The Political Economy of Carbon Pricing and Revenue Recycling in Peru

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Abstract

Even though recent research has produced compelling arguments in favor of carbon pricing, it remains a contentious issue in most developing countries. Based on expert interviews and detailed document analysis, we assess the possibilities and limitations of carbon pricing as a policy to jointly advance Peru's recently adopted climate change mitigation targets and advance socio-economic development. We draw parallels to the use of revenues from extractive industries, which are targeted to public investment but have been found to be ineffective in many instances. Finally, we discuss four key areas that would need to be addressed to advance carbon pricing. First, emphasizing and raising awareness for the co-benefits of carbon pricing. Second, reforming the power sector to increase the use of low-cost renewable sources. Third, assessing the distributional consequences of such policies and designing compensation systems. Fourth, increasing the capacity to effectively carry out public investment.

Keywords: Climate change, carbon pricing, mining, sustainable development, welfare diagnostics

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1. Introduction

Economic theory has frequently emphasized the importance of market-based policies, such as taxes and tradable permit schemes, to achieve environmental targets in a cost-efficient manner (Baumol and Oates 1988). Even though currently 40 (mostly higher-income) countries have introduced some form of a prices on greenhouse gas (GHG) emissions (World Bank and Ecofys 2016), carbon pricing in developing countries remains a sensitive issue. Frequently raised concerns include the fear that higher energy prices may slow down economic development and have adverse effects on the poorest segments of society (Jakob and Steckel 2014).

Recent literature has produced three important insights to allay these concerns. First, various studies suggest that emission pricing would likely result in progressive distributional outcomes. As it is mostly richer households who own e.g. cars and household appliances, they would account for the lion's share of the proceeds from a carbon tax (Sterner 2011). Second, emission pricing has been found to be economically beneficial for countries with large informal sectors, as the price signal is passed on to informal activities' energy use and is hence much harder to evade than taxes on income or labor (Markandya, González-Eguino, and Escapa 2013; Liu 2013). Third, it has been pointed out that the revenues from removing existing subsidies on fossil fuels or introducing carbon prices would generate substantial revenues that could be used to promote human development, e.g. by means in investments in basic infrastructure, and hence be particularly beneficial for poor people (Jakob et al. 2015, 2016).

During the last years Peru has put into place an array of energy- and climate-related policies (see Section 4.b for details), including a national climate change strategy and emission reduction targets (relative to a baseline) in its Intended Nationally Determined Contribution (INDC). However, none of these policies explicitly considers carbon pricing as a mitigation measure.

Based on 13 interviews (described in the Supplementary Information) carried out in Lima in May and June 2016 as well as detailed document analysis, this paper examines whether and to what extent carbon pricing might constitute a politically and institutionally feasible policy to jointly foster climate change mitigation and human development targets. The interviewed experts covered a broad range of expertise, including representatives of key ministries, civil society, academia, development cooperation and the private sector. For this reason, we deliberately refrained from using a standardized questionnaire and decided to resort to semi-structured interviews instead. Our analysis adopts a social welfare perspective and focuses on the question of whether carbon pricing revenues could be employed in a way that fosters human development objectives. Analyzing the system of so-called 'canons', which channel revenues from extractive industries (mining, as well as gas and oil extraction) to public investment in e.g. basic infrastructure (see Section 4.1), we aim to derive insights regarding the possibilities and potential obstacles for carbon pricing, in particular with regard to spending of the associated revenues.

Even though Peru is a comparatively small emitter, accounting for only 0.3% of global GHG emissions, understanding the political dynamics of carbon pricing in a developing country context can yield important insights to inform policy design in other countries. In addition, Latin America is often regarded as an example for other countries that aim at transitioning towards middle income status, for instance in Asia. Hence, successful steps towards low-carbon development in Latin America could strengthen the resolve in other regions to strengthen their climate policies (Edwards and Roberts 2015).

This paper proceeds as follows. Section 2 provides an overview of the relevant literature. Section 3 describes the socio-economic situation, energy use patterns and GHG emission trends. Section 4 summarizes existing policies governing natural resources and climate change, with a particular focus on emission reductions. Section 5 describes the analytical framework to analyze political and institutional constraints for the use of resource rents from extractive industries and discusses in how far these constraints can be expected to be relevant for the introduction of a carbon price. Section 6 outlines potential options to put carbon pricing into practice. Section 7 concludes.

2. Literature review

This study analyzes how carbon pricing, in combination with targeted use of the associated revenues, could contribute towards reconciling environmental and socio-economic objectives from an integrated sustainable development perspective. In this regard, it is closely related to the literature on multi-dimensional conceptions of human development (Alkire 2002) as well as multi-objective climate policy (Jakob and Steckel 2016). The most important challenges, advantages and implementation issues of carbon pricing have been extensively discussed in the literature and are summarized in e.g. Edenhofer et al. (2015). However, these insights have not yet been systematically applied to analyze climate change mitigation policies in Peru. Instead, most of the academic literature on climate change in Peru focuses on climate impacts and adaptation, in particular on problems related to melting glaciers and decreased water supply (Fraser 2012).

The idea of 'welfare diagnostics', which constitutes the analytical background for our analysis, is exposed in Jakob and Edenhofer (2014). The fundamental idea of this approach (discussed in more detail in Section 5.1), is to promote sustainable development by using market-based instruments to internalize environmental externalities and investing the associated public revenues into issues that are central to human well-being, such as health, education, and basic infrastructure. For instance, Fuss et al. (2016) and Jakob et al. (2016) demonstrate that revenues from natural resource rents and carbon pricing, respectively, could provide a substantial share of the funds required to close existing access gaps for basic infrastructure services, such as water, sanitation, or electricity.

To assess the feasibility of using carbon pricing revenues to promote human development, this paper aims at distilling key lessons from recent experiences with revenues from natural resource extraction. Several studies have examined the impacts of mining activities on human development and social conflicts resulting from the adverse impacts of extractive industries. Aragón and Rud (2013) show that the Yanacocha gold mine has raised the average living standards of the local population in Cajamarca, where the mine is located, as well as adjacent districts. However, Ticci and Escobal (2015) argue that mining has not produced linkages to other economic activities and emphasize the heterogeneity of development outcomes across urban and rural areas as well as areas with a long history of mining and new mining areas. Loayza and Rigolini (2016) present statistical evidence that districts in which mining operation takes place indeed display higher levels of consumption and lower poverty rates, but also more pronounced economic inequality. They also find that the canon minero, which distributes mining revenues across districts and regions (see Section 4.1), has no discernible influence on socio-economic development. Arellano-Yanguas (2011) attribute this outcome to the fact that efforts in the early 2000s to achieve more decentralization and assign greater responsibilities for the management of resource rents to sub-national governments have done little to ensure that revenues from extractive industries result in poverty reduction.

Mining has frequently been found to entail adverse effects that have sparked socio-environmental conflicts. Preciado Jeronimo et al. (2015) analyze how in Cajamarca gold mining reduces water availability for agricultural purposes, arguing that this competition has resulted in social conflict. Bebbington and Bury (2009) highlight institutional shortcomings regarding transparency and the equitable use of mining revenues, Hinojosa (2011) discusses the failure of the Peruvian government to design and implement policies to translate mining revenues into socio-economic development, and Jaskoski (2014) emphasizes the lack of stakeholder participation as important drivers of social conflict. A comprehensive first-hand account of citizens' concerns is compiled in a study commissioned by the mining company Yanacocha, which aims to identify best practices to improve community engagement (Kemp et al. 2013). The collected interviews suggest that people often suffer the effects of mining without receiving real, tangible benefits in return. According to Kemp et al. (2011) and Triscritti (2013), even though mining companies are increasingly trying to gain legitimacy for their operations by providing e.g. basic infrastructure, health and education for the local population, these efforts are often regarded as being insufficient and not well targeted to people's needs.

Very similar concerns have been brought forward regarding the adverse effects of oil and gas projects, related to the violation of indigenous rights and livelihoods as well as lacking stakeholder involvement (Finer et al. 2008; South Peru Panel 2015). In summary, the above evidence suggests that even though extractive industries have raised average incomes, they have at the same time undermined other development objectives and thus resulted in pronounced opposition by local populations.

3. Socio-economic data, energy use and emissions

This section first provides a brief overview of current socio-economic developments and the role of extractive industries in Peru. It then discusses the structure and development of Peru's energy use patterns and recent trends in GHG emissions.

3.1. Socio-economic situation

Peru's population amounts to about 31.4 mn (see Table 1). With a GDP of almost US$ 6'000 per capita (roughly US$ 11'800 if measured at purchasing power parity), Peru is classified as an upper middle income country. Over the last two decades, per-capita income has almost doubled, with low rates of unemployment of about 4% and steady inflation rates ranging from 1.5% to 3.7% during the last five years (World Bank 2016). This growth of economic activity has gone hand in hand with a decline in poverty and improved living conditions. Whereas in 2000 almost 17% of the population lived below the poverty line of US$ 1.90 per day, this figure now stands at roughly 3%. Likewise, life expectancy has increased by about 6.5 years since 1995, and child mortality dropped by more than two thirds. Nevertheless, more than 13% of the population do not have access to an improved water source, almost 24% lack access to improved sanitation, and almost 9% lack access to electricity. In addition, despite continuous reductions in economic inequality, the richest 10% of the population receive about one third of national income, whereas the poorest 10% only account for 1.6%.

Peru's economy is heavily dependent on extractive industries, in particular mining. In total, there are more than 30'000 mining claims, covering about 10% of the national territory (Bebbington and Bury 2009). In 2012, Peru was the world's second largest producer of silver and copper, and the sixth largest producer of gold. Minerals accounted for about 60% of export revenues, 15% of GDP, and 25% of tax revenues (KPMG 2013). Many interviewees regarded the country's heavy reliance on extractive industry as problematic and emphasized that diversifying the economy is one of the key challenges to avoid the 'middle-income trap'. A proposal to restructure the economy is included as one of the central pillars of the 'Plan Bicentenario', which outlines a long-term development plan for the period 2011-2021 (CEPLAN 2011). Likewise, civil society has repeatedly emphasized the importance of developing a vision for 'post-extractivist' alternatives to the current economic model.

[Table 1 here]

3.2. Energy use and emissions

Between 1990 and 2013, total energy consumption has more than doubled, with particularly steep increases from 2006 on (Figure 1a). Oil is still the dominant source of energy. Even though oil consumption has increased in absolute terms, its share in primary energy supply has dropped from almost 58% in 1990 to slightly above 45% in 2013. This development can mainly be attributed to sizable discoveries and exploitation of natural gas, which has replaced oil-fired power plants in the electricity sector and now accounts for almost 27% of primary energy use. For this reason, electricity is predominantly produced from hydropower and natural gas, which account for 54% and 40%, respectively. Despite a significant potential for low-cost solar and wind power, these renewable sources still only account for a negligible share of primary energy supply (see Section 5.3 for more details). According to BP (2016), proven natural gas reserves amount to roughly 33 times the current annual production (the so-called 'R/P ratio'). However, several interviewees have voiced concerns that in the face of increased exploitation, natural gas reserves might already be exhausted in the next 10 to 20 years.

Peru's oil production of about 113'000 barrels per day (i.e. about 0.1% of global production) covers slightly less than half of domestic demand (of about 243'000 barrels per day); that is, more than half of the consumed oil is imported. By contrast, natural gas production exceeds domestic consumption, 40% of production is exported as liquefied natural gas (LNG). For instance, the entire production of block 36 of the Camisea field, which is one of the country's largest producers of natural gas, is dedicated to export.

In parallel to rising energy consumption, total GHG emissions (i.e. from all gases and sectors) have almost doubled since 1990, with particularly strong growth of emissions from the industry, power, and transport sectors, which together account for slightly less than one third of total emissions. The largest source of emissions, accounting for more than 44% of the total, is land use, land use change, and forestry.[1] Per-capita GHG emissions in 2012 were 5.2 tCO_2-eq., about 20% below the global average of 6.6 tCO_2-eq. (CAIT 2014). In order to prevent an unabated increase of emissions, the government has adopted a range of policies which will be discussed in Section 0.

[Figure 1 here]

4. Policies related to natural resource rents and climate change

This section provides an overview of existing policies for the governance of natural resource endowments and the use of the associated public revenues. It then discusses energy- and climate-related policies. We also draw upon our stakeholder interviews to gain insight into the underlying motivations that have led to the adoption of these policies.

4.1. Natural resources

Under Peru's constitution, all natural resources belong the state. Exploitation of minerals, oil, and gas is carried out by domestic and foreign state-owned as well as private companies. Resource rents are appropriated via several mechanisms. First, companies pay income taxes of 30% of their net revenues (the tax rate will be reduced step by step to 26% in 2019). Second, mining and oil are charged royalties. For oil, royalties are negotiated on a case-by-case basis and amount to 15%-45% of the value of the extracted oil. For mining, royalty payments range from 1% to 3%, depending on the volume of annual sales net of operational costs. Finally, there are additional special mining taxes, which depend on the operating margin and are deductible from the income tax (Grupo Propuesta Ciudadana 2016b).

[1] No satisfactory explanation for the jump from 2005 to 2006 (such as an adjustment of the accounting method) could be obtained. However, the total emissions for 2010 of 158 $MtCO_2$-eq. in the CAIT (2014) data are rather close to the figure of 170.6 $MtCO_2$-eq. stated in Peru's national registry as reported in the country's INDC (Republic of Peru 2015).

Taxes and royalties are set and collected by the central government. About half of these revenues are distributed from the national budget to municipal and regional governments as well as public universities via different mechanisms. These include the so-called canons (canon minero, canon gasifero, canon petrolero), in addition to a scheme to redistribute mining royalties and a sustainable development fund fed by revenues from the Camisea gas field ('Focam'). As shown in Figure 2, 10% of the canons are allocated to the municipal government of the district of where a particular extractive activity is located, 25% to other municipal governments in the province, 40% to all municipal governments in the respective region, 20% to the regional government, and 5% to public universities in the region.[2]

The revenues that were collected from extractive industries and then redistributed peaked at more than US$ 3 bn in 2012 (see Figure 3). Due to declining commodity prices they dropped to about US$ 1.8 bn in 2015. Almost half of this amount (US$ 870 mn) came from mining, and more than one quarter from natural gas. These transfers from the national to sub-national governments are earmarked to be used for public investment projects, such as providing universal services benefiting local communities and carrying out maintenance works. As the current system incorporates central aspects of the proposal to combine resource rent taxation and infrastructure investment into a comprehensive approach to achieve sustainable development outlined in Section 5.a, it could serve as a blueprint for the use of revenues from carbon pricing. However, its effectiveness is undermined by various institutional and political factors, which will be discussed in Section 5.b.

[Figures 2 and 3 here]

[2] Sub-national governance in Peru is divided into 25 regions, which are subdivided into 194 provinces, which are again subdivided into 1'838 districts.

4.2. Climate-related policies

In the international climate policy arena, Peru has been aligned with the Independent Association of Latin America and the Caribbean (AILAC), which includes inter alia Chile, Colombia and Costa Rica. By accepting that not only industrialized, but also developing countries need to reduce their emissions, AILAC countries are generally regarded as assuming a progressive role, trying to bridge the traditional North-South divide in international climate negotiations. Furthermore, AILAC members have adopted a range of market-friendly policies (such as participation in free trade agreements) and are favorable towards market-based policy instruments (Edwards and Roberts 2015).

In its INDC submitted to the United Nations Framework Convention on Climate Change (UNFCCC), Peru's emission reduction targets are defined with respect to the business-as-usual scenario (BAU), which projects an increase of total greenhouse gas emissions of 75% by 2030 with respect to the base year 2010 (Republic of Peru 2015). The Peruvian government envisages unconditional emission reductions of 20% below the BAU, and 30% conditional on support from the international community, which would still amount to a substantial increase from the current level, but could nonetheless constitute an entry point for more ambitious future policies. 60% of these reductions are to be achieved in the land use, land use change, and forestry sector. The INDC does not spell out by which measures emission reductions shall be achieved. According to interviewees, waste management, renewable energy, and transport are priority areas in which first pilot projects have been initiated. For land use, measures to promote sustainable agricultural practices are currently in a preparatory stage.

The large majority of interview partners stated that Peru's exposure to climate impacts is a major concern for the population and policy makers and has been a major driving force for the adoption of climate measures. An influential report conducted by Peru's Central Bank has put economic losses of a 2°C temperature increase by 2050 at 20% of GDP (Vargas 2009). In addition, the fact that the 20th conference of the parties to the UNFCCC (COP20) was held in Lima is widely seen to have raised awareness for the importance of climate change and put the issue on the political agenda.

Nevertheless, it could well be argued that with 0.3% of global emissions, mitigation policies in Peru will only have a negligible effect on the global climate. According to the interviews, the Peruvian government aims at playing a constructive role in international climate negotiations in order to incentivize other countries to ratchet up their commitments. The most important motivation to adopt climate measures, however, probably lies in Peru's aspiration to become a member of the OECD, which requires adherence to some form of environmental standards and in particular green fiscal reforms. In addition, it was also stated that Peru would like to be perceived as a front-runner in the region. Chile and Mexico, who have both implemented some form of carbon pricing (and who are among the most developed countries in Latin America and the only OECD members in this region), were mentioned as important role models, suggesting they are triggering policy diffusion across jurisdictions.

Increased energy security and reduced local air pollution have been found to be important motivations to put climate policy on the political agenda in other countries, such as India (Dubash 2013) and Vietnam (Zimmer, Jakob, and Steckel 2015). However, according to our interviews, co-benefits do not seem to play an important role in the Peruvian discussion. The same is true of the possibility to raise revenues by means of carbon pricing. In a similar vein, financing from the international community was not seen as a major motivation, even though Peru received climate finance of about US$ 450 mn per year, predominantly from the Inter-American Development Bank and the Development Bank of Latin America (GFLAC 2015). In this context, several interviewees stated that climate finance would be a welcome add-on, but that as an upper middle income country, Peru may have difficulties to attract funding, such that measures which would also be viable without external funding should be given priority.

Hence, another important motivation for emission reductions (at least below the business-as-usual level) is the prospect of ‘no regret’ mitigation by means of low-cost renewable energy. Currently power companies are obligated to source 5% of their power generation from ‘non-traditional’ renewable sources, including solar, wind, biomass and small hydro. Remuneration is allotted by an annual auction (‘subasta’) to the lowest bidders. According to information provided by one interviewee, the most recent subasta included bids to supply wind and solar power for as little as 3.8 USc/kWh and 4.8 USc/kWh, respectively. Even though renewable energy at such prices would be competitive, it cannot be sold on the open market. This is due to the fact that the regulating entity ONSERIGMIN, which determines generation capacities and electricity tariffs, lacks the capability to effectively balance the power grid in face of the intermittency of wind and solar power.

In contrast to numerous other countries in Latin America in which fossil fuel consumption is subsidized, Peru has reformed its fuel pricing policies and levies taxes of between 7 USc/l and 9 USc/l for transport fuels according to their impacts on public health (as measured by the ‘indice de nocividad’).[3] At the time of writing, the average sales price for diesel was 0.82 US$/l and for gasoline 1.02 US$/l (GlobalPetrolPrices.com 2016). A plausible reason behind this is that fossil fuel subsidies are more likely to occur in exporting countries, where they are delivered by price controls and hence do not show up in the public budget, whereas the Peruvian government would be required to levy taxes in order to finance such support schemes.

[3] However, natural gas receives implicit subsidies, as geospatial data on already explored areas are provided to companies free of charge (thereby saving them the costs of exploration), and low-income household are granted gas connections free of charge as well as reduced rates for LNG (Gestion 2015).

For cost-benefit analysis applied to public investment projects, an implicit carbon price of US$ 6.39 is applied to take into account the social costs of carbon. According to one interviewee, extending this accounting price to transport fuels is being discussed within the finance ministry, which is regarded as being the most influential government department (the environment ministry, in turn, was only established in 2008 and is perceived as having lower standing). Peru has also signed the UN Secretary-General's Climate Leadership Summit declaration in favor of carbon pricing (World Bank 2014) and is a member of the World Bank's Partnership for Market Readiness (PMR). However, in its most recent PMR communication, the Peruvian government discards carbon pricing as an option, due to the country's large informal sector and the associated costs resulting for the private sector (Government of Peru 2016).

Peru's National Climate Change Strategy (Ministerio del Ambiente 2014) outlines the ambition of sustainable low-carbon development and lists priorities and institutional responsibilities for mitigation and adaptation, but does not spell out quantitative targets. In order to coordinate the relevant twelve ministries, the 'Comité de Trabajo Interinstitucional de Cambio Climático' has been established. Even though it has been judged to be largely ineffective in this task, interviewees pointed out that it has contributed towards establishing a platform for discussion and the development of a joint vision of climate policy between different ministries.

Between 2001 and 2014, on average roughly 120'000 hectares of forest was cut down per year. The National Strategy on Forests and Climate Change aims at net zero deforestation by 2021, thereby protecting 3.5 m hectares of forest until 2030 (Ministerio del Ambiente 2016)[4]. The World Bank's Clean Investment Fund (CIF 2016) has developed an investment plan to provide financial support of US$ 50 mn for Peru's policies to reduce land use emissions from deforestation and forest degradation (REDD+). According to Robiglio et al. (2014), local-level

[4] Note that the figure of 54 mn hectares stated in some official documents is incorrect, as it confounds annual with total deforestation.

initiatives have made significant advances, but national level efforts continue to suffer from a lack of coordination between ministries, insufficient understanding of deforestation agents and drivers, as well as lacking integration of REDD+ policies into national and regional plans.

5. Can carbon pricing foster sustainable development in Peru?

This section first explains the theoretical underpinning of using natural resource rents and revenues from carbon pricing to invest into sustainable socio-economic development. It then proceeds to review experiences with the use of natural resource rents accruing from mining and fossil fuel extraction. Finally, it discusses which of the problems encountered in this domain would likely also be relevant for carbon pricing.

5.1. Welfare diagnostics

Jakob and Edenhofer (2014) outline a three-stage process to achieve a balance between short-term exigencies of socio-economic development and long-term considerations to safeguard environmental integrity. This approach, labelled 'welfare diagnostics', requires the following: First, policy objectives, to be understood as relevant dimensions of social welfare (e.g. consumption possibilities and their distribution, or capabilities to realize people's respective goals in life), need to be identified, and the trade-offs between them need to be assessed. As social welfare crucially depends on normative parameters, no unambiguous definition of how different factors should be taken into account can be derived. However, it seems reasonable to assume that a large share of the population can agree to abolishing grave forms of human deprivation (such as absolute poverty, or lack of access to basic infrastructure) as well as safeguarding a certain level of environmental integrity necessary for the functioning of social systems. These requirements can be operationalized by defining minimum thresholds for environmental quality and human development. The policies that ensure that none of these thresholds is violated constitute the set of feasible public policies. The United Nations' Sustainable Development Goals could be regarded as one instance of such a feasible set.

Second, fiscal policies (taxes or auctioned tradable permits for natural resources and environmental externalities) can be employed to ensure that limits on natural resource use and environmental degradation are respected. These policy instruments convert the associated scarcity rents into revenues for the public budget.

Third, these revenues can then be invested in ways that promote human development, for instance by fostering health, education, social security, or access to water, sanitation and electricity. In this vein, Segal (2010) demonstrates that redistributing natural resource rents within countries could slash global poverty in half, Fuss et al. (2016) show that resource rents could make a significant contribution towards achieving universal access to basic infrastructure, and Jakob et al. (2015, 2016) obtain similar results for revenues from fossil fuel subsidy reform and carbon pricing that can be expected under a scenario consistent with the 2°C target, respectively.

Even though these analyses provide insightful information on the theoretical potential of resource rents and carbon pricing revenues to promote human development, they are unable to appropriately account for political and institutional factors and hence provide little guidance as to practical implementation. As these barriers are highly context-specific, case studies are an appropriate way to identify factors that determine whether revenues from natural resource extraction and emission pricing can be employed to improve human development outcomes. Due to the fact that Peru already channels revenues from extractive industries to infrastructure via the canons (as described in Section 4.1), very much in line with the approach described above, it is an interesting case to analyze.

In particular, we build on experiences from extractive industries to identify potential barriers for the introduction of a carbon price by analyzing each of the three stages identified above, namely (i) definition of thresholds, (ii) generation of revenues, and (iii) investments to promote sustainable socio-economic development. From this basis, we discuss which climate change mitigation policies could be realized within the existing institutional and political constraints.

5.2. Natural resource rents

Regarding the definition of thresholds, the literature reviewed in Section 2 suggests that in Peru exploitation of natural resources has in numerous instances resulted in adverse outcomes for poor, marginalized segments of the population. Such outcomes seem unlikely to be in line with minimum threshold for social welfare. In this regard, it seems especially problematic that environmental impact assessments of such projects is not performed by the environment ministry, but by the ministry of energy and mines, whose primary interest consists in furthering resource extraction instead of protecting livelihoods and environmental quality (DAR 2015a). Moreover, it has repeatedly been criticized that the right of prior consultation for indigenous and native peoples ('consulta previa', as stated in International Labour Organization Convention 169) is reduced to a mere provision of information on planned projects, but does not lend a say in the decision to affected communities (Sanborn and Paredes 2014). In this regard, government and the media are perceived as taking a dedicated pro-mining stance, depicting anti-mining activists as terrorists.

Several interview partners confirmed that dissatisfaction with mining is widespread in the Peruvian population. For instance, the government frequently allots mining claims that either conflict with formal land rights, or which are located on traditional land held by indigenous communities without formal tenure. In addition, mining is commonly regarded as negatively impacting the supply and quantity of scarce water resources even across territorial boundaries, e.g. by drawing from groundwater reserves or polluting lakes and rivers (De Echave and Diez 2013). As a result, neighboring rural populations, often highly dependent on agriculture, are threatened by deteriorating living conditions. As stated by one interviewee, these conflicts revolve around the central question of "who owns the land".

In addition, extractive industries have been reported to undermine important non-material values, such as traditional lifestyles and harmony with nature. The case of Máxima Acuña, who in 2016 was awarded the Goldman Environmental Prize for her fight to preserve Laguna Azul in Cajamarca from being destroyed by the envisaged Conga Mine, is a salient example of this type of conflict. In its latest report, the public 'Ombudsperson' lists 214 ongoing social conflicts, out of which 144 (i.e. more than two thirds) were classified as socio-environmental (Defensoría del Pueblo 2017). It has been estimated that as a result of these conflicts, more than US$ 20 bln of planned investment in mining are currently being held up (El Economista 2015).

With regard to the appropriation of resource rents, Peru's tax system is commonly regarded as functioning reasonably well, and the government levies inter alia value-added taxes, property taxes, and corporate taxes. Peru was the first country in Latin America to become a member of the Extractive Industries Transparency Initiative (EITI). Independent evaluations have arrived at rather favorable assessments regarding the conduct of the involved entities (DAR 2015b). However, it appears that a higher share of resource rents could be collected by raising companies' taxes and royalties. A back-of-the-envelope calculation suggests that currently only 15-20% of resource rents are actually appropriated by the state[5], with the remainder accruing to firms to cover their return on investment and risk premium.

Finally, investing revenues from extractive industries in ways that turn out beneficial for human development has been identified as a major challenge by practically all interview partners. In several conversations, it has been pointed out that decentralization has shifted responsibilities to local governments without providing the resources needed to effectively carry out these tasks

[5] For instance, in 2015, the canon minero amounted to about USD 870 mln, and total mineral rents to about USD 10 bn (World Bank 2016). As roughly half of firms' payments go to the canon, about USD 1.7 bn, or 17% of the total rent, were appropriated.

as regional and municipal governments often do not have the technical and administrative capacities to effectively carry out investment. For instance, one interview partner stated that mining regions were “flooded with money, but don’t succeed in creating good human development outcomes”. Furthermore, except lowering financial commitments, the national government has little leeway to hold local governments accountable. This has resulted in increased corruption and pork-barrel spending to please selected constituencies without ensuring sufficient involvement of the local population. In the words of one interviewee, canon monies are predominantly used to “buy votes instead of providing public goods”. This assertion is corroborated by the study by Loayza and Rigolini (2016), who find no significantly better development outcomes for areas receiving higher payments from the canon minero. Besides these concerns, restricting the use of mining revenues for physical infrastructure has been described as having an overly narrow focus by several interview partners, who expressed a preference to also include “social infrastructure”, such as health and education.

Whether public revenues can be translated into gains in terms of human development is not only crucial for the management of natural resource rents, but also for carbon pricing, as will be discussed below.

5.3. Possibilities for and limitations of carbon pricing

As GHG emissions are a global externality, defining a sustainable threshold for GHG emissions for individual countries is far from straightforward. The emission projections developed in preparation of Peru’s INDC include one scenario, called ‘required by science’. This scenario indicates what is deemed to be Peru’s fair share of emission reductions to achieve the 2°C temperature target (Libelula and E3G 2014). Under this scenario, emissions would need to start to decline immediately and reach roughly one third of their current level in 2050. Clearly, Peru's INDC, which envisages a substantial emission increase even in the most ambitious case, is not in line with such a development.

Climate policies do not only need to ensure that environmental thresholds are respected, but also take into account how they affect development outcomes, such as poverty and inequality (Jakob et al. 2014). Unlike the case of extractive industries, where adverse effects are geographically concentrated, the economic costs of a carbon price would be wide-spread among the entire population. Numerous studies assessing the distributional implications of carbon pricing have been carried out for developing countries that have considered such policies (e.g. Coxhead, Wattanakuljarus, and Nguyen 2013 for Vietnam). Similar analyses, which would provide a valuable source of information for policy makers to identify affected populations and economic sectors and develop compensation schemes, are not available for Peru.

With regard to levying a carbon price, an upstream carbon tax on fossil fuels would likely constitute an effective policy to put a price on emissions from industry and energy use. The fact that more than two-thirds of non-agricultural employment in Peru is informal (ILO 2014) would in this case not constitute a barrier to carbon pricing. Rather, such a carbon tax would broaden the tax base by covering fossil energy use in hitherto untaxed activities, which could improve the efficiency of the tax system (Liu 2013; Markandya, González-Eguino, and Escapa 2013). Even though Peru has made advances in measuring forest carbon and establishing a registry of REDD activities, establishing a price on emissions from land use, land use change and forestry, which currently constitute the main sources of emissions, would likely be hampered by high transaction costs related to e monitoring, reporting, and verification.

Earmarking tax revenues for dedicated investments can increase the political acceptance of a tax (Kallbekken, Kroll, and Cherry 2011). Even though this approach is not common in Peru (with the exception of resource rents), it would theoretically be feasible, and currently a part of the fuel tax is already earmarked for forest restoration. Earmarking revenues for investments that provide tangible benefits for the poorest segments of society, such as healthcare, education, and basic infrastructure, would be a way to increase public support for market-based climate mitigation measures. Furthermore, firms are allowed to contribute a share of the taxes they owe to the state in kind by carrying out public works ('Obras por Impuestos'), which could be extended to carbon taxes in order to increase buy-in from the private sector (SPDA 2015). However, judging from the experience with the canons used to redistribute natural resource revenues, investing revenues from carbon pricing could be a highly challenging endeavor under the existing political and institutional constraints. Alternative measures include providing direct cash transfers or lowering other taxes, e.g. income or value-added taxes, in a comprehensive package of green fiscal reform (Edenhofer et al. 2015; IMF 2013). Yet, many interviewees judged these alternatives as problematic. As a sizable fraction of the economically most vulnerable population, such as rural smallholders, are not easily identified, do not have bank accounts, or only pay little (or no) taxes, the received compensation would possibly be insufficient to undo the detrimental income effects from higher prices for fossil energy carriers.

6. Putting carbon pricing into practice

The above analysis clearly shows that carbon pricing is unlikely to be a panacea for climate change mitigation in Peru. However, it could be an important element in a balanced portfolio of emission reduction policies.

There appears to be substantial untapped potential to emphasize the co-benefits of climate policies. These include economic benefits of increasing the tax base, synergies with climate change adaptation measures, as well as reduced air pollution and traffic jams in cities, which many interviewees have described as serious impediments for the quality of life. Recent experiences suggest that energy market reforms could be successfully put into place in combination with substitutes for affected activities, such as increased provision of public transport (IMF 2013). Moreover, including the social costs of local air pollution, which have frequently been found to be even higher than climate damages (Nemet, Holloway, and Meier 2010) and have directly visible short-term impacts, in the accounting price for public investment in addition to the existing shadow price for GHG emissions would provide a powerful incentive to accelerate the transition to clean energy technologies. Furthermore, reforms of the power sector that would allow low-cost electricity from renewable sources on the open market could provide an option to achieve no-regret emission reductions while at the same time slowing down the projected decline of natural gas reserves.

With regard to policy design, there is no compelling reason why an upstream carbon tax applied to fossil fuels at the point of extraction or import should not be institutionally feasible. The fact that Peru already taxes transport fuels and applies a non-negligible shadow price in cost-benefit calculations for public investment suggests that carbon pricing could be extended to other economic sectors – a position that has been vindicated by at least some interview partners. In this context, it has also been pointed out that such an extension would need to occur gradually, for instance by first applying a carbon price to selected transport fuels (e.g. diesel) and then broadening the scope of coverage. Comprehensive studies on the distributional impacts of carbon pricing, which could be carried out by the Ministry of Economy and Finance and supported by bi- or multilateral donor organizations, would help to devise compensation scheme to prevent adverse development outcomes.

Recycling the revenues from a carbon price, either in the form of lowering other taxes, direct cash transfers, or targeted public investment, has turned out to be a major bottleneck. Potential uses of carbon pricing revenues suggested by interviewees include funding insurance schemes against the climate risks, or supporting energy efficiency measures. Furthermore, strengthening the capacities of local and regional administrations, perhaps with assistance from the international community, could contribute towards revenues being employed in a way that effectively promotes human well-being. The proposition advanced by one interview partner to establish a set of indicators which would enable the government to perform ex-post assessments of how infrastructure investments have advanced development goals seems a promising way towards evidence-based policy-making in this area. In addition, civil society involvement appears to be a critical aspect to guarantee for proper definition of spending needs and monitoring of investment activity (see Hochstetler 2012). Shortly after assuming office, Peru's president, Pedro Pablo Kuczynski, announced that avoiding social conflicts will be a major focus of his presidency (El Comercio 2016). This can be regarded as an indication that civil society involvement in public policy making, which had been frequently neglected by previous governments, could play a more prominent role in the future. A related approach suggested by another interview partner consists in disbursing carbon pricing revenues via a fund jointly managed by municipalities, communities and firms to ensure buy-in by these key actors.

A further caveat is that carbon pricing appears to be an unlikely candidate to reduce emissions from land use, land use change, and forestry (which is still the largest source of GHG emissions in Peru), due to high transaction costs and difficulties related to monitoring, reporting, and verification of emissions. Nevertheless, results-based payments to reduce deforestation below might be a welcome opportunity to attract funding from international sources, such as the Green Climate Fund. In 2014, Norway pledged US$ 300 mn to reduce deforestation in Peru, of which the first US$ 5 mn have been made available in 2015 during the COP21 meeting (Ministerio del Ambiente 2015). Extending the scope of such results-based financing would impose a 'shadow price' on land use emissions, as every generated unit of emissions incurs the opportunity costs of foregone payment (Steckel et al. 2017). Advances in this direction would not only promote cost-efficient mitigation of land-use emissions, but might also have wideranging implications for the build-up of capacities and institutions as well as establishing trust for deepening international cooperation by means of climate finance mechanisms that could have important long-term benefits for forest protection (Birdsall and Busch 2014). In addition, as pointed out by one interview partner, enforcement of already existing laws could reduce emissions from deforestation by up to 20% (see also DAR 2014). In this context, cross-country evidence highlights the importance of land tenure and forest property rights to provide incentives for conservation (Robinson, Holland, and Naughton-Treves 2014).

7. Conclusions

Our results indicate that four main areas would need to be addressed to effectively put carbon pricing into practice. First, increased emphasis of the co-benefits of carbon pricing (e.g. economic efficiency, reduced air pollution and less congestion in urban areas) could foster public support from various segments of society. Second, power market reforms would permit emission reductions at low (or perhaps even negative) costs and hence reduce the cost burden and the carbon price for other economic sectors. Third, a thorough understanding of the distributional effects of carbon pricing could prevent adverse development outcomes and would hence help increase its political feasibility. Fourth, strengthening administrative and institutional capacities could help to ensure that public investment is carried out effectively. In addition, results-based payments to reward emission reductions from land use, land use change and forestry could establish a shadow price in this sector and contribute to building up institutions and trust. In any case, it seems likely that reforms can only be carried out successfully if they are phased in gradually and in the right sequence (Meckling et al. 2015).

Besides these country-specific considerations, this paper has highlighted the importance of political and institutional factors from the perspective of multiple policy objectives (Staub-Kaminski et al. 2014). As short-term concerns about economic growth frequently trump long-term sustainability concerns, climate policies are most likely to be implemented and enforced if they contribute to other policy objectives, such as consolidating the public budget, increasing energy security, reducing local air pollution or expanding access to public transport.

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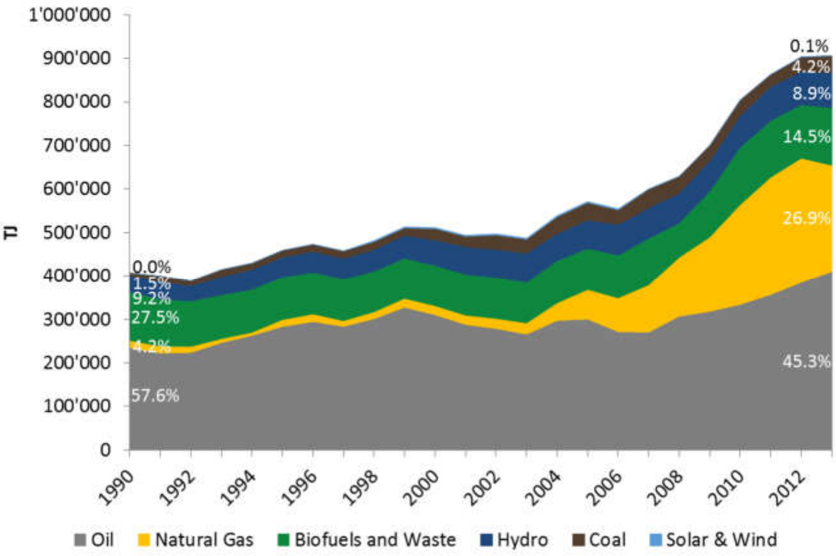
Tables and Figures

	1995	2000	2005	2010	2015
Population (mln)	24,0	25,9	27,6	29,4	31,4
GDP/cap (constant 2010 US$)	3140,0	3310,0	3830,4	5021,2	5934,5
GDP/cap, PPP (constant 2011 international US$)	6226,2	6563,3	7595,3	9956,6	11767,5
GDP growth (annual %)	7,4	2,7	6,3	8,3	3,3
Poverty headcount ratio ($1.90/day, 2011 PPP) (%)	..	16,7	14,2	4,7	3,1*
Life expectancy (years)	68,0	70,5	72,5	73,6	74,5*
Infant Mortality (per 1'000 live births)	42,5	29,6	21,3	16,3	13,1
Income share highest 10%	..	38,5	40,0	34,8	33,0*
Income share lowest 10%	..	1,1	1,2	1,5	1,6*
GINI index	..	50,8	51,8	46,2	44,1*
Access electricity (%)	..	72,9	..	85,0	91,2**
Access sanitation (%)	58,0	62,9	67,6	72,0	76,2
Access water (%)	77,1	79,8	82,3	84,6	86,7

*Table 1: Selected socio-economic indicators for Peru, 1995-2015. *= Data for 2014, **= Data for 2012. Data Source: World Bank (2016)*



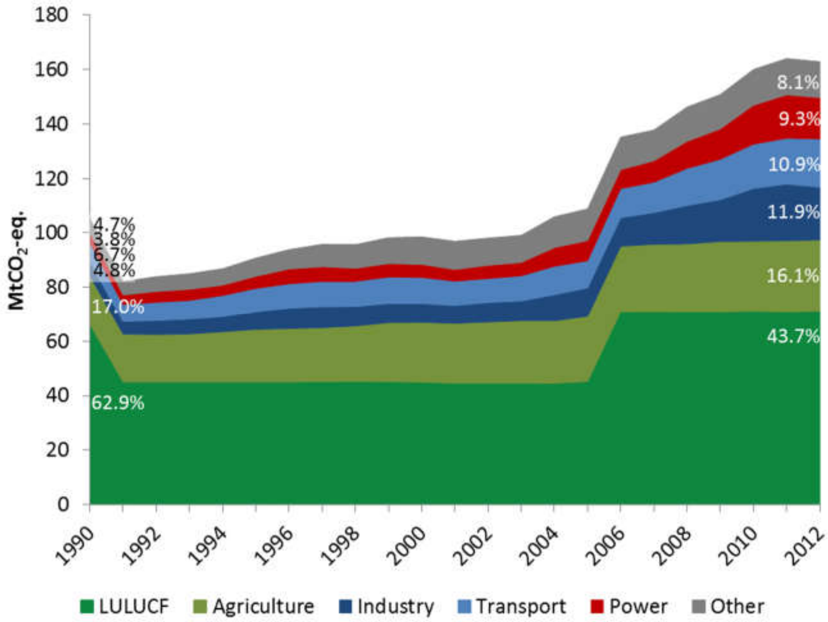


Figure 1: Primary energy supply by energy carrier (panel a) and GHG emissions by sector (panel b) over time in Peru. Data source: IEA (2015) and CAIT (2014).

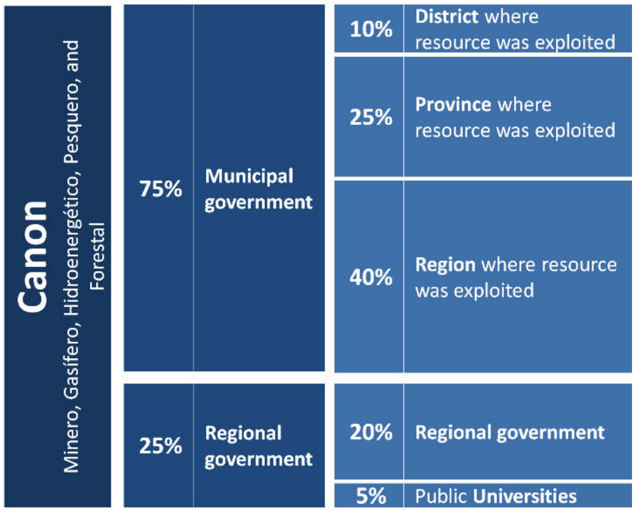


Figure 2: Distribution of revenues from extractive industries via different canons. Own depiction based on data from Aresti (2016).

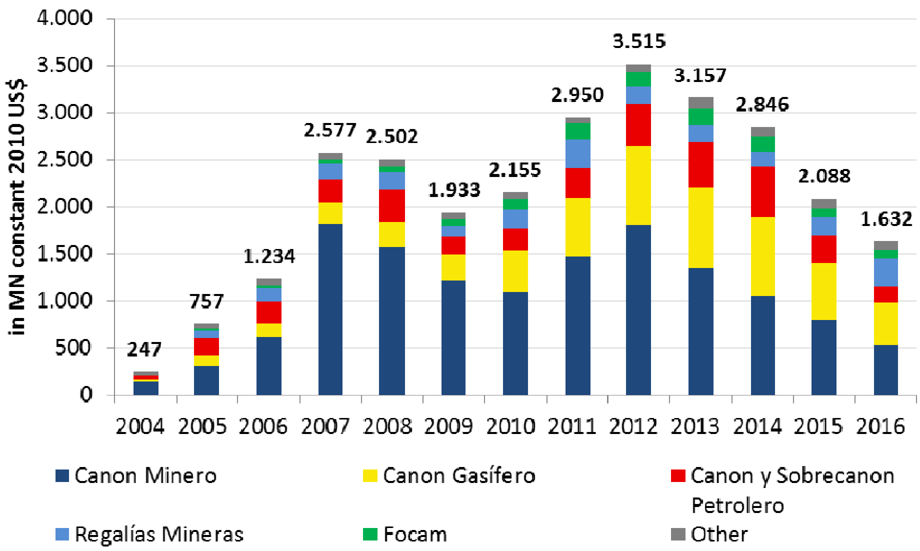


Figure 3: Revenues from extractive industries which are redistributed to regional and municipal governments via canons and similar schemes. Data source: Ministerio de Economía y Finanzas (2017).

805 **Supplementary Online Information: List of interview partners**

Unless otherwise noted, the Interviews were carried out in May and June 2016 in Lima in Spanish on a face-to-face basis. Quotes provided in the main text of the paper were translated into English by the author. More information on the design of the semi-structured interview questions is included in the supplementary online material.

Interviewee	Affiliation	Date
Silke Spohn	Gesellschaft für Internationale Zusammenarbeit (GIZ), §	May 18, 2016
Andrea Staudhammer	Gesellschaft für Internationale Zusammenarbeit (GIZ), §	May 24, 2016
Fernando León Morales	Gesellschaft für Internationale Zusammenarbeit (GIZ)	May 24, 2016
Suyana Huanari, Claudia Ramírez	Derecho, Ambiente y Recursos Naturales (DAR)	May 31, 2016
Miguel Ángel Gómez Ríos	Ministerio de Economia y Finanzas	June 1, 2016
Daniella Rough	Ministerio de Energía y Minas, *	June 1, 2016
Eva Tempelmann	Independent journalist, §	June 6, 2016
Carlos Trinidad	Sociedad Peruana De Derecho Ambiental (SPDA)	June 7, 2016
Javier Roca	Ministerio de Economia y Finanzas	June 7, 2016
Yuri Landa	Universidad de Lima	June 7, 2016
María Elena Guitierrez	Libelula	June 9, 2016
Remy Balarezo	Universidad de Piura	June 9, 2016
Mattes Tempelmann	Red Muqui, §, #	August 25, 2016

Table A 1: List of interview partners.

*: Interview carried out in English.

§: Interview carried out in German.

#: Interview carried out via telephone.

Supplementary Online Information: Example of interview questions

We carried out semi-structured interviews of 45-60 minutes with stakeholders from policy, civil society, academia and the private sector. For each interview, a set of questions was prepared in accordance with the interviewee's professional background. For this reason, different interview partners were in general asked different questions. An example of questions being asked during such an interview is listed below. We took care to offer the possibility to deviate from the prepared questions in any occasion in which interviewees had relevant information that we had not anticipated.

Interview questions:

1. General

- What are in your view the most pressing issues Peru faces at the moment?

- What are in your view the most important issues related to the environment and climate policy?

- Do you think the upcoming elections will have a significant impact on Peru's environmental policies?

2. *Extractives industries*

- How are claims for mining and exploitation of oil and gas allotted?

- What are the main concerns regarding extractive industries?

- Why and how have these concerns resulted in socio-environmental conflicts?

- How are public revenues from extractive industries managed?
- What would be the main needs where to invest these revenues?
- What kind of reforms of the canons would be desirable? Which of these reforms seem realistic?

3. Climate Policy

- What are the main reason for Peru to reduce emissions?
- What is the role of co-benefits (clean air, energy security etc.) in the public discussion?
- Which areas offer the highest potential for cost-effective emission reductions?
- Which measures are envisaged to realize Peru‘s emission reduction targets?
- What are the costs of emission reductions, and who how should they be distributed?
- What kind of support from the international community is required/expected?
- Who are the main proponents and opponents of climate policy, and what is the balance of power between them?
- How are market-based policy instruments regarded in the political arena, and what could be their legal basis?

4. Carbon Pricing

- Do you think carbon pricing would be a feasible option to reach national emission targets?
- What would a carbon price of 10, 20, 30 US$/tCO2 mean for the average Peruvian?

- What would be the most appropriate use for revenues? Reduction of other taxes, or targeted public spending on e.g. social programs?
- Who would promote and who would resist a carbon price?
- What could be done to make a carbon price politically feasible?
- What would need to be done before introducing a carbon price?
- What problems would you expect, and how could they be circumvented?
- What is the possibility for results-based payments to reduce deforestation?
- What is the interplay with other policies, and which coordination is necessary?