

Coping with seismic vulnerability: small manufacturing firms in western Athens

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This paper attempts to contribute to international discourse on the responsibility of macro structures (economic and political) and private agencies for the production and distribution of vulnerability. It does so by focusing on an individual economic entity, small manufacturing firms (SMFs), in a specific location, western Athens, Greece. By evaluating the losses that SMFs sustained in the earthquake of 7 September 1999, the paper points to variations in vulnerability levels among such firms and highlights the 'sources' of vulnerability they confront. Furthermore, the SMF recovery cycle is systematically monitored in parallel with relevant public policies and state reactions to private recovery methods. The analysis illustrates processes that externalise recovery costs, alter the relationship between physical and socio-economic vulnerability and shift the vulnerability load from macro structures to individual agencies or vice versa. It is based on two methodological approaches: the division of vulnerability into three constituent components (exposure, resistance and resilience); and the conceptual split between producers and carriers of vulnerability.

Keywords: continuity planning, earthquakes, exposure, manufacturing firms, recovery, resilience, resistance, small businesses, vulnerability.

Conceptual and methodological assumptions

Vulnerability has a common meaning: '[b]eing prone or susceptible to damage or injury' (Blaikie et al., 1994, p. 9). A simple working definition proposed by the same researchers and focusing on the social aspects of vulnerability is the following: '[b]y vulnerability we mean the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard' (Blaikie et al., 1994, p. 9). Some authors have contrasted vulnerability with 'capability—the ability to protect one's community, home and family and to re-establish one's livelihood' (Anderson and Woodrow, 1989, p. 28). The word 'livelihood' is important in this definition. The authors mean the command that an individual, family or other wider social group has over an income and/or bundles of resources that can be used or exchanged to satisfy needs (information, cultural knowledge, social networks, legal rights, as well as land, tools or other physical instruments).

The above definitions reveal an ambiguity with respect to the entity producing and carrying vulnerability. Is it the wider society or community structure as a whole or the individual that produces vulnerability, carries it and at some point or another becomes the very victim of its consequences? Timmerman (1981) reviewed vulnerability with regard to society or community and defined it as 'the degree to which a system or part of a system

may react adversely to the occurrence of a hazardous event' (Timmerman, 1981, p. 21). From the radical/structuralist perspective, Hewitt (1983), responding to the lack of critical evaluations of human causes of environmental hazards, championed an approach to disaster analysis that has its roots in the Marxist tradition and draws on dependency theory. He argued that natural disasters should be seen as part of an ongoing relationship between society and nature, not as one-time extreme events that occur outside of development.

The above society-level view of vulnerability has been challenged by Blaikie et al. (1994) on the grounds that it is people, rather than disembodied systems, who have to deal with a disaster. Adopting the same line of thought, Pelling (2003) calls into question the focus on macro national and global political and economic structures, as it underplays the role of the human agent. For Pelling, the challenge today is to integrate agency and structure into an examination of the production of vulnerability in specific places, while also acknowledging the importance of physical systems in generating hazards that can trigger a disaster.

The above definitions, however, do not clarify the relationship between socio-economic vulnerability and physical vulnerability (the vulnerability of engineered structures and physical spaces). How do these two forms and aspects of vulnerability interact? It is self-evident that physical vulnerability produces social vulnerability in the sense that engineered structures that are not disaster-resistant threaten human life and property. Within the human ecology discipline, social vulnerability is measured by exposure to hazard (Hewitt, 1983, pp. 3–32). Yet, how often does one observe the reverse action, where social vulnerability produces and reproduces physical vulnerability and under what circumstances? In concluding his review of disaster and risk management in ten mega-cities, Mitchell (1999, p. 480) refers to neglected approaches involving non-expert systems, informal procedures, non-structural technologies and private-sector institutions, as well as the actions of individuals, families, neighbourhood groups, firms and similar entities.

It is commonly accepted that the relief and recovery processes that take place in post-disaster periods are crucial to determining future levels of vulnerability. If the standard of reconstruction of the physical structure of a city is at pre-disaster or lower levels, physical vulnerability is recreated and perhaps even increased. Whether this recovery and restoration effort is conducted by the state or by private agencies may prove vital for vulnerability reproduction and/or redistribution. Pelling (2003, p. 35) argues that, in so-called developing countries and in more frequent localised disasters, reconstruction is more likely to proceed without state involvement and without the assistance of international non-governmental organisations (NGOs) or bilateral aid. This lowers the visibility of reconstruction efforts—many take place at the household level—and restricts the technical and financial resources available for reconstruction. The persistent re-urbanisation of hazard sites, without any additional mitigation initiatives, is a familiar consequence that leads to greater losses in future. This paper indicates that recovery processes may also incorporate the variables that trigger vulnerability transformation. In other words, recovery processes that reduce physical vulnerability may automatically raise social vulnerability or vice versa.

The changing nature of risk mitigation

With regard to small manufacturing firms (SMFs) in western Athens, Greece, those engaging in informal practices or operating in unauthorised premises (and not alone) managed to sidestep statutory administrative building repair channels after the earthquake of 7 September 1999.¹ Instead, the entrepreneur contacted an engineer who happened to be a friend or relative for advice on the building damage. Alternatively, the entrepreneur paid an Albanian builder working in a neighbouring structure a small sum to treat extemporaneously any concrete cracks. Such practices more likely than not increase the structural vulnerability of manufacturing buildings and, in turn, the physical vulnerability of the wider urban fabric. Tragically, the next major seismic event will almost certainly confirm this.

Similar processes, though, allowed firms to avoid economic losses stemming from operational disruption due to the statutory, yet bureaucratic and time-consuming, procedures associated with, for example, the issuing of building permits and the awarding of aid grants. It seems that contravention of the building and planning law renders firms more resilient to the economic consequences of disaster events, although the physical vulnerability of the city is heightened in the long run.

In the case of western Athens, private and informal recovery practices highlight the shift of responsibility for vulnerability management from governmental agencies to private individuals, households and enterprises. Christoplos (2003, p. 95), in an article entitled 'Actors in Risk', argues:

In the past disaster management was strongly infused with implicit assumptions that there were clear-cut 'normal' roles for the State, private sector and civil society. We felt that we at least knew who should do what when dealing with disaster mitigation, preparedness and response. In recent years however, changes in the nature of disasters ... in the roles and competences of the State, have compelled us to rethink about who should be doing what, before, during and after a disaster strikes. As neo-liberal policies have taken hold and there is a growing pressure on States to assume a narrower set of responsibilities, the latter are tempted to avoid engagement in disaster mitigation and preparedness planning.

Besides, risks smoulder and a long time may pass before a disaster strikes to reveal the dangers inherent in the spatial structure of a city. In such circumstances, it is tempting for the authorities to sit on their hands, arguing that there is no hard evidence to justify action. This narrow-minded political philosophy leads to repeated violation of the 'precautionary principle'—familiar to researchers and politicians preoccupied with sustainable development. The precautionary principle states that uncertainty is not sufficient reason to maintain the status quo and that the ramifications of inaction are potentially very great (Secrett, 1996, pp. 12–19). Waiting for real disaster victims before taking action is the same as conducting a scientific experiment in which members of the public take the place of laboratory animals.

An additional reason why disaster mitigation has gradually been pushed aside by central government is that ongoing development policies centre around the global decentralisation agenda, which has shifted responsibility for disaster management closer to those who

have been affected. This agenda has been driven by both left- and right-wing ideologies. Distrust of central government and faith in popular participation have coalesced and determined that risk is best addressed as close as possible to where disasters actually occur (Christoplos, 2003, p. 104).

In brief, for one reason or another, a shift is taking place: risk mitigation as a governmental policy is being replaced by risk mitigation as an option of the individual social or economic entity. The individual household or private enterprise must amass surplus assets to meet more than just running costs and secure multiple sources of income to confront crisis situations. The individual household or private enterprise must transform crisis experience into knowledge and information that can be used for self-protection. It seems, then, that individual households and economic entities are facing the inevitable dilemma of choosing between unilateral risk mitigation at their own expense on the one hand and dependence on inadequate governmental emergency relief and recovery mechanisms on the other.

This shift in responsibility for vulnerability management (from governmental agencies to private individuals, households and enterprises) can be easily discerned in the recent post-earthquake policy of Greece, too. Public financial assistance granted to SMFs to cover in part the repair and reconstruction costs resulting from the September 1999 earthquake was not a long-term, all-encompassing course of action. It did not amount to a package of relief measures that was more attractive than the alternative, individualised solutions of entrepreneurs: carrying out repairs oneself without an official building permit, and meeting repair costs oneself through reductions in production and output levels, or by dismissing labour. In fact, the public-policy measures appealed to entrepreneurs less than the private, individualised options. Seemingly, the public authorities let future vulnerability of the urban structure result by not reacting to the determinations of thousands of private individual decision-makers who often make risky choices (Sapountzaki, 2003b, p. 6).

Objectives of the study

It appears, therefore, that it is worthwhile to assess the vulnerability of individual economic entities, such as small manufacturing firms, and their usual post-disaster recovery responses, which often lead to increased vulnerability. The aim here is to show that abdication by the public authorities of their responsibility for post-earthquake recovery and the handing over of that task to private economic entities may easily exacerbate the vulnerability of the city structure and generate even greater losses in a future disaster cycle.

SMFs in western Athens, including those operating on the fringe of the formal and informal sectors of the economy, are suitable points of reference for this kind of analysis. This is because their limited viability forces them to come up with individualised solutions and to establish informal social support networks with the full knowledge of, and/or with tacit support from, the authorities.

The above objective of outlining the recovery process of SMFs and consequent vulnerability reproduction and redistribution is accomplished by:

- identifying the ‘sources’ of vulnerability of SMFs. This was facilitated by post-earthquake surveys carried out in western Athens, which addressed both the social and economic impacts of the seismic event of 7 September 1999 on small manufacturing firms (HUA, 2003); and
- systematically monitoring the recovery cycle in order to determine which processes are most likely to lead to the externalisation of recovery costs either by SMFs or by public authorities, thereby heightening the physical or socio-economic vulnerability of macro structures or individual agencies.

The paper attempts to contribute to the dialogue on the relationship between the vulnerability of macro structures and the vulnerability of micro structures, as well as the relationship between physical vulnerability and socio-economic vulnerability. It examines the post-earthquake responses of a specific agency (the SMF) in its struggle to survive and recover in the specific urban context of western Athens. State reactions to private recovery practices are also appraised, as are the reciprocal impacts of these responses on the vulnerability of interdependent micro, medium and mega entities.

The interpretative rationale is based on two methodological approaches. The first breaks down vulnerability into three components (Pelling, 2003, p. 47):

- *exposure*;
- *resistance*; and
- *resilience*.

According to Pelling (2003, p. 48), *exposure* is largely a product of physical location and the character of the surrounding manufactured and natural environments. The exposure component can be reduced through hazard mitigation investments made by individuals or single households or collectively through public–private social investment policy schemes, such as by establishing strict seismic design codes for public buildings.

Resistance reflects economic, psychological and physical health and their systems of maintenance and represents the capacity of an individual or group of people to withstand the impact of a hazard. If resistance is low, even a small hazard stress can result in the failure of a system.

Resilience to a natural hazard is viewed as the ability of an actor to cope with, or adapt to, hazard stress. It is a product of the degree of preparation undertaken in light of a potential hazard, and of spontaneous or premeditated adjustments made in response to a hazard, including relief and rescue. The most important policy options available to boost resilience are those that shape formal or informal insurance mechanisms (Pelling, 2003, pp. 48–49).

The second methodological approach centres on the conceptual division between *producers* and *carriers* of vulnerability. When a firm itself conducts unauthorised repairs to the damaged building within which it operates, the resulting vulnerability spreads out and affects not only the company but also the families and the households of workers. In this case, the firm is both the producer of vulnerability and the victim of it. The story does not end here, though: the produced vulnerability has a far-reaching distribution effect. The intention of this author is to locate and map it.

The following analysis draws on the post-disaster records of the Ministry of Internal Affairs, Public Administration and Decentralisation (MIAPAD) and the Ministry for the Environment, Spatial Planning and Public Works (MEPPW). Three years after the September 1999 earthquake, a research team from the Harokopion University of Athens (HUA)—of which this author was a member—engaged in a project to elaborate on and enhance the content of these records. Thus, first-stage recordings and processing of statistical data on building damage and other losses by the above ministries shortly after the seismic event (one and three months, respectively) were followed (three years later) by a second phase of data enrichment. Continued observation of the recovery process facilitated a holistic assessment and led to better understanding of recovery dynamics in terms of their effects on reproduction/redistribution of vulnerability.

SMFs in western Athens: exposure to a seismic hazard

The fundamental factors determining the degree of exposure of SMFs in western Athens to a seismic hazard are: a) the location of the firm vis-à-vis fault lines and other unsuitable territorial micro zones; b) the age (with respect to the date of modification of the 1959 Greek Seismic Design Code) and the (construction) quality of the SMF's premises; c) the practices adopted for the building of such accommodation or those employed during later intervention phases—practices that probably involve the contravention of the General Building Law and the Seismic Design Code; d) the susceptibility of mechanical equipment and stored raw materials and other stock to damage stemming from a seismic shock; and e) the likelihood of excess workers and/or pieces of heavy equipment being in inappropriate spaces due to the transgression of health and safety rules.

The level of exposure is also determined by external variables. Of major significance are the vulnerabilities of utility services (transportation, communication, water, electricity, gas and sewerage), particularly the possibility of serious interruptions (Dahlhamer and Tierney, 1996, p. 6; Webb et al., 2000, p. 86). Also important are environmental factors, which can result, for instance, in firms being cut off from their surroundings, employees being denied access to their place of work, and difficulties in obtaining supplies for production and delivering goods.

Research conducted after the earthquake in Northridge, California, on 17 January 1994 (Stallings, 1996; Tierney, 1995) identified pockets of severe residential and commercial damage and disruptions to businesses located within or near the affected areas. While not all businesses suffered direct physical damage, the emergence of 'ghost towns' in the aftermath of the earthquake caused them serious economic problems, especially if they were dependent on a local customer base, and limited their ability to recover. In their research on the regional economic impacts of the Northridge earthquake, Gordon et al. (1995) estimated that just over one-quarter of the losses stemming from business interruption were due to damage to the transportation system.

As of early 2005, no comprehensive study exists of the vulnerability of the building stock in Metropolitan Athens to a seismic event. However, there is awareness (among engineers and policymakers) of the most vulnerable types of buildings in the area. Non-

engineered, non-reinforced and badly maintained masonry buildings are the most hazardous ones. Also vulnerable are multi-storey, reinforced concrete frame structures built before the modification, in 1984, of the (1959) Greek Seismic Design Code. Much of the city's building stock consists of multi-storey apartment buildings, constructed in the 1960s and 1970s, when intense urbanisation took place in Athens. The vulnerability of these structures has been exacerbated in many cases by later interventions, some of them illegal, which sought to adapt old buildings to contemporary needs (NTUA, 1996). This sort of vulnerability is predominant in western Athens and largely determines the exposure level of small firms sheltered in multi-storey buildings of mixed use.

The September 1999 earthquake caused varying degrees of damage to the premises of SMFs in western Athens. Records are of great value for examining the exposure of manufacturing firms prior to the event.² According to the final report of the HUA, 2,103 firms (manufacturing and trading entities) located in western Athens suffered damage to their building accommodation—26% of the total number of firms that suffered building damage in Attica Region. Of the buildings that were damaged, 276 (13.1%) were marked 'red', that is, uninhabitable (slated for demolition), and 1,827 were marked 'yellow', that is, habitable only after repairs have been carried out.³ The average rate of employment per firm in the case of the above affected entities was 2.4. This is not surprising, since very small firms are common in cities in Greece.

Of the firms in marked premises, 15% closed as a result of damage to their building accommodation. The majority was 'red' cases; these firms were required to halt operations for a considerable amount of time to allow demolition and reconstruction work to take place.

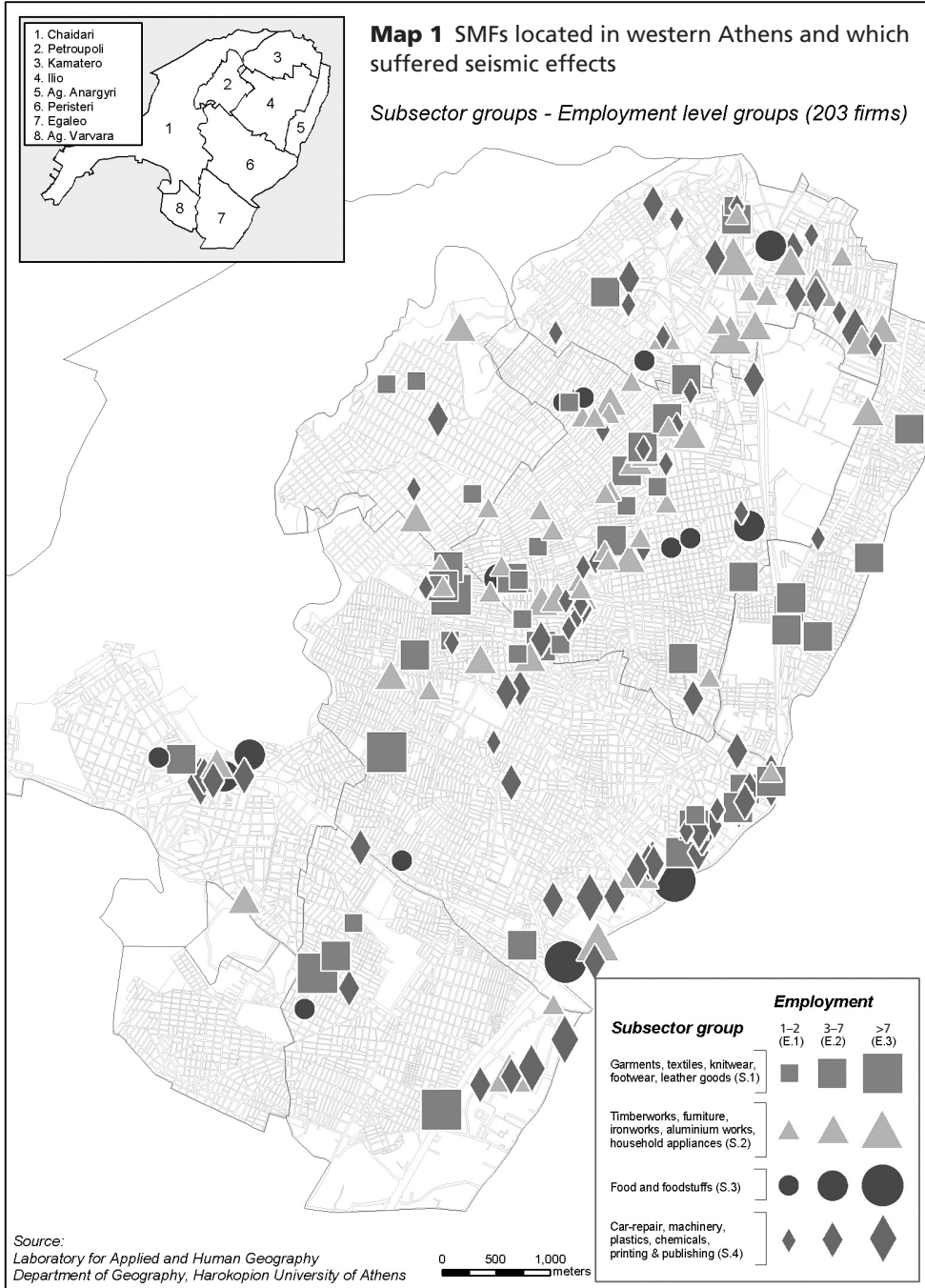
In sum, firms characterised by high *exposure* to a seismic hazard displayed minimal *resistance* to the effects of the disaster, resulting in total breakdown. It seems that those firms whose viability was already in doubt and which lost their accommodation either permanently or temporarily did not have the economic reserves needed to cope with operational interruptions and/or displacement.

The majority of the 'yellow' and 'red' firms whose operations were temporarily suspended due to reconstruction and repair work said that they intended to remain in their pre-disaster location. Only 15% was eager to relocate. Despite the damage to their premises, though, most of the 'yellow' firms resumed normal operation shortly after the seismic event, demonstrating the capacity of SMFs to adjust to post-disaster conditions. It remains to be seen, however, whether this *resilience* is due to transgression of health and safety rules.

Aside from the survey undertaken by the MIAPAD, the MEPPW established its own databases of damaged building stock in Metropolitan Athens. Three years after the earthquake, the HUA research team systematically elaborated on this information in order to develop a new database for 226 marked firms ('green', 'yellow' and 'red') dispersed across eight municipalities,⁴ constituting the nucleus of western Athens. Of the 226 marked firms, 203 have been mapped (see map 1).

With respect to output, the firms were divided up into four production sub-sectors (HUA, 2003):

- S1: garments, textiles, knitwear, footwear and leather goods;
- S2: timber works, furniture, ironworks, aluminium works and household appliances;
- S3: food and foodstuffs; and
- S4: car-repair shops, machinery shops, foundries, plastics, chemicals, printing and publishing houses and bookbinders.



Of the 226 firms, 175 (77%) were 'yellow' and only two were 'red'. (This is not surprising, since most of the 'red' firms shut down soon after the disaster.) Most of the 'yellow' cases were categorised as S4 (59) and S2 (56) sub-sector groups. With respect to labour, most 'yellow' firms were very small (nano) enterprises—47.4% employed between one and two workers, while 44.6% employed between three and seven workers.

For the purpose of obtaining detailed information on the identity of firms, material and immaterial losses suffered and the adopted recovery process, the HUA research team identified a representative sample of 50 SMFs to be approached and asked to complete a questionnaire. The sampling method used was based on random numbers. The sample resulted from triple stratification of the population (total number) of firms on the basis of three determinant groupings: the manufacturing sub-sector grouping (S1, S2, S3 or S4); the employment-level grouping (E1, between one and two workers, E2, between three and seven workers, or E3, more than seven workers); and the location grouping as regards clusters of affected firms.

From the questionnaire, the following facts were determined regarding the dominant profiles of firms and the level of exposure (HUA, 2003).

- Sixty-two percent of firms are sole traders and 18% are partnerships (the rest are categorised according to other kinds of legal identities). Thirty-six employ less than seven workers; only four employ more than 15. Most firms (29 out of 50) occupy the ground floor of a building—either exclusively or along with the basement and/or one or more floors. Twenty-one have complete use of the premises in which they are situated. The others are located in multi-storey buildings of mixed use, with residential accommodation being the main element. Seventy-four percent of buildings are 23 or more years old; hence they were constructed before the Seismic Design Code was modified (in 1984). It is doubtful, though, whether even one-half of the remainder conforms with the provisions of the revised code, since many lack official building permits. Less than 50% of firms own the building space that they use.
- Thirteen firms reported minimal damage, while 12, 13 and ten reported slight, substantial and major damage, respectively. By correlating the distribution of damage according to sectoral grouping and employment-level grouping, the research team concluded that there appears to be no relation between the seismic safety standards of building accommodation and firms' sectoral orientation or employment figures. Three years after the event, 33 firms had completed repairs, seven were still carrying out repairs and another seven had left the damage untouched, as they believed that it did not hinder the production process.
- With regard to the susceptibility of machinery to damage stemming from a seismic shock, the S3 sub-sector group (food and foodstuffs) seems to be in the worst position. In general, firms that utilise electronic and high-technology sensitive devices are most likely to experience machinery failures. Raw material damage or losses are common with respect to S43 (ceramics, detergents, marble, mattresses, ornaments, printing and publishing and toys), S3 (food and foodstuffs), S21 (furniture and timber works) and S23 (crystal, glass and lighting).⁵ Finally, firms producing furniture, ceramics, glass and aluminium frames reported damage to products owing to crumbling plaster

or masonry. In several cases, the degree of exposure was heightened by various illegal practices, such as using heavy machinery in buildings that cannot withstand the vibrations, and having redundant staff in inadequate manufacturing areas.

The level of exposure of the above firms was further increased by invisible factors and those that SMFs cannot control, such as the vulnerability of lifeline systems (Tierney and Nigg, 1995, pp. 72–79; Nigg, 1995, pp. 46–58) in neighbouring ‘out-of-plan’ industrial districts and low-income localities.

The overall exposure potential of SMFs in western Athens has been partly revealed by the September 1999 earthquake. The responsibility of individual SMFs for this potential was limited; basically, it was due to contravention of health and safety rules in industrial premises. For the most part, risk taking by SMFs was involuntary (Sjoberg, 1987, p. 270). This is evidently the case with rented accommodation. Entrepreneurs with cheap building space were either ignorant of the history of their premises or unwilling to intervene and make them earthquake-resistant. In such cases, the *producers* of vulnerability are the landowners, the builders and, generally, all those who have contributed to the life of the structure. Vulnerability *producers* also include governmental agencies and administrative authorities, which allowed thousands of private individuals to form and transform the physical environment of western Athens. Therefore, *exposure* of firms/tenants is beyond the control of entrepreneurs. The *exposure* component of vulnerability is in the hands of other actors and is facilitated by the macro structure, in this case, the Greek political and administrative system.

In situations where entrepreneurs are landowners and have also contributed to decisions regarding construction and/or later interventions, they are *co-producers* of the exposure component of vulnerability. Consequently, *exposure* to a seismic hazard is partly generated by the firm. However, the firm is not the sole victim of it. Exposure proliferates, drawing in multiple carriers, including the households of workers and clients and interdependent economic entities.

Low resistance and high resilience potential of SMFs

Resistance

Adapting the definition of Pelling (2003), the resistance of a manufacturing firm can be viewed in terms of its economic and other reserves that are not directly impaired by physical damage and which the firm can afford to draw on for its post-disaster recovery. In this sense, profitability, liquidity, the degree of dispersal of fixed capital, being a franchise or part of a chain instead of an individual, single location firm, the proportion of reserve funds vis-à-vis net fixed assets, outstanding debts, staff commitment and company reputation are all factors that affect the firm’s resistance potential.

Of the 50 SMFs contacted by the HUA research team, only one reported a substantial reduction in total sales between 1998 and 2002. The rest described consistent sales in that four-year period or a marginal decrease or increase. Given that the firms that have not recovered have either closed or are worse off than they were before the earthquake

(Dahlhamer and Tierney, 1996, pp. 1–27), it can be reasonably assumed that almost all of the firms interviewed are in recovery. That said, most of the firms (40 out of 50) reported cash-flow problems either because they had to shoulder the cost of repairs themselves, even when they were based in rented accommodation, or because they were forced to close until restoration work had been completed. It seems, then, that, for the most part, entrepreneurs met recovery costs.

This finding raises some questions, though. The sample is dominated by firms with a very low annual turnover (28 of the 50 SMFs interviewed made less than EUR 150,000 in 2002). In addition, they are very small firms that have few employees and are of marginal viability. Knowing that 39 suspended operations for a significant amount of time (from a couple of weeks to two months), the fact that they were able to cover running costs (rent and wages, for example) during the closure and repair costs seems very strange.

The answer to this conundrum may lie with the employment of informal practices and occasional breaches of the law. (There is a large variety of such practices.) Firms themselves highlighted the existence of credit facilities among the likes of suppliers, building proprietors, utility companies and social support networks. In other words, the pre-existing socio-economic context enhanced the ability of firms to function in abnormal conditions, that is, their resilience.

Yet, the resistance potential of SMFs was indeed very low. As noted above, most were individual, single location firms with low levels of profitability and an extremely restricted cash flow. They were saddled with debts, had a minimal number of long-term, regular employees who were committed to the firm, and their fixed capital was more or less concentrated in one place. It appears, therefore, that low resistance is the inevitable product of their smallness. This finding is in line with similar arguments in the relevant literature. After the Northridge earthquake of 1994, small firms situated in the area of the seismic event were found to be particularly vulnerable to disaster-related impacts and losses. This was because they tended to have limited cash reserves and generally could not afford to take various preparedness and mitigation steps, such as developing business continuity plans (Frost, 1994, pp. 7–15) and purchasing business interruption and hazard insurance (D'Souza and Dahlhamer, 1995, pp. 1–25; Dahlhamer and Tierney, 1996, pp. 1–27). Resistance potential thus remains low as long as the firm remains small, but improves when the firm grows and develops.

Resilience

The resilience of a manufacturing firm might be viewed in terms of its ability to make spontaneous or premeditated organisational and other adjustments to overcome hazard stress. Resilience has nothing to do with consuming reserves to assist recovery. On the contrary, it is wrapped up with the means and processes employed to avoid direct post-disaster recovery expenses.

Resilience assets to be utilised in a crisis situation include: access to credit; multiple suppliers and customers and/or product markets that are geographically dispersed; family and social support networks; formal or informal insurance; rental status (facilitating mobility); flexible forms of employment; access to political and administrative mechanisms; and trade-union membership, providing access to resources and political power.

The 50 SMFs considered were in a position to draw on several of these assets. More than one-half held rental status and more than one-half enjoyed family support (as sole traders). Most firms reported that they did not experience any trouble with their supply processes because several of their suppliers were located outside of the disaster area. Furthermore, in many instances, suppliers were willing to extend credit terms for stricken entrepreneurs (HUA, 2003, p. 135), demonstrating support between cooperating enterprises.

The most important aspect of resilience potential, though, concerns the informal, semi-illegal character of the socio-economic environment within which SMFs operate. As a result, the owner and family members could work extra hours, illegal immigrants could be employed, mandatory contributions did not have to be paid, activities and assets could be concealed and the company could function without a legal permit from the appropriate agencies (HUA, 2003, pp. 144–145). These informal, defensive practices tend to intensify in a crisis period, facilitate the externalisation of recovery costs and act as a lifebelt for firms that otherwise would face definite closure. The wide spatial and socio-economic structure of western Athens acts as an incubator for such practices, increasing the resilience potential of SMFs situated there. The same structure that creates exposure problems for SMFs allows for the emergence of benefits from a diffused nexus of informal conveniences.

The recovery process and the subsequent redistribution of vulnerability

Only 12 of the 50 firms surveyed succeeded in obtaining a loan or some sort of financial assistance to cover recovery expenses. In particular, one firm was reimbursed by an insurance company, three received financial support from competent public organisations, three received financial support from social agencies, and another two were granted loans (one under favourable conditions, the other under free-market conditions). The other three firms jointly utilised a couple of the above funding resources to cover recovery expenses. Most firms, however, have had to rely on their own private means. Four out of 24 firms situated in rented accommodation carried out quick repairs themselves. It seems that SMFs distanced themselves from public rehabilitation policies and took recovery and restoration steps themselves. This shift from the public to the private domain was the result of two major underlying causes.

- First, it was time-consuming and expensive to take advantage of public policies. Delays in assessing building damage, issuing restoration permits and awarding public funds, for instance, led to long operational interruptions with negative impacts on the economic status of firms. State policies accorded priority to households and dwellings and stricken production processes were supported only by measures and policies targeted at the residential sector. Emphasis was placed on material losses, basically building losses; other intangible ramifications, such as the length of the interruption to the production process, were ignored. This emphasis stemmed from the long-established political practice of the Greek state of granting individual seismic loans

to building owners. This policy disregards the content of building spaces. Besides, the economic costs involved in acquiring the necessary documents and creating the conditions set out in the building law drove firms away from authorised channels and sources of public support.

Once approved, the aid grant only covered the cost of the technical study; additional public assistance took the form of an interest-free loan. Entrepreneurs, however, were granted the loan only on condition that they mortgaged their accommodation.

Furthermore, according to key public officials (HUA, 2003), the entire assistance package (aid grant and interest-free loan) met no more than 50% of reconstruction or repair costs. Those firms that already had outstanding debts were thus placed in an even more difficult position. If they were awarded a new loan for post-disaster recovery, they would have to fulfil additional repayment obligations, not to mention come up with the extra funds needed for building work (Webb et al., 2000, p. 88).

As a result, manufacturing buildings either were not restored or underwent only temporary repairs. Entrepreneurs favoured externalising recovery costs instead of internalising or sharing them with the state, and governmental authorities supported indirectly these private practices by making statutory procedures inaccessible, at least to SMFs.

- Second, firms in rented premises did not have a chance to take advantage of public measures. Since the public protection umbrella only covered landowners, the latter could put pressure on tenants to evacuate buildings to allow repairs to be carried out and land-use changes to be made. In such a situation, the firm not only suffers harm due to the disaster event, but also it is displaced. Building owners, however, have been required to submit statements to the authorities in response to the claims of renters and to re-house them after restoration work has been completed. Nevertheless, the psychological pressures on firms lacking operational permits resulted, for the most part, in landowners maintaining a predominant position vis-à-vis tenants. In such cases, it is evident that landowners themselves take advantage of public financial support, simultaneously preventing former tenants from benefiting from building improvements. The displaced firm is probably facing the possibility of becoming alienated from local cooperation networks, incurring additional costs through relocation, and perhaps bankruptcy. Meanwhile, proprietors profit from the surplus value of their reconstructed or improved premises.

The above cases illustrate a specific process of vulnerability redistribution. Physical vulnerability of the formerly rented building is reduced (by means of engineering work) through exacerbation of the vulnerability of socio-economic agencies. Displaced firms striving to survive will most likely resort to even more vulnerable building spaces, having been deprived in the interim of a whole range of accessible resources, capital assets and cooperation networks.

Finally, semi-illegal firms operating without permits were unable to take advantage of public-policy measures even when the entrepreneur was the landowner. The legitimisation of illegal premises and the procurement of operational permits involved a high degree of expenditure and long procedures. This is why restoration by private means or no

restoration at all were the most common solutions among this category of SMFs, conforming with their usual defensive practice aimed at reducing production costs. Such practices are further encouraged by public distrust of governmental mechanisms.

For one reason or another, therefore, governmental authorities renounced responsibility for the post-disaster recovery of socio-economic entities, especially SMFs. Nevertheless, most SMFs refused any public offers of financial assistance and opted to assume responsibility for rehabilitation and regulation of their future vulnerability themselves.

Nonetheless, physical vulnerability is still an issue that is pursued by governmental agencies. An apparent alliance between governmental agencies and thousands of owners of landed property targeted vulnerability of building structures. Respective processes, though, increased vulnerability and undermined the viability of a series of economic entities.

A 'battle' between entrepreneurs/tenants and the owners of building accommodation has been evident throughout the recovery process. Public officials said that not only have landowners been pressing for 'yellow' cases to be turned 'red', but also tenants have been pressing for 'red' cases to be turned 'yellow', to allow them to remain in damaged premises (HUA, 2003, p. 175). This 'battle', however, has led to the redistribution of vulnerability.

In cases where SMFs have gained the upper hand and created their own recovery options, outside the realm of statutory procedures, the most common results have been an increase in the vulnerability of the wider physical structure (see map 1) and the weakest social groups. SMFs endeavouring to externalise recovery costs declined to pay for building repairs, refused to evacuate accommodation marked 'red', or compensated for economic losses through dismissals. Representatives of the Labour Centre of Athens reported that, shortly after the earthquake of September 1999, several firms took the opportunity to dispose of surplus labour (HUA, 2003, p. 176). Such moves had an adverse impact on macroeconomic indicators (like unemployment) and the social vulnerability of interconnected agencies, including the households of discharged workers. The firms kept their own resistance and resilience potential high by simultaneously burdening other agencies and macro structures.

By contrast, when state mechanisms concerned solely with building structures have the upper hand, the losers are the firms, which experience a decline in their pre-disaster resistance and resilience potential. This is confirmed, for example, by several cases of long-lasting harm caused by operational disruption, displaced firms being left to their fate, and firms being saddled with additional seismic loans. This time it is the state that externalises recovery costs.

Conclusion

Current international discourse on vulnerability issues is concerned with the responsibility of macro structures and private agencies for the production/reproduction and distribution/redistribution of vulnerability. The debate is between those who put the blame on anonymous social, economic and political macro structures and those who place emphasis on

the critical role of micro structures, that is, individual socio-economic agencies. However, this discourse is limited by the preoccupation of researchers with either macro structures or individual agencies, with physical vulnerability or with social vulnerability. Instead, one needs to determine the vulnerability relationship between physical structures and socio-economic entities, as well as between macro structures and individual agencies.

The conceptual analysis of vulnerability with regard to its constituent components—exposure, resistance and resilience—facilitates a good understanding of the vulnerability of socio-economic entities, such as SMFs in western Athens. It also helps in recognising and analysing the factors and processes that increase or decrease vulnerability and thereby in formulating public policies and private actions targeted at vulnerability reduction. Finally, this conceptual analysis could provide academics and politicians with an effective methodological instrument with which to address and decipher the distribution of vulnerability prior to a disaster and the redistribution of vulnerability during the recovery process.

This paper has concentrated on an individual agency (SMFs) and the urban context of western Athens. Through a rigorous examination of the responses of the specific agency and the reactions of embracing macro structures to the seismic event of 7 September 1999, vulnerability inequalities and vulnerability redistribution during the recovery process have been dealt with. To acquire such results, it was necessary to create a perceptual division between the producer and the carrier of vulnerability.

The *exposure* of SMFs to a seismic hazard was due to the old age of manufacturing buildings and firms being involved in practices that contravene the building law and health and safety rules for industrial premises. Exposure of an individual SMF is dependent not only on on-site structural characteristics but also on the likely vulnerability of macro structures, such as lifeline networks, and the spatial structure of neighbouring districts. This external vulnerability and the fact that, in most cases, the history of the firm's accommodation is unknown to the entrepreneur produces an exposure potential that is beyond the control and coping capabilities of the entrepreneur. Exposure, then, is involuntary and originates mostly from macro structures: transgressions of the law by building networks; governmental authorities turning a blind eye to breaches of the law; and the vulnerable condition of the physical structure of the wider districts.

However, the *resistance* of SMFs is very low, and it will remain so as long as they do not address the matter of their 'smallness'. In this regard, increasing the resistance potential depends on growth and development. A firm's growth rate and improved level of profitability in normal times helps to increase its resistance to seismic events. Resistance is an attribute that is determined primarily by the agency (the SMF) itself.

The most intricate of the three components is *resilience*. SMFs in western Athens offset low *resistance* against their high *resilience* potential. Most of them owe their recovery to the latter. Resilience is basically related to flexibility and the capability of firms to operate with the help of informal practices that eliminate and externalise recovery costs, while simultaneously increasing the vulnerability burden placed on interconnected agencies. It should not escape one's notice that these informal practices are accommodated by wider social and administrative structures. The same structures that present SMFs with exposure problems relieve them of a part of their vulnerability load by boosting their resilience capabilities.

During the recovery process following the September 1999 earthquake, most SMFs refused whatever public monetary assistance was on offer, believing that there was little advantage to be gained from accepting it (Webb et al., 2000, p. 86). Instead, they opted to utilise their resilience potential, a preference that, in the long term, and as a result of hundreds of relevant concurrent actions, led to the redistribution of vulnerability. By insisting on the protection of landed property and the mitigation of physical vulnerability alone, the state prompted socio-economic entities—if they managed to survive—to engage in informal and even illegal actions, undermining the very objectives of public policies.

It appears, therefore, that, by assuming the leading role in recovery, the individual agencies shift the vulnerability burden to other (interconnected) agencies and the macro structures of the city. Conversely, should the state maintain its primary role and its current emphasis on the physical vulnerability of spatial macro structures, more vulnerability will continue to be transferred to disadvantaged social and economic agencies. Hence, the state is bound to consider and manage the aggregate potential of vulnerability (including physical and socio-economic vulnerability) in order to deter unfair and unwelcome cases of over-vulnerable groups and geographical areas. The unilateral focus on the repair of physical structures is insufficient. What is needed is bundles of measures that jointly target the vulnerability of spatial structures and the socio-economic agencies within them; these measures should function holistically. Decision-makers should not forget that policies that seek to prevent an urban community from being exposed to a seismic hazard might deplete its resilience reserves and vice versa.

Alesch and Holly (1996, p. 8) noted in their study of small businesses following the 1999 Northridge earthquake that: ‘some owners simply try harder to keep their businesses operational and some owners make sounder business decisions than others’. This paper has attempted to explore the possibilities open to SMFs in western Athens (after September 1999) to make sound decisions, that is, their capacity to take decisions that drive them towards recovery and boost their chances of withstanding any subsequent disasters. From the cases examined, though, a key conclusion is that their resilience potential is their primary strength. When private agencies activate this potential on an individual basis, however, they probably make someone else vulnerable.

Endnotes

- ¹ The earthquake measured 5.9 on the Richter scale. The epicentre was beneath the Parnitha Mountain. In the region of the capital, 150 people were killed and 37 buildings collapsed.
- ² Analysis of the data amassed by the MIAPAD in October 1999 brought to light valuable information about the nature, origins and side effects of the exposure of manufacturing firms (HUA, 2003).
- ³ These markings were the result of a survey of damage to building stock in Metropolitan Athens conducted by the MEPPW.
- ⁴ Agii Anargyri, Agia Varvara, Chaidari, Egaleo, Ilion, Kamatero, Peristeri and Petroupoli.
- ⁵ S43 is a sub-category of S4, while S23 is a sub-category of S2, etcetera.

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