

# Public Expenditure Following Disasters

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## Abstract

This paper focuses on the impact of disasters on public expenditures, and how this impact might be valued. The impact may involve changes in the composition of spending, concurrently and over time. It may also involve changes in the level of spending and the profile of this over time. In the latter case, the associated financing must also be taken into

account. The changes of interest are those that would take place under a given sovereign disaster risk financing and insurance strategy, as opposed to what would take place otherwise. The paper concludes with some suggestions toward an operational framework for addressing these questions.

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# Public Expenditure Following Disasters<sup>1</sup>

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## **1. Introduction**

### *1.1 The focus of the paper*

This paper focuses on the impact of disasters on public expenditures, and how this impact might be valued. The impact may involve changes in the composition of spending, both concurrently and over time. It may also involve changes in the level of spending, and in the profile of this over time. In this latter case, the associated financing must also be taken into account.

### *1.2 The public economics perspective*

The perspective adopted here is that of public economics, and it may be helpful to indicate at the outset what this adds to the approaches already covered in other papers, which provide a fairly exhaustive range of microeconomic and macroeconomic analyses. Three aspects of this perspective may be highlighted.

First, it introduces government as an additional economic agent, or set of agents (since it may be misleading to think of government as a unitary and cohesive body). Just as with private agents, there is a choice to be made as to whether government should be thought of as an optimizing agent, or whether a behavioral perspective is more appropriate. In addition, even if the government is an optimizer, there is an issue as to what it might be optimizing. This is sometimes described as a planner's preference function, but that could mean some form of social welfare function, increasing in individual utilities; it could represent the political process (as for example via the median voter); or it could represent capture by some interest group (in the limit, leading to a predatory state). In addition, while corruption is not exclusive to the public sector, it is likely to be particularly significant in muddying the relation between what 'government' intends and what actually happens.

Second, public expenditures are, at least in principle, a matter of public record. Private activities require the construction of survey evidence to track what has been happening, but at least, provided the surveys are well designed, they should elicit the sort of information that is required. In principle, for public activities, it should be possible to reconstruct what was intended, and what actually happened, from budget books and from virements (reallocations) that shift expenditures from what had been planned, in response to contingencies. There are three problems here. One is that the categorization of expenditures in the budget books may not correlate well with the economic concepts of interest. (For example, an economically meaningful category like maintenance expenditure might be spread between various line items for wages and materials in both development and recurrent budgets, with all these line items including non-maintenance components.) Another is that expenditures may deviate from what was budgeted for many reasons, including all sorts of contingencies, but also including departmental power politics that were not resolved in the budget process. It would be very hard to partition these reallocations between those due to the disaster, and those due to this host of other reasons. Finally, the expenditure actuals may be incomplete (due to various off-budget devices) and take several years to finalize. In view of these manifold problems, it might seem

appropriate, if paradoxical, to adopt some sort of survey approach here as well. However, this might prove difficult, since the lack of transparency is likely to reflect a combination of a genuine lack of information, departmental turf wars, and the preference of some of the well-informed to avoid close scrutiny.

Third, the valuation of private activities is often fairly straightforward, and relies on the assumption of consumer sovereignty coupled with revealed preference. If a household purchases a quantity of a commodity, it is assumed that the household values the marginal unit at the purchase price. There may be various wedges (such as taxes or market imperfections) driving a wedge between producer and consumer prices, but these prices can be directly observed, and weighted using estimates of supply and demand elasticities. Valuing public expenditures is much more difficult. They may be pure public goods, or involve very substantial externalities. Even when they do not, typically the quantities consumed are rationed, so even if a price is charged, it offers no direct evidence on value. In consequence, a variety of strategies has been adopted to try and tease out how valuable the public expenditure actually is.

### *1.3 The structure of the paper*

The agenda stated in 1.1 poses (at least) five different challenges.

First, these matters may be considered from at least three perspectives, the normative, the positive, and a plausible hybrid of the two. The normative approach would focus on some sort of optimal or best practice expenditure responses, whereas the positive would focus on what is likely to happen in practice. The hybrid approach would consider how instruments might be designed to shift actual practice closer to best practice. These matters are considered further in section 2.

Second, the focus of the current research program is on what improvements could be supported by an appropriate choice of Sovereign Disaster Risk Financing and Insurance (SDRFI), or possibly a set of alternative choices. Hence, the issue is one of differential performance under different choices. This is discussed in section 3.

Sections 2 and 3 are concerned with how to establish how expenditure outcomes may differ. The third challenge is to attach values to these different outcomes. Assessing the benefits accruing from public expenditure can be exceedingly difficult even in what might be called the routine case, where no disasters or other shocks intrude. What is involved here is still more difficult, since it involves disruptions to the routine. The matter is considered further in Section 4, which shows that asymmetric damage to the public capital stock may mean that there is a very high cost to delayed reconstruction of public infrastructure, not only directly, but also indirectly, by compromising private incentives to rebuild damaged private capital as well.

Section 5 examines the fourth challenge, relating to macroeconomic impact. Papers by Fattal Jaef (2014) and Hallegatte (2014) consider macroeconomic modeling directly, so the treatment

in this paper can be brief. However, to the extent that different types of event will involve different expenditure choices and have different consequences for financing, these choices must be taken into account here.

While the focus in this paper is on post disaster expenditures, it is not possible to ignore some aspects of changes to the routine, pre-disaster, budget and its processes which is the fifth challenge is considered briefly in section 6. Section 7 concludes, making some suggestions towards the development of an operational framework for addressing these issues.

This is a daunting agenda, and existing information, and information that could feasibly be obtained in new case studies, will not permit answers to all these questions to be firmly based on evidence. As noted earlier, tracking public expenditure is notoriously difficult and a great deal of effort has been made to try and improve the reporting process over the years, but with limited success. Post-disaster expenditures become even more difficult when decentralized agencies make their own procurement arrangements following an event.

Observations from the broader Public Expenditure and Financial Accountability assessment are given in Appendix A to demonstrate some of the core issues faced with expenditure tracking more generally. The appendix also discusses Post Disaster Needs Assessments, provides some examples of specific post disaster expenditures, and looks at the uptake of SDRFI instruments. The whole thrust of this appendix is to underline how incomplete the evidential base is.

Consequently, it will be necessary to develop a more stylized approach, which, while respecting what limited data are available, makes use of plausible conjecture to cover aspects where the data are inadequate. The key consideration is that the paper must contribute to the process of developing an operational framework for impact appraisal, so it is not possible to leave areas blank where the data are inadequate.

## **2. What is the perspective?**

Teh (2014) addresses how counterfactuals are to be framed in a general sense. However, this issue needs to be examined in a rather specific way in the public expenditure context. This follows from the fact that public expenditure is, in principle and occasionally in practice, designed to optimize social outcomes. In practice, it might fail to do so for a very wide variety of reasons, including misconceptions in design, poor implementation due to defective capacity, and manifestations of political economy ranging from elite capture to downright corruption.

In other words, there may be a substantial gap between the normative view of what should get done, and the positive view of what actually gets done. This overall gap is a composite of two component gaps; the first is between optimal and imperfect design and the second between best practice and actual practice in implementation. These gaps exist both in the design and implementation of routine expenditures and, additionally, in the responses to disasters. One, but not the only, reason why the distinction may matter is that the different approaches to

SDRFI may have different potential for shifting actual practice closer to best practice. It seems unlikely, however, that these different approaches would have much purchase on the gap between optimal and imperfect design, since that is a reflection of the whole political process.

In consequence, analysis of these issues could make comparisons from (at least) three different perspectives, the normative, the positive, and a plausible hybrid of the two. The normative approach would focus on some sort of optimal or best practice expenditure responses, whereas the positive would focus on what is likely to happen in practice. The hybrid approach would consider how instruments might be designed to shift actual practice closer to best practice. De Janvry (2014) is intended to examine this issue in depth, and will hopefully provide a fuller treatment of these issues.

It seems desirable to make some attempt at all three approaches. The gulf between best practice and actual practice can be very wide. In these circumstances, to focus on actual practice without any consideration of best practice would be unacceptable; however to focus on best practice without any consideration of actual practice would be unrealistic. To the extent that the gap between the two can be identified, to design an SDRFI strategy without attempting to at least partially close this gap would be inappropriate.

At least partial information on best practice responses should be obtainable from Post Disaster Needs Assessments. Information on what was actually done is more difficult, because of the informational difficulties already alluded to. One suggestion, made in section 7, is to use the case studies to pursue this issue.

### **3. Differential outcomes**

The focus of the research program is on the relative costs and impacts of different SDRFI strategies. This is quite different from, and more demanding than, the conventional approach to assessing the impact of a disaster. In the latter, the question is what the net impact of the disaster was, given whatever risk transfer and other mechanisms were actually in place, compared to what would have happened absent the disaster. In the present case the focus is on what improvements could be achieved by an appropriate choice of SDRFI, or possibly a set of alternative choices. Hence, the issue is one of differential performance under different choices. These differences in public expenditure outcomes will themselves be contingent on the income level of the country, its level of indebtedness, and on the type and scale of the disaster.

In some respects that might make the exercise easier than the conventional one, in others, harder. It may be easier to the extent that certain expenditures are common across different SDRFI options; in other words, even though they are impacted by the disaster, they are not impacted differentially under the different options considered. For expenditures that are not common in this sense, it may be harder, because identifying differences in differences is more demanding than simply identifying differences.

In addition to changes in the level and composition of public expenditures, an SDRFI strategy may alter the timing of expenditures, by making funds available on a more timely basis. The avoidance or reduction in delays to the rehabilitation and reconstruction of damaged public assets may not only contribute directly to an accelerated recovery of output; it may also crowd in private expenditures on the replacement of assets. This possibility is analyzed in the following section, which shows that both effects may be very substantial.

## **4. Valuation**

### *4.1 Introduction*

The previous two sections were both concerned with the problem of establishing how expenditure outcomes may differ. The next challenge is to attach values to these different outcomes. Assessing the benefits accruing from public expenditure can be exceedingly difficult even in routine cases. What is involved here is still more difficult, since it involves disruptions to the routine. Consider the routine version first.

If a government had access to lump-sum taxation, so that raising revenue imposed no dead-weight losses on the private sector, then the marginal cost of public funds (MCF) would be one, and each type of public expenditure should be carried to the point at which a dollar spent had a (social) value of a dollar. Then the cost (lost benefit) of reducing any arbitrary type of public spending by a dollar would be a dollar. At the margin, all types would be worth the same amount, the cost of providing them.

In practice, governments raise revenue by imposing distortionary taxes, which do impose deadweight losses on the private sector. In consequence, the MCF exceeds one. There have been many attempts to estimate the MCF for different countries, and values in the range 1.25 - 1.5 are common.<sup>2</sup> This would imply that public spending should only be carried out to the point at which a dollar spent yielded social benefits of \$1.25-1.5, so that the marginal social benefit (MSB) equals the MCF. However, it is very hard to estimate the MSB for many types of expenditure, so it would be hard even for an optimizing government to equalize these. In addition, as already noted, governments may be very far from optimizing social welfare whether that failure is by design or by incapacity. It is also the case that estimates of the MCF of different taxes tend to vary widely, implying a failure to optimize the revenue system as well.

The problem becomes still worse when disruptions to the routine are involved. Revenues may be reduced in very random ways, with uncertain consequences for the MCF. Similarly, some expenditures may be increased and others reduced, again in very uneven and random ways, making the MSB even more difficult to assess.

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<sup>2</sup> The literature is very large. For a recent set of calculations for Sub-Saharan Africa, see Auriol and Warlters (2012).



## 4.2 Benefit estimation

In the absence of public goods, merit goods, externalities, imperfect information, indivisibilities, economies of scale, market power, and distributional issues, there would be no rationale for public expenditure, and the supply of all goods and services could be left to private producers. On the other hand, public production would do no harm, provided the outputs were sold freely at prices equal to marginal cost. In the presence of one (or indeed all) of these problems, there may be scope for public expenditure to improve outcomes. It does not necessarily follow that there should be public production; it may be better for the public sector to purchase privately produced goods and services and then make these available to private economic agents on terms that do not necessarily reflect these purchase costs. Whether or not the goods and services are publicly produced, this poses a valuation problem.

Economists tend to be most comfortable with valuations based on actual transactions where some reliance can be placed on revealed preference. That works well when pure private goods are exchanged on competitive markets, but becomes more problematic or possibly infeasible in the circumstances that make public expenditure appropriate. In some cases indirect techniques are possible, which can still utilize revealed preference to value things even when they are not directly bought or sold. A prominent member of this group is the rather oddly named hedonic pricing approach.<sup>3</sup> For example, variations in the prices paid for otherwise similar houses which are more or less exposed to airport noise can be used to attach a capitalized value to the flow of noise nuisance, even though there is no market in noise itself. The same approach can be used to price flood risk, which may differ sharply between closely neighboring properties. Another indirect approach uses drivers' differential preparedness to pay bridge or motorway tolls to save journey time to generate a demand curve for time savings, even though, once again, there is no market for time itself.

In other cases, these indirect methods fail, and reliance is frequently placed on contingent valuation and related methods which have recourse not to actual but to hypothetical choices, using surveys and interview techniques. This approach has been much used in the USA to value environmental costs and benefits. It is extremely contentious, and has generated quite a vituperative literature between opposing economists.<sup>4</sup> Part of the problem has been the frequently rather remote nature of the hypothetical questions. A major alternative to this approach has been a reliance on expert judgements.

Cost-benefit studies have frequently utilized a mixture of all three approaches (indirect revealed preference, contingent valuation, and expert judgement). It would be appropriate to take a similarly eclectic approach in the present context. However, the mix may be rather different. Indirect revealed preference may not be too helpful; if, *ex ante*, *all* the property on a small island is susceptible to catastrophic wind damage, there will be no useful variation in

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<sup>3</sup> For an early but influential illustration of a very large literature, see Brown and Mendelsohn, 1984.

<sup>4</sup> See, for example, the fairly belligerent exchanges in the *Journal of Economic Literature*, 2012, between Kling et al, Carson, and Hausmann.

property prices to permit estimation of the value, even if, ex post, some properties are destroyed and others spared. On the other hand, if the risk of flooding is restricted to a narrow coastal strip, the technique may have some utility. Again, if wind storms are a fairly familiar hazard, the contingent valuation approach may be more helpful than in the case of rather abstract environmental improvements.

#### *4.3 Output losses arising from destruction of public capital*

It is argued persuasively in Hallegatte (2014) that the existence of (sharply) diminishing returns to capital in the conventional production function may lead to an underestimate of output losses. This could be because a disaster may knock out infra-marginal capital which is more productive than marginal capital. However, another reason why capital destruction may cause bigger losses than marginal productivity calculations might suggest is down to complementarity issues, coupled with the fact that disasters are not even-handed in destroying complements. Apart from helping to explain why output losses may be large, complementarity also helps justify the view that it is important for the rehabilitation of public assets to be rapid.

These arguments are illustrated in this section, using a modest degree of capital disaggregation and two very simple set-ups. Suppose first that output is a Cobb Douglas function of public capital (which is a public good), private capital, and labor, with constant returns to the private factors. Thus:

$$Q = AK_p^\beta L^{1-\beta} K_g^\gamma \quad 1 > \beta, \gamma > 0 \quad (1)$$

where these are aggregate quantities formed by summing over individual firms which face a uniform wage and cost of capital. Given the cost of capital, these firms choose a uniform capital output ratio, so the equilibrium relation between output and public capital, given the labor supply, is:

$$Q \propto K_g^{\gamma/(1-\beta)} \quad (2)$$

A fairly common choice of  $\gamma$  by those using this specification is 0.2, and  $\beta$  is frequently assumed to be around 0.3. With these values, having 20% less public capital would imply a reduction in output of only 6.2%. That is an equilibrium relation, however, that includes the induced reduction in private capital that would occur if no restitution of public capital took place. If there were a 20% destruction of the public capital stock, that would temporarily lower output by only 4.4%, if private capital were left intact; if private capital suffered losses of 20% also, output would fall by 10.6%. Due to the peculiar properties of the Cobb Douglas function, these percentages are invariant, regardless of whether the public capital stock was initially at the efficient level or not.

Now suppose that there are two components of public capital,  $k1_g$ , and  $k2_g$ , which are combined to form the aggregate  $K_g$  that enters equations (1) and (2); this might now be thought of as “effective” public capital; the aggregation is done via a constant elasticity of substitution (CES) function, so:

$$K_g = (\alpha^{1/\varepsilon} k1_g^{1-1/\varepsilon} + (1-\alpha)^{1/\varepsilon} k2_g^{1-1/\varepsilon})^{1/(1-1/\varepsilon)} \quad (3)$$

where  $\varepsilon$  is the elasticity of substitution between the two components. If  $\varepsilon$  tends to infinity, the two components are perfect substitutes, and the composition of public investment is irrelevant; if  $\varepsilon = 1$ , the aggregator is itself Cobb Douglas and the two components enter equation (1) with exponents  $\gamma\alpha$  and  $\gamma(1-\alpha)$  respectively; if  $\varepsilon = 0$ , they are perfect complements, and the level of public capital is entirely determined by the one that is in shorter supply, relative to the efficient ratio of  $k1_g / k2_g = \alpha / (1-\alpha)$ . Table 1 gives the percentage output loss from a 20% reduction in the components of public capital under a range of assumptions about the elasticity of substitution ( $\varepsilon$ ), about the elasticity of output with respect to public capital ( $\gamma$ ), about the relative importance of the two components ( $\alpha$ ), and about how the 20% reduction is distributed between them. In all cases, it is assumed for simplicity that the pre-disaster composition of public capital is efficient, and that private capital escapes damage.

When the two components are perfect substitutes, it does not matter how the capital losses are distributed between them; public capital falls by 20% in any case, and output by 4.4% or 8.5% depending on its elasticity with respect to public capital. When they are not perfect substitutes, and losses are concentrated on one of the components, then effective public capital falls by more than 20%, and if the components are highly complementary, it is even possible for output itself to fall by more than 20%.

**Table 1: Reductions in effective public capital and in aggregate output when there is complementarity between components of public capital (%)**

$\alpha = 0.50$					$\alpha = 0.25$			
$k1_g$	40				80			
$k2_g$	0				0			
$k1_g + k2_g$	20				20			
$\varepsilon$	$\infty$	1	0.25	0.1	$\infty$	1	0.25	0.1
$K_g$	20.0	22.5	29.2	35.3	20.0	33.1	68.5	76.7
$Q$ if $\gamma = 0.2$	4.4	5.0	6.7	8.3	4.4	7.7	20.6	25.3
$Q$ if $\gamma = 0.4$	8.5	9.7	12.9	16.0	8.5	14.9	37.0	44.1

These calculations are highly stylized, but they do illustrate a phenomenon that is likely to be very important in practice, particularly for public infrastructure. While this first illustration has restricted attention to complementarity between components of public capital itself, the same consideration also applies to the relation between public and private capital. This is addressed in equation (4), which adopts an ‘AK’ approach to production, with total capital now being a CES aggregate of private and public capital.

$$Q = A(\alpha^{1/\varepsilon} K_p^{1-1/\varepsilon} + (1-\alpha)^{1/\varepsilon} K_g^{1-1/\varepsilon})^{1/(1-1/\varepsilon)} \quad (4)$$

where  $\varepsilon$  is now the elasticity of substitution between private and public capital. For the purposes of Table 2, it is assumed that public and private capital are equally important so that  $\alpha = 0.5$ . In all six columns, the total initial loss of capital stock is 40%; in columns 1 and 4, private capital falls by 60%, and public capital by 20%; these proportions are reversed in columns 3 and 6; and in columns 2 and 5, the damage is equally shared. The table gives the output loss associated with these assumptions for the two cases where the elasticity of substitution is 1.0 and 0.25. It also gives the rate of return to private investment after the disaster as a ratio of the pre-disaster rate of return.

The last two rows give the remaining loss of output and the private return ratio, conditional on the public capital loss having been fully made good. This makes starkly clear that it is crucial to make this loss good as quickly as possible, particularly if damage has been disproportionately suffered by the public sector. There are two separate reasons for this.

**Table 2: Reductions in aggregate output and changes to private rates of return when there is complementarity between public and private capital (%)**

	$\varepsilon = 1$			$\varepsilon = 0.25$		
<b>% red<sup>n</sup> in <math>K_p</math></b>	60.0	40.0	20.0	60.0	40.0	20.0
<b>% red<sup>n</sup> in <math>K_g</math></b>	20.0	40.0	60.0	20.0	40.0	60.0
<b>Initial % red<sup>n</sup> in <math>Q</math></b>	43.4	40.0	43.4	51.5	40.0	51.5
<b>Initial return ratio</b>	1.41	1.00	0.71	2.15	1.00	0.13
<b>Cond<sup>l</sup> % red<sup>n</sup> in <math>Q</math></b>	36.8	22.5	10.6	50.6	29.2	12.2
<b>Cond<sup>l</sup> return ratio</b>	1.58	1.29	1.12	2.32	1.94	1.45

First is the obvious point that rapid rehabilitation and reconstruction of public capital rapidly reduces the output loss. The second relates to the rate of return to the investment needed to reconstruct the lost private capital. If the original losses were concentrated in the public sector, this private return is depressed well below its equilibrium value, to only 13% of this value in column 6, when  $\varepsilon = 0.25$ , but to 71% even in the Cobb Douglas case of  $\varepsilon = 1$ . If the public sector is unable to replace lost assets quickly, the incentive to replace private assets is

lost. The final row shows that if public rehabilitation has been achieved, then private incentives to invest become strong. Depending on the detailed circumstances of each disaster, this crowding-in effect could be a major component in the total benefits accruing from rapid action.

The preceding illustrations rely on stylized models with the results sensitively dependent on parameter values about which we have little information. However, they do suggest that the effects could be large, and these processes should not be ignored. One, obviously flawed, way forward would be to seek an expert consensus on their likely size.

#### *4.4 A possible procedure*

Given these difficulties, it will probably be best to proceed in a two tier way, one tier being stylized, the other grounded in more specific information. For the stylized tier, one possible underlying assumption would be that expenditure reallocations were broadly sensible, so that the social pay-off to increased categories is higher than the lost benefits from the reduced categories. If it was assumed that, in the routine situation, public expenditure was on average at roughly the right level, then the assumed MSB might be close to estimates of the average MCF, and this might also be true of spending categories that have to be reduced in the disaster. Meanwhile, the categories that are increased would be assumed to have a higher value, by some factor to be decided. While it has the advantage of being much simpler than the alternatives, the major drawback of this approach is that it ignores much of what we know about public expenditure, namely that it is not usually optimally allocated, either before or after reallocation, so that it matters what specific form the reallocation takes. There are also likely to be significant costs to reallocation, which are again likely to be very sector specific. For example, a temporary halt to a non-disaster related construction program is likely to be very costly whereas a temporary halt to renewal of the government's vehicle fleet may not be.

In consequence, a somewhat more elaborate approach to the stylized tier would be desirable; this would be to make some allowance for known or expected imperfections in routine public expenditure composition, and for disaster related changes in these. An obvious contender here would be the well-documented underspending on public capital formation and on the recurrent (operations and maintenance) spending associated with the existing public capital stock. These consistent underspends might be supposed to result in a very high MSB, so any further reductions from a low base would be very costly. A related valuation issue concerns the timing of reconstruction of public assets that have been damaged by the disaster. As discussed earlier, one likely benefit of improved SDRFI is that reconstruction could take place earlier, or could involve a wider set of damaged assets in the same time frame. Both eventualities are likely to raise the MSB of these types of expenditure, and it will be necessary to derive a plausible factor or set of factors for these, possibly using an expert consensus as noted above.

The second tier would reinforce this stylized approach by plugging in whatever more specific, concrete valuation information might be available, necessarily on a piecemeal basis. This

information might be country-specific, or might be derived from a class of disasters with the additional assumption that responses to this class would be similar across countries.

## **5. Macroeconomic issues**

The emphasis so far has been on trying to track expenditure changes under different SDRFI strategies, and provide some basis for valuing these. (The direct costs of the strategies themselves are considered in other papers, but see the next section.) If the public expenditure responses, coupled with any impacts on revenue, left the net fiscal position unaffected at each point in time, then that would be the end of the story. However this may not be the case. The public deficit could widen in the short term, and public debt increase. This might reflect net expenditure increases, revenue losses, and possibly reduced aid inflows, if superior SDRFI instruments have the consequence of reducing ex-post assistance. If so, it would have immediate consequences, for example on interest rates, but also longer run consequences imposed by the government's inter-temporal budget constraint (IBC). Some attention may have to be paid to these matters, to close the circle. These issues are treated in more depth by Fattal Jaef (2014) and Hallegatte (2014).

While note needs to be taken that there may be macroeconomic effects, “one of the notable features of the empirical evidence is that disasters often have little discernible impact on public deficits or public debt. This seems to point to (a) the scale of reallocations (much of which is very poorly documented) and (b) delays in reconstruction, with costs being spread over a number of years.”<sup>5</sup> It may also reflect liquidity constraints on government. In many cases, governments of low- and middle-income countries are rationed in their access to concessional finance; are either close to prudential limits on non-concessional external debt, or can only access this source with substantial delays; face very limited domestic financial capacity; and find it very difficult to raise tax revenues in the short- or medium-run. They also may well be in IMF programs that severely limit their scope for expansionary monetary policy. In consequence, and unlike the position of governments in high-income countries, their liquidity may indeed be severely constrained, and they may be forced to rely on expenditure reallocations and delays. Given the inescapable difficulties in analyzing the costs and benefits of these reallocations and timing issues, it may be simplest to neglect the macroeconomic issues when studying public expenditure, unless there is clear evidence that they are significant.

## **6. Pre-disaster issues**

Another set of issues concerns changes to the routine or pre-disaster operation of government, exacerbated by their current economic situation, which will impact on the SDRFI tools available to them. As already noted, the direct financial costs of SDRFI instruments are not considered here. However, they still have to be taken into account. Ultimately, they will have to be financed by some combination of three sources; extra taxation (with an associated MCF); external assistance (which could be negative in the net, averaging over routine and post disaster

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<sup>5</sup> Charlotte Benson, personal communication.

operations); and reduced expenditure (with associated loss of MSB). They could temporarily be financed by increased debt, invoking the macroeconomic complications indicated in the previous section. However, ultimately, failing debt repudiation, the inter-temporal budget constraint reduces alternatives to those three. In short, the cost of SDRFI is not simply the upfront dollar cost, but must also allow for the consequences of the public sector financing utilized.

Any SDRFI instrument that is utilized will have an associated direct cost even if this is only the opportunity cost of holding the cash in an established reserve. More complex risk transfer instruments such as catastrophe risk insurance are often expensive and countries may have to pay a premium for many years before an event will trigger a pay-out. While one of the benefits of risk transfer may be that, since it arrives following an event, it cannot be misappropriated elsewhere, there is also the risk that if countries experience several disaster-free years the established budget line for the risk transfer instrument may be scrapped to raise funds for other priority expenditures. Governments need carefully to assess the costs and benefits of such tools in relation to the national budget before engaging in any form of risk transfer.

There is a clear time dimension relating to the post-disaster funding needs and the various phases of relief, recovery and reconstruction. Some financing instruments can be activated rapidly. Others may take longer to activate but can generate substantial funding. Many countries have chosen to establish a form of dedicated reserves to facilitate disaster response and if a decision on SDRFI is to be based on time alone this can be an effective mechanism. Increasingly, there is a call for these funds to be held at the local government level to reduce the time it takes to disburse funds from central to local government; however, clear acquittal procedures back to central government will need to be embedded in legislation to avoid misuse of the funds and this option may not be viable for every country. This suggests that there may be a trade-off between the speed of disbursement and the transparency of such dedicated reserves; often, once money has left central government, little or no information is reported back on how such funds were spent.

Clarke and Poulter (2014) address these issues in more detail.

## **7. Including public expenditure in an operational framework**

This paper provides a preliminary cut at which public expenditure issues need to be addressed within the context of the program, as well as asking some questions as to how this might be achieved. While it is obvious that use should be made of available evidence, it is equally obvious that that evidence is extremely incomplete, and it will be necessary to make a range of heroic assumptions. The trick will be to make these assumptions as plausible as possible, and also to conduct sensitivity analyses to discover which assumptions are most critical to the various choices available. What follows is a sort of ‘minimum’ list, supposing that there is very little supplemental information. To the extent that such information is available, it would be highly desirable to improve the procedure.

At base, there are three questions that need to be addressed. The first refers to how post-disaster expenditures are likely to differ, given some SDRFI package, from what they would otherwise have been. The second refers to how these changes might be valued. The third refers to whether the case studies could be used to explore these issues further. The discussion that follows is speculative in the extreme, and is offered more in the spirit of starting a discussion than of concluding one.

### *7.1 How might public expenditures differ?*

There are three aspects, level, timing, and composition. As regards the first two, the simplest assumption would be that aggregate public spending would differ by the amount of additional resources made available by the SDRFI. To the extent that these made resources available sooner, rather than increasing the total amount, they would affect the timing rather than the level. (These assumptions imply that the specific impact of the SDRFI is debt neutral, though the basic response to the disaster may not be.) As regards composition, there are two polar cases, consistent with the level and timing assumption. At one extreme, all the extra spending made possible by the SDRFI goes to the post disaster priority sectors. In other words, whatever reallocation of expenditure away from non-priority sectors would have taken place absent the SDRFI still takes place with it. Call this assumption 1. At the other extreme, the priority sectors would receive no more than without the SDRFI; the extra resources would be used to reduce the reallocation from non-priority sectors. Call this assumption 2.

### *7.2 How might these changes be valued?*

The basic assumption here would be that priority sectors have a higher MSB, say on average MSB1, than the rest, which are worth on average MSB2. This presupposes that the reallocation, even if highly imperfect and inefficient, does still manage to shift resources “in the right direction”. Under assumption 1, all the extra resources from the SDRFI would have this higher MSB1. Under assumption 2, they would only be worth MSB2. (These propositions suppose that the incremental resources are small relative to the damage.) It would be simplest to assume that MSB2 equals a dollar per dollar spent, and MSB1 a very speculative higher value, which could be guesstimated using the procedures sketched in section 4.3. Alternatively, the critical value of MSB1 which would make the expense of SDRFI just worth undertaking could be estimated and a judgement made as to whether this was above or below what was felt (by experts?) to be plausible.

### *7.3 How might the case studies explore these issues further?*

As just noted, there are two (sets of) deficiencies in the available evidence. One relates to what expenditure reallocations and other adjustments are likely to take place, and the other to how these might be valued. It would be possible to design the case studies to throw some light on both of these issues. Getting a handle on the first issue seems the more practical, but the extent of the challenge should not be underestimated. Given the inadequacy of the available data, and the impracticality of rectifying this in a ‘hard data’ sense, it would probably require extensive



interviews to gather essentially anecdotal information. However, that would be very valuable, especially if repeated across a number of studies, in providing some sense of the 'shape' of expenditure responses. If different studies produced reasonably coherent results, that would be really useful. But even if they did not, that would itself be germane to our understanding of the problems, and might provide a basis for sensitivity analysis. A second avenue may be to consult IMF country reports for low-income countries, both to check on the statistical information they contain, but also to utilize the narrative account they provide of policy recommendations and actions, including those in respect of supplementary budgets, and of any revenue and trade policy responses to disasters.

The second issue is even more difficult. It would almost certainly require a substantial exercise in contingent valuation, and this might be of dubious value, as already noted. It might also involve recourse to expert judgement. Once again, if these two avenues produced relatively similar assessments, that would be really useful, but even if not, that would still be germane, as before.

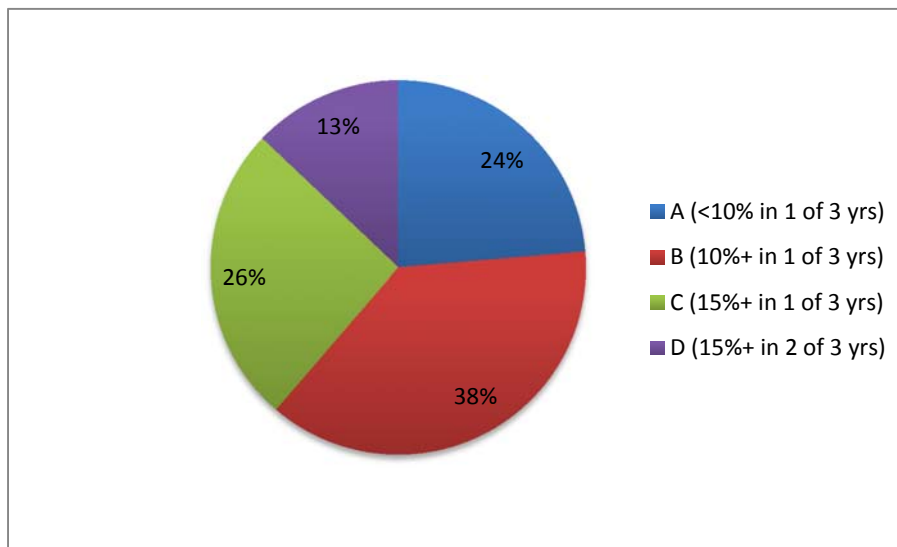
## Appendix A: Some Evidence on Public Expenditures

### A.1 Problems tracking post disaster expenditures - PEFA

The Public Expenditure and Financial Accountability (PEFA) assessment was developed to assess the condition of country public expenditure, procurement and financial accountability systems and develop a practical sequence for reform and capacity-building actions. It is also useful for the purposes of this paper to highlight the generic challenges faced in trying to establish expenditures. These same challenges are not only relevant to post disaster expenditures but often exacerbated due to the additional stress and time limitations facing governments responding to a disaster.

Of the 92 countries that reported on Performance Indicator (PI) 1; aggregate expenditure out-turn compared to the original approved budget, 24 percent scored an A, that is, experienced deviation from the original budget of no more than 10 percent in no more than one of the last three years. In contrast 13 percent of the countries that reported against this performance indicator experienced deviation from budget expenditure that was equivalent to over 15 percent of budgeted expenditures in two of the past three years (see figure 1) obtaining a score of D<sup>6</sup>. This indicator looks at domestic expenditure only excluding debt service payments and donor funded project expenditure, which are beyond the control of the government.

**Figure 1: PI-1 Actual expenditure deviations as a percentage of budgeted expenditure.**



Source: PEFA

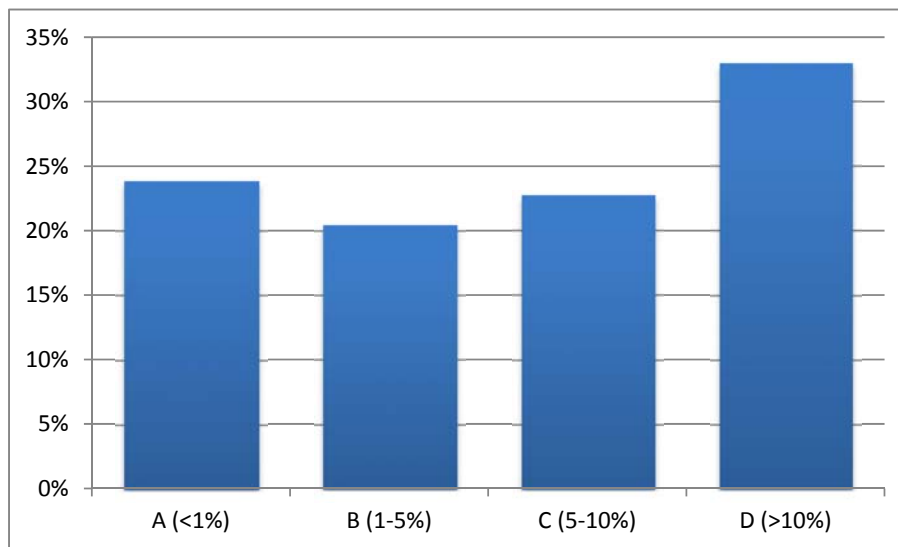
This suggests that the majority of respondents are able to deliver the public services for the year as planned or within a narrow margin of that plan. However, this result must be skewed by the fact that only 13 respondents answered the sub-component PI-2, which relates to the

<sup>6</sup> To obtain a score of D actual expenditure in 2 out of the last three years deviated from budgeted expenditure by an amount of 15% or more of budgeted expenditure. For scores A-C, expenditure deviates by the indicated amount in only one of the past three years.

contingency budget. Interestingly, only those respondents that had contingency expenditures equivalent to over 3 percent and less than 6 percent of the total expenditures in the budget answered. Whether the remaining participants had a contingency budget, did not use their contingency, or simply didn't answer the question could not be ascertained.

The PEFA assessment also attempts to give an indication of the extent of unreported government operations in PI-7. In total 33 percent<sup>7</sup> (the sum of D and D+) of respondents have a level of unreported budgetary expenditure which is more than 10 percent of total expenditure and the information on donor financed projects included in fiscal reports is seriously deficient (See Figure 2).

**Figure 2: PI-7 Extent of Unreported Government Operations**



Source: PEFA

The classification of C selected by a further 23 percent of respondents indicates that unreported extra-budgetary expenditures were between 5-10 percent of total expenditure. This demonstrated that over half of the respondents encountered significant levels of under-reporting. This serves to demonstrate the difficulty of tracking off budget expenditures; such as those funds, which could be associated with post disaster financial instruments

This aligns with what has been reported in the Hyogo Framework for Action (HFA); during the 2009-2011 assessment 34 out of 95 countries explicitly stated that they have inadequate funding for disaster risk reduction (Benson, 2011). This would imply that should a disaster arise the funding would be sought off budget or via some form of budget reallocation.

<sup>7</sup> B and B+, C and C+ and D and D+ have been summed for simplicity. A "+" is awarded to multidimensional indicators to account for superior performance in one or more of the indicators. Each component of the indicator is assessed individually and the lowest score awarded, the "+" indicates that one or more of the other components of the indicator scored higher.

The above discussion on PEFA serves to demonstrate that while countries appear to be good at staying within the confines of the budget set when unforeseen expenditures occur and the contingency budget is used few countries appear to have adequate tracking mechanisms. The same is true of any off budget expenditures. It is perhaps therefore unsurprising that tracking post disaster expenditures is notoriously difficult as these expenditures are normally off budget and drain any available contingency funds. Couple this with the fact that only a few countries have disaster expenditure tracking systems and it becomes a little more obvious as to why most evidence on post disaster expenditures is often anecdotal at best and non-existent at worst.

Those countries, such as Peru, where there are disaster tracking systems in place, still face problems with identifying what the money was used for. Post disaster expenditures often involve third parties from the international donor community and the expenditures remain off-budget; or, they are ex-ante disaster risk reduction expenditures which are often more difficult to track given the cross-cutting nature of the investment. The 2004 tsunami in Aceh and Nias in Indonesia saw over 300 contributions from a variety of institutions towards reconstruction efforts, financing over 1,500 projects (Fengler et al, 2008).

#### *A.2 Post Disaster Needs Assessments (PDNAs)*

These are often a good source of information on the extent of post disaster expenditures are conducted shortly after the event. These assessments generally feature a recovery and reconstruction framework. These give an indication of the potential burden on the fiscal purse. Table 1 indicates the public share of the total damage and loss, which ranges from 10 to 70 percent. This goes some way to demonstrate the level of contingent liability a country may face following a disaster. While some money may come from the international community, insurance, loans (concessional or otherwise) the Government will still be left to fund many initiatives to support the full recovery.

The 2010 floods in Thailand demonstrate just how large these funding requirements can be, the five year recovery and reconstruction plan is estimated to cost US\$50 billion, ten times the estimates of the damage and loss incurred from the flooding (Government of Thailand, 2010). Recovery and reconstruction frameworks are developed using the principle of build back better, that is improving the build quality of any destroyed or damaged assets to a higher quality in order that they become more resilient. This can at times often provide a window of opportunity for governments and the international community to incorporate or accelerate other key development projects. Both of these elements could have played a factor in the large recovery and reconstruction program for Thailand when you consider that only 10 percent of the identified damage and loss was to assets and income streams held by the public sector. Further, such a large program is likely to place expansionary pressure on a government's fiscal deficit. This was the case in Myanmar following tropical cyclone Nargis in 2008. The fiscal deficit increased from 3.4 percent in 2008 to 3.7 percent in 2009 and was in part attributed to tropical cyclone Nargis (ADB, 2010).

**Table 1: Indicative burden on the public purse from recent events**

Country	Year	Disaster	Damage and Loss				Estimated Recovery & Reconstruction Requirements
			Damage (US\$m)	Loss (US\$m)	Total (US\$m)	Public share of Total (%)	Total (US\$m)
Seychelles	2013	Flood	5.2	3.1	8.3	70	30.3
Fiji	2012	Cyclone	67.2	41.2	108.4	17	67.0
Samoa	2012	Cyclone	103.3	100.6	203.9	55	206.0
Malawi	2012	Flood	1.4	1.5	2.9		7.3
Bhutan	2011	Earthquake			24.5		22.63
Pakistan	2011	Flood	3,208.0	522.0	3,730.0		2,747
Japan	2011	Earthquake		210,200			
Thailand	2011	Flood	2,046	2,604.0	4,650.0	10	50,000
Djibouti	2011	Drought	51.7	157.3	209	67	318
Kenya	2011	Drought	805.6	11,300	12,105.6		1,770
New Zealand	2010-2011	Earthquake		15,950		15 <sup>8</sup>	

Source: Government of Seychelles, 2013; Government of Fiji ,2012; Government of Samoa, 2012; Government of Malawi, 2012; Royal Government of Bhutan, 2011; Government of Pakistan, 2011; Government of Japan, 2012; Government of Thailand, 2011; Government of Djibouti, 2011; Government of Kenya, 2011; and New Zealand Treasury, 2011.

Caution should be used when comparing PDNAs across countries, events and years. While an agreed framework for PDNAs have been developed the content can vary significantly depending on the sectors analyzed and the timeframe allocated for the assessment. The issue of timing is of great importance as they should not be conducted during the initial relief phase, first responders need time to ensure that the public are safe and have adequate shelter and basic provisions such as food and water. However, if the PDNA is conducted several weeks after an event it becomes difficult to assess the damage as the clear up will have begun; this is particularly true for the housing and infrastructure sectors where the cleanup begins almost immediately. As a rule of thumb PDNAs are normally conducted two to four weeks after the event. There are two distinct groups of people who conduct the PDNAs those with expertise of the PDNA framework and those with the in-depth country knowledge. PDNAs often involve an international team arriving in country to provide technical expertise and training to their in-country counterparts who hold the country expertise (and often sources of data) but have limited awareness on how to apply the PDNA framework. The quality of the PDNA is dependent on the strength of the relationship between these two distinct groups.

<sup>8</sup> For losses only no damage figure obtained.

### *A.3 A few examples of post disaster expenditures*

#### **Seychelles**

Following the 2013 floods the immediate fiscal impact of the disaster was estimated to be SR 4.3 million (0.03 percent of GDP or 0.08 of the recurrent budget). According to information recorded in the PDNA utilization of the government's budget framework accommodated the increased expenditures; no allocation for natural disasters was made to the contingency fund of SR 50 million. The SR4.3 million was spent on those areas identified with the greatest need. These being the provision of relief goods by the Agency for Social Protection SR3.3 million; emergency assistance provided by the Ministry of Land and Housing SR480,000 and the District Administrators have incurred expensed SR 0.6 million for similar activities. **Source: Government of Seychelles, 2013.**

#### **Pakistan**

Following the 2011 floods in Pakistan the additional expenditure needed to fund the necessary relief, rehabilitation and reconstruction was estimated to cause equivalent to 0.3 percent of GDP. Consequently, the already stretched target of running a budget deficit equivalent to 4 percent of GDP was forecast to reach 6 percent of GDP as a result of the increased expenditures. **Source: Government of Pakistan, 2011.**

#### **Fiji**

Post disaster expenditures will first and foremost be driven by the amount of cash readily available to the government. This makes the time that a disaster occurs a key issue; different amounts of funding will be available depending on whether the disaster occurs at the beginning or towards the end of the budget cycle. In December 2012 Fiji was struck by tropical cyclone Evan causing damage on the northern island of Vanua Levu and the western part of the main island of Viti Levu. The fiscal year in Fiji coincides with the calendar year so the government had a good idea what the full year expenditures had been and as a result they were able to swiftly reallocate FJ\$7 million (US\$3.7 million) from the national budget in 2012, equivalent to approximately 0.3% of the total budget. This money was used to finance the initial disaster response for TC Evan. A further FJ\$17 million (US\$9 million) was reallocated from the 2013 budget to finance housing rehabilitation, equivalent to 0.7 percent of total expenditures. **Source: Government of Fiji, 2012.**

### *A.4 Uptake of DRFI instruments*

The HFA national progress reports for 2009-2011 indicate that 60 out of 95 countries hold some form of national contingency fund for disaster response. In addition, 37 out of 95 countries indicated that they have some form of catastrophe insurance facility in place. The supporting narrative indicates that these figures include countries where private property and crop insurance schemes, as well as sovereign insurance mechanisms, are available (Benson, 2011). This number will have increased slightly following the launch of the Pacific Catastrophe Risk Insurance pilot in January 2013, which saw five, now six following the expansion in the second season, Pacific island countries (Cook Islands, Marshall Islands, Samoa, Solomon

Islands, Tonga, and Vanuatu) purchase catastrophe risk insurance against tropical cyclones and/or earthquakes/tsunamis with support from the Government of Japan. Tonga was the first country to receive a pay-out from the insurance program and received US\$1.27 million, which is equivalent to more than the 2013 contingency budget or half of the current reserves of the Tonga National Reserve Fund, demonstrating how effective sovereign DRFI can be. A similar scheme operates in the Caribbean; the Caribbean Catastrophe Risk Insurance Facility (CCRIF), and since its inception in 2007 has made a total of eight pay-outs totaling US\$32.1 million (see Table 2). The most cited pay-out was for Haiti following the earthquake in 2010, the pay-out of US\$8 million enabled the Haitian public sector and emergency services to continue to function despite the loss of many staff and the vast destruction to many central government buildings.

In order to demonstrate what the injection of liquidity is worth to countries in terms of additional budget Table 2 shows what the payouts from CCRIF are worth in terms of the total budget and the contingency budget. Data limitations were such that actual contingency budgets could not be ascertained so proxy of 1.5 percent of the total expenditures has been used. Looking at St Lucia, it can be seen that their payouts range from being equivalent to 6.5 percent to 49.3 percent of the contingency budget, providing a much needed boost to the limited resources for response and relief. For example, in Barbados following the aftermath of Hurricane Tomas on October 31st, 2010, the CCRIF payout of US\$8.5 million, equivalent to almost 30 percent of the contingency budget, was used to fund immediate infrastructure repairs which removed the need to gain parliamentary approval to receive the required parliamentary approval for supplementary expenditures thus removing the associated time lag enabling repairs to commence immediately (TI-UP Resource Centre, 2012).

**Table 2: Liquidity Injections from CCRIF**

Country	Event	Year	Payout (UD\$ millions)	Payout as a % of Total Expenditure	Payout as a % of Contingency Budget <sup>9</sup>
Dominica	Earthquake	2007	0.52	0.4	29.9
St. Lucia	Earthquake	2007	0.42	0.1	6.5
Turks and Caicos Islands	Tropical Cyclone	2008	6.3	-	-
Haiti	Earthquake	2010	7.8	-	-
Anguilla	Tropical Cyclone	2010	4.3	6.7	>200
Barbados	Tropical Cyclone	2010	8.6	0.4	29.4
St. Lucia	Tropical Cyclone	2010	3.2	0.7	49.3
St. Vincent and the Grenadines	Tropical Cyclone	2010	1.1	0.3	24.9
Total Payout		2007-2011	32.1		

**Source: CCRIF, Government of Anguilla, Government of Barbados, Government of the Commonwealth of Dominica, Government of St Lucia and Government of St Vincent and the Grenadines.**

<sup>9</sup> Using 1.5% of total budget as a proxy.

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