

Theory of regional stability as a public good: examples from southern Africa

Fungisai Nota

Most regions in the world have been or are currently confronted with some form of regional instability. The dream of a stable world has not materialized as intrastate conflicts have replaced interstate conflicts, especially in Africa. Examples of these intrastate conflicts include the genocide in Rwanda and the political upheaval and economic meltdown of Zimbabwe in southern Africa. Such intrastate instability occurred in many developing countries during the 1990s and may have stemmed from ethnic hatreds that manifest themselves in terms of nationalism, separatism, or fight for an ethnic identity.¹ In other situations, such as in Zimbabwe, instability may be rooted in greed as opposing interests vie for resource wealth and power. Regardless of whether these conflicts are grievance or greed-based, they have profound consequences on economic growth, not only at home but also in neighbors as FDI is diverted, social overhead capital destroyed, resources reallocated to less productive resources, trade disrupted, and human capital lost.

State borders are porous to pollutants, diseases, terrorism, knowledge, political upheavals, financial crisis, culture, and conflict. This gives rise to the issue of whether the consequence of intrastate instability and their spatial diffusion are region specific. For example, a study on regional spillover effects for 1960-1995 found that civil war's externalities on growth could be found up to 950 kilometers (km) away. The same study found that the effects of civil war reaches well beyond immediate neighbors, as far as 800 km away for a worldwide sample and 300 km for an African subsample. Generally, this dispersion is more localized in the short run than in the long run, particularly for the African subsample.²

Some of the flows that cross state borders are driven by market globalization and technology, indicating that collective action, orchestrated by regional and international organizations, is needed beyond the state to control an expanding number of regional public goods, including stability. In contrast to national public goods, regional public goods provide benefit or cost-spillovers regionally. For example, efforts to maintain stability in a region by one country benefit the entire region. When the public good's benefits are confined to two or more countries in a given location, then the good is a regional public good. Regional public goods, regional stability in particular, is the subject matter of this article.

Recent studies focus on regional public goods and their associated collective action problem.³ A primary concern is to distinguish regional public goods for which states have proper incentives to contribute from those where incentives are perverse. An additional concern relates to identifying the role of diverse agents and regional or

global organizations and charitable foundations in bolstering regional public good provision in developing countries. In recent years, increased foreign assistance has been channeled bilaterally and multilaterally to finance regional and transnational public goods in developing countries. Based on OECD data, aid-funded public goods more than doubled from 16 percent of assistance in 1980-1982 to 38 percent in 1996-1998.⁴

This article has three objectives. First, it provides knowledge of regional public goods and how regional stability matches the definition of a public good. Second, it offers a theoretical framework for modeling the financing of regional stability mainly through the contributions from developing countries in a region and from donors. All the properties of publicness — nonrivalry of benefits, nonexcludability of nonpayers, and the agglomeration technology (i.e., how individual contributions add to the level for consumption) — indicate where to direct efforts in providing regional public goods and will be analyzed. And third, the results from the second objective are used to justify the need for regional and international institutions in the provision of regional public goods. Moreover, the article identifies incentives that can be used by a dominant regional state to give impetus to other states in the region to contribute toward regional public goods.

Stability in a public good framework

This section explores the properties of stability as a regional public good in regards to developing countries in order to derive the optimal contributions by regional states. This section also identifies the need for regional institutions to bolster the provision of stability as a regional public good. In some instances, intervention may not be needed, but when required, the form of intervention and the requisite institutional arrangement hinge on the publicness properties of stability as a regional public good.

A regional public good provides benefits to two or more nations in a well-defined region. A region is a territorial subsystem of the global system whose basis may be geological (based on earth formations such as plain or coastline), geographical, political, cultural, or geoclimatic. Regional characteristics can influence the extent of spillovers from stability or instability. For instance, the Limpopo river, the Zambezi river, and the language barrier between Zimbabwe and its neighbors limit the

This article has three objectives. First, it provides knowledge of regional public goods. Second, it offers a framework for modeling the financing of regional stability. Third, the results from the second objective are used to justify the need for regional and international institutions in the provision of regional public goods. Moreover, the article identifies incentives that can be used by a region's dominant state to give impetus to other states to contribute toward regional public goods.

Table 1: Sources of public regional goods funding

- I. Public sources
 - 1. National
 - 1.1 Developed country sources
 - 1.2 Developing country sources
 - 2. Regional/International
 - 2.1 Regional and international financing institutions
 - 2.2 International organizations and agencies.
- II. Private sources
 - 1. Corporations (for profit)
 - 2. Corporations (not for profit)
- III. Partnerships
 - 1. Combination of the above

spillovers of instability in Zimbabwe. The rivers limit the migration of affected populations in Zimbabwe into neighboring countries.

Two classic properties of public goods give rise to market failures that may require either donor provision or some form of cooperation among the benefit recipients. First, nonexclusion results in market failure because once one state invests in regional stability, it cannot keep noncontributors from enjoying the benefits of whatever regional stability results. Once stability in a region is provided, other states have no incentive to contribute because their money can purchase other goods whose benefits are not freely available. Thus, regional stability is likely to be undersupplied, or not supplied at all. Second, nonrivalry means that extending the consumption to an additional user occurs at zero additional (or marginal) cost to the system. Exclusion-based fees are inefficient

because some potential users, who could derive benefits, are denied access even though it costs society nothing extra to include these users. Regional stability as a public good meets these characteristics.

Financing regional stability

The provision of regional stability can be financed through public sources or private sources, e.g., contributions by regional states that benefit from stability, and by public-private partnerships. The article focuses on contributions from developing countries and donors. The theoretical framework generates results that substantiate the need for some of the other sources listed in Table 1.

Theoretical framework for national and donor contributions

A so-called Stackelberg (or sequential, leader-follower) model is used to describe how states and donors may choose contribution levels toward regional stability. The model is appropriate if it is believed that states in a region will not contribute simultaneously toward regional stability and may need a leader to get things going. The leader can either be a state in the region or a donor. The general setup of the Stackelberg model is as follows:

- ▶ Assume 2 countries in the region (more will be added later)
- ▶ The follower state plays the best response to the leader’s contribution
- ▶ The leader state chooses a contribution level that maximizes her own welfare, taking into account the follower’s reaction function

Formally, this is described as

$$Game = [I, (g_i, u_i)]_{i=1,2},$$

where capital I is the total number of states in a region; g_i is a particular government i ’s consumption of regional stability (that is, the benefits that flow from regional stability); and u_i is government i ’s value function. The follower state solves its welfare maximization problem by taking the actions of the leader state as given. Thus, the follower develops a reaction function based on the actions of the leader. The leader will have to consider what the reaction from the follower would be before choosing an action or set of actions that induces the follower to follow.

The decision to be a leader is influenced by many factors among which are the cost of contributing, personal or “national” benefits from contribution, and the probability that other countries will contribute. Here the so-called Bayesian approach is used to determine the leader in a region of many states. The possibility that more than one leader emerges is allowed for as well.

A model with uniformly symmetric states in the region

Assumptions:

- ▶ n = number of states in the region (all uniform)
- ▶ c = uniform cost of contribution (both monetary and nonmonetary, e.g., political)
- ▶ α = uniform benefit from regional stability (the regional public good)
- ▶ v = uniform reservation wealth, welfare, and utility

One can then represent the welfare A of a specific state i as follows:

$$(1) \quad A_i = \begin{cases} v - c + \alpha & \text{if state } i \text{ contributes} \\ v + \alpha & \text{if another state contributes,} \\ v & \text{if no one contributes} \end{cases}$$

where for example the first line means that state i ’s new level of well-being or welfare A is the result of its present well-being (v), minus the cost contributed to “purchase” the regional stability good (c), plus the benefits derived from having such a good (α), if state i is the only state contributing to the purchase of the good. The second line means that if another state purchases the good, state i benefits (α) without needing to

subtract a contribution to the cost (c). The third line represents the status quo when no one contributes.

Further, assume that the probabilities of states contributing may be written as follows:

$$(2) \quad \begin{aligned} \Pr(\theta)^{n-1} &= \text{probability that some state } j \text{ contributes} \\ 1-\Pr(\theta)^{n-1} &= \text{probability that no one contributes} \end{aligned}$$

One may then represent these conditions in a decision tree diagram as in Figure 1. If a state contributes on its own, follow the left arm of the diagram. The state receives its status quo value (v) minus the cost contribution (c) plus the benefit (α). If it does not contribute, follow the right arm to another node. Here, the state receives benefits depending on the probability that another state makes a contribution. In this setup, where there are uniform states in the region, one can derive the following condition which determines when a state would contribute to the provision of the regional stability good. A state will contribute toward regional stability if and only if:

$$(3) \quad v - c + \alpha \geq [\Pr(\theta)^{n-1}] (v+\alpha) + [1-\Pr(\theta)^{n-1}] (v).$$

In words, the net benefit to a state, given on the left-hand side of expression (3), must be greater than or equal to the sum of the probability-weighted benefits on the right-hand side of the expression. To simplify, one can solve for the critical cost for a state to contribute. It is

$$(4) \quad c = [1-\Pr(\theta)^{n-1}] \alpha.$$

This result is called lemma 1. In words, it states:

Lemma 1: Given a region with uniform states and uniform benefits from contributions, each state will contribute if and only if the loss in expected benefits if no one contributes is equal to or greater than the cost of contributing.

A model for heterogeneous regions

Although the conditions that give rise to lemma 1 are not realistic, it does provide one with a baseline setup. The assumption of uniform states will now be relaxed to allow for asymmetries among states in a region. The asymmetry applies to the cost of contribution, to the benefits that accrue from stability when provided, and to the reservation wealth or welfare of a state.

By introducing heterogeneity we have the following indexed variables:

- ▶ c_i = costs of contributions differ across states

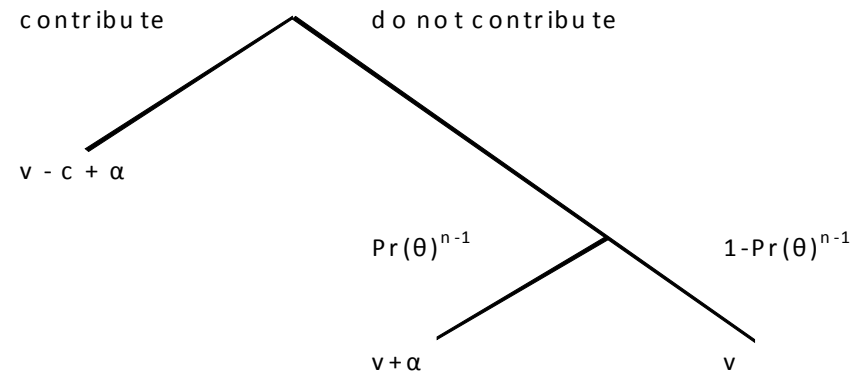


Figure 1: Uniform states with the probabilities that one or another state contributes to the regional stability public good

- ▶ α_{ij} = benefits from contributions differ depending on who has contributed
- ▶ v_i = each state has different reservation wealth, welfare, or utility

One can then express the welfare of a specific state i as follows:

$$(5) \quad A_i = \begin{cases} v_i - c_i + \alpha_{ii} & \text{if state } i \text{ contributes} \\ v + \alpha_{ij} & \text{if another state contributes} \\ v_i & \text{if no one contributes} \end{cases}$$

with the decision tree visualized in Figure 2. Clarifying the definitions:

- ▶ c_i = cost to state i of contributing
- ▶ α_{ij} = benefits from contribution to state i if state j contributes
- ▶ α_{ii} = own benefit from contribution for state i

As before, one can derive the critical cost that gives the impetus for a state to contribute. It is

$$(6) \quad c_i = \alpha_{ii} - [1-\Pr(\theta)^{n-1}] \alpha_{ij}.$$

Called lemma 2, this result states:

Lemma 2: In a region with heterogeneous states and the possibility that at least one other state will contribute toward the regional public good, the critical cost is

the difference between a state's own contribution benefit and the expected benefit from a contribution by another state.

Lemma 2 is more realistic than lemma 1 as most regions, including African regions, have at least one country that is likely to contribute, for instance, South Africa in southern Africa and Nigeria in western Africa. The lemmas are discussed in detail in the next section. Meanwhile, one more case is derived, namely that for at least two other states contributing toward regional stability. This is to illustrate the intuition that the more potentially contributory states there are in a region, the less the incentive for any one other state to contribute. The decision tree is pictured in Figure 3.

Under this setup, state *i* will contribute if and only if the following condition holds:

$$(7) \quad v_i - c_i + \alpha_{ii} \geq [\Pr(\theta)_j^{n-2}] (v_i + \alpha_{ij}) + [\Pr(\theta)_k^{n-2}] (v_i + \alpha_{ik}) + [1 - \Pr(\theta)_j^{n-2} - \Pr(\theta)_k^{n-2}] (v_i).$$

After some manipulation, the critical cost to induce contribution is:

$$(8) \quad c_i = \alpha_{ii} - [\Pr(\theta)_j^{n-2}] (\alpha_{ij}) - [\Pr(\theta)_k^{n-2}] (\alpha_{ik}).$$

This is lemma 3. Note the minus signs on the right-hand side of the expression: the larger these terms, the smaller the required cost contribution on the left-hand side. Thus, lemma 3 says, in words,

Lemma 3: In a heterogeneous region with the possibility of two or more states contributing, the critical cost of contribution required decreases with the number of states. (This also applies to the influence of region size in terms of the number of states: the larger the number of states, the lower the incentive to contribute, *ceteris paribus*.)

When a state benefits from regional instability then its own benefit from contribution (α_{ii}) will be smaller, thereby reducing its incentive to contribute toward regional stability.

The next section discusses the implications of these lemmas and how the summation method for regional stability as a public good influences the results. It is important to note that states' decisions to contribute based on the critical cost do not change as the region gets unstable.⁵

The wild card effect

For most regions there is at least one outside state with political or economic interests

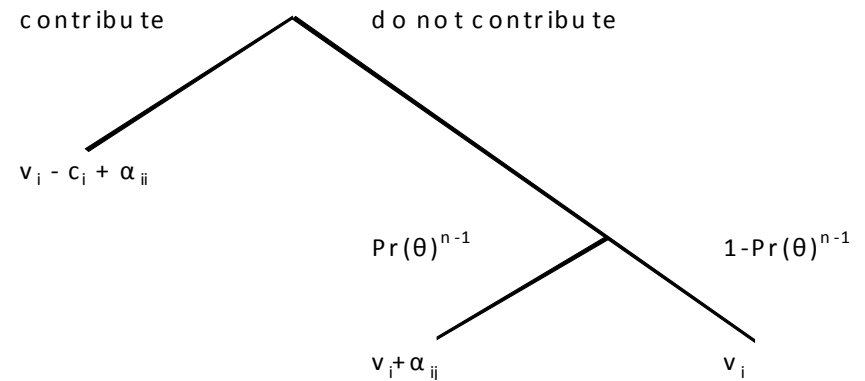


Figure 2: Heterogeneous states with the probabilities that one or another state contributes to the regional stability good

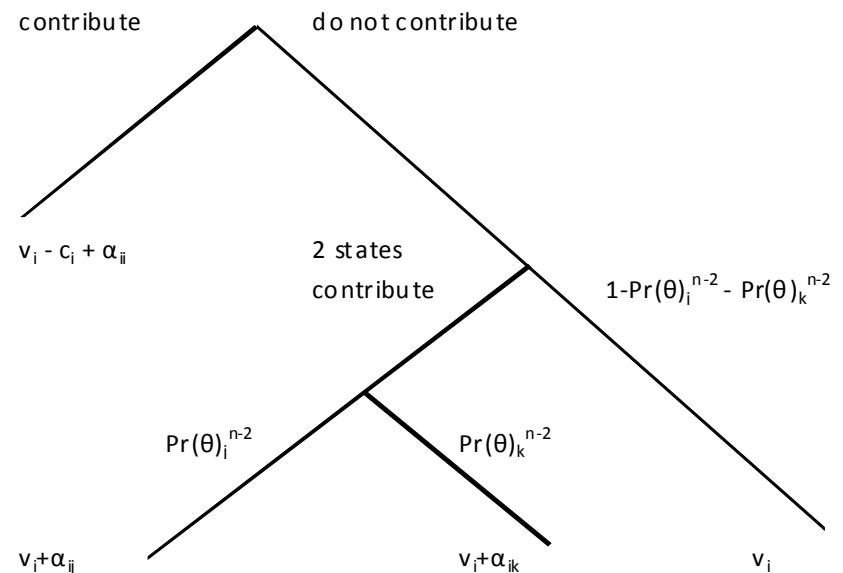


Figure 3: Heterogeneous region with the probabilities that two (or more) states contribute

in the region. To preserve these interests, the outside (“wild card”) state intervenes on certain issues in the region. Knowing that there is a wild card, regional states adjust their probabilities of contributing toward a regional public good in order to increase

the chances of free-riding on the outsider's contribution. In almost all cases, the wild card country has a GDP larger than those of the regional states. The United States, for example, is a wild card in the Middle East. Likewise, the United Kingdom, a former colonial power in many parts of Africa, plays the role of the wild card with many issues that arise in Africa.

Discussing the results: examples from southern Africa

Having set out conditions under which a state will be the leader in the provision of regional stability, certain results, known as lemmas, were derived. These and their implications are now discussed.

Lemma 1: Given a region with uniform states and uniform benefits from contributions, each state will contribute if and only if the loss in expected benefits if no one contributes is equal to or greater than the cost of contributing.

This lemma was derived under the assumption that all states in a region are uniform in terms of their GDP, cost of contributing, benefits from regional stability, and other factors. Although this assumption is unrealistic of course, the result provides the generic form, or baseline, of the cost structure that influences decisionmaking. Nonetheless, even this result is applicable in those regions that are very poor and have GDPs within the same low range. States in some sub-Saharan African regions may fit this situation well. In such cases, lemma 1 says that either all the countries contribute simultaneously or else no one contributes at all.

Lemma 2: In a region with heterogeneous states and the possibility that at least one other state will contribute toward the regional public good, the critical cost is the difference between a state's own contribution benefit and the expected benefit from a contribution by another state.

Most regions have at least one state that is economically more advanced than the rest and thus most regional states expect the most advanced state in the region to take the lead. In southern Africa, South Africa has a larger GDP than its neighbors, possesses a more robust economy, and hence is expected by its neighbors and by the global community to take action to stop for example the instability in Zimbabwe. With more than three million Zimbabweans reported to be living in South Africa illegally as the tension in Zimbabwean politics and economic collapse increases, CNN wrote:

“Zimbabwe's neighbors are under increasing pressure to do something about its chaos — in part because it is already spilling over in the form of migrants fleeing economic collapse and political clampdown. The South African Cabinet was expected to discuss Zimbabwe at a regular meeting Tuesday after sustained

criticism that the quiet diplomacy advocated by President Thabo Mbeki isn't working. South Africa, with the strongest economy in the region and the highest international profile, has been pressed to take the lead on Zimbabwe.”⁶

Nevertheless, it took South Africa a long time to make a significant contribution to help Zimbabwe and regain regional stability. There are three main reasons that explain this inaction. First, it is possible that South Africa is gaining from instability within the region through redirected FDI, through trade as the starving population of the state in conflict (Zimbabwe) imports food and other goods from South Africa, and as tourists choose South Africa over its unstable neighbor. All these reduce South Africa's own benefit (α_{ii}) from contributing toward ending the regional stability. Second, the minimum cost of contribution (both monetary and nonmonetary, that is, political) required to make an impact is exorbitantly high, and the probability that other neighbors will join in contributions is very low. Hence South Africa chooses not to contribute. Third, South Africa might be of the view that an outside state such as the United Kingdom, with its long-standing connections to Zimbabwe, will intervene and contribute. This introduces the wild card effect. In that case South Africa would free-ride on U.K. contributions. Lemma 2 says that the state that is most likely to contribute might be an outside state with an interest in the region. As tension have risen in Zimbabwe, the U.K. has seen a high influx of Zimbabwean refugees. Pressure mounted on South Africa as well, and in February 2009 it succeeded in helping to create a government of national unity in Zimbabwe. This was a step toward creating stability in the region.

Before this breakthrough, however, the possibility that the U.K or Botswana might contribute led to a long stalemate among state actors, and this leads to lemma 3:

Lemma 3: In a heterogeneous region with the possibility of two or more states contributing, the critical cost of contribution required decreases with the number of states. (This also applies to the influence of region size in terms of the number of states: the larger the number of states, the lower the incentive to contribute, *ceteris paribus*.)⁷

This general result suggests that the larger the number of states considered, the higher the probability that at least one of them will lead the contribution toward the public good. However, if each country bases its action on some other state contributing, then there might be no provision of the public good at all. With the addition of the United Kingdom as the wild card in alleviating the instability in southern Africa, some regional states might be hoping to free ride.

The political tensions and economic meltdown of Zimbabwe started in 2001. Almost the entire region, and beyond, has endured some of the negative spillovers. The major problem thus far has been the migration of Zimbabweans to neighboring states as they flee the harsh economic and political climate. In 2007, the International

Organization for Migration estimated that about 2.8 million Zimbabweans had migrated to South Africa illegally.⁸ Some organizations now estimate over 3 million Zimbabweans to be living in South Africa, and thousands more in Botswana and the United Kingdom. Desperate Zimbabweans have cut border fences and crossed rivers to get into South Africa and Botswana. South Africa has devoted hundreds of police officers to capture and deport illegal Zimbabwean immigrants. It is estimated that there are over 700,000 homeless people in South Africa, and the majority of them are illegal Zimbabweans. The government of Botswana has raised a high border fence to prevent illegal Zimbabwean migration. In the United Kingdom, the number of Zimbabwean refugees has increased to the extent that the U.K. government established a £3,000 reward for Zimbabwean refugees who are not granted asylum and want to return to Zimbabwe.⁹ To exacerbate the situation, a 2004 news report cites a study that found that a quarter of HIV/AIDS cases reported in the U.K. are Zimbabwean immigrants.¹⁰

One must ask why the spillover-affected states did not take action to stop the instability in Zimbabwe and mitigate the costs of the negative externalities they are facing. Lemma 2 provides some insight. South Africa is hoping that the United Kingdom or Botswana will take the lead, and the U.K. is putting pressure on South Africa and Botswana to take lead action. This is a typical public goods-case which results in underprovision or no provision at all, thus making it clear that there is a need for regional and international organizations to help in the provision of stability in a region.

Apart from costs, some states or donors might opt to contribute for any one of three other reasons:

- ▶ Pure altruism: $U_i = v_i + \tau v_j$, where $0 \leq \tau \leq 1$
- ▶ Duty: $U_i = v_i + \tau$, where $\tau \geq 0$
- ▶ Reciprocal: $U_i = v_i + \tau$, where $\tau > 0$,

where U_i = overall utility for state/donor i ; v_i = state/donor i 's wealth; v_j = state j 's wealth; and τ = benefit from contribution.

Pure altruism is the case where state i cares directly about the region. In this scenario, it will contribute no matter what other states in the region or foreign donors do. The second case, duty, occurs when a state feels obligated to contribute. For instance, with increasing pressure from the international community, South Africa might eventually contribute to stabilize the region, thus $\tau > 0$. In the third case, $\tau \geq 0$ if and only if the countries in agreement contribute. This corresponds to public goods that require a minimum contribution level before benefits can be accrued. If only one state contributes, the amount will be less than the minimum required amount and thus no benefits are accrued.

For the case of very poor regions, one may hope there is a pure altruistic country somewhere willing to provide the public good. This is common for a variety of both

regional and international public goods: wealthy nations have been called upon to provide influenza vaccination, malaria medication, and antiviral HIV/AIDS drugs. Through pure altruism or duty, most wealthy countries have embraced this responsibility and continue to provide regional and international public goods to the poor.

Conclusion

This article has provided a framework to highlight the conditions under which states make decisions whether to contribute toward a public good with regional spillovers. It is clear from the results that regional public goods will be underprovided or, as in southern Africa, not provided at all. People continue to die without rescue. Even when a leader state contributes, the private (or “national”) marginal benefit that would accrue to another state if it, too, contributes might still be less than the required cost contribution, resulting in a lack of followers. In such situations, the market failure associated with the provision of a good with spillovers will be reduced by the leader state but the overall provision will be suboptimal. (But this result depends on the summation technology of the regional public good.) This might also be the case in the Middle East where the United States is seeing little or no help from Iraq's neighbors, who might regard their contributions as too minor to warrant significant involvement.

Suggested measures

Alternative instruments that can be used to achieve optimal provision of goods with regional spillovers. Appropriate instruments will depend on the nature of the public good. In the case of regional stability, this might be disrupted by political unrest, economic meltdown, and sometimes devastating health issues. The instruments should target the causes of regional instability.

Large international organizations that should monitor and mitigate regional instability exist and are numerous (e.g., the United Nations, the African Union, the African Development Bank). Nevertheless, continuing instability calls for more effort. Regional institutions that oversee and control some of the factors that lead to instability are crucial. In order for these institutions to be effective they need to be locally oriented to sustain interest and drive contributions. Regions should set up a peacekeeping entity that mitigates and responds to political unrest in the region; an economic entity, such as a regional development bank, that monitors macroeconomic factors and offers services in monetary and fiscal policies to member countries; or a health service provision center that provides vaccination and health education.

There are several ways these regional organizations could be financed. First, since they are small counterparts of large international organizations they could benefit from the resources and expertise of the larger organizations. To give an impetus to member countries to contribute toward the financing of these institutions, membership

may be tied to trade agreement organizations. In southern Africa for example, all regional states have joined the Southern African Development Community (SADC) to enjoy the trading benefits. Under SADC, branches of trade, peacekeeping, and health can be formed. Subscriptions of member countries will be determined by the states's characteristics. Tying private benefits from trade to the provision of a regional public good might be an incentive for contributions to come forth. Additionally, wild cards and donors can help fund regional institutions. Regional lotteries can also be used to supplement funding.¹¹

The large regions covered by larger organizations make it difficult for them to stay abreast with the need for stability and economic sustainability. Much smaller regional institutions that link states and that foresee significant spillovers from each other might be more appropriate. These organizations should work closely together, sharing intelligence and capital. The combination of international, continental, and regional institutions can mitigate market failure in the provision of regional public goods.

Notes

Fungisai Nota is Assistant Professor of Economics, Department of Business Administration and Economics, Wartburg College, Waverly, Iowa, USA. He may be reached at fungisai.nota@wartburg.edu. He thanks Thomas Harris, Maureen Kilkenny, and Mehmet Tosun for helpful comments on this article.

1. 1990s: Wallenstein and Sollenberg (2001). Hatreds: James and Goetze (2001).
2. Murdoch and Sandler (2001).
3. Arce and Sandler (2002); Cook and Sachs (1999); Estevadeordal, Frantz, and Nguyen (2004); Sandler (1998; 2002); Stalgren (2000).
4. Based on OECD data; see Mascarenhas and Sandler (2005) and te Velde, Morrisey and Hewitt (2002).
5. See Appendix, Proof 1.
6. "Southern African Nations feel pressure to act on Zimbabwe." 20 March 2007. <http://www.bookrags.com/news/southern-african-nations-feel-pressure-moc/>.
7. See Appendix, Proof 2, involving n states in a region.
8. <http://news.bbc.co.uk/1/hi/world/africa/4416820.stm>; 8 November 2005 [accessed 1 May 2009].
9. <http://www.timesonline.co.uk/tol/news/uk/article787910.ece>; 13 January 2006 [accessed 1 May 2009]. In 2006, this was expected to cost the U.K. government in excess of £6 million if 3,000 people take up the offer.
10. <http://www.newzimbabwe.com/pages/aidsuk.1568.html>; 22 March 2004 [accessed 1 May 2009].
11. Morgan (2000).

References

- Arce, M. and T. Sandler. 2002. "A Conceptual Framework for Understanding Global and Transnational Public Goods for Health." *Fiscal Studies*. Vol. 23, No. 2, pp. 196-222.
- Bandayopadhyay, S. and T. Sandler. 2009. "The Interplay between Preemptive and Defense Counterterrorism Measures: A Two-Stage Game." 28 April 2009. Available at SSRN: <http://ssrn.com/abstract=1279536>.
- Cook, L.D. and J. Sachs. 1999. "Regional Public Goods in International Assistance," pp. 436-449 in I. Kaul, I. Grunberg, and M. Stern, eds. *International Public Goods: International Cooperation in the 21st Century*. New York: Oxford University Press.
- Estervadeordal, A., B. Frantz, T.R. Nguyen, eds. 2004. *Regional Public Goods: From Theory to Practice*. Washington, D.C: Inter-American Development Bank and Asian Development Bank.
- James, P. and D. Goetze. 2001. *Evolutional Theory and Ethnic Conflict*. Westport, CT: Praeger.
- Mascarenhas, R. and T. Sandler. 2005. "Donor's Mechanisms for Financing International and National Public Goods: Loans or Grants?" *World Economy* . Vol. 28, No. 8, pp. 1095-1117.
- Morgan, J. 2000. "Financing Public Goods by Means of Lotteries." *Review of Economic Studies*. Vol. 37, pp. 761-784.
- Murdoch, J.C. and T. Sandler. 2002. "Civil Wars and Economic Growth: A Regional Comparison." *Defense and Peace Economics*. Vol. 13, No. 6, pp. 451-464.
- Murdoch, J.C. and T. Sandler. 2002. "Economic growth, Civil Wars, and Spatial Spillovers." *Journal of Conflict Resolution*. Vol. 46, No. 1, pp. 91-110.
- Sandler, T. 1998. "Global and Regional Public Goods: A Prognosis for Collective Action." *Fiscal Studies*. Vol. 19, pp. 221-247.
- Sandler, T. 2002. "On Financing Global and International Publish Goods," pp. 81-117 in M. Ferroni and A. Mody, eds. *International Public Goods: Incentives Measurement, and Financing*. Dordecht: Kluwer.
- Sandler, T. 2005. "Regional Public Goods and International Organization." Los Angeles, CA: University of Southern California (unpublished manuscript).

Stalgren, P. 2000. “Regional Public Goods and the Future of International Development Cooperation: A review of Literature.” Working Paper 2002:2. Expert Group on Development Issues. Ministry for Foreign Affairs. Stockholm, Sweden.

te Velde, D.W., O. Morrissey, and A. Hewitt. 2002. “Allocating Aid to International Public Goods: An Empirical Analysis by Donor and Sector,” pp. 119-156 in M. Ferroni and A. Mody, eds. *International Public Goods: Incentives Measurement, and Financing*. Dordrecht: Kluwer.

Vicary, T. and T. Sandler. 2000. “Weakest-link Public Goods: Giving In-kind or Transferring Money.” *European Economic Review*. Vol. 46, pp. 1501-1520.

Wallenstein, P. and M. Sollenberg. 2001. “Armed Conflict, 1989-2000.” *Journal of Peace Research*. Vol. 38, No. 5, pp. 629-644.

Appendix

Proof 1: The decision to contribute based on the critical cost does not change as the region gets unstable. See decision tree in Figure A1. The state in conflict is denoted as m. Negative spillovers from the conflict are indexed by δ_{im} . Under this setup, state i will contribute if and only if the following condition holds:

$$(A1) \quad v_i - c_i - \delta_{im} + \alpha_{ii} \geq [\Pr(\theta)_j^{n-2}] (v_i - \delta_{im} + \alpha_{ij}) + [\Pr(\theta)_k^{n-2}] (v_i - \delta_{im} + \alpha_{ik}) + [1 - \Pr(\theta)_j^{n-2} - \Pr(\theta)_k^{n-2}] (v_i - \delta_{im}),$$

and the critical cost of contribution is:

$$(A2) \quad c_i = \alpha_{ii} - [\Pr(\theta)_j^{n-2}] (\alpha_{ij}) - [\Pr(\theta)_k^{n-2}] (\alpha_{ik}) \quad [Q.E.D.],$$

which is the same as derived for lemma 3.

Proof 2: The larger the number of states in a region, the less likely it is for some state i to contribute. The decision tree is depicted in Figure A2. In this example, P_1 and P_2 are the probabilities that one and two states contribute, respectively.

Solving for the critical cost required to contribute by state i yields the following result:

$$(A3) \quad v_i - c_i + \alpha_{ii} \geq P_1 v_i + P_1 \alpha_{ij} + P_2 v_i + P_2 \alpha_{ij} + P_2 \alpha_{ik} + \dots + P_{n-1} v_i + P_{n-1} [\alpha_{ij} + \alpha_{ik} + \dots + \alpha_{n-1}] + v_i - P_1 v_i - \dots - P_{n-1} v_i.$$

Thus

$$(A4) \quad c_i \leq \alpha_{ii} - [P_1 \alpha_{ij} + P_2 (\alpha_{ij} + \alpha_{ik}) + P_3 (\alpha_{ij} + \alpha_{ik} + \alpha_{il}) + \dots + P_{n-1} (\alpha_{ij} + \dots + \alpha_{n-1})],$$

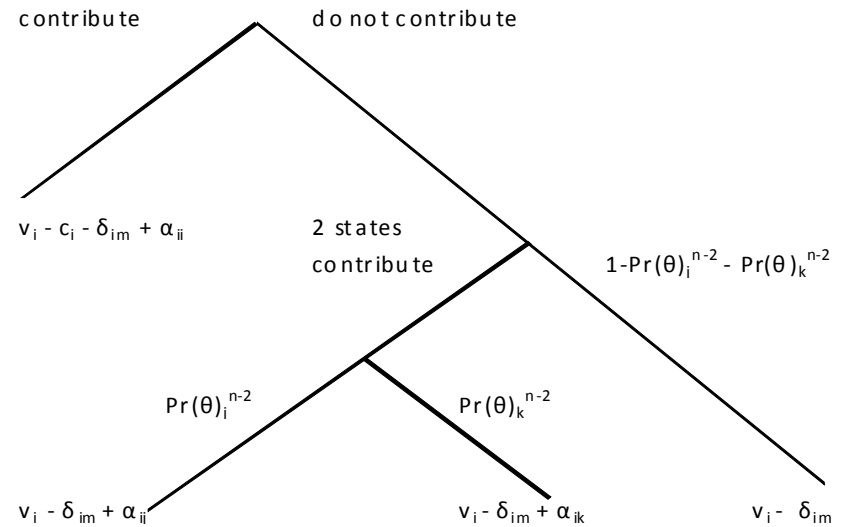


Figure A1: Heterogeneous region with negative conflict spillovers and the probabilities that two (or more) states contribute

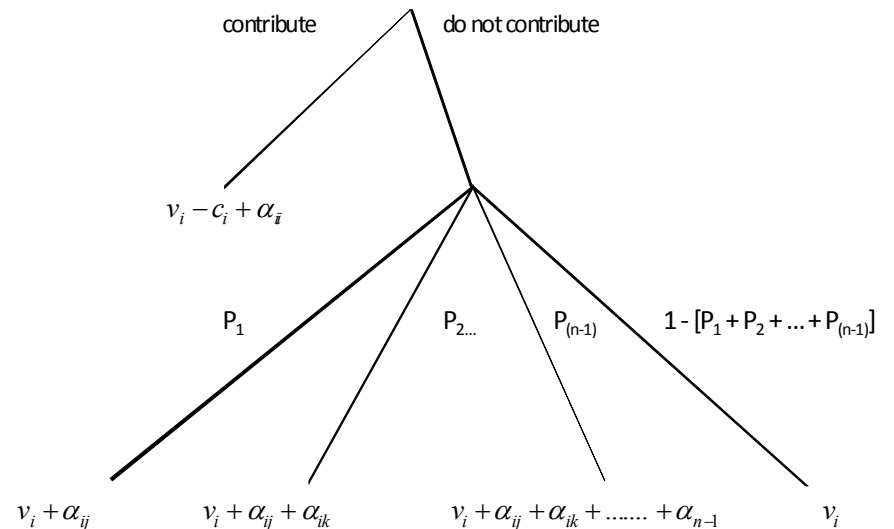


Figure A2: Heterogeneous region with many states with the potential to contribute

where $P_1 > P_2 > P_3 > \dots > P_{n-1}$ [Q.E.D.].

In words, the larger is the number of states in a region with a positive probability of contributing, the smaller is the required critical cost to some state i to contribute.