# The effects of natural resource extraction on the financial performance of local firms

**Liudmila Batishcheva**

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## DECLARATION

I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another university for the award of any other degree.

Signature:

Liudmila Batishcheva

## University of Sussex

Liudmila Batishcheva


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**Summary**

This thesis estimates the impact of local resource extractive industries on firms' financial performance across 15 post-communist economies in Europe. The thesis analysed separately the local firm effects of oil and gas industries, and the minerals and metals industries. We find that the nature of natural resource matters in terms of their impact on the local economy. The presence of oil and gas fields in firms' immediate vicinity (0 – 15 km) improves the financial performance of these local firms. However, little or no impact is found for firms located within close proximity to mines. Moreover, our results show no evidence of local 'Dutch disease' effects. In addition, we find that the business environment that firms operate within does not exert a differential effect between firms that operate close to or distant from the location of the extractive industries.

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# Chapter 1: Introduction

This paper studies the effect of natural resources on financial firm performance in 15 post-communist economies.[1] Natural resources in this context refer to natural assets like minerals and metals (including aluminium, copper, iron), non-metals (including sand, gravel, uranium), precious metals (gold, platinum, diamonds), and energy (oil and gas). For the purpose of the analysis, we split natural resources in two main groups: ‘oil/ gas’ and ‘mines’. The ‘oil/ gas’ group consists of two energy resources – oil and gas. The ‘mines’ group consists of all minerals and metals, non-metals as well as precious metals. The term ‘extractive’ as used in the text can refer, depending on the context, to either oil and gas extraction or mineral/ metal or coal extraction.

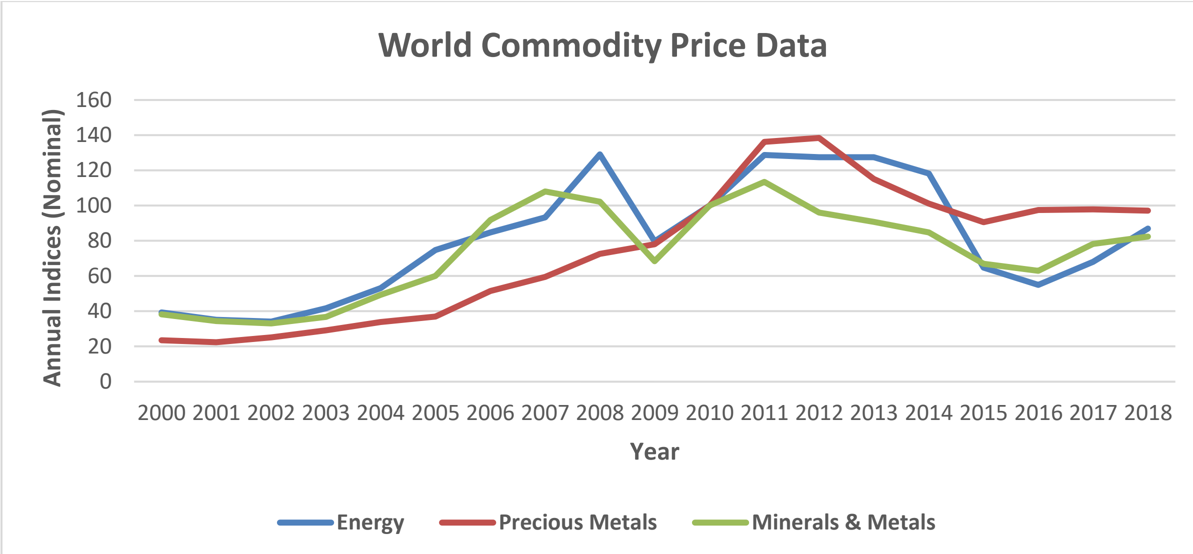
The past two decades witnessed an expansion in mining activities around the globe. An increased demand from the emerging market economies pushed prices of natural resources in general and oil, gas, and minerals and metals in particular in an upward direction. This led to increased investments in mining and created an incentive for extraction and exploitation.

Further, there has been a geographical shift of mineral deposit extraction from developed to emerging markets over the past 40 years. This is primarily due to the fact that most of the natural resource deposits in the developed countries have been intensively exploited over the past two centuries. Hence, in the 21st century, the largest mines and oil/gas fields can be found in Middle Eastern, Asian, African, and Latin American countries.

Based on the world commodity price graph (see Figure 1), an overall increasing price trend for all three main groups of commodities (i.e., energy, precious metals, and minerals & metals) can be observed. There is some degree of co-movement, which can also be seen between the categories. The natural resource boom has motivated research on the impact of such price booms on the economic growth of the exporting countries relative to non-resource dependent countries.

[1] We analyse 15 post-communist countries: Hungary, Kazakhstan, Romania, Russia, Tajikistan, Uzbekistan, Ukraine, Poland, Serbia, Republic of Northern Macedonia (RNM), Azerbaijan, Armenia, Kyrgyzstan, Czech Republic, Slovakia.

**Figure 1: World commodity price data**




Source: World Bank Commodity Price Data (The Pink Sheet)

Note to Figure 1: The 'Energy' category here includes gas and oil. For the purpose of the empirical analysis the two metal categories are conflated as one metal category.

This paper contributes to a growing literature on the economic impact of natural resource abundance. The existing literature investigates and analyses the impact of resource dependence on economic activities in resource rich countries. The findings contained in these studies are somewhat mixed.[2] Specifically, the current study contributes to the literature by estimating the impact of active natural resources on local economic and financial performance across a group of post-centrally planned economies. The financial performance measure is based on a latent dependent variable that captures the location of the firm in the distribution of the country's sales. The construction of this variable is discussed in detail in the data section (see Chapter 5.5).

[2] There are a number of surveys on this particular theme (e.g., see Van der Ploeg (2011)). For the case of negative effects, see specifically Sachs and Warner (1995, 1999). In regard to the Dutch disease, see Corden and Neary (1982), Corden (1984), Krugman (1987), Van Wijnbergen (1984), Matsuyama (1992), Sachs and Warner (2001), Van der Ploeg and Venables (2013). In regard to volatility, see Van der Ploeg and Poelhekke (2009), Cavalcanti et al., (2015), and for Institutions see Mehlum et al., (2006, 2006a), Bhattacharyya and Hodler (2010). Finally, for insights on the 'Red herring' effects, see Brunnschweiler and Bulte (2008).

In particular, the current research addresses two main questions:

- What is the effect of mines and oil & gas fields on the financial performance of nearby non-mining firms?

And, if there is an effect:

- Are there obstacles to doing business that exert stronger effects on the nearby non-mining firms rather than those further distant from the extraction site?

The above questions are analysed for a number of post-centrally planned economies, many of which are former socialist countries from within the old USSR. These are emerging markets and many of them are resource-rich countries. The set of countries provide an interesting, and yet to date unexplored, setting to examine the effect of a variant of the resource dependency curse at a local or regional level. In particular, the collapse of the Soviet Union meant that the market structures of these countries changed from a centrally planned to a market-based system. For example, in Russia, the first democratically elected president, Boris Yeltsin, implemented a number of radical economic reforms, one of which was mass privatization known as voucher privatization. Such reforms included a 'loans-for-shares' programme which allowed powerful businessmen, commonly known as oligarchs, to privatize state-owned natural resource corporations in exchange for loans to assist and contribute to the government budget, which then totalled about $800 million. Oil and gas sectors are partially controlled by the state government. Therefore, for political reasons, the oligarchs oversee the localities in which they are based, and part of the revenue generated from the natural resource extraction is invested in the infrastructure of the region and in the well-being of their populations (e.g., through the provision of health facilities). Other post-Soviet countries including Azerbaijan, Kazakhstan, Ukraine, Uzbekistan, and Tajikistan, followed similar reforms, where fields were privatized but the government retained control over them.

It is important to note that half of the countries that feature in the data are currently in the European Union (Slovakia, Hungary, Poland, Romania, and the Czech Republic), while the other half is not (Russia, Ukraine, Macedonia, Tajikistan, Azerbaijan, Kyrgyz Republic, Uzbekistan, Serbia, Armenia, and Kazakhstan). Although all these countries share in common a post-communist regime, the rules, regulations, and the political culture have evolved in different ways within these countries since the collapse of the Soviet Union. The standards set in these two blocks are different. Therefore, the analysis is based on a heterogeneous group of formerly socialist countries engaged in extractive activities, where the standards and restrictions applied for resource extraction differ.

In addition, institutions have changed as well with the most striking examples provided by those countries that joined the European Union (EU) with the Czech Republic, Hungary, Poland, and Slovakia joining the EU in 2004 and Romania in 2007. These countries have not been previously studied in the context of a resource dependency curse and this represents one of the significant contributions of this paper.

Another key and important feature of this paper is that it distinguishes between the potentially heterogenous effects on local economies of oil/gas and minerals/metal extraction. Most of the existing studies examine the effect of natural resource activity conflated across these different extractive activities. However, World Bank (2004) states that these two sets of extractive industries exhibit different structures in many aspects in terms of the economic changes undertaken within a region, and the environmental and social changes. For example, Cameron and Stanley (2017) define the differences between mines and oil/gas fields. One of the key differences is that the operations of mines are entirely land-based. Such operations require moving large masses of land, which affects local communities living or working in the area, often over protracted periods of time. This type of activity sometimes relies on using labour and other inputs from the local economy. In contrast, oil and gas fields are among the most capital-intensive industries and rely less on inputs from the local economies. In addition, their impact on the development of local infrastructure is invariably considerably less. For example, the extraction and distribution of coal requires the development of road infrastructure from which third parties local to the activity can benefit. In contrast, the extraction and distribution of oil and gas requires piping infrastructure specific to the resource that cannot be used to the benefit of third-party locals.

The research paper is organized as follows. The literature review summarizes important key aspects at the macro and the micro economic level, as well as outlining the main differences in the structure and possible 'linkage effects' created by the nature of natural resources. In addition, we discuss the role of obstacles in the firm and the effects on the performance. The 'Mechanism' section reviews possible mechanisms through which resource extraction activities are potentially transmitted to firms and businesses operating in the local economy. The ‘research question’ section describes the research question in detail. The data construction and description section describe in detail the data collection process, and outlines the variables used in the subsequent empirical analysis. The section on the econometric methodology outlines the regression models and derives the main set of testable hypotheses. The empirical results section presents the key econometric results and outlines some robustness checks. The conclusion and discussion sections provide some concluding remarks based on the key findings of the empirical analysis.

# Chapter 2: Literature Review

This research is informed by three key strands of the existing literature and is reviewed as follows: macro-level effects, micro-level effects, and the importance of the type of natural resource extracted. Additionally, given the research analyses the potential effects of obstacles to business enterprise on their financial growth and activity provides an important sub-theme, there is also a review of this strand of literature here.

## *2.1 Macroeconomic level*

“Extractive industries can contribute to sustainable development, when projects are implemented well and preserve the rights of affected people, and if the benefits they generate are well-used” as summarised in the World Bank Group’s Extractive Industries Review in 2004. (See notes: World Bank Group, 2004.)

Extractive firms are very important economic players in many developing countries. They generate significant levels of revenue for the state Treasury in the form of royalties (depending on the contracts entered with countries), income tax, and/or other forms of profit-sharing arrangements. In the early 1980s research revealed that resource rich countries tend to grow at a slower rate than resource poor countries. This view contradicted previous notions that natural resource abundance was a blessing for the economy (Smith, 1812). This contrary view encouraged the development of a literature analysing the effects of resource dependence on economic activity. Auty (1993) defined the poor economic performance of the resource rich countries as representing the ‘resource curse’ paradox. The micro-level empirical analysis undertaken in this thesis is motivated by this particular paradox. The ‘resource curse’ phenomenon suggests a negative relationship between natural resource dependence and growth in GDP per capita (Sachs and Warner; 1995, 1999, 2001). Of course, this raises the interesting question as to how such resource dependence impacts local and regional economies and whether, at that more granular level, such activity is also interpretable as a ‘curse’.

There are many economic and political explanations that account for the ‘resource curse’. One common economic explanation is the “Dutch disease” phenomenon outlined by Corden and Neary (1982). The extensive literature on the Dutch disease (Krugman, 1987; Van Wijnbergen, 1984; Matsuyama, 1992; Michaels, 2011; Van der Ploeg and Venables, 2012) reveals that a resource boom results in real exchange rate appreciation, which leads to a decline in the tradable (manufacturing) sector.

There are three factors that can generate a mineral resource extraction boom: a technology-induced rise in productivity, a new resource discovery, or a rise in the commodity world price. All three could be interpreted as representing supply shocks. Resource booms of one kind or another are central to the Dutch disease. The traditional explanation of Dutch disease distinguishes between two main effects of the resource boom: *resource movement* and *spending effects* (Corden and Neary, 1982).

First, higher revenues of the resource sector led to a *resource movement* from the tradable and non-tradable to the resource sector. Thus, the resource sector pulls in domestic resources (such as labour and materials that are shifted from tradable and non-tradable sectors to the resource sector). Such a resource shift leads to higher prices of inputs (such as labour and materials), which then leads to increased production costs in other sectors (Humphreys et al., 2007). The resource movement effect tends to be small for the oil industry since it is among one of the most capital- intensive industries. Conversely, the effect is expected to be greater for mineral and metal sectors since these industries are more labour-intensive.

*A spending effect* occurs when higher oil prices increase firm revenues, which then increase the income of resource dependent countries. This leads to a greater demand for both tradable and non-tradable sectors. Such an increase generates inflation and an appreciation of real exchange rates. Thus, the relative prices of non-resource commodities increase, and their exports become more expensive relative to the world market prices. This leads to a decline in competitiveness of these non-resource commodities, and reduced investment levels in these sectors eventually eroding the productivity in the non-resource sectors.

Therefore, the Dutch disease proposition postulates that a resource boom expands the tradable raw materials sector at the expense of manufacturing. The effect on the non-tradable services sector could be ambiguous depending on the relative strength of the spending effect and these resource reallocation effects (Corden and Neary, 1982). Others argue that the resource curse is a result of the volatile nature of natural resource prices in global markets. This volatility reduces economic growth since these countries are more exposed to global shocks and macroeconomic instability (Deaton, 1999; Van der Ploeg and Poelhekke, 2009; Cavalcanti et al., 2015).

In contrast, the resource curse also emphasizes the political economy dynamics of resource dependence (Sachs and Warner, 1995; Gylfason, 2001; Sachs & Warner, 2001). In short, resource dependence narrows the tax base, which in turn weakens property rights and erodes the quality of institutions. Weak institutions in turn adversely affect economic prospects over the long run (Ismail, 2010; Van der Ploeg, 2011; Sachs & Warner, 2001; Halvor et al., 2006). For example, Sachs and Warner's find in their analysis that resource abundance interferes with the activity of the manufacturing sector. Despite overwhelming support among growth economists on the existence of a 'resource curse', the main causes remain an unsettled issue among researchers (Gylfason, 2001). Most of the studies focus on the aggregate level and the cross-country empirical evidence remains mixed (Venables, 2016; Van der Ploeg and Poelhekke, 2016; and more).[3] Understanding the impacts of a resource boom on resource dependent countries is crucial for these economies and, in particular, it is important for an understanding of what effects it exerts at local levels (regions).

*2.2 Microeconomic level*

All extractive resources have a finite lifetime. Developing countries that are rich in such resources should apply correct strategies to harness the opportunities provided by the extractive industries to support sustainable economic growth during their lifetime. Specifically, setting local economy

[3] See Van der Ploeg (2011) and Frankel (2010) for comprehensive surveys of this theme.

rules that would enhance the development of manufacturing and the industrial capacity of the local economy. There are many challenges faced by companies and public policy makers such as the development of appropriate frameworks and regulations that would optimize national value creation from the resource extraction industries. This would then stimulate employment and entrepreneurship, the transfer of technology and knowledge creation.

Over the past decade, research moved from cross-country investigations to within-country analysis of the ‘resource curse’ paradox, which enables the investigation of local effects of a resource boom. This strand of the literature informs on potentially important transmission mechanisms for the macroeconomic symptoms of the ‘resource curse’ paradox. Such transmission mechanisms could be due to the geographic location of resource wealth that manifest themselves in terms of an unbalanced economic performance across different regions leading to an asymmetric allocation of extraction costs and benefits (Cust and Poelhekke, 2014). The set of existing studies mainly cover the United States (Allcott and Keniston, 2014), Latin America (Aragon and Rud, 2013; Caselli and Michaels, 2013) and African countries (Kotsadam and Tolonen, 2016; Mamo et al., 2019).[4]

The analysis by Allcott and Keniston (2014), based on the US within-country analysis for 1969-2014, revealed that during the oil boom periods it boosted local and resource-linked productivity. However, it did not lead to a long-lasting transformation of resource-abundant areas. In particular, their results provided evidence against the ‘resource curse’ paradox by confirming that the rise of local wages during the boom periods, did not crowd out the manufacturing sector. On the contrary, it experienced an overall increase driven by upstream and locally traded subsectors.

Mamo, Bhattacharyya and Moradi (2019) studied the economic consequences of natural resource extraction in Sub-Saharan Africa using night-time lights and household characteristics as a measure of living standards. Their study found that the extraction of mines only improves local living standards temporarily with almost no evidence of significant spill-over effects to neighbouring districts.  In contrast, Aragon and Rud (2013) investigated the impact of mining in Peru on socioeconomic impacts such as poverty and inequality. The results revealed positive

[4] See Cust and Poelhekke (2014) for a comprehensive survey of the literature based on within-country analysis.

average effects but negative distributional effects. Thus, mining activities raised the average income level at a local level but widened inequality and raised poverty at a national level.

Government support also plays an important role at microeconomic level supporting local economies by setting the contractual obligations and agreements to the extraction firms for meeting local requirements and social investment targets. For example, for the Sakhalin II project, the Russian government has set a requirement to use 70% of domestic services and materials (see notes: Shell, 2004). Such obligations stimulate natural resource companies to find local suppliers of goods and services.

It is also important to mention about the competition between the extractive industries and local firms. Extractive industries often require large amounts of water, electricity, labour, and infrastructure, for which they may compete with local manufacturers. Such increased demand drives up prices and makes it difficult to compete for small local firms.

The empirical analysis in the current study is motivated by the "Dutch disease" model of Corden and Neary (1982) which sets out how a resource boom pushes up wage costs for firms specialising in traded (i.e., manufacturing) sector as they compete for labour with firms in the resource and non-traded (services) sectors. We hypothesize that resource extractive industries and local manufacturing firms also compete for other inelastically supplied inputs and public goods—such as transport, infrastructure, and electricity—and that this harms firms operating in the tradeable-sector, which are price-takers on the markets. In a latter section we review the potential mechanisms through which resource extractive firms' activity may harm some sectors but benefits others.

### *2.3 Importance of the type of natural resource*

If accurately managed, the extractive industries can potentially lead to positive externalities on other sectors of the economy. This may be in the form of contributing to the establishment of new industries and raising the employment rate within the regional economies. As an example, in 2009, based on the American Petroleum Institute (API) information, the total economic impact from the extraction of oil and gas industries in the United States amounted to 5.3% of the total employment, 6% of the labour income and 7.7% of the value added. The direct impacts from the oil and gas industry extraction alone are clearly lower than these reported here, which occurred as a sum of indirect and induced impacts that took place in other sectors throughout the supply chain. It is important for resource-rich countries to stimulate the capture of these impacts, both direct and indirect ones. This may be done through encouraging the development of linkages.

The possible ‘linkage effects’ was referred to by Albert Hirschman in the 1970s, where the author explained the linkages through which sectoral growth could lead to a gain for the rest of the economy. The author referred to three types – fiscal, consumption and production – linkages between resource extracting and the industrial sectors. These linkages can appear either within the industry chain or outside of it. The concepts of backward linkages are also referenced, where industry connects with its suppliers, or forward linkages, where industry connects beneficiaries to produce value added goods (Sigam and Garcia, 2012). In addition, Kaplinsky (2011) notes the possibility of horizontal linkage with other industries in the economy to develop alternative technologies and knowledge usage. Such technology and knowledge spill-overs lead to multiplier effects, which improve local and domestic economic activity.

In order to have a better view of the effects of extractive industries on the economy, as well as local level economic activity, it is necessary to bear in mind the composition within the extractive sector. There are several studies that stress the importance of sectoral heterogeneity in helping explain aggregate economic activity (James, 2015; Jaimes and Gerlagh, 2020).

In this literature, it is important to distinguish the nature and type of natural resources being extracted. Although, natural resources are relevant to a variety of different sectors, the focus in this study is on the two most important industries of (i) oil and natural gas, and (ii) all mining sector activities (including metals, minerals, and construction materials, like sand, granite etc.). Both broadly defined industries can generate substantial economic rents (i.e., the revenue obtained is much greater than the cost of production, which is attractive to government tax policy design). In particular, the degree of wealth generated by oil and gas fields are much greater than those associated with extractive mining industries.  However, both types of industries exhibit a lack of mobility in that they have to locate the industry wherever the resources are discovered, which by necessity leads to investing and improving the local infrastructure. The volume invested, however, differs across these two broadly defined sectors.

The requirements of the labour-force and its structure also differs across these industries. Mine-based extraction is a more labour-intensive sector compared to petroleum. However, unlike the mining sector, the petroleum sector requires a greater number of skilled workers (professionals). Therefore, the mining sector is open to and attracts workers in the localities of the mines, whereas petroleum generally requires highly trained professionals recruited from outside the localities where the oil facilities are located. An implication of this difference across the sectors is that the wage rates offered by the employers in these two sectors inevitably differs with the local labour market effects more pronounced and directly affected in the case of the mining rather than oil extraction activity.[5]

There is growing literature that analyses the causality of these effects by applying region level data as well as period-specific dynamics within natural resource sector. For example, Fryer et al. (2017) found that oil production industries positively affected income and employment levels in US counties. Moretti (2010) found that local enterprises with strong upstream or downstream linkages to resource extractive industries are more likely to benefit from an increased demand for intermediate inputs. Such linkage is created through the specific nature of the supply chains of extractive industries.

Further detailed discussion on the potential linkages of extractive industries on local economies is elaborated on in mechanisms section below. In particular, we discuss the mechanisms through which extractive activities may hurt some firms, but actually benefit others.

### *2.4 The role of obstacles on firm financial performance*

In developing countries, including the transitional economies, many firms were historically state-owned due to central planned economic system. After the collapse of the Soviet Union these countries were implementing fundamental changes in institutional, legal, and regulatory systems to improve the health of the economy. Privatization as well as the entry of new firms into the market was inevitable part of the transitional process to the more market-based economic system. The key determinant for such implementation of new policies is economic growth and economic sustainability and, hence, the financial health of the firms and their performance. The financial

[5] The information is taken from the official website of National Council of Russian Federation. https://www.spkngk.ru/fileadmin/f/about/Monitoring_rynka_truda_v_ngk.pdf

health and performance of the firm is heavily influenced by the business obstacles that it is facing. There are various obstacles that constrain the well-being and growth of the enterprise, including the firms' access to inputs, such as finance and an educated workforce, access to infrastructure, and access to institutional quality. In general, business constraints create barriers for the firms to grow. There is growing literature that uses firm-level data to analyse the effect of obstacles on firm performance. For example, Gorodnichenko and Schnitzer (2013) analysed the effect of financial constraints on firm-level innovation activities in countries covering Eastern Europe and Commonwealth of Independent States. They found that financial constraints restricted the ability of domestically owned firms to innovate and to advance in terms of technological progress. Haas and Poelhekke (2019), on the other hand, estimated the impact of local mining activity on business constraints for eight resource rich countries. They found that business constraints worsened and thus slowed down the growth of firms with a close presence to extractive resources activity, but the constraints were more relaxed for those firms that located at a greater distance to operating mines.

In this paper we analyze the impact of three business obstacles, which are firm-level access to finance, to transportation, and electricity. In other words, we are interested in the capital market – financial support, as well as the role of access to the infrastructure – specifically transportation and electricity.

Overall, given the foregoing literature, this paper focuses on the pattern of nearby natural resources extractive activity on local economic activity, and then analyses its impact on the financial performance of local enterprises. Both, the country focus on the formerly socialist economies and the emphasis on firm-level financial performance represents a novel contribution to the growing literature on the economic impact of natural resource abundance on economic activity. In addition, we separate oil and gas from minerals and metals industries, which yields some differing and contrasting results.

## Chapter 3: Mechanisms

In understanding how the location of natural resource extraction impacts the local economy, we need to review possible mechanisms through which their activities are potentially transmitted to firms and business operations in the local economy. By their nature, extractive firms have longer time horizons than firms in many other industries. Such firms follow fixed placements of existing natural resources, and, hence, do not have much choice in the geographical location of their investment opportunities or their mobility.

Expanding economic activities in the localities where the natural resource extraction companies are operating is in the best interest of the extraction firms. It can potentially reduce the production costs, simplify the social license to operate, improve supply and the distribution outlets for goods and services, and lessen the risks to their activities through potential conflict with the local population. Flows of revenue (or royalties) from the resource extraction firms provided to local economies can be used to finance the local infrastructure, improve the provision of public goods such as roads, railways, bridges, and other public services like healthcare, education, and training. Of course, the extent to which these outcomes occur is context-specific and may vary across country settings depending on the nature of governance institutions.

There are different mechanisms (i.e., fiscal, and environmental) through which extraction industries drive economic activities locally. It is possible to view the form of these in terms of a standard multiplier effect. The employees of resource extraction firms live and work local to that area. Hence, they tend to improve economic activity locally by using available services and goods. Through the multiplier effect jobs are created, and these have a ripple effect on the local economy. Although mining, and oil and gas sectors work in a similar manner, the size of the multiplier effects are likely to differ. This potentially could have different effects on the local economy since the linkages and leakages are of different size and magnitude. The stronger the injections of an industry at a local level, the greater the linkage it has with other businesses within the locality. On the other hand, extraction industries require specialized heavy equipment. At what level does an industry obtain its demand locally? There are three potential leakages associated with the standard expenditure multiplier. These are the marginal propensity to consume (MPC), the marginal propensity to import (MPI) from outside the local region, and the tax rates that could affect the local economy. We analyse and compare the potential leakages for both extraction sectors.

Both extraction sectors tend to have linkages with the local communities. They both require machinery and labour, as well as goods and services to maintain the well-being of its staff and equipment. Hence, the supply requirements for the extraction firms do create an opportunity for the domestic firms within the local economy to sell their goods and services to the extraction firms and for new firms to enter the market. For example, Michielsen (2013) and Arezki et al. (2017) present evidence of positive effects on US manufacturing production and trade, specifically, for energy-intensive industries. Whereas, Black et al. (2005) studying four resource rich states in the US reported a positive effect of the coal boom in the 1970s on employment and income levels.

Although the mining sector requires heavy industrial equipment and skilled workers to use such machinery, the amount of highly skilled workers as well as the mining-specific equipment needed are much lower compared to those in the oil and gas sector. Thus, mining firms are more likely to attract more employees from the local areas. These workers live, work, and use services within its localities. Hence, their marginal propensity to import (MPI) from outside the local region is going to be lower for the mining sector. Hydrocarbon production industries are highly capital-intensive and, unlike mining industries, rely less on inputs from the local economies.

In addition, the infrastructure that is built for the mining sector can also be used as a public good (e.g., such as roads, train lines and bridges), and is greater than that associated with the oil/ gas sector. With regards to the infrastructure which is used as a public good, oil and gas firms tend to be more isolated due to the extensive use of the pipelines rather than roads to transport the outputs. Hence, the marginal propensity to consume for miners and those working in the mining industry is quite high for the local community compared to the oil/gas sector. However, marginal propensity to import (MPI) from outside the local area generated by mining companies is going to be lower than that of oil/ gas firms. Thus, both MPC and MPI are going to present a bigger leakage for the oil and gas companies' expenditure multiplier than for the mine companies' multiplier.

Differential tax rates potentially create another leakage in the multiplier effect. There is greater amount of high-skilled workers in oil/ gas field companies, therefore their tax rates are likely to be higher than that of mine workers. However, this could be context-specific and depend on a country's tax system. Nevertheless, in all likelihood, the local economy multiplier effect generated by the mining sector firms is likely to be higher than the one for the oil/ gas firms.

Another type of mechanism that potentially affects local economic activity is the externalities produced by the extractive companies. Resource activity can be welfare improving when used to provide public goods, such as transportation and communication between cities, education and training, and other services. Such positive externalities depend on the effective functioning of local institutions. Both extraction sectors generate positive externalities, but the size of these effects differs. The net worth is much more extensive and greater for mine extractive activities due to the roads and bridges that are required for the infrastructure, and which are then actively used by the local communities.

Extractive activities, however, also generate negative externalities such as pollution and environmental degradation that adversely impact the health of the local population, agricultural production and thus the livelihoods of local workers (Addison and Roe, 2018; Haas and Poelhekke, 2019; Von der Goltz and Barnwall, 2014; and others). Such negative externalities generally exert greater damage in the long-term rather than the short-to-medium term. Long-term environmental damage should be understood and managed carefully by both of the parties, the national and local governments, on the one hand, and the extraction sector industries on the other. This would ensure that local communities would not be adversely affected when these industries exit the local economy. For example, Von der Goltz and Barnwall (2014) analysing a set of developing countries found that although the extractive activity increased local asset wealth, it came at a cost of negative health effects due to the pollution created in those areas.

There are many studies suggesting that the political economy associated with resource extraction is another mechanism that plays a role for the country and the local economy.[6] The side effects generated by governance differs across the extractive sectors. This paper analyses the post USSR countries and those that were part of the Warsaw pact. It is crucial to bear in mind that there is a stark difference in governance and institutions among this set of countries. For the purpose of the analyses, we separate these countries into two blocks. One block of countries comprising Russia, Ukraine, Tajikistan, Uzbekistan, Kazakhstan, Azerbaijan, the Kyrgyz republic, and Armenia – all broadly followed a similar economic and political evolution after the collapse of the USSR, and have similar institutions and governance, and history and geography. In addition, the Russian language would be a common language that is widely spoken in all these countries. Whereas the second block of countries comprised of Romania, Hungary, Czech Republic, Poland, Slovakia, Romania, Serbia, and RNM.[7] All but two of these countries acceded to the European Union. This

[6] There are a lot of studies that raise the importance of the governance, such as: Corden and Neary, (1982); Allcott and Keniston (2014); Krugman, (1987); Haas and Poelhekke, (2019); and others.

[7] RNM and Serbia were part of former republics of Yugoslavia. Yugoslavia did not belong to the Warsaw pact and did not have an influence from USSR.

forced a more radical change in the structure of governance and institutions in most of these contained in this set of countries.

It is also worth noting that state-owned companies have been much less prominent in the mining sector than in the oil and gas sector. For example, in Russia, the oil and gas sectors are partially controlled by the government. Therefore, the companies' owners (i.e., oligarchs) are obliged to devote resources to the support of the local economies in which they are based. In one way this represents a positive externality for the local communities. A similar structure prevails in the Eastern Block of countries analysed in this paper. Such a governance structure, however, is not applicable to the Western set of countries, where the governance and institutions are stronger largely due to their closer ties with the European Union. For example, Ross (2015) concluded that petroleum does have negative effects on democratic governance such as encouraging corruption, supporting authoritarian governance, and even creating conditions within which civil conflict may emerge. It is acknowledged that this is context-specific with many oil producing countries in developed economies, for example, characterised by the presence of strong institutional oversight.

Furthermore, the taxation system is much more complex in the petroleum sector due to widespread use of production-sharing involving a different range of tax rates. The taxation in the mining sector is more straightforward, which tends to favour the use of royalty and profit taxes. The revenues generated by the mining firms and oil/gas firms differ substantially. Both sectors tend to support the local economy, but the magnitude of the contribution is very different. Russia, for example, is one of the largest players in both minerals and precious metals and gas/oil resource extractions compared to all set of countries analysed in this research. Taking a closer look at the list of the largest firms in Russia, in terms of revenue, oil and gas companies are clustered at the top end of the list, whereas mining firms are located around the middle of the list. 'Gazprom' and 'Lukoil' are the two most powerful firms in the oil and gas sector, with revenues of around \$112 billion and \$94 billion respectively. 'Evraz' and 'NLMK' are the two powerful firms in steel production sector, with revenues of around \$11 billion and \$10 billion respectively.[8] Therefore, a 10% share of the total spend of oil/gas revenues in the local economy, for example, is going to exceed a 10% share of the spend of mine revenues in terms of its absolute magnitude. Thus, the size of the oil

[8] See the link: https://pro.rbc.ru/rbc500

and gas revenues and associated expenditures substantially dominate the size of the extractive mining revenues with obvious consequences for the size of the 'trickle-down' effect.

Supply chains in resource extractive industries also play a significant role in the local economy as well as nearby enterprises. Supply chains refers to "any combination of processes, functions, activities, relationships and pathways along which products, services, information and financial transactions move in and between enterprises" (Gattorna, 2006). Tradable, construction, and resource sector firms are the ones to provide input to the production process of extractive industries. Ostensson (2017) analysed the ratio of shares of total procurement in resource extractive industries in developing countries. The author found that the local content shares (local goods and local services) are lower than imported services and goods, 45% and 55% respectively. Local services, such as catering, hospitality and transportation, accounts for 40% of total procurement, whereas local goods including specific to extractive industries machinery, equipment, as well as stationery and office equipment, accounts for just 5% of total procurement shares. Hence, non-traded sector firms located within close proximity to extractive industries tend to benefit the most.

Overall, based on the multiplier effects and the positive public good externalities, we would anticipate a potentially greater local economic effect from the mining than the oil sectors. However, the scale of these multiplier effects is likely to be smaller in the mining compared to the oil sector. The size of oil and gas revenue as well as the scale of the expenditure for localities is much greater than that of the mine sector revenues. Therefore, we would anticipate stronger overall economic effects on firm financial performance for those located within close proximity to oil/ gas extraction companies than mining companies. Moreover, due to local supply chains we expect that non-traded sector enterprises would generate a greater local effect.

A growing literature uses such survey data to gauge whether access to public goods affects firm performance. Firms' perceptions of the importance of external constraints on their activity can be used to determine which constraints affect economic activity the most (Carlin et al., 2010). The detailed data on firms from the EBRD-World Bank Business Environment and Enterprise Performance Survey (BEEPS) and the World Bank Enterprise Survey contain the responses of firm managers to questions on the severity of various constraints faced in the operation and growth of their businesses, including access to transport infrastructure, electricity, land, educated workers and finance.

These business constraints or obstacle variables measure competition for public goods directly, as they reflect firms' intended rather than the actual use of such goods and can therefore be interpreted as the shadow prices of public inputs. We exploit variation across firms in the reported severity of external constraints to assess how local mining activity, by affecting the quality and quantity of public good provision, influences the ability of local firms to grow.

## Chapter 4: Research questions

There are two separate key questions investigated in this research:

1. What is the impact of local mines on the financial performance of local firms?
2. What is the impact of local oil/ gas production facilities on the financial performance of local firms?

A sub-theme of the research is to establish whether the presence of obstacles to doing business interact with the natural resource extraction activities in such a way that those obstacles are stronger and have more potent effects on firm performance compared to those where there are no natural resources present in the immediate locality.

The innovative contribution of the paper comprises the construction of a variable on financial performance based on the position of a firm within the (country specific) distribution of sales. An ordinal measure is constructed as part of this exercise, and this is then used as an outcome measure in an ordered probit regression model. This approach is necessitated by the fact that the data are available across country and the use of dollar values is problematic given exchange rate volatility in the selected countries. Therefore, we locate the firm’s sales within one of the four quartiles of the country specific sales distribution, which enables us to construct a compatible outcome measure across the 15 countries subsequently used in the empirical analysis. The empirical analysis will then focus on whether the presence of extractive industries in a locality pushes a firm either up or down a real line with sales treated as a latent dependent variable. The sign and magnitude of the effects provides insights on the direction and strength of the effects of interest. Therefore, instead of looking directly at firm performance, we examine indirectly the impact of extractive industries' activity on local firm performance using information on the distribution of sales. In addition, we can control for obstacles to doing business. Specifically, in interacting nearby natural resources with the reported obstacles to doing business, we are able to assess whether the Haas and Poelhekke (2019) narrative is consistent with different types of natural resource activity nearby. As noted earlier, the separation of oil/gas from all other types of mining activities, for reasons outlined above, represents an additional novel contribution of this study.

## Chapter 5: Data construction and description

Our analysis investigates the effects of nearby energy and mine fields on local firm performance. These effects can be estimated through combining three geo-referenced datasets on firm-level activity, mines, and oil/gas fields covering the year 2008 - 2009. In the following subsections each of the datasets is explained in more detail.

### *5.1 Constructing the Firm-level dataset*

We use the 2008 - 2009 EBRD - World Bank Business Environment and Enterprise Performance Survey (BEEPS) and World Bank Enterprise Survey release. It is a firm-level survey, where top managers and CEOs of the firms respond to a set of questions that examine the quality of the business environment. Such a detailed survey allows for an analysis of the nature of the business and the different constraints that a particular firm faces in the business environment. Much of the existing literature also exploited these surveys for their studies.[9]

There was a major issue faced with one of the important variables of interest in this dataset as no geo-referenced data on the firm location are available. The firms' location – the longitudes and latitudes of the firms are crucial for this analysis as it allows us to capture the precise location of firms and the location of the natural resources with respect to these firms. The firm-level survey dataset contains 11,998 firm observations across 15 different countries, where the firm names are anonymized and assigned unique codes. The survey dataset also specifies country, region/ oblast', city/ village as the location of each firm. The lack of such crucial geo-referenced data on a firm's location was the major challenge faced in this research. In order to overcome this issue, we had to

[9] Gorodnichenko, Y., and Schnitzer, M. (2013) analysed financial constraints and innovation; Popov (2014) used credit constraints, Haas and Poelhekke (2019) used business constraints to investigate the effects of mining on firms.

manually construct two additional variables – longitude and latitude through the process of web searching for the specific location and postal address of each firm. The process took several months identifying the geo-referenced coordinates for each firm of the survey. This was done through an extensive and protracted web search, confirming the coordinates by checking several browsers for each firm.[10] We measured the distance by the map. Therefore, the coordinates are valid to within approximately 2 – 5 kilometres. We were not able to allocate all firms due to some missing information on their specific location. All in all, we managed to gather 10,214 geo-referenced coordinates, but losing a modest 1,784 firm-level observations in the process.

This geo-referenced data enables us to determine and match the approximate distance of the firm to the nearest natural resources' site. Based on the research questions of this study, the key outcome variable of interest is company level sales. This variable defines our main dependent or outcome variable, which is a firm's financial performance. The outcome measure in this study is a firm's financial performance rather than its productivity. There are several important reasons for the choice of this variable. The first relates to a lack of information provided in the survey necessary to compute either a labour productivity or a total factor productivity measure. There is no information on the fixed costs of the firms. In addition, an important issue relates to the desirability of using the exchange rate to convert sales to a common currency like the US dollar. This study was undertaken using 15 different countries each with their own national exchange rate, where the main variable of interest is 'sales' expressed in the national currency. Thus, the responses for this variable were originally reported in the country's national currency. In general, the exchange rates are very volatile by their nature and were particularly so over the period of the data given the on-going global financial crisis. This crisis impacted many of the domestic currencies of the countries that feature in this sample. The construction of the key outcome variable used in this study is discussed in more detail below.

The firm-level dataset also contains firm-level characteristics such as company age, size, region, industry, and the ownership structure of the firm. These are also available for the empirical analysis and are now discussed in more detail below.

[10] To collect the geocoordinates (longitude and latitude) we have mainly used 2 browsers: Google and Yandex.

We define the ‘size of the firm’ as: ‘micro’ (< 5), ‘small’ (>=5 and <=19), ‘medium’ (>=20 and <=99) and ‘large’ (>=100); ‘ownership’ as: ‘domestic’, ‘foreign’, ‘state’ and ‘other’, each of its type should have 50% (or more) of shares. Next, we define the variable – ‘age of the firm’ as the difference between the year of the survey and the year the establishment began its commercial operations. The industry of the firm is another of the control variables used in the analysis. The firm survey contains detailed data for all main industries, and these are constructed at the one-digit level here. Following Main and Sufi (2014), we divide our firms into four main sectors: tradable sector – consists of manufacturing, capital goods and chemicals; non-tradable – retail and services (including hotels and restaurants); construction – we investigate the effect on construction services separately; and natural resource sector – metal and non-metal mineral products.

In addition, although our key concern is to examine the direct effect of nearby natural resources on a firm’s financial performance, a sub-theme focuses on the impact on firm-level performance of reported obstacles to business. Specifically, these measures are interacted with the presence of extractive industries to determine if the nature of the obstacles differ with the proximity of natural resource extractive activities. In order to measure firm-level business constraints, we use EBRD-World Bank Business Environment and Enterprise Performance Survey (BEEPS) and the equivalent Worlds Bank Enterprise Survey. Thus, for this analysis, we include five additional variables, which are known as ‘obstacle to a firm’ from the firm-level dataset. These include obstacles related to access around the issues of finance, land, electricity, transportation, and licencing.

As a part of the survey, the business managers or owners evaluated aspects of the local business environment and public infrastructure in terms of how much they constrain the firm’s operations. These questions are aimed at distinguishing potential business constraints that would have an impact on growth, competition, and the operation of the firm. For instance, one of the questions in the questionnaire asks: ‘How much of an obstacle is electricity to the current operations of this firm? “No obstacle”, a “Minor obstacle”, a “Moderate obstacle”, a “Major obstacle” or a “Very severe obstacle”. Similar information was elicited about the following business constraints: access to finance; transportation infrastructure; access to land; and to a business licence. Fundamentally, these questions allow us to measure competition for inputs directly because they reflect a firm’s intended use of inputs as opposed to their actual use. Additionally, we do not have to rely on the price data which often do not exist for non-marketed public goods. For the purpose of this study, we have constructed dummy variables relating only to the major obstacles, which are defined as the aggregate of the last two categories: “Major obstacle” and “Very severe obstacle”.

For each firm we construct weighted average business constraints, which measures the weighted average of the five above-mentioned business constraint categories by applying the Principal Component Analysis (PCA). The Principal Component Analysis (PCA) is used to summarize the information on main obstacles to firms that could have a potential impact on a non-resource extraction firm’s financial performance. The PCA is a statistical technique that allows us to conflate the number of variables to a smaller set of summary indices that can be better analysed. Due to high correlation across the obstacles, the PCA approach potentially overcomes such issues by creating one single measure that captures number of highly correlated variables.[11]

For the purpose of the analysis, we have kept most relevant obstacles to our study that could provide potential evidence of the existing competition for inelastically supplied inputs and public goods – such as transport infrastructure and electricity as these influences whether firms are subject to disruption in the production process, as well as access to financial or credit support from lending institutions. Therefore, we have collected information from the respondents on five main obstacles – finance, land, electricity, transportation, and operating license. These variables are reported as categorical variables in the survey ranging from 0 to 4. For example: “Is transport no obstacle (0), a minor obstacle (1), a moderate obstacle (2), a major obstacle (3), or a very severe obstacle (4) to the current operations of this establishment?” As noted earlier, from this categorical data, we have constructed 0/1 dummies for the respondents based only on whether the firm faces major (3) or severe (4) obstacles to its business operations. These are then used either separately in the empirical analysis or as a part of a composite PCA measure computed across all included obstacles to doing business.

*5.2 Minerals and Metals dataset*

The data on minerals and metals were collected from MinEx Consulting (2013) and provides a comprehensive list of significant mineral deposits found in the world since 1950. There is a total of 1,869 mines based in 109 countries around the world. The Metal and Mineral data set contains

[11] Please refer to the Appendix for the more explicit definition of the PCA technique.

information on the type and size of the mine, its discovery, start up and shutdown year, detailed information on the status of the mine, geographical location, and metal/ mineral specific information. Geocoded coordinates are accurate between 500 metres to one kilometre of their location.

For the purposes of the analysis, we identify 11,434 firms around minerals and metals fields in the fourteen countries that are the subject of our research interest.[12] We observe the operating status of these mines, their location, size, and the primary metal mined there. Our data have a good size variation, including good range of major and giant production sites. Most common primary metals are gold, copper, and uranium, for the set of countries of interest. There are also other types, including nickel, zinc, fluorite, molybdenum, chromium, and others.

*5.3 Oil and Gas dataset*

We also use Mike Horn's (2003, 2004) dataset on oil and gas fields. The author reports the date and name of the discovering country, as well as the exact co-ordinate location of it for the given period - 1868 to 2003. Based on the Horn dataset we identify eight countries with a total of 203 fields that are relevant for our analysis.[13]

The data on oil and gas were collected in 2003, whereas our study uses the year 2008/9. Therefore, we assume there were no active oil or gas fields discovered since 2003. This is a reasonable assumption given that, on average, it takes around six to ten years from the day of the discovery to the first day of production (i.e., to become an active field). Therefore, for our analysis we have collected data for the following variables: the nature of the field (oil or gas), its location (latitude and longitude), and the status of the field (i.e., is it active or not). In particular, this will enable us to determine whether it is active or inactive for the specific year of the study.

*5.4 Combining three datasets*

Merging firm-level with oil/gas and mine datasets allows us to map the precise locations of the mines that are open, operating, and close in proximity to each enterprise. Hence, we have two

[12] The countries of interest that have mines are Ukraine, Uzbekistan, Russia, Poland, Romania, Serbia, Kazakhstan, Azerbaijan, RNM, Armenia, Kyrgyzstan, Czech Republic, Hungary, and Slovakia.
[13] The oil/gas countries of interest are Azerbaijan, Hungary, Kazakhstan, Romania, Russia, Uzbekistan, Ukraine, and Tajikistan. For example, Hungary has both resources: Algyo oil field located in southern region, and Mako gas field located in south-eastern region.

separate datasets. The first dataset contains all necessary information on oil/ gas fields and nearby enterprises – merging oil and gas with firm-level data. This is done by getting pairwise combinations (number of firms multiplied by number of mines) based on the co-ordinates (longitude and latitude), restricting to maximum distance of 1,000 kilometres. The second dataset contains all necessary information on mines and nearby enterprises – merging minerals and metals with firm-level data. The same method is applied, as for the oil/ gas and firm dataset. Most of the enterprises in our sample are in Eastern Europe, but there is sufficient geographical variation across the 15 countries comprising the dataset.

The mapping strategy employed minimizes endogeneity issues that normally plague country-level studies in that the location of the extractive industries is arguably an exogenous outcome. Moreover, it allows us to quantify the amount of nearby natural resources within a specific radius around each firm for all the countries used in the analysis. Bearing in mind that the activity of the natural resources and their performance depends on the inherent geology of the location and the world mineral prices, we argue that natural resources activities are exogenous to firm performance. Thus, it is possible to analyse the effect of mining on firm performance as representing a potential causal relationship.

A set of distance bins were constructed by assessing various distance circles in a radius of 10, 15, 20, 30, 50 and 100 kilometres, as well as exploring the spatial distance variation used in the literature (Aragon and Rud, 2013; Kotsadam and Tolonen, 2016; Haas and Poelhekke, 2019). We are interested in capturing the effect of a nearby mine or oil/ gas field. Therefore, the closer the field to the firm, the better the fit for the analysis. A distance radius of 10 km would have been more optimal. However, there are insufficient observations to capture such an effect. Thus, we choose 15 km as a starting point. In our actual analysis, we exploit various distance bins: 0 – 15 kilometres, 16-50 km, 51-75 km and 76-100 kilometres. Therefore, we use three distance bins in the analysis: 0 – 15 km, 16-50 km, and 51 – 1,000 kilometres.

Due to kilometrage restrictions imposed in the construction of the data (i.e., up to 1,000 km), as well as variables construction (lack of sales data), we have lost fair number of observations. Overall, we end up with data comprising a total sample of 3,052 enterprises located nearby oil and gas industries across eight countries, and 4,898 firms located close by minerals and metals industries across 14 countries.

*5.5 The Key Outcome Variable*

We now turn to a discussion of the construction of the key outcome variable for the analysis. In order to construct the outcome variable 'firm performance', we work out the quartile values for sales for each of the countries and allocate the firm's sales variable to the specific quartile using the country's domestic currency. This overcomes any potential exchange rate issues as noted earlier and helps capture the intensity of firm performance within each country. Specifically, we intend to exploit the fact that those firms in the highest quartiles have the largest within-country sales, while those in the lowest quartile have the lowest within-country sales. We assign each firm to a particular quartile and the resultant outcome variable is coded 1 to 4, with 4 representing a firm within the highest quartile of the financial performance distribution within the country. These firm-level country-specific rankings are then merged as part of the panel. Thus, the outcome variable captures the quartile location of the firm within each country. The key objective is then to determine how the presence of extractive industries within a particular radius of the firm impacts its country-specific distribution. The analysis is centred only on the financial performance of the non-resource firms contained in the dataset as defined across a broad group of industry sectors.

Haas and Poelhekke (2019), the closest paper to our study, examined the impact of mining on business constraints for a subset of eight resource rich countries including Russia, Ukraine, and Kazakhstan. However, the study of Haas and Poelhekke (2019) examined the effect on business constraints only. In addition, the authors do not separately examine the effect of mines, oil, and gas. The novelty of the current research is that this is the first empirical piece that separately studies the impact of mines and oil/gas fields on local financial performance across a group of post socialist economies.

*5.6 Summary Statistics*

First, we discuss the firm-level observations. Table 1 and 2 present the list of countries and their frequency in the sample for oil/ gas, and minerals and metals analysis.

**Table 1: Oil and gas industry panel**

| Name of the country | Frequency in the sample |
|---|---|
| Tajikistan | 285 |
| Ukraine | 597 |
| Uzbekistan | 328 |
| Russia | 648 |
| Romania | 354 |
| Kazakhstan | 190 |
| Azerbaijan | 370 |
| Hungary | 280 |
| **Total** | **3,052** |

**Table 2: Minerals and metals industry panel**

| Name of the country | Frequency in the sample |
|---|---|
| Ukraine | 597 |
| Kyrgyz Republic | 191 |
| Uzbekistan | 360 |
| Czech Republic | 196 |
| Russia | 467 |
| Hungary | 330 |
| Poland | 296 |
| Slovakia | 201 |
| Romania | 389 |
| Serbia | 375 |
| Kazakhstan | 513 |
| Azerbaijan | 372 |
| Macedonia | 318 |
| Armenia | 293 |
| **Total** | **4,898** |

Inevitably, the number of firm-level observations reduced significantly after merging with the natural resource datasets, restricting to specific distance bins, active extractive fields only, as well as creating the outcome variable of interest (sales). Overall, the total number of observed firms in the oil/ gas dataset reduced to 3,052 observations, and in mine dataset reduced to 4,898 observations.

There is an explanation for this. After merging two sets of the datasets (firms, mines, and oil/gas fields) and restricting the distance bins - many of the firms were excluded from the analysis since there is either no nearby natural resource located near the firm, or the nearest natural resource is further than 1,000 kilometres away from the firm. After restrictions on radius bins, we ended with 14 countries in nearby mine analysis and eight countries in nearby oil/ gas fields' analysis. In addition, in order to analyse the effect of nearby active resources on local domestic enterprises, we matched the country of the natural resource field to the domestic firm. [14]

Tables 3 and 4 provide summary statistics of the variables used in the analysis. We have three dummies in each table representing the number of active resource extractive industries' that located in close proximity to a firm as determined by the distance bin used. The variables used are as follows: active fields 0 – 15 km, active fields 16 – 50 km, and active fields 51 – 1,000 km respectively. These dummies are not mutually exclusive, because some firms have multiple responses indicating they have extractive activities both close by as well as more distant.

As noted earlier, we use an array of variables as controls including size, ownership structure, employment, and industry type, age of the firm, country, and region. In addition, we also create control variables for our analysis including different types of obstacles that could affect the financial performance of the firm.

Table 3 reports that there are 3,052 firms observed in oil and gas sample. The sample data across all these countries reveals that most of the companies are domestically owned, and most of these firms are small-sized firms. The average age of firms is around 15 years. It is also noted that most

[14] Oil/ gas and firm dataset countries of interest: Tajikistan, Ukraine, Uzbekistan, Russia, Romania, Kazakhstan, Azerbaijan, Hungary.
Mines and firm dataset countries of interest: Ukraine, Uzbekistan, Russia, Poland, Romania, Serbia, Kazakhstan, Azerbaijan, RNM, Armenia, Kyrgyzstan, Czech Republic, Hungary, and Slovakia.

firms trade in the traded sectors. The majority of the sample is located over a 50 kilometers radius to the nearest oil and gas fields.

For the mining sample, Table 4, there are 4,898 observations collected. The sample data across all these countries reveals that most of the companies are domestically owned, and most of these firms are small-sized firms. The average age of firms is around 15 years. It is also noted that most firms trade in the traded sectors. The majority of the sample is located over a 50 kilometers radius to the nearest mining fields.

**Table 3: Summary statistics for oil and gas sample**

| | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| *Dependent variable:* | | | | |
| Firm Performance | 2.489 | 1.114 | 1 | 4 |
| | | | | |
| *Independent variables:* | | | | |
| Domestic | 0.819 | 0.385 | 0 | 1 |
| Foreign | 0.035 | 0.185 | 0 | 1 |
| Small firm | 0.394 | 0.489 | 0 | 1 |
| Medium sized firm | 0.123 | 0.328 | 0 | 1 |
| Large firm | 0.250 | 0.433 | 0 | 1 |
| Firm age | 15.455 | 16.793 | 0 | 166 |
| Active fields 0-15km | 0.074 | 0.262 | 0 | 1 |
| Active fields 16-50km | 0.132 | 0.339 | 0 | 1 |
| Active fields 51-1,000km | 0.993 | 0.0827 | 0 | 1 |
| Traded sector | 0.439 | 0.496 | 0 | 1 |
| Construction sector | 0.081 | 0.273 | 0 | 1 |
| Resource sector | 0.074 | 0.261 | 0 | 1 |
| Non-traded sector | 0.406 | 0.491 | 0 | 1 |
| *Obstacles* | | | | |
| Finance | 0.320 | 0.466 | 0 | 1 |
| Land | 0.289 | 0.453 | 0 | 1 |
| Electricity | 0.351 | 0.477 | 0 | 1 |
| Transport | 0.196 | 0.397 | 0 | 1 |
| Licence | 0.198 | 0.399 | 0 | 1 |
| PCA | 0.000 | 1.475 | -1.681 | 4.247 |
| Sample size | 3,052 | | | |

Note: The construction of PCA described in the text

**Table 4: Summary statistics for mining sample**

| | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| *Dependent variable:* | | | | |
| Firm Performance | 2.480 | 1.120 | 1 | 4 |
| *Independent variables:* | | | | |
| Domestic | 0.816 | 0.387 | 0 | 1 |
| Foreign | 0.043 | 0.203 | 0 | 1 |
| Small firm | 0.389 | 0.488 | 0 | 1 |
| Medium sized firm | 0.114 | 0.318 | 0 | 1 |
| Large firm | 0.246 | 0.431 | 0 | 1 |
| Firm age | 15.680 | 16.544 | 0 | 164 |
| Active fields 0-15km | 0.003 | 0.055 | 0 | 1 |
| Active fields 16-50km | 0.029 | 0.168 | 0 | 1 |
| Active fields 51-1,000km | 0.736 | 0.441 | 0 | 1 |
| Traded sector | 0.360 | 0.480 | 0 | 1 |
| Construction sector | 0.098 | 0.298 | 0 | 1 |
| Resource sector | 0.072 | 0.259 | 0 | 1 |
| Non-traded sector | 0.469 | 0.500 | 0 | 1 |
| *Obstacles* | | | | |
| Finance | 0.286 | 0.452 | 0 | 1 |
| Land | 0.240 | 0.427 | 0 | 1 |
| Electricity | 0.348 | 0.476 | 0 | 1 |
| Transport | 0.202 | 0.402 | 0 | 1 |
| Licence | 0.167 | 0.373 | 0 | 1 |
| *PCA* | 0.000 | 1.445 | -1.585 | 4.493 |
| *Sample size* | 4,898 | | | |

Note: The construction of PCA described in the text

Tables 5 and 6 below provide descriptive statistics of the outcome variable of interest – the firm-level financial performance at different quartiles across the specific distance bins. This helps us to observe the categories of firms analysed in the research. We compare the proportion of firms of interest to the remaining observations, depending on the distance bin and the sales quartiles of the firm. Each distance bin contains active (firms of interest) and non-active (comparison group), the sum of firms in each distance bin is equal to 100%, i.e., the total amount of observations (3,052 firms for oil/gas field analysis, and 4,898 firms for mine industry analysis).

**Table 5: Descriptive statistics for the outcome oil/ gas sample**

| | **Oil/Gas: 0 – 15 km radius** | | **Oil/Gas: 16 – 50 km radius** | | **Oil/Gas: 51 – 1,000 km radius** | |
|---|---|---|---|---|---|---|
| **Quartiles** | Non-active | Active | Non-active | Active | Non-active | Active |
| **1** | 24.1% | 1.1% | 22.6% | 2.6% | 0.1% | 25.1% |
| **2** | 23.5% | 1.5% | 21.5% | 3.4% | 0.2% | 24.7% |
| **3** | 23.1% | 2.5% | 22.0% | 3.5% | 0.2% | 25.3% |
| **4** | 21.9% | 2.4% | 20.6% | 3.7% | 0.1% | 24.2% |
| **Total** | 92.6% | **7.4**% | 86.8% | **13.2%** | 0.7% | 99.3% |

Note: 'Active' described as observations (firms) of interest; 'Non-active' described as remaining observations (firms).

Table 5 above summarizes the information of firms located within a close distance to oil and gas fields. There are 3,052 firms being analysed for this sector. The first column represents the quartiles of the firm's sales. Columns 2 and 3 report the proportion of firms in the model within the 0 – 15 kilometre distance of non-active and active fields respectfully. Columns 3 and 4 contain the same information but at greater distance range to the nearby fields (i.e., 16 to 50 kilometres). Columns 5 and 6 represent the third group of the study with firms located within 51 to 1,000 kilometres away from the oil/ gas fields. The sum of active and non-active firms within each distance bin sums to 100%, hence 3,052 observations. Some of the firms fall more than just one distance bin, for example one firm is located within 15 km to one oil/ gas field, and same firm located within 51 – 1,000 km to another oil/ gas field. Columns 2 and 3 compare the proportion of active firms (variable of interest) to non-active (total amount of observed firms) depending on the quartiles of the firm's sales. In other words, in total there is 7.4 % of observed firms (equivalent to 226 firms) within 0 – 15-kilometre radius of active oil/ gas field industry, the remaining 92.6%

(equivalent to 2,826) of firms in the analysis is the comparison group. In the second distance bin (16 – 50 km) we observe 13.2% (equivalent to 403) firms located within active fields; we compare them to the remaining 86.8% (equivalent to 2,649) observations.

We appear to have a satisfactory spread of sales outcomes across the two active nearby fields distance bin categories, with 226 observations. This represents 7.4% of the total oil/gas fields. For the 0 – 15 km distance bin, we have 403 observations (13.2%) and for the 16 – 50 km respectfully. Next, we look at the distribution of observations of interest (i.e., firms located close to active fields). We find that there is a lot more activity at the top quartile categories than at the bottom quartile categories for both radiuses.

Table 6 reports the summary of firms located within close distance to mine fields. Columns 2 and 3 state that out of 4,898 firms (equivalent to 100% of observations), in total there is 0.3 % of observed firms (equivalent to 15 firms) within 0 – 15-kilometre radius of active minerals and metals industry, the remaining 99.7% (equivalent to 4,883) of firms in the analysis is the comparison group. Whereas columns 4 and 5 show that within 16 – 50 km distance to active mine fields, there is a total of 2.9% firms (equivalent to 142 firms) in the analysis. Next, we look at the distribution of observations of interest (i.e., firms located close to active fields). We find that the spread among the sale's quartiles of firms of interest (active) is nearly same among each distance bin. The furthest distance bin represents most of the sample size, with almost even spread of firms across all quartiles.

The lack of variation in the sales size for firms located within 0 – 15 kilometre range of active mine industries (column 2) may present as an issue in the regression analysis as the lack of variation may render some key estimates statistically insignificant given the lack of statistical power associated with the data here. Column 4 indicates better sample size variation (16 – 50km) than column 2. However, the spread of the firms across the quartiles, as well as sample size among firms of interest ('active' columns) is quite small.

**Table 6: Descriptive statistics for mineral and metal sample**

| | Mine: 0 – 15 km radius | | Mine: 16 – 50 km radius | | Mine: 51 – 1,000 km radius | |
|---|---|---|---|---|---|---|
| **Quartiles** | Non-active | Active | Non-active | Active | Non-active | Active |
| **1** | 25.7% | 0.1% | 24.9% | 0.9% | 7.1% | 18.7% |
| **2** | 24.7% | 0.1% | 24.2% | 0.6% | 6.3% | 18.5% |
| **3** | 24.9% | 0.0% | 24.2% | 0.8% | 6.6% | 18.4% |
| **4** | 24.3% | 0.1% | 23.8% | 0.6% | 6.4% | 18.0% |
| **Total** | 99.7% | **0.3%** | 97.1% | **2.9%** | 26.4% | **73.6%** |

Note: 'Active' described as observations (firms) of interest; 'Non-active' described as remaining observations (firms).

## Chapter 6: Econometric methodology

The primary objective of the study is to determine whether the proximity to natural resources impacts the financial performance of those firms within a certain distance band from the resource extraction location. As noted earlier, the outcome variable on firm sales is constructed as an ordinal variable ranked from 1 to 4 where firms are split into 4 groups along the sales distribution depending on the sales performance during the year 2009. Hence an ordered probit regression model is used in our empirical analysis.

This model allows us to explain the variation in an ordered categorical dependent variable as a function of explanatory variables using a relationship that links the covariates to an unobservable latent dependent variable in a linear fashion. First, we look at the effect of mines and oil and gas fields on the financial performance of nearby non-mining firms. Therefore, we estimate two ordered probit models, for mine and oil/ gas separately. Hence:

- *Oil/ Gas:*

$$P_{fc}^{*} = \boldsymbol{\gamma_1 OF1_{fc}} + \boldsymbol{\gamma_2 OF2_{fc}} + \boldsymbol{\gamma_3 OF3_{fc}} + \beta X_{fc} + d_{fc} + v_{fc}, \text{ where } v_{fc} \sim N(0,1) \quad [1]$$

- *Mine:*

$$P_{fc}^{*} = \boldsymbol{\gamma_1 MF1_{fc}} + \boldsymbol{\gamma_2 MF2_{fc}} + \boldsymbol{\gamma_3 MF3_{fc}} + \beta X_{fc} + d_{fc} + \varepsilon_{fc}, \text{ where } \varepsilon_{fc} \sim N(0,1) \quad [2]$$

where $P_{fc}^{*}$ is the latent outcome of interest in its latent form – and which is empirically represented in the data as the quartile position of the sales of a firm $f$ located in country *c*. $\boldsymbol{OF_{fc}}$ and $\boldsymbol{MF_{fc}}$ are the dummies representing the presence of active oil field ( $OF_{fc}$ ) or active mines ( $MF_{fc}$) within the specific distance radiuses, depending on the firm *f* and country *c*. Hence, we have three dummies in each regression model; for example, in model [1]: $\boldsymbol{OF1_{fc}}$ are active extractive oil/ gas fields located within 0 – 15 km, $\boldsymbol{OF2_{fc}}$ active extractive oil/ gas fields located within 16 – 50 km, and $\boldsymbol{OF3_{fc}}$ active extractive oil/ gas fields located within 51 – 1,000 km respectively. In model [2], we adopt a similar approach. In expressions [1] and [2] $\gamma_1, \gamma_2,$ and $\gamma_3$ are the key parameters of interest and are interpreted as the impact of local mine or oil and gas field intensity on the standardized ordered probit index, which corresponds to the financial performance of the firm. The standardized ordered probit index is centred around zero. Hence, every covariate estimate raises the standardized ordered probit index relative to the mean of zero. $X_{fc}$ comprises covariates that represent firm controls such as the region, age of the firm, employment size and type of the ownership. $d_{sc}$ captures country – sector fixed effects. We also use controls to eliminate any (un)observable variation at country level and to avoid our results being driven by sector-specific demand shocks or/ and country specific market structures.

As already noted above, we chose the quartile of firm's sales over the absolute value sales itself as a dependent variable largely due to volatility issues driven by use of the exchange rate during a period of financial uncertainty. Each firm represents its sales volume in its national currency depending on the country of origin. There are 15 countries used in the analysis. In order to determine the quartile of a firm's sales, we determine the quartiles for each country. Then, we allocate each firm depending on its sales to one of the four quartile outcomes. It is assumed that $P_{fc}^{*}$ captures the position in the distribution and is related to the observed ordinal variable $P_{fc}$ as follows:

- $P_{fc} = 1 = Q_1$ $['first\ quartile']$ if $-\infty < P^*_{fc} < \theta_0$
- $P_{fc} = 2 = Q_2$ $['second\ quartile']$ if $\theta_0 < P^*_{fc} < \theta_1$
- $P_{fc} = 3 = Q_3$ $['third\ quartile']$ if $\theta_1 < P^*_{fc} < \theta_2$
- $P_{fc} = 4 = Q_4$ $['forth\ quartile']$ if $\theta_2 < P^*_{fc} < +\infty$

[3]

where $\theta$ $[\theta_0, \theta_1, \theta_2]$ are the set of the threshold parameters: firms that are located in the first quartile implies that the latent dependent variable lies between minus infinity and first threshold value; firms that are located in the second quartile implies that the latent dependent variable lies between first threshold and the second threshold and so to the fourth quartile which lies beyond the final third threshold in this case.

The probabilities of being in one of the four different quartiles can be expressed as follows:

- $Prob[P_{fc} = 1] = \Phi(\theta_0 - \mathrm{X}_i\beta)$
- $Prob[P_{fc} = 2] = \Phi(\theta_1 - \mathrm{X}_i\beta) - \Phi(\theta_0 - \mathrm{X}_i\beta)$
- $Prob[P_{fc} = 3] = \Phi(\theta_2 - \mathrm{X}_i\beta) - \Phi(\theta_1 - \mathrm{X}_i\beta)$
- $Prob[P_{fc} = 4] = 1 - \Phi(\theta_2 - \mathrm{X}_i\beta)$

[4]

For notional compactness, $\mathrm{X}_i$ contains all the explanatory variables of interest, such as: $\boldsymbol{\gamma_1 MF_{fc}} + \boldsymbol{\gamma_2 MF2_{fc}} + \boldsymbol{\gamma_3 MF3_{fc}} + \beta X_{fc} + d_{fc}$ - for nearby mine fields (with similar process applied to oil/gas fields variables described as $\boldsymbol{OF}$). $\Phi(\cdot)$ denotes the cumulative distribution function operator for the standard normal. The likelihood function is the joint product of the four outcome probabilities listed above in [4].

Next, the research also explores as a sub-theme whether obstacles interact in such a way that they exert stronger effects on the nearby non-mining firms rather than those further distant from the extraction site. We use the principal component analysis to gather information on the obstacles to doing business facing firms. The Principal Component Index (PCI) is the weighted average of all five ('major' and 'severe') obstacle components. These obstacles are expressed as dummies reflecting the presence of major and severe obstacles. Next, we predict the first variation (PC1) that captures the most variation of the data and use it in the main regression model in two ways: checking the effect of obstacles on firms' sales performance as well as interacting PCI with the presence of natural resource variables. Hence, this enables a broader view of the possible effects of these obstacles to be determined and investigated empirically.

Therefore, in the second part of the research we follow similar approach as for the first question. Thus, we estimate two ordered probit models, for mine and oil/ gas separately. We interact PCI with nearby natural resource to check if it has any effect on the results. Hence:

- *Oil/ Gas:*

$$P_{fc}^{*} = \boldsymbol{\gamma_1 OF1_{fc}} + \boldsymbol{\gamma_2 OF2_{fc}} + \boldsymbol{\gamma_3 OF3_{fc}} + \boldsymbol{\gamma_4 OF1_{fc}} * \boldsymbol{PCI_i} + \boldsymbol{\gamma_5 OF2_{fc}} * \boldsymbol{PCI_i} + \boldsymbol{\gamma_6 OF3_{fc}} * \boldsymbol{PCI_i} + \beta X_{fc} + d_{fc} + v_{fc}, \text{ where } v_{fc} \sim N(0,1) \quad [5]$$

- *Mine:*

$$P_{fc}^{*} = \boldsymbol{\gamma_1 MF1_{fc}} + \boldsymbol{\gamma_2 MF2_{fc}} + \boldsymbol{\gamma_3 MF3_{fc}} + \boldsymbol{\gamma_4 MF1_{fc}} * \boldsymbol{PCI_i} + \boldsymbol{\gamma_5 MF2_{fc}} * \boldsymbol{PCI_i} + \boldsymbol{\gamma_6 MF3_{fc}} * \boldsymbol{PCI_i} + \beta X_{fc} + d_{fc} + \varepsilon_{fc}, \text{ where } \varepsilon_{fc} \sim N(0,1) \quad [6]$$

where $\boldsymbol{OF_{fc}} * \boldsymbol{PCI_i}$ and $\boldsymbol{MF_{fc}} * \boldsymbol{PCI_i}$ represent interactions between the active oil field ( $OF_{fc}$ ) or active mine field ( $MF_{fc}$) and the three distance bins (0 – 15 km, 16 – 50 km, and 51 – 1,000 km), depending on the firm *f* and country *c*. PCI represents our five main obstacles of the firm *i*. We interact our explanatory variable $\boldsymbol{OF_{fc}}$ and $\boldsymbol{MF_{fc}}$ with the obstacles $\boldsymbol{PCI_i}$ variable. We use the natural resource dummy as the reference dummy. The parameters $\gamma_1$, $\gamma_2$, $\gamma_3$, $\gamma_4$, $\gamma_5$, and $\gamma_6$ are the key parameters of interest in the interactive regression model.

Haas and Poelhekke (2019) stress the importance of business constraints being magnified through the presence of nearby mines. We believe there are other generic mechanisms involved around the relationship of these production activities and firm-level financial performance.

## Chapter 7: Empirical Results

This section reports the empirical results. We refer to the two main questions of the paper as follows.

### *7.1 What is the impact of local extractive industries on the financial performance of local firms?*

Tables 7 and 8 below present the baseline estimates of the impact of oil/ gas industries (Table 7) and mines (Table 8) on local financial performance of the firm within three distance bins, 0 – 15 km, 16 – 50 km, and 51 – 1,000 km respectively.  On the basis of the 'goodness-of-fit' measures all specifications report respectable fits to the data.  The baseline model is column (1), where only controls for inactive mines, firm attributes, and country sector fixed effects are included. Our preferred model is column (2), where we account for firm-level obstacles using the PCI method. In column (1), we present a different form of the specification of the main model without including the firms' obstacles. Column (3) accounts for the interaction of obstacles with active nearby natural resource extraction activities. The outcome variable of the model is financial performance of the firms in all three columns. In baseline (column 1) model we specify our key explanatory variable – active natural resources 0 – 15 km, 16 – 50 km, and 51 – 1,000 km – as 'dummy' variables. Thus, we are using the presence of mines and oil/ gas fields (depending on the model) to measure the intensity of local extractive activity.  We use the same specification in columns (2) and (3). In all three models we control for the presence of inactive mines, an array of firm characteristics such as age, country, employment size, and region and ownership structure. We also include country and sector-specific fixed effects. This means that we are effectively comparing—within one and the same country, and region—firms with and without the presence of nearby mines. In all three models we review the effect of the firms' sector. We have included three main sectors: non-traded, construction and resource. We compare the results to the base group – traded sector.

#### *7.1.1 Impact of local oil and gas fields on local firms*

Based on our empirical results in Table 7, we find that oil and/ or gas activity close to the firms increases the financial performance of the firm. The 'baseline' and 'full' models (column (1) and (2)) indicate that if there is an active oil/gas production facility within 15 km of the company it raises the standardized probit index by 0.469 of a standard deviation relative to the mean of zero.

The result is statistically significant at the 1% using a two-tailed test. The effect is found to attenuate as the distance increases. Therefore, active oil/ gas fields within the radius of up to 15 km near the firm tend to raise the revenues of the locally based companies. Our results hold regardless of the model specifications used in estimation.

We also find that the non-traded sector has higher turnover than the traded sector. The non-traded sector is the one that appears to benefit most in terms of financial performance relative to all other firms in the sample. The ‘baseline’ and ‘full’ models reveal that enterprises that specialize in non-traded sector increase the standardized probit index by 0.340 of a standard deviation relative to the mean of zero relative to those firms that specialize in the traded sector. Such firms specialize in hospitality (hotels and restaurants), motor vehicles and transport, as well as retail, wholesale, and IT. The construction and resource sectors are statistically significant at the 1% and 5% respectively. They do provide positive turnover but not as much as non-traded industry firms.

The preferred model (column (2)) also includes the obstacles presented in the form of the conflated PCI. We find no effect of obstacles on firms’ turnover. Column (3) includes the interactions of these obstacles with the three distance bins. There is no statistically significant effect detected regardless of the radius proximity measured used here. We now test the statistical significance of all interactions in the models. We use Wald test to test it. First, we test statistics of obstacles (PCI) and distance bins (three radius bins) interactions in column (3) of Table 7. The Wald test is distributed as chi-squared with 3 degrees of freedom and the estimate of the Wald test is 4.1 and probability value of 0.251. Chi-squared 3 at 5% level is 7.8; the estimate of 4.1 is less than 7.8. Hence, three of these interactions are not statistically significant, meaning that there is no variation in PCI across all tested distances to oil/ gas installations.

In addition, in column (4) of Appendix Table A1 we check for the possible effects on financial activity originated from the firms’ sector located within the certain distance bin. Hence, we interact three sector variables with three distance radiuses. Next, we apply same technique, i.e., Wald test, to check the statistical significance for interactions of all distance bins to firms’ sectors. First, we check for interaction of three sectors to 0 – 15 km distance bin, the estimate value of chi-squared with 3 degrees of freedom is 0.83 and probability value is 0.84. Chi-squared 3 at 5% level is 7.8; the estimate of 0.84 is less than 7.8. Second, we check for interaction of three sectors to 16 – 50 km distance bin. The Wald test is distributed as chi-squared with 3 degrees of freedom and the estimate of the Wald test is 2.58 and probability value of 0.461. Chi-squared 3 at 5% level is 7.8; the estimate of 2.58 is less than 7.8. Third, we check for interaction of three sectors to 51 – 1,000 km distance bin. The Wald test is distributed as chi-squared with 3 degrees of freedom and the estimate of the Wald test is 1.50 and probability value of 0.683. Chi-squared 3 at 5% level is 7.8; the estimate of 1.50 is less than 7.8. Hence, we find no variation in the sectors (non-traded, construction and resource) across three distance bins. This finding suggests that the impact of natural resource extractive industries does not vary across broadly defined sectors. This suggests the absence of a local economy 'Dutch Disease' type of effect where traded manufacturing activity is displaced by non-traded activity.

**Table 7: Effect of oil/ gas production industry on the firms' turnover**

| | | (1) | (2) | (3) |
|---|---|---|---|---|
| | **Interaction** | **Baseline** | **Full** | **Full with Interactions** |
| **Active resources 0-15 km** | | **0.469***** | **0.469***** | **0.417***** |
| | | (0.116) | (0.116) | (0.119) |
| **Active resources 16-50 km** | | 0.122 | 0.124 | 0.103 |
| | | (0.103) | (0.103) | (0.105) |
| **Active resources 51-1,000 km** | | 0.444 | 0.441 | 0.513 |
| | | (0.256) | (0.256) | (0.322) |
| PCI | | - | 0.004 | -0.018 |
| | | | (0.015) | (0.235) |
| Active resources 0-15 km | x PCI | - | - | -0.128 |
| | | | | (0.071) |
| Active resources 16-50 km | x PCI | - | - | -0.005 |
| | | | | (0.058) |
| Active resources 51-1,000 km | x PCI | - | - | 0.029 |
| | | | | (0.235) |
| Non-traded sector | | **0.340***** | **0.340***** | **0.335***** |
| | | (0.050) | (0.050) | (0.050) |
| Construction sector | | 0.440*** | 0.439*** | 0.436*** |
| | | (0.082) | (0.082) | (0.082) |
| Resource sector | | 0.234** | 0.234** | 0.231** |
| | | (0.084) | (0.084) | (0.084) |
| $\hat{\theta}_1$ | | 0.114 | 0.113 | 0.159 |
| | | (0.300) | (0.300) | (0.364) |
| $\hat{\theta}_2$ | | 1.076 | 1.075 | 1.122 (0.364) |
| | | (0.300) | (0.300) | |
| $\hat{\theta}_3$ | | 2.126 | 2.126 | 2.173 |
| | | (0.302) | (0.301) | (0.365) |
| **Observations** | | 3,052 | 3,052 | 3,052 |
| **Pseudo R-squared** | | 0.217 | 0.217 | 0.216 |
| **Log Likelihood** | | -3312 | -3311 | -3314 |
| **Active mines: 'yes'** | | Dummy | Dummy | Dummy |
| **Country-Sector FE** | | Yes | Yes | Yes |
| **Industry Sector** | | Yes | Yes | Yes |
| **Other Firm controls** | | Yes | Yes | Yes |
| **Controls for inactive mines** | | Yes | Yes | Yes |
| **Controls for Obstacles** | | No | Yes | Yes |

Note: Robust standard errors are shown in parentheses. ***, ** correspond to the 1% and 5% level of significance, respectively.

**Table 8: Effect of mine production industry on the firms' turnover**

| | | (1) | (2) | (3) |
|---|---|---|---|---|
| | **Interaction** | **Baseline** | **Full** | **Full with Interaction** |
| **Active resources 0-15 km** | | -0.185 | -0.183 | -0.288 |
| | | (0.300) | (0.299) | (0.319) |
| **Active resources 16-50 km** | | -0.185 | -0.182 | -0.186 |
| | | (0.104) | (0.104) | (0.104) |
| **Active resources 51-1,000 km** | | 0.002 | 0.011 | 0.018 |
| | | (0.140) | (0.140) | (0.142) |
| PCI | | - | 0.016 | -0.013 |
| | | | (0.012) | (0.026) |
| Active resources 0-15 km | x PCI | - | - | -0.327 |
| | | | | (0.231) |
| Active resources 16-50 km | x PCI | - | - | 0.011 |
| | | | | (0.061) |
| Active resources 51-1,000 km | x PCI | - | - | 0.038 |
| | | | | (0.029) |
| Non-traded sector | | **0.363*****| **0.362***** | **0.362***** |
| | | (0.039) | (0.040) | (0.040) |
| Construction sector | | 0.469*** | 0.469*** | 0.467*** |
| | | (0.061) | (0.061) | (0.062) |
| Resource sector | | 0.220*** | 0.220*** | 0.216*** |
| | | (0.068) | (0.068) | (0.068) |
| $\hat{\theta}_1$ | | -0.157 | -0.131<br>(0.356) | -0.087<br>(0.364) |
| | | (0.356) | | |
| $\hat{\theta}_2$ | | 0.827 | 0.853<br>(0.356) | 0.897<br>(0.364) |
| | | (0.356) | | |
| $\hat{\theta}_3$ | | 1.869 | 1.896<br>(0.357) | 1.940<br>(0.365) |
| | | (0.356) | | |
| **Observations** | | 4,898 | 4,898 | 4,898 |
| **Pseudo R-squared** | | 0.229 | 0.229 | 0.229 |
| **Log Likelihood** | | -5236 | -5235 | -5223 |
| **Active mines: 'yes'** | | Dummy | Dummy | Dummy |
| **Country-Sector FE** | | Yes | Yes | Yes |
| **Industry Sector** | | Yes | Yes | Yes |
| **Other Firm controls** | | Yes | Yes | Yes |
| **Controls for inactive mines** | | Yes | Yes | Yes |
| **Controls for Obstacles** | | No | Yes | Yes |

Note: Robust standard errors are shown in parentheses. ***, ** correspond to the 1% and 5% level of significance, respectively.

*7.1.2 Impact of local minerals and metals industries on local firms*

Table 8 above reports the estimated effect for nearby mining activity. In particular, we do not notice any statistically significant effects of active mines on financial performance within our distance bands, regardless of the model specifications used as well as the distance to active resource. Also, column (2) accounts for the obstacles presented in the form of PCI. We find no effect of obstacles to doing business on firm turnover. Column (3) includes the interactions of obstacles with three distance bins but again there is no significant effect detected regardless the radius proximity.

With regards to the sector of the firm, we find similar results as for the oil/ gas analysis, where the non-traded sector firms tend to benefit the most across the economy. Column (2) states that the enterprises that specialize in non-traded sector increase the standardized probit index by 0.362 of a standard deviation compared to those firms that specialize in traded sector activity. Also, we find that construction sector has positive impact near the mining industry.

In addition, in column 4 of Appendix Table A2 we assess possible effects on financial productivity coming from the firms' sector located within the certain distance bin. Hence, we interact three sector variables with three distance radiuses. We also check goodness of fit of the model by applying Wald tests on interactions, using same technique as in previous analysis in oil/ gas model. Chi-squared 3 at 5% level is 7.81; the estimate of PCI to distance rings is 3.23 and is less than 7.81. Hence, three of these interactions are not statistically significant, meaning that there is no variation in PCI across all tested distances to oil/ gas installations. As for sector to distance bins interaction we also find no variation (estimate 4.19 is less than chi-square value of 7.81). We find no variation neither in sector to distance rings, nor in obstacles (PCI) to distance bins. The former finding again suggests the absence of a local 'Dutch Disease' type effect for mining activity.

Overall, the proximity of mines appears to exert no independent statistical effect for the local economy in the immediate vicinity of the mine. Our results hold regardless of the model specifications used and contrast with what was reported for oil/gas extraction activity earlier.

*7.1.3 Discussion of the empirical results*

One of the possible reasons for such difference in the results among two extractive sectors is the difference in size of revenue generated and the style of ownership structure present in the different sectors. We would anticipate for both extractive industries the effect to be negative. The further away the firm is located from the extractive industry, the worse is the financial performance of the local firms. However, due to oil and gas revenue generated as well as the ownership structure, where in the case of Russia and the former republics of the USSR, oligarchs are obliged to look after the welfare of local economies, we find a positive effect on financial performance of those firms that located nearby oil/ gas firms. However, this explanation could not be taken to extend to the non-USSR post-socialist countries in the sample.

Another reason that could explain the difference in the spread of the revenues generated across the firms is the variation in the outcome variable with respect to the presence of the extractive industries. Our data reflect the presence of a higher firm quartile revenue spread for the oil and gas sample than for the minerals and metals sample (see Tables 5 and 6). For example, in Table 5 (descriptive statistics for oil/ gas sample) we noted a lot more activity at the top revenue quartile categories than at the bottom quartile for 0 – 15 km and 15 – 50 km range of nearby active oil or gas fields (columns (2) and (4)). Whereas, in the descriptive statistics for minerals and metals sample (Table 6) we find lack of sample size of firms located within a close distance to the active mine fields (0 – 15 km and 16 – 50 km), as well as lack of spread across the revenue quartiles. This suggests that the negative effect of firm financial productivity located nearby minerals and metals industries is driven by a very few observations.

Overall, the results provide evidence that the nature of natural resource matters in terms of the effect on local economic activity. We find a positive effect of local oil and gas industries on local firms within their immediate vicinity (0 – 15 km). This suggests a ‘local resource blessing’ effect.

One of the mechanisms that possibly takes place is positive externalities produced by oil and gas extraction sites. Since oil and gas extraction sites are partially controlled by government, and in certain contexts the owners of extractive companies are obliged to oversee and take care of their local economies, this could lead to higher local investments. These comprise investments in local infrastructure and public goods, which tend to improve local welfare. In addition, due to higher revenues generated, as well as the greater magnitude of the contribution in oil and gas extraction industries than is the case for mine extraction industries, this has an additional positive impact on the localities where they are situated.

Regarding the analysis of the effect of local extraction fields on the industrial sector of the firms (broadly defined), we find no evidence of differential spending effects across different industries as anticipated by the local 'Dutch Disease' effect. Hence, there is no evidence of a differential impact of local extraction sites on the sector of the firms. Thus, the key results here suggest the absence of local 'Dutch Disease' effects as found elsewhere in the literature particularly in the work cited earlier for the US. Overall, we find a positive and statistically significant effects on financial sales for firms in the non-traded traded and construction sectors regardless of their proximity to resource extraction fields. In contrast, the financial performance of the manufacturing sector (traded) is the lowest of all sectors, but this is the case whether or not the firms are located close to extractive sites or not.

Therefore, there may be more an indirect impact coming from extraction sites on local economy. The induced impacts are taking place in other sectors throughout the supply chain, where the resource extraction labour reside and work locally, and hence spend their salary locally. Specifically, the non-traded sector tends to benefit the most through indirect impact induced by resource extraction workers. The empirical evidence by Ostensson (2017) also shows that extractive industries have greater dependence for local services rather than goods.

### *7.2 The effect of nearby resources on firms' business constraints*

We have looked at the impact of nearby natural resources on firm performance. A second hypothesis states that local resource activity affects firms through the presence of different obstacles. In order to examine this, we interacted different types of obstacles with the nearby active natural resources. Haas and Poelhekke (2019) concluded that the presence of nearby natural resources increased the constraints in input (finance, land, and workforce) and infrastructure (transport and electricity) within the local firm's immediate vicinity (up to 20 km), but it relaxes it at longer distance.

Our analysis examined the effect of the three main obstacles: transport, finance, and electricity separately. Hence, Table 9 and Table 10 present the effect of obstacles on financial performance of the firms that are close by distances to operating oil and gas fields (Table 9) and operating minerals and metals fields (Table 10) respectively. The outcome variable of the model is financial performance of the firms in all five columns. In all five models we control for inactive mines, firm controls, such as age, country, employment size, and region and ownership structure. We also include country and sector-specific fixed effects, so that we effectively compare—within one and the same country, and region—firms with and without the presence of nearby mines.

Columns (1) – (3) analysed in the first sub-part of the analysis above, where column (2) captures the weighted average of the severe obstacles (PCI), and column (3) interacts PCI to different distance rings of the nearby extractive fields. Columns (4) and (5) are the models of interest. Column (4) analyses the effect of three main firms' constraints on the firm financial productivity. Column (5) interacts three obstacles to the nearby extractive fields, thus checking whether the effect of the constraints strengthens within a certain proximity to operating extractive field.

*7.2.1 The effect of local oil and gas industries on local firms' business constraints*

Based on our results in Table 9, first we find that the sales of the firms increase within the immediate vicinity (up to 15 km) of the active oil and gas fields. This result holds regardless of the model specification at 1% significance level. Next, we are interested in the effect of obstacles on the firm financial performance. Therefore, to observe the underlying mechanisms, we include three main firms' obstacles (finance, transport, and electricity) in the model.

Overall, in column (4), we find that firms mostly suffer due to difficulties in accessing finance (i.e., capital market) and electricity connection. Specifically, the presence of an electricity constraint reduces the standardized probit index by 0.143 of a standard deviation and is statistically significant at the 1% level. The constraints related to access to finance also decreases the standardized probit index by 0.100 of a standard deviation and is found to be statistically significant at the 5% level using two-tailed tests.  Hence, access to electricity and finance deteriorates the business environment of the firms and its financial performance as one would anticipate. The transportation constraint, on the other hand, raises the standard deviation of the dependent variable by 0.248. The result is statistically significant at the 1% using a two-tailed test.

This finding may be related to the fact that larger firms (i.e., those with higher sales activity) are more likely to complain about poor transportation infrastructure (e.g., the existing road and rail networks) than smaller firms (i.e., those with lower levels of sales), and interpret the poor infrastructure as a significant constraint on their business activity and further development.

Column (5) adds to the existing model (column (4)) the interaction term of business constraints to difference distance bins of the nearby oil and gas field. Thus, estimating the impact of local oil and gas industries on business constraints we find no direct effect of nearby oil/gas fields on local financial performance originating through the impact of any of the various business constraints. Therefore, the effect of local oil and gas extraction fields on financial productivity of the firms does not come from the business constraints directly.

**Table 9: Effect of oil/ gas production industry on the firms' turnover through business constraints**

| | | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|---|
| | **Interaction** | **Baseline** | **Full** | **Full with Interactions** | **Obstacles** | **Transport interacted** |
| **Active resources 0-15 km** | | **0.445*** ** | **0.446*** ** | **0.392*** ** | **0.427*** ** | **0.492*** ** |
| | | (0.116) | (0.116) | (0.119) | (0.117) | (0.146) |
| **Active resources 16-50 km** | | 0.130 | 0.133 | 0.111 | 0.127 | 0.173 |
| | | (0.103) | (0.103) | (0.105) | (0.103) | (0.127) |
| **Active resources 51-1,000 km** | | 0.421 | 0.421 | 0.497 | 0.443 | 0.384 |
| | | (0.256) | (0.062) | (0.323) | (0.257) | (0.309) |
| PCI | | - | 0.007 | -0.021 | - | - |
| | | | (0.015) | (0.236) | | |
| Active resources 0-15 km | x PCI | - | - | -0.129 | - | - |
| | | | | (0.071) | | |
| Active resources 16-50 km | x PCI | - | - | -0.003 | - | - |
| | | | | (0.058) | | |
| Active resources 51-1,000 km | x PCI | - | - | 0.034 | - | - |
| | | | | (0.236) | | |
| **Obstacles:** | | | | | | |
| **Transport** | | - | - | - | **0.248*** ** | 0.317 |
| | | | | | (0.057) | (0.703) |
| **Finance** | | - | - | - | **-0.100** ** | -2.644 |
| | | | | | (0.049) | (111.037) |
| **Electricity** | | - | - | - | **-0.143*** ** | -0.993 |
| | | | | | (0.048) | (0.675) |
| Active resources 0-15 km | x Transport | - | - | - | - | -0.488 |
| | | | | | | (0.323) |
| Active resources 16-50 km | x Transport | - | - | - | - | 0.286 |
| | | | | | | (0.234) |
| Active resources 51-1,000 km | x Transport | - | - | - | - | -0.080 |
| | | | | | | (0.702) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Active resources 0-15 km | x Finance | - | - | - | - | -0.200 |
| | | | | | | (0.237) |
| Active resources 16-50 km | x Finance | - | - | - | - | -0.106 |
| | | | | | | (0.182) |
| Active resources 51-1,000 km | x Finance | - | - | - | - | 2.565 |
| | | | | | | (111.037) |
| Active resources 0-15 km | x Electricity | - | - | - | - | 0.301 |
| | | | | | | (0.290) |
| Active resources 16-50 km | x Electricity | - | - | - | - | -0.294 |
| | | | | | | (0.165) |
| Active resources 51-1,000 km | x Electricity | - | - | - | - | 0.806 |
| | | | | | | (0.674) |
| $\hat{\theta}_1$ | | 0.173 | 0.173 | 0.223 | 0.110 | -0.061 |
| | | (0.300) | (0.300) | (0.365) | (0.302) | (0.352) |
| $\hat{\theta}_2$ | | 1.138 | 1.138 | 1.190 | 1.080 | 0.911 |
| | | (0.301) | (0.301) | (0.365) | (0.303) | (0.352) |
| $\hat{\theta}_3$ | | 2.191 | 2.191 | 2.244 | 2.140 | 1.972 |
| | | (0.302) | (0.302) | (0.366) | (0.304) | (0.353) |
| **Observations** | | 3,052 | 3,052 | 3,052 | 3,052 | 3,052 |
| **Pseudo R-squared** | | 0.217 | 0.217 | 0.218 | 0.222 | 0.221 |
| **Log Likelihood** | | -3311 | -3312 | -3308 | -3298 | -3296 |
| **Active mines: ‘yes’** | | Dummy | Dummy | Dummy | Dummy | Dummy |
| **Country-Sector FE** | | Yes | Yes | Yes | Yes | Yes |
| **Industry Sector** | | Yes | Yes | Yes | Yes | Yes |
| **Other Firm controls** | | Yes | Yes | Yes | Yes | Yes |
| **Controls for inactive mines** | | Yes | Yes | Yes | Yes | Yes |
| **Controls for Obstacles** | | No | Yes | Yes | Yes | Yes |

Note: Robust standard errors are shown in parentheses. ***, ** correspond to the 1% and 5% level of significance, respectively.

Based on our results in Table 10, first we find no effect of nearby minerals and metals fields on financial performance of the firm. This result holds regardless of the model specification used. Next, we are interested in the effect of obstacles on the firm financial performance, hence, column (4) and (5). In general terms, firms mostly suffer due to difficulties in accessing finance, which may relate to problems with capital market. Constraints faced by firms in terms of finance decrease the standardized probit index by a modest 0.085 of a standard deviation, which is statistically significant at the 5% level. Thus, the access to capital markets and credit is more constrained for the firms, and such a constraint adversely affects their financial performance. Whereas transportation constraint increases the standardized probit index by 0.243 of a standard deviation. The result is found to be statistically significant at the 1% level using a two-tailed test. In other words, the access to transportation is less constrained for these firms, and this does not have a negative effect on their growth, for reasons as discussed earlier.

Column (5) adds to the existing model (column 4) the interaction term of business constraints to difference distance bins of the nearby oil and gas field. We find no direct effect of nearby oil and gas fields on local productivity that come from business constraints. Our results contradict to Haas and Poelhekke (2019) findings, where they find that the presence of active mines in firms within 21 to 150 kilometres relaxes business constraints for all firms. Overall, the effect of local mine extraction fields on financial productivity of the firm does not come from the business constraints directly.

**Table 10: Effect of mine production industry on the firms' turnover through business constraints**

| | | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|---|
| | **Interaction** | **Baseline** | **Full** | **Full with Interaction** | **Obstacles** | **Transport interacted** |
| **Active resources 0-15 km** | | -0.189 | -0.188 | -0.289 | -0.236 | -0.248 |
| | | (0.300) | (0.300) | (0.319) | (0.300) | (0.460) |
| **Active resources 15-50 km** | | -0.183 | -0.179 | -0.183 | -0.187 | -0.166 |
| | | (0.104) | (0.104) | (0.104) | (0.104) | (0.138) |
| **Active resources 51-1,000 km** | | -0.003 | 0.005 | 0.011 | 0.013 | 0.008 |
| | | (0.140) | (0.140) | (0.142) | (0.140) | (0.146) |
| PCI | | - | 0.017 | 0.009 | - | - |
| | | | (0.012) | (0.026) | | |
| Active resources 0-15 km | x PCI | - | - | -0.330 | - | - |
| | | | | (0.231) | | |
| Active resources 16-50 km | x PCI | - | - | 0.014 | - | - |
| | | | | (0.061) | | |
| Active resources 51-1,000 km | x PCI | - | - | 0.034 | - | - |
| | | | | (0.029) | | |
| **Obstacles:** | | | | | | |
| **Transport** | | - | - | - | **0.243*** ** | **0.183** ** |
| | | | | | (0.045) | (0.091) |
| **Finance** | | - | - | - | **-0.085** ** | -0.091 |
| | | | | | (0.037) | (0.075) |
| **Electricity** | | - | - | - | -0.066 | -0.016 |
| | | | | | (0.038) | (0.075) |
| Active resources 0-15 km | x Transport | - | - | - | - | -0.381 |
| | | | | | | (0.780) |
| Active resources 16-50 km | x Transport | - | - | - | - | -0.105 |
| | | | | | | (0.263) |
| Active resources 51-1,000 km | x Transport | - | - | - | - | 0.090 |
| | | | | | | (0.105) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Active resources 0-15 km | x Finance | - | - | - | - | 1.760 |
| | | | | | | (0.910) |
| Active resources 16-50 km | x Finance | - | - | - | - | 0.285 |
| | | | | | | (0.237) |
| Active resources 51-1,000 km | x Finance | - | - | - | - | -0.009 |
| | | | | | | (0.086) |
| Active resources 0-15 km | x Electricity | - | - | - | - | -6.672 |
| | | | | | | (191.379) |
| Active resources 16-50 km | x Electricity | - | - | - | - | -0.201 |
| | | | | | | (0.233) |
| Active resources 51-1,000 km | x Electricity | - | - | - | - | -0.057 |
| | | | | | | (0.087) |
| $\hat{\theta}_1$ | | -0.135 | -0.107 | -0.072 | -0.090 | -0.124 |
| | | (0.356) | (0.356) | (0.364) | (0.357) | (0.367) |
| $\hat{\theta}_2$ | | 0.851 | 0.879 | 0.915 | 0.900 | 0.867 |
| | | (0.356) | (0.356) | (0.364) | (0.357) | (0.368) |
| $\hat{\theta}_3$ | | 1.895 | 1.924 | 1.960 | 1.949 | 1.918 |
| | | (0.356) | (0.357) | (0.365) | (0.357) | (0.368) |
| **Observations** | | 4,898 | 4,898 | 4,898 | 4,898 | 4,898 |
| **Pseudo R-squared** | | 0.230 | 0.230 | 0.230 | 0.232 | 0.233 |
| **Log Likelihood** | | -5230 | -5229 | -5228 | -5215 | -5208 |
| **Active mines: ‘yes’** | | Dummy | Dummy | Dummy | Dummy | Dummy |
| **Country-Sector FE** | | Yes | Yes | Yes | Yes | Yes |
| **Industry Sector** | | Yes | Yes | Yes | Yes | Yes |
| **Other Firm controls** | | Yes | Yes | Yes | Yes | Yes |
| **Controls for inactive mines** | | Yes | Yes | Yes | Yes | Yes |
| **Controls for Obstacles** | | No | Yes | Yes | Yes | Yes |

Note: Robust standard errors are shown in parentheses. ***, ** correspond to the 1% and 5% level of significance, respectively.

# Chapter 8: Conclusion

We estimate the local impact of resource extractive industries using data for 3,052 firms in oil and gas model, and 4,898 firms in minerals and metals extraction. We analyzed the effect of eight resource-rich countries in the oil and gas dataset, and 14 countries in the mine analysis respectively. We exploit spatial distance variation in local resource extractive activity within these set of countries to provide some causal inference using cross-sectional settings.

The results appear quite robust: overall, we note two main results. First, there is a positive impact on firm performance within the immediate vicinity (up to 15km) to operating oil/ gas industries. Also, although there is no effect within the immediate vicinity (0 – 15km) of nearby operating mineral and metal industries on firm performance, we find a slight negative impact (at 10% significance level) withing 16 – 50 km radius. Second, when we analyze the effect of nearby active extractive resource industries on firms' financial performance depending on the sector of the firm, we do not find any statistically significant effect. Hence, we find no evidence of the 'Dutch disease' at local level.

In line with James (2015), Galiendo et al., (2018), and Jaimes and Gerlagh (2020) the results provide evidence that the nature of natural resource matters. We find a positive effect on the local economy within close vicinity to oil and gas fields ('local resource blessing'). Whereas the effect changes to negative when we estimate the effect for local firms within 16 – 50 km to active minerals and metals industries ('local resource curse'). The latter effect, however, is only statistically significant at 10%, this is due to small sample size.

Although, we find no evidence of the 'Dutch disease', the results show that the sector of the firm effects on its financial performance. There are several policy implications that follow from this research. To be able to minimize the localized negative effects on the business environment, policy makers may think regarding ways to let producers share extractives-related infrastructure. This could potentially decrease the infrastructure bottlenecks and congestion effects that we observe in our dataset. Inadequate transport, electricity, and other important infrastructure could not only help the tradables sector but also stimulate services sectors and clusters of down and upstream industries that are related to the resource and construction sectors. To maximize positive spillovers, policy makers can also help small firms to become 'fit to supply' local resource extractive-related supply chains. Also, it is important to analyse and capture the effect of local governance and the level of institutional quality which measure the extent to which the revenues generated from extraction fields are put to effective use for advancing developmental outcomes in localities.

## References


Addison, T., and Roe, A., (2018). “Extractives for development: Ten main messages”. No wp-2018-99, WIDER Working Paper Series, World Institute for Development Economic Research (UNU-WIDER).

Allcott, H., and Keniston, D., (2014). “Dutch disease or agglomeration? The local economic effects of natural resource booms in modern America”. National Bureau of Economic Research.

API, (2011). “The Economic Impacts of the oil and natural gas industry on the US”.

Aragon, F.M., and Rud, J.P., (2013). “Natural resources and local communities: evidence from a Peruvian gold mine”. Am. Econ. J. Econ. Pol. 5 (2), 1–25.

Arezki et al., (2017). **“**On the comparative advantage of U.S. manufacturing: evidence from the shale gas revolution”. J. Int. Econ., 107 (2017), pp. 34-59.

Auty, R.M. (2001). “*Resource Abundance and Economic Development”*. Oxford, UK: Oxford University Press.

Auty, R.M., (1993). “Sustaining Development in Mineral Economies: The Resource Curse Thesis”. Routledge, London.

Badeeb, R.A., et al., (2017). “The evolution of the natural resource curse thesis: A critical literature survey”. Resources Policy, Volume 51, 123-134.

Bhattacharyya, S., and Hodler, R., (2010). "Natural resources, democracy and corruption". European Economic Review, Elsevier, vol. 54(4), pages 608-621.

Black et al., (2005). “The economic impact of the coal boom and bust**”.** Econ. J., 115 (2005), pp. 449-476.

Brunnschweiler, C. N., and Bulte, E. H., (2008). "The resource curse revisited and revised: A tale of paradoxes and red herrings." *Journal of environmental economics and management* 55, no. 3: 248-264.

Caliendo et al., (2018). **“**The impact of regional and sectoral productivity changes on the U.S. economy”. Rev. Econ. Stud., 85 (2018), pp. 2042-2096.

Cameron, P.D., and Stanley, M., (2017). “Oil, Gas and Mining: A sourcebook for understanding the extractive industries”. International Bank for Reconstruction and Development, World Bank Group.

Carlin, W., Schaffer, M., and Seabright, P., (2010). "A Framework for Cross-Country Comparisons of Public Infrastructure Constraints on Firm Growth". CEPR Discussion Paper No. 7662.

Caselli, F., and Michaels, G., (2013). “Do Oil Windfalls Improve Living Standards? Evidence from Brazil”. American Economic Journal: Applied Economics 2013, 5(1): 208 – 238.

Cavalcanti, T. V., Mohaddes, k., and Raissi. M., (2015). "Commodity price volatility and the sources of growth." *Journal of Applied Econometrics* 30, no. 6: 857-873

Commander, S., and Svejnar, J., (2011). “Business environment, exports, ownership, and firm performance”. The Review of Economics and Statistics 93(1), 309–337.

Corden, W., and Neary, J., (1982). “Booming Sector and De-Industrialisation in a Small Open Economy”. *The Economic Journal, 92*(368), 825-848.

Corden, W.M., (1984). “Booming sector and Dutch disease economics: survey and consolidation”. Oxford Econon. Paper, 359–380.

Council for professional qualifications in the oil and gas complex (2017). ‘Monitoring rynka truda v ngk’. Available at *‘https://www.spkngk.ru/fileadmin/f/about/Monitoring_rynka_truda_v_ngk.pdf’* .

Cust, J., and Poelhekke, S., (2014). “The local economic impacts of natural extraction”. Annual Review of Resource Economics, 7 (1).

Deaton, A., (1999). “Commodity prices and growth in Africa”. Journal of Economic Perspectives, 13, 23 – 40.

Frankel, J., (2010). “Natural Resource Curse: A Survey”. HKS Working Paper no. rwp10-005.

Gattorna, J., (2006). “Supply Chains Are the Business”. Supply Chain Management Review, 10(6), 42-49.

Gorodnichenko, Y., and Schnitzer, M., (2013). “Financial constraints and innovation: Why poor countries don't catch up”. Journal of the European Economic Association 11, 1115–1152.

Gylfason, T., (2001). “Natural Resources, Education, and Economic Development”. European Economic Review, 45, 847-859.

Haas, R.D., and Poelhekke, S., (2019). “Mining matters: Natural resource extraction and local business constraints”. Journal of International Economics, volume 117, 109 – 124.

Halvor, M., Moene, K., and Torvik, R., (2006). "Cursed by resources or institutions?". *World Economy* 29, no. 8: 1117-1131.

Halvor, M., Moene, K., and Torvik, R., (2006). "Institutions and the resource curse". *The economic journal* 116, no. 508: 1-20.

Hamilton, J. D., (2009). “Causes and Consequences of the Oil Shock of 2007-08”. National Bureau of Economic Research.

Hamilton, J. D., (2011). “Historical oil shocks”. National Bureau of Economic Research.

Hirschman, A. O., (1981). Essays in Trespassing: Economics to Politics and Beyond, New York, Cambridge University Press.

Humphreys, M., Sachs, J., and Stiglitz, (2007). “Escaping the Resource Curse”. Columbia University Press, New York, pp. 11–13.

IMF, (2007). “Inter-sectoral linkages and local content in extractive industries and beyond”. The case of Sao Tome and Principe. WP/07/213.

Ismail, K., (2010). “The Structural Manifestation of the 'Dutch Disease’: The Case of Oil Exporting Countries”. *IMF Working Papers*, 1-36.

Jackman, S., (2000). ‘Models for Ordered Outcomes’. Political Science 200C. Available at: *‘https://web.stanford.edu/class/polisci203/ordered.pdf’.*

Jaimes, R., and Gerlagh, R., (2020). “Resource-richness and economic growth in contemporary U.S”. Energy Economics, Volume 89, 104810.

James, A., (2015). “The resource curse: a statistical mirage?”. Journal of Development Economics 114 (C), 55–63.

Kaplinsky, R., (2011). “Commodities for Industrial Development: Making Linkages Work”. UNIDO working paper December 2011.

Kilian, L., (2008). “The economic effects of energy price shocks”. *Journal of Economic Literature, 46*(4), 871-909.

Kotsadam, A., and Tolonen A. (2016). “African Mining, Gender, and Local Employment”. World Development 83: 325–39.

Krugman, P., (1987). “The narrow moving band, the Ducth disease, and the competitive consequences of Mrs. Thatcher: Notes on trade in the presence of dynamic scale economies”. Journal of Development Economics, Volume 27, Issues 1 – 2, 41-55.

Mamo, N., et al (2019). “Intensive and extensive margins of mining and development: Evidence from Sub-Saharan Africa”. JDE, 139, 28-49.

Matsuyama, K., (1992). “Agricultural Productivity, Comparative Advantage, and Economic Growth”. Journal of Economic Theory 58, 317-334.

McMahon, G., and Moreira, S., (2014). “The Contribution of the Mining Sector to Socioeconomic and Human Development”. Extractive industries for development series no.30. World Bank, Washington, DC. Available at: *‘https://openknowledge.worldbank.org/handle/10986/18660 License: CC BY 3.0 IGO’*.

Mehlum, H., Moene, K., and Torvik, R., (2006). “Institutions and the resource curse”. Econ. J. 116 (508), 1–20.

Mian, A., and Sufi, A., (2014). "What explains the 2007-2009 drop in employment?". *Econometrica* 82(60), 2197–2223.

Michaels, G., (2011). "The long-term consequences of resource-based specialization". Econ. J. 121 (551), 31–57.

Michielsen, T., (2013). "The distribution of energy-intensive sectors in the USA". J. Econ. Geogr., 13 (5) (2013), pp. 871-888.

Moretti, E., (2010). "Local multipliers". American Economic Review Papers and Proceedings 100, 1–7.

Östensson, O., (2017). "Local Content, Supply Chains and Shared Infrastructure". WIDER Working Paper 2017/96. Helsinki: UNU-WIDER.

Rajan, R. G., and Subramanian, A., (2011). "Aid, Dutch disease, and manufacturing growth". *Journal of Development Economics, 94*(1), 106-118.

Roe, A. R., and Round, J., (2017). "Framework: The channels for indirect impacts". United Nations University World Institute for Development Economics Research. WIDER Working Paper 2017/79. Available at: '*https://www.wider.unu.edu/sites/default/files/wp2017-79.pdf*'.

Rosenstein-Rodan, P.N., (1943). "Problems of industrialisation of Eastern and South-Eastern Europe". Econ. J. 53, 202–211.

Ross, M. L., (2015). "What Have We Learned about the Resource Curse?" *Annual Review of Political Science* 18.1: 239–259. Available at: '*https://www.annualreviews.org/doi/10.1146/annurev-polisci-052213-040359*'.

Sachs, J. D., and Warner, A. M., (1995). "Natural resource abundance and economic growth". National Bureau of Economic Research.

Sachs, J. D., and Warner, A. M., (2001). "The curse of natural resources." *European economic review* 45, no. 4-6: 827-838.

Sachs, J.D. and Warner, A.M., (1999). "Natural resource abundance and economic growth, In: *Leading Issues in Economic Development".* G. Meier and J. Rauch (eds.), Oxford University Press, Oxford.

Shell, a.n.d. (2007). "Buying Locally". Available at: *'https://www.shell.com/about-us/major-projects/sakhalin/sakhalin-an-overview.html'*.

Sigam, C., and Garcia, L., (2012). "Extractive Industries: Optimizing value retention in host countries". UNCTAD/SUC/2012/1.

Smith, A., (1812). "An inquiry into the Nature and Causes of the Wealth of Nations". Oxford: Clarendon Press.

Smith, B., (2014). “Dutch disease and the oil and boom and bust”. Oxford Centre for the Analysis of Resource Rich Economies, University of Oxford.

Smith, B., (2015). “The resource curse exorcised: Evidence from a panel of countries”. *Journal of Development Economics, 116*, 57-73.

SUEK (2010). ‘Sustainability report 2009-2010’. Available at: *http://www.suek.ru/upload/files/pdf/ru/Korporativnyj-socialnyj-otchet-za-2009_2010-gody.pdf*

SUEK. Official website. Available at: *http://www.suek.ru/sustainability/communities/*

Surgutneft. ‘Regional infrastructure plan’. Available at: *http://neftianka.ru/surgutneftegaz-nachal-dobychu-na-lenskom-mestorozhdenii-v-yakutii/ .*

Surgutneft. Official website. Available at: *‘https://www.surgutneftegas.ru/responsibility/social_politics/’.*

Tolonen, A., (2014). “Local Industrial Shocks, Female Empowerment, and Infant Health: Evidence from Africa’s Gold Mining Industry”. Unpublished manuscript. University of Gothenburg, School of Business, Economics and Law, Gothenburg.

Treisman, D. (2010). ‘” Loans for shares” revisited’. National Bureau of economic research. Working paper 15819. Available at: ‘*http://www.nber.org/papers/w15819’.*

van der Ploeg, F., and Venables, A. J., (2012). “Natural Resource Wealth: The Challenge of Managing a Windfall”. *Annual Review of Economics, Vol 4, 4*, 315-+.

van der Ploeg, F., (2011). “Natural resources: curse or blessing?”. *Journal of Economic Literature* 49(2), 366–420.

van der Ploeg, F., and Poelhekke, S., (2009). "Volatility and the natural resource curse." *Oxford economic papers* 61, no. 4: 727-760.

van der Ploeg, F., and Poelhekke, S., (2016). “The impact of natural resources: survey of recent quantitative evidence”. J. Dev. Stud., 1–12.

van Wijnbergen, S., (1984). “The Dutch Disease': a disease after all?”. *The economic journal, 94*(373), 41-55.

Venables, A., (2016). “Using Natural Resources for Development: Why Has It Proven So Difficult?”. Journal of Economic Perspectives, vol. 30, no. 1, 161-84.

Von der Goltz, J. and Barnwall, P., (2014). “Mines. The local wealth and health effects of mining in developing countries”. mimeo.

Wise, H., and Shtylla, S., (2007). “The Role of the Extractive Sector in Expanding Economic Opportunity”. Harvard University. Available at:'*https://www.hks.harvard.edu/sites/default/files/centers/mrcbg/programs/cri/files/report_18_EO%2BExtractives%2BFinal.pdf*'.

World Bank Group, (2004). World Bank Management Group Response: "Striking a Better Balance – The World Bank Group and Extractive Industries". The Final Report of the Extractive Industries Review.

Wright, G., and Czelusta, J., (2007). "Resource-based growth past and present. In: Natural Resources: Neither Curse nor Destiny". Stanford, CA: Stanford University Press.

# Appendix

*Description of PCA*

Principle Component Analysis (PCA) is a statistical technique for the compression and classification of data. Such technique is used to reduce the dimensionality of large data set of variables, by transforming large sample set into a smaller one, that nonetheless contains most of the sample's information (i.e., variation in the sample). The new set of variables are called Principal Components (PCs). PCs are series of linear least squares fits to a sample, each orthogonal to all the previous, and they are statistically linear independent of one another. Hence, PCs are uncorrelated and are ordered by the fraction of the total information each retains, such as: PC1 captures the most variation in the sample, PC2 captures the second most variation, and so on.

*Robustness checks*

<u>*Variation of distance radiuses:*</u>

While in the main analysis we investigate the effect of local extractive industries using three main distance bins: 0 – 15 km, 16 – 50 km, and 51 – 1,000 km, in the robustness test we have checked other distance ring variances. Increasing the first bin to 20 km, did not alter the key results obtained here. The purpose of the paper is to analyse the local effect, hence, we shortened the first distance bin to 10 km. However, due to lack of observations within 10 km radius, we decided to keep the first distance band at 15 km. As of the second and third bins, we also varied to different radiuses (21 – 50km, 21– 75 km and 76 – 1,000km. For example, Tables A3 and A4 illustrate the effect of the local oil and gas industries (Table A3), while Table A4 illustrates the effect of the minerals and metals industries, applying alternative distance radiuses: 0 – 20 km, 21 – 75 km, and 76 – 1,000 km). It can be noticed that the main results hold regardless of the distance radiuses used. Such that, by looking at column (1) and (2), i.e., Baseline and Full models in Table A3, we also find the positive statistically significant effect (at 1% significance level) of nearby oil and gas industries on local firms within immediate vicinity (0 – 20 km).  In other words, column (1) states if there is an active oil/gas production facility within 20 km of the company it raises the standard deviation of the dependent variable by 0.492. Whereas no effect found at longer distance. Hence, the main effect does not change varying the distance radius.

Table A4 columns (1) and (2), i.e., Baseline and Full models, find no effect of active minerals and metals industries on local firms. Therefore, our main results hold regardless of the distance radiuses specification used.

*Effect of active extractive resource industries on firms' obstacles:*

Next, in the baseline models of the analysis, column (1) in Tables 7 and 8, we controlled for firms' obstacles. The main result has not changed regardless the extractive industry (oil/ gas or mines) analysed. We have also controlled for the giant extractive oil and gas fields as well as giant minerals and metals; our main results hold regardless of the models' specification used.

*Effect of active extractive resource industries on local firms' sectors:*

In addition, in the robustness test, we have analysed whether the presence of nearby extractive resources (within 0 – 15 km) have a direct impact on specific sectors of the firms. Based on Haas and Poelhekke (2019) analysis, they found that the presence of active mines reduces the economic activity of firms specialised in manufacturing sector within close vicinity (up to 20 km). Therefore, we interacted firms' sectors with the distance bins. Column (4) in Tables A1 and A2 show no evidence of direct impact of nearby extractive industry on specific sector of the firm.

*Tables*

**Table A 1: Effect of active oil/ gas industries on nearby firms' sectors**

| | | (1) | (2) | (3) | (4) |
|---|---|---|---|---|---|
| | **Interaction** | **Baseline** | **Full Model** | **Full with Interactions** | **Full with sector Interactions** |
| **Active resources 0-15 km** | | **0.469***** | **0.469***** | **0.417***** | **0.342**** |
| | | (0.116) | (0.116) | (0.119) | (0.165) |
| **Active resources 16-50 km** | | 0.122 | 0.124 | 0.103 | -0.042 |
| | | (0.103) | (0.103) | (0.105) | (0.137) |
| **Active resources 51-1,000 km** | | 0.441 | 0.441 | 0.513 | 0.515 |
| | | (0.256) | (0.256) | (0.322) | (0.389) |
| PCI | | - | 0.004 | -0.018 | 0.089 |
| | | | (0.015) | (0.235) | (0.266) |
| Active resources 0-15 km | x PCI | - | - | -0.128 | -0.105 |
| | | | | (0.071) | (0.073) |
| Active resources 16-50 km | x PCI | - | - | -0.005 | 0.003 |
| | | | | (0.058) | (0.059) |
| Active resources 51-1,000 km | x PCI | - | - | 0.029 | -0.078 |
| | | | | (0.235) | (0.267) |
| Non-traded sector | | **0.340***** | **0.340***** | **0.335***** | 0.739 |
| | | (0.050) | (0.050) | (0.050) | (0.613) |
| Construction sector | | 0.440*** | 0.439*** | 0.436*** | 0.561 |
| | | (0.082) | (0.082) | (0.082) | (0.934) |
| Resource sector | | 0.234** | 0.234** | 0.231** | -0.698 |
| | | (0.084) | (0.084) | (0.084) | (1.169) |
| Non-traded sector | x 0-15km | - | - | - | 0.185 |
| | | | | | (0.225) |
| Non-traded sector | x 16-50km | - | - | - | 0.211 |
| | | | | | (0.164) |
| Non-traded sector | x 51-1,000km | - | - | - | -0.446 |
| | | | | | (0.612) |
| Construction sector | x 0-15km | - | - | - | -0.031 |
| | | | | | (0.374) |

| | | | | | |
|---|---|---|---|---|---|
| Construction sector | x 16-50km | - | - | - | 0.426 |
| | | | | | (0.286) |
| Construction sector | x 51-1,000km | - | - | - | -0.116 |
| | | | | | (0.936) |
| Resource sector | x 0-15km | - | - | - | 0.063 |
| | | | | | (0.352) |
| Resource sector | x 16-50km | - | - | - | 0.367 |
| | | | | | (0.296) |
| Resource sector | x 51-1,000km | - | - | - | 0.891 |
| | | | | | (1.168) |
| $\hat{\theta}_1$ | | 0.114 | 0.113 | 0.159 | 0.122 |
| | | (0.300) | (0.300) | (0.364) | (0.424) |
| $\hat{\theta}_2$ | | 1.076 | 1.075 | 1.122 | 1.087 |
| | | (0.300) | (0.300) | (0.364) | (0.424) |
| $\hat{\theta}_3$ | | 2.126 | 2.126 | 2.173 | 2.139 |
| | | (0.302) | (0.301) | (0.365) | (0.424) |
| **Observations** | | 3,052 | 3,052 | 3,052 | 3,052 |
| **Pseudo R-squared** | | 0.217 | 0.217 | 0.216 | 0.217 |
| **Log Likelihood** | | -3312 | -3311 | -3314 | -3311 |
| **Active mines: ‘yes’** | | Dummy | Dummy | Dummy | Dummy |
| **Country-Sector FE** | | Yes | Yes | Yes | Yes |
| **Industry Sector** | | Yes | Yes | Yes | Yes |
| **Other Firm controls** | | Yes | Yes | Yes | Yes |
| **Controls for inactive resources** | | Yes | Yes | Yes | Yes |
| **Controls for Obstacles** | | No | Yes | Yes | Yes |

Note: Robust standard errors are shown in parentheses. ***, ** correspond to the 1% and 5% level of significance, respectively.

**Table A 2: Effect of active mine industries on nearby firms' sectors**

| | | (1) | (2) | (3) | (4) |
|---|---|---|---|---|---|
| | **Interaction** | **Baseline** | **Full** | **Full with Interaction** | **Full with sector Interaction** |
| **Active resources 0-15 km** | | -0.185 | -0.183 | -0.288 | 0.279 |
| | | (0.300) | (0.299) | (0.319) | (0.268) |
| **Active resources 16-50 km** | | -0.185 | -0.182 | -0.186 | -0.098 |
| | | (0.104) | (0.104) | (0.104) | (0.145) |
| **Active resources 51-1,000 km** | | 0.002 | 0.011 | 0.018 | 0.068 |
| | | (0.140) | (0.140) | (0.142) | (0.146) |
| PCI | | - | 0.016 | -0.013 | -0.015 |
| | | | (0.012) | (0.026) | (0.257) |
| Active resources 0-15 km | x PCI | - | - | -0.327 | -0.278 |
| | | | | (0.231) | (0.235) |
| Active resources 16-50 km | x PCI | - | - | 0.011 | 0.002 |
| | | | | (0.061) | (0.062) |
| Active resources 51-1,000 km | x PCI | - | - | 0.038 | 0.040 |
| | | | | (0.029) | (0.029) |
| Non-traded sector | | **0.363***** | **0.362***** | **0.362***** | **0.447***** |
| | | (0.039) | (0.040) | (0.040) | (0.069) |
| Construction sector | | 0.469*** | 0.469*** | 0.467*** | 0.465*** |
| | | (0.061) | (0.061) | (0.062) | (0.062) |
| Resource sector | | 0.220*** | 0.220*** | 0.216*** | 0.218** |
| | | (0.068) | (0.068) | (0.068) | (0.068) |
| Non-traded sector | x 0-15km | - | - | - | -0.799 |
| | | | | | (0.662) |
| Non-traded sector | x 16-50km | - | - | - | -0.177 |
| | | | | | (0.198) |
| Non-traded sector | x 51-1,000km | - | - | - | -0.104 |
| | | | | | (0.076) |
| $\hat{\theta}_1$ | | -0.157 | -0.131 | -0.087 | -0.029 |
| | | (0.356) | (0.356) | (0.364) | (0.366) |
| $\hat{\theta}_2$ | | 0.827 | 0.853 | 0.897 | 0.956 |
| | | (0.356) | (0.356) | (0.364) | (0.366) |

| | | | | |
|---|---|---|---|---|
| $\hat{\theta}_3$ | 1.869 | 1.896 | 1.940 | 2.000 |
| | (0.356) | (0.357) | (0.365) | (0.367) |
| | | | | |
| **Pseudo R-squared** | 0.229 | 0.229 | 0.229 | 0.230 |
| **Log Likelihood** | -5237 | -5236 | -5234 | -5230 |
| **Active mines: 'yes'** | Dummy | Dummy | Dummy | Dummy |
| **Country-Sector FE** | Yes | Yes | Yes | Yes |
| **Industry Sector** | Yes | Yes | Yes | Yes |
| **Other Firm controls** | Yes | Yes | Yes | Yes |
| **Controls for inactive mines** | Yes | Yes | Yes | Yes |
| **Controls for Obstacles** | No | Yes | Yes | Yes |

Note: Robust standard errors are shown in parentheses. ***, ** correspond to the 1% and 5% level of significance, respectively.

**Table A 3: Effect of oil/ gas production industry on the firms' turnover**

| | (1) | (2) |
|---|---|---|
| | **Baseline** | **Full** |
| **Active resources 0-20 km** | **0.492*** ** | **0.543*** ** |
| | (0.116) | (0.105) |
| **Active resources 21-50 km** | 0.101 | 0.051 |
| | (0.103) | (0.069) |
| **Active resources 51-1,000 km** | 0.450 | 0.249 |
| | (0.256) | (0.242) |
| $\hat{\theta}_1$ | -0.240 | -0.832 |
| | (0.301) | (0.155) |
| $\hat{\theta}_2$ | 0.723 | 0.130 |
| | (0.301) | (0.155) |
| $\hat{\theta}_3$ | 1.773 | 1.180 |
| | (0.302) | (0.156) |
| **Observations** | 3,052 | 3,052 |
| **Pseudo R-squared** | 0.216 | 0.216 |
| **Log Likelihood** | -3316 | -3316 |
| **Active mines: 'yes'** | Dummy | Dummy |
| **Country-Sector FE** | Yes | Yes |
| **Industry Sector** | Yes | Yes |
| **Other Firm controls** | Yes | Yes |
| **Controls for inactive mines** | Yes | Yes |
| **Controls for Obstacles** | No | Yes |

Note: Robust standard errors are shown in parentheses. ***, ** correspond to the 1% and 5% level of significance, respectively.

**Table A 4: Effect of mine production industry on the firms' turnover**

| | (1) | (2) |
|---|---|---|
| | **Baseline** | **Full** |
| **Active resources 0-20 km** | -0.118 | -0.110 |
| | (0.172) | (0.172) |
| **Active resources 21-75 km** | -0.069 | -0.068 |
| | (0.075) | (0.075) |
| **Active resources 76-1,000 km** | 0.044 | 0.052 |
| | (0.132) | (0.132) |
| $\hat{\theta}_1$ | -0.438 | -0.410 |
| | (0.340) | (0.340) |
| $\hat{\theta}_2$ | 0.547 | 0.574 |
| | (0.339) | (0.340) |
| $\hat{\theta}_3$ | 1.589 | 1.617 |
| | (0.340) | (0.340) |
| **Observations** | 4,898 | 4,898 |
| **Pseudo R-squared** | 0.229 | 0.229 |
| **Log Likelihood** | -5238 | -5237 |
| **Active mines: 'yes'** | Dummy | Dummy |
| **Country-Sector FE** | Yes | Yes |
| **Industry Sector** | Yes | Yes |
| **Other Firm controls** | Yes | Yes |
| **Controls for inactive mines** | Yes | Yes |
| **Controls for Obstacles** | No | Yes |

Note: Robust standard errors are shown in parentheses. ***, ** correspond to the 1% and 5% level of significance, respectively.