WIDERAngle

February 2010

Density and Disasters: Economics of Urban Hazard Risk

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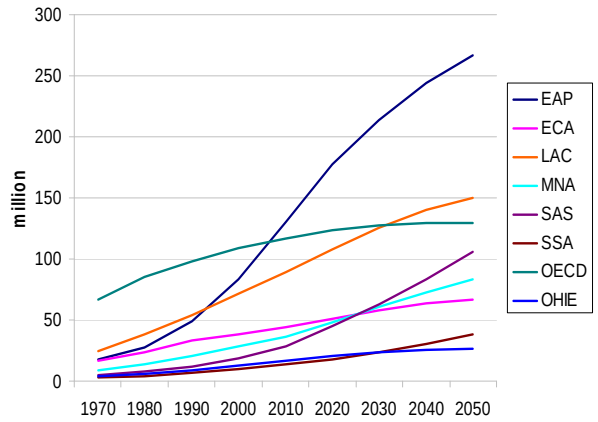
Following the terrible disaster which struck Haiti last month, in which more than 200,000 people are estimated to have died, the degree to which human populations are vulnerable to natural disasters as — they agglomerate in urban areas — has received renewed attention. After all, most of those killed in Haiti lived in the capital city, Port au Prince. This is a particularly relevant question given that the World Bank (2009) estimates that across the world the urban population in areas with significant probability of major earthquakes will increase from 370 million to 870 million between 2000 and 2050 (figure 1).

Figure 1: Population in large cities exposed to earthquakes increases from 370 to 870 million between 2000 and 2050



Note: OHIE: other high income economies; World Bank (2009)

What should be done to prevent future earthquakes (and other natural hazards) from exacting a huge toll on such populations?

In this article, based on a recent World Bank Policy Research Paper (see further reading) we describe the cope-mitigate-transfer framework as a method to inform natural hazard management options for various types and sizes of cities, and emphasize the importance of good urban management and public disclosure of information in hazard risk reduction.

The cope-mitigate-transfer framework

Even in the most hazard-prone cities, disaster risk is unlikely to reduce population growth, because the economic premium due to agglomeration economies and the amenity value of large cities dominate the location decisions of firms and people. Public policies aimed at slowing down the growth of hazard-prone cities are unlikely to succeed.

However, reducing urban hazard risk through large scale mitigation infrastructure must carefully consider the dynamics of city demand. Building large protective infrastructure may make sense in rapidly urbanizing places that are attracting skilled workers and private investment, where land is scarce, and fiscal capacity sufficient. They may not be justified in stagnant or declining areas. This applies to ex-ante investments as much as to the decision to rebuild. Sometimes, rather than "build back better" the preferred strategy may be "better build elsewhere."

Seminal work by Isaac Erlich and Gary Becker emphasized the interaction among self protection, self insurance and market insurance in managing hazardous events. This framework can inform natural hazard management options across the urban portfolio. For the largest and most dynamic cities we expect that the benefits from agglomeration economies outweigh greater risk, especially when the probabilities are

relatively small for any reasonable time period (as in the case of earthquake risk). The stakes are too high for people to be deterred, so they are unlikely to move or stay away. As a result, moving to alternate locations in response to hazard risk is less likely, especially in developing countries with high primacy. Risk mitigation (e.g., retrofitting buildings) and risk transfer (e.g., insurance) will be the main responses (table 1). Mitigation is likely to have a positive benefit-cost ratio, and will be the mainstay of efforts in countries with weak information. In the longer term, as credible information on risk becomes available, the large market will be attractive for risk pooling through insurance.

Table 1: Cope-mitigate-transfer across the urban portfolio

	Cope / Move	Mitigate	Transfer risk / Insure
Advanced urbanizers "superstars"	X	✓	✓
Secondary cities / Intermediate	✓	✓	X (information failures, market size)
Market towns /incipient urbanization	✓	X (does not justify costs)	X

For secondary or intermediate cities, the options are less clear. People are more likely to move to more dynamic cities or to invest in mitigation. However, cost benefit analysis may not generate long term positive yields from large scale mitigation efforts, and insurance options can be stymied by limited market size and information failures. For smaller market towns and incipient urbanizers, moving out of harm's way is likely to be the dominant response for reducing risk. Significant investment in mitigation is unlikely to be cost-effective and insurance markets are unlikely to extend to the smallest towns.

Urban management

Hazard risk reduction in cities requires, first and foremost, good general urban management. Hazard management in cities needs to be seen as an integral part of urban planning and management, not as a separate activity. Urban disasters are frequently the *consequence of poor urban management.* Three aspects are particularly important: First, hazard proofing new urban infrastructure should be standard procedure, but is frequently ignored. This includes implementing structural engineering standards for public buildings, but also sizing of drainage systems for peak events, or developing steeply sloped land without increasing the probability of landslides.

Second, maintenance of infrastructure and good basic service provisions reduce the impacts of hazardous events and prevent further indirect damages. In most developing country cities, public services such as water, sanitation, sewerage, lighting, and health services are underprovided. Poor service delivery not only has adverse direct effects on household welfare, it can also convert everyday hazards into disasters. For instance, where drainage networks are poorly maintained, even moderate floods can cause deaths from waterborne diseases and cross contamination between water and sewer lines. Where roads on steep terrain are not kept in good condition, they can increase erosion and landslide risk. These "institutional"

efforts of achieving minimum standards in service delivery should form the bedrock of hazard risk reduction strategies.

Third, land use management, in particular zoning, needs to prevent settlement of the most hazardous areas. Poor people often bear a disproportionate burden of hazard risk because land scarcity forces them to "sort" into informal settlements or low rent dwellings in hazard prone areas such as flood plains or steeply sloped land. For instance, in New Orleans: "*After [Hurricane] Betsy [in 1965] highlighted the differentials of flood risk, the middle classes moved away from the eastern part of the city and the lowest lying districts became increasingly unimproved rental properties - the preserve of low income and elderly residents.*" (Muir-Wood, 2008). While enforcement of zoning laws may limit development in hazardous locations, it can cut poor people off from labor market opportunities by forcing them onto cheaper land far from the city's economic center. Complementary demand side policies such as reforming land use regulations for higher density growth, rent vouchers or improving access to housing finance can help informal sector residents move into better quality dwellings. Investments in affordable transport integrate lower cost residential areas and expand a city's economic reach—creating a larger integrated labor and housing market. With good transport services, households do not need to locate in informal settlements in hazard-prone parts of the city. Local governments must develop the capacity to balance the need for flexible land use management with the enforcement of zoning and building standards.

Provision of Information

Collection and public disclosure of credible information on the source and location of hazards helps people and businesses make better choices on where to live and where to invest. Generating and disseminating hazard information is perhaps the sharpest urban hazard management policy. Where credible information on the distribution of geophysical hazard risk and the vulnerability of structures exists, empirical evidence suggests that hazard risk is capitalized into prices for residential properties and office space. Informed residents can choose between risk transfer through insurance (where it is available), investing in mitigation in situ such as retrofitting houses to comply with building practices, or moving to less risky locations. Places close to economic density (within and across cities) are likely to see market induced self discipline where individuals comply with building practices to lower physical harm and disruption in business. In places far from economic density, where land values are low, people are more likely to move into lower risk locations. Credible and public information also provides basis for the emergence of efficient private insurance markets — reducing the disadvantage that residents face when risk assessments are generated by the insurer and not disclosed. Finally, public risk information serves as a sound basis for transparent and less distortionary zoning decisions and other land use restrictions. Unfortunately, encouraging data sharing, even when data generation was funded with public resources, is not a trivial task. Public agencies often see data as a strategic or marketable asset rather than as a public good whose wide and inexpensive distribution increases overall welfare.

Conclusion

Global urban hazard risk will likely continue to increase even if hazard probabilities remain constant, because greater population exposure likely offsets gradually decreasing vulnerability that comes with rising incomes. As many cities in developing countries will double in size over the next few decades, there is an opportunity to channel this growth so hazard risk is minimized. This will challenge management capacity at all levels of government—from urban development ministries to small town mayors. But the payoffs in saved lives and damages avoided will be high.

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Further Reading:

Lall, S.V. and Deichmann, U. (2009). 'Density and Disasters: Economics of Urban Hazard Risk', *Policy Research Working Paper no. 5161*, The World Bank. *(This paper was prepared as a background paper commissioned for the forthcoming joint World Bank – UN Assessment on the Economics of Disaster Risk Reduction "UnNatural Disasters, Natural Hazards: Effective Prevention Through the Economic Lens." Funding from the Global Facility for Disaster Reduction and Recovery is gratefully acknowledged*). Click here.

Muir-Wood, R. (2008) 'Climate Change, Insurance and Development', Presentation by Robert Muir-Wood of Risk Management Solutions, Inc., World Bank, December 3, 2008.

World Bank (2009), Current and future estimates of exposure to natural hazards in the world's large cities, Background analysis for the Economics of Disaster Risk Reduction report, Washington, D.C.

WIDER Angle newsletter, February 2010

ISSN 1238-9544