Training incidence is positively associated with employee turnover.

The content of training programmes is related to the production process of the sector in which the company is active but is rather general and transferable to other firms.

Most businesses offering OJT evaluate this positively, given that they train regularly. Sim-

ilar to already existing evidence in the literature, the analysis in this paper finds that OJT leads to an increase in productivity and therefore in companies' competitiveness. Furthermore, it finds a positive two-way association between OJT and innovation; companies introducing innovations are more likely to provide OJT and those offering OJT more likely to innovate.

Despite this finding, most firms active in Greece do not appear to be convinced of the usefulness of OJT. They are rather of the belief that the existing skills and competences of their employees meet the current needs of their organisation. This behaviour, however, is compatible with stagnant enterprises.

The prevalence of small firms and the composition of economic activity in Greece explain part but not the whole of the gap between Greece and EU-27 in the incidence of OJT. Simplification of the system of financial subsidies towards the cost of training, together with more extensive information on other public policy initiatives to encourage training and with the evaluation of the effectiveness of OJT, are likely to lead to more extensive training.

APPENDIX

Table A1 Percentage of firms providing continuing vocational training (CVT) by enterprise size (all enterprises), 2005[1]

Country	All enterprises	By enterprise size (number of employees)				
		10-49	50-249	250-499	500-999	1000+
UK	90	89	92	95	99	99
Norway	86	86	88	99	89	77
Denmark	85	83	96	99	97	100
Austria	81	79	91	98	100	100
Sweden	78	74	95	99	100	100
Finland	77	73	89	92	98	93
Netherlands	75	71	88	94	98	98
France	74	69	98	100	100	100
Slovenia	73	67	85	96	100	98
Czech Republic	72	66	93	100	100	100
Luxembourg	72	68	85	-	-	-
Germany	69	65	81	82	89	97
Estonia	67	62	85	98	94	100
Ireland	67	61	86	-	-	-
Belgium	63	58	86	99	100	100
EU-27	**60**	**55**	**78**	**88**	**93**	**97**
Slovakia	60	56	74	90	91	99
Hungary	49	42	77	85	95	99
Spain	47	43	68	87	89	95
Lithuania	46	40	64	84	93	96
Portugal	44	39	70	88	92	98
Romania	40	36	50	66	77	91
Latvia	36	31	56	70	84	88
Poland	35	27	55	76	84	89
Italy	32	29	58	82	87	97
Bulgaria	29	24	44	58	67	64
Greece	**21**	**16**	**39**	**62**	**79**	**90**

Source: Eurostat, *Continuing Vocational Training Survey - CVTS3.*
1 Countries ranked in decreasing order of CVT provision rate (first column).

Table A2 Percentage of enterprises providing continuing vocational training (CVT) by sector of economic activity (all enterprises), 2005[1]

Country	By sector of economic activity[2]											
	All enterprises	Mining - quarrying	Manu-facturing	Electricity, gas, water supply	Construction	Trade	Hotels and restaurants	Transport	Post and telecommuni-cations	Financial intermedia-tion	Real estate, renting and business activities	Other services
UK	90	93	88	89	86	87	89	82	89	96	98	92
Norway	86	85	85	91	88	91	62	74	98	95	98	73
Denmark	85	64	79	100	84	93	58	68	71	99	91	100
Austria	81	79	82	99	84	85	70	64	90	99	87	82
Sweden	78	75	76	100	74	79	59	78	77	97	90	70
Finland	77	44	69	90	68	77	66	72	86	91	98	79
Netherlands	75	84	75	100	81	71	57	67	62	89	82	76
France	74	76	75	99	59	74	66	75	61	92	82	79
Slovenia	73	88	74	86	58	75	50	69	73	79	78	91
Czech Republic	72	86	73	90	78	69	49	70	80	80	73	85
Luxembourg	72	-	70	-	-	71	-	-	-	92	92	91
Germany	69	69	71	92	56	70	53	58	60	99	81	78
Estonia	67	72	68	80	61	64	61	70	66	85	76	61
Ireland	67	-	70	-	-	62	-	-	-	94	-	60
Belgium	63	72	68	95	46	64	43	62	77	96	76	57
EU-27	**60**	**54**	**54**	**79**	**53**	**60**	**49**	**57**	**63**	**88**	**75**	**70**
Slovakia	60	73	61	91	59	60	30	69	78	90	65	67
Hungary	49	40	48	83	44	50	30	42	70	88	58	52
Spain	47	44	48	59	42	52	32	44	48	79	54	47
Lithuania	46	62	44	79	55	44	27	40	50	85	56	55
Portugal	44	42	37	89	38	49	38	55	89	88	68	48
Romania	40	41	39	66	38	40	34	44	39	51	53	42
Latvia	36	35	32	58	39	38	20	35	59	63	44	35
Poland	35	49	32	61	29	32	18	36	50	73	45	56
Italy	32	27	28	69	37	32	14	35	43	73	47	36
Bulgaria	29	51	28	67	34	24	22	24	33	67	39	27
Greece	**21**	**25**	**19**	**31**	**17**	**25**	**10**	**16**	**32**	**63**	**36**	**23**

Source: Eurostat, *Continuing Vocational Training Survey - CVTS3.*
1 Countries ranked in decreasing order of CVT provision rate (first column).
2 The sectoral classification follows NACE rev.1.

Table A3 Percentage of employees participating in CVT courses by enterprise size (enterprises providing CVT), 2005[1,2]

Country	Overall participation rate (%)	By enterprise size (number of employees)				
		10-49	50-249	250-499	500-999	1000+
Czech Republic	67	73	66	66	65	66
Ireland	60	49	51	-	-	-
Luxembourg	60	49	47	-	-	-
Slovenia	58	48	45	55	67	72
Slovakia	56	56	47	52	53	64
Belgium	51	40	44	50	57	60
Spain	51	47	45	48	53	56
Sweden	51	51	50	53	48	51
France	50	38	40	48	57	60
Italy	49	44	42	47	50	56
Norway	48	50	44	49	48	48
Portugal	46	47	40	45	46	53
Finland	46	43	36	45	51	53
EU-27	**43**	**43**	**40**	**44**	**47**	**45**
Germany	39	47	40	45	38	36
Netherlands	39	31	32	40	45	47
UK	39	44	42	42	50	33
Austria	38	36	32	35	43	45
Denmark	37	38	39	51	46	27
Poland	36	39	32	29	33	40
Bulgaria	33	37	31	30	35	34
Estonia	32	36	31	31	26	42
Romania	31	37	26	28	29	33
Greece	**28**	**31**	**21**	**28**	**24**	**33**
Lithuania	28	32	23	25	30	31
Latvia	27	27	24	26	36	28
Hungary	23	23	16	18	22	32

Source: Eurostat, *Continuing Vocational Training Survey - CVTS3.*
1 Countries ranked by decreasing CVT participation rate (first column).
2 Measures participation of employees only in firms providing CVT.

Table A4 Percentage of employees participating in CVT by sector of economic activity (enterprises providing CVT) in 2005[1,2]

Country	Overall participation rate (%)	By sector of economic activity[3]										
		Mining-quarrying	Manu-facturing	Electricity, gas, water supply	Construction	Trade	Hotels and restaurants	Transport	Post and telecommuni-cations	Financial inter-mediation	Real estate, renting and business activities	Other services
Czech Republic	67	80	66	82	77	57	60	70	69	81	68	60
Ireland	60	-	57	-	-	64	-	-	-	71	60	52
Luxembourg	60	-	58	-	-	51	-	-	-	82	63	58
Slovenia	58	32	61	50	33	61	47	56	69	81	54	56
Slovakia	56	74	54	69	57	58	35	70	38	78	43	33
Belgium	51	43	51	63	34	46	48	52	74	68	50	35
Spain	51	57	50	61	48	45	54	57	67	70	48	42
Sweden	51	25	53	72	54	51	39	52	37	51	46	63
France	50	42	49	104	39	40	43	52	59	72	47	44
Italy	49	59	42	78	45	52	36	52	44	76	51	43
Norway	48	35	42	61	43	50	33	48	24	59	57	52
Portugal	46	41	43	54	38	52	50	52	44	68	38	35
Finland	46	55	50	88	46	43	59	43	40	64	49	25
EU-27	**43**	**38**	**43**	**61**	**42**	**35**	**43**	**41**	**48**	**62**	**45**	**47**
Germany	39	48	42	58	35	30	30	35	22	55	37	47
Netherlands	39	64	37	44	45	31	28	44	43	57	41	37
UK	39	72	38	25	49	23	49	26	60	48	52	54
Austria	38	30	34	52	26	36	22	47	55	65	29	46
Denmark	37	38	31	74	37	26	65	22	40	38	60	58
Poland	36	21	36	36	29	35	34	39	47	55	31	21
Bulgaria	33	37	30	26	21	36	39	26	55	59	47	34
Estonia	32	37	21	47	28	38	43	31	64	72	39	41
Romania	31	23	33	28	23	30	28	26	12	64	35	24
Greece	**28**	**26**	**27**	**19**	**11**	**34**	**21**	**27**	**23**	**45**	**24**	**18**
Lithuania	28	25	24	44	20	24	50	25	33	53	37	22
Latvia	27	15	24	34	22	26	27	32	12	52	27	27
Hungary	23	28	17	35	20	22	18	38	54	39	17	14

Source: Eurostat, *Continuing Vocational Training Survey - CVTS3.*
1 Countries ranked by decreasing CVT participation rate (first column).
2 Measures participation of employees only in firms providing CVT.
3 See Note 2 of Table A2.

Table A5 Average number of hours spent in CVT courses per employee, by firm size (enterprises providing CVT), 2005[1]

Country	Average hours in all CVT-providing firms	By enterprise size (number of employees)				
		10-49	50-249	250-499	500-999	1000+
Hungary	37	35	34	40	35	38
Netherlands	36	37	36	35	32	36
Sweden	34	26	25	30	33	43
Luxembourg	33	34	29	-	-	-
Lithuania	32	30	35	31	30	32
Slovakia	32	27	26	31	24	38
Norway	32	28	36	34	51	16
Belgium	31	34	27	25	33	33
Romania	31	26	29	33	30	32
Bulgaria	30	33	38	28	19	29
Denmark	30	31	32	27	34	29
Germany	30	26	29	25	28	32
Poland	30	24	27	30	30	33
Slovenia	29	39	31	27	27	27
France	28	28	25	25	27	30
EU-27	**27**	**26**	**26**	**25**	**26**	**29**
Estonia	27	26	28	27	35	17
Austria	27	19	29	30	28	29
Spain	26	25	22	23	25	28
Latvia	26	32	26	31	22	24
Portugal	26	29	28	25	31	22
Ireland	25	23	26	-	-	-
Greece	**25**	**25**	**35**	**20**	**20**	**24**
Italy	25	25	25	22	24	27
Finland	25	26	27	28	28	22
Czech Republic	23	18	20	22	23	31
UK	20	22	22	19	18	19

Source: Eurostat, *Continuing Vocational Training Survey - CVTS3.*
1 Countries ranked in decreasing order of CVT hours (first column).

Table A6 Average number of hours spent in CVT per employee, by sector (enterprises providing CVT), 2005[1]

Country	Average hours in all CVT-providing firms	By sector of economic activity[2]										
		Mining, quarrying	Manu-facturing	Electricity, gas, water supply	Construction	Trade	Hotels and restaurants	Transport	Post and telecommuni-cations	Financial inter-mediation	Real estate, renting and business activities	Other services
Hungary	37	24	37	69	29	33	24	29	31	33	53	29
Netherlands	36	51	38	30	34	29	47	34	21	36	42	30
Sweden	34	13	45	32	16	22	19	19	27	20	42	33
Luxembourg	33	-	46	-	-	22	-	-	-	29	34	34
Lithuania	32	44	31	41	33	25	19	39	28	39	37	26
Slovakia	32	17	30	57	19	34	12	21	41	50	26	30
Norway	32	24	45	38	26	26	14	41	33	52	21	26
Belgium	31	33	32	20	25	25	15	31	45	29	36	37
Romania	31	18	30	55	35	22	60	24	55	24	42	20
Bulgaria	30	42	26	18	27	44	33	40	11	20	44	57
Denmark	30	27	37	36	24	24	26	30	22	30	31	34
Germany	30	33	29	26	23	24	25	20	59	41	34	23
Poland	30	36	26	32	26	31	18	25	37	44	32	18
Slovenia	29	25	29	62	20	17	20	35	25	34	39	34
France	28	25	30	14	26	25	22	34	28	37	27	30
EU-27	**27**	**27**	**28**	**27**	**23**	**25**	**17**	**26**	**29**	**36**	**29**	**25**
Estonia	27	22	26	25	22	21	20	25	19	59	39	23
Austria	27	33	27	38	21	24	17	23	11	50	23	17
Spain	26	22	24	29	21	36	12	31	29	28	20	24
Latvia	26	30	30	32	23	28	18	17	37	23	38	17
Portugal	26	21	28	33	19	27	20	26	23	23	32	26
Ireland	25	-	28	-	-	22	-	-	-	21	30	17
Greece	**25**	**54**	**24**	**37**	**20**	**18**	**19**	**30**	**27**	**28**	**39**	**39**
Italy	25	51	24	26	17	22	12	28	35	37	22	19
Finland	25	19	24	48	23	19	15	16	32	29	35	28
Czech Republic	23	17	21	30	21	21	12	21	28	58	28	19
UK	20	9	18	19	19	19	12	18	10	27	24	24

Source: Eurostat, *Continuing Vocational Training Survey - CVTS3.*
1 Countries ranked in decreasing order of CVT duration (first column).
2 See Note 2 of Table A2.

Table A7 Percentage of firms offering initial vocational training (IVT)[1] by enterprise size (all enterprises), 2005[2]

Country	In the full sample	By enterprise size (in terms of employment)		
		10-49	50-249	250+
Germany	55	51	66	79
UK	51	46	64	67
Austria	49	47	56	83
Denmark	45	42	56	78
Netherlands	41	40	45	44
Italy	40	40	40	37
France	37	34	50	78
EU-27	**31**	**28**	**39**	**52**
Luxembourg	28	26	32	40
Ireland	24	23	28	37
Norway	23	20	41	58
Lithuania	17	12	27	59
Finland	17	16	18	44
Spain	14	13	22	39
Belgium	9	9	11	16
Poland	9	8	11	10
Slovenia	9	7	16	15
Sweden	7	7	7	6
Hungary	6	5	12	16
Latvia	5	4	8	21
Portugal	5	4	11	20
Bulgaria	4	3	8	13
Czech Republic	3	1	10	16
Greece	**3**	**2**	**5**	**11**
Romania	2	1	4	7
Estonia	1	1	2	8
Slovakia	1	1	2	7

Source: Eurostat, *Continuing Vocational Training Survey - CVTS3.*
1 Initial Vocational Training (IVT) is defined as training addressed to apprentices which has a duration of at least 6 months and leads to a formal qualification.
2 Countries ranked in decreasing order of IVT provision rate (first column).

Table A8 Percentage of firms providing IVT by sector of economic activity (all enterprises), 2005[1]

Country	All Firms	Mining-quarrying	Manufacturing	Trade	Financial intermediation	Real estate, renting and business activities	Other services
Germany	55	59	58	53	77	51	40
UK	51	57	53	48	47	49	43
Austria	49	51	66	56	21	4	49
Denmark	45	59	48	49	34	20	25
Netherlands	41	48	40	42	36	35	34
Italy	40	42	42	41	29	27	30
France	37	49	37	37	30	22	29
EU-27	**31**	**34**	**31**	**29**	**33**	**28**	**28**
Luxembourg	28	31	23	35	8	17	39
Ireland	24	28	26	17	13	31	22
Norway	23	34	33	14	1	3	29
Lithuania	17	18	18	15	26	8	23
Finland	17	20	18	18	11	3	28
Spain	14	12	16	15	21	17	16
Belgium	9	12	8	8	6	7	9
Poland	9	7	11	11	1	1	6
Slovenia	9	15	9	10	–	3	3
Sweden	7	16	5	7	5	1	–
Hungary	6	6	6	7	15	5	4
Latvia	5	5	6	5	8	5	2
Portugal	5	4	5	5	12	9	11
Bulgaria	4	4	5	3	19	5	8
Czech Republic	3	3	6	3	–	1	2
Greece	**3**	**2**	**2**	**2**	**3**	**6**	**1**
Romania	2	1	3	1	2	3	1
Estonia	1	1	2	1	3	–	–
Slovakia	1	2	3	0	–	–	–

Source: Eurostat, *Continuing Vocational Training Survey - CVTS3.*
1 See Notes 1 and 2 of Table A7.

Table A9 R&D expenditure as a percentage of GDP, 2005

Country	%
Sweden	3.75
Finland	3.41
Germany	2.49
Denmark	2.45
Austria	2.23
France	2.16
Belgium	1.92
Netherlands	1.85
UK	1.76
Ireland	1.17
Italy	1.10
Spain	1.03
Portugal	0.78
Greece	**0.57**

Source: Eurostat.
1 Countries ranked in decreasing order of R&D expenditure as a percentage of GDP.

Table A10 Means of variables appearing in Table 2

Variable	Mean
CVT_{05}	0.285
CVT_{04}	0.231
Introduction of new products/methods/services	0.230
Distribution of firms by size	
10-49 employees	0.640
50-99 employees	0.137
100-249 employees	0.114
250-499 employees	0.058
500-999 employees	0.028
1000+ employees	0.025
Distribution of firms by sector of economic activity	
Mining-quarrying	0.028
Manufacturing	0.458
Electricity. gas and water supply	0.020
Construction	0.053
Trade	0.199
Hotels and restaurants	0.074
Transport	0.058
Post and telecommunications	0.019
Financial intermediation	0.025
Business activities	0.045
Services n.e.c.	0.022

Source: ELSTAT, *2005 Annual Continuing Vocational Training Survey in Enterprises.*

Table A11 Means of variables appearing in Table 3

Variable	Mean		
	Total	Men	Women
Employee participation in CVT	0.062	0.056	0.076
Age (years)	40.797	41.416	39.448
Proportion of men in the sample	0.663		
Proportion of employees on fixed-term contracts	0.074	0.068	0.088
Proportion of employees with Greek nationality	0.904	0.889	0.930
Distribution of employees by highest education level attained			
PhD or post-graduate studies	0.019	0.017	0.024
Tertiary education	0.124	0.112	0.150
Higher vocational school	0.190	0.158	0.249
Upper secondary	0.365	0.393	0.358
Lower secondary	0.127	0.139	0.106
Primary school	0.175	0.198	0.137
Distribution of employees by firm size			
1-10 employees	0.639	0.649	0.636
11-19 employees	0.181	0.176	0.190
20-49 employees	0.063	0.056	0.075
50+ employees	0.117	0.120	0.099
Distribution of employees by sector of economic activity			
Mining-quarrying	0.009	0.014	0.000
Manufacturing	0.198	0.219	0.165
Electricity, gas and water supply	0.016	0.000	0.012
Construction	0.129	0.191	0.000
Trade	0.263	0.412	0.360
Hotels and restaurants	0.093	0.070	0.141
Transport, storage and communication	0.103	0.122	0.070
Financial intermediation	0.043	0.038	0.056
Real estate, renting and business activities	0.097	0.082	0.130
Other services	0.050	0.043	0.065

Source: ELSTAT, *Adult Education Survey*.

Table A12 Means and definitions of variables appearing in Table 7

Notation	Variable	Definition	Mean	Source
ln(Y/L)	Log of labour productivity	Value added per employee	10.864	ELSTAT, *Annual Industrial Survey for 2006*
1/N	Inverse of the number of firms in the sector		0.0395	ELSTAT, *Annual Industrial Survey for 2005*
	CVT_{05}	Percentage of enterprises providing CVT in 2005	0.290	ELSTAT, *2005 Annual Continuing Vocational Training Survey*
	CVT_{04}	Percentage of enterprises providing CVT in 2004	0.244	ELSTAT, *2005 Annual Continuing Vocational Training Survey*
	$Innovation_{05}$	Percentage of enterprises introducing new products/methods/services in 2005	0.285	ELSTAT, *2005 Annual Continuing Vocational Training Survey*
	Subsidised enterprises	Percentage of enterprises that received a training subsidy in 2005	0.192	ELSTAT, *2005 Annual Continuing Vocational Training Survey*
	Percentage of employees with tertiary education	Percentage of employees with tertiary education in 2004	0.291	ELSTAT, *LFS 2004*
	Log of investment (gross fixed capital formation)		17.743	ELSTAT, *Annual Industrial Survey for 2006*

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CONTENTS

Fiscal policy and financial market movements

Working Paper No. 116
Athanasios Tagkalakis

The adverse economic and financial market developments back in 2008-09 went hand in hand with a significant fall in asset prices, which in several asset classes and countries resembled the case of an asset price bust, following several years of asset price boom (e.g. house price developments in Ireland, the UK, Spain and the US). These developments had significant implications for fiscal balances, both through automatic and discretionary fiscal policy responses. Given that the links between the real economy and the financial sector could pose risks to economic and financial stability, one of the issues arising is to better understand the feedback loops between government activity and financial and real estate markets.

The present paper investigates the links between financial market movements and fiscal policy developments. It goes beyond earlier studies in that it investigates econometrically, by estimating fiscal policy reaction functions, whether there is any evidence that fiscal balances (primary balances, current expenditure and current revenue) have been affected by or responded to financial and real estate market movements (i.e. changes in residential property, commercial property and equity prices and changes in the slope of the yield curve). Therefore, we try to understand how fiscal policy responds to or is affected by financial and real estate market changes (e.g. asset price changes) and real economy developments and how the two interrelate and constrain or reinforce government reaction.

These issues are particularly relevant and should be taken on board by policy makers because financial market developments (like a steeper yield curve) might reflect market concerns regarding the sustainability of a country's fiscal position. Furthermore, asset price movements are relevant for the following reasons: (1) they should be controlled in order for the policy maker to have a better grasp of the actual cyclically adjusted fiscal stance; and (2) they could carry information on cyclical economic conditions, on top of the information provided by economic activity variables. This would imply that fiscal policy makers should build up fiscal buffers (e.g. by using windfall revenues) for rainy days, when economic conditions are good and asset prices are booming.

Our findings suggest that financial market variables play a very important role. An increase in asset prices affects in a positive and significant manner primary balances, with the response reflecting both an increase in government revenues and a cut in government spending. The most important impact on fiscal balances is due to changes in residential property prices. Equity price changes and commercial property price changes were also found to be important determinants of fiscal balances. The importance of residential property and equity prices as determinants of primary balances has increased over the course of the years. The effect of residential property prices, in recent years, reflects an automatic rather than a discretionary response of cyclically adjusted fiscal balances. In the case of equity prices, there is both an automatic and a discretionary response. The steepening of the slope of the yield curve contributes to fiscal discipline, particularly in recent years, by inducing expenditure cuts.

Current account determinants and external sustainability in periods of structural change

Working Paper No. 117
Sophocles N. Brissimis, George Hondroyiannis, Christos Papazoglou, Nicholas T. Tsaveas and Melina A. Vasardani

Large and persistent current account deficits constitute a cause for concern, particularly when sustainability issues are raised and thus the economic prospects of a country are put at risk. Against this background, identifying the determinants of the current account is of considerable importance, as also documented by the development of a number of theoretical intertemporal models in the literature over the past decade. Several empirical applications of these models have drawn on the national accounting identity, which treats the current account balance as the difference between national saving and investment, emphasising the important role of the factors that influence consumption (saving) and investment decisions in explaining current account positions.

This paper attempts to ascertain empirically the determinants of the current account balance in Greece. The analysis extends over a period of almost 50 years (1960- 2007) and aims at revealing the main macroeconomic, financial and structural factors that influenced net national saving and thus shaped the course of current account developments. It should be noted that during most of the period under consideration, Greece experienced medium to small current account deficits, which were the result of diverse circumstances and policies in different sub-periods. In the last sub-period of 1999-2007, however, substantial widening and high persistence of the current account deficit were observed. This, in turn, has raised the issue of Greece's external sustainability in the context of the economy's ability to service its accumulated external debt obligations in the long run.

Our empirical analysis starts off by examining the current account from a long-run (equilibrium) perspective. We apply standard econometric techniques to establish whether there is a stable (co-integrating) relationship between the current account and several "fundamental" determinants of net national saving. Then, at a second stage, we explore the short-run dynamics of the current account in periods of small and large current account imbalances.

One of the main findings is that the financial liberalisation that took place in the 1990s and the process of monetary integration that led to the adoption of the euro in 2001 resulted in considerable credit expansion and fall in private savings, contributing to a substantial deterioration of the current account deficit. In the subsequent period of euro area membership, credit expansion and the current account deficit were maintained at high levels.

From a policy perspective, widening domestic saving and investment imbalances could lead to potentially disruptive adjustments, with implications for financial market stability and economic activity. Even though in principle large imbalances can be unwound in a gradual and orderly fashion, there are important downside risks. A slowdown in economic activity, perhaps larger than anticipated, along with heightened concerns over fiscal sustainability, could trigger a change in foreign investors' behaviour that could lead to very high risk premia or even abrupt disruptions in financial flows. This is particularly relevant in the context of the recent global financial and economic crisis which, although inducing some current account adjustment, seems to have exacerbated these risks.

Therefore, policy actions are needed to contain the current account deficit within limits. Indeed, while reverting to external sustainability is feasible, wide-ranging and bold policy adjustments that address both domestic demand excesses and unfavourable relative price differentials are needed for this purpose. The policy

options that could be considered to restore current account equilibrium are fiscal consolidation, improvement of external competitiveness and implementation of structural reforms. Action on only one front is not sufficient to restore external sustainability within a reasonable time frame.

Macroeconomic and bank-specific determinants of non-performing loans in Greece: a comparative study of mortgage, business and consumer loan portfolios

Working Paper No. 118
Dimitrios P. Louzis, Angelos T. Vouldis and Vasilios L. Metaxas

This paper uses dynamic panel data methods to examine the determinants of non-performing loans (NPLs) in the Greek banking sector, separately for each type of loan (consumer, business and mortgage loans). The study is motivated by the hypothesis that both macroeconomic and bank-specific variables have an effect on loan quality and that these effects vary between different categories of loans. The results show that NPLs in the Greek banking system can be explained mainly by macrofundamentals (GDP, unemployment, interest rates) and management quality. Differences in the quantitative impact of macroeconomic factors among types of loans are evident, with non-performing mortgages being the least responsive towards changes in the macroeconomic conditions.

What is the best environmental policy? Taxes, permits and rules under economic and environmental uncertainty

Working Paper No. 119
Konstantinos Angelopoulos, George Economides and Apostolis Philippopoulos

We welfare rank different types of second-best environmental policy. The focus is on the roles of uncertainty and public finance. The setup is the basic stochastic neoclassical growth model augmented with the assumptions that pollution occurs as a by-product of output produced and environmental quality is treated as a public good. To compare different policy regimes, we compute the welfare-maximising value of the second-best policy instrument in each regime. In all cases studied, pollution permits are the worst recipe, even when their revenues are used to finance public abatement. When the main source of uncertainty is economic, the best recipe is to levy taxes (on pollution or output) and use the collected tax revenues to finance public abatement. However, when environmental uncertainty is the dominant source of extrinsic uncertainty, Kyoto-like rules for emissions, being combined with tax-financed public abatement, are better than taxes. Finally, comparing pollution and output taxes, the latter are better.

Rent-seeking competition from state coffers in Greece: a calibrated DSGE model

Working Paper No. 120
Konstantinos Angelopoulos, Sophia Dimeli, Apostolis Philippopoulos and Vanghelis Vassilatos

We incorporate an uncoordinated redistributive struggle for extra fiscal privileges and favours into an otherwise standard dynamic stochastic general equilibrium model. Our aim is to quan-

tify the extent of rent seeking and its macroeconomic implications. The model is calibrated to Greek quarterly data over 1961:1-2005:4. Our work is motivated by the rich and distorting tax-spending system in Greece, as well as the common belief that interest groups compete with each other for fiscal privileges at the expense of the general public interest. We find that (i) the introduction of rent seeking moves the model in the right direction vis-à-vis the data, (ii) an important fraction of GDP is extracted by rent seekers and (iii) there can be substantial welfare gains from reducing rent seeking activities.

Inter-industry wage differentials in EU countries: what do cross-country time varying data add to the picture?

Working Paper No. 121
Philip Du Caju, Gábor Kátay, Ana Lamo, Daphne Nicolitsas, Steven Poelhekke

This paper documents the existence and main patterns of inter-industry wage differentials across a large number of industries for 8 EU countries at two points in time and explores possible explanations for these. The analysis uses the European Structure of Earnings Survey (SES), an internationally harmonised matched employer-employee dataset, to estimate inter-industry wage differentials conditional on a set of employee, employer and job characteristics. After investigating the possibility that unobservable employee characteristics lie behind the conditional wage differentials, a hypothesis which cannot be accepted, the paper investigates the role of institutional, industry structure and performance characteristics in explaining inter-industry wage differentials. The results suggest that inter-industry wage differentials are consistent with rent sharing mechanisms and that rent sharing is more likely in industries with firm-level collective agreements and with higher collective agreement coverage.

The fatal flaw: the revived Bretton-Woods system, liquidity creation, and commodity-price bubbles

Working Paper No. 122
Harris Dellas and George S. Tavlas

Does the current international monetary regime encourage asset-price bubbles? Following the sharp rise in US share prices during the second half of the 1990s, and their subsequent sharp falls in 2000 and 2001, those prices – along with the prices of other assets, including property, commodities and bonds – exhibited further major upward movements between 2002 and 2007, until the onset of the financial crisis in August 2007. This paper argues that the present constellation of exchange-rate arrangements among the major currencies has been conducive to the creation of excessive global liquidity, which contributed to unsustainable asset-price booms.

The paper focuses on the international component of monetary regimes and the exchange rate arrangement that characterises the international monetary system. Although the exchange rates of many of the major currencies float against each other, the currencies of many Asian emerging-market economies and oil-exporting economies are pegged to the US dollar. This circumstance has provoked a series of articles by Dooley, Folkerts-Landau and Garber (hereinafter DFG), who argue that the present constellation of global exchange-rate arrangements constitutes a revived Bretton-Woods, or Bretton-Woods II (BWII), regime.

This paper takes a different view. It argues that the original Bretton-Woods system comprised two fundamentally different variants. The first variant lasted from the inception of the system in 1947 until around 1969. The second variant had a much shorter lifespan – lasting from about 1970 until the collapse of the system in 1973. Whatever may have been the underlying stability characteristics of the first variant, the variant that emerged around 1970 was fundamentally unstable; it was conducive to high global liquidity creation and asset-price bubbles. The paper argues further that, to the extent that the global financial system has metamorphosised into a revived Bretton-Woods regime, the revived regime resembles more the second variant with its propensity to high global liquidity creation and asset-price bubbles.

Skills and wage inequality in Greece: evidence from matched employer-employee data, 1995-2002

Working Paper No. 123
Rebekka Christopoulou and Theodora Kosma

In this paper we examine how the distribution of individuals' wages has changed in Greece, over the period 1995-2002, and what has been the role of skills (education, tenure, age - potential labour market experience) in these changes. We use a matched employer-employee data set that provides information on both employee and employer/job characteristics and separate, at each decile of the wage distribution, the part of wage changes that is due to changes in the job/employer and employee characteristics (composition effects) from the part due to changes in the returns to these characteristics (price effects).

We find that over 1995-2002 wage inequality increased; more so for men and those at the upper end of the wage distribution. The contribution of the composition and return effects of skills to the evolution of Greek wage dynamics has been important. Of the skill composition effects, tenure and education effects have had the most significant impact. The composition effects of tenure are mostly negative and, by reducing wages more for those in the lower part of the wage distribution, contribute to the observed pattern of wage inequality. On the other hand, the composition effects of education are positive but they also contribute to higher wage inequality. This result contradicts standard expectations for a negative relationship between rising education and wage equality and it is possibly the outcome of higher wage dispersion among the high skilled.

Our analysis of the price effects of skills suggests that, even though they are smaller in magnitude than the respective skill composition effects, they have also had an important role in shaping changes in the Greek wage distribution. The price effects of skills have formed a U-shaped pattern along the wage distribution, which, though not a proof of, can be considered as being broadly in line with the routinisation hypothesis; a variant of the skill-biased technical change theory. As to the sign of individual price effects, the age price effects are negative, while the tenure and education return effects are positive. Interestingly, the U-shaped pattern is more or less sustained for all individual skill price effects. The sign and U-shaped pattern of the age price effects could be regarded as partly reflecting the interaction between institutional changes that are not age-neutral and different unobserved ability of employees along the wage distribution.

The decomposition results imply that economic developments have had a significant contribution to the changes in the Greek wage distribution. Indeed, we find that the combined impact of the skill return effects and composition effects of tenure, which are arguably responsive to economic developments, is important in magnitude.

On the other hand, predetermined demographic changes, as those captured by the composition effects of age and education, have had a relatively milder contribution.

The Greek financial crisis: growing imbalances and sovereign spreads

Working Paper No. 124
Heather D. Gibson, Stephan G. Hall and George S. Tavlas

We discuss the origins of the Greek financial crisis, as manifested in the growing fiscal and current-account deficits since euro-area entry in 2001. We then provide an investigation of spreads on Greek relative to German long-term government debt. Using monthly data over the period 2000-2010, we estimate a cointegrating relationship between spreads and their long-term fundamental determinants (including a measure of the fiscal situation, competitiveness of the Greek economy, economic activity and oil prices, reflecting the high dependence of the Greek economy on imported energy) and compare the spreads predicted by this estimated relationship with actual spreads. We find that spreads were significantly below what would be predicted by fundamentals from end-2004 up to the middle of 2005; by contrast, since May 2010, actual spreads have exceeded predicted spreads by some 400 basis points.

On the geography of international banking: the role of third-country effects

Working Paper No. 125
Georgios Fotopoulos and Helen Louri

International banking is a complex phenomenon. Among its determinants, distance has been found to be critical. But does distance only have a negative linear direct effect? Or is the role of geography more intricate? Applying spatial analysis techniques on BIS data of bank foreign claims in 178 countries in 2006, evidence of positive spatial autocorrelation under alternative spatial weights schemes is brought to light. The geographical aspects of international banking are further explored by a spatial autoregressive gravity model. The results obtained maintain that the operation of a spatial lag leads to important indirect or third-country effects. Evidence of such financial spillovers is further corroborated by results of a spatial autoregressive Tobit model. Geography is more important than the effect of distance alone would suggest. Third-country effects operate in a manner that subsequently connects countries through links beyond those immediately involved in borrowing (destination) and lending (origin) relationships. Confirming earlier results, the economic size of sending and recipient countries, cultural similarity and in-phase business cycles enhance international banking, while distance and exchange rate volatility hinder it. Also, while lower political risk (implying better institutional quality and political stability) has a positive role, so do higher financial and economic risks (indicating a preference for higher but riskier returns and possibly a disregard for economic fundamentals), thus perhaps reflecting some of the factors behind the recent financial crisis. Since the indirect effects for all these variables are found to be almost as large as the direct effects, future studies in international banking should consider looking beyond changes in the variables corresponding only to countries directly involved in bilateral cross-border banking activities.

Returns to scale, productivity and efficiency in US banking (1989-2000): the Neural Distance Function revisited

Working Paper No. 126

Panayotis G. Michaelides, Angelos T. Vouldis and Efthymios G. Tsionas

Productivity and efficiency analyses have been indispensable tools for evaluating firms' performance in the banking sector. In this context, the use of Artificial Neural Networks (ANNs) has been recently proposed in order to obtain a globally flexible functional form, which is capable of approximating any existing output distance function, while enabling the a priori imposition of the theoretical properties dictated by production theory, globally. Previous work has proposed and estimated the so-called Neural Distance Function (NDF) which has numerous advantages when compared to widely adopted specifications. In this paper, we carefully refine some of the most critical characteristics of the NDF. First, we relax the simplistic assumption that each equation has the same number of nodes because it is not expected to approximate reality with any reasonable accuracy and different numbers of nodes are allowed for each equation of the system. Second, we use an activation function which is known to achieve faster convergence compared to the conventional NDF model. Third, we use a relevant approach for technical efficiency estimation based on the widely adopted literature. Fitting the model to a large panel data we illustrate our proposed approach and estimate the Returns to Scale, the Total Factor Productivity and the Technical Efficiency in US commercial banking (1989-2000). Our approach provides very satisfactory results compared to the conventional model, a fact which implies that the refined NDF model successfully expands and improves the conventional NDF approach.

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