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Designing Intergovernmental Fiscal Transfers for Conservation: The case of REDD+ revenue distribution to local governments in Indonesia

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Abstract

A REDD+ scheme would involve the transfer of financial resources to forested developing countries taking part in it. This paper simulates different approaches to the design of intergovernmental fiscal transfers (IFTs), a possible means to channel a REDD+ international payment to local governments which, in several countries, have a certain degree of authority over forest management. Using Indonesia as a case study, the cost-reimbursement and the derivation approaches are tested. It is demonstrated that both approaches could be used. Using the cost-reimbursement approach, localities with more degraded forests would receive a higher compensation per unit of carbon emission reduction than districts with primary forests. Avoiding further conversion of logged-over areas is associated with higher opportunity costs when compared with preventing the conversion of primary forests. In contrast, the derivation approach sets a fixed percentage and rate to distribute REDD+ revenues and ignores the opportunity costs of REDD+ incurred by local governments. The distribution of REDD+ revenues to eligible local governments is based on an assumed market price of carbon credits from REDD+. This paper concludes by discussing the implications of the findings for designing the distribution of REDD+ revenues, both for Indonesia and more generically for other developing countries.

Keywords: REDD+, Intergovernmental Fiscal Transfers, Opportunity Costs, Decentralisation, Indonesia

1. Introduction

A Reducing Emissions from Deforestation and Forest Degradation scheme (REDD+) is expected to provide performance-based payments to reduce emissions from deforestation and forest degradation in developing countries (UNFCCC, 2011). Such a scheme would require developing countries to set aside additional forest areas, which may not necessarily yield additional environmental services for local residents. Additional forest conservation would compete with other land-use activities, such as commercial logging, timber and oil palm plantations. REDD+ measures would therefore lead to a substantial loss of public revenues at various government levels (Irawan et al., 2011). Local governments, such as districts and municipalities, would be more likely to be interested in REDD+ when the costs of conservation are appropriately compensated.

One of the possible means for channelling REDD+ payments to local governments is an intergovernmental fiscal transfer (IFT) scheme (Irawan and Tacconi, 2009; Ring et al., 2010). IFTs have been proposed as an economic instrument to address spatial externalities of biodiversity conservation provided by local governments (e.g. Ring et al., 2010; Ring 2008a, 2008b, 2008c; Köllner et al., 2002; Kumar and Managi, 2009; Santos et al., 2012). IFTs help reconcile the local costs with the spill-over benefits of conservation that reach far beyond local boundaries. Brazil and Portugal, for instance, use IFTs to support biodiversity conservation by transferring a portion of the national or state governments' taxes (e.g., in Brazil, state-level value-added tax) to the local levels on the basis of conservation and ecological indicators (Grieg-Gran, 2000; May et al., 2002; Ring, 2008c; Santos et al., 2012). Several studies have also suggested transferring a portion of the national or state governments' revenues to local levels to compensate them for the management and forgone opportunity costs borne by localities with protected areas (Köllner et al., 2002; Ring, 2008b; Kumar and Managi, 2009).

Using IFTs to channel REDD+ payments to local governments requires a new approach to determine the size of transfers. As a REDD+ scheme would involve the transfer of financial resources from developed to participating developing countries, the purpose of IFTs would not simply be to correct the spatial externalities of conservation but also to distribute that revenue (which could exceed the opportunity costs) vertically between government levels. REDD+ revenues could therefore be distributed using a vertical revenue-sharing scheme, which is commonly used to distribute taxes and fees collected by the national government. The size of the vertical revenue-sharing is usually determined on the basis of a share of a national tax and the amount of taxes collected within certain administrative boundaries (Bird, 1999; Bahl and Wallace, 2007).

This paper examines different approaches to determine the size of IFTs for forest conservation using the distribution of REDD+ revenues to local governments in Indonesia as a case study. We examine two important aspects of an IFT design: (i) the grant size to be allocated to different levels of government; and (ii) the IFT size allocated for each eligible locality to pursue REDD+. The grant size, or distributable pool, is the vertical dimension of IFTs that determines the size of grants or transfers distributed to different levels of government; the distribution formula, which is the horizontal dimension, decides the size of transfers allocated to each local government unit (Bird, 1999; Bahl, 2000).

In this paper, we assume that REDD+ would be implemented using a national-based implementation approach in which the national government would receive REDD+ payments and in which there would be no direct payments from the international level to local governments (Angelsen et al., 2008). Scholars have also proposed a nested approach to the implementation of REDD+ in which sub-national projects could be allowed to receive payments directly from international buyers (e.g. Pedroni et al., 2009). Busch et al. (2011) assume that the nested approach would be adopted and estimate the incentive structure required for local governments in Indonesia to participate in REDD+. Their approach, however, ignores the existing political economy of land-use change in Indonesia, including the distribution of power between the central and local governments and the existing incentive structures influencing different stakeholders in the pursuit of forest exploitation and land-use change. The national government currently retains most of the revenues from land-use alternatives to REDD+ (Irawan et al., 2011). This situation is also common in other decentralised countries, where the higher level of government collects the largest share of public revenues and distributes part of this to local governments using IFTs (de Mello, 2000). IFTs are, therefore, still the cornerstones of subnational government financing in most developing and transition countries (Bahl, 2000). This paper first discusses the approaches that are commonly used to determine the size of the grant and the size of IFTs to be allocated to local governments in the fiscal decentralisation literature and provides international experiences of the distribution formulae of IFTs to support biodiversity conservation. The provinces of Riau and Papua, selected for this case study, are then presented, and the approximation of their reference emissions levels (RELs) are discussed. RELs determine the business-as-usual scenario of carbon emissions that would be released from deforestation and forest degradation in the future without REDD+ (Meridian Institute, 2009). Different possible approaches to calculate RELs result in different amounts of emission reductions achieved by a locality, which in turn would affect the value of REDD+ incentives to be allocated to the subnational level (Cattaneo, 2011; Busch et al., 2009). The methods adopted to estimate the grant size for different government levels and the IFT size for eligible district governments in Indonesia are then discussed. After presenting the results of the analysis, the paper discusses the advantages and disadvantages of the cost-reimbursement and the derivation approaches considered for the design of the IFTs. The paper concludes with the general implications of the findings for designing REDD+ payment distribution.

2. Intergovernmental fiscal transfers (IFTs) for biodiversity conservation

2.1 Theoretical framework for distribution formula

IFTs are commonly used in decentralised countries to distribute public revenues from national to decentralised levels of government. As previously mentioned, the main purposes of IFTs are to distribute a share of the national government's revenues to subnational governments (vertical revenue-sharing) and to correct for spatial externalities generated from the provision of public services (Bird and Smart, 2002; Shah, 2006). Vertical revenue-sharing aims to address the mismatch between expenditure needs and the public revenues generated at the local level. Since the tax base of local governments tends to be narrow, and non-tax revenues such as user charges, rents, royalties, and fees are also limited, revenue-sharing is then an option to close the fiscal gap (de Mello, 2002). Spatial externalities create an inefficient outcome of public service provision, as local decision-makers often neglect the benefits accrued to outsiders beyond local boundaries in the decision-making process (Bird, 1999). Pigou (1932, cited in Oates, 1972, p. 66) proposed that to address such spatial externalities: 'the economic unit generating the spillover should receive a unit subsidy equal to the value at the margin of the spillover benefits it creates'. By providing a unit of subsidy equal to the value at the margin of the spillover benefits, local governments are expected to provide the right amount of public service (Oates, 1972).

Related to the size of the transfers are two key aspects of the design of IFTs: the size of the 'distributable pool' and the basis for distributing transfers to each eligible local government (Bird, 1999, p. 24). The three approaches to determine the size of grant/transfer pool are based on: i) a defined percentage of the national government's revenues; ii) an ad hoc approach based on a discretionary decision that may vary from year to year; and iii) a cost reimbursement based on the costs of public service delivery at the local level, defined by the national government (Bird, 1999; Bahl 2000; Bahl and Wallace, 2007). Decentralised countries usually use the defined (percentage) approach or the shared-tax approach to vertically distribute revenues that are collected from taxes and fees between government levels (Bird, 1999; Bahl 2000; Bahl and Wallace, 2007). The ad hoc approach is similar to any other budgetary government expenditures, where the parliament or president decides on an allocation to the subnational government on a discretionary basis (Bird, 1999; Bahl 2000; Bahl and Wallace, 2007). Finally, the cost-reimbursement approach decides the size of a grant pool based on a proportion of specific local expenditures to be reimbursed by the central government. Central governments usually define a service for which they guarantee to cover the costs incurred by local governments in delivering the service (Bird, 1999; Bahl, 2000; Bahl and Wallace, 2007).

Approaches to the determination of the amount of IFTs to eligible local units (horizontal dimension) are based on: i) the origin of the collection of the tax (derivation approach); ii) a formula based approach; iii) a total or partial reimbursement of costs; and iv) an ad hoc approach (Bahl, 1999; 2000). The derivation approach determines the size of transfers to local governments based on a share of a national tax, and each local government receives an amount based on the total tax collected within their geographic boundaries (Bahl, 1999; 2000). The formula approach applies objective and quantitative criteria to determine the IFT size among eligible local government units (Bahl, 1999; 2000). The cost-reimbursement approach distributes grants on the basis of reimbursement of costs of specified services (Bahl, 1999; 2000). There is a fine line between determining the IFT size using the formula approach and the cost-reimbursement approach (Bahl, 2000). Both approaches might use an exact equation for the distribution of the IFTs, however the cost-reimbursement approach stipulates the level of services to be provided by the local governments. Finally, the ad hoc approach determines the size of the transfer to the local unit on the basis of the decision-makers' judgment, usually without specific criteria or formulae (Bahl, 1999; 2000).

A taxonomy of IFTs that considers both the distributable pool (grant size) and the distribution formula has been developed (Bahl and Linn, 1992; Bahl, 1999; 2000) (Table 1). Type A IFTs use a shared tax approach (derivation approach), where subnational governments are allowed to keep a share of the taxes or fees collected within their administrative boundaries (Bahl, 1999; 2000; Bird 1999). The objective of this scheme is to ensure the stability of revenue sources for local governments as well as provide some degree of flexibility on how the funds can be spent at the local level (Bahl and Wallace, 2007; Bahl, 2000). Type B IFTs distribute a portion of the national tax among local governments on the basis of a formula. For instance, in Indonesia and the Philippines, 26 and 40 per cent of national revenue collections respectively are distributed to local governments based on population, land area and other indicators (Bahl, 2000; Kaiser et al., 2006; Fadliya and Mcleod, 2010). Type C IFTs distribute a share of the national tax to cover the costs of providing specific services at the local level, such as the costs of teachers' salaries (Bahl 1999; 2000). Type D IFTs are seldom mentioned in the literature where the grant is a share of national taxes that is distributed to eligible local governments on the basis of ad hoc decisions.

Types E, F, G IFTs distribute grants amongst local government units objectively with specific criteria, although the distributable pool is decided on the basis of ad hoc decisions and without any objective criteria. Type G IFTs involve a grant where central governments make all the decisions about who will receive the grant and how much is given to each recipient, without particular criteria. The drawbacks of the ad hoc approach include: i) lower transparency as it is subject to political manipulation; ii) leading to uncertainty and affecting fiscal planning and effective budgeting; and iii) no clear link between revenue sources and expenditure responsibilities (Bird, 1999; Bahl, 1999; 2000). On the other hand, this approach provides maximum flexibility for the central government to decide the size of the transfers distributed to local governments each year, particularly during times of budget constraint (Bahl, 1999). The ad hoc approach is usually acceptable for the allocation of funds to regions facing special needs, such as during emergencies or natural disasters (Bird, 1999; Bahl and Wallace, 2007; Bahl, 2000).

Table 1. Types of intergovernmental fiscal transfers

Method of allocating divisible pool among eligible unit (horizontal dimension)	Method of determining the total distributable pool (grant size)		
	Specified share of national or state government tax	Ad hoc decision	Reimbursement of approved expenditures
Origin of collection of tax	A	N.A	N.A
Formula	B	E	N.A.
Cost reimbursement approach	C	F	H
Ad hoc	D	G	N.A.

N.A. Not Applicable

Source: Bahl, 1999; 2000.

The cost-reimbursement approach (Type H) establishes the size of the transfer based on a proportion of specific local expenditures to be reimbursed by the central government (Bahl, 2000). The central government defines a public service for which it will guarantee to cover expenditures incurred by local government in delivering it (Bird, 1999; Bahl and Wallace, 2007; Bahl, 2000). This approach is normally used to: i) correct spatial externalities associated with public service provision at the local level; ii) provide direct investment to high priority national needs, otherwise some local governments would underspend on services with regional and national benefits; and iii) ensure uniform service provision standards across the country. However, this approach may compromise local choice and can hold back fiscal decentralisation. It also involves higher implementation costs because the central government must monitor the compliance of local governments with national standards (Bahl, 2000).

2.2. International experience with the distribution formula for biodiversity conservation

In the case of biodiversity conservation, type B IFTs are commonly used to distribute public resources to support conservation at the local level. In Brazil, a portion of the ICMS tax,1 which represents the largest source of state revenues, is distributed back to local governments on the basis of ecological indicators (May et al., 2002; Grieg-Gran 2000; Ring, 2008c). The grant size of the ICMS tax is the total Value-Added Tax (VAT) collected in each state, where 75 per cent of this state-level VAT is redistributed using the derivation approach, while the remaining 25 per cent is distributed on the formula approach using several indicators, including land area, population, and ecological indicators (May et al., 2002; Grieg-Gran 2000; Ring, 2008c). In Portugal, the grant size is based on a certain percentage of the General Municipal Fund, which amounts to 50 per cent of the Financial Equilibrium Fund (Santos et al., 2012). The grant size is then divided on the basis of a formula approach, using indicators such as land area (weighted by elevation levels) and protected areas, which varies on the basis of the percentage in a municipality (Santos et al., 2012) (Table 2).

Studies advocating the use of IFTs for biodiversity conservation have mostly focused on the horizontal dimension that determines the IFT size for each eligible local government area. The formula approach is commonly suggested to derive the amount of the funds to be distributed to eligible localities (Köllner et al., 2002; Kumar and Managi, 2009; Ring, 2008b). Different indicators are used to determine the IFT size allocated for each eligible locality (Table 2). The indicators are used as proxies for the local governments' opportunity and management costs of biodiversity conservation. Hence, one could argue that the formula

[1] ICMS – Imposto sobre Circulação de Mercadorias e Serviços.

approach, used to determine the IFT size for conservation, is rather similar to the cost-reimbursement approach. As previously mentioned, both the formula and the cost-reimbursement approaches are similar. The main difference is that the cost-reimbursement approach stipulates the specific services to be provided by the local governments (Bahl, 1999; 2000).

This paper will explore both the cost-reimbursement and the derivation approaches to determine the IFT size to distribute REDD+ revenues. As REDD+ would result in financial flows from the international to local levels, the scheme could therefore be perceived as being similar to other productive land-use activities that generate payments for the government from taxes and fees. In other productive land-use activities, such as logging and timber plantation, taxes and fees generated are usually distributed back to subnational government using the derivation approach. The implication of using the derivation approach to determine the IFT size for REDD+ revenues is examined, together with the cost-reimbursement approach that is commonly used in the determination of the IFT size for conservation.

Table 2. International experience with IFTs for biodiversity conservation

Country (introduction of scheme)	Model	Conservation indicator
Brazil (since 1992) Source: Grieg-Gran (2000); May et al. (2002); Ring (2008c)	ICMS Ecológico (state level): Size grant: a certain percentage of state value-added tax revenues Distribution formula: formula-based – lump sum transfers from state to local governments based on ecological indicators	Conservation units: - based on designated protected areas in relation to municipal area - weighted by management category of protected area accounting for relative land-use restrictions
Portugal (since 2007) Source: Santos et al. (2012)	Local financing law: Size grant: a certain percentage of the General Municipal Fund (FGM), being equal to 50% of the Financial Equilibrium Fund (the latter is made up of 25.3% of the average revenues from personal income tax, corporate profit tax and value-added tax) Distribution formula: formula-based – lump sum transfers from national to local governments based on ecological indicators	- Natura 2000 and other protected areas - in municipalities with: i) less than 70% of protected areas (PAs) in relation to municipal area, 5% of FGM is allocated for PAs; ii) more than 70% of PAs, 10% of FGM is distributed for PAs.
Switzerland (proposed) Source: Köllner et al. (2002)	Size grant: previous compensation sum for structurally weak cantons and a part of the petroleum tax Distribution formula: formula-based – integrating biodiversity indicators to the existing fiscal transfer	Biodiversity index: - based on the cantonal plant species diversity - weighted by the degree of biodiversity integration from low to high scenario
Germany (proposed) Source: Ring (2008b)	Size grant: depending on model selected Distribution formula: formula-based - integrating conservation units into general lump sum transfers (considering local fiscal need and capacity) - distributing a specified amount through unconditional special transfers based on conservation units	Conservation units: - based on designated protected areas in relation to municipal area - weighted by management category of protected area accounting for relative land-use restrictions
India (proposed) Source: Kumar and Managi (2009)	Size grant: (assumed at) 1,000 billion rupees Distribution formula: formula based – integrating environmental services in the fiscal transfers that reflect conservation efforts and stock of natural resources	- Forest cover - Geographical area

3. Determining reference emission levels (RELs) and IFT distribution formulae: Methodological approaches and application to the case studies

3.1 Historical deforestation in Riau and Papua

In Indonesia, Forestry Law 41/1999 grants the national Ministry of Forestry the authority to manage 120 million hectares of state forest land. According to the Law, forested lands are classified into production, protection, and conservation forests. The main function of production forests is to produce forest commodities, mainly timber. Some production forests are also classified as conversion forests, which can be legally converted to other non-forest land-use activities. The Law further stipulates that exploitation activities cannot take place in protected and conservation forests, which are intended to provide environmental services and to conserve biodiversity.

Riau province has the highest rate of deforestation in Indonesia. Timber and oil palm plantations are a major cause of deforestation. The total area classified as state forestlands in Riau comprises 8.6 million hectares. Approximately 89 per cent of the total area is classified as production forest, where 50 per cent can be converted to other land-use activities and the remaining 39 per cent is classified as permanent production forest. Both commercial logging and timber plantations can operate in permanent production forests. However, as commercial logging is no longer feasible in Riau, the expansion of timber plantations replaces the logged-over production forests. The issue of licences for timber plantations in Riau was approximately 106,625 hectares/year between 2001 and 2008, although the actual conversion of forests to acacia plantations was reported at 37,943 hectares/year between 1982 and 2007 (Ministry of Forestry, 2008a).[2] Forests that are currently not under concession are mostly secondary forests

[2] This rate is obtained based on the total area designated for timber plantations between 2000 and 2008, totalling 746,563 hectares (The Ministry of Forestry, 2008c).

with no potential for commercial logging, and can be converted to timber plantations. The total production forest area, with and without active licences, that could be further converted to timber plantations amounts to 1,517,306 hectares (Ministry of Forestry, 2008a). Assuming the continuation of the current annual land-use change, all the remaining production forests would be converted to timber plantations over the next 40 years (Table 3).

Another major cause of deforestation is the expansion of oil palm plantations, which can take place in conversion forests. The total forest loss, due to oil palm plantations, was estimated at 1,113,090 hectares (around 44,000 hectares/year) between 1982 and 2007 (Uryu et al., 2008). In Riau, the remaining area of conversion forests with tree cover was estimated at 620,100 hectares (The Ministry of Forestry, 2008) (Table 3). Should the existing annual land-use change for oil palm plantations persist, Riau is expected to lose all the remaining forest cover in areas designated as conversion forests during the next 14 years.

Table 3. Remaining production and conversion forest area in Riau

Forest Classification	Total area (ha)	Area with Tree cover (ha)*	Activities permitted by law Annual Deforestation (ha/yr)
Production forests without active concessions	712,614	712,614	Timber plantations - Actual forest cover change to timber plantations was 37,943 ha/year between 1982 and 2007 (Uryu et al., 2008)
Production forests under commercial logging concessions	1,207,003	804,692	- Timber plantation licences issued were106,625 ha/year (The Ministry of Forestry, 2008a)
Conversion forests	4,107,500	620,100	Oil palm plantations - Forest cover change to oil palm plantations was 44,000 ha/year between 1982 and 2007 (Uryu et al., 2008)
Total	6,027,117	2,137,406	

*** Source:** Ministry of Forestry, 2008c.

In contrast to Riau province, Papua is home to the largest area of remaining tropical forests in Indonesia, with currently the lowest rate of deforestation in the country. In Papua, around 31 million hectares are designated as forest zone, of which 10 million hectares are classified as production forests and an additional 6 million hectares as conversion forests. Moreover, approximately 14 million hectares are protected as conservation and protection forests. The main productive activity taking place in Papua's forests is commercial logging. If the current trend continues in Papua province, all the remaining production forests currently without active concessions would be allocated to logging concessionaires over the next 30 years (Table 4). Commercial logging usually results in severe forest degradation. The areas degraded and deforested within the commercial logging concessions between 2000 and 2005 were reported at 709,968 hectares and 71,666 hectares respectively (Andrianto et al., 2008). At the existing annual rate of degradation (65,231 hectares/year), 1.96 million hectares of forests currently under logging concessions would be degraded over the next 30 years. Furthermore, between 1992 and 2008, the issue of licences to convert forests to oil palm plantations in Papua reached 318,550 hectares, or around 19,909 hectares annually (Ministry of Forestry, 2008c). Land-use change from forests to crop plantations in Papua and West Papua was reported at 7,510 hectares and 25,201 hectares between 2000 and 2005 and 2005 and 2008 respectively (Tropenbos International, 2010). With the current annual rate of expansion of oil palm plantations, which is 2,520 hectares in Papua province alone, deforestation would amount to 75,000 hectares over the next 30 years.

Table 4. Remaining production and conversion forest areas in Papua

	Total area (ha)	Area with tree cover (ha)*	Activities permitted by law Annual Deforestation/Degradation (ha/yr)
Production forests without active concessions	3,845,902	3,845,902	Commercial logging - logging licences issued between 1988 and 2008 in Papua were 300,000 ha/year.
Production forests under commercial logging concessions	6,173,980	4,386,857	Total degradation in logging concessions between 2000 and 2005: - 709,968 ha in both Papua and West Papua provinces (Ardianto et al., 2008) or 404,687 ha in Papua province alone, which equals 80,935 ha/year - 572,208 ha in both Papua and West Papua provinces (Tropenbos International, 2010) or 326,158 ha in Papua alone, which equals 65,231 ha/year
Conversion forests	6,568,816	4,795,236	Crop plantations - Plantation licences issued between 1992 and 2008 cover 318,550 ha in Papua province alone or around 19,909 ha/year - Forest cover change to crop plantations in both Papua and West Papua provinces was 7,510 ha between 2000 and 2005 as well as 25,201 ha between 2005 and 2008 (Tropenbos International, 2010). Annual expansion of oil palm plantations is around 12,601 ha/year
Total	16,588,698	13,027,995	

* Source: Ministry of Forestry, 2008c.

3.2 Comparing different approaches to determine reference emission levels (RELs)

RELs for Riau and Papua may be developed using the different approaches being proposed in the literature at the global level, including: i) average emissions from deforestation over a recent historical reference period (Santilli et al., 2005); ii) a combined incentives mechanism, which combines higher reference emission levels for countries with historically low deforestation rates and lower reference emission levels for countries with historically high deforestation rates (Strassburg et al., 2009); and iii) the annualised fraction of the volume of terrestrial carbon stocks estimated to be at risk of emission in the long run, based on biophysical, economic and legal considerations (Ashton et al., 2008).

When determining a REL for a locality it is important to consider the remaining carbon stocks in standing forests and alternative land-use activities. A locality with a historically high deforestation rate, such as Riau, normally only has a small amount of carbon stocks stored in the remaining standing forests. Thus, even if the historical deforestation rate persists, the trend of carbon emissions from deforestation and forest degradation is declining due to diminishing carbon stocks in standing forests. The approach to determine RELs proposed by Ashton et al. (2008) considers the remaining forest areas that are currently at risk. However, this approach ignores the existing practice of deforestation and uses only time as the indicator to estimate the total area of forests that will be deforested. Furthermore, in the case of Indonesia, certain alternative land-use activities can only legally take place in a particular forest classification. We assume that forest classifications would not be changed unless the existing regulations were amended. Hence, estimation of the RELs needs to examine the historical deforestation rates caused by particular land-use activities and the remaining forests in forest classifications that could be converted to the land uses in question.

This paper examines another approach to establishing the REL by combining three important indicators: i) the historical deforestation rate at the local level; ii) the remaining carbon stocks in standing forests that can be legally converted; and iii) the alternative land-use activities that can legally take place in particular forest classifications. The following formulae formally describe the four approaches to calculating reference emission levels simulated in the paper:

1. Approach 1: historical reference emission levels (Santilli et al., 2005 cited in Busch et al., 2009)

   Bi = Hi

where, Bi = reference emission level (baseline) for locality i (tCO_2eq);

Hi = historical emission level (business as usual) for locality i (tCO_2eq);

2. Approach 2: reference emission level is weighted average of national and local historical rates (Strassburg et al., 2009 cited in Busch et al., 2009)

   Bi = [α × Di + (1 − α) × GAD] × CDi × 3.67

   Di = historical deforestation rate for locality i (ha/yr);

   α = weight placed on the national historical deforestation rate;

   GAD = national average deforestation rate (ha/yr);

   CDi = carbon density for locality i (tC/ha);

   3.67 is the atomic ratio of carbon dioxide to carbon;
3. Approach 3: the reference emission level is the annualised fraction of forest carbon at risk of emission (Ashton et al., 2008 cited in Busch et al., 2009)

   Bi = Ai/T

   Ai = forest carbon stocks at risk of deforestation over the long term in locality i (tCO_2eq);

   T = time over which forest carbon stocks is at risk (year);
4. Approach 4: reference emission level is based on a combination of the historical deforestation rate and the remaining carbon stocks in forests that can be legally converted to other land-use activities.

   Bi = (Fi × Gi)/Di

   Fi = areas that can be converted to other land-use activities in locality i (ha);

   Gi = carbon emissions released due to land-use change from forest to other land-use activities (or emission factors) (tCO2eq/ha);

   Di = historical deforestation rate for locality i (ha/yr).

Using the historical rate of deforestation (Approach 1) results in the highest estimate of carbon emissions (Table 5) since it does not consider the remaining forest areas that can actually be converted to other land-use activities. For instance, the annual deforestation from oil palm plantations in Riau is around 44,000 hectares. Should the existing rate persist, total deforestation over the next 30 years would amount to 1.32 million hectares. However, the remaining forests that can be legally converted to oil palm plantations in Riau amount to only 620,100 hectares. Thus, carbon emissions from deforestation and forest degradation could be expected to decrease due to the diminishing forest stocks. Approaches 3 and 4 consider the remaining forests that can be legally converted to other land-use activities. As previously mentioned, we assume that the present forest classifications stipulated by regulations would not be amended. Approach 2 assigns weights for both the historical deforestation rate and the carbon stocks in standing forests (Strassburg et al., 2009). The assumptions used in this study are similar to those of Busch et al. (2009), where the national average deforestation rate for Indonesia is 0.47 per cent, while the weights assigned to the historical deforestation rate and to the total carbon stocks in standing forests are 0.85 and 0.15 respectively. Assigning a weight to the total carbon stocks in standing forests within the administrative boundaries results in lower total carbon emissions compared with Approach 1.

Approach 3 assumes that the carbon stocks in forests at risk is emitted during the next 50 years (similar to the assumption made by Busch et al., 2009). Under this assumption, all forest areas that are currently classified as conversion forests in Papua (totalling 2.87 million hectares) will be converted to oil palm plantations over the next 30 years. In contrast, Approach 4 assumes that carbon stocks in standing forests at risk (or forests that can be legally converted to other land uses) will be deforested based on the historical rate. Using this approach, the total deforestation caused by oil palm plantations in Papua would only be 378,015 hectares over the next 30 years.

Table 5. Reference emission levels using four different approaches for Riau and Papua

Approach	Annual emissions (tCO2eq)	Emissions over 30 years (tCO2eq)
Papua		
1	247,324,581	7,419,737,416
2	210,425,660	6,312,769,804
3	165,565,144	4,966,954,314
4	113,390,197	3,401,705,907
Riau		
1	11,096,721	332,901,632
2	9,439,922	283,197,648
3	7,447,380	223,421,391
4	9,223,460	276,703,796

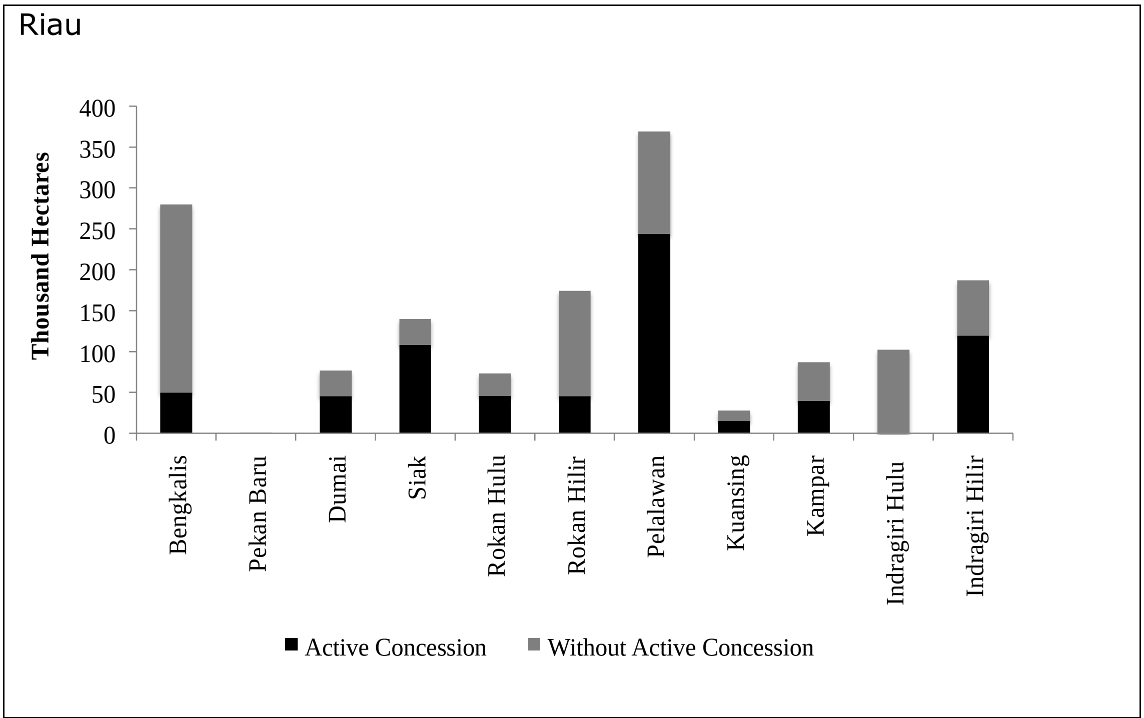
Applying different approaches results in varying estimates of RELs, which will eventually determine the assessment of performance achieved by each locality in reducing carbon emissions. Using the historical rate approach would result in an overestimate of the reduction in total emissions. Thus, we argue that the remaining forests that can be converted to other land-use activities should be considered in the estimation of REL. Although Approach 3 considers the remaining forests (forests at risk), it ignores the historical deforestation rate. In this paper, therefore we use Approach 4 to generate the REL on which we then make a simulation of the IFT size to distribute REDD+ revenues, which considers both the remaining forests (carbon stocks) within the administrative boundaries and the historical deforestation rate.

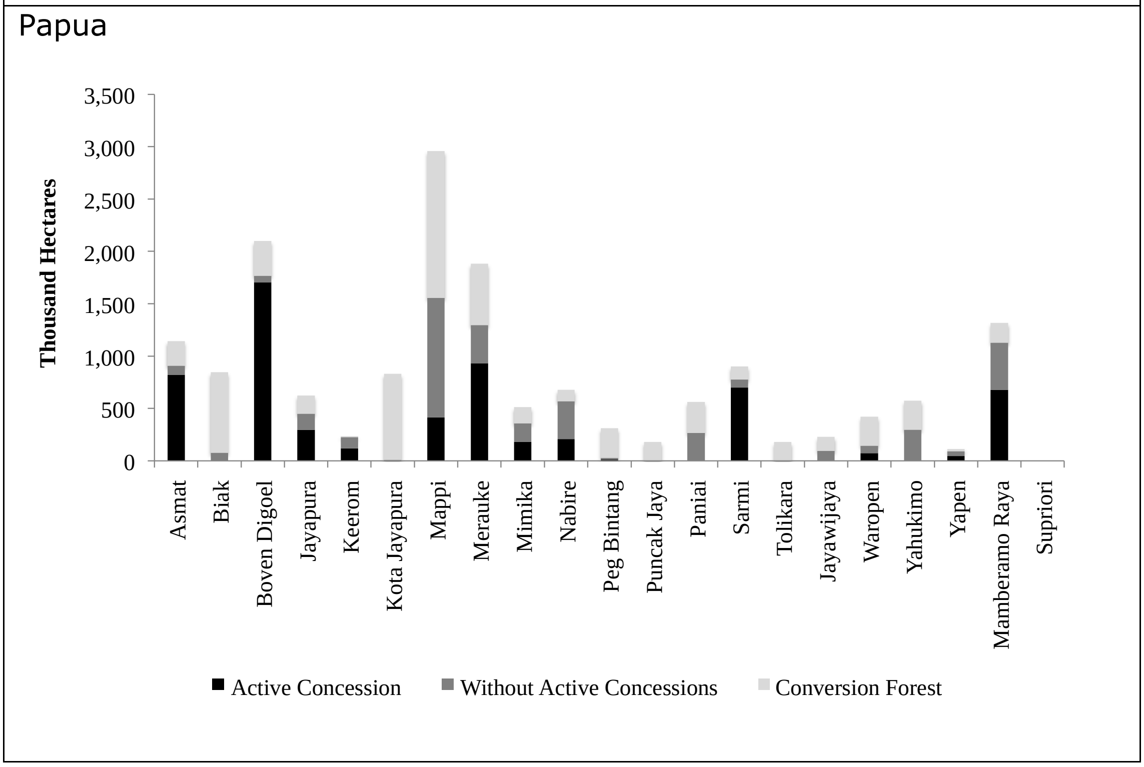
Following estimation of the REL, the IFT size allocated to Riau and Papua is simulated. It was assumed that all localities in Indonesia had reduced emissions by 50 per cent from the business-as-usual (BAU) level in the next 30 years. This figure is set in proportion to Indonesia’s commitment to reduce emissions by 26 per cent (without international support) or 41 per cent (with international financial support) from the BAU level by 2020 as stipulated in Presidential Decree 61/2011. In order to determine the RELs and total carbon emissions reduced at the district level, the average deforestation rate of all districts is assumed to be similar to that at the provincial level. Hence, the amount of carbon emissions released by each district will vary depending on the total production forests that can be legally converted to other land-use activities (Figure 1). Data on forests, classified as conversion forests, at the district level in Riau are currently unavailable. For this reason, the fiscal simulation analysis for districts in Riau focuses on production forests with and without active concessions.

3.3 Suggesting distribution formulae of IFTs for REDD+ in Indonesia

This paper assumes that the central government would obtain a portion of REDD+ payments through taxes and fees collected from REDD+ projects implemented by private companies. The involvement of the private sector in REDD+ should be encouraged in forest areas that are currently under active concessions. On the other hand, the benefits generated by REDD+ projects operating in forest areas without active concessions could be retained entirely by the state, since private companies do not need to be compensated. To determine the amount of REDD+ revenues to be distributed to local government levels, the derivation approach (Option 1) and the (opportunity) cost-reimbursement approach (Option 2) are simulated.

Figure 1. Status production forests in the districts of Riau and Papua 2008





Source: Ministry of Forestry, 2008a.

The derivation approach (Option 1) determines the total grant size and the IFT size for each district government based on a specified percentage of the total taxes or fees collected from REDD+ within a locality. The calculation of the grant size and the IFT size allocated to eligible district governments under Option 1 applies the following formula:

$$IFTD_i = \alpha_d \times P \times Q_i$$

$$GS\ IFT_D = \sum_{i=1}^{z} IFTD_i$$

where, $IFTD_i$ is the amount of IFT for District *i*;
α_d is the percentage of revenue distributed to the district level;
P is the price of carbon from REDD+ ($/$tCO_2$);
Q_i is the total carbon emission reduction in district *i* (tCO_2e);
$GS\ IFT_D$ is the grant size for the district level using the derivation approach.

To decide the percentage of revenues distributed to the district level (α_d), this study refers to Ministerial Decree 36/2009 on REDD+ Implementation (Table 6). Ministerial Decree 36/2009 sets the portions of REDD+ revenues allocated to different stakeholders, including companies, various governmental levels and local communities. The decree has been criticised by some stakeholders, as it does not appear to be based on a detailed quantitative assessment of the share to be allocated to each stakeholder group. This paper, however, uses the portions regulated by the Decree only to simulate the impact of distributing revenues between different stakeholders, using the proposed percentages. Ministerial Decree 36/2009 allocates the largest share of the revenues to companies, the second largest share to the local community and the remainder is shared between government levels, with the central government receiving a significantly smaller share of the total revenues than the private and public revenues arising from current land-use activities (Table 6).[3] The distribution stipulated in the Decree differs significantly from the existing allocation of revenues to different stakeholders from land-use alternatives to REDD+, which sees the central government receiving the largest share of revenues as reported in Irawan et al. (2011). The Decree, therefore, appears to provide incentives to the various stakeholders (except for the central government) to choose REDD+ activities compared with land-use alternatives, as long as the absolute value of the former is not lower than the latter. The non-producing districts are the only stakeholders who would not receive a share of REDD+ revenues.

Table 6. Revenue distribution between stakeholders (per cent)

Activity	Company	Total Government	National	Provincial	Producing District	Other District	Local community
Based on existing opportunity costs							
Commercial logging in primary forests	45.4	54.6	31.9	1.4	16.7	4.6	
Timber plantations in degraded forests	59.2	40.8	29.8	1.1	8.0	1.9	
Oil palm plantations in degraded forests	54.1	45.9	44.7	0.1	1.0	0.2	
Oil palm plantations in primary forests	55.3	44.8	39.9	0.4	3.8	0.7	
Based on the Ministerial Decree 36/2009							
REDD+ in production forests	60.0	20.0	8.0	4.0	8.0	0.0	20.0

Source: Ministerial Decree 36/2009.

Option 2 determines the IFT size to eligible units based on the cost-reimbursement approach (the costs of REDD+ at the local level). Ideally, the

[3] Local community probably refers to local stakeholder groups, however the Decree does not provide a clear definition.

cost-reimbursement approach should include the estimation of all costs of REDD+, including opportunity, management and transaction costs. However, this study focuses only on the opportunity costs due to the paucity of data related to REDD+ management and transaction costs. It draws on the analysis of REDD+ opportunity costs reported in Irawan et al. (2011), who derive the share of revenues accruing to the various stakeholders on the basis of ongoing land uses, the taxation framework, and revenue-sharing among the different government levels. The distribution formula for the cost-reimbursement approach is as follows:

$$IFTCR_i = (OC_{Doil} \cdot Qi_{oil}) + (OC_{Dtimber} \cdot Qi_{timber}) + (OC_{Dlogging} \cdot Qi_{logging})$$

where, $IFTCR_i$ is IFT for District *i* based on the cost-reimbursement approach;
OC_{Doil} is the opportunity cost accruing to the district level from palm oil ($/tCO_2e$);
$OC_{Dtimber}$ is the opportunity cost accruing to the district level from timber plantation ($/tCO_2e$);
$OC_{Dlogging}$ is the opportunity cost accruing to the district level from commercial logging ($/tCO_2e$);
Qi_{oil} is the total carbon emission reductions in District *i* from avoided oil palm plantations (tCO_2e);
Qi_{timber} is the total carbon emission reductions in District *i* from avoided timber plantations (tCO_2e);
$Qi_{logging}$ is the total carbon emission reductions in District *i* from avoided commercial logging (tCO_2e).

4. The results for grant sizes and the amount of IFTs

Using the cost-reimbursement approach, the size of grants allocated to provincial and district governments will be similar to the opportunity costs incurred to reduce deforestation and forest degradation. The distribution of REDD+ revenues therefore considers the cost curve of reducing emissions in each province and district, which varies depending on the condition of the forests and land-use alternatives. If all provinces had to reduce deforestation and forest degradation by 50 per cent below the BAU level, the total emission reductions would be 138 million tCO_2eq and 1,700 million tCO_2eq in Riau and Papua respectively. Reducing emissions in Riau would involve a cost of US$ 18.94/tCO_2eq for the first 154 million tCO_2eq (mainly from preventing the conversion of degraded forests to timber plantations). Reducing an additional 122 million tCO_2eq would cost US$ 56.34 per tCO_2eq, which arises from preventing the conversion of degraded forests to oil palm plantations (Figure 2). In Papua, reducing the first 2,998 million tCO_2eq would cost only US$ 0.56 per tCO_2eq (from preventing commercial logging in primary forests), whilst an additional reduction of 328 million tCO_2eq and 74 million tCO_2eq would cost US$ 12.9 per tCO_2eq (from preventing the conversion of degraded forests to timber plantations) and US$ 18.9 per tCO_2eq (from preventing the conversion of primary forests to oil palm plantations) respectively (Figure 3).

Figure 2. The cost curve of reducing emissions from deforestation and forest degradation in Riau

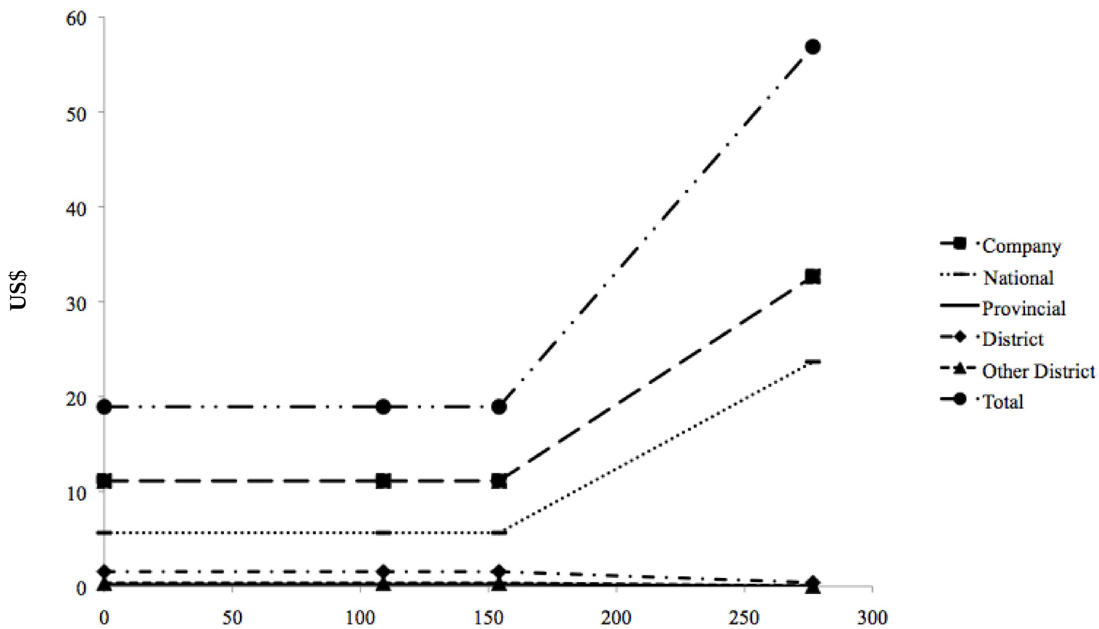
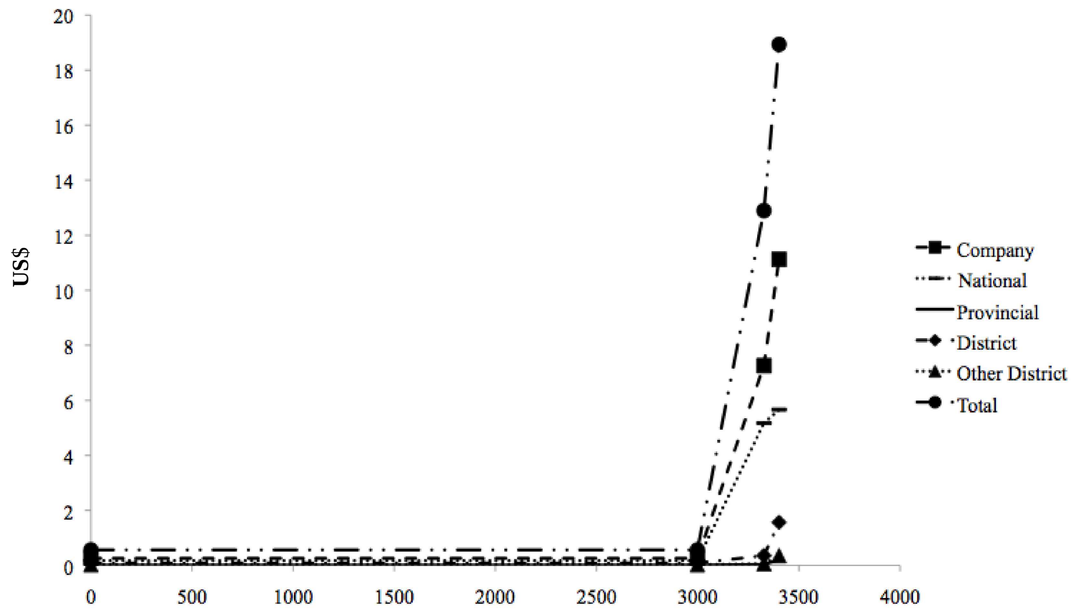


Figure 3. The cost curve of reducing emissions from deforestation and forest degradation in Papua



Using the derivation approach, the distribution of REDD+ revenues is based on the assumed price of carbon and the shares of revenues allocated to local levels. Hence, the derivation approach in the distribution of benefits from REDD+ would set a flat rate per ton of carbon emissions reduced and ignore the opportunity costs of local governments from alternative land-use activities. Using the existing carbon price in the European market (EUA), which is in the range of US$16–17,[4] the grant size for Papua would be significantly higher than the actual opportunity costs (Table 7). In contrast, the grant size for the district level in Riau, determined by the derivation approach, would be lower than that decided by the cost-reimbursement approach. Furthermore, the provincial level in Riau could obtain a higher transfer when determining the IFT size using the derivation approach than the cost-reimbursement approach, because the share of revenues

[4] http://www.pointcarbon.com, accessed on 5 June 2011.

allocated for the provincial level is significantly higher under Ministerial Decree 36/2009 when compared with the actual opportunity costs (Table 7).

Table 7. Grant size for each government level using Approach 4 to determine RELs (US $ million)

Options	National	Provincial	Producing District	Other District
Riau				
Cost reimbursement	784	30	217	50
Derivation Ministerial Decree 36/2009[1]	188	94	188	0
Papua				
Cost reimbursement	305	12	150	46
Derivation Ministerial Decree 36/2009[2]	2,313	1,157	2,313	0

Legend:

1. Additional US$ 470 million for local communities.
2. Additional US$ 5.8 billion for local communities.

If all districts in Papua were required to reduce emissions by 50 per cent from the BAU level, most districts could reduce their emissions at a cost of US$ 0.56 per tCO_2eq (from preventing commercial logging in primary forests). Some districts, such as Sarmi and Boven Digoel Districts, would have higher opportunity costs to reduce 50 per cent of the emissions from the BAU level, as they would also need to prevent the conversion of primary forests to oil palm plantations (or agricultural activities), which would cost US$ 12.89 per tCO_2eq. In Riau, the cost of reducing 50 per cent of the emissions from the BAU level is approximately US$ 18.96 per tCO_2eq (from preventing the conversion of degraded forests to timber plantations), except in a few districts such as Pekan Baru, Kuantan Singgingi and Dumai Districts. In these districts, reducing 50 per cent of the emissions from the BAU level would also require preventing the conversion of degraded forests to oil palm plantations, which would cost US$ 56.34 per tCO_2eq.

Using the cost-reimbursement approach, districts with logged-over forests, such as in Riau, would receive higher revenues compared with their counterparts with intact primary forests, such as in Papua. Avoiding further conversion of logged-over areas is associated with higher opportunity costs when compared with preventing the conversion of intact primary forests as discussed in Irawan et al. (2011). The conversion of logged-over forests is associated with higher opportunity costs because the alternative land-use activities in those areas are mainly timber plantations and oil palm plantations. These activities generate higher revenues compared with commercial logging that can only take place in primary forests. Additionally, the total carbon stocks retained in logged-over forests are much lower compared with the intact primary forests, which further increases the opportunity costs per unit carbon reduction (Palm et al., 1999).

Using the derivation approach, districts with more intact primary forests, which have not been exploited, would benefit more from REDD+ compared with their counterparts with more logged-over areas. Districts in Papua would receive approximately 10 times the actual opportunity costs (Figure 4), whilst districts in Riau would receive transfers lower than the opportunity costs (Figure 5). With the assumed price of carbon, Riau might not be interested in REDD+, particularly in forests currently under active concessions, although REDD+ may compete economically with other land-use activities in forest areas, currently without active concessions, as the government can retain all the benefits that may accrue from REDD+. In forests currently without active concessions, the portion of benefits for companies can be retained by the government entirely and distributed to different levels. For this reason, the government may want to conserve forests currently without active concessions and focus on maximising revenues from productive activities in forests with active concessions. A total of 712,614 hectares and 3.8 million hectares of forests are currently without active concessions in Riau and Papua respectively.

Figure 4. The amount of IFTs allocated to district governments in Riau (US$million)

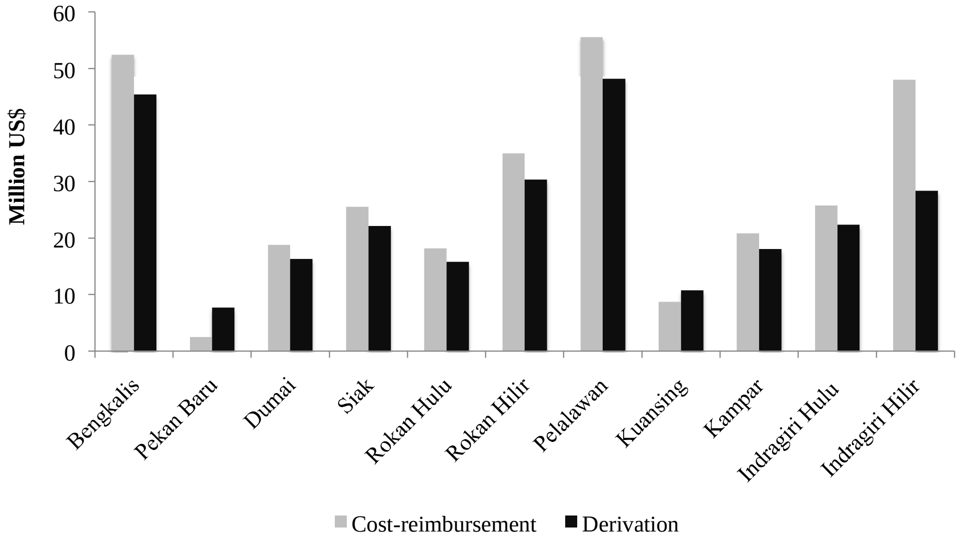
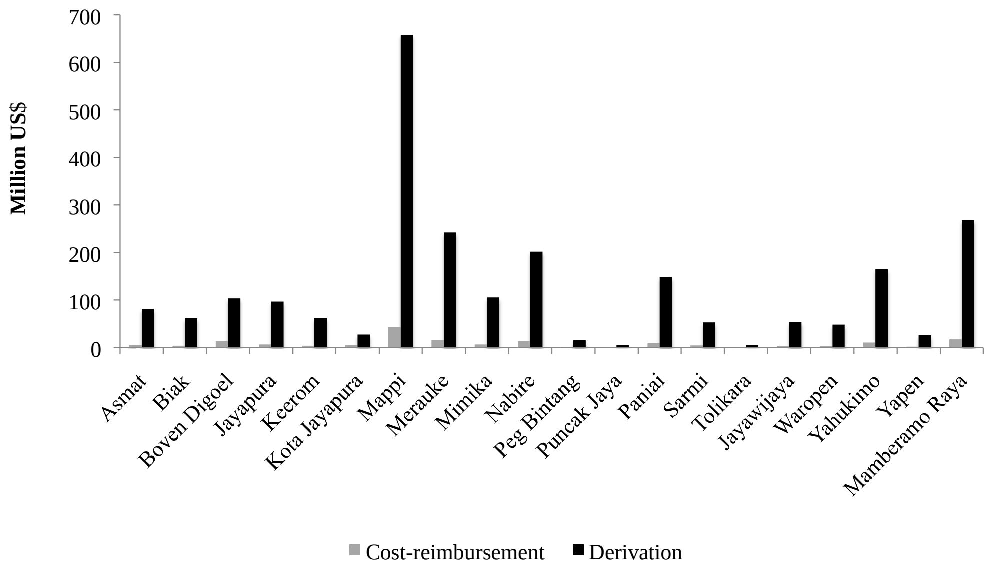


Figure 5. The amount of IFTs allocated to district governments in Papua (US$million)



Using both approaches, and assuming that REDD+ would not provide compensation for the existing protected and conservation forests, districts such as Boven Digoel, Mappi, Merauke, Sarmi, Mamberamo and Asmat Districts in Papua (Figure 4), would obtain higher transfers compared with their counterparts that do not have production forest areas, such as Pegunungan Bintang and Puncak Jaya Districts. Most districts with extensive conservation and protection forests in Papua are fiscally poor (i.e. Pegunungan Bintang and Puncak Jaya) due to their lower access to forests and limited alternative land-use activities. In Riau, there is no clear relationship between fiscal capacity and the area of conservation and protected forests. The main income source in Riau is oil, and the forestry and agricultural sectors do not play a significant role in the revenue composition (that is, fiscal capacity) of local governments. Districts that would obtain high revenues from REDD+ implementation in Riau are Bengkalis, Pelalawan and Indragiri Hilir (Figure 5). Bengkalis is one of the districts in Riau with high fiscal capacity, while Pelalawan has low fiscal capacity.

5. Discussion: the derivation vs the cost-reimbursement approach

In this paper, we demonstrate that it is possible to use both the derivation and the cost-reimbursement approaches to determine the IFT size to distribute REDD+ revenues. Using the cost-reimbursement approach, the IFT size allocated to district governments is just enough to cover the costs of reducing carbon emissions at the local level. The payment per ton of carbon for each district will vary depending on the alternative land-use activities and the carbon stocks retained in the forests. Local governments with low opportunity costs would receive a lower IFT size per ton of carbon compared with their counterparts with higher opportunity costs. The cost-reimbursement approach results in higher transfers to districts with more degraded forests than those with more primary forests.

Determining the IFT size using the cost-reimbursement approach would avoid an excessive producer surplus allocated to districts with low opportunity costs. The producer surplus is the area above the cost curve and below the price line (Hanley and Spash, 1993). At the international level, Cattaneo (2008), for instance, suggests that the producer surplus could be used to compensate for carbon stocks in standing forests to reduce leakage (Cattaneo, 2008). Leakage, which occurs when the pressure of deforestation shifts from one location to others within a country, can result in no significant emission reductions from deforestation in the country overall. Providing incentives for all standing forests in a country could be expected to reduce leakage (Cattaneo, 2008). At the local level, a producer surplus can also be allocated to offset more emissions from deforestation and forest degradation in other localities with higher opportunity costs. However, localities with low opportunity costs would rather keep the producer surplus (as net profits), rather than allow the national government to keep it for offsetting more carbon (or the opportunity costs) in other locations.

When deciding on the land-use allocation of a unit of land within their administrative boundaries, local governments would prefer to generate the highest return (profit) from the land, and would be less concerned about the total reductions of emissions achieved in the country [as a whole?].

The derivation approach to determine the size of IFTs for local governments sets a flat rate per unit of avoided carbon emission, irrespective of the costs of REDD+ borne by local stakeholders. The size of IFTs is decided entirely by the defined percentage of revenues to be distributed to local levels and the price of carbon credits in the market. When the price of carbon is low, REDD+ can only attract the participation of low-cost districts, while a high carbon price would generate a producer surplus for low-cost producing districts. Hence, using the derivation approach, local governments should be allowed to decide voluntarily their participation in REDD+ based on the assessment of cost–benefit of REDD+. Voluntary participation would allow the government to allocate lands for land-use activities that generate the highest return, either for productive activities or conservation (REDD+), to maximise society's welfare as a whole.

Using the derivation approach, the grant size of IFTs allocated to the local levels is decided on the basis of a fixed percentage. In the case of Indonesia, Ministerial Decree 36/2009, for instance, stipulates that the district level obtains as much as 8 per cent of the total revenues generated from REDD+. In contrast, according to the results of the opportunity cost analysis reported in Irawan et al. (2011), the revenue distribution from oil palm plantations is currently centralised, with district governments obtaining a meagre portion of the total revenues captured by the government. Given the existing fiscal decentralisation in Indonesia, it is thus important to question whether distributing the revenues based on the existing incentive structure is sufficient to shift the interest of local governments in favour of conservation. Increasing the portion of revenues allocated for local governments would provide more incentives for local stakeholders to pursue REDD+. However, it would also compromise the total revenues retained by the national government. Therefore, if the national government is committed, then a larger portion needs to be assigned to local stakeholders at the expense of the national government's portion of revenues.

6. Conclusion

Building on the case of Indonesia with two contrasting provinces in terms of deforestation history and trends, this paper has advocated the importance of assigning sufficient financial resources to support conservation, and particularly REDD+, to local governments in decentralised countries. Intergovernmental fiscal transfers (IFTs) can be used as a means to distribute REDD+ revenues from the national level to local governments. In order to determine the IFT size to distribute REDD+ revenues, both the cost-reimbursement and the derivation approaches can be used. Using the cost-reimbursement approach, the IFTs distributed to local governments for pursuing REDD+ are determined entirely on the basis of the opportunity costs, which vary depending on land-use alternatives and the condition of the forests within a locality. There will therefore be an equity issue associated with this approach, as districts that have degraded their forest would receive higher revenues using this approach than those that have not pursued deforestation and forest degradation. Using the cost-reimbursement approach would also require an estimation of the costs of REDD+ for all localities, which may involve high transaction costs. In contrast, the distribution of REDD+ revenues amongst eligible district governments using the derivation approach ignores the opportunity costs of local governments from alternative land uses and focuses only on the market price of carbon credits and the share of revenues allocated to local levels. Localities with opportunity costs higher than the price of carbon credits should be allowed to refuse their participation in REDD+, while localities with low opportunity costs would be allowed to keep the producer surplus from reducing deforestation and forest degradation. Voluntary participation of local governments is therefore a prerequisite for this approach to succeed. Furthermore, using the derivation approach does not require an estimation of REDD+ costs for all districts, which will reduce the transaction costs of the implementation of REDD+.

Designing IFTs for channelling REDD+ revenues to local governments requires ecological indicators that differ from those that are usually used to determine the IFT size for biodiversity conservation discussed in the literature. Indicators that are commonly used to determine the size of IFTs for biodiversity conservation include the surface of protected areas, biodiversity indices and the total forest cover and geographical areas (e.g., Grieg-Gran, 2000; May et al., 2002; Köllner et al., 2002; Kumar and Managi, 2009; Ring 2008b; Santos et al., 2012).

REDD+ focuses on the additional forest conservation to avoid carbon emissions from deforestation and forest degradation and the enhancement of carbon stocks in forests. The distribution of REDD+ revenues should therefore consider indicators such as the historical deforestation rate, forestlands that can be legally converted to other land-use activities (the remaining carbon stocks in forests), and the alternative land-use activities.

Existing protected areas may not be eligible for compensation under REDD+ as compensation is only justifiable when a REDD+ measure can be shown to be contributing to an additional reduction of emissions and enhancement of carbon stocks. However, if there is no compensation for existing conservation forests, there will be an inequality implication for districts sustaining protected areas.

With limited forest resources that could be legally exploited, those districts are often poorer than their counterparts with abundant production forests. If all the easily accessible forests are closed to exploitation, deforestation pressure could be shifted to protected and conservation forests. Financial allocation to support forest conservation would therefore be required. As a result, the distribution of REDD+ revenues should consider existing protected forests.

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