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EXTRACTIVE INDUSTRIES AND LOCAL DEVELOPMENT IN THE PERUVIAN HIGHLANDS: SOCIO-ECONOMIC IMPACTS OF THE MID-1990S MINING BOOM

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Abstract

Since the late Nineties, the mining sector in Peru has been experiencing a protracted period of rapid growth. This paper investigates local impacts of the mining boom on migration, on access to basic services, on labour market and on occupational distribution across sectors. By applying propensity score matching technique, mining and non-mining districts are compared. The results show that recent mining expansion has encouraged migration inflows to mining districts and affected the sectoral composition of the labor force in these areas. However, despite the great expectations and the new institutional and legislative settings, the mining growth has not produced a multiplicative effect on non-mining and non-agricultural activities and did not boost a process of economic diversification towards non-primary sector. Finally, the analysis shows a significant heterogeneity in impacts on labour opportunities and on access to basic services across rural and urban areas, and between districts with a long history of mining exploitation and new mining areas.

Keywords

Extractive industry, Peru, local development.

1. Introduction[*]

Throughout its long history of mining exploitation, Peru did not manage to transform its enormous mineral wealth into a sustained process of economic and human development. In the Nineties, however, the country promoted a set of economic and institutional reforms that, in combination with a boom in commodity prices, led to a sustained expansion of mining activities and fed renewed hopes in the pro-development role of this sector. The mining sector is now one of the fastest growing sectors in Peru and this boom of mining activities has occurred in an institutional context that should encourage a positive interaction of mines with local populations. Environmental regulation and monitoring have become more restrictive, while the government, national and international NGOs and organizations exert constant pressure on mining enterprises to apply socially responsible policies and participatory approaches in their relationships with local communities. Finally, the current fiscal legislation provides for redistributive mechanisms that should prioritize those areas more exposed to potential negative effects of mining operations. However, despite this promising context, the mining industry has also faced a state of growing unrest and protests from local interest groups.

The perceptions and expectations of different actors are a key factor for the understanding of this climate of hostility, but a starting point to interpret local populations' reactions can be provided by an evaluation of the impacts of mining activities on their living conditions.

This paper sheds some light on the impacts of the mining boom in the decade up to 2007 on populations living in mining areas of the Highlands, the Peruvian region that is most affected by the proliferation of mining operations. The paper concentrates on three developmental dimensions. The first concerns average impacts on housing conditions and access to basic services. In particular, the paper analyzes whether the recent wave of mining investments is associated with better access to public services such as water, electricity and a sewage system and to better housing quality. The second set of questions relates to demographic trends and to migration flows towards mining areas: do mining districts attract migration flows? Do they offset outflows of migrants? This leads to the third set of questions, which concern the impact of mining growth on local labour and business opportunities, on sectoral composition of the labour force and on return to agriculture activities.

Finally, the study analyses the heterogeneity of impacts across different areas. Since the effects of mining operations can depend also on different initial characteristics and conditions, we carry out a separate analysis for urban and rural areas and for new and old mining areas. In this way, we are able to evaluate whether mining impacts are homogenously distributed or have contributed to widen the rural-urban gap, and whether the capacity of a territory to exploit potential benefits of new mining investments depends on its "experience" with mining activities.

The paper is organized as follows. Section 2 provides a brief overview of the debate on the role of mineral resource wealth for promoting economic development and Section 3 presents the recent changes in the history of the Peruvian mining sector. Section 4 develops a simple conceptual framework to show that the impacts of mining growth on local populations are theoretically ambiguous. Section 5 provides a brief description of data sources and presents the methodology we apply for evaluating impacts and exploring differences in impacts. Section 6 explains the adopted classification of mining areas. Section 7 and 8 discusses the main results and Section 9 summarizes the key findings and offers some conclusions.

[*] I thank Daniel Calvelo, Mary Luz Chávez, José De Echave, Javier Escobal, Manuel Glave, Juana Kuramoto, José Carlos Orihuela, Jorge Tuesta and Eduardo Zegarra for their clarifications about many aspects of the impact of the mining sector on local communities and for providing me with useful suggestions, material and data. I am also grateful to the Robert Schuman Centre for Advanced Studies at the European University Institute for the post-doctoral fellowship which funded my research. The usual disclaimers apply.

2. Exploiting mining resources: a risky opportunity that cannot be renounced

The debate on the relationship between mining, growth and poverty is still open. Natural resources are regarded both as a blessing and as a curse. Mineral resources are a form of wealth and, as such, their extraction might contribute to human and economic development. Resource abundance can attract inflows of mining investments and help technological transfer and innovative capacity (Wright 1999); the mining industry can provide tax revenues and create new jobs, while mining exports represent a rich source of foreign currency. It has been observed, for example, that some advanced economies (e.g. Australia and Canada), based their development process of natural resource extraction[1] (Adelman and Morris 1988, De Ferranti et al. 2001). At the same time, extraction of raw commodities poses great developmental challenges: incentives for corruption and rent-seeking activities, the so-called “Dutch Disease” and crowding out of other sectors (Auty 1993 and 2001, Gylfason 2001, Matsuyama 1992), exposure to commodity price volatility (Ross 2001; Blattman et al. 2007; Hausmann and Rigobon 2003; Poelhekke and van der Ploeg 2007) and negative health and environmental externalities (Pegg 2006, Bebbington et al 2008). One of the most controversial issues is the impact on local communities. On the one hand, populations living close to mines are the most exposed to water, air and soil pollution of the mining industry; they are likely to compete with mines for the governance of the territory and for water and land use; they set big hopes and keep a watchful eye on mining spillovers and on the distribution of mineral revenues; they can experience social and cultural repercussions from inflows of new workers and changes in local power relationships. On the other hand, local communities are also more likely to enjoy the potential benefits of the mining industry: job creation, infrastructure construction and multiplier effects on regional economies.

The benefits of mining development, however, do not come automatically: bad management and unfair distribution of fiscal resources, low complementarities with local firms and the low labour intensity of technology can jeopardize pro-poor and employment effects and the spill-over of mining investments.

This theoretical ambiguity of the contribution of mining to human and economic development is mirrored by the variety of empirical findings. Cross-country evidence on the development-mining nexus numbers studies supporting both the “mining is good” (Davis 1995, Brunnschweiler and Bulte 2008) and the “the mining is bad” hypothesis (Ross 2003, UNCTAD 2002, Sachs and Warner 1995) but it also provides mixed results (Ding and Field 2005, Stijns 2005). Several authors suggest that the developmental outcomes of mining exploitation depend on pre-existing institutional or socio-economic contexts rather than on mining or resource abundance as such (Holder 2005, Humphreys and Sandbu 2007, Mehlum et al. 2006).

Empirical literature about the impact of mining on local development also does not reach univocal conclusions. Evidence, in this case, is more anecdotal, but it already runs into decades of case studies. Part of this literature describes and stresses environmental and health impacts of mining activities on local populations and the risk that most benefits of mining exploitation are transferred outside the zone of extraction or processing (IIED and WBCSD 2002, Bebbington and Bury 2009, Yelpaalaa and Ali 2005, Martines-Alier 2002 and, above all, numerous documents provided by journalists and activist organizations[2]). Despite the consensus about these risks, other studies, instead, emphasize the progressive role of mining operations in local development and in the control of negative externalities (McMahon and Remy 2001, World Bank and IFC 2002, case studies described by the industry association ICMM [3])

Different perspectives from critics’ scepticism to proponents’ optimism notwithstanding, the debate on mining and development seems to converge on the idea that the resource curse is avoidable. The key question is not if countries should or should not renounce their resource wealth, but what policies can ensure

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1 Adelman and Morris (1988) observe that in Canada, Australia, New Zeeland and Scandinavian countries, expansion of commodity exportation helped industrialization.

2 See, for instance, information and documents at the following websites: Earthworks, http://www.earthworksaction.org/; Mines and Communities, http://www.minesandcommunities.org/; No Dirty Gold, http://www.nodirtygold.org/; Observatory for Mining Conflicts in Latin America, http://www.conflictosmineros.net/ ; and Oxfam America, http://www.oxfamamerica.org/.

3 The International Council on Mining and Metals has collected several case studies to assess the impact of large mines on the socio-economic development of host countries. See ICMM (2007a, 2007b, 2007c, 200d) and information at http://www.icmm.com/our-work/case-studies.

that extractive activity contributes to economic development and poverty alleviation, provided that governments are willing to use resource endowments for the country's prosperity (Davis and Tilton 2005, Humphreys et al. 2007a, Frankel 2010). Indeed, governments of resource-rich countries have continued to promote extractive activities, often with the financial, technical and advisory support of the World Bank Group and other development banks. In the last twenty years, over ninety countries have rewritten mining and investment codes (Bridge, 2004) and investments in mineral exploration in developing countries have been constantly increasing (Bebbington et al. 2008, Hinojosa et al. 2010). At the same time, international organizations and financial institutions[4] (McMahon and Remy 2001, IFC 2007, World Bank 2005, Ortega Girones et al. 2009, Otto et al. 2008), but also industry associations[5], research centres (IIED and WBCSD 2002, Salim 2003) and major NGOs (Herbertson et al. 2009, Oxfam America 2009) have made great efforts to distil toolkits, lessons and guidelines for all stakeholders in order to tackle the risks of local and national resource paradox and to ensure that resource wealth translates into equitable and sustainable development both at national and local level. This body of guidelines and operational criteria seems to converge in a set of general principles: promotion of an investment climate for mining development; social and environmental sustainability and fairness; transparency in dispute resolution and in managing mining revenues and taxes; long-term vision in tackling price and revenue volatility; informed and capacitated participation of all stakeholders; government capacity of enforcement, supervision and regulation (Natural Resource Charter 2010, Humphreys et al. 2007, World Bank 2008). Some international institutions have been also directly involved in assisting resource-rich countries to implement these principles by providing technical, financial and legal assistance. Multi-donor funds, often managed by the World Bank or IFC[6], have been created to finance advisory services and capacity building for extractive industry policy frameworks and contract negotiations (e.g. Extractive Industries Technical Advisory Facility). The International Finance Corporation, for instance, offers financial products and advice to mining companies for their productive projects, but also for community development projects, for environmental and social responsibility assessment, monitoring and implementation, and for stakeholder consultation.

Despite these efforts, in many parts of the world the expansion of mining operations is still accompanied by protests and social conflicts. Some practitioners and scholars suggest that these tensions and the unaccomplished application of the above principles are ascribable to a mismatch and friction between the continual pressure for mining expansion and the need to ensure ex-ante institutional and governance conditions (Bebbington et al. 2008, Pegg 2006). Others take this line of reasoning further arguing that the priority given to mining investment promotion vis-à-vis socio-environmental regulation and monitoring might have created the effect of reducing the institutional capacity of host countries (Campbell 2009 referring to mining in Africa) or that, in presence of power and capacity asymmetries between the stakeholders (weak public institutions, poor communities, big companies) some reforms, which should enhance the developmental impact of mining industry, are exposed to a distorted use which in turn generates a climate of self-reinforcing conflicts (Arellano-Yanguas 2008). Can mining conflicts be traced back to an incomplete application of the recommendations of international institutions or is there something instead? A closer look at those countries, such as Peru, that pursue a faithful application of these prescriptions can provide useful insights for interpreting the continuous climate of tension surrounding mining operations.

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4 Many guides and criteria are collected by the website of IFC and World Bank's Oil, Gas and Mining Sustainable Community Development Fund (CommDev) http://commdev.org/

5 See website of ICMM (http://www.icmm.com)

6 For instance, the Oil, Gas and Mining Sustainable Community Development Fund (CommDev) created by the World Bank and IFC.

3. The mining boom of the 21st century and Peru's response to international initiatives

From the early Nineties, Peru has made some progress in following the policy agenda recommended by international organizations and NGOs. In fact, in 2007, Peru was admitted to the Extractive Industries Transparency Initiative[7] as Candidate country. In the Nineties, the government passed several legislative measures[8] to reduce obstacles to foreign capital inflows towards the mining industry, to promote privatization and to ensure a favourable fiscal regime and a stable and clear legal framework. The unification of exchange rates and reduction of export taxes increased returns on mining investments. The new legal context, moreover, established the principle of no discrimination between foreign and national investors and admitted the possibility of entering into tax and juridical stability agreements with the Government for mining companies with sizeable mining operations. Other provisions for setting a favourable investment climate are freedom to make remittances of profits, dividends and financial resources abroad, freedom to dispose of foreign currency and liberalization of mining products. In addition, the legislation grants the possibility to exonerate new projects from income tax payment during their first 8 or 10 years of operation and tax deductibility for investment in public service infrastructure (Pascó-Font, 2000). Finally, unless mines and landowners fail to reach an agreement on use of land for mining operation, the Land Law (Ley de Tierras), passed in 1995, allows the enterprises to ask for mining easement. The law gives priority to investors' interests and does not require the owner's consent on land use: payment of compensation fixed by the General Mining Directorate (Dirección General de Minería) automatically gives the investor the right to use the land[9].

In the late 1990s, these new investment conditions, economic stabilization of the Peruvian economy, recovery of the international economic cycle and consequent growth in demand and price of metals led to a surge in mining investments and production (see Graphs 3.1-3.4).

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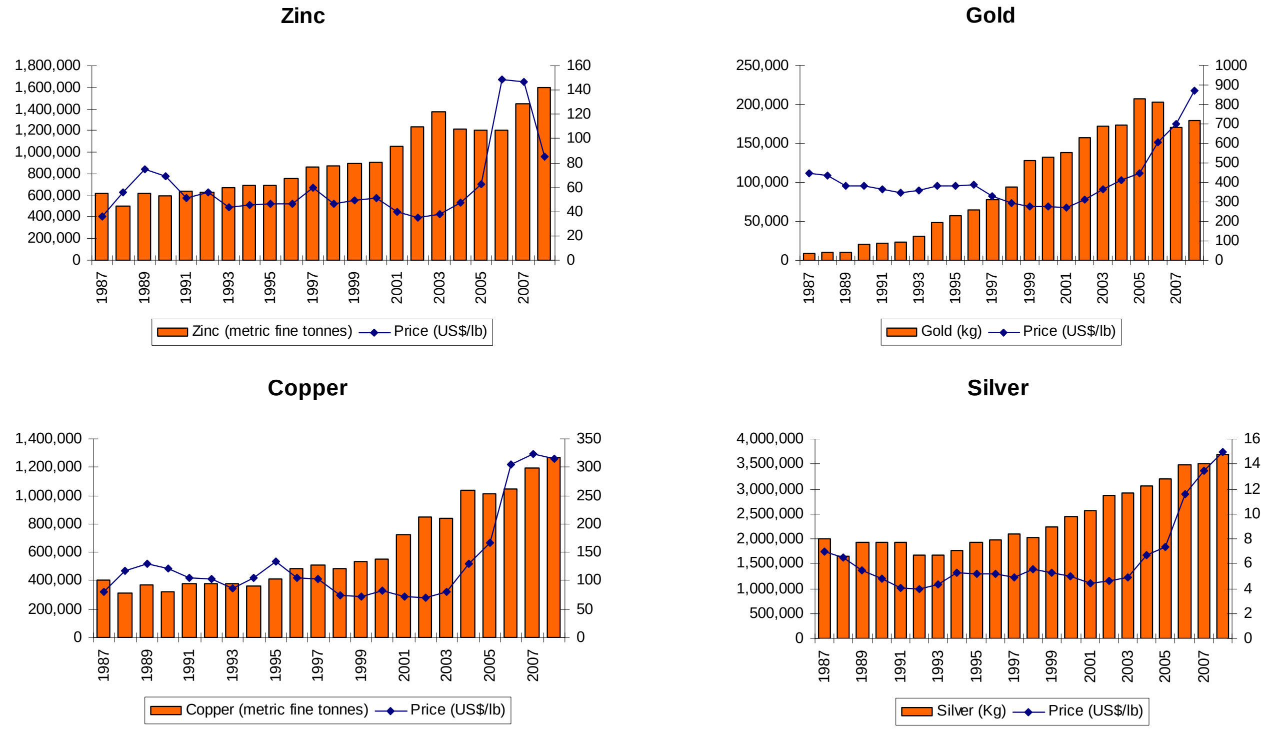
7 EITI is a coalition of governments, companies, civil society groups, investors and international organizations that aims to improve governance, transparency and accountability in the extractive sector. In 2007, Peru was accepted as candidate country, but it failed to meet the deadline (9 March 2010) to complete external EITI validation and it, therefore, risked to be dropped from EITI with the option to reapply for candidate status. In April 2010, however, the International EITI Board agreed to grant extensions of Peru's deadline. In September, a final validation report was submitted to the Board and is awaiting the Board decision.

8 In 1991, it was emanated the Legislative Decree 662 that introduced measures for attracting foreign investments. The Legislative Decree 674 promoted privatization of public enterprises, while the Legislative Decree 708 provided specific incentives for mining investments. In 1996, Legislative Decree 818 provided incentives for investment in mega-projects for exploitation of natural resources. The LD 708 modified Natural Resources and Environment Code in the part related to exploitation of mining resources.

9 Some authors (Glave and Kuramoto, 2002; Pascó-Font et al. 2001) note that large mining enterprises try to avoid this procedure because it often leads to violent protests by *comunidades campesinas*. However, it has been also observed (Pascó-Font et al. 2001, Damonte et al., 2002) that, even it is not applied, the possibility of appealing to mining servitude is used as mechanisms of negotiation or to bargain lower prices.

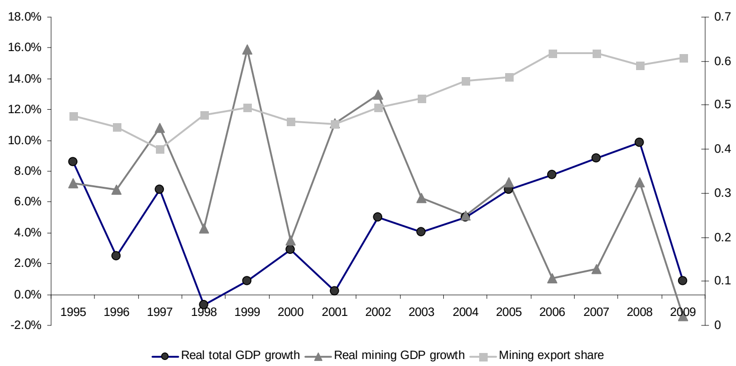
Graph 3.1-3.4: National production and international prices of the main minerals extracted in Peru



Source: MINEM

In 2008, Peru was the first and second world producer of, respectively, silver and zinc, and the third producer of copper, tin and bismuth. Between 1996 and 2000, annual mining investments grew from 387 to 1,502 Million US$ (MINEM, 2004) and after a slowdown at the beginning of the 2000s, the trend accelerated again in 2005 reaching 2,771 Million US$ of mining investments in 2009 (MINEM, 2009). The bulk of new investments were financed by foreign capital that concentrated on acquisition of state enterprises and extension of old plants, but also on exploration operations and installation of new plants. Capital inflows resulted in a rise of mining production capacity. From 1995 to 2005, mining GDP grew at yearly average rates of 8.2 percent compared to a total GDP growth of 3.2 percent[10], while metallic mining export share rose from 48 percent to 56 percent. In the following years, mining growth slowed down due to the international crisis and its impact on world demand and the price of raw materials, but in 2008 the sector registered a growth of 9.8 percent (Graph 3.5).

Graph 3.5: Macroeconomic indicators

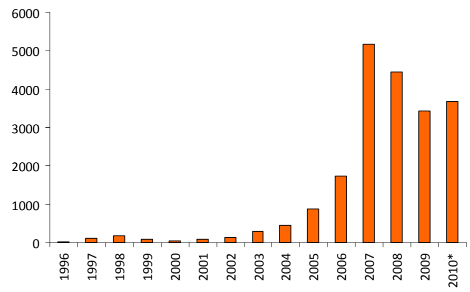


Source: MINEM

10 Author's elaboration from MINEM.

The decade of the mining boom also witnessed a strengthening of the role of the State in environmental regulation and control. Several environmental institutions were constituted and provisions, laws, guidelines and standards were passed[11]. Under this new system of controls and pressure by external and local actors, mining companies have improved their environmental performance and inflows of new foreign capital have brought new and less polluting technologies (Kuramoto 2001, Pascó-Font 2000). Application of the lixiviation process, for example, has permitted the reduction of air contamination. Since 2000-2002, Peru has also promoted fiscal and political decentralization. In the last fifteen years, several functions of labour and environmental monitoring, regulation and promotion of mining investments have been transferred to Mining Regional Directorates. Local governments of areas with mining operations have progressively received more fiscal resources: in 1992 the government established that 20 per cent of the income tax paid by mining companies was due as mining canon to the departments, provinces and districts which hosted them. In 2001 the government raised the tax rate to 50 percent, while, over the last ten years, the distribution system has increasingly concentrated mining canon in producer districts. Now, the canon paid by mining firms is distributed according to this rule: 10 percent of the canon is transferred to the producer district, 25 percent to the producer province, 40 percent to the department where the mine is located and 25 percent to the regional government. These new rules and the surge in mining production led to a rapid increase of transfers to regional governments that in 2007 reached a level 38 times higher than in 2002. (Graph 3.6). As a result, revenues generated by the mining sectors[12] now account for a large share of total transfers to regional (60 percent) and local governments (39 percent)[13].

Graph 3.6: Mining canon transferred to regions (millions of Nuevo soles)



Source: Group Propuesta Ciudadana 2005 and 2010. Notes: * estimation

[11] In 1990 the Natural Resources and Environment Code (Código del Medio Ambiente – CAM) introduced the basic principles of environmental legislation (citizen's participation, polluter-pays principle, submission of environmental impact studies). In 1993 the Unifying Text of the General Mining Law (D.S. 016-93-EM) and its successive modifications established that the Ministry of Energy and Mines is the competent authority for application of the Environmental Code and for environmental issues concerning the mining sector. It introduced new instruments of environmental controls and obligations such as Environmental Impact Studies (EISs) in the case of new projects and Environmental Adjustment and Management Programs (PAMAs) in the case of on-going operations. EISs and PAMAs have to be approved by the Ministry of Energy and Mines and the annual investment involved in the PAMA must be equivalent to at least 1 percent of total sales. Holders of mining concessions have also to present an Annual Sworn Statement (Declaración Jurada Anual) that is a report on emissions and tailings generated by the mining activity. Finally, the General Mining Law has introduced other provisions for mine closure. However the application of these regulations presented some problems until the introduction of the Ministerial Resolutions 011 and 315-96-EM of 1996 that established maximum limits for mining emissions of gases and liquids (but not for soil contamination). In 1992 the General Directorate of Environmental Mining Affairs of MINEM was created and 1994 the National Environmental Council (Consejo Nacional del Ambiente - CONAM) was funded with the purpose to define the national environmental policy and to coordinate evaluation, control, preservation and restoration of environment. In the last years, other organs have been established, provisions have been adopted and several environmental guides have been issued.

[12] Contributions of the mining sector to revenues of regional and local governments include mining canon, royalties and sub-surface fees. Accounting for about 87 percent of total revenues from mining firms, mining canon is the most important contribution of mining sector to government finance (IIMP 2010).

[13] 2008 data reported by IIMP (2010).

At the same time, Peru has fostered public-private partnership, popular participation and consultative mechanisms in managing community-mine relationships (Arellano-Yangua, 2008)[14]. On the one hand, the importance of multilateral negotiations has increased: representatives of mining corporations have taken part in several dialogue roundtables and the process of participative negotiations with local communities, NGOs and local authorities[15]. On the other hand, some companies, especially multinational corporations that are more exposed to international pressures, are beginning to incorporate criteria of corporate social responsibility into their business strategies and to invest in development projects. According to a survey conducted by the Peru Mining Engineers Institute, in 1990-2000 the involvement in construction and maintenance of roads and other communication infrastructures was the same as before 1990 , but the mining industry was starting to invest in development projects. In 2000 mining companies spent US$ 30.5 million on infrastructure and social programs: US$ 7 million of this amount was invested in agro-pastoral development projects and US$ 1,6 million for training centres and initiatives for other productive activities (Hoyos Ordonez, 2002). Since then, the trend has been constantly positive. By 2009, this figure had already doubled and the mining industry’s expenditure on social development (US$ 56 million) had surpassed that for infrastructure (US$ 7.5 million). Moreover, about half of funds for infrastructure is earmarked for health and education facilities and for water, sewage and electricity systems (IIMP 2010).

Local community organizations have strengthening their capacity to coordinate and defend their interests. For instance, the Coordinadora Nacional de Comunidades Afectadas por la Minería, founded in 1999, by 2000 already included 1126 communities. National and international NGOs have also played a role in facilitating resolution of social and environmental conflicts, in reducing asymmetric information among the stakeholders and in providing technical and organizational competences to local populations.

Despite this notable progress in the legal and institutional setting, the local struggles against mining firms have mushroomed throughout the Highlands territory. The mining boom has resulted in a large expansion of mining operations also in unexplored areas occupied by agro-pastoral communities. The number of concessions for mining exploration and exploitation rose from 1525 in 1994 to 2100 in 2007 with a peak of 2775 concessions in 2003, while mining rights for exploitation operations tripled from 231 in 1994 to 616 in 2008 (Datamart de Minéria). In particular, the Northern Sierra during the 1990s became a new important mining region after the opening of big new plants such as the Pierina mine, the Yanacocha mine which is now the primary producer of gold in Latin America, and Antamina, one of the biggest producers of copper and zinc in Peru. This rapid extension of the territorial influence of mining has increased the contacts as well as conflicts between enterprises and local communities. According to Proyecto Especial de Titulación de Tierras (PETT) in 2000, 3500 *comunidades nativas y campesinas* out of 6872 had titled land in areas under mining rights (Dalmonte Valencia et al., 2002). At the same time, mining activities, which usually require water-intensive technologies, increasingly compete against other human and productive water uses. In 2009, about 24 percent of 21 major populated watersheds were subject to mining concessions (elaborated from Bebbington and Bury 2009). Between 2004 and 2007, Peruvian Defensoría del Pueblo (Ombudsman’s office) recorded 23 mining conflicts (Defensoría del Pueblo 2007). In 2009, it recorded 250 conflicts, of which 129 were socio-environmental and about 65 percent of them (83) were mining-related disputes. Glave and Kuramoto (2007) highlight that mining conflicts are equally distributed along the Highlands and most of

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[14] Peruvian legislation has also taken up the principle of citizen’s participation by passing the Regulation of Citizens' Participation in the Approval Procedure of Environmental Impact Assessments (2002). In addition, in 2001 the MINEM published the first Guide to Communitarian Relations, government institutions have participated to some processes of negotiation for resolution of mining-community conflicts, while the General Directorate of Social Management of the MINEM was created in 2005 as the organ competent for the promotion of relationships between mining enterprises and civil society.

[15] For instance, initiatives for communitarian participation in monitoring of mining activities have been organized for disputes against BHPB Tintaya mine (Cusco Department in Southern Peru), Manhattan Minerals (Piura Department in the Northern Peru), and Yanacocha mine (Cajamarca Department). In 2000 a workshop of negotiations among stakeholders involved in mining-communities relationships in La Oroya-Yauli Province gave rise to the “Mesa de Concertatión Provincial”, while some limited initiatives of multilateral participation have been undertaken also in San Marcos district (Ancash Department) which hosts Antamina Mining Company.

them are, primarily, struggles for use and contamination of water resources (60 percent) and for land acquisition and access (15 percent)[16].

In spite of some differences in opinions and interests, local populations and their organizations[17], overall, agree that the mining companies, so far, have not produced a positive impact on their living conditions, especially of the poorest people, and that their role in promoting local development has been weak. They claim that labour opportunities in mines are very limited and not stable, while fiscal revenues distributed at local level are lower than expected and insignificant in comparison with the profits of the company. In several cases, expropriations or land acquisitions have been necessary. Rural organizations often protest because land transactions with mines are characterized by lack of transparency, asymmetric power relationships, and inadequate compensation. The people that have been displaced also object that the legislation does not ensure an adequate and fair protection of their rights to land use and property and, in some cases, they report human rights abuses. Moreover, several local communities have denounced the adverse environmental impact of the mining operations and they consider that the environmental legislation or its enforcement are inadequate to protect them from damage to health, pastures and water, soil and air resources. Finally, in some cases, they claim that local people and communities are not sufficiently informed about mining impacts or involved in the governance of local territory.

In fact, it is not all positive in the recent mining economic growth and the improved institutional and governance. Progress in the process of decentralization is very recent. Moreover, a mismatch between functions, fiscal resources and technical capacity of regional government institutions can hinder the role of decentralization in promoting and translating mining growth into equitable and sustainable development[18].
Some observers note that the government's inadequate human and financial resources, both at national and local level, lack of coordination and centralization of conflicting functions within the Ministry of Energy and Mines (MINEM)[19] partially hinders the application and effectiveness of socio-environmental regulation (Núñez-Barriga and Castañeda-Hurtado, 1999, Arellano Yanguas 2008, Bebbington and Bury 2009, Glave and Kuramoto 2007). In this context, the actual impact of mining operations on natural resource use, degradation and pollution is still unclear. While the empirical literature documents many past cases of severe environmental contamination with negative effects on local populations and other economic activities caused by the mining industry (Núñez-Barriga and Castañeda-Hurtado 1999, ONERN 1986, Danmert and Meza 1999, Caballero, 1980, Alarcón 1994, Balvin Diaz 1995), empirical evidence on the ecological footprint of current mining operations is mixed. Some companies are clearly reluctant to invest in environmental control (as in the case of La Oroya); others have substantially increased their investments in environmental technologies. However, even in cases of the most innovative firms, such as Yanacocha Mine, local populations' perceptions (Zárate and Durand 2005), results of independent reports (Bury 2004, Stratus Consulting Inc. 2003) and statements made by companies often do not agree. Overall, Glave and Kuramoto (2002) observed that traditional companies are less open than modern ones to involvement in communitarian and environmental issues, but, in some cases, also the engagement of modern companies is more formal than

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16 For an overview of the most emblematic cases of social protests against large mines in Peru see Revesz and Diez (2006).

17 For these information I refer to some reports issued by CooperAccion, a Peruvian NGO (De Echave et al., 2005), and Oxfam Australia (2001, 2003) on the case related to mine of Tintaya in south Peru (Espinar province). Many opinions are also collected from the report of the seminar "Mineria y Comunidades" held in Lima in 1999 where representatives of institutions, comunidades campesinas, mining enterprises participated (CooperAccion, 1999). Another source of information of grievance and positions of local communities is represented by the surveys carried out by CooperAccion in communities of Tintaya-Marquiri, Yauli and Vicco (De Echave, 2001), while Zarate and Durand (2005) produced a qualitative study on population's perception on economic, social and environmental impact of Yanacocha mine in Cajamarca Department and Antamina mine in Ancash Department. Finally, CONACAMI (2000) issued a report of the positions and analyses that had been expressed during the First Congress of Communities Affected by Mining, while Glave and Kuramoto (2002) carried out a report on a series of workshops attended by local and central government, industry representatives, civil society groups, communities, trade unions, academics. The vision of several grassroots groups is also expressed in a letter sent in 2004 to the World Bank by more than 50 Peruvian NGOs. It was a letter on the Extractive Industries Review.

18 For details on decentralization process in mining policy, see Glave and Kuramoto (2007).

19 Until 2008, MINEM was in charge of promoting mining investments, regulating and controlling socio-environmental impacts, granting land concessions. The functions of environmental monitoring now have been to the Ministry of Environment that was created in 2008.

concrete. Environmental externalities and the contentious use of resources in mining areas are recognized also by the Peruvian Defensoría del Pueblo (2007).

Socio-environmental impacts of the mining industry, moreover, depend on how different interests are mediated in the negotiations between all stakeholders: national and local governments, local communities, grassroots organizations, national and international NGOs and mining companies. Case studies on community-mine relationships and the functioning of consulting boards reveal a marked differentiation of scenarios and dynamics (GRADE 2002, Aste Daffós et al. 2004), but several negotiations have been characterized by power asymmetries, weak organization of local actors, fragmentation of local groups of interest, and lack of transparency (Arellano-Yanguas 2008). According to Grompone (2005), the rhetorical use of participation is recurrent, while Revesz and Diez (2006) suggest that local politicians sometimes exploit mining conflicts to gain electoral consensus or to channel pre-existing disputes and they underscore episodes in which state's representatives have been non-collaborative with local communities, absent or even a partial arbitrator in favour of the mining industry. This situation, in turn, feeds mistrust in public institutions and mines, unrealistic expectations, and misunderstandings.

To confuse matters even more, management and distribution of mining taxes and royalties are also found to be problematic. In some cases, local government's lack of technical and organizational resources, information and competence have resulted in an improper or inefficient use of resources and have induced some companies to carry out their projects without the involvement of the local institutional actors[20] (Zárate and Durand 2005). Inflows of fiscal resources might also be influenced by political factors: according to data from the Ministry of Economy and Finance, over the 1992-2001 period, the districts without mining operations received 67% of canon resources compared to the 20 percent that they were expected to receive and 66 mining districts received only 9 percent of canon compared to the 20 percent that they should have received by law (Kuramoto, 2003). Moreover, distribution of canon among local governments is highly concentrated: in 2004, 74 districts out of 1526 received 54% of the total amount (Barrantes, 2005).

Also direct investment by mines in social development and infrastructures are not homogeneously distributed across regions and areas close to the biggest firms have benefited most. In 2007-2009, for instance, only Cajamarca (29 percent), Apurimac (11 percent), La Libertad (8 percent) and Pasco (7 percent) departments received more than half of the funds financed by the mining industry for social and infrastructure development (Datamart de Mineria). In 2008, two companies alone (Yanacocha Mining and Activos Mineros) financed 36 percent of all funds allocated in that year (IIMP 2010).

The ambiguity of mining impacts also involves the multiplicative effects of the mining sector on labour and business opportunities at micro and meso level. In some areas, the local economy and mining activities are intrinsically intertwined. Even in La Oroya, emblematic of health and environmental hazards produced by mining, inhabitants want mines and smelters to remain active, as these activities are also their main source of income. However, overall, expectations by the surrounding populations regarding local job creation usually are not fully met due to the skilled-labour and capital-intensive nature of the industry. Glave and Kuramoto (2002), moreover, found that capital inflows, promotion of mega-projects and substitution of obsolete plants with advanced techniques have led to a further increase in capital intensity. In the 1990-1999 period, the size of mining firms and productivity grew, but the increase in direct employment of new workers was not proportional to the production growth[21]. Moreover, new labour legislation has allowed for contracts that are more flexible and many mining enterprises have started to outsource some operations and to cut costs through the extension of working hours. Finally, in several mines the composition of workers has shifted in favour of skilled labour, employment of unskilled workers has declined. The result has been a

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[20] The canon revenues can be employed exclusively for capital investments. However, Zárate and Durand (2005) found that in districts of Ancash, some mayors claim that the local governments are not able to finance projects of infrastructures because the resources from canon are insufficient and cannot be used for acquiring technical vealed lack of coordination between regional and local governments as the main cause of ineffectiveness of projects financed by canon. Similar findings

[21] Glave and Kuramoto's study reports that between 1990 and 1999 direct labor employed in big mining declined from 29 to 23 miles individuals, while many small enterprises, generally more labor intensive, closed because of the competition with technological advanced mines and the disappearance of the Banco Minero which represented an important source of funding. In contrast, in the Nineties, the numbers of workers in median mines doubled from 15 to 30 miles.

lower labour absorption associated with better remuneration and a weakening of mining trade unions. The authors state that indirect generation of jobs has also remained low: if in Peru a new job in mining produces four jobs in other sectors, in United Stated this multiplicative factor rises to 15. More recent data of MINEM provide a better picture: between 2000 and 2009, the number of people working for mines or their contractors increased by 176 percent passing from 175 to 132 thousands compared to a real mining GDP growth of 169 percent in the same period.

Empirical literature on complementarities, upstream and downstream links of Peru mines with local activities is still sparse. Kuramoto's study (2000) shows that, in the Nineties, the Yanacocha Mine established most of its commercial, institutional and productive relationships with foreign or Lima-based customers and suppliers, while economic integration and network links with other local activities were negligible. Torres-Zorrilla (2000), analyzing the case of the Southern Peru Cooper Coorporation, another big company, reaches similar conclusions: forward linkages with national enterprises are almost inexistent, national suppliers provide 80 percent of intermediate goods and 35 percent of machineries and equipment, but most of them are based in Lima. Also the Antamina Mine in Ancash Department faces constraints in employment of local (as opposed to national) labour and use of local inputs (ICMM 2007). These case studies suggest that, so far, the mining industry has not helped the regional economy to become more dynamic and diversified, but it often acquires the typical characteristics of an enclave with little integration with surrounding economic activities.

In conclusion, this snapshot of mining and local human and economic development in Peru is far from being clear. Application of the international recommendations has made important progress, but it does still not seem fully implemented. Case-studies of the last fifteen years disclose light and shade in the interactions between mines and local communities and local economy, but emblematic examples do not always fully reflect general patterns and trends. Only a few studies have tried to evaluate the overall impacts of the recent mining boom on local economies, reaching mixed conclusions. Echave and Torres (2005) found a negative correlation between human development indicators and mining GDP at departmental level between 1991 and 2001. Zegarra et al. (2007) found a positive effect of the mining boom on per capita urban income, but a non-significant effect on per capita rural income and expenditure and on urban household expenditure. Moreover, their study showed a large heterogeneity of effects between Northern, Central and Southern Highlands and across rural and urban areas. This study integrates earlier works based on nationally representative data by analysing CENSUS data in order to evaluate the effects of mining activities between 1993 and 2007 on a set of welfare indicators at district level. We apply a method similar to that of Zegarra et al. but we include a larger number of districts and we control for time-invariant unobservable factors that can affect both the exposure to the mining boom and outcomes, and we focus on district variables. On the other hand, unlike in Zegarra et al. we cannot evaluate heterogeneity of impacts across type of households as our units of analysis are districts. In contrast, we study heterogeneity across different geographical characteristics.

4. The expected impacts of mining development on local economies

This section briefly describes and schematizes the expected microeconomic and social impacts of mining activities drawing on the above-discussed empirical and theoretical literature and on available case-studies. The discussion provides a conceptual framework which is used to formulate empirical questions and to comment on results of the following data analysis.

The expansion of existing mining activities or the opening of new mining operations can produce a range of interconnected local effects that involve political, socio-economic and cultural spheres.

1. <u>Public goods and access to public services</u>. Mining industry can lead to an increase in public goods and services through different channels:

- Increase in demand for public goods and services, rise in political opportunity for their provision and reduction in their financial cost due to changes in size, income and geographical distribution of population;

- Loosening of government budget constraint due to a rise in inflows of revenues such as mining canon and royalties;
- Increase in private investment in construction and maintenance of infrastructure (roads, power plants, water, sewage and electricity networks and health and education facilities);
- Promotion of local development projects by mining firms.

2. Financial, physical and human capital. Economic dynamics triggered by a mining expansion might produce direct and indirect effects on private assets of local households. Enlargement of mining concessions require land acquisitions (transactions or expropriations) with local communities and households. The corresponding compensation and payments constitute a form of financial capital that local people can spend for consumption or productive uses. Moreover, to the extent that the mining sector represents an "engine of growth" for local economy, it stimulates private investment in physical and human capital. In Peru, some mining companies promote education, health and adult technical training. In addition, mining donations and fiscal revenues are also used to finance communication, transport, health and education infrastructures and facilities. All these initiatives can enhance human capital.

3. Social capital. The potential impact of mining growth on social capital is twofold. Benefits and costs of mining activities are usually not homogenously distributed within local population and households have different opportunities and capacity to interact with mines, government representatives, community and supra-communal organizations. This power and socio-economic differentiation can erode social capital networks, create horizontal inequalities and foster conflicts between households and between local interest groups. At the same time, protests against mining activities can act as a constant pressure for building more inclusive institutions and for improving social mobilization capacity and organization of local populations.

4. Migration flows and urbanization: Mining development might also affect migration flows, urbanization and geographical distribution of population across rural and urban areas. People movements might be induced by push and pull forces:

- Environment and land-related movements: farm households that have lost their lands or have been negatively affected by environmental externalities of mining may move to other districts and provinces or to urban areas.
- Labour-related migrations: mining areas usually attract immigration flows of people who seek jobs in the mining industry or in other sectors with upstream or downstream linkages. As mines are often located at high altitudes, in some cases newcomers settle in remote areas characterized by low demographic density.

5. Farming activities: Mining operations often require an intensive use of water resources, are land demanding and can create heavy environmental externalities. The consequent effects on land productivity, animal health and farmers' land rights, access to community pastures, to water and other natural resources can damage farming activities reducing their asset base and return. Impacts of mining activity on land, soil and air quality can spread over vast territorial areas, but local populations living in areas immediately surrounding mining operations usually suffer the most critical effects besides being more exposed to land acquisitions. On the other hand, mines can produce positive effects on farming to the extent that mining enterprises promote agricultural and rural development projects. In addition, if mines attract new workers and their families, local food markets might grow resulting in increased returns to agriculture. Mining frontier expansion also often causes a surge in land prices which can have opposite effects: farmers who sell their lands can benefit but other farmers with few landholdings are not able to purchase new plots any more because they have become too expensive. An impact evaluation study in three communities near to Yanacocha Mine, for example, reported both these dynamics (Bury 2004).

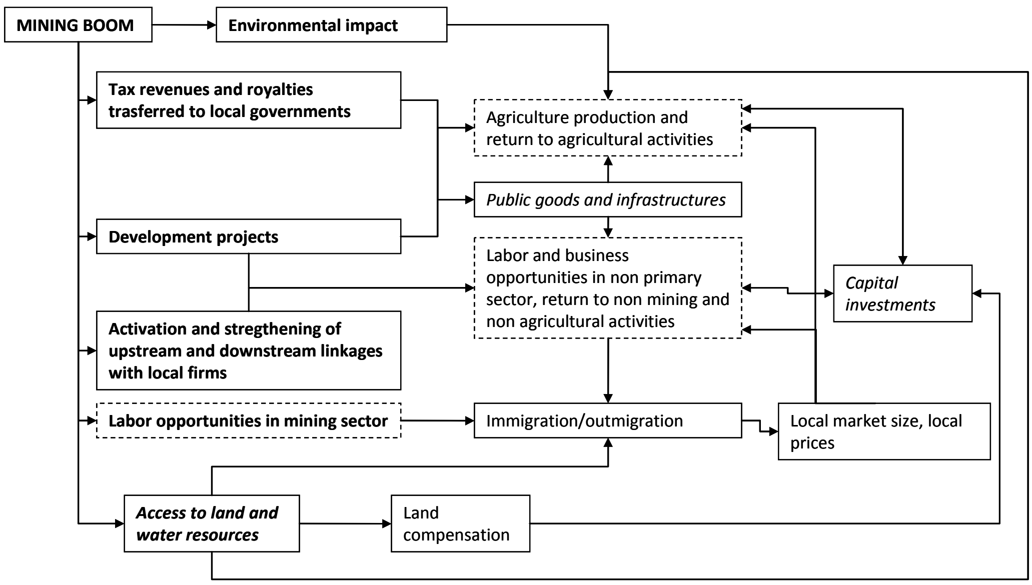
6. Relative and absolute local prices, wages, employment and sector composition of local economy: Intensification of existing mining operations and activation of new mines in a region can lead to range of effects that influence local prices, labour and business opportunities and remuneration of off-farm labour. A mining boom can be associated with changes in population size and in composition of population by age, income, occupation and education. Mines and surrounding economic activities can increase labour demand.

All these factors are likely to shape the level and structure of both labour demand and supply and to induce economic diversification of household income sources out of the farming sector.

The potential effects of mining growth on private and public asset endowments, on economic and institutional environment, climate investments, power relationships, local governance, and household purchasing power are likely to manifest themselves as an impact on level and distribution of household economic wealth and expenditure. The final effect, however, is ambiguous. Graph 4.1 illustrates the main mechanisms at stake, but, as the above discussion shows, not all channels are always activated in all mining areas, neither do the effects always have the same signs. Political and institutional contextual settings, mines' attitudes, initial household asset endowments and ex-ante specialization and tradition of local economy conditions, indeed, can mediate or feed the various interlinks.

The effects of the recent mining boom on Peruvian local economies are therefore not theoretically predictable. Did the mining boom lead to a process of economic diversification in mining areas? Which forces (migration flows, increase in access to public services, effects on agriculture or on off-farm activities) could have contributed to this process? Are rural and urban areas affected in a different way? Does a tradition of mining history shape these dynamics? The empirical analyses of the next sections and their interpretations based on the proposed conceptual framework will attempt to answer these questions.

Graph 4.1: Main channels of mining impacts on local economies.



5. Estimation methodology and data sources

We estimate the effects of the mining boom on a set of outcomes by combining a difference-in-difference (DD) with propensity score matching (PSM), a technique developed in the literature as an instrument for evaluating social programs. Participation in a program is considered as participation in a treatment and PSM consists of comparing the outcome of each treated agent with a corresponding hypothetic counterfactual scenario able to approximate the (unobservable) outcome if the same unit had not taken part in the program. In this study, Highlands districts constitute our units of analysis and the exposure to the 1993-2007 mining boom represents their "treatment". Therefore, the treated and untreated groups are made up of mining and non-mining districts, respectively.

The simple comparison between mean outcomes of treated and untreated units might be misleading if some factors, usually referred as confounding variables, influence both the outcome and the probability of participating in the treatment. That is, if there are systematic differences between mining and non-mining areas that could affect the outcome indicators even in absence of a mining boom, we cannot simply compare mining and non-mining areas because we would risk attributing to mining presence some effects that, instead, are determined by other factors. We need, instead, to use "comparable" districts, namely districts that, in absence of a mining boom, would have shown similar outcome indicators. Therefore, we do not apply propensity score matching technique to take into account how the rules for the assignment to a social program can affect its impact, but we resort to this statistical device to balance for observable characteristics and create groups that are as similar as possible in terms of confounding variables.

A formal description of PSM can clarify when and how this technique can be applied. Let Y_i^1 be the outcome value of district i if *i* is treated (i.e. is a mining district) and Y_i^0 the outcome value of district i if *i* is not treated (i.e. is a non-mining district). We also define D(Z) as the observed participation status, with *D=1* in case of treatment, *D=0* otherwise, and Z indicating the set of variables which determine treatment group membership (i.e. exposure to the mining boom). A relevant measure of the effect of the mining boom on impact variable is the "Average Treatment Effect on Treated" (ATT) which indicates the average change of Y for treated districts due to the event D only and which can be defined as:

$$ATT = E(Y_i^1 - Y_i^0 / D = 1) = E(Y_i^1 / D = 1) - E(Y_i^0 / D = 1)$$

For each *i* we can observe only one outcome. Therefore, $E(Y_i^0 / D = 1)$, the average outcome that the treated districts would have shown in absence of treatment is not observed. This creates the so-called "problem of causal inference" (Holland 1986) which requires replacing missing counterfactual data for the treatments by using information from the control group of non-mining districts. Under the strong ignorability assumption (Rosenbaum and Rubin 1983), we can estimate ATT using $E(Y_i^0 / D = 0)$, the expected value of Y_i^0 for the untreated districts. This assumption includes two conditions:

- *Unconfoundedness*[22]: Given a set of observable covariates Z that are not affected by treatment, potential outcomes are independent of treatment assignment. This assumption implies

(1) $$E(Y_i^0 / Z_i, D_i = 1) = E(Y_i^0 / Z_i, D_i = 0)$$

- *Overlap or common support condition* :

(2) $$0 < Pr(D_i = 1 / Z_i) < 1$$

The strong ignorability assumption implies that, conditional on Z, the distribution of counterfactual outcome for the treated is the same as that for the control group, which is estimable. In this way, the problem of selection bias due to approximation of $E(Y_i^0 / D = 1)$ with data from the control group is solved. In fact, from (1), it follows that ATT can be calculated as

(3) $$ATT = E_Z \{[E(Y_i^1 / Z_i, D_i = 1) - E(Y_i^0 / Z_i, D_i = 1)] / D_i = 1\}$$

Overlap assumption, moreover, ensures that there are both treated and untreated districts for each Z we try to compare. However, when the dimension of Z is very high, the matching method is very difficult to apply as the number of covariates in Z drastically reduces the possibility of finding a good matching.

Rosenbaum and Rubin (1983) and Rosembaum (2002) demonstrated that it is possible to summarize the information in vector Z and reduce it to a one-dimensional score, namely the propensity score defined as the conditional probability of receiving the treatment (being exposed to mining boom) given the values of characteristics Z:

(4) $$p(Z_i) \equiv Pr(D_i = 1 / Z_i)$$

In particular, it can be shown that treated and control units with the same propensity score value have the same distribution of covariate Z and therefore, for a given propensity score, they are on average identical. Therefore, the PSM estimator for ATT can be computed as:

(5) $$ATT = E_{p(Z / D_i = 1)} \{[E(Y_i^1 / D_i = 1, p(Z_i)) - E(Y_i^0 / D_i = 1, p(Z_i))] / D_i = 1\}$$

[22] Other authors refer to this assumption as selection on observables (Heckman and Robb, 1985) or conditional independence assumption (CIA) (Lechner, 1999).

As explained by Caliendo and Kopeinig (2008), in other words, the PSM estimator is the mean difference in outcomes over the common support, appropriately weighted by the propensity score distribution of treated units. We calculate propensity scores using a logit that includes initial conditions that might affect both outcome indicators and the probability of being exposed to the mining boom. However, the probability of observing a control and a treated unit with the same propensity score is zero since $p(Z)$ is a continuous variable (Ichino and Becker 2002). We therefore need to choose a technique that matches each mining district with similar non-mining districts in terms of propensity score. This study uses the nonparametric kernel matching in which each treated district is matched with weighted average of a large proportion of those in the control group and weights are inversely proportional to the distance between the propensity scores of the treated and controls.

In practice, the PSM estimator for ATT can be rewritten by the following expression (Guo and Fraser 2010):

$$(6) \qquad ATT = \frac{1}{n_1} \sum_{i \in I_1 \cap Sp} \left[Y_i^1 - \sum_{j \in I_{01} \cap Sp} W(i)Y_j^0 \right]$$

where n_1 is the number of mining districts, $i \in I_1$ are mining districts, $j \in I_0$ are non-mining districts, *Sp* is the common-support region, and $W(i,j)$ is the weight given to the *j*-th non-mining district in making a comparison with the *i*-th mining district. Weights are assigned according to a kernel function of the predicted propensity score following Heckman, Ichimura, and Todd (1997):

$$(7) \qquad W(i,j) = \frac{G\left(\frac{p_{j-}p_i}{h}\right)}{\sum_{k \in I_0} G\left(\frac{p_{k-}p_i}{h}\right)}$$

where p_i, p_j, p_k are, respectively, the propensity score of treated case $i \in I_1$, and the untreated cases $j \in I_0$, $k \in I_0$ used as comparison districts, while *h* is the number of observations falling into the span between *j*-th and *k*-th cases. The fraction that determines *h* is called bandwidth. Silverman (1986) and Pagan and Ullah (1999) show that the choice of the bandwidth can affect goodness and efficiency of fit. Therefore, we test the sensitivity of the findings to different specifications on bandwidth. Standard errors, instead, are estimated using a/the bootstrapping method.

PSM assumes that treatment group membership (i.e. exposure to the mining boom) can be explained purely in terms of observable characteristics included in Z and there are no other unobservable variables which are linked to the exposure to the mining boom and which also affect expected impacts Y. If this condition is not met, the matching method will generate biased estimates of impacts. However, if the unobservable variables that have these features are permanent, the bias may be eliminated coupling PSM with difference-in-difference estimates (Heckman et al. 1998). For example, this method controls for the bias arising from a change in the economic environment - a macroeconomic change or a weather shock such as El Niño - that involves all districts and that might affect both outcome variables and mining operations. Moreover, by focusing the analysis on the Highlands region the assumption of homogenous impacts across districts appears more plausible.

PSM-DD estimator of ATT is constructed comparing the before and after mining boom mean change in outcome measures for the mining districts with those for the matched non-mining districts:

$$(8) \qquad ATT = E_{p(Z/D_i=1)} \left\{ \left[E(Y_i^{1,t+1} - Y_i^{1,t} / D_i = 1, p(Z_i)) - E(Y_i^{0,t+1} - Y_i^{0,t} / D_i = 1, p(Z_i)) \right] / D_i = 1 \right\}$$

Equation (8) can be analytically expressed as:

$$(9) \qquad ATT = \frac{1}{n_1} \sum_{i \in I_1 \cap S_p} \{ (Y_i^{1,t+1} - Y_i^{1,t}) - \sum_{j \in I_0 \cap S_p} W(i)(Y_j^{0,t+1} - Y_j^{0,t}) \}$$

The DD-PSM estimator eliminates temporarily invariant sources of bias; therefore, our key assumption is that we exclude the presence of non-observables that are correlated with the exposure to the mining boom as well as with the *change* over time of outcome variables. Though we can never rule out this possibility, we can reasonably assume that the exposure to the mining boom is influenced by initial conditions and not by other later factors that affect districts in a different way. In fact, the participation to the mining boom usually requires previous investments in new mining operations, machineries or in technological upgrading.

Finally, we consider the possibility that some of channels through which mining growth affects outcome measures are active only under certain circumstances. For instance, a long history of mining experience can influence the impact of the mining boom. Districts with a mining tradition might host old mining firms that use more polluting techniques. When these firms increase their production, they may cause a greater environmental impact than new companies that usually adopt modern technologies. Thus, old mining districts can be affected by previous and long-lasting environmental problems. On the other hand, integration of mining activities with other local activities and employment of local workers can be easier in old mining districts where mining firms are better established in the local context and are more likely to find labour with appropriate skills. Finally, as mining impacts can be influenced by initial economic specialization of the territory, we can expect that rural and urban areas might be affected in a different way. For these reasons, we carry out a separate analysis for districts with and without a long mining tradition and for rural and urban areas.

Our empirical analysis is based on a data set that combines various data sources. Data on socio-demographic characteristics and labour indicators at district level come from the Population and Housing Census of 1993 and 2007. The Mining Directory of the Ministry of Energy and Mines has provided the list of all mining units in activity in the Peruvian territory. For additional mining information, we rely on Datamart system of the Ministry of Energy and Mines that has been collecting "Declaraciónes Anual Consolidada" of mining firms from 1994. Through this system, all mining firms have to communicate information on their mining rights and concessions, operations[23] and on the number of their workers and of the workers employed by their contractors. Our analysis draws data on agricultural production and agricultural producer prices from SISAGRI, the source for aggregated Ministry of Agriculture (MINAG) data, while other information on agricultural and farming stocks comes from 1994 Peru National Agricultural Census (CENAGRO 1994). This information is also linked to other data on geographical characteristics that are gathered by National Statistical Office (INEI 1995). Finally, Grupo de Análisis para el Desarrollo (GRADE) elaborated the coding of districts to take into account changes in district administration division across years, while information about areas where mineral exploration and mining activities are restricted is derived from the online maps of Mining Cadastre.

6. Classification of mining areas

The first step to investigating the welfare and distributive impacts of mines at local level is the creation of a dummy variable which captures those areas that have been exposed to the influence of the recent mining boom. From the available data sources it has not been possible to reach a lower level of analysis than the district one. This implies the assumption that the impact of mines at local level is limited to the district area. However, some episodes of environmental contamination can be concentrated in the nearest areas to mines, while economic linkages might cross district borders, especially for big installations. Therefore this limitation has to be considered in interpreting the results of this work.

Earlier studies compared districts with and without metal production plants. Zegarra et al. (2007), for example, defined mining districts as those where at least one medium or big mining firm is located in 2001-2003 and a similar approach is used by Barrantes (2005). However, a distinction based on the presence of productive unities does not consider at all how pervasive or relevant mining operations are in each district: even if only one mining company is present, a district can be classified as "mining", but, in this case, positive or negative externalities, links or consequences for economic activities might not arise. Moreover, some districts can be classified as non-mining even if there are companies operating in the territory but with headquarters in a close district. In order to deal with these difficulties of measurement, this study adopts a

[23] Life of mines can be divided into three main phases: exploration, exploitation and closure.

different approach which embodies other dimensions of interest such as size and extension of mining operations that, in turn, are likely to reflect the scope of socio-economic direct and indirect impacts. More precisely, districts are divided according to the following classification:

a) *New mining districts* (NMD) are defined as districts without units of mining production in 1994 *and* that meet one of these criteria:
    i. in 2007 had a share of district surface under metallic mining concessions above a threshold *k or*
    ii. in 2007 had a number of workers employed in the mining sector above the average within the group of districts with at least one mining worker *and* at least one mining unit in activity.

b) Old mining districts (OMD) are defined as those districts with units of mining production in 1994 and which meet the above conditions (i) or (ii)

c) Non-mining or untreated districts (UD): all the remaining districts.

In order to assess the robustness of the results to small changes in classification, the analysis will be replicated by using three values of *k* thresholds (30, 40 and 60 percent of district surface) which identify three possible groupings of Highland's districts (Table 6.1).

Table 6.1: Classification of Highland's districts

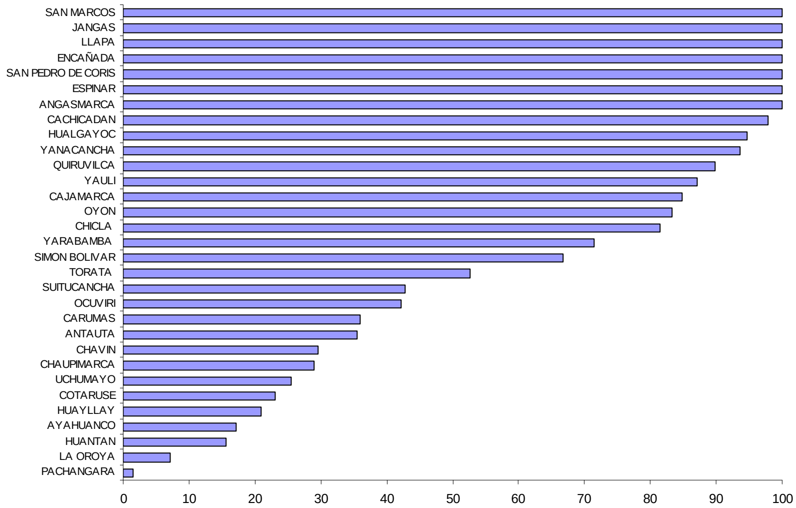
	Thresholds (% of district surface under mining concessions)		
	30%	*40%*	*60%*
Non mining districts (NMD)	919	997	1,078
Old mining districts (OMD)	68	56	44
New mining or untreated districts (UD)	220	154	85
All Highland's districts	1,207	1,207	1,207

There is some evidence that this classification is able to capture districts under the influence of an intense mining activity both in the past and in the present (OMD) or only in the present (NMD). For example, in almost all districts where large mining companies[24] are located and, therefore, where the exploitation of mining resources reaches a big scale, the percentage of land under concessions is quite high, over 30% (Graph 6.1). Moreover, the inclusion of the condition on job employment in addition to that on operative mining operations allows us to discard those districts where mining units are registered but are still not or not any more active or that are small firms. Finally, these conditions allow inclusion of districts where mining activities are very intensive but with small territory extension such as districts that host smelters.

The proposed classification also mirrors the exposure of district territory to environmental risks. As shown in Table 6.2, the amount of annual mining tailings is much greater in districts classified as mining than non mining ones. Moreover, in line with qualitative information, a tradition of mining exploitation increases the risks of potential environmental pressures: tailings dumped in old mining districts are about 10 times greater than in new mining areas.

[24] Mines that process more than 5,000 TM and between 5.000 and 200 TM per day are classified as large and medium mines, respectively (Glave and Kuramoto 2002).

Graph 6.1: Share of district surface under mining concessions in 2007, districts with large operative smelting or ore reduction plants



Source: author's elaboration based on MINEM.

Table 6.2: Average annual mining tailings in 2004-2008 (tons)

	Thresholds (% of district surface under mining concessions)		
	30%	*40%*	*60%*
Non mining districts (UD)	140	322	1,209
Old mining districts (OMD)	125,097	151,837	172,820
New mining districts (NMD)	9,931	12,961	22,510
All	8,965	8,965	8,965

In contrast, benefits of mining development in terms of fiscal revenues do not exactly overlap with our district classification. The incidence of mining canon on the main public transfers to local governments is higher among mining than non-mining districts, but this gap has tended to increase especially in recent years and it is particularly marked only when mining concessions cover 60 percent of district surface (Table 6.3). Thus, on the one hand, mining canon also reaches non mining districts and this in line with the allocation rules of mining canon; on the other hand it seems to have been concentrated in districts with a very intense and widespread mining activity and to have grown only recently. Therefore, the expected overall impact of the mining boom on public goods which could be financed by mining revenues is undetermined.

Table 6.3: Mining canon as a share of the main transfers to local governments

	1996-2005			**2003-2005**		
Thresholds (% of district surface under mining concessions)	*30%*	*40%*	*60%*	*30%*	*40%*	*60%*
Non mining districts	10.4	10.5	10.4	16.8	17.0	16.8
Old mining districts	17.1	17.2	18.6	27.9	28.0	32.3
New mining districts	13.6	14.9	19.7	22.3	24.5	31.7
All	11.4	11.4	11.4	18.5	18.5	18.5

Note: Main transfers to local governments include Canons, Vaso de Leche Program, Foncomun

7. Potential biases

In order to create a comparable control group for mining districts and to estimate the propensity scores, we evaluate a set of potentially relevant control Z variables that might affect both changes in outcome variables and the likelihood of participating in the mining boom. Factors that might introduce bias in the estimates of mining impacts include the following location and private characteristics:

a) ***Land utilization and presence of farm activities prior to mining boom.*** Mining investments might be discouraged in districts where land disputes with local populations are more likely, namely in districts with greater utilization of lands for productive uses and higher return to farm activities before the mining boom. At the same time, farming specialization and potentialities of agricultural activities might affect both exposure of the local economy to mining risks and its capacity to capture mining benefits. The analysis uses a set of proxies of these factors drawn from 1994 CENAGRO: share of district total land owned by farmers, share of district agriculture land, average number of livestock units per hectare of agricultural area in the district, average share of farmers' agricultural area irrigated in the district, share of communitarian farmland. Finally, potential bioclimatic scores elaborated by INEI provide information on climate conditions and territory characteristics that might affect forestry, breeding and agriculture.

b) ***Geographical distribution of district population prior to mining boom.*** Expansion of mining operations might be easier and less contentious in less populated districts. Demographic density can also be linked to performance of local economies, availability of local labour force and per capita costs of investment in public goods. In our analysis, this dimension is measured by average size of rural villages and towns ("centros poblados") in the district.

c) ***Average district altitude:*** the presence of metal resources is more likely in districts at high altitudes (Bebbington and Bury 2009), but these areas can also be less accessible and less endowed with public services because costs for public service provision are higher than in other areas. This, in turn, might influence return to economic activities and migration decisions. Moreover, altitude tends to correlate with climate conditions that affect types and productivity of farming activities.

d) ***Mining exploration operations and exploitation activities in the surrounding districts prior to mining boom:*** existence of these operations can prefigure successive activities of mining exploitation in the district. At the same time, exploration activities can also produce environmental damage and land disputes or transactions, while local populations can change their investment and migration choices or political claims and requests as they anticipate a future mining expansion. Among possible confounding variables, we therefore include a dummy that indicates whether in the district there was at least one concession for mining exploration in 1994-1997 and a dummy that takes value 1 if the district belongs to a province where another district had at least one mining exploitation concession in 1994-1997.

e) ***Protected areas in the district*** can prevent mining investments and influence other economic activities, infrastructural development and distribution of human settlements.

f) ***Regional dummies*** (Central-North, Central-South and South-Eastern regions compared to Central Highlands) are used to control for historical and political factors (such as the influence of Sendero Luminoso movement, political connections of local governments to central government) which can affect district economic performances, the structure of local economies and incentives to mining investment. Regional dummies also help to control for differences in rock composition, in distribution of mineral deposits and availability of water resources which are important inputs for both mining and energy industry.

g) ***Human capital at household level prior to mining boom***. We control for some average household initial characteristics that could correlate with the probability of living in mining or non-mining areas but also with affordability in meeting private costs associated with access to public services (private costs of connection, preparation of home facilities etc) and with changes in overall social and economic welfare status. In order to avoid the problem of endogenous effects, we introduce variables that can influence outcomes but not are affected by them: average education level of household heads in 1993 and share of household heads whose mother tongue was a native language in 1993.

By introducing three possible alternatives (UD, OMD and NMD), we consider a multiple "treatment" case. As suggested by Lechner (2001), we estimate a series of binomial models to compute propensity scores instead of using multinomial models[25]. We restrict the analysis to two comparisons: between UD and OMD and between UD and NMD, while the direct comparison between OMD and NMD is not considered since it goes beyond the scope of the analysis.

Table 7.1 shows the logit estimations for each classification of mining districts. A number of explanatory variables are significant. The coefficient of the share of district agricultural land, one of the best indicators of potential collision between mining and agricultural activities, is always significant and negative as expected. Altitude and the presence of exploration operations in the mid-Nineties increase the probability of participating in the mining boom. Higher human capital stock at district level (represented by a lower share of household heads with a native mother tongue and a higher level of education) is associated with a higher probability of being an old mining district. Therefore, a long mining tradition in the past might have had a positive effect on initial endowments of human capital prior to the mining boom. The likelihood of being a new mining district is also negatively associated with the share of household heads who are native language speakers, but for this type of "treatment" the coefficient of education of household heads is negative or not significant. Language barriers and fear of finding a hostile environment might have negatively influenced incentives to invest in mining operations. At the same time, these results suggest that, compared to old mining districts, new mining areas are potentially less able to exploit potential benefits from mining development, as this capacity might be affected by initial level of education in the district. Finally, the regional dummies are significant and they point out that Northern and Southern Sierra were more involved in the recent mining growth than Central and South-Eastern areas.

[25] Lechner (2001) found that a series of binomial model performs as a multinomial probit and it is likely to give results that are more robust since a misspecification in one of the binomial models will not compromise the others.

Table 7.1: Estimation of the propensity scores, logit model

	Threshold 30%		Threshold 40%		Threshold 60%	
	1	2	3	4	5	6
	OMD	NMD	OMD	NMD	OMD	NMD
Share of farmers' land	-2.456*	-1.046*	-1.824	-0.212	-0.804	0.132
	(2.03)	(2.20)	(1.37)	(0.43)	(0.6)	(0.22)
Share of agricultural land	-3.393**	-1.154*	-4.324**	-1.525*	-3.742**	-1.646~
	(3.01)	(2.08)	(3.30)	(2.29)	(2.69)	(1.86)
Average share of irrigated land	-1.199~	0.435	-0.909	0.546	-1.243	0.257
	(-1.9)	(1.42)	(1.33)	(1.55)	(1.6)	(0.55)
Stock of animals per hectare	-0.026	-0.003	-0.025	-0.004	-0.041	0.006
	(1.42)	(0.26)	(1.28)	(0.34)	(1.59)	(0.41)
Size of rural villages	0.001*	0.000	0.001*	0.000	0.002**	0.001
	(2.32)	(0.44)	(2.17)	(0.48)	(2.74)	(1.42)
Potential bioclimate score	-0.002	0.006~	-0.003	0.004	-0.009	0.000
	(0.37)	(1.95)	(0.58)	(1.3)	(1.31)	(0.11)
Mining exploration in 1994-97	2.392**	0.757**	2.067**	0.726**	2.315**	0.746**
	(4.96)	(4.33)	(3.96)	(3.61)	(3.50)	(2.80)
Mother tongue of household heads (Share of native)	-5.228**	-1.131**	-6.041**	-1.181**	-5.438**	-0.858~
	(5.33)	(3.23)	(5.00)	(2.99)	(3.99)	(1.73)
Average education level of household heads	1.062	-1.419*	1.798*	-1.164	1.715 ~	-1.105
	(1.29)	(2.55)	(2.12)	(1.83)	(1.89)	(1.36)
District average altitude	0.002**	0.000**	0.002**	0.000	0.002**	0.000
	(5.03)	(2.61)	(4.87)	(1.48)	(4.11)	(0.48)
Protected areas	0.238	0.248	0.49	0.246	0.646	0.487
	(0.42)	(0.93)	(0.86)	(0.8)	(1.05)	(1.29)
Share of communitarian land	0.301	-0.382	0.461	-0.09	1.109~	-0.19
	(0.61)	(1.48)	(0.86)	(0.31)	(1.88)	(0.48)
Central-Southern Sierra	2.835**	1.668**	3.371**	1.972**	1.294	2.022**
	(3.86)	(5.15)	(4.11)	(5.02)	(-1.35)	(3.72)
South-Eastern Sierra	2.096**	0.3	2.119**	0.592	1.547~	0.113
	(3.07)	(0.86)	(2.67)	(1.34)	(1.73)	(0.16)
Central-Northern Sierra	3.238**	1.617**	3.136**	1.867**	2.739**	2.195**
	(5.56)	(5.58)	(5.08)	(5.25)	(4.43)	(4.39)
Mining operations in districts of the same province in 1994-97	0.03	0.331~	-0.11	0.261	-0.039	0.666*
	(0.07)	(1.79)	(0.25)	(1.23)	(0.08)	(2.35)
Constant	-12.007**	-2.858**	-13.678**	-3.102**	-12.79**	-3.483*
	(5.67)	(2.71)	(5.82)	(2.60)	(5.07)	(2.30)
Observations	917	1056	978	1068	1042	1079

Note: Absolute value of z-statistics in parentheses. ~ significant at 10% level; * significant at 5% level; ** significant at 1% level. Stata module used to estimate propensity scores is pscore by Becker and Ichino (2002). In each logit model, the balancing test is satisfied. In order to improve quality of the matches, the balancing test is restricted to the common support, namely it is performed only on the observations whose propensity score belongs to the intersection of the supports of the propensity score of treated and controls. This restriction is particularly important in Kernel matching since it uses nearly all observations in the control group and therefore this matching algorithm might include observations that are bad matches (Caliendo and Kopeinig 2008).

8. Average treatment effects

We assess impacts of the mining boom on a set of outcome variables that cover various dimensions of local development: demographic trends, access to public goods, housing conditions, employment and diversification of local economy. Each mining district is matched with a weighted average of a share of non-mining districts in the control group on common support. This share is determined by the choice of bandwidth. Estimates are replicated for four bandwidths (0.06, 0.01, 0.08 and 0.5) and only results, which are confirmed for most levels, are considered robust.

8.1 Impacts on demographic trends and migration flows

If mining development leads to an improvement in economic and labour opportunities or in access to public services, it can generate pull migration forces. We estimate the mean impacts of the mining boom on the district population incidence of immigrants who came from other districts between 2002 and 2007. In 2007, recent migrants in old mining districts accounted for 14-17 and for 16-18 percent of rural and urban populations, respectively. Table 8.1 and 8.3 show the mean changes in share of rural population and of migrant population between 1993 and 2007 in mining and non-mining districts and the estimated DID average treatment effects for the treated group by the kernel-based matching analysis. The PS-DD estimates of ATT highlight that the expansion of mining operations in those districts that already had a mining tradition caused an increase in population share of recent migrants both in rural (by 6-8 percent points) and in urban areas (by 3-4 percent points), while in non-mining districts, in the same period, population share of immigrants declined (Table 8.1). This means that, in old mining districts, the mining growth spurt generated pull migration forces. Interestingly, population growth between 1993 and 2007 was higher in old mining districts than in non-mining ones and the gap widens as the thresholds select districts that experienced a more intensive mining activity (Table 8.2). In old mining districts, therefore, out migration did not offset immigration flows.

When mining investments arrived in new areas, the impact on inward migration was still positive but it had a smaller scope and it was limited to urban areas. Overall, in new mining districts, urban population share of recent migrants was stable or declined but this reduction was less marked than in non-mining areas (Table 8.3). In rural areas, instead, changes in incidence of migrant population did not differ between non-mining and new mining districts. At the same time, new mining areas show similar population growth rates to non-mining districts (Table 8.2). As data on out migration are not available, we cannot draw definitive conclusions, but two alternative trends can explain this pattern: inflows of urban migrants were accompanied by similar migration outflows or to a reduction in natural demographic growth.

Finally, the recent mining boom did not affect internal population distribution. Our estimates do not detect an impact on urbanization. In fact, the percentage of district population living in rural areas exhibits a similar decline across different levels of mining development.

Table 8.1: Impacts on population share of migrants – Comparison between UD and OMD

Comparison between UD and OMD	Threshold at 30%: 65 treated and 431 untreated districts			Threshold at 40%: 53 treated and 458 untreated districts			Threshold at 60%: 42 treated and 375 untreated districts		
	Change in share of rural population	*Change in share of recent migrants in rural areas, from other districts*	*Change in share of recent migrants in urban areas, from other districts*	*Change in share of rural population*	*Change in share of recent migrants in rural areas, from other districts*	*Change in share of recent migrants in urban areas, from other districts*	*Change in share of rural population*	*Change in share of recent migrants in rural areas, from other districts*	*Change in share of recent migrants in urban areas, from other districts*
Mean change in outcome indicators (1993-2007)									
non mining districts	-5.66	-1.84	-3.06	*-5.62*	*-1.62*	*-2.91*	*-5.17*	*-1.43*	*-3.00*
old mining districts	-2.56	5.87	2.62	*-2.66*	*7.51*	*3.38*	*-1.86*	*8.38*	*4.50*
PS kernel matched DD estimates of ATT	3.10	8.90**	6.20**	6.10	10.50**	4.30	3.80	8.60*	7.70**
Bandwith 0.06									
t-statistics	*1.09*	*3.07*	*2.64*	*1.45*	*3.50*	*1.59*	*0.91*	*1.97*	*3.23*
Sensitivity analysis									
Changing bandwidth									
0.01	4	6.5*	3.4	1.3	7.5*	3.7	5.80	5.60	7.20 ~
T	*1.207*	*2.342*	*1.479*	*0.30*	*2.32*	*1.35*	*1.06*	*1.20*	*1.79*
0.08	3.1	8.8**	6**	7.0 ~	10.8**	4.3 ~	4.10	7.90*	7.30**
T	*1.046*	*4.199*	*2.59*	*1.76*	*3.73*	*1.71*	*1.24*	*1.98*	*2.60*
0.5	2.4	8.2**	6.4**	4.0	9.5**	5.8	3.10	9.30**	7.90**
T	*1.105*	*4.991*	*3.527*	*1.36*	*4.13*	*2.86*	*1.02*	*3.98*	*3.20*

Notes: Mean changes in outcome indicators between 1993 and 2007 are restricted to only those districts determined by PSM. PS kernel matched standard errors are obtained by bootstrapping (100 repetitions). Double differences are expressed in changes in percentage points. t-statistics obtained when testing the null hypothesis of equality of mean between UD and OMD changes in italics: ~ significant at 10% level; * significant at 5% level; ** significant at 1% level

Table 8.2: Average percentage growth of district population between 1993 and 2007

	Threshold at 30%:	Threshold at 40%:	Threshold at 60%:
non mining districts	9.64	8.36	6.87
old mining districts	12.34	15.24	18.35
	Threshold at 30%:	Threshold at 40%:	Threshold at 60%:
non mining districts	12.48	11.61	11.37
new mining districts	7.99	10.44	9.92

Notes: The sample consists of Highlands districts on common support as determined by propensity score matching.

Table 8.3: Impacts on population share of migrants – Comparison between UD and NMD

	Threshold at 30%: 204 treated and 829 untreated districts			Threshold at 40%:143 treated and 887 untreated districts			Threshold at 60%: 79 treated and 956 untreated districts		
Comparison between UD and NMD	*Change in share of rural population*	*Change in share of recent migrants in rural areas, from other districts*	*Change in share of recent migrants in urban areas, from other districts*	*Change in share of rural population*	*Change in share of recent migrants in rural areas, from other districts*	*Change in share of recent migrants in urban areas, from other districts*	*Change in share of rural populati on*	*Change in share of recent migrants in rural areas, from other districts*	*Change in share of recent migrants in urban areas, from other districts*
Mean change in outcome indicators (1993-2007)									
non mining districts	-5.47	-1.61	-2.96	-5.71	-1.65	-2.78	-6.07	-1.39	-2.69
new mining districts	-7.75	-0.62	-0.36	-7.18	-0.22	-0.18	-6.07	-0.61	0.78
PS-DD estimates of ATT	-1.5	0.6	1.9**	-1.5	0.8	1.9*	0.30	-0.40	2.50*
Bandwith 0.06									
t-statistics	*-1.228*	*1.087*	*2.599*	*-1.33*	*1.24*	*2.37*	*0.22*	*-0.34*	*2.21*
Sensitivity analysis									
Changing bandwidth									
0.01	-1.7	0.6	1.7*	-1.90	0.70	2.00*	0.20	0.30	2.40
t	*-1.382*	*0.915*	*2.226*	*-1.33*	*1.13*	*1.98*	*0.10*	*0.31*	*1.57*
0.08	-1.6	0.6	2**	-1.50	0.90	2.00*	0.20	-0.10	2.60*
t	*-1.442*	*1.113*	*2.911*	*-1.29*	*1.41*	*2.34*	*0.12*	*-0.08*	*2.27*
0.5	-2.2*	1	2.5**	-1.40	1.40*	2.50**	-0.10	0.80	3.40**
t	*-2.122*	*1.719*	*3.761*	*-1.35*	*2.34*	*3.13*	*-0.10*	*1.04*	*2.98*

Notes: Mean changes in outcome indicators between 1993 and 2007 are restricted to only those districts determined by PSM. PS kernel matched standard errors are obtained by bootstrapping (100 repetitions). Double differences are expressed in changes in percentage points. t-statistics obtained when testing the null hypothesis of equality of mean between UD and NMD changes in italics: ~ significant at 10% level; * significant at 5% level; ** significant at 1% level

8.2 Impacts on access to basic services and housing quality

Tables 8.4-8.7 present mean changes in access to basic services and share of population living in houses with safe walls in mining and non-mining districts and PS-DD estimates of ATT on these indicators. We observe that in 1993-2007 period, Highlands's rural areas experienced considerable advances in access to water, electricity and sanitation services, but the mining boom in the decade up to 2007 did not accelerate this progress. Actually, our results show a negative impact on access to some public services in rural areas of new mining districts. As reported in table 8.4, between 1993 and 2007, the share of rural population with access to electricity and to improved sanitation services increased more in non-mining than in new mining districts, while the difference between non-mining and old-mining districts is not statistically significant. This finding deserves further investigations as it might be explained by a disengagement of the Peruvian government in basic services provision due to expectations of an increased role of mining firms in taking over state functions.

The contribution of the mining sector to public services slightly improves in urban areas of new mining districts but it is still limited and the findings are not completely univocal. Our ATT estimates show a positive impact on electrification of urban areas in new mining areas, but this result is found only when the threshold for district classification is set at 30 percent of land surface, while for higher thresholds the impact is positive but not significant. Moreover, urban access to other housing facilities (improved water and sanitation services) is not affected by the arrival of new mining firms. In addition, in new mining areas the impact on share of urban population living in dwellings with safe walls was negative. This negative link can be explained by inflows of new urban dwellers from other districts which exerted pressures on housing availability. Finally, in urban areas of old mining districts, changes of housing facilities were not affected by the mining boom and they followed similar trends as in non-mining districts. In conclusion, also in urban areas, the mining boom that began in the mid-1990s had a very modest effect on access to public goods and quality of housing facilities and these findings are in line with widespread concerns regarding total amount (which has grown only recently), management and geographical concentration of mining revenues.

Table 8.4: Impacts on access to basic services and housing quality– rural areas – Comparison between UD and OMD

Comparison between UD and OMD	Threshold at 30%: 65 treated and 431 untreated districts				Threshold at 40%: 53 treated and 458 untreated districts				Threshold at 60%: 42 treated and 375 untreated districts			
	Change in share of rural population...				***Change in share of rural population...***				***Change in share of rural population...***			
	with access to electricity	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*	*with access to electricity*	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*	*with access to electricity*	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*
Mean change in outcome indicators (1993-2007)												
non mining districts	29.53	22.32	8.24	1.11	29.53	21.52	8.10	0.82	29.17	22.52	8.65	0.94
old mining districts	21.16	15.00	7.61	-1.20	19.47	13.73	8.37	-1.43	20.00	14.05	9.25	-1.31
PS-DD estimates of ATT	-4.20	-5.20	-0.60	-1.30	-8.30	-8.80	0.04	-1.90	-4.00	-3.30	1.60	-1.20
Bandwith 0.06												
t-statistics	*-0.96*	*-0.91*	*-0.27*	*-0.59*	*-1.49*	*-1.46*	*0.02*	*-0.94*	*-0.58*	*-0.44*	*0.59*	*-0.46*
Sensitivity analysis												
Changing bandwidth												
0.01	-1.300	-6.6	-0.4	-2.2	-0.6	-4.9	0.4	-0.4	4.10	4.90	1.50	-1.20
t	*-0.20*	*-0.906*	*-0.188*	*-1.226*	*-0.09*	*-0.56*	*0.19*	*-0.15*	*0.46*	*0.51*	*0.49*	*-0.43*
0.08	-4	-4	-0.7	-1	-7.7	-8.6	0.1	-1.9	-4.30	-4.70	1.30	-1.30
t	*-0.714*	*-0.766*	*-0.349*	*-0.49*	*-1.59*	*-1.39*	*0.02*	*-1.12*	*-0.60*	*-0.68*	*0.42*	*-0.57*
0.5	-4.7	-5	-0.4	-1.6	-8.0~	-7.1	0.3	-2.1~	-6.50	-7.30	0.40	-1.50
t	*-1.355*	*-1.01*	*-0.291*	*-1.012*	*-1.77*	*-1.52*	*0.16*	*-1.80*	*-1.31*	*-1.30*	*0.18*	*-0.83*

Notes: Mean changes in outcome indicators between 1993 and 2007 are restricted to only those districts determined by PSM. PS kernel matched standard errors are obtained by bootstrapping (100 repetitions). Double differences are expressed in changes in percentage points. t-statistics obtained when testing the null hypothesis of equality of mean between UD and NMD changes in italics: ~ significant at 10% level; * significant at 5% level; ** significant at 1% level

Table 8.5: Impacts on access to basic services and housing quality– rural areas – Comparison between UD and NMD

Comparison between UD and NMD	Threshold at 30%: 204 treated and 829 untreated districts				Threshold at 40%: 143 treated and 887 untreated districts				Threshold at 60%: 79 treated and 956 untreated districts			
	Change in share of rural population...				***Change in share of rural population...***				***Change in share of rural population...***			
	with access to electricity	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*	*with access to electricity*	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*	*with access to electricity*	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*
Mean change in outcome indicators (1993-2007)												
non mining districts	30.66	23.21	8.25	0.88	30.76	23.40	8.01	0.76	30.29	22.64	7.69	0.80
new mining districts	25.40	22.50	5.12	0.23	23.86	21.78	4.99	0.55	24.95	26.72	5.37	1.27
PS-DD estimates of ATT	-6.4*	-2.4	-2**	-0.4	-7.4**	-3	-1.6~	0.1	-5.10	2.40	-1.00	1.00
Bandwith 0.06												
t-statistics	*-2.46*	*-0.871*	*-2.997*	*-0.836*	*-3.16*	*-0.99*	*-1.79*	*0.10*	*-1.52*	*0.70*	*-0.98*	*1.00*
Sensitivity analysis												
Changing bandwidth												
0.01	-6.300*	-2.7	-1.9*	-0.4	-8.4**	-3.8	-1.8~	0.1	-5.50	0.30	-1.10	1.00
t	*-2.56*	*-0.948*	*-2.54*	*-0.679*	*-2.77*	*-1.32*	*-1.69*	*0.08*	*-1.53*	*0.07*	*-0.90*	*1.00*
0.08	-6.3**	-2.2	-1.9**	-0.4	-7.4**	-3.3	-1.7*	0.03979	-5.00~	2.30	-1.20	0.90
t	*-2.902*	*-0.815*	*-2.652*	*-0.816*	*-3.34*	*-1.14*	*-2.06*	*0.06*	*-1.73*	*0.70*	*-1.11*	*1.04*
0.5	-5.7**	-0.9	-2.8**	-0.6	-7.3**	-1.9	-2.8**	-0.2	-5.50~	4.00	-2.30	0.50
t	*-2.991*	*-0.409*	*-4.553*	*-1.079*	*-3.32*	*-0.70*	*-4.01*	*-0.28*	*-1.73*	*1.32*	*-2.11*	*0.51*

Notes: Mean changes in outcome indicators between 1993 and 2007 are restricted to only those districts determined by PSM. PS kernel matched standard errors are obtained by bootstrapping (100 repetitions). Double differences are expressed in changes in percentage points. t-statistics obtained when testing the null hypothesis of equality of mean between UD and NMD changes in italics: ~ significant at 10% level; * significant at 5% level; ** significant at 1% level

Table 8.6: Impacts on access to basic services and housing quality – urban areas – Comparison between UD and OMD

Comparison between UD and OMD	Thresholds at 30%: 65 treated and 431 untreated districts				Threshold at 40%: 53 treated and 458 untreated districts				Threshold at 60%: 42 treated and 375 untreated districts			
	Change in share of urban population…				***Change in share of urban population…***				***Change in share of urban population…***			
	with access to electricity	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*	*with access to electricity*	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*	*with access to electricity*	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*
Mean change in outcome indicators (1993-2007)												
non mining districts	39.66	-8.72	29.27	4.40	*39.70*	*-11.16*	*28.01*	*4.30*	*37.82*	*-11.78*	*28.43*	*4.02*
old mining districts	27.05	-19.43	23.44	0.19	*28.08*	*-18.38*	*21.96*	*-0.04*	*26.53*	*-17.17*	*24.28*	*3.32*
PS-DD estimates of ATT	-4.80	-13.20	-3.90	-3.70	-3.50	-8.70	-2.90	-5.50	-0.50	3.90	2.40	-1.20
Bandwith 0.06												
t-statistics	*-0.56*	*-1.34*	*-0.79*	*-1.35*	*-0.43*	*-0.95*	*-0.58*	*-1.64*	*-0.06*	*0.32*	*0.41*	*-0.36*
Sensitivity analysis												
Changing bandwidth												
0.01	-6.8	-10.9	-3.9	-2.8	-2.3	-6.9	-2.4	-6.5	-7.00	13.90	3.00	-1.30
t	*-0.633*	*-0.962*	*-0.734*	*-0.878*	*-0.23*	*-0.58*	*-0.35*	*-1.49*	*-0.59*	*0.92*	*0.37*	*-0.30*
0.08	-6.2	-13	-4.9	-3.1	-3.5	-7.4	-2.3	-5.7	-2.00	1.20	1.30	-1.20
t	*-0.691*	*-1.192*	*-1.027*	*-0.925*	*-0.50*	*-0.70*	*-0.43*	*-1.57*	*-0.33*	*0.11*	*0.20*	*-0.29*
0.5	-8.5	-9.4	-4.3	-3.3	-7.7	-7.7	-4.9	-4.3	-6.00	-5.60	-2.20	0.40
t	*-1.528*	*-1.219*	*-1.053*	*-1.414*	*-1.30*	*-1.10*	*-1.31*	*-1.54*	*-0.98*	*-0.61*	*-0.53*	*0.16*

Notes: Mean changes in outcome indicators between 1993 and 2007 are restricted to only those districts determined by PSM. PS kernel matched standard errors are obtained by bootstrapping (100 repetitions). Double differences are expressed in changes in percentage points. t-statistics obtained when testing the null hypothesis of equality of mean between UD and OMD changes in italics: ~ significant at 10% level; * significant at 5% level; ** significant at 1% level

Table 8.7: Double difference estimates of changes in access to basic services – urban areas – Comparison between UD and NMD

Comparison between UD and NMD	Thresholds at 30%: 204 treated and 829 untreated districts ***Change in share of urban population…*** *with access to electricity*	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*	Threshold at 40%: 143 treated and 887 untreated districts ***Change in share of urban population…*** *with access to electricity*	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*	Threshold at 60%: 79 treated and 956 untreated districts ***Change in share of urban population…*** *with access to electricity*	*with improved water services*	*improved sanitation services*	*who live in households with safe walls*
Mean change in outcome indicators (1993-2007)												
non mining districts	43.14	-7.21	28.19	4.30	43.76	-7.24	28.14	4.09	44.31	-8.31	27.52	3.71
new mining districts	52.02	-12.72	27.12	1.52	49.62	-15.99	27.21	1.26	48.03	-14.74	29.74	2.08
PS-DD estimates of ATT	6.5*	-5.5	-1.3	-1.7**	2.4	-7.1	-1.3	-1.7*	0.10	-3.10	2.10	-0.50
Bandwith 0.06												
t-statistics	*2.158*	*-1.374*	*-0.607*	*-2.828*	*0.63*	*-1.49*	*-0.51*	*-2.57*	*0.02*	*-0.56*	*0.79*	*-0.43*
Sensitivity analysis												
Changing bandwidth												
0.01	7.5*	-6.3	-1.1	-1.7*	3.7	-6.9	-1.6	-1.6~	-0.50	-6.30	2.20	-0.60
t	*2.329*	*-1.56*	*-0.474*	*-2.477*	*0.97*	*-1.39*	*-0.57*	*-1.80*	*-0.10*	*-0.90*	*0.69*	*-0.49*
0.08	6.7*	-5.5	-1.2	-1.8**	2.8	-7.6	-1.2	-1.7*	0.60	-3.40	2.10	-0.60
t	*2.094*	*-1.537*	*-0.703*	*-2.874*	*0.81*	*-1.68*	*-0.59*	*-2.23*	*0.12*	*-0.59*	*0.79*	*-0.56*
0.5	7.9**	-5.3	-0.9	-2.5**	5.2	-8.7	-0.9	-2.7**	3.50	-6.40	2.20	-1.60
t	*3.214*	*-1.422*	*-0.448*	*-4.021*	*1.73*	*-2.06*	*-0.44*	*-3.89*	*0.84*	*-1.15*	*0.98*	*-1.58*

Notes: Mean changes in outcome indicators between 1993 and 2007 are restricted to only those districts determined by PSM. PS kernel matched standard errors are obtained by bootstrapping (100 repetitions). Double differences are expressed in changes in percentage points. t-statistics obtained when testing the null hypothesis of equality of mean between UD and NMD changes in italics: ~ significant at 10% level; * significant at 5% level; ** significant at 1% level

8.3 Impacts on labour market and occupational distribution

Inflows of massive mining investments or a rapid acceleration in exploitation of existing mining plants can generate important spill-overs on local economy. We therefore tested for impacts on a number of variables that represent returns and business opportunities in non-mining sectors, labour composition and sectoral structure of local economy. Tables 8.8-8.11 report our estimates.

Evidence of the effect of the mining boom on local labour markets is mixed. In rural areas of old mining districts (Table 8.8), the effect of the mining boom on the proportion of the adult population engaged in economic activities is positive in half of the combinations of parameters and non significant for the remaining cases. Also in urban areas, on average, the proportion of the population who were economically active increased more in old mining districts (by 9 percentage points) than in non-mining districts (by 5-6 percentage points), but the difference is not statistically significant (Table 8.10). Nor did we detect evidence of significant impact on unemployment rates in old mining districts either in rural or in urban areas.

In new mining districts, we found no sign of impacts on adults engaged in productive activities (Tables 8.9 and 8.11). Urban areas of new mining districts, on average, experienced a decline in unemployment between 1993 and 2007 (3-11 percentage points) compared to a small increase (2 percentage points) in non-mining districts on common support. However, also in this case, the difference is not statistically significant. These non-significant but large differences in mean changes suggest that the employment effect of mining operations varies much across urban new mining areas.

As regards occupational distribution, we can observe that, overall, Highlands districts experienced a generalized reduction in labour share of farming activities and an increase in labour share of non-primary activities with the only exception of old mining districts where the portion of population engaged in non-primary activities declined both in rural and in urban areas. In old mining districts, in fact, our estimations find a positive effect on mining labour share and a negative impact on share of population working in non-mining and non-agricultural activities. Therefore, economies with a long mining tradition appear to be well equipped to exploit labour opportunities in the mining sector, but they are also likely to be trapped in mining specialization. In old mining districts, mining labour share experienced a very large increase, by more than 15 percentage points, while economic diversification towards non-primary activities did not progress but was blocked (Table 8.8 and 8.10). Moreover, in old mining districts, the mining boom attracted larger inflows of migrants and demographic growth exhibited higher rates than in other Highlands districts. In these areas, therefore, changes in labour allocation might be driven by inflows of new mining workers while the role of internal dynamics generated by linkages between mining firms and other local activities might be limited In rural areas, we also find a negative impact on labour share of farming activities that presents a larger decline in old mining than in non-mining districts. However, we cannot unequivocally conclude that the mining boom caused a process of “de-agrarization” nor we can deduce whether push or pull forces out of farming occupation prevail. In fact, the data do not allow us to conclude whether the reduction in agriculture labour share is explained by the arrival of new workers employed in mining-related activities or by a negative effect of mining on access or quality of land and water resources. As we see above, old mining districts tend to be more exposed to environmental risks than other areas. At the same time, we also estimated ATT on crop producer prices and on district agriculture GDP[26], but we find no impact caused by the mining boom either in new and old mining districts.

Also in new mining areas, we find a direct effect on mining labour share, but the data do not reveal if this expansion induced a labour shift from agriculture or from non-primary activities since the impact on labour share of each of these sectors is not significant (Table 8.9 and 8.11). In other words, there are no sign that mining growth triggered multiplicative effects on non-primary activities in new mining districts, as the increase in labour share of this sector is not statistically higher in these areas than in non-mining districts. Nor we find evidence that mining boom has lead to a process of “de-agrarization”.

In short, the mining effects on labour allocation across sector were larger than impacts on employment level though they were more marked when districts had already developed mining activities prior to the recent boom.

[26] Full details are available from the author.

Table 8.8: Double difference estimates of changes in labour market indicators – rural areas – Comparison between UD and OMD

Comparison between UD and OMD	Threshold at 30%: 65 treated and 431 untreated districts					Threshold at 40%: 53 treated and 458 untreated districts					Threshold at 60%: 42 treated and 375 untreated districts				
	Change in share of rural…					***Change in share of rural…***					***Change in share of rural…***				
	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities
Mean change in outcome indicators (1993-2007)															
non mining distr	6.26	1.01	2.10	-4.58	2.47	6.22	*0.92*	2.42	-4.49	2.07	6.61	*0.68*	2.44	-4.06	1.61
old mining distr	11.79	-0.21	19.34	-13.65	-5.69	14.09	*0.25*	21.93	-16.30	-5.63	14.55	*0.31*	25.10	-18.26	-6.84
PS-DD estimates of ATT	0.05	-1.60	0.16**	-0.06	-0.11*	6.40~	-0.01	17.90**	-9.50~	-8.40~	7.80	-0.40	19.70**	-8.35	-11.40*
Bandwith 0.06															
t-statistics	*1.49*	*-1.26*	*5.35*	*-1.37*	*-2.53*	*1.77*	*-0.01*	*5.32*	*-1.74*	*-1.71*	*1.56*	*-0.23*	*4.30*	*-1.50*	*-2.46*
Sensitivity analysis															
Changing bandwidth															
0.01	0.90	-0.5	14.80**	-2.60	-12.10**	2.30	0.5	15.10**	-6.50	-8.60	2.00	0.20	17.70**	-10.80	-6.50
t	*0.22*	-0.277	*3.70*	*-0.55*	*-2.87*	*0.57*	*0.29*	*3.16*	*-1.19*	*-1.62*	*0.35*	0.12	*3.86*	*-1.35*	*-1.13*
0.08	0.06	-1.7	0.16**	-0.06	-0.10*	7.40*	-0.1	3.10**	-10.00*	-8.60	7.20	-0.40	18.80**	-7.90	-11.70*
t	*1.44*	-1.453	*5.15*	*-1.55*	*-2.56*	*1.99*	*-0.05*	*6.07*	*-2.30*	*-1.48*	*1.69*	-0.26	*5.92*	*-1.27*	*-2.31*
0.5	0.06*	-1.6	0.17**	-0.08*	-0.09**	7.90**	-0.6	19.30**	-11.90*	-7.40~	8.20	-0.60	19.80**	-11.00**	-10.40*
t	*2.08*	-1.589	*6.20*	*-2.34*	*-2.94*	*2.89*	*-0.61*	*6.58*	*-3.21*	*-1.85*	*2.49*	-0.53	*6.60*	*-2.79*	*-2.25*

Notes: Mean changes in outcome indicators between 1993 and 2007 are restricted to only those districts determined by PSM. PS kernel matched standard errors are obtained by bootstrapping (100 repetitions). Double differences are expressed in changes in percentage points. t-statistics obtained when testing the null hypothesis of equality of mean between UD and OMD changes in italics: ~ significant at 10% level; * significant at 5% level; ** significant at 1% level

Table 8.9: Double difference estimates of changes in labour market indicators – rural areas – Comparison between UD and NMD

Comparison between UD and NMD	Threshold at 30%: 204 treated and 829 untreated districts					Threshold at 40%: 143 treated and 887 untreated districts					Threshold at 60%: 79 treated and 956 untreated districts				
	Change in share of rural…					***Change in share of rural…***					***Change in share of rural…***				
	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities
Mean change in outcome indicators (1993-2007)															
non mining distr	4.61	*2.14*	1.22	-4.49	3.26	4.71	2.02	1.51	-4.65	3.15	4.37	2.02	1.62	-4.63	3.01
new mining distr	2.00	*1.97*	3.43	-6.90	3.47	1.09	2.12	3.32	-7.58	4.27	3.11	1.27	4.70	-7.97	3.27
PS-DD estimates of ATT *Bandwith 0.06*	-2.30~	-0.2	1.80*	-1.40	-0.30	-2.80	0.1	1.50	-3.40	1.90	0.20	-1.10	2.60~	-2.00	-0.60
t-statistics	*-1.66*	*-0.421*	*2.13*	*-0.97*	*-0.23*	*-1.58*	*0.13*	*1.43*	*-1.89*	*1.18*	*0.11*	*-1.01*	*1.65*	*-0.84*	*-0.34*
Sensitivity analysis															
Changing bandwidth															
0.01	-2.00	-0.4	1.90*	-1.30	-0.60	-2.20	-0.3	1.60	-3.20~	1.60	0.70	-0.80	3.40*	-3.30	-0.10
t	*-1.26*	*-0.607*	*2.21*	*-0.85*	*-0.45*	*-1.03*	*-0.42*	*1.55*	*-1.70*	*0.84*	*0.32*	*-0.64*	*1.97*	*-1.39*	*-0.06*
0.08	-2.30~	-0.2	1.70~	-1.50	-0.30	-2.70	0.1	1.50	-2.80	1.30	0.20	-1.10	2.80	-2.30	-0.50
t	*-1.72*	*-0.338*	*1.79*	*-1.03*	*-0.19*	*-1.56*	*0.14*	*1.49*	*-1.47*	*0.74*	*0.13*	*-0.92*	*1.48*	*-0.96*	*-0.30*
0.5	-2.60~	-0.2	2.10**	-2.30	0.20	-3.50*	0.1	1.80	-2.80*	1.00	-1.20	-0.80	3.10*	-3.30	0.20
t	*-1.88*	*-0.253*	*2.67*	*-1.46*	*0.17*	*-2.43*	*0.12*	*1.61*	*-2.01*	*0.77*	*-0.62*	*-0.62*	*1.96*	*-1.41*	*0.14*

Notes: Mean changes in outcome indicators between 1993 and 2007 are restricted to only those districts determined by PSM. PS kernel matched standard errors are obtained by bootstrapping (100 repetitions). Double differences are expressed in changes in percentage points. t-statistics obtained when testing the null hypothesis of equality of mean between UD and NMD changes in italics: ~ significant at 10% level; * significant at 5% level; ** significant at 1% level

Table 8.10: Double difference estimates of changes in labour market indicators – urban areas Comparison between UD and OMD

Comparison between UD and OMD	Threshold at 30%: 65 treated and 431 untreated districts					Threshold at 40%: 53 treated and 458 untreated districts					Threshold at 60%: 42 treated and 375 untreated districts				
	Change in share of urban...					***Change in share of urban...***					***Change in share of urban...***				
	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities
Mean change in outcome indicators (1993-2007)															
non mining districts	5.08	2.33	1.48	-9.72	8.24	5.57	*1.99*	1.63	-9.24	7.6	5.68	*1.94*	1.7	-9.1	7.39
old mining districts	8.7	-0.12	14.03	-9.11	-4.92	9	*-0.31*	15.78	-8	-7.78	9.22	*-0.2*	18.64	-8.22	-10.41
PS-DD estimates of ATT	0.02	-1.2	0.12**	0.03	-0.15**	1.8	-0.5	13.00**	1.6	-14.60**	3.6	-0.3	15.90**	3.2	-19.20**
Bandwith 0.06															
t-statistics	*0.92*	*-1.23*	*4.78*	*0.71*	*-3.43*	*0.87*	*-0.43*	*4.04*	*0.52*	*-2.95*	*1.24*	*-0.22*	*3.94*	*0.85*	*-3.3*
Sensitivity analysis															
Changing bandwidth															
0.01	1.4	-1.4	7.90*	2.4	-10.30*	0.6	0.2	11.10**	-1	-10.1	3.1	-0.4	13.30**	-0.9	-12.4
t	*0.55*	-1.044	*2.37*	*0.62*	*-2.06*	*0.2*	*0.16*	*2.84*	*-0.24*	*-1.62*	*0.94*	-0.21	*2.68*	*-0.15*	*-1.36*
0.08	0.02	-1.4	0.12**	0.03	-0.15**	1.8	-0.5	13.30**	2.2	-15.60**	3.4	-0.2	15.90**	3.7	-19.60**
t	*1.03*	-1.322~	*4.53*	*0.86*	*-3.11*	*0.81*	*-0.46*	*3.83*	*0.71*	*-3.87*	*1.22*	-0.19	*4.49*	*0.92*	*-3.3*
0.5	0.03~	-1.7*	0.12**	0.01	-0.13**	2.90~	-1.6~	14.00**	2	-16.00**	3.70~	-1.2	16.90**	1.7	-18.60**
t	*1.86*	-2.12	*4.61*	*0.33*	*-3.72*	*1.74*	*-1.9*	*5.18*	*0.8*	*-4.04*	*1.77*	-1.21	*4.82*	*0.46*	*-4.29*

Notes: Mean changes in outcome indicators between 1993 and 2007 are restricted to only those districts determined by PSM. PS kernel matched standard errors are obtained by bootstrapping (100 repetitions). Double differences are expressed in changes in percentage points. t-statistics obtained when testing the null hypothesis of equality of mean between UD and OMD changes in italics: ~ significant at 10% level; * significant at 5% level; ** significant at 1% level

Table 8.11: Double difference estimates of changes in labour market indicators – urban areas – Comparison between UD and NMD

Comparison between UD and NMD	Threshold at 30%: 204 treated and 829 untreated districts					Threshold at 40%: 143 treated and 887 untreated districts					Threshold at 60%: 79 treated and 956 untreated districts				
	Change in share of urban...					***Change in share of urban...***					***Change in share of urban...***				
	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities	population 15+ engaged in economic activities	labour force that is unemployed	15+ active population employed in mining activities	15+ active population employed in agricultural activities	15+ active population employed in non mining and non agricultural activities
Mean change in outcome indicators (1993-2007)															
non mining districts	5.35	2.29	0.98	-8.77	7.79	5.42	2.17	1.09	-8.79	7.71	5.31	2.15	1.18	-9.02	7.84
new mining districts	4.70	-3.08	3.22	-12.71	9.48	4.44	-5.01	4.04	-14.63	10.59	6.28	-11.10	5.96	-14.44	8.48
PS-DD estimates of ATT	-0.60	-5.6	2.00*	-1.20	-0.80	-1.00	-7.2	2.80**	-3.80	1.00	2.30	-13.60	4.70**	-2.60	-2.10
Bandwith 0.06															
t-statistics	*-0.43*	*-0.991*	*2.82*	*-0.78*	*-0.52*	*-0.58*	*-0.98*	*3.37*	*-2.35*	*0.57*	*1.18*	*-1.02*	*3.35*	*-1.05*	*-0.96*
Sensitivity analysis															
Changing bandwidth															
0.01	-0.70	-5.8	2.20**	-1.30	-0.90	-0.60	-7.4	2.90**	-3.70~	0.80	2.00	-14.20	5.10**	-2.80	-2.30
t	*-0.46*	*-0.911*	*3.03*	*-0.75*	*-0.52*	*-0.36*	*-0.88*	*3.06*	*-1.78*	*0.45*	*0.93*	*-1.02*	*3.33*	*-1.10*	*-0.88*
0.08	-0.60	-5.6	2.00**	-1.30	-0.60	-0.90	-7.2	2.90**	-3.90*	1.10	2.10	-13.60	4.70**	-2.90	-1.80
t	*-0.51*	*-1.002*	*2.88*	*-1.00*	*-0.45*	*-0.69*	*-0.90*	*3.29*	*-2.42*	*0.70*	*1.04*	*-1.18*	*3.43*	*-1.31*	*-0.81*
0.5	-0.70	-5.4	2.20**	-3.40*	1.30	-1.00	-7.2	2.90**	-5.60**	2.60	1.00	-13.30	4.80**	-5.30**	0.50
t	*-0.58*	*-0.895*	*3.75*	*-2.53*	*1.03*	*-0.69*	*-1.01*	*3.88*	*-3.77*	*1.76*	*0.57*	*-1.20*	*3.12*	*-2.69*	*0.23*

Notes: Mean changes in outcome indicators between 1993 and 2007 are restricted to only those districts determined by PSM. PS kernel matched standard errors are obtained by bootstrapping (100 repetitions). Double differences are expressed in changes in percentage points. t-statistics obtained when testing the null hypothesis of equality of mean between UD and NMD changes in italics: ~ significant at 10% level; * significant at 5% level; ** significant at 1% level

9. Conclusions

Empirical and theoretical literature on the mining-development nexus suggests that the role of mineral wealth in fostering economic development is ambiguous, controversial and often contentious especially at local level. Also in Peru, local benefits, costs, spill overs and externalities of mining are highly debated and public opinion is split between opponents and supporters of the mining industry as engine of growth for local economies. At the same time, the bulk of the evidence about the actual impact of mining operations on the welfare of local populations comprises case-studies that focus on the most emblematic episodes of mining-community conflicts. Research based on nationally representative data is still scant though it could shed some light on to what extent the state of growing unrest in Peru is due to unfulfilled expectations attributed to the mining industry and lack of information in local communities rather than to an actual negative impact on their well-being. To help to fill this gap we have studied the impacts of the recent mining boom (from the mid-Nineties to 2007) on local economies of Highlands by combining census data with other information on mining presence and geographic characteristics. Our empirical methods combine a double difference estimator with propensity score matching on pre-boom covariates. We examine average impacts on population share of recent migrants, on district labour allocation, on unemployment and participation in economic activities as well as on basic services and housing quality. We have focused on a number of questions.

Did the mining boom lead to a process of income diversification in mining areas? Which forces could have contributed to this process? There are indications that propulsive spill over effects of mining on non-primary sectors were limited. In rural areas, the mining boom led to a decline in dependence of local economies on farming activities but, on balance, migration seem to be an important driving factor of the changes in the structure of local economies.

Did the mining boom affect rural and urban areas in a different way? Did a tradition of mining history shape these dynamics? Our findings point out heterogeneity in the effects of the mining boom in relation to initial conditions, namely in previous experience of mining exploitation and they highlight the fact that impacts on local economies also vary slightly across rural and urban areas. On balance, economic and demographic effects of the mining boom tended to be less in new mining districts, especially in rural areas. In contrast, the impact on public services and housing quality involved only new mining areas. More precisely, we can summarize our findings as follows:

- The proliferation of mining operations generated pull migration forces towards extractive areas especially towards districts with a long tradition of mining development. In these districts, migration flows led to an increase in population share of recent migrants from other districts. As a result, in 2007, recent migrants accounted for more than 15 percent of both rural and urban population of old mining districts. There is also evidence that, in old mining districts, migration flows offset outward migration resulting in a positive effect on demographic growth. New mining areas were affected in a different way. The mining effects on migration were limited to urban areas where share of migrant population remained stable compared to a decline in non-mining areas. This suggests that here the pull migration forces manifest themselves also as a curb on outward migration from the Highlands.
- The history of mining exploitation also shapes the effects of the mining boom on the labour market and on the structure of local economy. Overall, the recent mining boom led to an expansion of labour opportunities in the mining sector, but it did not trigger a process of economic diversification towards non-primary activities. This pattern is more evident in old mining districts where the mining boom had a substantial negative effect on labour share of non-primary activities and no impact on unemployment rates. It is worth observing that rural old mining areas, however, were also the only areas in the Highlands where the mining boom caused a positive effect on the proportion of population that was engaged in economic activities. At the same time, in rural areas of old mining districts, the proportion of labour employed in farming

was negatively affected by the presence of mining operations. Since we find no impact on agricultural production and crop prices, these changes in structure of local economy can be traced back more noticeable inflows of new mining workers and their families than to a process of "de-agrarization" due to the recent boom. Indeed, these areas also experienced a larger increase in incidence of immigrant inhabitants than the rest of Highlands and they already showed a lower incidence of agriculture labour before the mining boom. In 1993, 67-70 percent of the rural population and 25-32 percent of the urban population in old mining districts was engaged in farming activities compared to 82 and 55 percent, respectively, in non-mining districts. In new mining areas, the effects on allocation of labour force across sectors and on unemployment are less clear. Urban areas of new mining districts exhibit a larger decline in agriculture labour share and a higher growth in non-primary labour share than non-mining urban areas. In addition, they experienced a marked reduction in unemployment rates compared to growing unemployment in non-mining urban centres. These differences between new and non-mining urban areas, however, are not significant. A possible explanation is that the impact of mining development on employment opportunities in economic activities is still incipient and is particularly differentiated across new mining areas with some zones more able to capture positive effects of mining growth. In rural areas of new mining districts, instead, there are no sign of these dynamics at all.

- Finally, our findings point out that the mining boom did not produce one of the most expected effects, namely to an improvement in access to basic services. Interestingly, we also found a negative impact on access to water and sanitation services in rural areas of new mining districts.

In conclusion, all this evidence suggests that the potential welfare and income effect of the mining boom at local level is likely to be largely untapped. Therefore local populations' claims that the recent proliferation of mining operations in their territory has not produced a significant positive impact on their living conditions find a confirmation in our findings.

References

Adelman, I. and C. T. Morris (1988) *Comparative Patterns of Economic Development, 1850-1914*, The John Hopkins University Press, Baltimore

Aste Daffós, J., J. De Echave Cáceres, M. Glave Testino (2004), *Resolviendo Conflictos entre el Estado, las Empresas Mineras, las Comunidades Campesinas y los Organismos de la Sociedad Civil, Procesos de Concertación y Desarollo Local en Zonas Mineras*, Lima, Peru.

Auty R.M. (1993) *Sustaining development in mineral economies: the resource curse thesis*. Routledge, London

Auty RM (2001) "The political economy of resource-driven growth", *European Economic Review*, 45(4-6): 839-846

Barrantes, R. (2005), "Mineria, desarrollo y pobreza en el Peru, o de como todo depende del cristal con que se mire". In R. Barrantes, P. Zarate and A. Durand, "*Te quiero pero no": mineria, desarrollo y poblaciones locales*, Instituto de Estudios Peruanos and Oxfam America, Lima.

Bebbington, A., L. Hinojosa, D. Humphreys Bebbington, M.L. Burneo and X. Warnaars (2008) "Contention and Ambiguity: Mining and the Possibilities of Development", *Development and Change*, 39(6): 887–914.

Bebbington, A. and J. Bury (2009) "Institutional challenges for mining and sustainability in Peru", *Proceedings of the National Academy of Sciences,* 106(41): 17296-17301.

Becker, S. O. and A. Ichino (2002), "Estimation of average treatment effects based on propensity scores", *The Stata Journal*, 2(4): 358-77.

Blattman, C., J. Hwang, and J. Williamson (2007) "Winners and losers in the commodity lottery: The impact of terms of trade growth and volatility in the Periphery 1870-1939", *Journal of Development Economics*, Elsevier, 82(1): 156-179

Brunnschweiler C.N., E.H. Bulte (2008) "The resource curse revisited and revised: a tale of paradoxes and red herrings", *Journal of Environmental Economics and Management*, 55(3): 248–264

Bulte, E.H., R. Damania, R.T. Deacon (2005) "Resource intensity, institutions, and development", *World Development*, 33(7):1029–1044

Bury, J. (2004) "Livelihoods in transition: transnational gold mining operations and local change in Cajamarca, Peru", *Geographic Journal*, 170(1): 78-91

Caliendo, M. and S. Kopeinig (2008), "Some practical guidance for the implementation of propensity score matching", *Journal of Economic Surveys*, 22(1): 31-72

Campbell, Bonnie (ed) (2009) *Mining in Africa. Regulation and Development, International Development Research Centre and The Nordic Africa Institute*, Pluto Press, London and New York

Davis, G. A. (1995) "Learning to Love the Dutch Disease: Evidence from the Mineral Economies." *World Development*, 23(10): 1765-79.

Bridge, G. (2004) "Mapping the Bonanza: Geographies of Mining Investment in an Era of Neoliberal Reform", *Professional Geographer*, 56(3): 406–21.

Davis G. (1995) "Learning to love the Dutch disease: evidence from the mineral economies", *World Development*, 23(10): 1765–1779

Davis G. and J. E. Tilton (2005) "The resource curse", *Natural Resources Forum*, 29(3):233–242

De Echave, J. and C. Víctor Torres (2005) *Hacia una estimación de los efectos de la actividad minera en los índices de pobreza en el Perú*, CooperAcción, Lima, Peru.

Defensoría del Pueblo (2004) *Reporte de conflictos sociales No. 10*, Defensoría del Pueblo, Lima, Peru

Defensoría del Pueblo (2007). *Informe extraordinario. Los conflictos socioambientales por actividades extractivas en el Perú*, Defensoría del Pueblo, Lima, Peru

Defensoría del Pueblo (2009) *Reporte de conflictos sociales No. 69*, Defensoría del Pueblo, Lima, Peru

De Ferranti, D., G. Perry, D. Lederman and W.F. Maloney (2001) *From Natural Resources to the Knowledge Economy Trade and Job Qualit,* Washington, D.C. World Bank.

Ding N. and B.C. Field (2005) "Natural Resource Abundance and Economic Growths", *Land Economics* 81: 496-502.

Frankel, J. (2010) "The Natural Resource Curse: A Survey", NBER Working Paper No. 15836

Glave M. and Kuramoto J. (2002), "Mineria, Minerales y Desarrollo Sostenible en el Peru". In International Institute for Environment and Development (IIED) and World Business Council for Sustainable Development (WBCSD), *Mineria, Minerales y Desarrollo Sustentable- America del Sur*, Santiago de Chile

Glave, M. and J. Kuramoto, (2007) "La minería peruana: lo que sabemos y lo que aún nos falta por saber", in *Investigación, políticas y desarrollo en el Perú*. Lima: GRADE**.**

Grompone R. (2005) "Posibilidades y Limites de Algunas Experiencias de Promoción de la Participación Ciudadana en el Perú", in P. Zarate (ed.), *Participación Ciudadana y Democracia: Perspectivas Críticas y Análisis de Experiencias Locales*, Lima: Instituto de Estudios Peruanos

GRADE (2002), *Participatión Comunitaria en el Monitoreo de las Actividades Mineras: Los Casos de Vico y de San Mateo de Huanchor*, Programa APGEP-SENREM Convenio USAID-CONAM, Lima, Peru

Grupo Propuesta Ciudadana (2005) *Reporte Nacional Nº 2 de Vigilancia de las Industrias Extractivas,* Lima

Grupo Propuesta Ciudadana (2010) *Reporte Nacional Nº 11 de Vigilancia de las Industrias Extractivas*, Lima

Guo S. and M.W. Fraser (2010) *Propensity Score Analysis, Statistical Methods and Application*, SAGE Publications, Inc. Thousands Oaks, California.

Gylfason, T. (2001) "Natural Resources, Education, and Economic Development", *European Economic Review*, 45: 847-59

Hausmann, R. and R. Rigobon (2003) "An Alternative Interpretation of the 'Resource Curse': theory and Policy Implications," in J. Davis (ed) *Fiscal Policy Formulation and Implementation in Oil-Producing Countries,* International Monetary Fund: Washington, DC

Heckman, J., H. Ichimura, and P. Todd (1997) "Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Program", *Review of Economic Studies*, 64: 605-654

Heckman, J., H. Ichimura, J. Smith, and P. Todd (1998) "Characterizing selection bias using experimental data", *Econometrica*, 66(5): 1017–1098.

Heckman, J. and R. Robb (1985) "Alternative models for evaluating the impact of interventions". In J. Heckman and B. Singer (eds), *Longitudinal Analysis of Labor Market Data*. Cambridge: Cambridge University Press.

Holder, R. (2005) “The curse of natural resources in fractionalized countries”, *European Economic Review*, 50(6): 1367-1386.

Holland P.W. (1986) “Statistics and causal inference”, *Journal of the American Statistical Association*, 81:945–970

Humphreys, M., J. Sachs and J. Stiglitz, (2007a) “Future Directions for the Management of Natural Resources”. In Humphreys, Sachs, and Stiglitz, (eds.), *Escaping the Resource Curse*, Columbia University Press: New York

Humphreys, M., J. Sachs and J. Stiglitz (2007b) *Escaping the Resource Curse*, Columbia University Press: New York.

International Council on Mining and Metals - ICMM (2007a) *Ghana Country Case Study. The challenge of mineral wealth: using resource endowments to foster sustainable development*, ICMM

International Council on Mining and Metals - ICMM (2007b) *Chile Country Case Study. The challenge of mineral wealth: using resource endowments to foster sustainable development*, ICMM

International Council on Mining and Metals - ICMM (2007c) *Tanzania Country Case Study. The challenge of mineral wealth: using resource endowments to foster sustainable development*, ICMM

International Council on Mining and Metals - ICMM (2007d) *Peru Country Case Study. The challenge of mineral wealth: using resource endowments to foster sustainable development*, ICMM

International Institute for Environment and Development - IIED and World Business Council for Sustainable Development – WBCSD (2002) *Breaking New Ground: The Report of the Mining, Minerals and Sustainable Development Project*, Earthscan Publications Ltd London

Instituto de Ingenieros de Minas del Perú Minería Peruana (2010) *Contribución al Desarrollo Económico y Social*, IIMP, Lima

Instituto Nacional de Recursos Naturales -INRENA (1995) *Natural Resources in Peru 1995: bioclimate and land potential scores*, INRENA, Lima

International Finance Corporation – IFC (2007) *Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets*. Washington, DC: IFC

Herbertson, K., A. Ballesteros, R. Goodland, I. Munilla (2009) *Breaking Ground: Engaging Communities in Extractive and Infrastructure Projects*, World Resources Institute (WRI)

Kuramoto, J. R. (2000) “Las aglomeraciones productivas alrededor de la minería: el caso de la minera Yanacocha S.A”, Documentos de Trabajo 27, Grupo de Análisis para el Desarrollo (GRADE).

Kuramoto, J. R. (2001) “Las aglomeraciones mineras en Peru”. In Rudolf M. Buitelaar *Aglomeraciones mineras y desarrollo local en America Latina*, CEPAL, IDRC and CIID, Bogota.

Kuramoto, J. R. 2003, “La Minería Peruana, Desarrollo Nacional y Regional”, Boletín Informativo de la Sociedad Nacional de Minería, Petroleo y Energía, 15/2/2003 available at http://www.grade.org.pe/asp/brw_med1.asp?id=8017

Lechner, M. (1999) “Earnings and employment effects of continuous off-the-job training in East Germany after unification”, *Journal of Business Economic Statistics* 17(1): 74–90

Lechner, M. (2001) Identification and estimation of causal effects of multiple treatments under the conditional independence assumption. In M. Lechner and F. Pfeiffer (eds), *Econometric Evaluation of Labour Market Policies* (pp. 1–18). Heidelberg: Physica.

Hinojosa, L., A. Bebbington, A. Barrientos and T. Addison (2010) “Social Policy and State Revenues in Mineral-Rich Contexts”, Social Policy and Development Programme Paper Number 44, UNRISD, Geneva

Martines-Alier, J. (2002) *The environmentalism of the poor: a study of ecological conflicts and valuation*, Edward Elgar Pub., Cheltenham, UK.

Matsuyama, K. (1992) "Agricultural Productivity, Comparative Advantage, and Economic Growth", *Journal of Economic Theory*, 58(2): 317-34

McMahon G. and F. Remy (eds) (2001) *Large mines and the community: socioeconomic and environmental effects in Latin America, Canada, and Spain*. International Development Research Centre/World Bank Group, Ottawa/Washington, DC

Mehlum, H., K. Moene and R. Torvik (2006) "Institutions and the Resource Curse", *Economic Journal*, 116 (508): 1-20.

Ministry of Energy and Mines - MINEM (2004), *Anuario Minero 2004*, Lima

Ministry of Energy and Mines - MINEM (2005) "Concertación Minería Comunidad: una Alianza para el Desarollo Sostenible", presentation, Ministerio de Energía y Minas, 23 June 2005, available at www.comexperu.org.pe/archivos%5Cforo%5Cforo_23062005%5CFelipe%20Quea.ppt

Ministry of Energy and Mines - MINEM (2009), *Mining Annual Report 2009*, Lima

Otto, J., C. Andrews, F. Cawood, M. Doggett, P. Guj, F. Stermole, J. Stermole, J. Tilton (2006) *Mining Royalties A Global Study of Their Impact on Investors, Government, and Civil Society*, World Bank, Washington DC

Ortega Girones, E., A. Pugachevsky, G. Walser (2009) "Mineral Rights Cadastre. Promoting Transparent Access to Mineral Resources", Extractive Industries for Development Series N.4, World Bank, Washington DC

Oxfam America (2009), *Oxfam's oil, gas, and mining program*, Oxfam America, Boston

Pagan, A. and A. Ullah (1999) *Nonparametric Econometrics*. Cambridge: Cambridge University Press

Pasco-Font, A. (2000) "El impacto del programma de estabilizacion y las reformas estructurales sobre el desempeno ambiental de la mineria de cobre en Peru: 1990-1997", Serie Medio Ambiente e Desarrollo, No. 25, CEPAL, Santiago de Chile.

Pasco-Font, A, A. Diez Hurtado, G. Damonte, R. Fort and G. Salas (2001), "Peru: Learning by Doing". In G. McMahon and F. Remy (eds.), *Large Mines and the Community: Socioeconomic and Environmental Effects in Latin America, Canada, and Spain*, IDRC and World Bank, Washington DC.

Pegg, S. (2006) "Mining and Poverty Reduction: Transforming Rhetoric into Reality", *Journal of Cleaner Production* 14(3–4): 376–87.

Poelhekke, S. and F. van der Ploeg (2007) "Volatility, Financial Development and the Natural Resource Curse", Economics Working Papers ECO2007/36, European University Institute.

Revesz, B. and A. Diez. (2006) 'El Triángulo sin Cúpula (o los Actores Desregulados en los Conflictos Mineros)', in E. Toche (ed.), *Perú Hoy, Nuevos Rostros en la Escena Nacional*, Lima: Desco

Rosenbaum, P. and D. Rubin. 1983. "The Central Role of the Propensity Score in Observational Studies for Causal Effects", *Biometrika* 70: 41-55.

Rosenbaum, P. R. 2002. *Observational Studies*. Second Edition. Springer-Verlag. New York.

Ross M.L. (2001) *Extractive sectors and the poor,* Oxfam America, Washington, DC

Ross M.L. (2003) "How does mineral wealth affect the poor?" Unpublished manuscript, UCLA. Available at http://www.sscnet.ucla.edu/polisci/faculty/ross/minpoor.pdf

Sachs J.D. and A.M. Warner (1995) "Natural resource abundance and economic growth", Harvard Institute for International Development Discussion Paper No. 517a, Cambridge, MA.

Salim, E. (2003) *Striking a Better Balance: The Final Report of the Extractive Industries Review*, Extractive Industries Review, Jakarta Selatan and Washington DC

Silverman, B. (1986) *Density Estimation for Statistics and Data Analysis*. London: Chapman and Hall.

Stijns, J.P. (2005) "Natural resource abundance and economic growth revisited", *Resources Policy*, 30:107–130

Stratus Consulting Inc. (2003) *Report on the Independent Assessment of Water Quantity and Quality near the Yanacocha Mining District, Cajamarca, Peru*, Prepared for IFC/MIGA Compliance Advisor/Ombudsman.

Torres-Zorrilla, J. (2000) "Una estrategia de desarrollo basada en recursos naturales: análisis cluster del complejo de cobre de la Southern Perú", Serie Desarollo Productivo, No 70, Santiago de Chile, CEPAL.

United Nations Conference on Trade and Development -UNCTAD (2002) *The least developed countries report 2002*, United Nations, New York.

United Nations Development Programme - UNDP (2006) *Niger Delta Human Development Report*, Abuja, Nigeria.

World Bank (2005) "Community Development Toolkit", *ESMAP Formal Report Series,* Report No. 310/05, World Bank, Washington DC

World Bank (2008) *Implementing the Extractive Industries Transparency Initiative. Applying Early Lessons from the Field*, World Bank, Washington DC.

Yelpaala, K. and S. H. Ali (2005) "Multiple scales of diamond mining in Akwatia, Ghana: addressing environmental and human development impact", *Resources Policy*, 30(3): 145-155.

World Bank and IFC (2002) *Large Mines and Local Communities: Forging Partnerships, Building Sustainability*, World Bank and IFC, Washington DC

Wright, G. (1999) "Can a Nation Learn? American Technology as a Network Phenomenon". In N. R. Lamoureaux, D.M.G. Raff and P. Tennin (eds), *Learning by Doing in Markets, Firms and Countries*. National Bureau of Economic Research and University of Chicago Press, Chicago

Zarate, P. and A. Durand (2005) "El desarrollo a la vuelta de la mina: Percepciones sobre desarrollo, pobreza y mineria". In R. Barrantes, P. Zarate and A. Durand, *"Te quiero pero no": mineria, desarrollo y poblaciones locales*, Instituto de Estudios Peruanos and Oxfam America, Lima.

Zegarra, E., J. C. Orihuela, M. Paredes (2007) "Minería y economía de los hogares en la sierra peruana: Impactos y espacios de conflicto", Documento de Trabajo No. 51, GRADE, Lima.

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