CHAPTER

18

STRENGTHENING SCHOOL BUILDINGS TO RESIST EARTHQUAKES: PROGRESS IN EUROPEAN COUNTRIES

Robin Spence

University of Cambridge and European Association for Earthquake Engineering, United Kingdom

Abstract: This paper reviews progress in programmes for screening, evaluating and strengthening existing vulnerable buildings, including schools, in high-risk areas in Europe. It is argued that legislation is needed to ensure the long-term financial commitment that is required for strengthening programmes. The experience of a lethal earthquake – as in Italy in 2002 and Turkey in 2003 – is the most effective catalyst for action, but computed scenarios can also motivate action. Data available on the extent and possible scope of a programme for the retrofit strengthening of school buildings for the six most at-risk countries in the European Union are presented. The costs are substantial but reasonable when distributed over a period of years with some adjustment of capital expenditure priorities.

Introduction

On 15 January 2003, the following written question – drafted in consultation with the Executive Committee of the European Association for Earthquake Engineering – was presented to the European Parliament by Mihail Papagiannakis, European Parliament member for Greece:

> In San Giuliano di Puglia, Italy, on 31 October 2002, a recently modified school building collapsed in a moderate-sized earthquake, resulting in the death of 27 occupants (25 of them schoolchildren). According to the European Association of Earthquake Engineering this is not an isolated incident. Similar incidents could happen in many European countries; however, the problem is preventable and the risk can be substantially reduced by a programme of expert assessment of the older and more vulnerable existing structures and a programme of strengthening works in the highest-risk areas. The rules for the assessment and strengthening of structures are available in the European Standard, Part 1-4 of Eurocode 8, prEN 1998-3. In the interest of preventing further loss of life and considering that in many member states there is considerable earthquake activity, could the Commission formulate a directive requiring the member states to establish programmes of assessment (according to the above-mentioned European Standard) of all buildings and structures in areas known to be prone to damaging earthquakes and of strengthening the ones which are found to be inadequate?

A few weeks later, on 24 February 2003, the response from the European Union Environment Commissioner Margot Wallström on behalf of the Commission was presented on the European Parliament Web site (*www.europarl.eu.int*) as follows:

> The Commission deeply regrets the loss of human lives and the damages caused to the population of San Giuliano di Puglia. At this stage, the Commission does not envisage any specific proposal for legislation in the field of earthquake mitigation.

The reply also mentions other initiatives which the Commission has and will take to stimulate action for risk mitigation against natural disasters. The urgency of the question posed was dramatically and tragically confirmed on 1 May 2003 when another school collapsed, trapping over 100 schoolchildren in an M6.4 earthquake in Bingöl, Turkey.

Whose responsibility is it to formulate and enact the legislation to ensure that school buildings, and indeed all other buildings used by the public, are earthquake safe? Certainly the European Commission has some powers in this area. Many regulations already exist at the European level in areas affecting the health and safety of the public, and particularly

PEB

the workforce, and are seen as a necessary means to ensure a uniform level of protection for the citizen and a level playing field for business throughout Europe. Regulation has a special validity in circumstances where decisions affecting the risks to peoples' life and health are taken by others (for example their employers); where individuals are not readily aware of the risks associated with their actions; and where action to mitigate the risks must be taken at a community, regional or even international level. All of these circumstances are true of earthquake risk, and this is of course recognised in the regulations covering the design of new buildings, which are now in the process of being unified at European Union (EU) level through the adoption of the Eurocodes. There is also a special validity, which can be widely supported, in legislation to protect the lives of schoolchildren who have no choice over which buildings they use and little awareness of the risks involved.

It is not surprising, though, that the European Commission does not appear to favour the idea of regulation on this issue at the European level. Among the possible tools for government action, regulation tends to be losing popularity in the EU – in common with other advanced economies of the world – in favour of various other kinds of incentives to achieve desirable social and environmental goals. Supporting underpinning research, demonstrating best practice, proposing voluntary codes and even providing tax incentives are today preferred to regulation because of the perceived costs to the economy and the additional problems of enforcement that new regulations often bring. And, in any case, the principle of *subsidiarity* makes the European Commission reluctant to initiate action in any matter in which effective action can be taken by member states individually.

Necessary action for earthquake protection can easily become a victim of this kind of thinking. For the building stock at large, regulation would impose obligations on property-owners to strengthen their buildings, thus increasing rents and reducing the stock of cheap accommodation; and this would certainly be opposed by many of those owners, and perhaps by the business community at large. For publicly-owned buildings, the introduction of such regulations would impose additional burdens on national budgets, which would have to be met by increasingly tax-averse electorates. And it can also be argued that each country – and each city – has its own separate risks and set of social conditions, which means that uniform legislation across the whole EU would be inappropriate.

The aim of this paper is to argue the contrary, that the logic which applies to protecting life through the design of new buildings should also apply to the much more difficult issue of protecting life in existing older buildings. All kinds of activities are needed at an EU and at a national level to support this, including research, public awareness-raising, and the drafting of model documents. But experience from other countries suggests that unless these activities are underpinned by legislation – primarily concerned with strengthening, demolishing and replacing existing high risk-buildings – resistance will be strong and little progress will be made (Spence, 2003). Without underpinning legislation, other supporting actions will simply lack the "teeth" to be really effective in reducing the highest risks. Whether this legislation should be at an EU or individual country level is an open question, but EC support for such work could be a powerful stimulus to action.

To support this argument, the paper first looks at actions taken or in progress in some of the European Association for Earthquake Engineering (EAEE) countries to achieve this type of risk mitigation. It then considers the costs and benefits of strengthening existing high-risk buildings, and examines the possible scale of the programme of work needed to bring Europe's school buildings up to an acceptable standard of earthquake safety.

Risk mitigation action in the European area

The ESC-SESAME Seismic Hazard Map shows that Europe is a seismically diverse area (Giardini, Jiménez and Grünthal, 2003). Converting the hazard map into a map of relative risks is a difficult task because much depends on the population density and the relative vulnerability of the building stock, both of which change over time. One way to look at relative risks is by examining the number of earthquake casualties over a long time period on a country-by-country basis. Such a study (Spence, 2003) for the 29 current member countries of the EAEE shows that the three highest risk countries – Iran, Italy and Turkey – had long-term annual fatality rates over the 20th century that were greater than 15 per million of the 2001 population; while several others, including Algeria, Cyprus, Greece and Romania, some of the countries of the former Soviet Union and Yugoslavia (but here recent changes in political geography make exact comparisons complicated), had annual fatality rates of between 1 and 6 per million of the 2001 population. The remainder, including most of the 23 existing and potential EU countries, have lower long-term risk rates. As would be expected, countries with the highest risk rates – and the most recent experience of a damaging earthquake – are currently most active in risk mitigation, and are also those that require most help. Activities in a number of countries will be discussed briefly.

Greece

In Greece, frequent damaging earthquakes in the last 25 years, including those in Thessaloniki (1978), Corinth (1981), Kalamata (1986), Aegion (1995), Kozani (1995) and Athens (1999), have created a highly developed national consciousness of the earthquake problem. Improved economic performance has also led to a general rise in the standards of buildings. Most of the buildings which collapsed in recent earthquakes were identified as older buildings, which were built prior to the present-day building code. But many such buildings remain, and in the last two years a framework for the pre-earthquake assessment of public buildings was developed and approved by the national earthquake mitigation authority (OASP) (Penelis, 2001). It is recognised that the cost of bringing these buildings – which include public schools, hospitals and public administration buildings – to a satisfactory standard of earthquake resistance will be substantial. For schools in Thessaloniki alone, it was estimated that the cost would be equal to the entire budget of the region for new schools over the next six years. Thus a lengthy programme for action is envisaged, of perhaps 15 years.

A three-stage process is envisaged, beginning with a rapid visual screening procedure (RVSP), followed by the calculation of a seismic score. This will be followed by an approximate seismic evaluation of those buildings with a low seismic score. For those buildings that do not pass this evaluation, a third more detailed assessment will be performed, leading to recommendations for strengthening. An attempt to validate the RVSP for a large sample of buildings in Thessaloniki, by comparing the seismic score with their actual performance in the earthquake of 1978, showed poor correlation building by building. Nevertheless, a clear trend of reduced average repair costs with increasing seismic score was established for reinforced-concrete buildings (Penelis, 2001).

Italy

In Italy, a substantial programme of repair and strengthening of older buildings followed the 1976 Friuli, 1980 Irpinia, 1997 Umbria-Marche and 1998 Pollino earthquakes, and a number of other post-earthquake projects have begun to tackle the problem of the existing building stock at risk in these areas. Progress towards reducing risks in Italy as a whole has been supported by a new system of tax incentives introduced in 2001 for private owners for upgrading their buildings. Most recently, following the tragic loss of schoolchildren's lives, the 31 October 2002 Molise earthquake provided a large stimulus to earthquake risk mitigation throughout Italy, with important implications for older building stock. Within months, a new earthquake code was drafted and is now proceeding into law, which among other changes introduces a new seismic zonation – including for the first time the whole of the Italian territory, many parts of which were not previously designated as seismic areas – and will set out detailed procedures for evaluating and strengthening existing structures. In parallel with this initiative and without precedent, the 2003 allocation of funds from central government to the regions provides funds for the evaluation of public buildings, leading to the creation of a list of priorities for strengthening, and with an emphasis on school buildings at risk. Further legal instruments will set deadlines of a few years to carry out this large strengthening programme (Dolce, 2003; Zuccaro, 2003).

Portugal

In Portugal, while there has been no earthquake on the mainland in recent years, the Azores islands of Terceira and Faial were badly affected by the earthquakes of 1980 and 1997, respectively, which claimed 70 lives. The memory of the 20th century earthquakes in 1909, 1941 and 1969, in addition to the historical memory of the devastating 1755 Lisbon earthquake, provides an incentive for risk mitigation activity. At the government level, the regional government of the Azores is at a relatively advanced stage in terms of policy to intensify efforts to rehabilitate and maintain the existing housing stock, creating credit lines (including earthquake insurance) aimed at strengthening older housing while maintaining architectonic characteristics, and introducing special measures for protecting people living in high-risk locations. Subsidies are also available for houses damaged in the 1998 earthquake. At a national level, the Portuguese Association of Earthquake Engineering (SPES, 2001) has formulated a National Plan for Reducing the Seismic Vulnerability of Constructions, which is modelled on the National Earthquake Hazards Reduction Programme (NEHRP) in the United States. This plan envisages a series of activities, including implementing surveys of housing stock to assess the risk; defining and developing intervention strategies; creating support legislation; training; preparing master plans; and carrying out the rehabilitation. A 25-year programme is envisaged, with a cost of around 1% of gross national product over that period. The legislation has several dimensions, including certifying designers, improving building control, defining situations that require compulsory seismic rehabilitation, and creating tax incentives. However, to date this plan remains a proposal, supported in terms of research work, but lacking the government backing to bring it to fruition.

Turkey

In Turkey, the tragic 1999 earthquakes in Kocaeli and Düzce, which killed about 18 000 people, were primarily caused by the collapse of relatively recent buildings, built without proper design or building control. Much of the action taken in recent years has been aimed at improving control of new buildings, including those built in Turkey's reconstruction phase. A study of the causes of poor quality construction in Turkey (Gülkan *et al.*, 1999) pointed to deficiencies in both the nature and implementation of laws and regulations concerning the planning system, the project supervision at the design stage, and the system of on-site supervision, and recommended a range of government actions, some of which have been implemented.

Fresh impetus for mitigation action in Turkey has been provided by a forecast that a major earthquake (M>7.5) can be expected in the area of the North Anatolian fault closest to Istanbul, with a 60% probability of occurrence within 30 years (Parsons *et al.*, 2000). A study of the effects of this scenario conducted by JICA-IMM (2002) estimated that 7.1% (51 000) of buildings in Istanbul will be heavily damaged, and casualties will reach 0.8% (73 000). While not all seismologists accept the assumptions behind this prediction, it has prompted consideration of the special risk problem of Istanbul, where a high proportion of the population (73%) live in the type of apartment blocks that suffered so badly in the Kocaeli earthquake, few of which are built to satisfactory earthquake-resistant standards.

A proposed Istanbul Rehabilitation Project conducted for the Istanbul Metropolitan Municipality (Sucuoglu, 2003) will attempt to take action on the vast number of sub-standard buildings in a three-stage process. In the first stage, street surveys will identify the most at-risk buildings; in the second stage, these buildings will be surveyed by dimensional measurements at ground floor to determine action needed for the third stage, which is seismic rehabilitation for those in the highest risk category. In some cases, where high-risk buildings are scattered, the process will take the form of simplified strengthening interventions; but in other cases, where whole housing estates are in a state of deterioration, it is envisaged that wholesale redevelopment will be undertaken on existing or new sites.

Other countries

France and Romania have also established programmes to evaluate and strengthen important high-risk buildings. In France, the programme is concerned with the protection of public buildings – schools and hospitals – in the high-risk Antilles islands of Guadeloupe and Martinique (French Government, 2001). In Romania, the scope is limited to a relatively small number of multi-storey reinforced-concrete buildings in the capital, Bucharest, which were shown by the 1977 earthquake to be highly vulnerable and in some cases were inadequately repaired following the earthquake (Lungu, 2003).

 PEB

Costs of strengthening

Table 18.1. Typical reconstruction cost ratios for strengthening interventions

Country	Building type	Construction type	Technique	Strengthening-cost ratio	Source
French Antilles	Public buildings	Masonry and reinforced concrete		up to 50%	French Government
Greece	Schools	Masonry and reinforced concrete	Varies	10-20%	Penelis, 2001
Portugal	Apartments	Rubble masonry	Wall ties	5%	Cóias e Silva, 2001
Turkey	Apartments	Reinforced concrete	X-bracing Part shear wall Full shear wall	16% 20% 34%-40%	Altay *et al.*, unpublished
Eastern Turkey	Houses	Rubble masonry	Adding ties	27%	Coburn and Spence, 2002
California, United States	Apartments	Unreinforced masonry	Wall anchors, etc.	25%	Alesch *et al.*, 1986
Missouri, United States	Houses	Masonry Reinforced concrete		25% 30%	Cóias e Silva, 2001

Table 18.1 shows a compilation of recent studies of the costs of retrofit strengthening buildings to improve earthquake resistance. A useful way to present these costs is as a percentage of the total rebuilding costs of the same facility. Since both strengthening and rebuilding depend on building costs, the ratio tends to remain stable as prices rise. Table 18.1 shows a wide range of strengthening-cost ratios: from 5% to 50%. The cost ratio depends on a number of factors including:

- The type of building considered and its existing resistance.
- The intended level of strengthening.
- The cost of design and preliminary studies.
- Only structural costs or other associated refurbishment.
- The cost of taking the building out of use while work is undertaken.

In many cases, the strengthening-cost ratio for the structural intervention required to achieve an adequate degree of life safety tends to be in the range of 20% to 30%. This may be taken as a starting point for estimating the costs of a general strengthening programme. However, not all buildings would need strengthening.

The only study listed in Table 18.1 which specifically relates to schools is that carried out by Penelis *et al.* (2001) for the city of Thessaloniki. Costs of carrying out the three-stage procedure described below for the 500 schools in the region have been estimated in national currency; the figures converted into euros are shown in Table 18.2. The preliminary procedure, which would amount to 0.04% of reconstruction costs, would be carried out in all 500 schools. Of these, 400 schools would require the second-stage evaluation, which costs 0.4%. A detailed assessment would perhaps be needed for about 300, comprising 2% of reconstruction costs. Then, strengthening work would be carried out, meaning that 150 buildings would require work costing 10%, and 150 further strengthening work costing 20%. The cost of the whole programme would therefore be about 10.5% of the total reconstruction cost.

Table 18.2. Proposed strengthening programme for 500 school buildings in the Thessaloniki region

(after Penelis, 2001)

	Number of schools	Unit cost (euros)	Cost ratio	Total cost (million euros)
Preliminary rapid visual screening procedure	500	587	0.04%	0.3
Approximate evaluation	400	5 869	0.40%	2.4
Detailed assessment	300	29 347	2.00%	8.8
Strengthening work, 1	150	293 470	20.00%	44.0
Strengthening work, 2	150	146 735	10.00%	22.0
Total cost				77.0
Value of existing building stock	500	1 467 351	100.00%	733.0
Percentage of reconstruction cost				10.5%

Based on this study, a crude preliminary estimate was made of the possible costs of a strengthening programme for all of the school building stock (primary and secondary) in the six European Union countries with a significant seismic risk (Table 18.3). It is based on the following assumptions:

- Each of the six countries are divided into four seismic zones, using the ESC-SESAME map, by the expected 475-year peak ground acceleration (PGA) level, and its population is assumed to be uniformly distributed.[1]
- For the highest risk zone (PGA > 0.24 g) the average strengthening-cost ratio is estimated at 10% (as for Thessaloniki); for the second zone (0.24 g > PGA > 0.16 g) the average strengthening-cost ratio is estimated at 5%; and for the third zone (0.16 g > PGA > 0.06 g) the cost is estimated at 1%. The school population is estimated for the 11 years of compulsory schooling, which is standard in EU countries.

Table 18.3. Likely cost of school strengthening programmes in high-risk countries in the European Union

	Strengthening-cost ratio unit	Austria	France	Greece	Italy	Portugal	Spain
% of population in Zone 3 (0.16 g > PGA > 0.06 g)	0.01	1.0	0.3	0	0.4	0.8	0.5
% of population in Zone 2 (0.24 g > PGA > 0.16 g)	0.05	0.05	0.05	0.25	0.49	0.20	0.05
% of population in Zone 1 (PGA > 0.24 g)	0.1	0	0	0.75	0.16	0	0
Estimated number of schoolchildren	million	0.94	7.97	1.11	5.84	1.23	4.31
Space requirements at 6 m^2 per child	million m^2	5.65	47.83	6.66	35.03	7.39	25.86
Cost of building schools per m^2		1235	942	600	1 100	598	903
Total rebuilding cost	million euros	7 000	45 000	4 000	38 000	4 400	23 000
% expected strengthening costs		0.012	0.0055	0.0875	0.044	0.018	0.0055
Total strengthening costs	million euros	84	250	350	1670	80	130
% of GDP spent on education		5.9	5.9	3.6	4.5	5.7	7.5
Education capital expenditure (ECE)	million euros	614	6 297	751	3 513	376	3 725
Strengthening costs as % ECE...		13.6%	3.9%	46.5%	47.6%	21.2%	3.5%
...or annually as a 20-year programme		0.7%	0.2%	2.3%	2.4%	1.1%	0.2%

- Data on school-age population, school enrolment, expected space requirements for each child, rebuilding costs and national budgets spent on school building are taken from a variety of statistical sources (DfEE, 1996; Eurostat, 2003; UNDP, 2001; Langdon *et al.*, 2000).

The resulting estimates of strengthening costs for each of the six countries are shown in millions of euros, then as a percentage of each country's annual capital expenditure on education, and finally as an annual percentage, assuming a programme of 20 years' duration. The data show that Italy is the country with the highest relative cost (47.6% of the annual capital budget for education at current levels),[2] followed by Greece (46.5%), Portugal (21.2%) and Austria (13.6%). The costs do not seem completely unmanageable given that the estimated length of the programme is 20 years and also considering that these costs are offset by the reductions in damage, disruption and human casualties that such a programme would entail.

In practice, a 20-year programme could be designed in such a way that retrofitting work would be carried out alongside other necessary maintenance or refurbishing work; and the natural process of replacing older school buildings already planned and budgeted for would avoid the need for upgrading some of the oldest and most vulnerable school buildings. Thus, the real additional costs would be significantly less.

Conclusions

This paper has argued that legislation is necessary to ensure that the work needed to make public buildings earthquake-safe is carried out. The paper has also described the required scope of a programme of work that would bring school buildings up to acceptable life-safety standards in the six most earthquake-prone countries in the European Union. Such a programme is certainly affordable for EU countries over a 20-year period, although it would involve some revision of national capital expenditure priorities over that time.

The extension of this retrofitting approach to poorer countries is likely to be more problematic, both because of the limited resources available for public expenditure, and also because strengthening in many existing school buildings may not be technically feasible. In the most earthquake-prone countries, most effort should be devoted to ensuring that new school buildings are built to adequate standards, and that unsafe buildings are replaced. El Salvador, which suffered an earthquake in 2001 in which over 60% of the school buildings in the entire country suffered damage, has already adopted such an approach.

An urgent and preliminary task is to define a set of life-safety standards that could be adopted internationally. With such a definition, it would be a straightforward, if laborious, task for structural engineers to define more precisely the scope of the building programme needed in any country or region. Pressure must be placed on the EU and national governments to adopt regulations and to put in place the programmes necessary to protect the lives of future generations of schoolchildren worldwide. A clear set of guidelines, which establishes what can be achieved, will help to create a situation in which governments and their ministers will be forced by their electorates to take responsibility for the consequences of their inaction.

Notes

1. This assumption leads to an overestimation of the exposure to seismic risk, since the highest risk areas are generally mountainous and relatively lightly populated.

2. An estimate by the Italian government assumed that all schools constructed before 1979 in the three highest seismic risk zones defined in the Italian seismic code would

require strengthening to two-thirds of the full code resistance, which resulted in significantly higher assumed overall costs. However, this estimate was not based on a detailed vulnerability survey, and it used operational cost data from a post-earthquake situation (Goretti, 2004). The estimate covers students aged between three and 18 in public schools.

References

Alesh, D.J. and W.J. Petak (1986), *The Politics and Economics of Earthquake Hazard Mitigation*, Institute of Behavioural Science, University of Colorado.

Altay, G., *et al*. (unpublished), "Benefit Cost Analysis for Earthquake Mitigation: Evaluating Measures for Apartment Houses in Turkey".

Coburn, A.W. and R.J.S. Spence (2002), *Earthquake Protection*, John Wiley and Sons, Hoboken.

Cóias e Silva, V. (2001), "Technical Feasibility of the National Programme for Reducing the Seismic Vulnerability of the Building Stock", *Conference on Reducing the Seismic Vulnerability of Constructions*, National Laboratory of Civil Engineering (LNEC), Lisbon, Portugal, 2001.

Department for Education and Employment (DfEE) (1996), *Area Guidelines for Schools, Building Bulletin 82*, Architects and Building Branch Department for Education and Employment, London.

Dolce, M. (2003), Personal communication.

Eurostat (2003), "Public Expenditure on Education in the EU in 1999", *Statistics in Focus, Theme 3 –22/2003*, Eurostat, Quebec.

French Government (2001), Personal communication from Pierre Mouroux, Office of Geological and Mining Research, France (BRGM).

Giardini, M., J. Jiménez and G. Grünthal (2003), *European-Mediterranean Seismic Hazard Map,* European Seismological Commission, International Geological Correlation Programme, Project No. 382, SESAME, *http://wija.ija.csic.es/gt/earthquakes/imatges/ESC-SESAME_poster_A4_75q.jpg*.

Goretti, A. (2004), Personal communication.

Gülkan, P., *et al*. (1999), *Revision of the Turkish Development Law No. 3194 and its Attendant Regulations with the Objective of Establishing a New Building Construction Supervision System Inclusive of Incorporating Technical Disaster Resistance-Enhancing Measures* (3 Volumes), Turkish Ministry of Public Works and Settlement, Istanbul.

Japan International Co-operation Agency and Istanbul Metropolitan Municipality (JICA-IMM) (2002), *The Study on a Disaster Prevention/Mitigation Basic Plan in Istanbul Including Seismic Microzonation in the Republic of Turkey*, IMM, Istanbul.

Langdon, D., *et al.* (2000), *Spon's European Construction Costs Handbook*, Routledge mot E F and N Spon.

Lungu, D. (2003), Personal communication.

Parsons, T., *et al.* (2000), "Heightened Odds of Large Earthquakes Near Istanbul: An Interaction-Based Probability Calculation", *Science*, Vol. 268, pp. 661-665.

Penelis, G. (2001), "Pre-Earthquake Assessment of Public Buildings in Greece", *International Workshop on Seismic Assessment and Rehabilitation of Structures*, Athens, Greece, January 2001.

Portuguese Association of Earthquake Engineering (SPES) (2001), "Contributing to a National Programme for Reducing Seismic Vulnerability of Constructions", *Conference on Reducing the Seismic Vulnerability of Constructions*, National Laboratory of Civil Engineering (LNEC), Lisbon, 2001.

Spence, R. (2003), "Earthquake Risk Mitigation in Europe: Progress towards Upgrading the Existing Building Stock", Keynote paper for 5th Turkish National Conference on Earthquake Engineering, July 2003.

Sucuoglu, H. (2003), Personal communication.

United National Development Programme (UNDP) (2001), *Human Development Report 2001*, UNDP, New York, *http://hdr.undp.org/reports/global/2001/en/*.

Zuccaro, G. (2003), Personal communication.

Acknowledgements

The ideas of many people active in earthquake protection issues in Europe have contributed to this paper. Special thanks are given to Mihael Papagiannakis MEP, Polat Gülkan, Panayotis Carydis, Andrew Coburn, Giulio Zuccaro, Antonios Pomonis, Julian Bommer, Mary Comerio, Carlos Oliveira, Artur Pinto, Haluk Sucuoglu, Pierre Mouroux, Dan Lungu, Agostino Goretti and Mauro Dolce for fruitful discussions and valuable comments on earlier drafts.

PEB