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Can land taxes foster sustainable development? An assessment of fiscal, distributional and implementation issues

Matthias Kalkuhl[a,b,*], Blanca Fernandez Milan[a], Gregor Schwerhoff[a], Michael Jakob[a], Maren Hahnen[a], Felix Creutzig[a,c]

[a] Mercator Research Institute on Global Commons and Climate Change (MCC) Berlin, Torgauer Str. 12-15, 10829 Berlin, Germany
[b] University of Potsdam, Faculty of Economics and Social Sciences, Potsdam, Germany
[c] Technische Universität Berlin, Sustainability Economics of Human Settlements, Germany

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ABSTRACT

Economists argue that land rent taxation is an ideal form of taxation as it causes no deadweight losses. Nevertheless, pure land rent taxation is rarely applied. This paper revisits the case of land taxation for developing countries. We first provide an up-to-date review on land taxation in development countries, including feasibility and implementation challenges. We then simulate land tax reforms for Rwanda, Peru, Nicaragua and Indonesia, based on household surveys. We find that (i) land taxes provide a substantial untapped potential for tax revenues at minimal deadweight losses; that (ii) linear land value taxes tend to put a high relative burden on poor households as land ownership is pervasive; (iii) non-linear tax schemes could avoid adverse effects on the poor; and that (iv) with technological advances, administrative costs of land taxes have reduced substantially and are outweighed by tax revenues and co-benefits of formalized land tenure. Enforcement and compliance remain, however, a key challenge.

1. Introduction

Economic theory provides a strong case for land rent taxation to improve economic efficiency of fiscal systems especially for developing countries with highly distortionary tax systems (Lee and Gordon, 2005). Developing countries tend to have a low tax-to-GDP ratio in spite of social and development objectives that would require increased investments (Schlegelmilch et al., 2010). Due to their small distorting impact on the economy, land taxes could be a central policy to increase domestic resource mobilization, which is one of the main goals of the Addis Ababa Action Agenda (United Nations, 2015). In the past, excessive administrative costs were seen as the main explanation for the "weak link between the theoretical and practical aspects of land taxation" (Skinner, 1991a, 1991b). Administrative costs, however, no longer seem to be a fatal obstacle for land rent taxation. International organizations and developing countries have developed fit-for-purpose land administration (Enemark et al., 2014) and land administration reforms have been implemented in Rwanda (Sagashya, 2012), Ethiopia (Deininger et al., 2008) and other countries. In addition, computer assisted mass appraisal (CAMA) is lowering costs of valuation while yielding very accurate results (Barańska, 2013; McCluskey et al., 2013a,b).

There are very few assessments of the benefits and challenges of land taxation (Norregaard, 2013). Skinner (1991a, 1991b) and Khan (2001) study some countries which have previously introduced land taxes. Emphasizing the efficiency of land taxes, they study the obstacles to overcome and identify "administrative costs" and "political and administrative considerations" as the major obstacles. Bird and Slack (2004) provide a detailed compendium of knowledge on land and property taxes, including case studies from all over the world. Most recently, Henry et al. (2009) and Mirrlees and Adam (2011) considered land taxes in assessments of tax policy. Their respective chapters on land taxation come to a favorable conclusion on their usefulness and consider the implementation challenges as manageable. In this paper, we update the analysis of practical obstacles of land taxation to recent technological progress and improvements in governance. The main additional step we take is to use survey data to estimate the revenue potential in four developing countries and, most importantly, the distributional effects of land taxation. Using newly available data we thus move out of the narrow space of previous experiences and analyze potential benefits and future use of land taxes.

We focus in our quantitative analysis on the introduction of a new

* Corresponding author at: Mercator Research Institute on Global Commons and Climate Change (MCC) Berlin, Torgauer Str. 12-15, 10829 Berlin, Germany.
E-mail addresses: kalkuhl@mcc-berlin.net (M. Kalkuhl), bfmilan@gmail.com (B. Fernandez Milan), schwerhoff@mcc-berlin.net (G. Schwerhoff), jakob@mcc-berlin.net (M. Jakob), maren.hahnen@posteo.de (M. Hahnen), creutzig@mcc-berlin.net (F. Creutzig).

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land value tax and do not consider general equilibrium effects of a reduction in other taxes or increased government spending. The analysis can thus be considered a first order approximation. Our results demonstrate that in the case study countries land rent taxation has the potential to contribute a substantial share to the public budget. Even though administrative costs might be in some cases slightly higher than for other taxes, they are unlikely to be prohibitive. We also find that linear land taxes could put a relatively larger burden on poor than on wealthier households, as de-facto land ownership is common among all income groups. We show how this can be avoided under a non-linear scheme that allows for a tax-free amount of land ownership.

The paper is structured as follows: We provide a brief overview on past implementations of land tax in Section 2. Based on the literature review and conceptual analysis in Section 3, we develop in Section 4 a country typology using easily accessible proxy indicators for various benefit and cost dimensions. Constructing Pareto frontiers, the typology aims to identify countries with preferential benefit-cost ratios, i.e. where implementing or extending land rent taxation can be expected to be particularly promising. The typology also provides a transparent way for selecting case-study countries that are analyzed in more detail in Section 5. We assess the magnitude and the distribution of agricultural and urban land rents among household and conduct a micro-simulation of various land tax schemes. We further elaborate on the status quo on land taxes and potential reform options. We conclude by summarizing the major insights from the article and outlining major design options and policy recommendations for land tax reforms in developing countries.

2. Experience with land taxes

More than 30 countries, including developing countries, use or have used some sort of land tax (Bird and Slack, 2004; Dye and England, 2010; McCluskey and Franzsen, 2005; Milan et al., 2016). Land taxes vary with tax base, the appraisal, and to whom it may apply. For example, land taxes may apply to all land uses, or only to developed land, with varying permissions granted (Fig. 1).

Land taxes proliferated in places where a system of registration of title or deeds was already in place (i.e. Fiji, Kenya, and South Africa), and where there is no major issue regarding tenure insecurity and boundary disputes (McCluskey and Franzsen, 2005). Local governments in South Africa have relied upon taxation of urban land values as a significant revenue source for almost a century until early the 2000s, when a law eliminated the local option of a split-rate tax in favor of a single-rate property tax (Andelson, 2001).

Agricultural land is typically assessed using an area-based approach (Khan, 2001). When the tax applies to all land uses, including developed land, market or cadastral values are more common. Governments tend to implement relief mechanisms for farmers. They use deferrals of non-agriculture related values (New Zealand), differential and preferential rates (Australia and South Africa respectively), limiting taxable values to current use (Australia), rebates (Jamaica), or simply exclude rural land (Kenya and Fiji). In places where development is coupled with rapid urbanization, governments tend to shift towards property taxes to avoid land value appraisal processes (Jamaica, Kenya). In Fiji, however, local authorities have focused on enhancing the assessment process instead of changing the tax base (McCluskey and Franzsen, 2005).

There is a trend towards implementing differential taxation according to land values and land uses (South Africa, Fiji, Kenya, among others), penalizing unimproved land in particular to curb land speculation (i.e. Hungary, Tunisia). Tax rates in middle and high income countries are typically adjusted annually to avoid the gradual erosion of the tax base (as has happened in the case of Jamaica) (McCluskey and Franzsen, 2005). Classified assessment systems are another common and cost-effective way of differentiating among property classes (i.e. the Philippines). Under this system, a uniform tax rate is applied and properties are differentiated through assessment value ratios (the percentage of assessed value that is accepted as tax base) (Bird and Slack, 2004; Milan et al., 2016).

Land as well as property taxes are often important sources of local revenue, and thus have historically been locally governed (with a few exceptions like Ethiopia, Jamaica and Chile, where national governments regulate and administrate the tax). Their contribution to local revenues is highest in high-income countries, followed by Latin America, and some African countries, and lowest in Asian countries (Bird and Slack, 2004). Revenues are typically reported together with

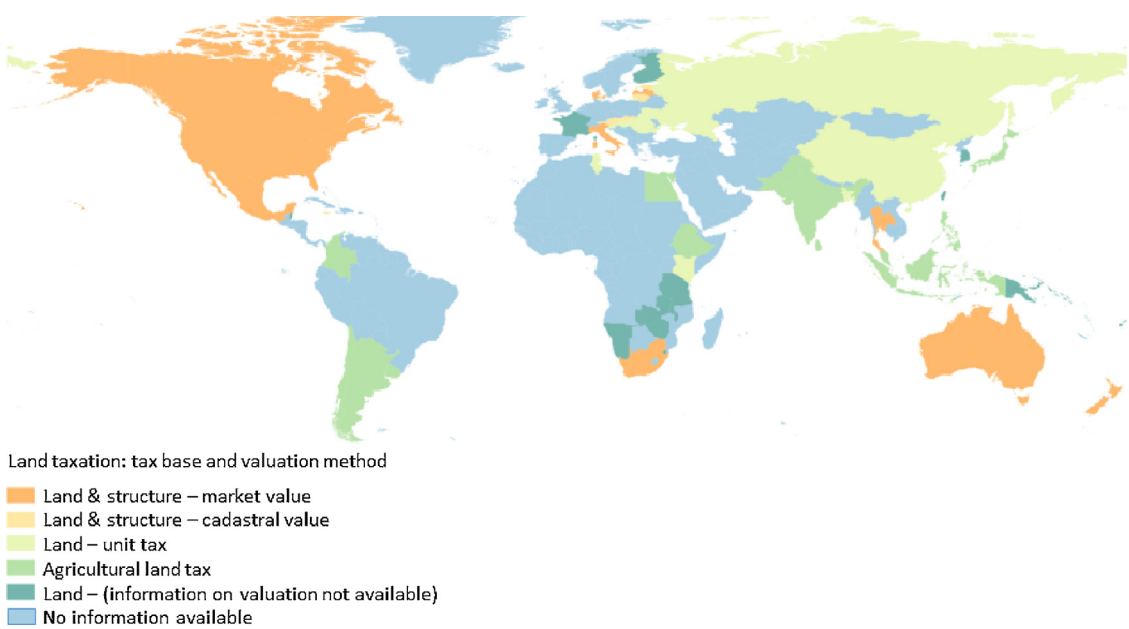

Fig. 1. Land taxation experience.
Note: based on Bird and Slack (2004); Dye and England (2010); Khan (2001); McCluskey and Franzsen (2005) and Milan et al. (2016). Countries may have only a land-based tax ("Land") or a combined land & structure tax ("property tax"). For some countries, information on the land valuation method or type of tax base was not available; for coutnries in blus, no information on existence of land-based taxes was available. For detailed country-based information see the Online Appendix).

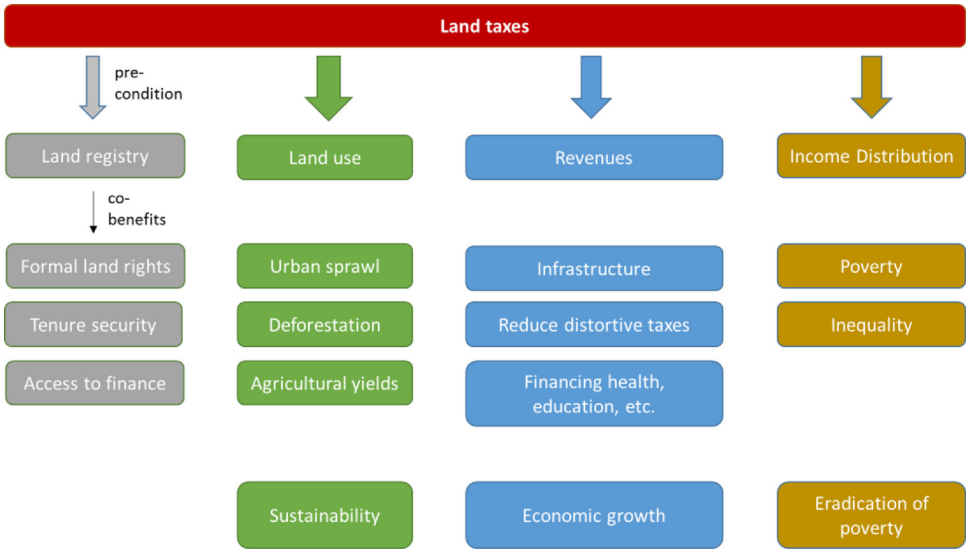

Fig. 2. Land taxes and sustainable development – synthesis. Source. Own elaboration based on previous subsections.

other local taxes in place (Bird and Slack, 2004). In Europe, revenue raised exclusively from land taxes is highest in Denmark, Slovenia and Estonia with around 1 percent of GDP and 2.5 percent of total tax revenues (Milan et al., 2016). Overall, the experience with land taxes is very broad (see Fig. 1) and interaction effects have to be discussed at the national level.

3. General assessment of land taxes

In the following, we elaborate on various aspects of land taxes with respect to efficiency, environment, distribution, administrative costs, compliance and feasibility. The main findings on aspects related to development objectives are summarized in Fig. 2. While the case for efficient revenue raising is strong and supported by the literature, weaker evidence exists on the potential to change land use dynamics. Existing model calculations by equilibrium models on land tax shifts confirm that land taxation increases efficiency (decreases marginal costs of public funds – MCF); models with endogenous land supply also indicate land-sparing effects while distributional effects are often very heterogeneous (see the Online Appendix for details).

The ultimate impact of land tax reform depends strongly on how income from land taxes is used. Reducing taxes with high MCFs will increase economic growth; reducing taxes with adverse environmental or food production effects, such as agricultural taxes, affects land-use dynamics and food security (see Malan (2015) for Africa). Spending land tax revenues on infrastructure, health or social security could create social returns and facilitate the achievements of the SDGs. Infrastructure access, in turn, can contribute to more productive land-use (Craig et al., 1997; Headey et al., 2010; Pinstrup-Andersen and Shimokawa, 2006), e.g. by improving agricultural yields, but it can also foster environmental destruction, e.g. as shown by deforestation spatially entangled with road infrastructure in the Brazil Amazon (Pfaff, 1999).

3.1. Economic efficiency

A land value tax of less than 100 percent is non-distorting in the sense of not reducing the tax base (Oates and Schwab, 2009). While this observation has already a long tradition in economic thinking (George, 1879; Ricardo, 1817; Smith, 1776), various economists have advocated land taxes recently (see, e.g. Mirrlees and Adam (2011) for the UK or Henry et al. (2009) for Australia). Most countries finance their government budget to a large extent by taxing labor, capital, and consumption, the latter particularly in the form of value added taxes (Johansson et al., 2008). Since these taxes make it less profitable to provide capital and/or labor, they create undesired economic distortions. These are particularly strong for labor taxes (Feldstein, 1999; Slemrod and Yitzhaki, 2002), which reduce work incentives in developed countries and induce a shift of labor from the formal to the informal sector in developing countries (Meghir et al., 2015; Ulyssea, 2010).

A widely used concept to measure the welfare costs of distortionary taxation is the marginal costs of public funds, MCF (Browning, 1976), which measures the tax burden plus the marginal welfare costs associated with a marginal increase in tax revenue (exclusive of the welfare effects of government spending). Thus, a MCF of one indicates a perfectly efficient tax system, as raising one additional dollar for the government costs only one dollar to society. Estimates of MCFs typically range between 1.2 and 1.5, depending on the country and specific tax considered to raise public revenues (Auriol and Warlters, 2012). In a recent study, Auriol and Warlters (2012) estimate MCFs for 38 African countries, finding that costs are highest for capital and labor taxes (on average 1.60 and 1.51, respectively), with intermediate values for import taxes (average 1.18) and lowest for domestic consumption taxes (average 1.11). Standard economic reasoning implies a MCF of one for land value taxes as land supply is fixed.

Land value taxes are neutral (Tideman, 1982; Fane, 1984), if they are compensated. A compensated tax means that each household receives a lump-sum transfer from the government equivalent to its tax payments. As Feldstein (1977) has pointed out, the uncompensated tax has distortionary effects, for example through a wealth effect. For policy analysis, usually a compensated land value tax is considered to disentangle revenue-spending effects from the allocation and efficiency effects of using the tax to gain revenues. This means that uncompensated land value taxes will be distortionary, but less so than non-neutral taxes which incur additional efficiency losses beyond the wealth effect. Land taxation might also alter households' saving and investment behavior through the so-called 'portfolio effect' (Feldstein, 1977): households typically use some of their labor income to save for retirement. These savings are used to purchase assets like capital and land. When land value is taxed, it becomes more attractive to invest in capital and as a consequence, capital accumulates faster. In a situation where capital is under-accumulated, it is welfare increasing to intentionally trigger the portfolio effect (Edenhofer et al., 2015).

As pure land taxes are rarely implemented, there is only scant empirical evidence of their effect. Property and split-rate taxes are

common in practice and are thus more frequently analyzed. As these instruments tax land plus the structure on it, they discourage investments into structure and buildings. Property taxes are considered less distortionary than income taxes (OECD, 2010) and there is some empirical evidence that taxes on immoveable property have the smallest growth reducing effects compared to any other form of taxation (Arnold, 2008).

3.2. Environment

Besides increasing economic efficiency, land taxes can under specific conditions affect land use decisions. If land is an open-access resource (i.e. no one can be excluded from using it), it is prone to unsustainable overuse. To overcome this challenge, economic theory advocates enforceable private property right. As an alternative, in many countries (especially developing ones) land is frequently communally owned and governed by often informal rules and institutions. How well these non-state institutions succeed in preventing the overuse of land depends on various factors, such as the ability to monitor rule violations and apply gradual sanctions (Ostrom, 1990).

In cases in which private property rights cannot be straightforwardly assigned or communal ownership is not successful, a unit tax on land can promote sustainable land use. Such a tax will prevent the acquisition of all land with a marginal productivity below the tax rate. This is particularly the case if land can be appropriated by clearing and cultivating open-access forest area (Kalkuhl and Edenhofer, 2016)

In many countries, the amount of land used for economic purposes extends at the cost of natural ecosystems (DeFries et al., 2010), which contribute to human well-being as well as economic production (De Groot et al., 2012). While agricultural land taxes can help reduce overall pressure on ecosystems, they are unlikely to conserve specific ecosystems or environmental sites. They are therefore best understood as complementary policies to protected areas, payments for ecosystems services or subsidies on forest conservation (Barua et al., 2014, 2012; Busch et al., 2012). Land taxes can further absorb the additional land rent increase resulting from increased scarcity due to more stringent environmental measures (Kalkuhl and Edenhofer, 2016).

For the case of urban space, urban sprawl might constitute a welfare-decreasing externality (Bento et al., 2011). Various empirical studies emphasize that replacing property taxes (which discourage investments in higher density) by land value taxes reduces urban sprawl (Banzhaf and Lavery, 2010; Plassmann and Tideman, 2000; Song and Zenou, 2006). By contrast, empirical research on the land-conserving and investment-increasing effects of land taxes for agricultural land is not available. While drawing a parallel with the urban context suggests that land taxes may also limit extensification and increase intensification, the precise environmental effectiveness of this policy still needs to be explored.

3.3. Distribution of income

As land is unequally distributed, land value taxation affects some households more than others. While most research on land and property taxes focuses on their allocative effects, distributional effects are rarely investigated (Norregaard, 2013). This is surprising as distributional effects are one of the major aspect for political feasibility and public support.

Distributional effect are related to (i) intergenerational equity, (ii) vertical equity and (iii) horizontal equity. Intergenerational equity is related to households saving for their retirement by buying land (Koethenbuerger and Poutvaara, 2009). A land tax would therefore predominantly have negative effects for households that are near or in retirement at the time of the introduction of the tax. At the same time, these households would not benefit directly from a potential reduction in labor income taxes. Vertical equity concerns the distributive effect of land taxation among households with different levels of wealth. There is ongoing controversy whether land ownership increases proportionally or more than proportionally with wealth. Stiglitz (2015) claims that rents are generally highly concentrated among the rich while Bucks et al. (2006) emphasize that land ownership in the US increases in absolute terms in wealth, but decreases in relative terms. Finally, horizontal equity refers to the different tax burden among households with equal levels of total wealth which can be a major concern (Plummer, 2010). When two households with the same amount of total wealth own different amounts of land, a land tax would require them to pay different amounts of taxes in spite of their equal ability to pay.

Governments commonly understand very well that every tax reform creates winners and losers. To avoid drastic changes, a land tax can be designed according to local circumstances, for example with gradual tax shifts, careful timing of reforms and appropriate recycling of the revenues.

3.4. Administrative costs

Land or property taxes require a system of land registration, or cadaster, which includes fiscal, social, economic, legal and environmental information on land and its owner. The costs of introducing land registration can in some cases be considerable (Deininger and Feder, 2009). The fact that a large number of low-income countries have some form of property taxes (see Table 2.2 in Bird and Slack (2004)) implies that the costs for establishing basic cadastral requirements for land taxation are not prohibitive. A more sophisticated cadaster, including accurate market-based property values, requires larger investments, however.

Establishing formal and transparent land rights through a land registry has a number of co-benefits that are worth mentioning. There is growing empirical evidence that secure land rights increase agricultural investments as well as sustainable land use practices (Abdulai et al., 2011; Abdulai and Goetz, 2014; Lawry et al., 2016). Further benefits include improved land access for women (Ali et al., 2014), with improved educational outcomes for children (Matz and Narciso, 2010), and reduced deforestation (Etongo et al., 2015; Robinson et al., 2014). Because of the various benefits, establishing tenure rights has become an objective of governments and international organizations (FAO, 2012), independent from its instrumental role for tapping an additional source of government revenue. Besides the co-benefits of establishing formal land rights, a well-managed public system of assessing land value increases transparency in land markets. A prime example is the Dutch assessment system that is considered to influence and guide market prices as buyers and sellers of properties take the assessed values as reference prices (Bervoets et al., 2017). Increased transparency on land values can also help to facilitate fairer transactions on large-scale land investment where compensation of indigenous people might be below the true land value.

We can distinguish between fixed costs like setting up a land registry or cadaster and recurrent costs like maintaining and updating a cadaster, valuing property etc. With respect to set-up costs, a closer look at World Bank projects for creating land registries reveals a rough indication of the scale of these costs: For various countries, costs range typically between 10 and 100 mln USD (see Online Appendix for details). This suggest, that set-up costs are relevant but constitute a rather small share of national GDP. They are also quickly recovered by potential revenues from land taxation.

Administrative costs of land taxation refer typically to recurrent costs, which are the costs of assessing land value and collecting taxes. Only a few studies quantify these costs: In the case of Croatia, administrative costs as a percentage of property tax raised varied between 5–50 percent (Blažić et al., 2014). A comprehensive study on property taxes in Latin American municipalities by De Cesare (2010) revealed substantially lower costs of 1–20 percent of taxes raised, with 6 percent costs for the median municipality. As tax rates are often below one percent of the property value, applying higher tax rates can further

reduce the cost-to-collection ratio as revenues are increased while costs are hardly affected. With respect to administrative costs, land taxes tend to be slightly more expensive than average costs of tax administration that is around 2 percent for developing countries (Auriol and Warlters, 2012).

In developed countries, land value taxation is demanding because the total value of a property assessed in market transactions is composed of the land value and the value of improvements, in particular buildings located on the land. Sophisticated techniques allow for estimating both components with satisfactory accuracy (Bell et al., 2009). In the United Kingdom, the Valuation Office Agency (VOA) is successful in determining land value, see Chapter 16 of Mirrlees and Adam (2011). Even if land value is assessed with error, it is still less distorting than a property tax (Chapman et al., 2009).

Another way of reducing administrative costs is to use unit taxes, which are locally differentiated to account for different land values in coarser geographical resolution. Unit taxes would relate the tax burden to the size of a specific plot of land irrespective of its actual value. As it is not necessary to assess the value of every individual plot of land but only of the average land value per area in a specific geographic unit, administrative costs and cadastral requirements are low and, thus, favorable for developing countries (Khan, 2001). Several developing countries—including Bangladesh, Ethiopia and Malaysia—use unit taxes and others move towards a land value tax, by adjusting the unit tax by the availability of irrigation and quality of soils (Khan, 2001).

3.5. Compliance

An important reason why real world tax systems differ significantly from those considered „optimal“ by economic theory, in particular in developing countries, is tax evasion and non-compliance (Gordon and Li, 2009). The existence of commodity taxation (Boadway et al., 1994; Richter and Boadway, 2005), gasoline taxation (Liu, 2013) and tariffs (Emran and Stiglitz, 2005) can be partly explained by compliance problems of alternative taxes. Similarly, taxes on property and land are difficult to evade since the tax base is highly visible, immovable and can be easily verified by property assessors (Kenny and Winer, 2006).

Taxpayer morale and missing incentives and fines are considered the major cause for non-compliance (De Cesare, 2010; Kelly, 2000). Tax compliance depends in general on crucial design aspects like taxpayer segmentation and use of third-party information, but also consideration of behavioral aspects of taxpayers that are related to social norms, intrinsic motivation and perceived fairness, among others (Del Carpio, 2013; IMF, 2015; Manaf et al., 2005). The quality of the administration is therefore key and the literature has identified various ways and lessons learned on how to increase compliance (Bahl et al., 2008; Bandyopadhyay, 2014; Bird and Slack, 2004; Kelly, 2000,1993).

3.6. Political feasibility

One key reason as to why land taxation is difficult to implement is its “strong and vocal opposition”, in particular by “the rural elite” (Khan, 2001). This is easily understandable as an expression of Olson’s asymmetry (Olson, 1965): if land ownership is concentrated, landowners have a strong incentive to lobby against land taxes. This renders implementation cumbersome, compared to e.g. taxes on consumption, which result in a more distributed incidence, and where interests are less well vocalized and organized. Land taxes might further be subject to opposition when land is more evenly distributed, in particular if the livelihood of farmers crucially depend on a stable income. High volatility in agricultural revenues adds an additional difficulty for farmers to comply with a fixed land rent. Fixed annual payments can arguably decrease rural livelihood security, and even lead to revolts (Scott, 1977, p. 77). Availability of appropriate insurance tools like rainfall indices can be one way of easing temporal liquidity constraints and reducing revenue risk (Karlan et al., 2014). In any case, a precise understanding of the tax incidence is necessary to assess political feasibility.

A primary approach for increasing acceptance is emphasizing the direct and indirect benefits through the revenues collected. The provision of co-benefits, like formal land rights, can increase support (Booth, 2014). Local acceptance for the tax seems to be decisive as well – it can be increased due to higher transparency on the use of the tax revenues. According to Skinner (1991b) the tax is more likely to be supported if it is collected by local governments so that it is easier to track how its revenues are used. In addition, Booth (2014) finds that using revenues for projects that yield direct benefit to rural people increased acceptance. Redirecting local revenues from land taxation for local investments is closely related to the idea of fiscal decentralization. Kelly (2000) argues that central governments might be reluctant to empower local governments through fiscal decentralization and property tax reform.

An open question is whether land owned by communities, in particular, indigenous communities, should or can be subject to land taxation, even when revenues remain in the communities. One concern is that communal and collective forms of land use enable access to land inter alia according to needs. Land taxes could then imply a monetization of land use practices, and ensuing risks for most vulnerable populations. These concerns are serious but do not necessarily prohibit locally appropriate design of land taxes. For example, land taxes could be adaptive to climate conditions, and revenue could be locally invested into yield and productivity increasing technologies and management practices or into programs related to social services.

While locally governed property taxes are subject to tax competition problems, land taxes are less so. The classical case of tax competition between local jurisdiction focuses on property taxes, poll taxes or other taxes on personal or corporate income, commonly denoted as Tiebout tax competition (Tiebout, 1956; Wilson, 1999). The key rational is that jurisdiction want to keep tax rates low to attract capital and investments, and engage in competition with other local jurisdictions. This results into suboptimal low tax rates. Empirical research demonstrates that local tax rates on property are consistent with tax competition models (Brueckner and Saavedra, 2001). Local tax competition can be avoided by nationally harmonized tax rates. Contrary to these findings, land taxes are not subject to tax competition as the tax base, land, is an immobile factor and its supply is independent of tax rates (Hoyt, 1991). The owner of land cannot reduce the tax burden by moving to a different jurisdiction. Moreover, land taxes are perfectly capitalized in land prices. Thus, when citizens can chose between two jurisdictions which are identical except in their land tax rates, they will be still indifferent as the higher tax rate in one jurisdiction is exactly offset by lower land prices. Hence, while tax competition tends to reduce property taxes, this is not so the case for land taxes (Hoyt, 1991).

4. Data and methods

For our in-depth analysis, we first characterize the macro data used. Second, we describe the typology that sorts countries across benefits and feasibility of land rent taxation, using the macro data. We third describe the household data used to infer land rents. We forth explain how we use micro-simulations to assess distributional impacts of land taxation.

4.1. Macro-data

To select and characterize case study countries, cross-country data for 83 middle and low-income countries are used representing all world regions. Data represent potential environmental, economic and fiscal benefits and administrative feasibility. Environmental motivations are encoded as (1) deforestation rates indicating the environmental effects of land demand and (2) cereal yields representing land use efficiency. Within the economic dimension of land taxes, we use (3) agricultural land rents indicating the maximum amount of revenues that can be

obtained by agricultural land rent taxation (urban land rent data are not available) and (4) financial needs for development-related infrastructure investments. High financial needs indicate large social returns of public investments which need to be compared with the efficiency and administration costs of the fiscal system to raise revenues. The efficiency of the fiscal system is approximated by (5) taxes on trade that are usually more distortionary than taxes on consumption and land (see section 3.1).[1] A land tax also affects wealth and income distribution and therefore poverty levels. As a proxy for the land tax burden on the poor, we consider (6) the shares of small sized agricultural holdings with area size less than 2 ha. The welfare-related indicators are complemented by two feasibility indicators, which address institutional barriers for implementing a land tax reform: (7) the quality of land administration index, and (8) the control of corruption index. Land tax reforms should be easier to implement in countries with high quality of land administration services. Compliance and revenues created are also higher for countries with high quality of land administration and low levels of corruption. Table 1 lists data sources; the Online Appendix provides a more detailed description.

4.2. Country typology and selection criteria

We group the indicators into a 'benefit' category and a 'feasibility' category. For selecting case study countries, we are interested in cases with high benefit potential and high feasibility. Here land tax reforms would have a high chance of success. Because our indicators are non-commensurate, there is no clear way of aggregating them. Rather, we plot countries in the benefit-feasibility space (varying by indicator set) and choose the Pareto-frontier of countries. A country lies in the Pareto frontier if there is no other country with higher benefits and feasibility.[2] The identification of the Pareto frontier is subject to measurement error and imperfections in the underlying data. To relax the strict Pareto criterion, we include subsequent Pareto frontiers that lie behind the first frontier. Considering the first three Pareto frontiers allows for a selection procedure for case study candidates that is robust and less prone to measurement errors.

Our selection criteria are based on a combination of factors: the representation of different world regions, their performance in the typology, the availability of up to date household data, and the motivation to select non-neighboring countries within each region in an attempt to be as representative as possible. For example, while Uganda would be a suitable candidate, we omitted Uganda as neighboring Rwanda was already previously selected.

4.3. Micro-data

Our micro-simulations build on nationally representative household surveys that include information on income, expenditures, land ownership and property ownership (see Table 2). For calculating land rents, we distinguish agricultural land, housing land (property) and other land (typically business property), depending on availability in the household survey. For agricultural land, we use the rent flow from renting out land that households own. If households own land, they are typically asked about the value of selling that plot of land (or buying or renting an equivalent plot of land). As we use (annual) land rent inflows as tax base in our study, we calculate the implicit rent flow from owned land with a country-specific price-to-rent ratio. For property, we proceed equivalently. The large prevalence of informal land ownership, traditional land regimes and government- or community owned land in developing countries requires some additional explanations. We consider households to be land owners if they self-declare ownership in the questionnaire (Indonesia, Nicaragua, Peru) or when land was obtained by inheritance, purchase, as gift or by appropriation (as for Rwanda, where questions on ownership are missing; see Tab. 11 in the Online Appendix). In these cases, households are generally the economic owners of the land rent as they have large control over the land and how it is used or cultivated and as the household does not pay a lease fee or any other financial or in-kind compensation for using the land. Tenure security might differ substantially and it could well be that local chiefs, communal governments or the central government perceives themselves as ultimate owners of the land while tolerating de-facto land ownership. Informal ownership can be widespread. Detailed information is given in the Indonesian survey where 42% of households' largest plots hold a formal land title with highest tenure security. 30% hold land with certificates from local authorities based on customary law but which are not recognized by national law. For calculating the land rent, informal status, however, should have little impact on the land rent income of households as it is deferred from questions on the value of the land (e.g. with respect to lease costs or purchase price of an equivalent plot of land). Customary and traditional land tenure for de-facto individual ownership of land is therefore not an issue for calculating the land rent income. For the later simulations of land taxes, we assume that de-facto owners would become de-jure owners, e.g. due to formalized land tenure and introduction by a land registry or cadaster. While a large redistribution of land ownership according to political power is possible under formalization of land tenure, we cannot predict this outcome and therefore assess the tax incidence of the de-facto status quo distribution of land rent income.

Unlike agricultural land, the value of housing property depends also on the structures in place. In order to infer the pure land rents of housing properties, we decompose the property value p_i into a land component l_i and a housing cost (i.e. structure) component s_i, following Davis and Heathcote (2007):

$$p_i = l_i + s_i$$

The household-specific land to property value ratio, l_i/p_i indicates the share of the land value on the total property value, as only the land value share would be subject to land value taxation.[3] While data on the property value p_i is available in our data, we have neither information on l_i nor s_i. Other works (Davis and Heathcote, 2007; Davis and Palumbo, 2008) use housing characteristics and additional information on construction costs to calculate s_i and obtain $l_i = p_i - s_i$. As we do not have information on construction costs in developing countries, we follow a different approach: We regress the property rent against two groups of covariates: a) structure-based factors, such as type of construction materials and property size that affect s_i, and b) land-based factors, such as accessibility to basic public infrastructure (transport, water, schools, etc.) and distances to these public facilities and regional dummies that affect l_i (see the Online Appendix for more details). With the obtained coefficients, we can decompose property value p_i into a land and structure component which serves as rough approximations of s_i and l_i. Note that we are not interested in the precise values of s_i and l_i but only in their relative ratio to obtain the property ratio. One implication of this procedure is that we account for the fact that properties in remote areas with poor access to infrastructure have a lower land value share on the property value than properties in high-demand locations, if the structure components are the same. We include a sensitivity test against an assumed constant land value share of 40% for all

[1] Ideally, we would use MCFs as indicators for the efficiency of the tax system. There is no comprehensive and consistent dataset on MCFs estimates. Taxes on capital and labor might also serve as indicator for the efficiency of the tax system but data is available only for a limited number of countries.

[2] Formally, the Pareto frontier is defined by $i \in P^1 \leftrightarrow \text{for all } j \in N, j \neq i\text{: } b_j > b_i \text{ and } f_j > f_i$ with i,j indicating countries (total N), and b_j benefits and f_j feasibility of the respective country.

[3] We could not find any estimates of land value shares for developing countries. Estimates for the US (Davis and Palumbo, 2008) find land value shares of about 50 percent on average.

Table 1
Description of variables and indicators used for the typology.

#	Variable	Data Source & Description	Year	Unit
	Environmental effects			
1	Deforestation	FAO, Global Forest Resources Assessments (FAO, 2016). Change forest area relative to base year.	2005-2015	% of land area
2	Cereal yields	Kalkuhl and Mujahid (2014), based on FAOSTAT. Area-weighted average cereal yields per country	2010-2014	Mcal/h
	Economic effects			
3	Agricultural rents	The Changing Wealth of Nations (World Bank, 2011)	2005	% GDP
4	Financing needs	Data on financing needs for development infrastructure (water, electricity, sanitation, ICT and roads provided by (Jakob et al., 2016).	2010	% GDP
5	Existing tax distortions	World Development Indicators (World Bank, 2016a). Sum of customs and other import duties and taxes on exports.	MRY	% GDP
	Distributional effects			
6	Small-holder agriculture	FAO, 2014: The State of Food and Agriculture Innovation in family farming (FAO, 2014). Shares of agricultural holdings for land size area between 0 and 2 ha.	2014	%
	Feasibility aspects			
7	Quality of Land Administration Index	Registering Property – Doing Business Report 2015-2016 (World Bank Group, 2015). Sum of sub-indices on reliability of infrastructure, transparency of information, geographic coverage and land dispute resolution	2015	normalized between values 0 (lowest) – 1 (highest)
8	Control of Corruption Index	Worldwide Governance Indicators (WGI) (Kauffmann and Kraay, 2018; World Bank, 2016b). Measures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests	2015	normalized between values 0 (lowest) – 1 (highest)

Note: MRY – Most recent year.

Table 2
Household data.

Country	Year	Database
Rwanda	2013-2014	Integrated Household Living Conditions Survey (EICV4), 2013-2014, Cross-Sectional Sample
Peru	2015	Encuesta Nacional de Hogares 2015 – Encuesta Continua
Nicaragua	2014	Encuesta Nacional de Hogares sobre Medición de Nivel de Vida 2014
Indonesia	2014-2015	Indonesian Family Life Survey 5 (IFLS 5)

households in Sec. 12 in the Online Appendix. Except for Nicaragua, the distribution of land rents across income quintiles remains robust.

Households are grouped into five income quintiles depending on their adult-equivalent per-capita expenditure. Income is normalized by household size, considering children (0–14 years) to be equivalent to 0.3 adults in Rwanda, Peru and Nicaragua and 0.5 adults in Indonesia (Deaton, 2003). Aggregate expenditure data are used as they provide a reliable proxy for the permanent net income of households (Friedman, 1957; Slesnick, 1993), except for Peru where aggregated income data was available. In the following, we use the term income synonymously with permanent income or expenditure.

4.4. Methods for household analysis and micro-simulations

To calculate land rents and their distribution among the population, the median land ownership and the median rent income share of land owning households for different income quintiles was estimated. The median rent income share is taken as it is less sensitive to outliers driven by households with very low incomes, which inflate land income shares. We further upscale households' land rents to the national total using the survey weights from the sampling design, which gives an estimate of the national annual land rents for different land uses.

To estimate the revenues of a land value tax as well as the distributional effects among households relative to their income we assume that land owners will carry the full burden of the land tax. We analyze two different designs of land taxes. First, we apply a linear tax of 25 percent and 50 percent on the annual rent flow. With a price-to-rent ratio of 20, a land rent tax of 20 percent corresponds to a tax on land value of one percent. As property taxes typically range between 0.1 and 2 percent of the property value (see De Cesare (2010) for Latin America), the 25 percent rent tax corresponds to a rather typical property tax rate on the land without structure. As moving from property taxation to land taxation reduces the tax base because the value of structure is not taxed, our 50 percent land rent tax can be considered as a land rent tax that generates revenues similar to those of a typical property tax. Due to the linear nature of the assumed taxation scheme, revenues and distributional effects for different tax rates can be deduced in a straightforward manner by scaling. Second, we apply a non-linear land tax that assumes a "tax-free" amount based on the median total rent of landowners in the poorest quintile (including agricultural land and housing land), see Fig. 3. Above that tax-free amount, the linear tax applies. This non-linear tax scheme may a) reduce the administrative costs and b) enhance the progressivity of the tax design. In fact, we also tested for other exemption schemes, based on land types and rural/urban location (see Appendix). These alternative schemes do not create more progressive outcomes.

5. Country case studies

We present in the following quantitative and qualitative in-depth analyses of land tax reforms in four developing countries. First, the selected countries based on the typology are characterized. Next, we present magnitude and distribution of land rents in the household data

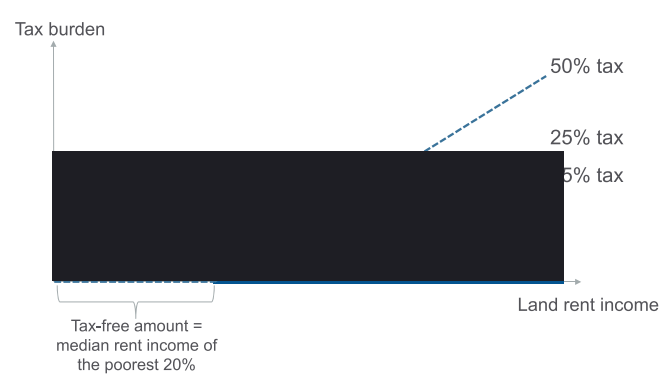

Fig. 3. Policy simulations: non-linear tax schemes.

Table 3
Key characteristics of the countries selected.

Indicator	Rwanda	Peru	Nicaragua	Indonesia	Source
Income group	Low	Upper middle	Lower middle	Lower middle	
Population (mill.)	11.34	30.97	6.02	257.60	Year 2015. World Development Indicators (WDI, (World Bank, 2016a))
Population growth (annual %)	2.30	1.30	1.10	1.20	Year 2015. WDI
Urban share (%)	28.81	78.61	58.78	53.74	Year 2015. WDI
GDP/cap (US$)	690	5934	1849	3834	Year 2015. GDP/cap refers to constant 2010$; WDI
Agricultural land rents (% of GDP)	29.63	4.21	11.74	5.10	See Table 1
Agricultural land rents (% of GDP)	NA	2.65	NA	5.34	(Lee et al., 2009)
Financial needs (% of GDP)	266	64	310	44	See Table 1
Trade tax revenues (% of GDP)[a]	1.25	0.30	0.74	0.58	See Table 1
Deforestation rate (% of total area)	−1.40	0.70	0.00	1.90	See Table 1
Quality of land administration	0.86	0.55	0.14	0.21	See Table 1
Control of Corruption	0.77	0.30	0.20	0.35	See Table 1
Yields (Mcal/ha)	7102	11530	6218	13269	See Table 1
Small agricultural holdings	–	0	21	88	See Table 1
Poverty rate (%)	60.43	3.13	6.22	8.25	WDI, most recent value
Gini Index	44.8	44.14	47.05	39.47	WDI, most recent value; except Rwanda: Rwandan Fourth Population and Housing Census – 2012
Nominal rate of assistance (NRA)	–	–	−0.12	0.20	Anderson and Masters (2009)
Land tax potential	1,2,3,4,5	1,4	4	1, 6	Shows for which indicators the countries appear on the first three Pareto frontiers. 1: deforestation; 2: yields; 3: agricultural land rents; 4: financial needs; 5: tax distortions; 6: share of small farm holders

[a] Sum of the share of customs and other import duties and taxes on exports as % GDP, using most recent year (between 2010 and 2015).

as well as results on the microsimulation on land tax regimes. Finally, we look at the specific country context of existing land taxes as well as institutional and implementation aspects.

5.1. Country typology and characteristics of case study countries

As an example of the method described in Section 3.2, Fig. 3 illustrates the Pareto frontiers for the quality of land administration index and agricultural land rents. Pareto frontiers for other dimensions are shown in the Online Appendix. The countries that emerge as the most promising candidates for land taxation are located in different world regions and income groups, which suggests that land rent taxation might be of interest for a broad array of countries. In Sub-Saharan Africa, the spending dimension ('fiscal needs') is of particular relevance, followed by the potential to reduce distortive taxes and enhance yield production. Latin American countries show higher potential with regard to the environmental dimension (agricultural productivity and deforestation). Countries from Southeast Asia and the Pacific show no preferential dimension, performing well across all indicators. Lower middle-income countries seem to perform particularly well with respect to the share of small farm holders.

We select Rwanda, Indonesia, Nicaragua, and Peru for in-depth analysis, capturing a variety of countries with differing welfare and feasibility aspects. Table 3 summarizes their main characteristics. Rwanda is a country with relatively good institutions with respect to land administration and control of corruption, high agricultural rents and high financial needs. Demand for housing but also for land for food production is likely to increase in all four countries with substantial increases in Rwanda due to high population growth. Indonesia is a country that experiences high deforestation. Thus, taxes on agricultural land (in particular land for palm oil production) could reduce deforestation. As Indonesia already uses land taxes, institutional feasibility for upscaling land taxes should be rather high, though the land administration is plagued by bureaucratic rules, complex multi-level governance and corruption. Because most farmers in Indonesia are small-scale farmers, distributional effects are of particular interest. Peru has rather high fiscal needs to ensure universal access to essential infrastructure. Agricultural holdings are relatively large, indicating that land taxes would not affect many households under the extreme poverty line. Rwanda, and Nicaragua have low cereal yields, indicating large land-saving potential if and taxes trigged more efficient land use. Negative rates of assistance (i.e. effectively taxation) for agricultural products in Nicaragua might be one explanation for these low yields as they discourage investments. In contrast, yields in Peru, and Indonesia are already high. Absolute poverty is highest in Rwanda while the remaining countries have poverty rates below 10 percent.

Table 4
Overview of current fiscal system and the role of land and property taxes.

	Rwanda	Peru	Nicaragua	Indonesia
Current fiscal system				
Tax revenues (% GDP) - Total	16.04	18.92	20.37	12.17
Income	5.98	7.72	5.77	5.17
VAT	5.18	7.06	6.33	3.87
Trade	1.58	0.18	0.62	0.41
Land & property (recurrent)	0.00	0.22	0.12	0.22
Marginal costs of public funds (MCF)[a]	1.23-2.47[b]	0.60-1.71[c]	NA	0.74-1.91[d]

[a] As MCF are calculated for individual taxes, we show a range over all considered taxes with income taxes typically on the upper range. MCFs smaller than one indicate welfare gains that can arise if a tax reduces other market imperfections or distortions.
[b] Source: Auriol and Warlters (2012).
[c] Source: Cordano and Balistreri (2010).
[d] Source: Devamjan et al. (2002).

Table 4 emphasizes the main characteristics of the fiscal systems of the case study countries. While Peru enjoys large revenues, particularly from natural resource extraction and mining, the main sources of tax revenues in all countries are income and consumption taxes. The allocative efficiency costs of these distortionary taxes can vary substantially and can exceed 100 percent, as in the case of Rwanda. In contrast, land and property related taxes constitute only a minor share of government revenues. Hence, shifting the source of government revenues from distortionary taxes to land taxes can have substantial economic benefits by reducing deadweight losses of the existing tax system.

5.2. Quantitative results for case study countries

This sub-section first provides an overview of the size and distribution of land rents in the selected case study countries. It then proceeds to perform micro-simulations to assess the distributional impacts of different land taxation schemes.

5.2.1. Magnitude and distribution of land rents

Land ownership is widespread and rather homogenous (Table 4): except for Nicaragua, more than 90% of households in the lowest income group are de-facto landowners, mostly as they own the house they live in.[4] In contrast, high-income households tend to be less likely to be landowners: they frequently live in cities in rented apartments and they rarely own agricultural land, since they do not work as farmers. Hence, land rent taxation will affect a large share of the population and therefore the tax base will be broad. One implication of this broad tax incidence that land taxation creates 'ownership' of the tax, in the sense that tax payers hold (local) governments accountable for efficient spending of the tax.

Our decomposition of property value into a land value and a structure value reveals that land values constitute on average 40 to 50 percent of the property value (see Online Appendix). This is consistent with other estimates of land value share on housing values (Knoll et al., 2017). The subsequent calculations for urban land rents refer therefore to the pure land rent component of property. As expected, agricultural rents are more relevant for the rural population and constitute 2–7% of household income. Median housing rents constitute 3–7% of income and total land rents range from 8 to 12% of household income (Table 5).

The nationally up-scaled household data gives substantially lower aggregate household incomes than national GDP numbers (up to 50%). Additionally, total land owned by households is considerably lower than actual agricultural land. This might be due to various reasons: (i) wealthier households might be under-represented, (ii) downward biased consumption or income data, (iii) incomplete reporting on expenditure or income, (iv) missing income and land ownership from foreigners, large national, multinational or state-owned companies and (v) land owned by communities or the state (see Online Appendix for further discussion). All of these issues are common for household wealth and income data (Eckerstorfer et al., 2016; Vermeulen, 2017). Underreporting of wealthier households is often related to high opportunity costs of responding completely to interviews (Kennickell, 2017). In our case, underreporting will likely imply downward-biased aggregated land rents and skew the distribution of land rents more to the poor. Nevertheless, household data are the only source of information on land ownership and income distribution. Hence, the insights from the household data analysis should be understood as an effort to expand the available knowledge and data on land values and their distribution.

With respect to the distribution of land rents, low-income households tend to have, in our data, larger rent income shares than richer households. These reach up to 17% of income, as in the case of the poorest quintile in Rwanda, constituting a substantial share of household income. Data on the highest income groups should be considered with great caution due to underreporting of land values (see discussion above). Where data is available (Rwanda), we further find that only a minor share of households actually pays property taxes. These revenues constitute a negligible amount of government revenues (Fig. 4).

5.2.2. Micro-simulations of land tax reforms

Our analysis reveals that a 25 percent linear tax creates revenues ranging from 0.25% (Peru) to 1.87% (Nicaragua) of GDP (Table 6). Although these numbers seem to be small, they may constitute a substantial share of the current government revenues. Note further that actual tax revenues might be higher than simulated because of downward biased land rents in the household data. Levying a tax of 50% on land rents would be sufficient to cover more that 14 percent of the current government budget for Rwanda, Indonesia and Nicaragua. For Peru, only data on land rents related to housing are available; applying a tax of 50% on these rents would amount to only 0.5% of GDP, or less than 3 percent of the existing government budget.

Fig. 5 shows the tax burden for each household as a percentage of total income (only considering households who are landowners). Even though absolute rents are on average higher in middle and high-income households, housing land ownership and average rents as a percentage of income are higher for lower income households. Hence, poorer households may carry a higher relative burden of the land tax then richer households.[5] For instance, in Rwanda, the 50 percent land rent tax would amount to about 6 percent of available household income for the poorest quintile and 5 percent for the middle income group, but less than 3 percent for the richest.

Under our nonlinear scheme, a tax-free amount applies to all households based on the median total land rent of the poorest income quintile (see Table 5). Above that amount, tax rates of 25 percent (green) and 50 percent (orange) are applied on land rents. By accepting revenues that are between 26 percent and 38 percent lower than they would be under linear taxation, high tax burdens on the poor can be avoided with the non-linear tax scheme (Table 6). The average effective tax rate falls substantially because of the tax free amount: Even for the 50 percent non-linear tax scheme, effective tax rates range from 30 to 39 percent suggesting a more moderate tax burden. Table 6 also shows that under a nonlinear tax, depending on the country, the number of taxpayers would be reduced by between 30 percent and 46 percent, which would further decrease administrative costs.

Finally, in Rwanda we can also compare the proposed systems with that currently existing system (green-grey in Fig. 5). Property taxes in Rwanda perform worse in both revenue raising and progressivity compared to the proposed tax systems. Interestingly, in Rwanda, both simulated non-linear tax schemes will lead to larger tax liabilities for richer households but not for the poorest ones, in comparison to the current tax regime.

5.3. Qualitative analysis: lessons learnt and reform options

In the following, we review the existing fiscal systems for property and land taxes for the case study countries and discuss relevant reform options, with reference to our quantitative analysis. Detailed information on the existing tax systems are in the Online Appendix.

5.3.1. Rwanda

Most Rwandans live in single-family houses, where each family owns a plot of land. In urban areas, people live in high-rise condominiums and informal settlements. Here several housing units are built on parcels on leasehold bases (Kopanyi, 2015).

Major problems related to the current property and land tax system are the narrow tax base, low tax rates (a tenth of mean international rate), low collection efficiency (possibly no more than 30%) and adverse incentives to register land because of registration fees and increased tax base (Grote et al., 2014; Kopanyi, 2015). The government initiated a "Fiscal Decentralization Project" in early 2014 to increase local revenues. The reform aims at addressing these problems; the tax

[4] Recall that we consider all households as de-facto land owners who do not pay for using the land (i.e. who therefore receive the land rent).

[5] For our household data, the linear land tax has regressive income effects. Due to the bias to underreport land rent incomes especially for higher income groups (because of data problems discussed above), it is unclear whether high-income households would indeed pay such low taxes as indicated by our simulation.

Table 5
Household survey data – analysis of land rents.
Source: Own calculations based on household surveys.

	Rwanda[a]	Peru[b]	Nicaragua	Indonesia[c]
Agricultural land rents (% GDP)	3.91	–	4.70	0.97
(% Household income)	6.72	–	7.27	2.39
Housing land rents (% GDP)	1.48	0.98	2.78	2.11
(% Household income)	2.54	1.96	4.30	5.19
Total land rent (% GDP)[d]	5.39	–	7.48	3.42
(% Household income)	9.27	–	11.57	8.41
Land ownership (% of HH)				
Poorest quintile	95.31	96.97	75.41	96.46
Middle quintile	93.50	90.34	73.34	93.46
Wealthiest quintile	69.92	87.10	76.24	85.61
Median rent income share of land-owning HHs (%)		(Housing)		
Poorest quintile	16.77	3.64	9.21	9.96
Middle quintile	13.95	2.30	6.28	5.81
Wealthiest quintile	7.82	1.72	5.31	3.44
Median annual land rent in poorest quintile[e]		(Housing)		
Local currency	RWF 42.407	S/ 330	NIO 5410	IDR 1,606,229
US$ (adjusted to 2014 PPP conversion factor)	160	201	510	350
Property tax revenue (% of GDP) current system	0.12	–	0.05	–
Property tax payers (as a percentage of HH) current system	7.73	–	15.71	–

[a] Main figures: Tax revenues (as % GDP) for 2015, source: (World Bank, 2016a). Income, VAT, Trade, Land and Property figures from 2009, source: (US AID, 2011).
[b] Data only available for housing for all analysis but also for land ownership where agricultural land is also reported.
[c] Main figures source: data for Indonesia for 2005–2008 (average) from Table 1 in Amir et al. (2013).
[d] Indonesia reports also for „other land rents", which include for example, business land, and represent 0.33 and 0.82% of GDP and of Household income respectively.
[e] Only landowners included (renters excluded). PPP conversion factors for private consumption (LCU per international $), 2014 Source: World Bank (2016a).

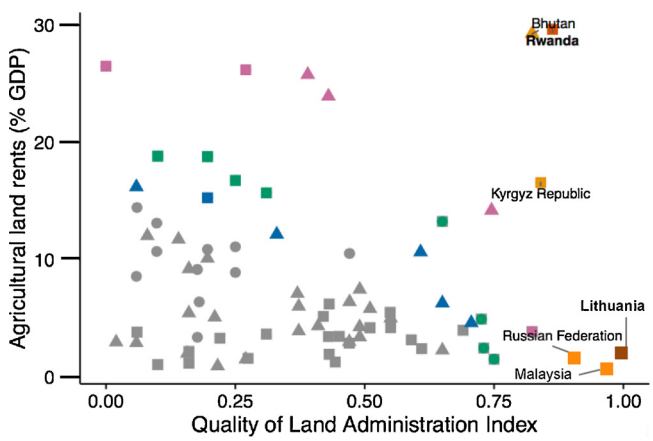

Fig. 4. Typology results - Pareto frontiers for the indicators Quality of Land Administration Index and Agricultural Land Rents.

administration shall be equipped with computerized databases and state of the art filing and collection instruments to reduce administration costs and increase compliance. The draft law reflects a major policy shift by declaring all fixed assets as subject of taxation, regardless of legal status –whether personal ownership has been registered or not. Although the market value is the general tax base, two forms of taxes are defined: a) property value-based FAT (hereafter VFAT) and b) land area-based FAT (hereafter AFAT) which is linked to market value indirectly. The valuation method will consist of the single-property valuation of market value of fixed assets by the owners and self-filing.

Although the government has followed key recommendations from international experts (Grote et al., 2014) there are still areas that need further refinement and analysis. For example, the IMF strongly suggested a single land-value option compared to the current VFAT based on Rwandan circumstances (the valuation approach is complex, difficult to administer, lacks oversight and quality control and is expensive) (Grote et al., 2014; Kopanyi, 2015). Current self-assessment is considered problematic as owners have an incentive to under-report land

Table 6
Main revenue implications of land taxes. Note: Tax-free amounts are based on the median annual total land rent in poorest quintile (see Table 5).

	Rwanda	Peru (housing only)	Nicaragua	Indonesia
A. Linear tax scheme				
Nº tax paying households	2,219,040	7,741,249	1,069,663	64,082,198
Tax revenue (% of GDP) at 25% tax rate	1.35	0.25	1.87	0.86
Tax revenue (% of GDP) at 50% tax rate	2.69	0.49	3.74	1.71
Government budget increase (%) at 25% tax rate	8.40	1.30	9.17	7,03
Government budget increase (%) at 50% tax rate	16.76	2.58	18.35	14,06
B. Non-linear tax scheme				
Taxpayers drop out (nonlinear vs. linear) (%)	35.36	30.06	33.43	45,97
Total revenue reduction (nonlinear vs. linear) (%)	27.10	39.79	22.20	28.76
Average tax rate of non-linear 25% tax (%)	18.21	15.08	19.43	17.81
Average tax rate of non-linear 50% tax (%)	36.43	30.23	38.86	35.62

The Online Appendix provides further results; outcomes of policy simulations are calculated using tax-free amounts based on land types and location (urban and rural).

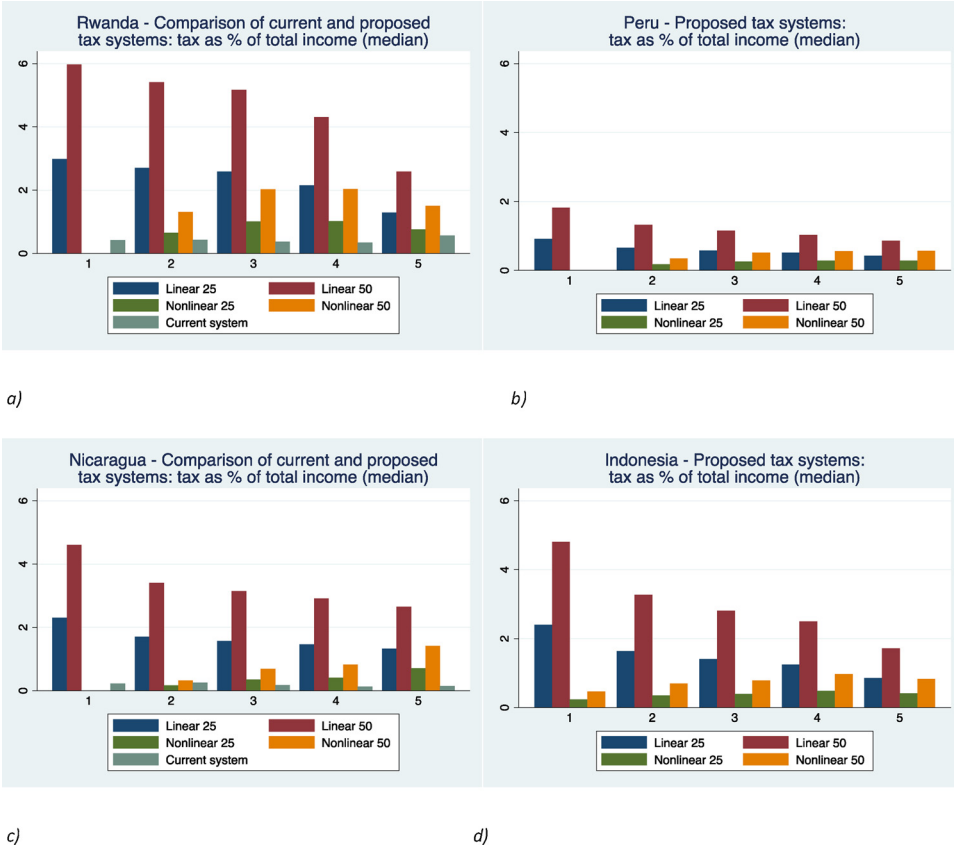

Fig. 5. Distributional implications of different land tax systems over expenditure quintiles. Note: Tax paid by each household as a percentage of total income over the income quintiles (x-axis) for a 25 percent and 50 percent tax rate for the linear and the nonlinear system for a) Rwanda b) Peru c) Nicaragua and d) Indonesia (median). Only households owning land are considered. Quintile 1 are the poorest households and quintile 5 the richest ones. Non-linear taxes consider a "tax-free amount" equal to the median land rent of the lowest income quintile – see Table 5. In the case of Rwanda, expenditures on current actual land taxes are also included.

holdings. Hence, including modern techniques of land valuation can help stabilize the tax base and ensure fair treatment.

Our micro-simulation reveals that extending land taxation would increase government revenues substantially, allowing for upscaling infrastructure investment in rapidly urbanizing areas or for reducing income taxes. Co-benefits of the envisaged land tax reform relate to improvements in institutional quality by increased land tenure security and transparency by full registration of property.

5.3.2. Peru

More than 70 percent of landholders still lack official proof of their property in Peru. High administrative costs for registering land titles are the main obstacle for smallholders and indigenous communities. Customary law hitherto governs them. Social conflicts originate from claims of extractive industries (Bebbington and Bury, 2009).

A real estate property tax for rural and urban areas exist. The tax rate is set by the national government but is collected by local authorities who also assess the value of the property based on fiscal characteristics, unit values and taking into account depreciation. Unit values are updated every fiscal year by the national Ministry for Housing, Construction, and Sanitation (Centro de Gestión Tributaria de Chiclayo, 2016; Rojas, 2015). Tax rates range from 0.2 percent to 1 percent of the property value and increase progressively with real estate value.

Higher revenues from land-related taxes could be used to reduce other distortionary taxes, e.g. VAT or income taxes, or to increase public investment. To date, about 15 percent of the population lacks access to clean water and electricity, and almost 30 percent to sanitation. Access gaps are especially pronounced in rural areas. Revenues from land taxation could provide the financial means to close these gaps. The potential of using land tax revenues for improving infrastructure in poor rural areas is, however, limited due the decentralized property tax system. Additionally, past experiences with the 'canon minero' on redistributing revenues from mining activities for local development projects suggest that limited institutional and administrative capacities have diverted funds to special interest groups (Loayza and Rigolini, 2016).

Agricultural land expansion is a major driver of deforestation. About 10 percent of tropical rainforest had already been lost by 2014. The recently released national strategy on forests and climate change (Ministerio del Ambiente, 2016) aims at net zero deforestation by 2021, thereby protecting 3.5 mln hectares of forest until 2030. A land unit tax on agricultural or deforested land could provide an additional incentive to refrain from deforestation, together with mechanisms planned by the Ministerio del Ambiente (2016) to actively reward avoided deforestation

5.3.3. Nicaragua

Nicaragua has a highly unequal distribution of land ownership and high tenure insecurity, reflected in a Gini coefficient of land ownership distribution of 0.86 (Deininger et al., 2003a). Lack of access to land is a major determinant of poverty (Merlet and Pommier, 2000). During the export booms in the late 19th century (coffee) and the mid 20th century (livestock and cotton), well-connected individuals appropriated frontier land. A land reform program after 1979 had only small effects on land re-distribution as civil war continued. Since 1990, conflicting land titles originating from the pre-Sandista and the Sandista period led to partial insecurity in land tenure. A land reform between 1995 and 2001 provided 30,000 land titles, increasing land tenure security; access to land through inheritance remains nevertheless fundamental (De Janvry and Sadoulet, 2001). Various land market imperfections and land holdings for speculative, status or wealth portfolio reasons by a small land-based elite impede the functioning of the agricultural sector and reduce agricultural efficiency (Deininger et al., 2003a). Current property taxes account for only 6 percent of local tax revenues (World Bank, 2003), because property values are outdated and numerous exemptions apply.

A comprehensive reform on land tenure and land taxation can have

substantial agricultural co-benefits. Formalizing land titles benefits largely the poor, as they often hold contested land titles and are disproportionally affected by insecure land titles. Taxing land value could reduce speculative and inefficient acquisition of land by the rich, and provide incentives for more productive allocation (Deininger et al., 2003b; Strasma et al., 1987). Our quantitative analysis reveals that moderate land tax rates can increase the government budget substantially (Table 6). Despite the concentration of rural land among large-scale rural land owners, overall distributional effects (rural and urban areas) of a linear tax would be regressive.

Land taxes could be implemented with few technical barriers as the cadastral valuation methods used already differentiate between structures and land, also with detailed valuation for agricultural land, for both infrastructure in place and terrain characteristics (PGR, 2016). Revenues from land rent taxation could support smaller farmers with programs on education and access to credit markets. Because rural land is rather concentrated in Nicaragua, a comprehensive land tax reform might provoke substantial resistance from the rural land elite.

5.3.4. Indonesia

Land status is divided in state land and privately used land, with state land accounting for more than two-thirds of total land, mostly forest land (Yusuf, 2011). Land regulation is extraordinarily complex with more than 570 laws, regulations, and other documents relating to land and formal government processes.

Indonesia has a real property tax (Pajak Bumi dan Bangunan/PBB) that consists of two main parts. The first part is a tax on urban and rural land and property under the responsibility of regional governments. Tax rates are progressive, with a maximum of 0.3 percent of the assessed value (NJKP). The second part is a tax on plantation, mining, and industrial forest, which is under the authority of the central government. Further land or property related taxes or duties apply to the transfer of property and sales of luxury property, as well as income from property rental.

Our quantitative analysis suggests that Indonesia captures already a substantial share of land rents, though our simulation does not cover land tax revenues from large domestic and foreign agricultural companies and state-owned enterprises. Further increase in revenues has been limited so far by low capacity of local governments to enforce tax collection (Von Haldenwang, 2015). Current government initiatives focus on increasing revenue from housing properties, ignoring other land uses that are quite relevant for the Indonesian case.

Indonesia is a global hotspot of deforestation and biodiversity loss due to the creation and expansion of largely community-owned cropland for palm oil plantations, a main export staple crop. Under the business-as-usual scenario, intact forest cover will decline to 4 percent by 2020 contributing also to carbon emissions (Carlson et al., 2012). Establishing large-scale plantations can involve social conflicts with poor settlers and customary users, mostly indigenous populations (Creutzig et al., 2013). Urbanization effects food supply as it may consume additional 0.6 Mha of highly productive cropland (1.1 percent of Indonesia's cropland) (Brend'Amour et al., 2016). Differentiated land unit taxes could therefore play a role in slowing deforestation and directing urban expansion.

The case of Indonesia illustrates the challenges of a country faced with legal pluralism due to the coexistence of the national state law and customary laws (adat) that govern Indonesia's traditional communal land tenure system. More secure land titles would provide incentives for sustainable management and investment (Delninger et al., 2011). New issues and initiatives such as the insistence on recognition of adat community rights, efforts to settle and resolve land conflicts, and REDD + schemes try to address environmental and social issues (Busch et al., 2012; Carlson et al., 2012; Earth Innovation Institute, 2015).

6. Conclusions

This paper has revisited the case of land taxation in developing countries. Using land taxes as non-distorting source for public revenues is an old idea in economics, which recently gained new interest, and has been suggested to play a role in the increasingly intertwined global land-based public goods (Creutzig, 2017). Previous assessments, however, concluded that implementing land taxes in developing countries faces serious challenges because of high administrative costs (Skinner, 1991a, 1991b). The perception of high administrative costs, low (fiscal) benefits and limited public support may explain why many countries do not tax land rents or do so ineffectively.

Nevertheless, four major trends are strengthening the case for land taxes: First, technological advancements in assessing land values have reduced administrative costs considerably. Second, economists as well as policy makers have become aware of the various co-benefits of formalized land tenure, which is a necessary first step for establishing land taxes. Third, land rents, being the base for taxation, have been growing substantially in the past (Knoll et al., 2017) and are expected to grow further. Demand for land increases (Bird and Slack, 2004; Dye and England, 2010; McCluskey and Franzsen, 2005; Milan et al., 2016) while degradation and climate change reduce available land (Barros et al., 2014; Blaikie and Brookfield, 2015). Fourth, governments in developing countries need to improve their fiscal systems to raise domestic funds for achieving development goals and to reduce tax evasion due to shifting activities into the informal sector.

For the first time, we assessed not only the revenue potential for land taxation using macro and micro data for selected countries but also provided a rough estimate of the distributional incidence of linear land value taxes. Evaluating household data in four developing countries, we find that de-facto land ownership is pervasive among households in all income groups. Standard tax schemes could even put a higher relative tax burden on the poor. As the household surveys we used might suffer from incomplete data on land ownership in particular from wealthier households, one needs to be careful drawing conclusions on the tax burden on top income households.

We propose a simple approach for exempting small-land holdings from land taxation, which prevents adverse effects on poor households. Rwanda, Nicaragua, Vietnam, and Indonesia use already non-linear or progressive schemes for land or property taxes. Earmarking tax revenues for investments in pro-poor and local infrastructure and amenities further reduces adverse effects on the poor and increases acceptance. Benefits are directly channeled to taxpayers. Non-linear taxes might have, however, allocative effects which should be considered as well: Progressive land taxes (in land value) tend to induce fractionalization of land into smaller holdings; they could also increase smallholder and subsistence farmers relative to large-scale agricultural firms due to the tax advantage. Hence, land productivity might be affected as well. These allocative effects need to be balanced against the distributional effects, in particular in cases where smallholder farmer use the land less efficiently than larger firms.

We find a large potential for land taxes to become a relevant source of government revenue. Taxing half of land rents increases government budgets by about 15 percent for several of the case studies considered. The revenues from land taxation are a multiple of current tax revenues from property-related taxes; they also by far exceed costs of setting up registry. Nevertheless some challenges remain. Future research could help addressing compliance problems, which are pervasive in many countries. Additionally, the incidence of land taxes on land use dynamics is poorly understood. Theory predicts implications on land use under specific conditions. For example, land taxes are part of an optimal policy mix for energy-efficient urban form (Borck and Brueckner, 2016). But the empirical base remains weak – perhaps not surprisingly, given that existing land taxes have never been designed purposely to affect land use dynamics.

In the Addis Ababa convention, developing countries resolved to

make fiscal systems more broad, fair and efficient. Land taxes can be an important part of this. Our results implicate suggestions for sound policy. First, develop a "fit for purpose" land registration as suggested by the International Federation of Surveyors (FIG) and the World Bank, among others. Second, introduce a land tax, which corresponds to the capacity of the country's land administration system, using the available information on land value. Third, implement a tax threshold, which exempts subsistence farmers and relieves low-income households. Finally, use the additional tax revenue in a transparent and productive manner to increase acceptance of the tax and taxpayer morale.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.landusepol.2018.07.008.

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