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Is mining harmful or beneficial? A survey of local community perspectives in China

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ABSTRACT

Mining activities often have significant impacts - both positive and negative - on local communities. This study shares experiences from China, surveying perspectives from rural communities on the net benefits of mining. Four indicators are identified and used to determine impact: employment opportunities, environmental pollution, land expropriation, land subsidence and associated resettlement. The analysis uses a demographically and economically diversified sample of 352 farmers residing in the vicinity of mines across six provinces. The study found that only a small number of farmers perceive mining to be providing net benefits, and that in such cases, direct employment is the main factor influencing this position. While land expropriation does not affect perceived net benefits, land subsistence does, and although relocation helps peasants minimize risks, it does not significantly change the population's generally negative view of mining. The priority for the Chinese government should be to formulate a sustainable framework to mitigate the risks of mining, particularly displacement and resettlement.

1. Introduction

The question “is mining good for development?” has rallied both those favoring, as well as those opposing mineral resource exploitation. On the one hand, mining has been actively promoted as a way to boost the economy and reduce poverty. Previous studies (Aroca, 2001; Lagos and Edgar, 2010; Hajkowicz et al., 2011; Rolfe et al., 2011) have indicated a positive contribution of mining to the regional economy regarding GDP growth and income increments. On the other hand, scholars proposed the ‘resource curse’ hypothesis, positing that countries most abundantly endowed with mineral resources fare least in terms of GDP growth (Auty, 1993, 2007; Sachs and Warner, 1995). Others have also reported on mining’s impact on the environment, resource use, and health. Mining activities have significantly decreased the quality of the ecosystem (Vatalis and Kaliampakos, 2006; Zhang et al., 2011), disrupted land and water use (Hilson, 2002a; Sonter et al., 2014), and induced a higher incidence of cancer, and heavy metal-related diseases (Tschakert and Singha, 2007; Zhuang et al., 2009; Fernández-Navarro et al., 2012). However, mining companies have also helped to establish health infrastructure and services, and introduced health campaigns, with significant improvements in infant mortality and life expectancy in some remote areas (Thomason and Hancock, 2011; Kuir-Ayius, 2016).

In the context above, it is important to also include the view from those directly affected by mining: local communities. Their perceptions towards the sustainability of mining should be assessed comprehensively – not only the economic impact should be taken into account, but the environmental and social impact as well (Azapagic, 2004). For this purpose, this study presents a “view from below” in China, currently the world’s largest producer of numerous mineral resources, including coal, iron ore, aluminum, tin, zinc, bismuth, and gold. However, only a few studies have examined the social, economic and environmental impact of mining at the (rural) community level in China. This paper aims to provide a critical contribution to the literature on the impact of mining in the context of rural China.

This study aims to answer the following research questions: 1) what are the economic, environmental and social impacts of mining perceived by Chinese local communities? 2) how do local communities perceive the net benefits of mining? and, 3) how do the impacts of mining affect the perceptions of net benefits? The impacts that the paper will assess are shifts in, respectively, employment opportunities, environmental pollution, land expropriation, land subsidence and resettlement.

The paper is structured as follows: Section two presents the literature review. Section three presents the analytical framework and concepts used in this paper, showing the four impacts that mining brings to

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local communities, and the concept of perceived net benefits. Section four outlines the study area and the data. Section five presents the empirical results, showing how the four impacts affect local communities and influence the perceived net benefits. The final section provides discussion and final conclusions.

2. Pros and cons of mining: the global and Chinese experience

The various impacts brought about by mining, both beneficial and adverse, have been the subject of public and scientific debate for decades. By using different indicators, methods and data, scholars have reached variegated conclusions about the total net effect of mineral exploitation.

It is often ascertained that mining activities can provide opportunities for economic growth, poverty reduction, and increased integration with the global economy. For instance, in the case of Chile and Australia, increased mining investment has allegedly coincided with an upturn in domestic growth (Lagos and Edgar, 2010; Hajkowicz et al., 2011). The positive economic impact of mining has also been found to encompass the local level as well. For instance, Rolfe et al. (2011) maintain that mining can make an important contribution in terms of local employment and provide opportunities to strengthen local (auxiliary) businesses. Specifically, artisanal mining has been found to provide new employment opportunities to resource-poor groups, yielding higher incomes and greater economic autonomy (Labonne, 1996; Hilson, 2002b; Shen and Gunson, 2006).

In contrast, the resource curse hypothesis suggests and validates that resource-abundant countries may suffer from lower rates of economic growth compared to those without such resources (Auty, 1993, 2007; Sachs and Warner, 1995). On a local level, mining activities have been found to have adverse impacts on socially vulnerable groups, such as women, elderly, ethnic and indigenous minorities, and the disabled. These groups are more easily prone to social marginalization, often due to lacking ownership of productive resources and a low(er) socio-economic status (Lahiri-Dutt, 2008; Ahmad and Lahiri-dutt, 2006).

The employment effects of mining, however, do not only affect local people but may also attract migrants from other regions (Aroca, 2001; Carrington and Pereira, 2011; Rolfe et al., 2011). The inflow of migration often increases the demand for goods and services, leading to increases in production and consumption. However, goods and services also become more expensive, and those working in the agricultural and services sector (with generally lower wages compared to those employed in the mining industry) may not be able to afford the increased costs of living.

Mining projects momentously affect local communities with regard to ecosystems and land use. Emissions from mining and mineral processing, such as dust, noise, wastewater, and heavy metals, have significantly decreased the quality of the ecosystem (Vatalis and Kaliampakos, 2006; Dogaru et al., 2009; Zhang et al., 2011). In turn, environmental degradation has also led to public health issues, such as a higher incidence of cancer, mercury-related diseases, and elevated lead levels in the blood (Tschakert and Singha, 2007; Zhuang et al., 2009; Fernández-Navarro et al., 2012). Mining also disrupts land and water use, which reduces the viability of other industries, such as agriculture, aquaculture, and tourism (Hilson, 2002a; Sonter et al., 2014). Mining-induced displacement is another way that endangers the livelihood of local communities. The displacement is often coupled with ill-implemented resettlement and uneven compensation (Downing, 2002; Ahmad and Lahiri-Dutt, 2006). Therefore, the communities in mining areas are undergoing accumulative livelihood dispossession (Perreault, 2013). However, the mining industry also can bring positive effects on local communities. In some instances, mining firms establish health infrastructure and services in remote areas, resulting in significant improvements in infant mortality and life expectancy (Thomason and Hancock, 2011; Banks et al., 2013; Kuir-Ayius, 2016).

The international debate, with disagreement on the impacts of mining, as outlined above, are echoed in the literature on Chinese mining as well. China's mining industry – with particular reference to coal mining – is regarded as a driving force of the nation's economy, providing employment and alleviating rural poverty (Rui, 2005; Shen and Gunson, 2006; Ge and Lei, 2013; Lei et al., 2013). Contrarily, others have pointed to the environmental problems, such as water and air pollution, hydrological disturbance, and acid mine drainage, i.e. the outflow of acidic water from metal or coal mines (Bian et al., 2010). Mining has also displaced millions of people in China (Zhang, 2013; VanderKlippe, 2015; Xinhua, 2015), and has led to substantive tensions between mining industries and peasants (Zhang, 2013; Yang et al., 2017; Yang and Ho, 2018). It is generally believed that land expropriation is the dominant factor for displacement in mining areas (Ahmad and Lahiri-Dutt, 2006; Abuya, 2013; Madebwe et al., 2013). However, a recent study by Yang et al (2017) shows that land subsidence resulting from mining activities is also a dominant cause of displacement. Scholars have argued that the costs of mining in China in terms of displacement, pollution, and health have outweighed the short-term economic benefits (Andrews-Speed et al., 2002; Economy, 2007; Mao et al., 2008).

Given that mining activities directly affects local residents, examining local communities' perceptions is a task deemed essential. Over the years, there has been a steady increase in studies on community's perceptions on the impacts of mining (Kitula, 2006; Garvin et al., 2009; Petkova-Timmer et al., 2009; Badera and Kocoń, 2014). In contrast, community-level studies on the comprehensive impact of mining in China are relatively few. Previous studies have focused on either the economic aspects (Wright, 2004; Rui, 2005) or the environmental impact (Shi and He, 2012; Li et al., 2014; Shi, 2014). To address this gap, this study focuses on Chinese rural communities' perceptions of the *net benefits* of mining as operationalized through four indicators, elaborated on in the following section.

3. The analytical framework: assessing four impacts

Based on the literature review in Section 2, four key impacts are identified that may influence the perceptions of local communities (Fig. 1). Before the perceptions of mining impacts were disaggregated, respondents were first asked whether and to what extent they felt that the benefits of mining outweigh the costs. This was done by the use of a five-point Likert scale.

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1 *Employment opportunities*. Respondents were asked whether mining activities had benefited them through a series of questions with regard to work in the mining sector, mining-related transport and related services.
2 *Environmental degradation*. Participants were asked to evaluate the seriousness of the main forms of mining-induced environmental degradation, that is, air, noise, and water pollution, based on a scale from 1 (none) to 5 (very serious).
3 *Land expropriation*. This indicator aims to assess the impact of land loss on the perceptions of the net benefit of mining. Respondents were asked whether their land was subject to expropriation, and if so, further questions inquired about the procedure of land acquisition and satisfaction concerning compensation.
4 *Resettlement and land subsidence*. Respondents were asked the situation of land subsidence, and if they were relocated, various questions regarding the resettlement were asked.

4. Study sites and sampling

4.1. Study sites

The fieldwork was conducted in eight counties across five provinces and one provincial-level municipality (Table 1), respectively Binxian

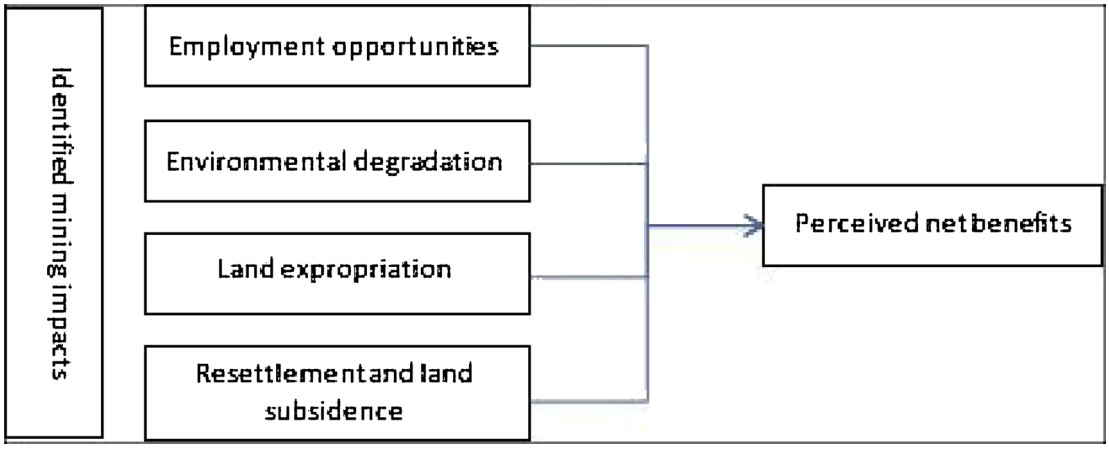

Fig. 1. Analytical framework of this study.
Source: illustrated by the author.

Table 1
Description of study sites.
Source: The survey.

Area	Province	County	Type of mineral	Stages of mining	Size of mines[a]
Northwest China	Shaanxi	Binxian	Coal	Developing stage	Large
		Hancheng	Coal	Maturing stage	Medium, small
	Shanxi	Shuozhou	Coal	Developing stage	Medium, small
East China	Shandong	Jining	Coal	Maturing stage	Large
		Tengzhou	Coal	Depletion stage	Large
	Jiangsu	Peixian	Coal	Recovery stage	Large
Southwest China	Chongqing	Xiushan	Manganese	Maturing stage	Medium and small
	Hunan	Huayuan	Zinc / Lead	Maturing stage	Small

[a] By scale, coal mines in China are divided into 3 types: large, medium-sized, and small, whose annual production capacity is larger than 0.9, 0.3-0.9, and below 0.3 million ton per year, respectively (Shen and Gunson, 2006, p. 429). This classification roughly applies to other minerals as well.

and Hancheng County (Shaanxi Province), Shuozhou County (Shanxi Province), Jining and Tengzhou County (Shandong Province), Peixian County (Jiangsu Province), Xiushan County (Chongqing Municipality), and Huayuan County (Hunan Province).

The counties were selected on the basis of an official list of mineral resource-based counties issued by the Chinese State Council (2013), with the aim to represent and account for:

(1) geographical variety: i) the east coast (Jiangsu and Shandong Province), ii) Northwest (Shanxi and Shaanxi Province), and ii) Southwest (Hunan Province and Chongqing Municipality). These areas are covered by plains, arid steppes, and mountainous areas. Note that different geological environments contribute to different problems: e.g. land collapse, sinkholes, ground fissure, and subsidence, tend to occur more often in the plains, while landslides and collapse are more common in mountainous terrain.
(2) varying levels of economic development: The eastern coastal provinces are relatively wealthy (i.e. GDP per capita in 2014 in Jiangsu and Shandong is respectively 81,874 and 60,879 RMB); the inland provinces are relatively poor (GDP per capita in Shanxi, Hunan, Shaanxi, and Chongqing is 35,064, 40,287, 46,928, and 47,859 RMB) (National Bureau of Statistics of China, 2015);
(3) various stages of mineral resource exploitation: i) the developing stage (Shuozhou, Binxian); ii) maturing stage (Hancheng, Jining, Xiushan, Huayuan); iii) depletion stage (Tengzhou); and iv) mine reclamation or recovery stage (Peixian), as distinguished in the report by the State Council (2013).
(4) different mineral resources: as coal is the most important source of energy in China, therefore in this study six coal-rich counties are chosen as study sites. In addition, two metal ore mining counties are chosen, which are located in Chongqing Municipality and Hunan Province, which are ranked among the nation's largest producers of zinc, lead, and manganese. It is important to note that in China coal is mostly extracted through underground mining[1] . Given that most observed cases in this study extract coal, the impacts of surface mining (such as large-scale land removal induced displacement and resettlement, and contamination of air and water) are underrepresented in this study.
(5) different size of mines: The small-scale mines contribute a large share of the national primary energy production and employment, but also generate numerous negative environmental and societal impacts (Rui, 2005; Shen and Gunson, 2006; Bian et al., 2010), which dominate scholarly publications of the sector. Contrarily, the impacts of the large state-owned mining enterprises are less studied. To account for this, the selection of the study sites takes the size of the mines into consideration, so as to generate a balanced picture of the overall sector.

This purposive selection of the research sites aims to generate a representative picture of the mining in China to the largest extent. However, given the size of China, it is an inexhaustible job to represent the whole China. For example, a limitation is that the coal mining might be overrepresented, therefore, metal ore mining is added as complementary.

[1] In the case of coal, 95% is produced from underground mines (compared to 31% in the United States and 22% of in Australia; Bian et al., 2010, p.217). Underground mining is also prevalent for lead, zinc, and manganese (Zhang et al., 2011).

4.2. Sampling

This study adopts both qualitative (semi-structured interviews and participatory observation) and quantitative methods (rural household survey). First, a pilot study was conducted in three sites in April and May 2015.[2] Semi-structured interviews with 29 key informants were conducted, including officials in the county mining and land administration departments, mining right holders, interviewees from the mining association, cadres from the township government, and a dozen local farmers.

Second, a survey was carried out between May and September 2015 by a team of specially trained local undergraduate students, supervised by one of the authors. A total of 352 valid questionnaires were collected. In the selected counties, the mines were first chosen and then three to five neighboring villages were visited. In each village, a household-to-household approach was utilized. Group meetings or group discussions were intentionally avoided to reduce the influence of others. At the same time, the approach to respondents by the interviewer, instead of vice versa, and selection of respondents based on availability reduces the chance of self-selection bias, namely, these with particularly negative opinion. Although the sampling is non-random and the sample is not representative, a higher degree of validity (data accuracy) and reliability (data consistency) was sought through the purposive selection of the research sites. Moreover, theoretical saturation was used to determine the sample size, up to the point where additional data provided no new insights (Morse, 2004; Small, 2009). To protect the integrity of the respondents, the survey and in-depth interviews were anonymized and carried out with prior informed consent from the respondents. The research was overseen by the Ethics Officer of the European Research Council and an independent Human Research Ethics Committee of the university.

The survey sample included 67.9% male respondents and 32.1% female respondents. The majority (58.3%) was older than 50 years, reflecting the growing left-behind elderly in rural China (Pang et al., 2004). The level of education was equally distributed between respondents, ranging from no education and a university degree. The average household size was 4.92 (see Table 2).

Table 2
Characteristics of the sample (n = 352).
Source: the survey.

	Number	Percentage
Gender		
Male	239	67.9
Female	113	32.1
Age distribution		
18-30	38	10.8
31-40	36	10.2
41-50	74	21.0
51-60	84	23.9
> 60	120	34.0
Educational level		
Illiterate	69	19.6
Primary school	99	28.1
Middle school	125	35.6
High school	42	11.9
University	17	4.8
Household size		
≤3	104	29.5
4-5	123	34.9
≥6	125	35.6

5. Results

The empirical findings are structured according to the analytical framework presented above. It respectively discusses the perceived net benefits of employment opportunities, environmental degradation, land expropriation and resettlement, and land subsidence. The final section will discuss the comprehensive perception of net benefits.

5.1. Employment opportunities

Mining is often regarded as a key to lifting rural people out of poverty through the creation of jobs which generates income for workers and their families (Wright, 2004; Rui, 2005). In this study, respondents consider employment opportunities as the most significant benefit. A number of 121 respondents, or 34.4% of the sample, indicate that at least one of their immediate family members have worked for mining companies. Mining activities also created other economic opportunities, such as for transportation (8.2%), the supply of groceries (2.6%), house rental (2.3%), and restaurant services (1.1%).

Mining related employment provides a relatively high salary.[3] Compared to migrating to work in other provinces, 76% of the investigated households prefer their family member to work at nearby mines. However, among those respondents who do not work in mining companies, 71.5% complain that they are rejected job opportunities because mining companies have become less willing to hire local residents.[4] This is similar to studies in other regions that also found that local residents are often excluded from the socio-economic benefits of adjacent mining operations (Downing, 2002; Carrington and Pereira, 2011; Horsley et al., 2015).[5]

In the Chinese context, three reasons explain the company's reluctance to hire local residents. First, from the perspective of mines, it's difficult to deal with local workers. Most local workers remain to be 'half peasant, half worker', and still have agricultural duties for which they occasionally leave work. Contrarily, migrant workers from other provinces usually live on-site and work more consistent throughout the year.

Second, local residents' dual roles as an employee and peasant could influence the company-community relation. While mining provides a complementary livelihood, however, mining also has detrimental impacts on the local environment that makes farming more difficult. Emerging issues such as air and water pollution, land productivity loss, and land subsidence, have heightened tensions between local farmers and mining companies. In one of the observed villages, after failing to reach an agreement about the compensation on land productivity loss, the villagers blocked the road for days to stop the outbound transport. After this instance, all local workers were fired by the company.

The third and most important reason is that in the case of a mining accident, it is easier to disguise it when only non-local workers are involved. The mining industry in China has a particularly poor safety record and accidents occur frequently (Wright, 2004; Tu, 2007; Chan and Gao, 2012; Feng and Chen, 2013). The central government has imposed strict measures that if an accident in a mine causes fatality exceeding the designated indicators,[6] mining activities are suspended and safety measured have to be improved first. Failing to do say may

[2] The three pilot sites are Xiushan County in Chongqing, Huayuan County in Hunan, and Songtao County in Guizhou Province.

[3] According to the statistics compiled by the National Bureau of Statistics of China, the average wage in the mining industry in 2015 is 59,404 RMB. This is higher than other sectors where migrant workers are employed, most notably the construction sector (48,886 RMB) and manufacturing sector (55,324 RMB) (National Bureau of Statistics of China, 2015).

[4] Other reasons for not working in mining companies include: did not apply (12.9%), age not suitable (10.2%), health not suitable (4.3%), and an unattractive prospective salary (1.2%).

[5] For example, only about 100 of 17,300 Freeport workers in the Grasberg mine in Indonesia are native to the mining area (Downing, 2002, p. 10).

[6] Since 2004, the Work Safety Commission (WSC) of the State Council has established a set of national annual fatality indicators. There are two types of fatality indicators: absolute and relative. A detailed description is provided in Chan and Gao (2012).

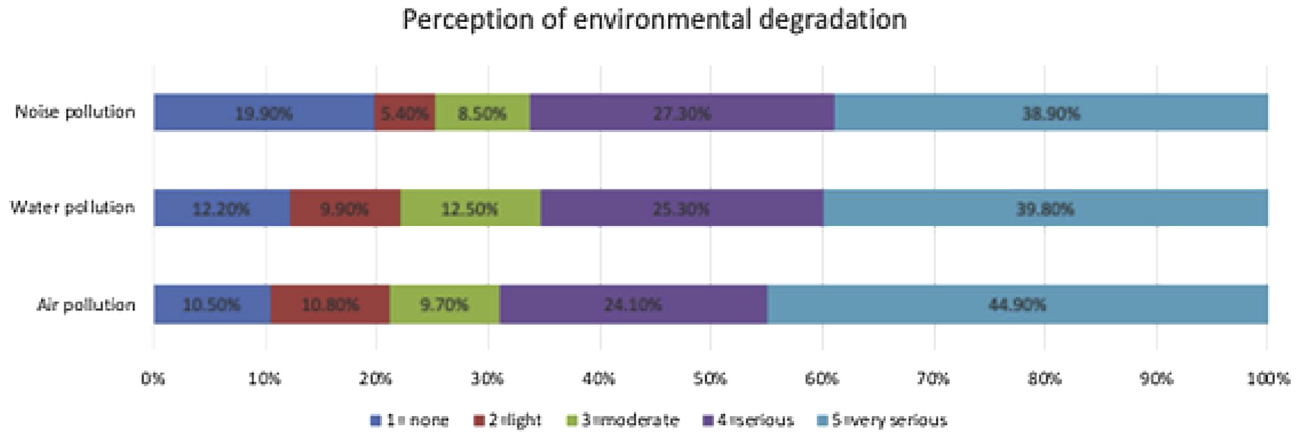

Fig. 2. Perception of environmental degradation.
Source: the survey.

ultimately lead to revocation of the company's licenses. Avoiding such penalties, mine operators and local officials frequently try to silent accidents and casualties. [7] Asides from bribing, mining companies pay families of victims to sign agreements to settle the matter immediately and promise not to speak to outsiders (China Labour Bulletin, 2008). For non-local workers, the lump-sum compensation always means the end as the family of the victims leave the site. However, for local workers, the family might come back to the mines and ask for more in case of any life difficulties.

In sum, while it appears that mining allows for important job opportunities, the reluctance of the mining company to hire local residents is a significant barrier to local employment. At the same time, local residents also have decreasing incentives to work in mines due to the reasons such as the dangerous working conditions in mines, and conflict of interest over land appropriation. Therefore, job opportunities and other economic benefits have declined for local communities.

5.2. Environmental degradation

The second considered factor relates to environmental degradation. Mining is the most hazardous industrial occupation, it not only competes for land and water resources but also produces health-threating waste and pollutants. The majority of respondents consider environmental pollution, regardless of air, water and noise pollution, as serious (Fig. 2). The mean values of the perception of air pollution (Mean = 3.820, SD = 1.377), water pollution (Mean = 3.707, SD = 1.95), and noise pollution (Mean = 3.298, SD = 1.517), are relatively high.

5.3. Land expropriation

Mining requires large areas of land, and therefore competes with existing uses of land, such as agriculture. Land expropriation, as an inevitable outcome, can occur in two ways. The first is that land is expropriated by the local government, and then transferred to its new user – the mining company. The second is the direct land lease between farmers and the mining company. When farmers' land is expropriated, farmers are compensated based on the national standard or a negotiated price. Below, the two different types of land expropriation are not distinguished, but only the general perception towards land expropriation is assessed.

In the study area, 20.4% of respondents claim that their land was partially expropriated. However, in terms of scale, land expropriation for mining is relatively small in the study area. There are two reasons. First, agricultural land in China is highly fragmented, for instance, a previous nation-wide survey found that every Chinese rural household has on average around six plots of land scattered around the village (Tan et al., 2005). Second, underground mining is predominantly in the study area, and land expropriation is concentrated around the operational site of mines, and that land, where underground mining take place underneath, is often not expropriated beforehand. Therefore, most households only lose part of their land to mining.

For both those who have and have not experienced expropriation, ambivalent attitudes towards land expropriation prevail. For those who have experienced expropriation, more than 80% of respondents are dissatisfied with compensation. For the non-expropriated land, mining disrupts the land use and decreases the productivity. The majority of respondents (93.9%) claim that land productivity is negatively influenced by mining activities, in terms of reduced output or increased input, such as the amount of fertilizer needed. Moreover, it is often hard to claim compensation for the productivity losses. During the fieldwork, it was often argued that respondents rather have their land expropriated to get some compensation, than to remain working on contaminated land.

5.4. Resettlement and land subsidence

The last factor considered concerns the mining-induced land subsidence and resettlement. Respondents are divided into three groups: i) those that have been relocated (N = 120), and ii) those affected by mining-induced land subsidence but who have not been resettled (N = 110), and iii) those not affected by land subsidence (N = 122). The third group did not encounter visible land subsidence and therefore resettlement was not relevant, and is left from further analysis in this section.

Respondents of the first group were relocated after visible and serious land subsidence occurred. The need to resettle has both positive and negative effects on peasants' perception of net benefits. On the one hand, resettlement helps to mitigate the risks of land subsidence and provides a better living environment. The majority of respondents found basic infrastructure and utilities at the new living environment convenient, including improved transportation (satisfaction rate 87.6%), electricity (satisfaction rate 90.1%), and tap water supply (satisfaction rate 72.7%). However, more than half of the respondents (56.2%) are dissatisfied with the building quality of the new housing in the relocation village. Farmers bemoan that relocated houses are poorly built and badly maintained. Upon moving in, problems as water leakage and the peelings and cracks in walls were already apparent.

[7] For example, 34 miners and a rescuer died after a blast ripped through the Lijiawa mine in Yuxian County on July 14, 2008. The mine bosses relocated bodies, destroyed evidence, and paid the journalists 2.6 million RMB to cover up the disaster, keeping the tragedy out of the public eye for 85 days. In November 2008, 10 journalists and 48 officials were charged with taking bribes to cover up the disaster (Wang, 2010).

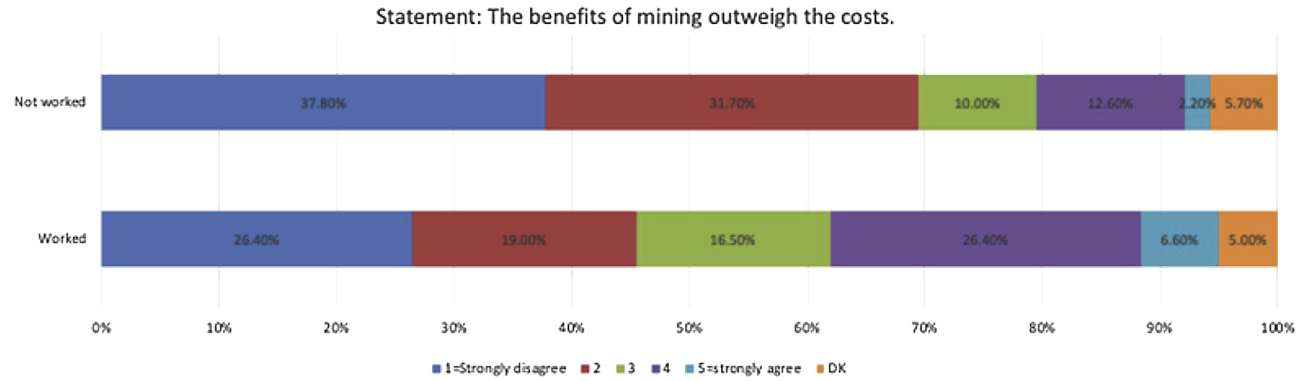

Fig. 3. Employment opportunities significantly influence the perceived net benefits.
Source: the survey.

Meanwhile, resettled peasants received no new land and remained dependent on agricultural land in the original village. As the relocation village is usually located at some distance from the original village, farmers have to spend hours on foot to cultivate their land. Therefore, some are forced to abandon their original land and instead rent farmland nearby the relocation village. Although formally not landless, those farmers often likened themselves to landless tenants in the "jiu shehui" (old, feudal society), which is a socio-politically sensitive image, as it refers to the resurfacing of the cleavages and inequity of pre-Communist times.

A final concern is the increased cost of living. In the relocation village fees for water and gas were higher compared to the original village, and 36.7% of the respondents indicated that their monthly living expenses had significantly increased. Virtually none of the respondents stated that their living expenses decreased. As the compensation has mostly been spent on the purchase of new housing, agricultural productivity has been adversely affected, and the off-farm employment opportunities are limited, most peasants are deeply concerned that their livelihood cannot be maintained on the medium or long term.

For the second group that had not been scheduled for resettlement, mining-induced subsidence and house damage were regarded as a serious problem. For this group, it is difficult to predict whether or when they will be affected. They became aware and concerned about the mining activities only after the damage to land and housing started to occur. The majority, 68.7%, of the respondents hoped to be relocated. The remaining percentage of those who were not willing to be relocated showed concerns about inadequate compensation and expected their living costs to increase in the future. However, affected peasants even did not know when the relocation would take place, and were unaware where they would be relocated to. While awaiting relocation, most villagers had to find temporary accommodation or stay in with relatives.

5.5. Perceived net benefits

After discussing the four impacts that mining brings about, this section will examine the local communities' perceptions of net benefits, and how these four impacts influence the perceived net benefits. Different statistical techniques, such as independent sample *t*-test or one-way analyses of variance, were performed to statistically test whether the means of the subsamples are significantly different from each other ($p < 0.05$). Because this study focuses on the four impacts that mining activities bring about, it does not account for the influence of individual characteristics. However, the sample *t*-test suggests that gender and educational level have no significant effect on the perception of net benefits. Younger generations tend to show a neutral, and thereby less negative, attitude towards mining activities than seniors, which is presumingly due to the direct employment opportunities.

When asked to evaluate the extent to which the benefits of mining outweigh the costs to their families, a total of 61.3% disagree, amongst which 33.9% strongly disagree,[8] indicating that the majority of respondents perceive that mining activities do not bring net benefits. Below, a quantitative analysis is applied to examine the role of the four factors in more detail.

Concerning employment opportunities, for those who once worked in the mining company, around a third agree that the benefits of mining outweigh the costs, generating a mean value of 2.661 (SD = 1.330) on perceived net benefits. Contrarily, the majority (69.5%) of those who not worked for the companies agreed that mining does not bring net benefits, amongst which 37.8% strongly disagree (Fig. 3). The mean value of the perceived net benefits for the latter group is 2.012 (SD = 1.119). Independent sample *t*-test was performed to determine whether the means of the two subgroups are significantly different. The results ($T = 4.488$, $p = 0.000$) indicate that those two groups have significantly different perceptions. In other words, with a working history in a mining company, respondents are more likely to report having received a net benefit than those whose family members never worked in the mining companies.

The effect of environmental degradation on the perceived net benefits is also assessed. Linear regression was performed to test the perception of air, water, and noise pollution towards the perceived net benefits (Table 3). The results for the regression reveal that the perception of water pollution was significant, with air and noise pollution not significant. The overall result for the regression is significant, however, the adjusted R-square value is 0.025, indicating the perception of environmental pollution only explain 2.5% of the perceived net benefits. In this sense, the perception of environmental pollution may not translate into the perception of economic loss.

Third, the influencing factor of land expropriation is examined. As shown in Fig. 4, the majority of both groups who had their land expropriated and those who had not been expropriated (65.3% and 60.2%, respectively), disagree that mining brings net benefits. The related mean values are 2.171 (SD = 1.274) and 2.279 (SD = 1.220), respectively. As illustrated in Section 5.3, both groups have ambivalent attitudes towards land expropriation. The vast majority of those whose land was expropriated were dissatisfied with the compensation. At the same time, however, the contamination of land and decreased productivity made others prefer having their land being expropriated in order to get compensation. The results of the *t*-test ($T = 0.631$, $p = 0.529$) shows that there is no significant difference of perceived net benefits between those two groups. That is to say that land expropriation neither positively nor negatively influence the perception of net benefit.

[8] 12.3% 'neutral', 17.4% 'agree', 3.7% 'strongly agree', and 5.4% 'do not know'. When calculating the mean value, the answer 'do not know' was excluded.

Table 3
Effect of perception of environmental pollution on perceived net benefits.
Source: the survey.

Dependent variable: perceived net benefits			
	Standardized coefficient (beta)	t-value	Significance
Constant	4.189	26.208	.000
Perception of air pollution	−0.012	−0.179	.858
Perception of water pollution	−0.138	−2.296	.022
Perception of noise pollution	−0.038	−0.725	.469
R Square = 0.034 Adjusted R Square = 0.025;		F = 3.804; Significance = 0.011	

Finally, the influencing factor of resettlement and land subsidence is accounted for. Among the three groups, it is clear that the second group of peasants, who are severely impacted by land subsidence but not yet been relocated, have the highest (75.9%) disagreement with any perceived net benefit (Fig. 5). Accordingly, the mean value of perceived net benefits is also the lowest (Mean = 1.905, SD = 1.179). Comparably, 57.8% of the already resettled group and 49.1% of the non-affected group disagree that the benefits of mining outweigh the costs to their families, with mean values of 2.304 (SD = 1.184) and 2.596 (SD = 1.243), respectively.

The results of the ANOVA test (F = 9.206, p = 0.000) indicate that there is a significant difference among the three groups. Therefore, further t-tests were performed between either two groups. For the respondents in the second group, a significantly lower mean value of the perceived net benefit is observed when compared to the third group (T = 4.230, p = 0.000), which means that land subsidence significantly and negatively affected the perception of net benefits. When the first and second group are compared, the mean value of the perceived net benefits of the first group is significantly higher than the second group (T = 2.545, p = 0.012). This indicates that relocation, as a remedy, does help affected peasants to minimize the risks and have an increased perception of net benefits. However, when compared to the those not affected (and therefore not relocated), relocated farmers do not have a significantly lower or higher perception of net benefits, which indicates that the relocation process just about restores the situation.

6. Conclusions

Based on a national survey that examined local communities' perception of the impacts of the mining activities, this study revealed that only about 20.0% of residents living in mining areas consider mining as beneficial. Stated differently, it was widely perceived that mining activities do not bring net benefits. By disaggregating various impacts found in literature, this study finds that mining did bring employment opportunities for local communities, which significantly and positively influenced the perceived net benefits. However, the benefit was offset by many other negative impacts, in particular, mining-induced land subsidence. As a remedy, relocation did help affected farmers out of a deprived situation. However, the protracted process of relocation, insufficient compensation, and long-term livelihood concerns, as illustrated in Yang et al. (2017), does not significantly improve the perceived benefits among the relocated farmers comparing to those who are not affected.

By disaggregating the various impacts mining that brings about, and its influence on communities' perceived net benefits, this study draws

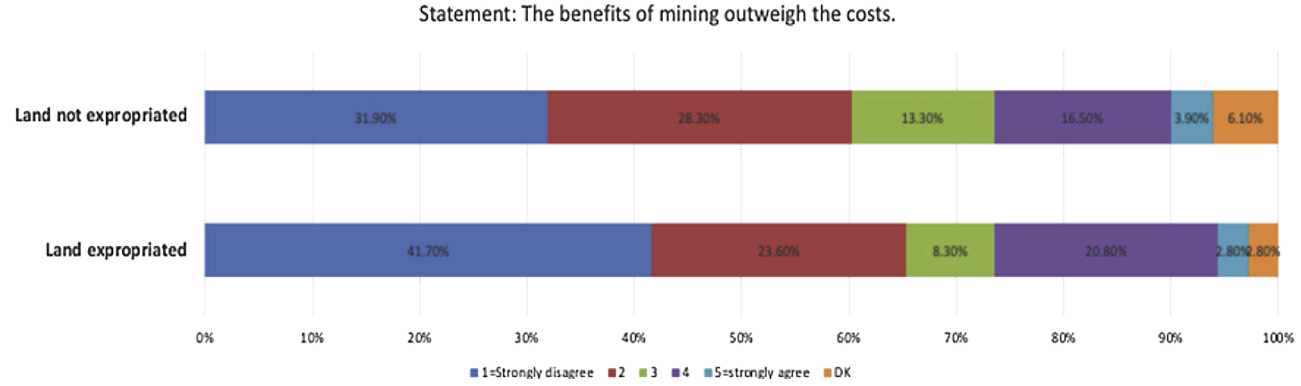

Fig. 4. Land expropriation does not influence the perceived net benefits.
Source: the survey.

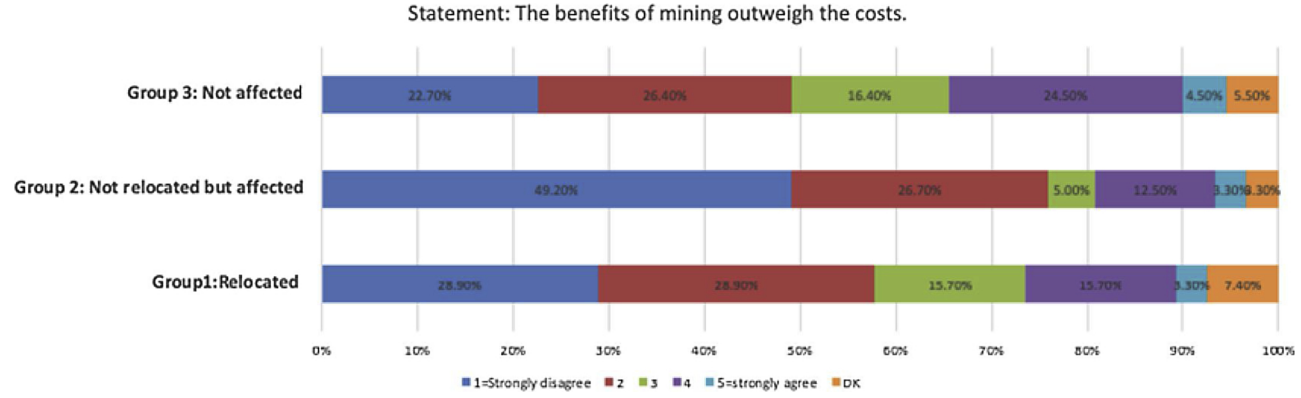

Fig. 5. Land subsidence negatively affects the perceived net benefits.
Source: the survey.

several implications. First, it shows that, in the study area, mining-induced land subsidence has negatively and significantly affected local communities. However, mining-induced land subsidence and displacement are not well acknowledged in literature, as studies have mostly focused on mining land acquisition induced displacement (Ahmad and Lahiri-Dutt, 2006; Abuya, 2013; Madebwe et al., 2013). It should be noted that local governments' relocation and compensation policies vary across regions. For instance, one study in Inner Mongolia showed that the entire village was relocated before any property damage from land subsidence occurred (Zeng and Zhan, 2015). In the study area, affected farmers were relocated after visible land subsidence occurred, and resettlement funds were often firstly secured for residents near the key state-owned mines (Yang et al., 2017). However, despite variations in geography, the scale of mines, and the ownership of enterprises, some general patterns can be observed. Most notably, mining activities are often paired with low compensation and a high potential of conflicts. In addition, this study also finds that resettlement does not significantly improve the perceived benefits among the relocated farmers compared to those who are not affected. Second, this study indicates that the perception of the environmental pollution may not translate into the perception of economic loss. However, the accumulative effects of mining activities will inevitably continue to result in livelihood dispossession. Meanwhile, the local participation in the mining workforce may be lower due to the reluctance to hire local residents. When losing ways to join in with the economic benefits of mining, the local communities may be more prone to resist to mining. If China doesn't formulate a sustainable framework, more local conflicts are more likely to occur. This is not only negative for local communities, but also goes against national aims of preserving harmony in China's countryside.

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