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Mining Matters: Natural Resource Extraction and Local Business Constraints

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Abstract

We estimate the impact of local mining activity on the business constraints experienced by 22,150 firms across eight resource-rich countries. We find that the presence of active mines deteriorates the business environment in the immediate vicinity (<20 km) of a firm but relaxes business constraints of more distant firms. The negative local impact of mining is concentrated among firms in tradable sectors whose access to inputs and infrastructure becomes more constrained. This deterioration of the local business environment adversely affects firm growth and is in line with a natural resource curse at the sub-national level.

JEL codes: L16; L25; L72; O12; O13; Q30

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1. Introduction

The last two decades have witnessed an extraordinary expansion in global mining activity. A surge in commodity demand from industrializing countries pushed up the price of metals, minerals and oil. This in turn led to substantial new mining investment, an increasing share of which was concentrated in emerging markets (Humphreys, 2010). As a result, the world's largest mines can nowadays be found in Africa, Asia and Latin America. This geographical shift reflects that many American and European mineral deposits have by now been depleted and that the long-distance transport of minerals by sea has become less costly (ICMM, 2012).

The mining boom has also reinvigorated the debate about the impact of mining on economic activity and welfare. Some regard mines simply as stand-alone enclaves without any notable local impacts (Hirschman, 1958). Others point to the potentially negative consequences of natural resource dependence: the appreciation of the real exchange rate and deindustrialization; higher economic volatility; and more corruption (see van der Ploeg (2011) for a survey). At the local level, mines may also pollute and threaten the livelihoods of food producers. Mines also require vast amounts of water, electricity, labor and infrastructure for which they may compete with local manufacturers. Yet others stress the potential for *positive* spillovers to firms and households as mining operators may buy local inputs and hire local employees.[1] Local wealth may also increase if governments use taxable mining profits to invest in regional infrastructure or make transfers to the local population.

This paper informs the debate on the economic consequences of mining by estimating the impact of active mines on nearby firms across eight countries with large manufacturing and mining sectors: Brazil, Chile, China, Kazakhstan, Mexico, Mongolia, Russia and Ukraine. Our detailed cross-country data allow us to get around the endogeneity issues that plague country-level studies as well as the limitations to external validity of well-identified country-specific studies. Our empirical analysis is motivated by the 'Dutch disease' model of Corden and Neary (1982) which sets out how a resource boom drives up wage costs for firms in the traded (manufacturing) sector as they compete for labor with firms in the resource and non-traded sectors. We hypothesize that mining companies and manufacturing firms also compete for other inelastically supplied inputs and public goods—such as transport infrastructure and electricity—and that this especially hurts tradable-sector firms which are price takers on world markets.

[1] Wright and Czelusta (2007), for instance, argue that "linkages and complementarities to the resource sector were vital in the broader story of American economic success".

We test this hypothesis by combining two main datasets. First, we use detailed data on 22,150 firms from the EBRD-World Bank Business Environment and Enterprise Performance Survey and the World Bank Enterprise Survey. These survey data contain the responses of firm managers to questions on the severity of various obstacles to the operation and growth of their business, including access to transport infrastructure and electricity, the availability of educated workers, the cost of land, access to finance, and crime and corruption. A small but burgeoning literature uses survey data like these to gauge whether and how institutional quality as well as access to public goods and finance may affect firm performance.[2]

Second, we use the proprietary SNL Metals & Mining dataset which contains comprehensive information on the geographical location, operating status and production data for individual mines. We identify the latitude and longitude of 3,793 mines producing 31 different metals and minerals in our country sample. Depending on the year, we observe the operating status of between 1,526 and 2,107 mines.

Merging these firm and mine data allows us to paint a precise and time-varying picture of the mines that open, operate and close around each firm. Since local mining activity is plausibly exogenous to the performance of individual firms—as it largely depends on local geology and world mineral prices—we can identify the impact of mining on local business constraints and firm performance. To the best of our knowledge, ours is the first paper to estimate this impact of mining activity on firm performance across a variety of countries.

Two core results emerge from our analysis, both consistent with a sub-national version of the seminal Corden and Neary (1982) model. First, in line with a 'resource-movement effect', we uncover heterogeneous mining impacts in the immediate vicinity (≤ 20 kilometers) of active mines that depend on whether a firm produces tradable or non-tradable goods. Only producers of tradables that are close to active mines report tighter business constraints (as compared to similar firms that are not close to mines). These firms are especially hampered in their ability to access transport infrastructure, educated workers and finance. Importantly, these mining-induced business constraints hurt firm performance in terms of employment, asset size and sales. Our results indicate that moving a producer of tradables from a region without mines to a region with average mining intensity would reduce sales by 10 percent on average. In sharp contrast, up- or downstream firms in the natural resource sector itself and firms in the construction and non-traded sector actually *benefit* from local mining activity.

[2] See, for instance, Commander and Svejnar (2011) and Gorodnichenko and Schnitzer (2013). Appendix B contains the questions we use in this paper and http://www.enterprisesurveys.org/ provides additional background information. The surveys also provide a rich array of firm covariates, such as their industry, age, sales, employment, and ownership structure.

Second, in line with a sub-national 'spending effect' we find that current mining activity improves the provision of public goods in a distance band of between 20 and 150 kilometers around firms. This indicates that while mines can cause infrastructure bottlenecks in their immediate vicinity and crowd out other firms, they may improve the business environment on a wider geographical scale.

In robustness tests we vary the distance bands around firms; exclude young firms which may self-select into locations close to mines; exclude firms that have plants in multiple locations; examine coal mines separately; control for giant oil and gas fields; analyze panel data for a sub-set of firms; and measure mining activity using satellite imagery of night-time light intensity. None of this affects our main results.

This paper contributes to a growing literature on the economic impact of natural resource abundance. Early contributions point to a negative cross-country correlation between resource exports and long-term economic growth (Sachs and Warner, 1997 and Auty, 2001). Various mechanisms have been proposed for why resource-rich countries appear unable to convert their natural resources into productive assets. These include an appreciation of the real exchange rate which turns non-resource exports uncompetitive (the aforementioned Dutch disease); worsening institutions and governance (Besley and Persson, 2010; Dell, 2010); rent seeking (Mehlum et al., 2006; Beck and Laeven, 2006) and increased conflict (Collier and Hoeffler, 2004; Miguel, Satyanath and Sergenti, 2004). The cross-country evidence remains mixed—partly reflecting thorny endogeneity issues—and the very existence of a resource curse continues to be heavily debated (van der Ploeg and Poelhekke, 2010; James, 2015).

To strengthen identification, more recent papers exploit micro data to estimate the impact of natural resource discoveries on local living standards.[3] Aragón and Rud (2013) show how the Yanacocha gold mine in Peru improved household incomes and consumption within a radius of 100 kilometers. Their findings indicate that mining can have positive local equilibrium effects if backward linkages are strong enough.[4] Loayza, Mier y Teran and Rigolini (2013) and Lippert (2014) also document average positive impacts on local living standards for Peru and Zambia, respectively. For the case of Ghana, Fafchamps, Koelle and Shilpi (2015) document that gold mining has led to agglomeration effects that stimulate non-

[3] See Cust and Poelhekke (2015) for a survey. Others estimate impacts on health and behavioral outcomes such as female empowerment and infant morbidity (Tolonen, 2015) and risky sexual behavior (Wilson, 2012). Sub-national data have also been used to reassess claims that are based on cross-country data, such as that natural resources cause armed conflict and violence (Dube and Vargas, 2013; Arezki et al., 2015; Berman et al., 2015).

[4] Backward linkages exist if mines purchase local inputs such as food, transportation services and raw materials. Forward linkages include the downstream processing of mineral ores such as smelting and refining.

farm activities.[5] Consistent with these country studies, Von der Goltz and Barnwall (2014) show for a sample of developing countries that while mining activity boosts local (≤5 km) asset wealth, it often comes at the cost of negative health effects due to pollution. We contribute to this nascent literature in two ways. First, we shift the focus from households to firms in order to gain insights into the mechanisms through which mining affects local economic activity (and ultimately household incomes).[6] We not only observe firm-level outcomes (such as sales and employment) but also the mechanisms through which mining activity hampers some sectors but benefits others. Second, we exploit data for eight countries with large mining and manufacturing sectors. Using harmonized micro data from a diverse set of countries adds to the internal as well as external validity of our results.

Our paper also relates to a small parallel literature on local oil and gas booms in the U.S. Michaels (2011) and Allcott and Keniston (2014) show that historical hydrocarbon booms benefited county-level economic growth through positive agglomeration effects, backward and forward linkages, and lower transport costs.[7] In contrast, Jacobson and Parker (2014) find that the U.S. oil and gas boom of the 1970s led to negative long-term income effects. They suggest that contrary to booms in the more distant past (as studied by Michaels, 2011) the persistent negative effects of the 1970s boom offset any long-term positive agglomeration effects. We assess whether our results are sensitive to the presence of oil and gas production by extending our regressions with the number of oil and gas fields (if any) around each firm.

We also contribute to the literature on the relationship between the business environment and firm performance. This literature has moved from using country-level proxies for the business environment (Kaufmann, 2002) to firm-level, survey-based indicators of business constraints. While various papers find negative correlations between such perception-based regressors and firm performance, endogeneity concerns linger.[8] Commander and Svejnar (2011) link firm performance in 26 transition countries to firms' own assessment of various aspects of the business environment. They conclude that once country fixed effects are included, firms' perceptions of business constraints add little explanatory power. Our

[5] Aragón and Rud (2015) show the flipside of Ghanaian gold mining: increased pollution, lower agricultural productivity and more child malnutrition and respiratory diseases.

[6] Glaeser, Kerr and Kerr (2015) show how proximity to mining deposits led U.S. cities to specialize in scalable activities, such as steel production, at the cost of fewer start-ups. This negative impact on local entrepreneurship can become entrenched if entrepreneurial skills and attitudes are transmitted across generations (Chinitz, 1961).

[7] Caselli and Michaels (2013) show that revenue windfalls from Brazilian offshore oil wells (where backward and forward linkages are less likely) led to more municipal spending but not to improved living standards.

[8] E.g. Johnson, McMillan and Woodruff (2002); Beck, Demirgüc-Kunt and Maksimovich (2005); Dollar, Hallward-Driemeier and Mengistae (2006) and Hallward-Driemeier, Wallstein and Xu (2006). Some papers use industry or city averages of business constraints as regressors or instruments to reduce endogeneity concerns.

contribution is to use exogenous shocks that stem from the opening of large-scale mines to help mitigate the endogeneity concerns that continue to plague this literature.

Lastly, a related literature investigates the negative externalities (congestion) and positive externalities (agglomeration) of geographically concentrated economic activity.[9] Congestion occurs when firms compete for a limited supply of infrastructure or other public goods.[10] Agglomeration effects emerge when spatially proximate firms benefit from deeper local labor markets, the better availability of services and intermediate goods, and knowledge spillovers (Marshall, 1920 and Krugman, 1991). In line with agglomeration benefits, Greenstone, Hornbeck and Moretti (2010) show that U.S. firms close to new large plants experience positive productivity spillovers. We assess whether for nearby firms either positive agglomeration or negative congestion effects of newly opened mines dominate.

The paper is organized as follows. Section 2 develops a simple theoretical model and derives our main testable hypotheses. Sections 3 and 4 then describe our data and empirical strategy after which Section 5 presents our results. Section 6 concludes.

2. Theory and hypotheses

To build intuition on how a mining boom affects both local and more distant firms, we adapt a multiregional de-industrialization model (Allcott and Keniston, 2014). This theoretical framework is closely related to earlier Dutch disease models (Corden and Neary, 1982; Van Wijnbergen, 1984). The distinctive feature of our simple model is that there are multiple regions across which labor is assumed to be (imperfectly) mobile and that redistribution of natural resource rents may take place between regions.

We model each region as a small open economy where each consumer supplies one unit of labor. Consumers are employed in one of three sectors: the manufacturing sector m which produces goods that are tradable internationally and across regions; services n which are non-tradable across regions; and the tradable natural-resource sector r. The prices of both manufacturing goods p_m and minerals p_r are set on world markets and are therefore

[9] For a survey of the agglomeration literature, see Combes and Gobillon (2015).

[10] A recent literature investigates the spatial impact of infrastructure construction on economic activity. Donaldson (2014) shows how new railways in colonial India integrated regions and allowed welfare gains from trade to materialize. In a similar vein, Bonfatti and Poelhekke (2014) show how purpose-built mining infrastructure across Africa determined long-term trading patterns between countries. In China, the construction of trunk roads and railways reinforced the concentration of economic activity and increased economic output (Faber 2014 and Banerjee, Duflo and Qian, 2012). In the United States, Chandra and Thompson (2000) and Michaels (2008) exploit the construction of interstates to document agglomeration effects.

exogenous. Only the price of non-traded services p_{ni} is endogenous and varies by region. Each sector s produces $X_{si} = A_{si} F_s(l_{si}, h_{si})$ where A_{si} is productivity. A_{si} has a local component due to a sector's reliance on region-specific inputs such as agglomeration economies or natural resource deposits. F_s is a production function common to sector s with $F_s(0) = 0$, $F_s'(\cdot) > 0$ and $F_s''(\cdot) < 0$, and l_{si} is labor employed by sector s in region i.

Employment is perfectly substitutable across sectors and is mobile between regions such that total labor supply L_i is an increasing function of both wages and transfers received by workers: $L_i = L(w_i + b_i)$. With full employment we have:

$$l_{mi} + l_{ri} + l_{ni} = L(w_i + b_i) \tag{1}$$

Per capita transfers b are an increasing function of national resource rents $R = \sum_i (p_r X_{ri} - w_i l_{ri})$ but ultimately depend on the country's welfare function and the exogenous weights attached to individuals in the extracting region. For example, if local consumers own the mining land (which resembles the institutional setting in the United States) then transfers in the form of royalty payments can be substantial. Conversely, if the state owns the mining rights (as is the case in most other countries) then fewer mining rents are redistributed to the producing region and rents are instead spread across regions.

Labor input *l* can also be interpreted as being used in combination with public good inputs, such as infrastructure, which are used in fixed proportion to labor. We assume that such public goods are not mobile across regions, exogenously provided by a higher layer of government, and increasing in national natural resource rents *R*. A higher demand for *l* then translates into a higher demand for public goods as well. Crucially, the supply of such goods does not endogenously adjust to higher shadow prices for their use. For example, increased congestion on rail and roads will drive up delays and transportation costs, but it is up to the (national) government to invest more in these public goods.

We assume that all minerals are directly or indirectly exported.[11] Aggregate income in region i then equals consumption of manufacturing goods and services from which consumers with Cobb-Douglas preferences derive utility U :

$$(w_i + b_i) L_i = p_m C_{mi} + p_{ni} C_{ni} \tag{2}$$

[11]Downstream sectors may use minerals as inputs and subsequently export all downstream products.

where C_{mi} includes imports from other regions and countries. Demand is given by:

$$p_{ni}C_{ni} = L_i\alpha\left(w_i + b_i\right) \tag{3}$$

$$p_m C_{mi} = L_i\left(1-\alpha\right)\left(w_i + b_i\right) \tag{4}$$

The term b_i is the spending effect in the terminology of Corden and Neary (1982). If these transfers are zero, then an increase in the profitability of the natural resource sector will raise wages and non-traded prices proportionally. Note that transfers may be such that a natural resource boom in region i can introduce a spending effect in region $\backslash i$, for example in the state or province to which the region belongs.

The services and traded manufacturing goods market equilibria follow as:

$$C_{ni} = X_{ni} = A_{ni}F_n\left(l_{ni}\right) \tag{5}$$

$$C_{mi} = X_{mi} + IM_{mi} = A_{mi}F_m\left(l_{mi}\right) + IM_{mi} \tag{6}$$

where IM_m are net imports of manufactured goods. Finally, perfect sectoral labor mobility equalizes wages across sectors to their marginal product:

$$w_i = p_m A_{mi}F_m'\left(l_{mi}\right) = p_r A_{ri}F_r'\left(l_{ri}\right) = p_{ni}A_{ni}F_n'\left(l_{ni}\right) \tag{7}$$

We model a local resource boom as an exogenous shock to the natural resource sector in region i such that this sector becomes more productive. This can either be achieved through a rise in p_r, the world price of minerals, or through a rise in A_{ri}, which can be thought of as an improvement in extraction technology or the discovery of new deposits in region i.[12] In both cases local profits increase, which also increases transfers b_i.

The impact of the local resource boom $p_r A_{ri}$ will be fourfold. First, the demand for labor and public goods in the mineral sector rises and wages increase (see equation 7). However, to the extent that labor supply L_i is not perfectly inelastic, immigration from other regions will

[12] New discoveries are assumed to be exogenous as exploration is spatially homogeneous within country-years in the sense that it is uncorrelated with pre-existing economic activity and other local characteristics.

dampen this increase in wages.[13] For perfectly elastic supply, the increase in labor demand in the mineral sector is completely met by supply from other regions.[14] Moreover, to the extent that supply chains are local, firms with strong upstream or downstream linkages to mines may benefit from an increased demand for intermediate inputs (Moretti, 2010).

Second, the boom in $p_r A_{ri}$ raises services prices p_{ni} and induces a real appreciation in region i. The production of non-traded services increases too. Higher wages (if labor demand is not fully met through immigration) are passed on to higher non-traded prices through a rise in local aggregate demand. Moreover, a rise in $p_r A_{ri}$ raises mineral rents and thereby regional transfers b_i. This also raises local aggregate demand and further drives up prices p_{ni} and services production X_{ni}.[15]

Third, if wages increase, profitability in the manufacturing sector declines because the traded sector is a price taker on world markets. From the marginal product of labor in the manufacturing sector it follows that l_{ri} and X_{ri} decrease, which is the resource movement effect in the terminology of Corden and Neary (1982). Manufacturing will consequently contract as firms compete with establishments in non-resource regions that did not suffer the same increase in input costs (Moretti, 2011).

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[13] Since labor and public goods are used in fixed proportions immigration will not dampen the wage increase unless more public goods are supplied as well. These may be financed by the natural-resource rents.

[14] An increase in $p_r A_r$ raises the marginal product of labor in the resource sector and thus wages in (7). It also decreases employment in the other two sectors (rewrite (7) for sector *m* (an equivalent for *n*) as $n_{mi} = F_m'^{-1}\left(\frac{p_r A_{ri}}{p_m A_{mi}} F_r'(l_{ri})\right)$). Labor reallocates from sectors *m* and *n* to sector *r*. However, through combining equation 1 and 7, the upward pressure on wages and subsequent reallocation is muted to the extent that total labor supply is elastic. Wages increase as long as total regional labor supply is not fully elastic.

[15] We assume that an exogenous fraction ω of national rents are spent in the producing region. Total local income from rents is equal to $\omega_i \sum_i p_r A_{ri} \left(F_r(\cdot) - F_r'(\cdot) l_{ri}\right)$, such that local rents are increasing in $p_r A_{ri}$. This relaxes the consumer budget constraint 3 and increases demand for non-traded goods, raising prices p_{ni}. Combining equations 3, 5 and 7 yields $p_{ni} A_{ni} F_n(l_{ni}) = L_i \alpha (w_i + b_i) = w_i \frac{F_n(l_{ni})}{F_n'(l_{ni})}$, and provides an expression for non-traded services production as a function of population and natural resource production: $L_i \alpha + \omega_i \alpha \sum_i \left(\frac{F_r(l_{ri})}{F_r'(l_{ri})} - l_{ri}\right) = \frac{F_n(l_{ni})}{F_n'(l_{ni})}$. Taking the derivative to $p_r A_{ri}$ and using the fact that F is concave, $\partial L_i / \partial p_r A_{ri} \geq 0$, and $\partial l_{ri} / \partial p_r A_{ri} \geq 0$ yields that an increase in $p_r A_{ri}$ raises both non-traded labor input and production. This results from an increase in wages and thus population L_i and through increased demand due to the transfer of rents. Finally, non-traded prices increase.

Fourth, to the extent that labor is mobile between regions and rents are redistributed across regions, we should expect spillover effects. The immigration of labor into the boom region results in excess labor demand in origin regions and possibly a shrinking of services and manufacturing sectors in these regions. Unless labor is highly mobile, we expect this effect to attenuate with distance.

The increase in aggregate demand in the producing region spills over into higher demand for manufactured goods which have to be supplied through imports from other regions or countries. In the former case, the demand for manufacturing goods in non-booming regions will increase. This effect is particularly strong if no redistribution of rents takes place and local income increases by the full amount of rents. In our sample of countries, it is more likely that the increase in national mineral rents spreads to non-booming regions through transfers. These transfers thus introduce a spending effect in non-booming regions as well. From the perspective of the traded sector, the positive trade and spending effects are likely to be attenuated less by distance than the wage effect (which reflects regional competition for relatively immobile labor).

In all, this theoretical discussion suggests two main testable hypotheses with regard to the impact of mining on the business constraints faced by nearby firms:

1. In line with a sub-national resource movement effect in the immediate vicinity of mines, firms in tradable sectors experience tighter business constraints (in terms of access to labor and public goods such as infrastructure and institutions) than firms in non-tradable sectors or the natural resource sector because the former cannot pass on the higher costs of these inputs to consumers.
2. Through a sub-national spending effect, mining activity may expand the provision of public goods and improve the business environment. In the presence of negative resource movement effects in the vicinity of mines, positive spending effects may only lead to *net* positive impacts at a greater distance from the mine. In contrast to the resource-movement effect, positive spending effects are expected to benefit firms across all sectors in non-extracting regions.

3. Data

For our purposes we need data on the business constraints experienced by individual firms as well as detailed information on the presence of mines in the vicinity of each of these firms. We therefore merge our firm-level survey data from eight emerging markets—Brazil, Chile, China, Kazakhstan, Mexico, Mongolia, Russia and Ukraine—with the geographical coordinates of the near universe of minerals (including coal) and metal mines in these countries. All of these countries are geographically large, have a substantial mining sector and participated in one or more business-environment surveys.[16]

3.1. Mining data

We download mining data from the leading provider of mining industry information, SNL's Metal & Mining (formerly Raw Materials Group). The dataset contains for each mine annual information on the production levels for each mineral as well as the GPS coordinates for its center point. We also know the operation status at each point in time. This allows us to distinguish between active (operating) and inactive mines. The status of a mine is typically driven by exogenous world prices: when prices rise, more mines (re-)open. We assemble this information for the 3,794 mines scattered across the eight countries.

For a subset of active mines we also know their mineral ore production and reserves.[17] Production is measured in millions of tons (metric megaton, Mt) of minerals mined per annum while reserves refer to the Mt of probable and proven ore still in the ground.[18] While a measure of ore produced (which includes both rocks and minerals) is a better gauge of how many inputs the mine requires, we also experiment with the weight in mineral content being produced.

We exclude data on the production of oil and gas as hydrocarbon production typically has a different structure in terms of the environmental, social and economic changes in a region (World Bank, 2002). For instance, oil and gas tend to occur in larger concentrations of wealth than metals and other minerals and this might lead to larger spending effects. Hydrocarbon production is also more capital intensive and may therefore affect labor demand to a lesser extent. We return to the issue of hydrocarbon production in Section 5.5.

[16] The value of natural resource extraction at world prices as a share of GDP in 2008—not taking into account production costs—was 15 percent in China; 12 percent in Mexico; 40 percent in Russia; 17 percent in Ukraine; 56 percent in Kazakhstan; 8 percent in Brazil; 35 percent in Mongolia, and 25 percent in Chile (source: World Bank, Adjusted Net Savings Data).

[17] Each mine typically produces several minerals. Appendix Table A3 provides a frequency table of the minerals in our dataset. All minerals and metals are point-source resources: unlike diffuse natural resources such as coffee and tobacco, they are produced in geographically concentrated locations.

[18] SNL's Metal & Mining defines ore reserves as the sum of probable and proven reserves, where "an ore reserve is defined as the economically mineable part of a measured or indicated mineral resource. It includes diluting materials and allowances for losses, which may occur when the material is mined. Appropriate assessments, which may include feasibility studies, have been carried out, and include consideration of and modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate that, at the time of reporting, extraction could reasonably be justified".

3.2. Firm data

To measure firms' business constraints we use various waves of the EBRD-World Bank Business Environment and Performance Survey (BEEPS) and the equivalent World Bank Enterprise Surveys. Face-to-face interviews were held with the owners or top managers of 22,150 firms across 2,144 locations in our sample of countries with the aim of understanding to what extent particular aspects of the business environment hold back firm performance. The surveys are administered on the basis of a common design and implementation guidelines and we use questions that were identical across countries. We have data for the fiscal years 2005, 2007, 2009 and 2011.

Firms were selected using random sampling with three stratification levels to ensure representativeness across industry, firm size and region. Due to stratification, the sample includes firms from all main industries, allowing us to use industry fixed effects in our regression framework. Importantly, and unlike many other firm surveys, our data contain firms in both the manufacturing and the services sectors. While mines themselves were not part of the surveys, upstream and downstream firms in the natural resource sector were included. The first four columns of Appendix Table A4 summarizes the number of observations by year and country (all regressions include year and country fixed effects). For each firm we know the name and geographical coordinates of its location (city or town). We exclude firms in capital cities.

As part of the survey, owners or top managers evaluated aspects of the local business environment and public infrastructure in terms of how much they constrain their firm's operations. For instance, one question asks: *"Is electricity "No obstacle", a "Minor obstacle", a "Moderate obstacle", a "Major obstacle" or a "Very severe obstacle" to the current operations of your establishment?*". Similar information was elicited on the following business constraints: inadequately educated workforce; access to finance; transportation infrastructure; practices of competitors in the informal sector; access to land; crime, theft and disorder; business licenses and permits; political instability; corruption; and courts. Because the scaling of the answer categories differs across survey waves (either a five-point Likert scales, as in the example above, or a four-point scale) we rescale all measures to a 0-100 scale using the conversion formula (value – minimum value)/(maximum value – minimum value).

For each firm we construct the variable *Average business constraints* which measures the average of the abovementioned twelve constraint categories. Like the underlying components, this average measure ranges from zero to 100. Appendix A contains a histogram of the distribution of this variable. In addition to this catch-all measure, we create three measures for

Input constraints (access to land, access to an educated workforce and access to finance); local *Infrastructure constraints* (electricity and transport); and *Institutional constraints* (crime, informal competitors, access to business licenses, corruption, political instability and court quality). These three measures again range from zero to 100. The average complaint rate of a firm is 30.2 but there is wide variation with a standard deviation of 27.3. The most binding constraints are those related to access to inputs (34.7), followed by infrastructure constraints (29.5) and institutional constraints (23.4).

We also create firm-level variables that we use as covariates in our regression framework. These include dummy variables to identify *Small firms*, *Medium-sized firms* and *Large firms*; the firm *Age* in number of years; a dummy for *International exporters* (firms whose main market is abroad), for *Foreign firms* (foreigners own 10 percent or more of all equity) and a dummy for *State firms* where state entities own at least ten per cent of the firm's equity. We create the following industry dummies: *Manufacturing*, *Construction*, *Retail and wholesale*; *Real estate, renting and business services;* and *Others*.[19]

Lastly, the enterprise surveys not only measure the business constraints that firms experience on a day-to-day basis but also their performance. We create log *Employment*, log *Assets* and log annual *Sales* as firm-level performance measures. Table A1 in the Appendix provides an overview of all variable definitions while Table A2 provides summary statistics.

3.3. Combining the mining and firm data

A final and crucial step in our data construction is to merge—at the local level—the information on individual firms with information on the mines that surround each firm (if any). We identify all mines within a radius of 20 kilometers (12.4 miles) and within a distance band of between 21 and 150 km (13.0–93.2 mi) around each firm. We disregard sub-national administrative boundaries. Figure 1 provides an overview of the resulting data structure for two sample countries, Ukraine and Kazakhstan. The top panel shows the location of firms and mines and indicates that geographical coverage is comprehensive. Firms are not concentrated in only a few cities nor are mines concentrated in only a few regions. Zooming in on the squares in the bottom panel also reveals substantial variation in distances between firms and mines: there are firms with and without mines in their immediate vicinity (as represented by the circles with a 20 km radius around firms).

[19] Once we separate firms into traded, non-traded, construction and natural resource related sectors we replace sector dummies with dummies for those categories.

[Insert Figure 1 here]

We are agnostic about the spatial range within which mines affect firm constraints and therefore start by exploring spatial rings used in the literature.[20] We assess distance circles of radius 10, 20, 50, 100, 150, 300 and 450 km. Exploratory regressions (in Appendix Table A9) show positive effects on firms up to 20 km, after which the sign switches to negative effects up to 150 km. After 150 km the effects become very small. We therefore group mines into three distance bands: up to 20 km, 21-150 km and 151-450 km and find that only the first two bands show significant and economically meaningful results.[21] All our results are robust to redefining these two distance bands by reducing or expanding them by ten percent.

Using our merged data, we then create variables that proxy for the extensive and intensive margin of mining activity in each of the two distance bands. At the extensive margin, we create dummy variables that indicate whether a firm has at least one active mine in its direct or its broader vicinity (*Any active mine*). In our sample, 24 percent of all firms have at least one mine within a 20 km radius while 77 percent have at least one mine within a 21–150 km radius. At the intensive margin, we measure the number of mines around firms (*№ active mines*). On average, each firm has 0.6 active mines within a circle with a 20 km radius but there is wide variation: this variable ranges between zero and 19 mines. Within a 21–150 km distance band, the number of mines is on average 7.6 and again ranges widely between zero and 152 mines. We also create similar variables that measure inactive mines and mines with an unknown operating status. We use these as control variables in our analysis. Lastly, we measure total mining production in log metric megatons of annual output for nearby as well as more distant mines.

[20] Kotsadam and Tolonen (2013) and Tolonen (2015) show that the impact of African gold mines on labor markets is strongest within a radius of 15 to 20 km. Cust (2015) finds that labor market impacts are concentrated within a 15 km radius around Indonesian mines. Aragón and Rud (2015) use a 20 km radius to study agricultural productivity near African gold mines while Goltz and Barnwall (2014) take a 5 km cutoff based on prior evidence on the spatial extent of pollution. Aragón and Rud (2013) analyze longer-distance impacts (100 km) of the Peruvian mine they study. Finally, Glaeser et al. (2015) examine distances of up to 500 km between historical coal deposits and large cities in the U.S. Papers that focus on district-level impacts due to fiscal channels typically also use longer distances (Loayza et al. 2013 and Allcott and Keniston, 2014).

[21] The same pattern emerges when including interactions with sectors in Panel B of Table A9. Comparing column (2) with (8) and (9) in both panels of Table A9 also shows that the results of the number of mines within 20 km on (traded) firms do not depend on inclusion of the outer band(s). Although there is some positive spatial correlation between the number of mines across the distance rings, this does not cause severe multicollinearity.

4. Empirical strategy

We consider the following empirical model to estimate the impact of mining on firms' business constraints within a certain distance band:

$$Y_{fsct} = \beta M_{fsc,t-2} + \gamma X_{fsct} + d_{sct} + \varepsilon_{fsct} \tag{8}$$

where Y_{fsct} indicates for firm *f* in sector *s* in country *c* in year *t* either the local *Average business constraints* it experienced on a scale of 0 to 100 or, more specifically, the *Input constraints, Infrastructure constraints* or *Institutional constraints.* $M_{fsc,t-2}$ contains a number of two-year lagged indicators of local mining activity within a 0-20 or 21-150 km spatial band around firm *f*.[22] X_{fsct} is a matrix of firm covariates related to firm age, size and ownership.

We saturate the model with country-year-sector fixed effects—d_{sct}—to wipe out (un)observable variation at this aggregation level and, in particular, to rule out that our results are driven by industry-specific demand shocks and production structures within a country in a particular year. These fixed effects also take care of any (unintended) differences in survey implementation across countries, years and sectors. Robust standard errors are clustered by country-year-sector. We are interested in the OLS estimate of β, which can be interpreted as the impact of local mining intensity on firms' average business constraints.[23]

Our data also allow us to test whether the impact of mining on firm-level constraints differs across sectors. As discussed in Section 2, theory suggests that the impact of local mining may be positive for non-tradable sectors and construction but negative for firms in tradables sectors. We therefore also estimate:

$$Y_{fsct} = \beta M_{fsc,t-2} \times N_s + N_s + \gamma X_{fsct} + d_{sct} + \varepsilon_{fsct} \tag{9}$$

[22] While it may take time for mining activity to impact local firms, impacts and employment generation may already be substantial during the investment phase (Tolonen, 2015). Appendix Table A8 shows that our results are robust to changing the time lag to 0, 1 or 3 years. Only 0.16 percent of firms were exposed to a recent mine opening or closing in their neighbourhood. Because we do not know for each mine how long it has been active or closed (due to incomplete recording of the history after the year 2000) we do not attempt to separate short run from medium or long run effects.

[23] Alternatively, one can estimate (1) with ordered logit to take into account that our constraints measure is the average of rescaled business constraints. However, after rescaling and averaging the resulting business-constraint measure takes 327 different values, which makes logit results less straightforward to interpret. All our results are nevertheless robust to ordered logit estimation or to using a Tobit model with a lower (upper) limit of 0 (100).

where N_s is one of four dummies that identify whether a firm is in the *Tradables* sector, a *Construction* sector, a *Non-traded* sector or the *Natural resources* sector. We discuss this sector classification in more detail in Section 5.2.

Our identification exploits that the local presence of mining deposits is plausibly exogenous and can be treated as random 'geological anomalies' (Eggert, 2001; Black, McKinnish and Sanders, 2005). The only assumption we need is that spatial exploration intensity within country-years is homogeneous in the sense that it is uncorrelated with pre-existing business constraints and other local characteristics and instead only depends on national institutions such as expropriation risk (Bohn and Deacon, 2000). We can then treat the local presence of mines as a quasi-experimental setting that allows us to identify the general equilibrium effects of exogenous geologic endowments on local businesses. To the extent that exploration intensity is driven by institutional quality, openness to FDI or environmental regulation, such effects will be taken care of by our country-year fixed effects.

5. Results

5.1. Baseline results

Table 1 reports our baseline results on the impact of mining on local business constraints. In each regression, the dependent variable is the average of the business constraints as perceived by individual firms. We present different functional forms of our main independent variables: the number of active mines in the 0-20 km and the 21-150 km spatial band around each firm.

In the first four columns we use a simple count variable—the number of active mines—to measure local mining activity. In the fourth column, we impute the operational status (active or inactive) on the basis of data on night-time light emissions in the direct vicinity (1 km radius) of the mine.[24] In column 5, we take the log of the number of mines plus one to allow for concavity in mining impacts.

[24] Source: Earth Observation Group. Night-time light intensity (luminosity) as captured by satellite imagery is increasingly used to measure economic activity at the most disaggregated geographical level (Henderson, Storeygard and Weil, 2011). To impute the missing operating status for mines, we first run a probit regression of mine operating status on the luminosity (on a scale of 0 to 63) within a 1 km radius of the mine interacted with open-pit (versus underground) status of mines, and country-year fixed effects. The coefficient on lights is positive and highly significant for both types of mines with coefficients of 0.015 and 0.008, respectively, and the difference is significant. This suggests that open pit mines emit almost twice as much night-time light. We then use this model to predict missing operating statuses and assume that a mine is operating if the predicted probability is above the median. This affects 119 observations in the 0-20 km band and 2,520 observations in the 21-150 km band.

In line with our discussion in Section 2, we find that mining activity near firms increases business constraints as perceived by these firms themselves. In contrast, mining activity relaxes constraints at a longer distance: between 21 and 150 km we find mostly positive mining impacts. These findings hold regardless of the functional form of our mining variables and regardless of whether we saturate the model with country-year fixed effects (column 1), country-year-sector fixed effects (all other columns) or exclude our standard set of firm covariates (column 3). The unreported covariate coefficients show that larger firms are more and foreign-owned firms less constrained on average. Firm age does not matter much.

These results are in line with negative local resource movement effects and positive regional spending effects. A one standard deviation increase in nearby mining increases the average business constraint by 0.6 percentage points (on a 0-100 scale with an average of 30.2) while more distant mining activity reduces constraints by 3.4 percentage points. The effect of mining on the local business environment hence appears modest for the *average* firm. However, theory predicts that the sign of the impact will depend on the sector of the firm. In Section 5.2 we will therefore split the average effect by sector while in Section 5.3 we estimate the real effects of increased business constraints and find that these are substantial.

In column 6, we measure mining activity by night-time light emitted within a 1 km radius around mines. It is reassuring that this alternative way to calculate the intensity of local mining yields qualitatively very similar impacts.[25] In column 7, the mining count variables are expressed as the log of the number of active minus where zero values are set to missing. We now also add two dummy variables that separate out localities with and without any mining activity. This effectively splits the earlier effect into impacts along the extensive and intensive margin. The economic and statistical significance of our earlier results hardly changes. This shows that even when we control for the fact that locations with mining activity may be different from locations without mining, we find that—conditional on mines being present—more mining activity leads to tighter business constraints nearby and less constraints further away. This also indicates that concavity in the mining impact does not change the baseline impacts. We therefore measure mining activity by the simple count of mines from now on.

Lastly in column 8, we add two variables that measure the joint production of all mines in the vicinity of a firm (in log Mt. ore). The number of mines continues to be a significant determinant of business constraints and the size of the coefficients only decreases slightly as compared with the equivalent regression in column 2. In addition, we find—conditional on

[25] The marginal effect of a one standard deviation increase in mines' night-time light is 0.5 percentage points.

the number of mines—that more productive mines tend to further deteriorate business constraints of nearby firms while improving them for firms further away.[26]

In sum, the results in Table 1 show that mining activity is associated with a deterioration of the business environment in the immediate vicinity of firms but with an improvement at a larger distance. Conditioning on the presence of any mines, we find that this effect is stronger when there are more mines and when these mines are larger in terms of total ore output.

[Insert Table 1 here]

5.2. The impact of mining on tradable versus non-tradable sectors

Our first hypothesis states that local mining activity affects tradable and non-tradable sectors in different ways. In order to test this hypothesis we therefore need to decide whether firms belong to a tradables or a non-tradables sector. This split is not entirely straightforward as many goods can both be consumed locally and traded (inter)nationally. For example, a leather tannery may sell exclusively to a local downstream clothing manufacturer or may (also) sell internationally. To solve this issue we apply two methodologies—based on Ellison and Glaeser (1997) and Mian and Sufi (2014) —to classify sectors. We then show that our results are robust to either classification method.

First, we follow Mian and Sufi (2014) and classify the retail sector and restaurants as non-tradable (*NT*). In addition, we also consider hotels and services of motor vehicles as non-tradable. Construction *C* is classified separately, while non-metallic mineral products plus basic metals are labeled the natural resource sectors *R*. All other sectors are then considered to be tradables (*T*). In a slightly different version of this baseline classification, we further restrict tradables to include only those sectors that export on average at least five percent of output (either directly or indirectly through intermediaries) and in a third version exclude the retail sector from non-tradables. These excluded sectors and firms are in this case combined in a separate *Other* category.

Second, we define tradables and non-tradables according to their geographical concentration, in line with Ellison and Glaeser (1997). The basic idea is that producers of traded goods do not have to locate close to consumers and can therefore agglomerate in

[26] We also experiment with replacing ore production by the value of mineral content produced. While we know world prices of the minerals produced, we do not know production costs and thus cannot assume that an increase in value produced translates directly into a larger spending effect. The log total value of minerals mined is insignificant at both distance rings, while the mine count variables remain unchanged.

clusters, while producers of non-traded goods tend to spread across space to serve consumers from a shorter distance. A measure of agglomeration is then informative of the degree of tradability of a sector. We construct an index that is a measure of excess concentration with respect to a random distribution of sectors across space. Such excess concentration may come from either natural advantages or agglomeration economies. Let *G* be a measure of raw geographic concentration, where s_{ir} is the share of industry *i*'s employment in region *r* and x_r the share of aggregate employment in region *r*:

$$G_i = \sum_r (s_{ir} - x_r)^2$$

Furthermore, let *H* be the Herfindahl-Hirschmann index of industry concentration, where z_{ij} is establishment *j*'s employment share by industry *i*:

$$H_i = \sum_j {z_{ij}}^2$$

G and *H* can now be combined into the following Ellison-Glaeser agglomeration index:

$$\gamma_i = \frac{G_i - (1 - \sum_r {x_r}^2)H_i}{(1 - \sum_r {x_r}^2)(1 - H_i)}$$

As H_i approaches zero (at high levels of aggregation, when the number of plants is large, or for an increasing number of equally sized establishments) γ_i approaches $G_i/(1 - \sum_r {x_r}^2)$ and is a rescaled measure of raw concentration. The index is unbounded on both sides, but $E(\gamma_i)=0$ when no agglomerative spillovers or natural advantages exist. Positive values suggest more concentration than a random distribution would predict, while negative values suggest that establishments locate relatively diffusely.

We calculate γ_i for each country-sector-year to allow for different stages of development of each country over time, which may translate into changing agglomeration patterns. In other words, we allow for the possibility that a sector becomes more tradable over time, for example due to trade liberalization or technological progress. As in Mian and Sufi (2014), we classify sectors as non-traded if they are within the first decile (most dispersed) of the country-sector γ_i distribution.

Appendix Table A5 lists the number of firms by classification method. Firms in construction and natural resources never change sector by definition. At the margin, different methodologies cause firms to switch between tradable and non-tradable status, but the differences in terms of sample size by classification do not change a lot. The average index value of the Ellison-Glaeser index is close to zero (-0.018) for tradable sectors, but much more negative (-1.183) for the non-tradable sectors, indicating more dispersion.

In Table 2 we first use our baseline sector classification based on Mian and Sufi (2014). Using this split, columns 1 to 3 show that only traded firms, which take world or national prices as a given, suffer from nearby mining activity while natural resource and non-traded firms benefit. These opposite impacts are fully consistent with the predictions of the standard Corden and Neary (1982) model as well as our model of Section 2. A one standard deviation increase in the number of active mines within a radius of 20 km leads to a 1.1 percentage points increase in the average business constraints for firms in the tradables sector. Each additional active mine within 20 kilometers of a tradable-sector firm increases business constraints by an additional 0.6 percentage points. In contrast, an increase in local mining activity reduces business constraints by 2.1 percentage points for firms in non-tradable firms and by 0.4 percentage points for natural-resources firms (see column 1 in Table 5).

At a longer distance, *all* firm types turn out to benefit from local mining activity although this effect is imprecisely estimated for firms in the non-traded sectors. A one standard deviation increase in mining activity in the 21-150 kilometer band around firms, leads to a decline in business constraints of 3.8, 4.6 and 5.0 percentage points for firms in the traded, construction and natural resources sectors, respectively.

In column 4, local mining activity is measured as the night-time light emitted within 1 km around mines. The results are very similar to the earlier regressions based on simply counting the number of mines: a one standard deviation increase in mining leads to a 0.8 percentage points increase in business constraints. Appendix Table A11 shows that this result, as well as our previous findings, continue to hold when we control for general local economic activity as measured by night-time light emitted in a 20 kilometer circle around firms.

In column 5, we exclude the 10 percent largest and youngest companies. Excluding younger firms reduces the risk that firms have moved to or from newly established mines thus undermining our assumption that mining activity is exogenous. Excluding the largest firms may disregard firms that are least sensitive to the local business environment. When we exclude these two types of firms, our results continue to hold. Note that the negative effect of local mining on the business constraints of natural resources companies now disappears. This reflects that some of the largest and youngest firms in our dataset are mining-related companies as well as newly established upstream and downstream companies. Removing these firms makes it difficult to precisely estimate the impact of the mining activity on the business environment as perceived by these firms. In column 6, we exclude firms that operate as multi-plant establishments and that have their headquarters in another region than were the interview took place. Our findings continue to hold here as well. Lastly, in column 7 we replace our country-year-sector fixed effects with region-year-sector fixed effects. We now compare firms with and without local mines *in the same year, in the same sector and in the same geographical region*. Our main results go through in this very restrictive specification.[27]

Robustness results in Appendix Table A6 indicate that the findings based on the Mian and Sufi (2014) classification are robust to applying other classification methods. In particular, the effect of mines in the direct vicinity of tradable sector firms is reassuringly similar across all specifications. In the rest of our analysis we therefore use our baseline classification.

[Insert Table 2 here]

Next, we unpack the average business constraint variable in order to understand *how* local mining affects firms in different sectors. To get at the underlying mechanisms, we create three sub-indices of business constraints related to inputs (access to land, an adequately educated workforce, and finance), infrastructure (electricity and transport) and institutions (crime, competition from informal sector, ease of obtaining an operating license, corruption, political instability, court quality). Each of these indices is an unweighted average of the underlying constraints and ranges between zero and one hundred.

The results in Table 3 indicate that firms in traded sectors suffer from mines in their immediate vicinity due to increased difficulties in accessing inputs (column 1, in particular qualified employees) and infrastructure (column 2, in particular transport). To a lesser extent they also complain more about institutional constraints such as those related to crime (column 3). Perhaps not surprisingly, both firms in the construction and the natural resources sector suffer significantly less from a constrained access to inputs when they are near mines.

The beneficial effects of mining at a slightly larger distance manifest themselves mainly in the form of fewer problems in accessing inputs, especially land and a suitable workforce. To a lesser extent more distant firms also complain less about competition from the informal sector. The fact that we do not find strong effects with regard to infrastructure provision

[27] As regions we use the highest administrative level in each country: states in Brazil and Mexico (*estado*), regions in Chile (*región*), mainland provinces in China, oblasts in Kazakhstan and Ukraine, provinces in Mongolia and federal subjects in Russia.

(column 2) suggests that governments in our country sample do not use natural resource revenues to invest heavily in regional public infrastructure. Only the natural resource sector itself reports fewer infrastructure constraints, which may point towards purpose-built infrastructure rather than open access transportation links. This contrasts with the findings of Michaels (2011) who shows that public good provision prolonged the positive effects of a local resource boom in the U.S. during the last century.

[Insert Table 3 here]

5.3. Real effects

An important empirical question is whether the impact of mining on local business constraints also translates into measureable effects on firm performance in terms of employment, assets and sales. To analyze this issue, we follow Commander and Svejnar (2011, henceforth CS) who examine the impact of local business constraints on firm performance using BEEPS data for 26 European transition countries. They find that country fixed effects absorb nearly all the variation in business constraints across firms within countries and hence conclude that country-level institutions (and other characteristics) are responsible for holding back firms.

We first replicate their findings based on our sample which includes a larger number of BEEPS/Enterprise Survey waves and a smaller but more diverse set of countries. It is therefore worthwhile to examine if this additional variation leads to different results. Contrary to CS, we use a 2SLS approach where in the first stage we instrument business constraints with local mining activity (and the interaction terms of mining activity with economic sector dummies). In the second stage we then treat average business constraints as the endogenous variable that explains firm performance. The sample size is much reduced when we include assets and sales, because few firms report these numbers and because the 2005 survey wave did not include questions about assets or sales in China, Kazakhstan, Russia and Ukraine.

Table 4 summarizes our results. Column 1 reports our first-stage regression which also includes interaction terms between local mining activity and the four main economic sectors. The specification contains country-year-sector fixed effects as well as our standard firm-level covariates. We exclude firm size as it may be a 'bad control' that is affected by mining activity itself and can thus introduce selection bias.

As before, we find that mining activity in a 21-150 km band around firms reduces average business constraints for all firms whereas mining in the immediate vicinity (<20 km) hurts firms in tradable sectors but benefits those in non-tradables sectors. Local mining activity is overall a strong predictor of average business constraints. This is confirmed by the robust first stage F-test on the excluded instruments, which is consistently and comfortably above the often-used rule-of-thumb of 10. Our instruments (mining activity and the sectoral interaction terms) appear valid according to a Hansen's J-test for overidentifying restrictions.

In the second stage, we regress the log of employment, total assets or sales on the average of reported constraints (columns 2-3-4).[28] As before, we include firm-level covariates related to ownership and age and we saturate the model with country-year-sector dummies (similar to the OLS regressions of CS that include country-year fixed effects). Including this rich set of controls and fixed effects allows us to examine whether constraints as predicted by local mining activity matter when controlling for national institutions.

The results show that predicted business constraints reduce employment, assets and sales. The effects are economically quite large. A one standard deviation increase in local mining activity, reduces employment by 2.2 per cent, assets by 6.3 per cent and lets sales decline by 2.6 per cent for a producer of tradables.[29] In contrast, there are sizable positive impacts of mining on both assets and sales of firms producing non-tradables and those in the natural-resource sector. Table 5 provides a summary of all marginal effects.

[Insert Tables 4 and 5 here]

Table A10 in the Appendix shows a number of alternative IV specifications. Throughout the table we replace country-year-sector fixed effects with sector fixed effects. This yields more precisely estimated second-stage results. We think, however, that it is important to use country-year-sector fixed effects in our baseline specification in Table 4 to adequately control for country-specific unobserved effects, such as institutions and macroeconomic fluctuations. While this somewhat reduces the statistical significance of the main estimates (in line with CS) we nevertheless continue to find relatively precisely estimated negative real impacts.

In columns 5 and 6 we use firm-size dummies. A comparison with the preceding two columns shows that adding these potentially 'bad controls' reduces the coefficients. This

[28] Employment is the sum of permanent full-time employees plus the number of part-time or temporary employees at the end of the last fiscal year. Assets are the replacement value of machinery, vehicles and equipment in the last fiscal year in US$. Sales are annual sales in the last fiscal year in US$. All our results are robust to using the book value instead of the replacement value of assets.

[29] These negative real impacts also indicate that an increase in self-reported business constraints does not simply reflect a booming local economy in which firms struggle to meet demand. If this would drive our results in Tables 1 and 2, then we should find that lower reported business constraints lead to positive instead of negative real effects. In other words, instrumenting firm-level constraints reduces concerns about endogeneity of firms' demand for inputs in the sense that more productive firms need more inputs and thus feel more constrained.

suggests that controlling for firm size may introduce some positive selection bias and lead to an underestimation of the effect of business constraints on real firm outcomes.

5.4. Robustness: Panel data

While our main firm dataset consists of repeated but independently-sampled waves of cross-sectional survey data, a subset of firms were interviewed in at least two years in Chile, Kazakhstan, Mexico, Russia and Ukraine. We can use this small panel to observe the same firms at different points in time and compare how firms that experienced an increase in local mining activity differ from firms that did not. Importantly, this difference-in-differences framework allows us to include firm fixed effects to control more tightly for time invariant firm and locality characteristics.

Table 6 shows the results of this exercise. Controlling for firm fixed effects, we continue to find an impact of mining activity on firms' business constraints (columns 1 and 2). We now also find a much larger effect: a one standard deviation increase in mining activity is associated with a 6.3 percentage point increase in constraints for the average firm (column 1). Column 2 confirms our earlier finding that this negative impact is driven by firms in the tradables sector, in line with local resource movement effects. The spending effects in the wider area are less clear cut, reflecting the smaller sample size in these panel regressions.

Columns 3 to 5 present a similar IV framework as in Table 4 (we use the specification in column 2 as the first stage). We find similar negative impacts on firm growth although, again, the estimates are less precise due to the smaller panel dataset.

[Insert Table 6 here]

5.5. Robustness: Controlling for oil and gas fields

One may be concerned that our results are confounded by mining localities that also produce oil and gas. Oil and gas tend to occur in higher concentrations of wealth than metals and other minerals which may lead to larger local spending effects. On the other hand, production tends to be more capital intensive which may imply smaller effects on local labor demand.

To assess whether our results are sensitive to the local presence of large-scale hydrocarbon production, we extend our regressions with the number of oil and gas fields within distance bands of each firm. We use data from Horn (2003) who reports both the geographic coordinates and the size of 874 giant onshore and offshore oil and gas fields (with a minimum pre-extraction size of 500 million barrels of oil equivalent).[30] These data build on previous data sets (such as Halbouty et al. 1970) and attempt to include every giant oil field discovered around the world by 2003.

In Table 7 we report our baseline regressions while adding the number of active oil and gas fields (column 1), total oil and gas reserves (column 2) or the remaining oil and gas reserves (column 3). In each case we include these variables both measured within a 20 km distance of the firm and for a 21-150 spatial distance ring. Controlling for giant oil and gas fields does not alter our main result that nearby mining activity constrains firms in tradables sectors but helps firms in the non-tradables sector as well as firms downstream and upstream of natural resource companies.

We also find that the presence of oil and gas fields themselves decreases reported business constraints. However, closer inspection of the data reveals that relatively few firms have any oil and gas fields nearby (Table A7). While there is on average 0.5 mine within 20 km of a firm, there is only 0.01 oil and gas field within that distance. In fact, no firms in Brazil, Chile, Kazakhstan, Mexico and Mongolia have any fields within 20 km. This suggests that most fields are located in remote regions and that the negative effect is driven by very few observations.

[Insert Table 7 here]

6. Conclusion

We estimate the local impact of mining activity on the business constraints of over 20,000 firms in eight resource-rich countries. We exploit spatial variation in local mining activity within these countries to facilitate causal inference in both a cross-sectional and a panel setting. Our results are clearly at odds with views that consider mines as 'enclaves' without any tangible links to local economies. Instead we find that the presence of active mines deteriorates the business environment of firms in close vicinity (<20 km) to a mine but relaxes business constraints for more distant firms. The negative local impacts are concentrated exclusively among firms in tradable sectors. In line with mining-related congestion effects and infrastructure bottlenecks, the ability of these firms to access inputs, labor and infrastructure is hampered. This mining-induced deterioration of the local business environment also stunts the growth of these firms: they generate less employment, sell less

[30] Oil, condensate and gas are summed using a factor of 1/.006 to convert gas trillion cubic feet to oil equivalent million barrels.

and own fewer assets. In sharp contrast, firms in the services and natural resource sector appear to *benefit* from local mining activity.

In line with the Dutch disease model of Corden and Neary (1982), our results provide evidence for negative resource movement effects in the immediate vicinity of mines (a 'local curse') as well as positive spending effects in a wider geographical area (a 'regional blessing'). We believe that these findings can contribute to a better understanding of why studies of the local impact of mining often find positive effects on household income, while many aggregate studies find adverse effects on national income growth. Our results suggest that only traded sector manufacturing firms suffer from mining, and only at a localized level, while the non-traded and construction sectors benefit. Because most firms are traded we find that the net average effect is negative at the local level. Moreover, the spending effect may increase demand for all sectors in the wider economy.

From a policy perspective our results indicate that, on average and across countries, mining activity can have a positive impact on local economies. To minimize localized negative effects on the business environment, policy makers should think about ways to let local producers share extractives-related infrastructure. This may reduce the infrastructure bottlenecks and congestion effects that we currently observe in the data. Insufficient transport, electricity, water and other enabling infrastructure may not only help the tradables sector but also further stimulate local services sectors and clusters of down and upstream industries that are related to the mining sector. To maximize positive spillovers, policy makers can also help small firms to become 'fit to supply' local mining-related supply chains. These measures can help meet the preconditions for a resource boom to trigger agglomeration and positive long-term impacts.

Finally, the geographical and sector distribution of the economy at the time of natural resource discoveries also matters for whether resource booms have aggregate negative growth effects or not. Moreover, to what extent any negative effects will persist depends on whether the contraction of the tradables sector during the boom will be reversed once a boom ends. Tradables sectors may remain depressed for a protracted period if during the boom local residents have specialized in resource-related skills that are not easily transferable to other sectors. Here policy has a clear role to play as well.

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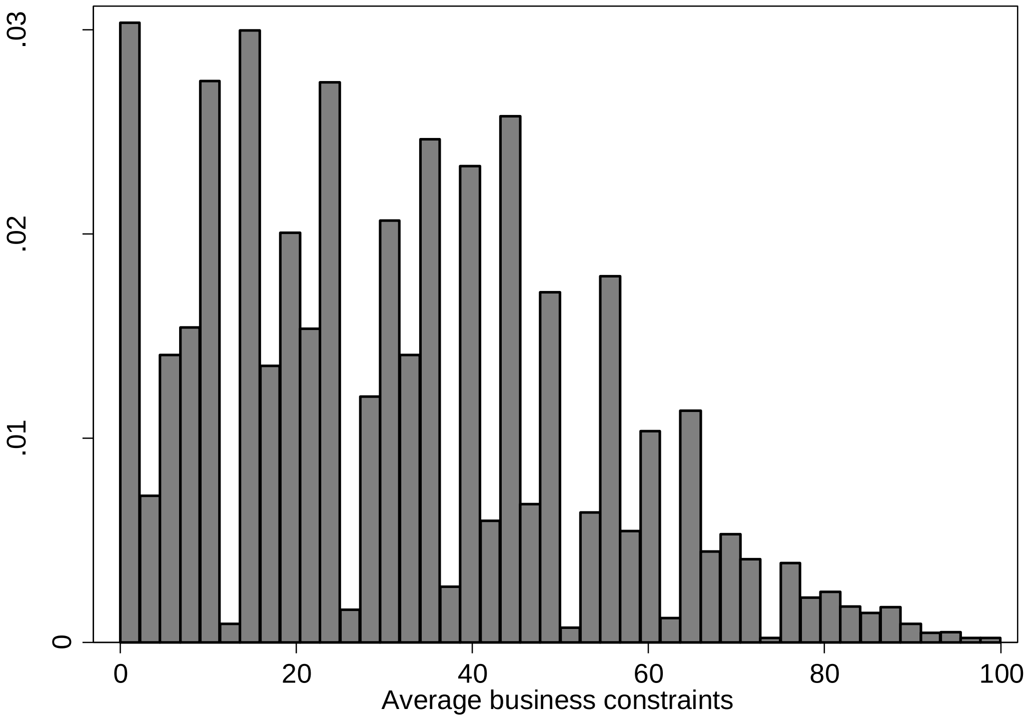
Appendix A. Histogram of *Average business constraints*



Appendix B. Survey questions

We use the following BEEPS V survey questions to measure firm-level business constraints. In each case the following answer categories were offered: *No obstacle*, *Minor obstacle*, *Moderate obstacle*, *Major obstacle*, *Very severe obstacle*, *Don't know*, *Does not apply*. For earlier survey rounds and for the World Bank Enterprise Surveys we use equivalent questions.

Question C.30a: Using the response options on the card, to what degree is ***electricity*** an obstacle to the current operations of this establishment?

Question D.30a: Using the response options on the card, to what degree is ***transport*** an obstacle to the current operations of this establishment?

Question E.30: Using the response options on the card, to what degree are ***practices of competitors in the informal sector*** an obstacle to the current operations of this establishment?

Question G.30a: Using the response options on the card, to what degree is ***access to land*** an obstacle to the current operations of this establishment?

Question I.30: Using the response options on the card, to what degree is ***crime, theft and disorder*** an obstacle to the current operations of this establishment?

Question K.30: Using the response options on the card, to what degree is ***access to finance*** an obstacle to the current operations of this establishment?

Question J.30c: Using the response options on the card, to what degree are ***business licensing and permits*** an obstacle to the current operations of this establishment?

Question J.30e: Using the response options on the card, to what degree is ***political instability*** an obstacle to the current operations of this establishment?

Question J.30f: Using the response options on the card, to what degree is ***corruption*** an obstacle to the current operations of this establishment?

Question H.30: Using the response options on the card, to what degree are ***courts*** an obstacle to the current operations of this establishment?

Question L.30b: Using the response options on the card, to what degree is an ***inadequately educated workforce*** an obstacle to the current operations of this establishment?

Table 1
Local mining and business constraints

	Average business constraints							
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
№ active mines 0-20 km	0.353**	0.351**	0.376**	0.356**	1.039**	0.008**	0.897**	0.292**
	(0.132)	(0.134)	(0.144)	(0.151)	(0.461)	(0.004)	(0.365)	(0.128)
№ active mines 21-150 km	-0.245**	-0.245**	-0.239**	-0.246**	-2.280**	-0.009**	-2.403***	-0.229**
	(0.113)	(0.114)	(0.113)	(0.111)	(0.866)	(0.005)	(0.829)	(0.106)
Any active mine 0-20 km							0.771*	
							(0.414)	
Any active mine 21-150 km							1.325*	
							(0.688)	
Total mining production 0-20 km (log)								1.607*
								(0.835)
Total mining production 21-150 km (log)								-0.771***
								(0.200)
Definition "№ active mines"	Count	Count	Count	Count NTL	Log(n+1)	NTL	Log(n)	Count
Country-Year-Sector FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	No	No	No	No	No	No	No
Firm controls	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Controls for inactive mines	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,150	22,150	23,045	22,150	22,150	22,150	22,150	22,150
R-squared	0.269	0.272	0.295	0.272	0.273	0.271	0.274	0.274

Notes: This table shows OLS regressions to estimate the impact of local mining activity on firms' business constraints. In columns 1-2-3-8 *No. active mines 0-20 km (21-150 km)* are count variables. Column 3 excludes our standard set of firm covariates. In column 4 above-ground mines with missing operating status are given an imputed status based on night-time light (NTL) predictions. In column 5 the *No. active mines* variables are expressed as the log of the number of active minus plus 1. In column 6 mining activity is measured by NTL emitted within a 1 km radius around mines. In column 7 the *No. active mines* variables are expressed as the log of the number of active minus where zero values are set to missing (while adding separate dummy variables *Any active mine 0-20 km (21-150 km)*). Column 8 controls for total mining production. Robust standard errors are clustered by country-year-sector and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. All specifications include country-year-sector fixed effects, firm controls (size, age, international exporter and ownership) and controls for inactive mines in the vicinity of firms. Sectors are Manufacturing; Construction; Retail and wholesale; Real estate, renting and business services; Other. Tables A1 (A2) in the Appendix contain variable definitions and data sources (summary statistics).

Table 2
Local mining and business constraints: Sector heterogeneity

	Interaction with:	Baseline [1]	Baseline no firm controls [2]	Mines: NTL corrected count [3]	Mines: NTL [4]	Excl. largest and youngest firms [5]	Excl. multi-establishment firms [6]	Region FE [7]
№ active mines 0-20 km	x Traded	0.587***	0.611***	0.602***	0.013***	0.573***	0.595***	0.352**
		(0.158)	(0.183)	(0.174)	(0.005)	(0.209)	(0.151)	(0.137)
	x Construction	-0.322	-0.287	-0.312	-0.021**	-0.418	-0.414	0.075
		(0.377)	(0.389)	(0.397)	(0.008)	(0.366)	(0.390)	(0.496)
	x Non-traded	-1.172**	-0.642*	-1.122**	-0.019	-1.346**	-1.059**	-0.925
		(0.527)	(0.343)	(0.512)	(0.013)	(0.653)	(0.500)	(0.848)
	x Natural resources	-0.209***	-0.193***	-0.199***	-0.007***	-0.083	-0.208***	0.016
		(0.034)	(0.041)	(0.044)	(0.001)	(0.070)	(0.033)	(0.072)
№ active mines 21-150 km	x Traded	-0.275**	-0.272**	-0.280**	-0.010**	-0.250**	-0.278**	-0.131*
		(0.115)	(0.115)	(0.110)	(0.005)	(0.113)	(0.115)	(0.071)
	x Construction	-0.332**	-0.336**	-0.346***	-0.011**	-0.278**	-0.333**	-0.310
		(0.132)	(0.134)	(0.127)	(0.005)	(0.125)	(0.133)	(0.376)
	x Non-traded	-0.132	-0.129	-0.142	-0.003	-0.091	-0.124	-0.228**
		(0.092)	(0.093)	(0.086)	(0.003)	(0.079)	(0.092)	(0.098)
	x Natural resources	-0.360***	-0.340***	-0.366***	-0.016***	-0.367***	-0.363***	-0.153***
		(0.089)	(0.089)	(0.087)	(0.006)	(0.114)	(0.087)	(0.048)
Country-Year-Sector FE		Yes	Yes	Yes	Yes	Yes	Yes	No
Region-Year-Sector FE		No	No	No	No	No	No	Yes
Firm controls		Yes	No	Yes	Yes	Yes	Yes	Yes
Controls for inactive mines		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations		20,812	21,704	20,812	20,812	15,847	20,305	20,812
R-squared		0.288	0.310	0.288	0.285	0.329	0.285	0.368

Notes: This table shows OLS regressions to estimate the impact of local mining activity on firms' business constraints. In column 3 above-ground mines with missing operating status are given an imputed status based on night-time light (NTL) predictions. In column 4 mining activity is measured by the sum of NTL emitted within a 1 km radius around mines. The sample used in column 5 excludes the 10 percent largest and youngest firms while the sample in column 6 excludes multi-establishment firms. Column 7 includes region fixed effects, where a region is nested within a country and measures up to 5 by 5 degrees. There are 114 regions in total. Robust standard errors are clustered by country-year-sector and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. All specifications include firm controls (size, age, international exporter, and ownership) and controls for inactive mines in the vicinity of firms. Constant included but not shown. Table A1 in the Appendix contains all variable definitions and data sources while Table A2 contains summary statistics.

Table 3
Local mining and business constraints: Inputs, infrastructure and institutions

		Average business constraints related to:		
		Inputs	Infrastructure	Institutions
	Interaction with:	[1]	[2]	[3]
№ active mines 0-20 km	x Traded	0.636***	0.665**	0.223***
		(0.119)	(0.307)	(0.081)
	x Construction	-1.304***	0.337	-0.144
		(0.399)	(0.604)	(0.512)
	x Non-traded	-0.725*	-1.326	-1.396**
		(0.384)	(1.150)	(0.627)
	x Natural resources	-0.229***	-0.155*	-0.267***
		(0.048)	(0.090)	(0.040)
№ active mines 21-150 km	x Traded	-0.287***	-0.268	-0.199**
		(0.026)	(0.268)	(0.082)
	x Construction	-0.325***	-0.256	-0.300**
		(0.066)	(0.258)	(0.124)
	x Non-traded	-0.227***	-0.098	-0.056
		(0.054)	(0.183)	(0.081)
	x Natural resources	-0.304***	-0.448**	-0.250***
		(0.027)	(0.175)	(0.066)
Country-Year-Sector FE		Yes	Yes	Yes
Firm controls		Yes	Yes	Yes
Controls for inactive mines		Yes	Yes	Yes
Observations		20,808	20,810	20,808
R-squared		0.173	0.153	0.372

Notes: This table shows OLS regressions to estimate the impact of local mining activity on firms' business constraints. related to inputs (access to land, access to adequately educated workforce, access to finance), infrastructure (electricity and transport) and institutions (crime, competition from informal sector, ease of obtaining an operating license, corruption, political instability, court quality). Robust standard errors are clustered by country-year-sector and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. All specifications include country-year-sector fixed effects, firm controls (size, age, international exporter, and ownership) and controls for inactive mines in the vicinity of firms. Constant included but not shown. Table A1 in the Appendix contains all variable definitions and data sources while Table A2 contains summary statistics.

Table 4
Local mining, business constraints and firm growth

		Average constraint	Employment (ln)	Assets (ln)	Sales (ln)
		1st stage	2nd stage		
		[1]	[2]	[3]	[4]
			-0.021**	-0.060***	-0.025**
	Interaction with:		(0.010)	(0.015)	(0.012)
№ active mines 0-20 km	x Traded	0.613***			
		(0.165)			
	x Construction	-0.301			
		(0.386)			
	x Non-traded	-1.165**			
		(0.526)			
	x Natural resources	-0.214***			
		(0.034)			
№ active mines 21-150 km	x Traded	-0.273**			
		(0.118)			
	x Construction	-0.333**			
		(0.136)			
	x Non-traded	-0.129			
		(0.095)			
	x Natural resources	-0.352***			
		(0.088)			
Country-Year-Sector FEs		Yes	Yes	Yes	Yes
Firm and inactive mine controls		Yes	Yes	Yes	Yes
Observations		20,820	20,820	4,378	8,023
№ clusters		44	44	23	42
Kleibergen-Paap F-statistic		142			
Hansen J-test p-value		0.536			

Notes: This table shows 2SLS regressions to estimate the impact of local mining activity on firm growth. Robust standard errors are shown in parentheses and clustered by country-year-sector. ***, **, * correspond to the 1%, 5%, and 10%, level of significance, respectively. All sales and assets specifications include firm controls (size, age and ownership) and controls for inactive mines in the vicinity of firms, unless otherwise stated. All employment specifications include firm controls (age, international exporter, and ownership) and controls for inactive mines in the vicinity of firms. Constant included but not shown. Standard Table A1 in the Appendix contains all variable definitions and data sources while Table A2 contains summary statistics.

Table 5
Marginal effect of a one standard deviation increase in mining

		1st stage	2nd stage		
		Average constraints	Employment	Assets	Sales
		[1]	[2]	[3]	[4]
№ active mines 0-20 km	x All sectors	0.6 **	-1.3% **	-3.8% **	-1.6% **
	x Traded	1.1 ***	-2.2% ***	-6.3% ***	-2.6% **
	x Construction	-0.6	1.2%	3.5%	1.4%
	x Non-traded	-2.1 **	4.4% **	12.6% **	5.2% **
	x Natural resources	-0.4 ***	0.8% ***	2.2% ***	0.9% **
№ active mines 21-150 km	x All sectors	-3.4 **	7.2% **	20.6% **	8.6% **
	x Traded	-3.8 **	8.1% **	23.1% **	9.6% **
	x Construction	-4.6 **	9.7% **	27.8% **	11.6% **
	x Non-traded	-1.8	3.9%	11.1%	4.6%
	x Natural resources	-5.0 ***	10.6% ***	30.2% ***	12.6% **

Notes: This table shows marginal effects of a one standard deviation increase in mining by sector. Coefficients for column [1] are taken from Table 1 column 2 (‘all sectors’) and Table 2 column 1 (by sector). Coefficients for columns [2-4] are taken from Table 4 columns 2-4, respectively. ***, **, *, correspond to the 1%, 5%, and 10%, level of significance, respectively. For columns 2-4 the significance level is the minimum of the direct and the indirect effect. For example, mines within 20km have no significant effect on constraints reported by the construction sector. We therefore conclude that employment, assets and sales of the construction sector are also not significantly affected by mining.

Table 6
Robustness: Panel-data regressions

	Dependent variable →	Average business constraints		Employ-ment (ln)	Assets (ln)	Sales (ln)
		OLS		2nd stage IV		
	Interaction with ↓	[1]	[2]	[3]	[4]	[5]
				-0.018**	0.011	-0.002
				(0.007)	(0.167)	(0.016)
№ active mines 0-20 km		7.962*				
		(4.061)				
№ active mines 21-150 km		-0.147				
		(0.480)				
№ active mines 0-20 km	x Traded		11.309**			
			(4.446)			
	x Construction		-3.433			
			(4.389)			
	x Non-traded		8.185			
			(13.153)			
	x Natural resources		[-]			
№ active mines 21-150 km	x Traded		-0.094			
			(0.558)			
	x Construction		-0.835			
			(2.299)			
	x Non-traded		-1.241			
			(1.726)			
	x Natural resources		-0.242			
			(6.249)			
Country-sector-year FE		Yes	Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes	Yes
Firm size dummies		Yes	Yes	No	No	No
Firm controls		Yes	Yes	Yes	Yes	Yes
Controls for inactive mines		Yes	Yes	Yes	Yes	Yes
Observations		798	798	794	327	675
Kleibergen-Paap F-statistic		-	24.11			
Hansen J-test p-value		-	0.699			
R-squared		0.802	0.802	-	-	-

Notes: This table shows OLS regressions, based on a subset of firms that were surveyed in at least two years, to estimate the impact of (increased) local mining activity on firms' business constraints. Column 2 provides the first-stage regression for the IV results in columns 3-4-5. Robust standard errors are clustered by country-year-sector and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. All specifications include country-year-sector fixed effects, firm fixed effects and time-varying firm controls (age, international exporter, and ownership). Capital cities are excluded. Constant included but not shown. Standard Table A1 in the Appendix contains all variable definitions and data sources while Table A2 contains summary statistics.

Table 7
Robustness: Controlling for giant oil and gas fields

	Interaction with:	[1]	[2]	[3]
№ active mines 0-20 km	x Traded	0.612***	0.610***	0.610***
		(0.143)	(0.129)	(0.128)
	x Construction	-0.323	-0.315	-0.297
		(0.357)	(0.343)	(0.339)
	x Non-traded	-1.086*	-1.048*	-1.020*
		(0.555)	(0.588)	(0.596)
	x Natural resources	-0.188***	-0.173***	-0.178***
		(0.032)	(0.030)	(0.026)
№ active mines 21-150 km	x Traded	-0.271**	-0.258**	-0.255**
		(0.115)	(0.113)	(0.110)
	x Construction	-0.320**	-0.306**	-0.304**
		(0.128)	(0.127)	(0.123)
	x Non-traded	-0.129	-0.122	-0.122
		(0.090)	(0.089)	(0.088)
	x Natural resources	-0.366***	-0.354***	-0.353***
		(0.088)	(0.085)	(0.084)
№ oil and gas fields 0-20 km		-6.869***		
		(1.253)		
№ oil and gas fields 21-150 km		-1.042***		
		(0.290)		
Oil and gas reserves 0-20 km (ln)			-1.294**	
			(0.540)	
Oil and gas reserves 21-150 km (ln)			-0.315***	
			(0.100)	
Oil and gas remaining reserves 0-20 km (ln)				-2.107***
				(0.602)
Oil and gas remaining reserves 21-150 km (ln)				-0.512***
				(0.130)
Country-Year-Sector FE		Yes	Yes	Yes
Firm controls		Yes	Yes	Yes
Controls for inactive mines		Yes	Yes	Yes
Observations		20,812	20,812	20,812
R-squared		0.291	0.291	0.292

Notes: This table shows OLS regressions to estimate the impact of local mining activity on firms' business constraints while controlling for the local presence of gian oil and gas fields. Oil and gas reserves measure the total size of fields by their ultimate recovery equivalent, which is the original size of the field as it was known in 2003. Oil and gas remaining reserves is an estimate of the current field size by applying a half-life time of 10 years, which corresponds to the average half-life of fields in North America, Europe, and the former U.S. S. R. See Horn (2003) for details. Robust standard errors are clustered by country-year-sector and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. All specifications include country-year-sector fixed effects, firm controls (size, age, international exporter, and ownership) and controls for inactive mines in the vicinity of firms. Constant included but not shown. Standard Table A1 in the Appendix contains all variable definitions and data sources while Table A2 contains summary statistics.

Figure 1
Geographical distribution of firms and mines

These graphs depict the geographical distribution of the firms and mines in our dataset for Ukraine (left) and Kazakhstan (right). Scale varies by country. Similar maps are available for Brazil, Chile, China, Mexico, Mongolia and Russia in the on-line Appendix. Red triangles (blue dots) indicate individual firms (mines). The lower maps zoom in to the area highlighted by the red rectangles in the upper maps. The circles around firms have a 20 kilometer radius. Source: EBRD-World Bank BEEPS Surveys and SNL Metals and Mining.

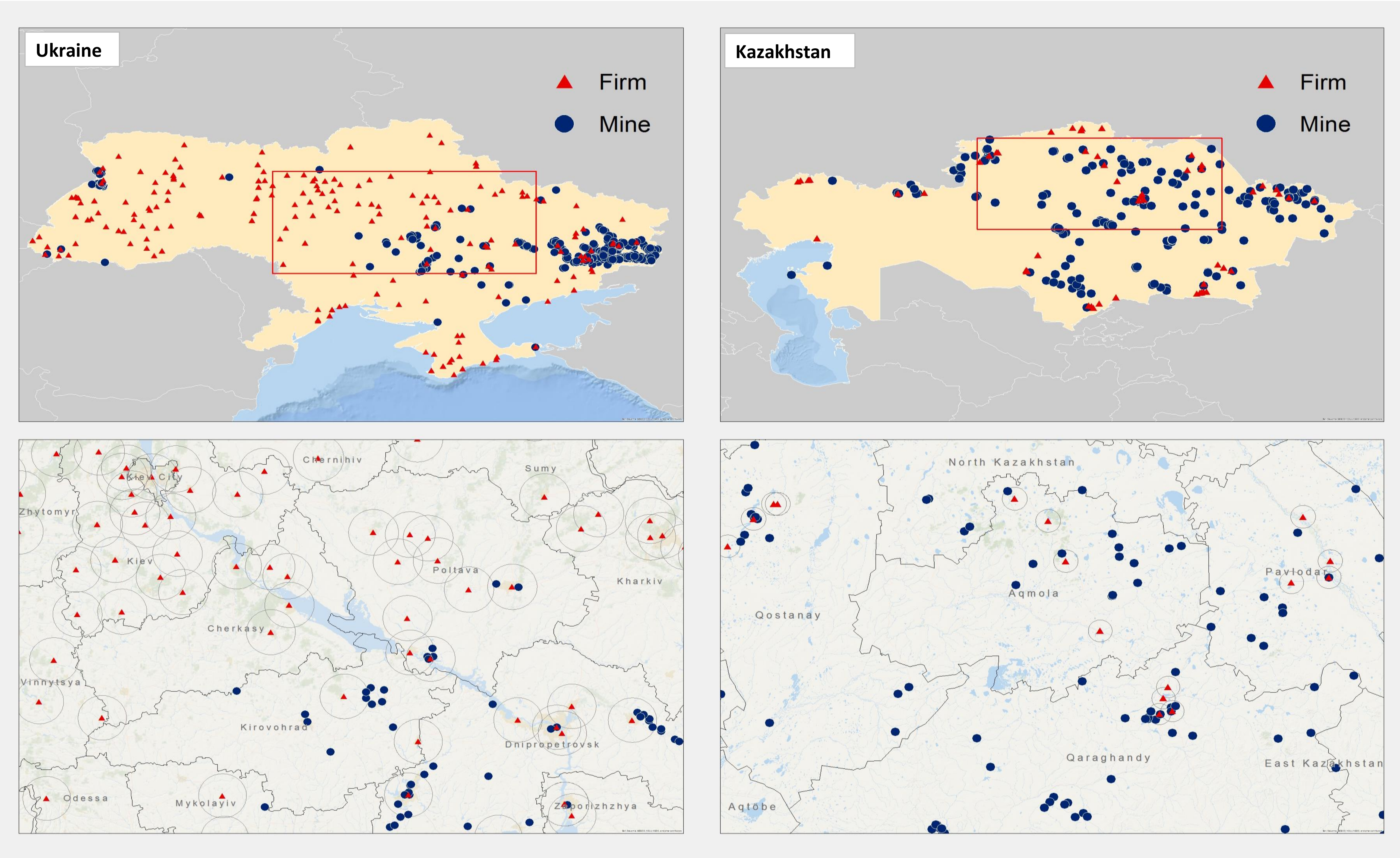


Table A1
Variable definitions and data sources

	Definition	Source	Unit
Dependent variable:			
Average business constraints	Firm's perception of severity of business constraints (rescaled to 0, 100)	Enterprise Surveys	-
Input constraints	Firm's perception of severity of constraints related to access to land, an educated work force and finance (rescaled to 0, 100)	Enterprise Surveys	-
Infrastructure constraints	Firm's perception of severity of constraints related to electricity and transport (rescaled to 0, 100)	Enterprise Surveys	-
Institutional constraints	Firm's perception of severity of constraints related to crime, informal competitors, access to business licenses, corruption, political instability and court quality (rescaled to 0, 100)	Enterprise Surveys	-
Independent variables:			
№ active mines 0-20 km	Number of open mines around the firm within a circle with a 20 km radius	SNL	-
№ active mines 21-150 km	Number of open mines around the firm between concentric circles with a 20 km and 150 km radius	SNL	-
Any active mine 0-20 km	Dummy variable that is '1' if there is at least one open mine around the firm within a circle with a 20 km radius; '0' otherwise.	SNL	0/1
Any active mine 21-150 km	Dummy variable that is '1' if there is at least one open mine around the firm between concentric circles with a 20 km and 150 km radius; '0' otherwise	SNL	0/1
№ inactive or unknown mines 0-20 km	Number of closed mines and mines with unknown operating status around the firm within a circle with a 20 km radius	SNL	-
№ inactive or unknown mines 21-150 km	Number of closed mines and mines with unknown operating status around the firm between concentric circles with a 20 km and 150 km radius	SNL	-
Any inactive or unknown mine 0-20 km	Dummy variable that is '1' if there is at least one closed mine or mine with unknown operating status around the firm within a circle with a 20 km radius; '0' otherwise.	SNL	0/1
Any inactive or unknown mine 21-150 km	Dummy variable that is '1' if there is at least one closed mine or mine with unknown operating status around the firm between concentric circles with a 20 km and 150 km radius; '0' otherwise	SNL	0/1
Total mining production 0-20 km (ln)	Log total mining production around the firm within a circle with a 20 km radius	SNL	-
Total mining production 21-150 km (ln)	Log total mining production around the firm between concentric circles with a 20 km and 150 km radius	SNL	-
№ oil and gas fields 0-20 km	Number of oil and gas fields with a minimum pre-extraction size of 500 barrels of oil around the firm within a circle with a 20 km radius	Horn (2003)	-
№ oil and gas fields 21-150 km	Number of oil and gas fields with a minimum pre-extraction size of 500 barrels of oil around the firm between concentric circles with a 20 km and 150 km radius	Horn (2003)	-
Oil and gas reserves 0-20 km (ln)	Log '1' plus total oil and gas reserves around the firm within a circle with a 20 km radius. Reserves measure the total size of fields by their ultimate recovery equivalent, which is the original size of the field as it was known in 2003.	Horn (2003)	-
Oil and gas reserves 21-150 km (ln)	Log '1' plus total oil and gas reserves around the firm between concentric circles with a 20 km and 150 km radius. Reserves measure the total size of fields by their ultimate recovery equivalent, which is the original size of the field as it was known in 2003.	Horn (2003)	-
Oil and gas remaining reserves 0-20 km (ln)	Log '1' plus total oil and gas remaining reserves around the firm within a circle with a 20 km radius. Remaining reserves are estimated on the basis of current field size by applying a half-life time of ten years, which corresponds to the average half-life of fields in North America, Europe, and the former USSR.	Horn (2003)	-
Oil and gas remaining reserves 21-150 km (ln)	Log '1' plus total oil and gas remaining reserves around the firm between concentric circles with a 20 and 150 km radius. Remaining reserves are estimated on the basis of current field size by applying a half-life time of ten years, which corresponds to the average half-life of fields in North America, Europe, and the former USSR.	Horn (2003)	-
Night-time light	Night-time light intensity as captured by satellite imagery	NGDC EOG	
Small firm	Dummy variable that is '1' if firm employs between 5 and 19 people; '0' otherwise	Enterprise Surveys	0/1
Medium-sized firm	Dummy variable that is '1' if firm employs between 20 and 99 people; '0' otherwise	Enterprise Surveys	0/1
Large firm	Dummy variable that is '1' if firm employs 100 or more people; '0' otherwise	Enterprise Surveys	0/1
Firm age	Number of years since the firm was established	Enterprise Surveys	-
Foreign firm	Dummy variable that is '1' if foreigners own 10 percent or more of the firm's equity; '0' otherwise	Enterprise Surveys	0/1
State firm	Dummy variable that is '1' if state entities own 10 percent or more of the firm's equity; '0' otherwise	Enterprise Surveys	0/1
Firm competes internationally	Dummy variable that is '1' if main product sold mostly on international markets or more than 25% of sales are earned overseas; '0' otherwise	Enterprise Surveys	0/1
Employment (ln)	Number of permanent full-time employees plus the number of part-time or temporary employees of the firm at the end of the last fiscal year	Enterprise Surveys	-
Assets (ln)	Total replacement value of the physical equipment owned and used by the firm (in US$)	Enterprise Surveys	-
Sales (ln)	Total annual turnover of the firm (in US$)	Enterprise Surveys	-

Notes: This table gives the definition, source and unit for each of the variables used in the analysis. SNL: SNL Metals and Mining database. NGDC EOG: National Geophysical Data Center Earth Observation Group.

Table A2
Summary statistics

	Obs.	Mean	Median	St. dev.	Min	Max
Dependent variables:						
Average business constraints	22,150	30.22	20.69	27.27	0	100
Input constraints	20,808	34.68	33.33	24.33	0	100
Infrastructure constraints	20,810	29.54	25.00	27.40	0	100
Institutional constraints	20,808	23.38	25.00	24.81	0	100
Independent variables:						
№ active mines 0-20 km	22,150	0.58	0	1.79	0	19
№ active mines 21-150 km	22,150	7.56	4	13.98	0	152
№ inactive or unknown mines 0-20 km	22,150	0.12	0	0.77	0	12
№ inactive or unknown mines 21-150 km	22,150	2.69	1	7.22	0	88
Any inactive or unknown mine 0-20 km	22,150	0.24	0	0.43	0	1
Any inactive or unknown mine 21-150 km	22,150	0.77	1	0.42	0	1
Total mining production 0-20 km (ln)	22,150	0.02	0	0.30	-1.20	4.14
Total mining production 21-150 km (ln)	22,150	0.36	0	1.20	-2.83	6.06
№ oil and gas fields 0-20 km	22,150	0.01	0	0.14	0	2
№ oil and gas fields 21-150 km	22,150	0.27	0	0.70	0	4
Oil and gas reserves 0-20 km (ln)	22,150	0.05	0	0.62	0	8.21
Oil and gas reserves 21-150 km (ln)	22,150	1.20	0	2.68	0	9.49
Sum of NTL active mines 0-20 km	22,150	19.53	0	58.79	0	694.23
Sum of NTL active mines 21-150 km	22,150	146.39	61.47	242.77	0	2476.13
Small firm	22,150	0.20	0	0.40	0	1
Medium-sized firm	22,150	0.29	0	0.46	0	1
Large firm	22,150	0.48	0	0.50	0	1
Firm age	22,150	15.38	11	15.04	0	203
Foreign firm	22,150	0.15	0	0.35	0	1
State firm	22,150	0.17	0	0.37	0	1
Firm competes internationally	22,150	0.13	0	0.33	0	1
Employment (ln)	20,820	4.89	4.81	1.68	0.69	13.5
Assets (ln)	4,952	12.52	12.53	2.32	2.22	22.68
Sales (ln)	9,741	13.77	13.74	2.23	2.74	25.03

Notes: This tables provides summary statistics for all variables used in the analysis. Table A1 contains all variable definitions.

Table A3
Frequency table of minerals

Mineral produced	Percent	Cum.	Mineral produced	Percent	Cum.
Missing	*5.67*	*5.67*	Nickel	1.05	80.33
Antimony	0.3	5.97	Niobium	0.33	80.66
Bauxite	1.07	7.04	PGMs	0.67	81.33
Boron	0.08	7.11	Palladium	0.45	81.79
Chromite	0.5	7.61	Platinum	0.59	82.38
Coal	35.42	43.03	Potash	0.23	82.61
Cobalt	0.46	43.49	Rhodium	0.22	82.83
Copper	8.69	52.19	Silver	9.26	92.1
Diamonds	0.22	52.4	Tantalum	0.21	92.3
Gold	11.72	64.13	Tin	0.96	93.26
Iron ore	8.37	72.49	Titanium	0.09	93.35
Lead	3.66	76.15	Tungsten	1.02	94.37
Lithium	0.29	76.43	Uranium oxide	0.52	94.9
Manganese ore	1.31	77.74	Vanadium	0.05	94.95
Mercury	0.02	77.76	Zinc	4.86	99.81
Molybdenum	1.52	79.28	Zirconium	0.19	100

Notes: This frequency table summarizes the minerals produced by the mines in our dataset. The unit of observation is a mine-mineral-year (each mine can produce several minerals). Source: SNL Metal & Mining.

Table A4
Number of firms by country, survey year and sector type

	All				Tradable sectors				Non-tradable sectors				Construction				Natural resources			
	2005	2007	2009	2011	2005	2007	2009	2011	2005	2007	2009	2011	2005	2007	2009	2011	2005	2007	2009	2011
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]
Brazil		1,791				1,614				158				19						
Chile	421		344		280		254		81		63		31		8		1		19	
China	11,900			2,549	9,849			1,793				408				120	2,051			228
Kazakhstan	512	496			n.a.	243			n.a.	178			54	62			n.a.	13		
Mexico	1,145		1,084		833		902		103		139		29		18		135		25	
Mongolia		153				57				65				22				9		
Russia	444	990			n.a.	715			n.a.	197			61	52			n.a.	26		
Ukraine	499	722			n.a.	531			n.a.	155			68	22			n.a.	14		

Notes: This table shows the number of sample firms by country, the fiscal year that the survey refers to, and sector type. For some countries the 2005 sample cannot be fully split up by sector type. These instances are indicated by "n.a.". Source: World Bank Enterprise Surveys and BEEPS.

Table A5
Sectoral firm distribution by classification method

Classification method →	Mian-Sufi			Ellison-Glaeser
	I: Baseline	II	III	index
	[1]	[2]	[3]	[4]
Tradable	19,470	16,280	16,280	19,603
Construction	673	673	673	673
Non-tradable	1,879	1,879	592	1,746
Natural resources	2,648	2,648	2,648	2,648
Other	0	3,190	4,477	0
Total number of firms	24,670	24,670	24,670	24,670

Notes: This table summarizes various ways to classify firms into tradable versus non-tradable sectors. Columns 1-3 follow Mian and Sufi (2014). Retail, restaurants, hotels and motor vehicle services are categorized as non-tradable. Column 2 further restricts tradables to sectors in which firms export on average at least 5 per cent of output either directly or through intermediaries (source: World Bank Enterprise Surveys). Column 3 also excludes the retail sector from non-tradables (and labels it Other). Column 4 follows Ellison and Glaeser (1997) and defines (non-)tradables according to their geographical concentration. The index is a measure of excess concentration with respect to a random distribution of sectors across space, where excess concentration may either reflect natural advantages or agglomeration economies.

Table A6
Robustness: Alternative classifications of tradable versus non-tradable sectors

		Average business constraints			
		Mian-Sufi			Ellison-Glaeser
		I: Baseline	II	III	index
	Interaction with:	[1]	[2]	[3]	[4]
№ active mines 0-20 km	x Traded	0.587***	0.589***	0.580***	0.581***
		(0.158)	(0.158)	(0.163)	(0.136)
	x Construction	-0.322	-0.321	-0.375	-0.233
		(0.377)	(0.382)	(0.378)	(0.393)
	x Non-traded	-1.172**	-1.171**	-0.733	0.279
		(0.527)	(0.532)	(0.570)	(0.599)
	x Natural resources	-0.209***	-0.208***	-0.211***	-0.205***
		(0.034)	(0.034)	(0.034)	(0.035)
	x Other		0.588*	-0.025	
			(0.342)	(0.407)	
№ active mines 21-150 km	x Traded	-0.275**	-0.276**	-0.276**	-0.292**
		(0.115)	(0.114)	(0.115)	(0.108)
	x Construction	-0.332**	-0.330**	-0.328**	-0.349***
		(0.132)	(0.133)	(0.135)	(0.126)
	x Non-traded	-0.132	-0.130	-0.143*	-0.182**
		(0.092)	(0.092)	(0.083)	(0.090)
	x Natural resources	-0.360***	-0.360***	-0.360***	-0.364***
		(0.089)	(0.089)	(0.089)	(0.088)
	x Other		-0.264**	-0.228*	
			(0.126)	(0.122)	
Country-Year-Sector FE		Yes	Yes	Yes	Yes
Firm controls		Yes	Yes	Yes	Yes
Controls for inactive mines		Yes	Yes	Yes	Yes
Clusters		44	53	52	42
Observations		20,812	20,812	20,812	20,812
R-squared		0.288	0.288	0.288	0.287

Notes: This table shows OLS regressions to estimate the impact of local mining activity on firms' business constraints. Column 1 replicates our baseline results of column 2 in Table 2. The following columns show similar regressions while using different ways to classify firms into tradable versus non-tradable sectors. Columns 1-3 follow Mian and Sufi (2014). Retail, restaurants, hotels and motor vehicle services are categorized as non-tradable. Column 2 further restricts tradables to sectors in which firms export on average at least 5 per cent of output either directly or through intermediaries (source: World Bank Enterprise Surveys). Column 3 also excludes the retail sector from non-tradables (and labels it *Other*). Column 4 follows Ellison and Glaeser (1997) and defines (non-)tradables according to their geographical concentration. The index is a measure of excess concentration with respect to a random distribution of sectors across space, where excess concentration may either reflect natural advantages or agglomeration economies. Robust standard errors are clustered by country-year-sector and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. All specifications include country-year-sector fixed effects, firm controls (size, age, international exporter, and ownership) and controls for inactive mines in the vicinity of firms. Constant included but not shown. Standard Table A1 in the Appendix contains all variable definitions and data sources while Table A2 contains summary statistics.

Table A7
Distribution of the number of active mines and oil & gas fields around firms

	Active mines		Oil & gas fields	
	0-20 km	20-150 km	0-20 km	20-150 km
	[1]	[2]	[5]	[6]
Brazil	0.35	1.30	0.00	0.05
	(1.17)	(3.76)		(0.23)
Chile	0.06	6.68	0.00	0.00
	(0.26)	(3.13)		
China	0.70	8.67	0.01	0.34
	(1.75)	(9.07)	(0.16)	(0.73)
Kazakhstan	0.18	1.29	0.00	0.04
	(0.38)	(2.52)		(0.20)
Mexico	0.00	1.22	0.00	0.00
	(0.07)	(0.90)		
Mongolia	0.05	1.54	0.00	0.00
	(0.22)	(0.80)		
Russia	0.36	5.78	0.03	0.25
	(0.52)	(18.41)	(0.16)	(0.72)
Ukraine	1.34	18.48	0	0.72
	(3.96)	(39.29)	(0.04)	(1.00)
All countries	0.53	7.1	0.01	0.25
	(1.68)	(13.17)	(0.13)	(0.66)

Notes: This table shows for each sample country the mean and (in parentheses) the standard deviation of the number of active mines and oil & gas fields surrounding firms. Mines and oil & gas fields are matched to firms based on a circle with a 20 kilometre radius around each firm (odd columns) or a distance ring of between 20 and 150 kilometres (even columns). Source: World Bank Enterprise Surveys, SNL Metals and Mining, Halbouty et al. (1970) and Horn (2003).

Table A8
Local mining measured at varying time lags

Lag of mine variables:		*t*	*t-1*	*t-2* *(baseline)*	*t-3*
	Interaction with:	[1]	[2]	[3]	[4]
№ active mines 0-20 km	x Traded	0.613***	0.518**	0.587***	0.618***
		(0.060)	(0.193)	(0.158)	(0.157)
	x Construction	-0.483	-0.556*	-0.322	-0.207
		(0.370)	(0.318)	(0.377)	(0.286)
	x Non-traded	-1.656***	-1.190**	-1.172**	-1.095**
		(0.390)	(0.475)	(0.527)	(0.518)
	x Natural resources	-0.232***	-0.202***	-0.209***	-0.221***
		(0.015)	(0.040)	(0.034)	(0.025)
№ active mines 21-150 km	x Traded	-0.262***	-0.233**	-0.275**	-0.247***
		(0.036)	(0.098)	(0.115)	(0.083)
	x Construction	-0.287***	-0.281**	-0.332**	-0.253***
		(0.077)	(0.110)	(0.132)	(0.082)
	x Non-traded	-0.081	-0.084	-0.132	-0.105
		(0.064)	(0.074)	(0.092)	(0.064)
	x Natural resources	-0.388***	-0.351***	-0.360***	-0.351***
		(0.017)	(0.086)	(0.089)	(0.081)
Country-Year-Sector FE		Yes	Yes	Yes	Yes
Firm controls		Yes	Yes	Yes	Yes
Controls for inactive mines		Yes	Yes	Yes	Yes
Observations		18,340	20,812	20,812	20,812
R-squared		0.217	0.286	0.288	0.286

Notes: This table shows OLS regressions to estimate the impact of local mining activity, measured at varying time lags, on firms' business constraints related to inputs (access to land, access to adequately educated workforce, access to finance), infrastructure (electricity and transport) and institutions (crime, competition from informal sector, ease of obtaining an operating license, corruption, political instability, court quality). The smaple is smaller in columns 1 and 5-8 because the mine status is not known for 2011. Robust standard errors are clustered by country-year-sector and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. All specifications include country-year-sector fixed effects, firm controls (size, age, international exporter and ownership) and controls for inactive mines in the vicinity of firms. Constant included but not shown. Table A1 in the Appendix contains all variable definitions and data sources while Table A2 contains summary statistics.

Table A9

Average business constraints as a function of mines at varying distances from firms

Panel A	*s=10*	*s=20*	*s=50*	*s=100*	*s=150*	*s=300*	*s=450*	*s=20*	*s=20*
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	s=10	*s=20*	*s=50*	*s=100*	*s=150*	*s=300*	*s=450*	*s=20*	*s=20*
№ active mines within *s* km	0.078	0.166*	-0.146***	-0.238***	-0.205**	-0.097***	-0.068**	0.331*	0.351**
	(0.220)	(0.097)	(0.024)	(0.040)	(0.086)	(0.031)	(0.032)	(0.176)	(0.134)
№ active mines 21-150 km								-0.157*	-0.245**
								(0.080)	(0.114)
№ active mines 151-450 km								-0.059*	
								(0.030)	
Country-Year-Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls for inactive mines	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21,150	21,150	21,150	21,150	21,150	21,150	21,150	21,150	21,150
R-squared	0.266	0.266	0.266	0.269	0.270	0.272	0.275	0.277	0.272

Panel B		*s=10*	*s=20*	*s=50*	*s=100*	*s=150*	*s=300*	*s=450*	*s=20*	*s=20*
	Interaction with:	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
№ active mines within *s* km	x Traded	0.581***	0.390***	-0.054**	-0.230***	-0.215**	-0.102***	-0.069**	0.569***	0.587***
		(0.203)	(0.112)	(0.020)	(0.039)	(0.081)	(0.032)	(0.032)	(0.194)	(0.158)
	x Construction	-1.837***	-0.535*	-0.288***	-0.375***	-0.346***	-0.158***	-0.069	-0.042	-0.322
		(0.528)	(0.288)	(0.072)	(0.073)	(0.103)	(0.049)	(0.044)	(0.409)	(0.377)
	x Non-traded	-1.501***	-0.651***	-0.269***	-0.257***	-0.171*	-0.051**	-0.032	-1.170**	-1.172**
		(0.469)	(0.214)	(0.060)	(0.056)	(0.086)	(0.025)	(0.020)	(0.468)	(0.527)
	x Natural resources	-0.936***	-0.456***	-0.438***	-0.438***	-0.346***	-0.138***	-0.099***	-0.139	-0.209***
		(0.029)	(0.021)	(0.042)	(0.035)	(0.076)	(0.029)	(0.026)	(0.098)	(0.034)
№ active mines 21-150 km	x Traded								-0.190**	-0.275**
									(0.092)	(0.115)
	x Construction								-0.283**	-0.332**
									(0.114)	(0.132)
	x Non-traded								-0.089	-0.132
									(0.078)	(0.092)
	x Natural resources								-0.183***	-0.360***
									(0.067)	(0.089)
№ active mines 151-450 km	x Traded								(0.031)	
									-0.009	
	x Construction								(0.038)	
									-0.017	
	x Non-traded								(0.018)	
									-0.085***	
	x Natural resources								(0.022)	
									(0.022)	
Country-Year-Sector FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls for inactive mines		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations		20,812	20,812	20,812	20,812	20,812	20,812	20,812	20,812	20,812
R-squared		0.279	0.279	0.279	0.281	0.285	0.286	0.289	0.293	0.288

Notes: This table shows OLS regressions to estimate the impact of local mining activity, measured at varying distances from firms, on firms' average business constraints. Robust standard errors are clustered by country-year-sector and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. All specifications include country-year-sector fixed effects, firm controls (size, age, international exporter, and ownership) and controls for inactive mines measured within the same distance from firms as the number of active mines. Constant included but not shown. Table A1 in the Appendix contains all variable definitions and data sources while Table A2 contains summary statistics.

Table A10
Local mining, business constraints and firm growth: Robustness

		Average constraint	Employ-ment (ln)	Assets (ln)	Sales (ln)	Assets (ln)	Sales (ln)
		1st stage	2nd stage				
		[1]	[2]	[3]	[4]	[5]	[6]
			-0.054***	-0.110***	-0.082***	-0.072**	-0.041**
	Interaction with:		(0.010)	(0.030)	(0.024)	(0.027)	(0.020)
№ active mines 0-20 km	x Traded	0.198					
		(0.414)					
	x Construction	-2.317**					
		(1.039)					
	x Non-traded	-2.075*					
		(1.091)					
	x Natural resources	-0.179					
		(0.113)					
№ active mines 21-150 km	x Traded	-0.559***					
		(0.116)					
	x Construction	-0.534***					
		(0.154)					
	x Non-traded	-0.417**					
		(0.176)					
	x Natural resources	-0.491***					
		(0.061)					
Country-Year-Sector FEs		No	No	No	No	No	No
Sector FEs		Yes	Yes	Yes	Yes	Yes	Yes
Firm size dummies		No	No	No	No	Yes	Yes
Firm and inactive mine controls		Yes	Yes	Yes	Yes	Yes	Yes
Observations		20,820	20,820	4,378	8,023	4,378	8,023
№ clusters		44	44	23	23	23	42
Kleibergen-Paap F-statistic			36.93	36.97	36.97	45.96	45.96
Hansen J-test p-value			0.257				

Notes: This table shows 2SLS regressions to estimate the impact of local mining activity on firm growth. Robust standard errors are shown in parentheses and clustered by country-year-sector. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. All sales and assets specifications include firm controls (size, age, international exporter, and ownership) and controls for inactive mines in the vicinity of firms, unless otherwise stated. All employment specifications include firm controls (age and ownership) and controls for inactive mines in the vicinity of firms. Constant included but not shown. Standard Table A1 in the Appendix contains all variable definitions and data sources while Table A2 contains summary statistics.

Table A11
Local mining and business constraints: Controlling for NTL near firms

		Baseline		Mines: NTL	
	Interaction with:	[1]	[2]	[3]	[4]
№ active mines 0-20 km		0.362***		0.008*	
		(0.116)		(0.004)	
№ active mines 0-20 km	x Traded		0.582***		0.013**
			(0.140)		(0.005)
	x Construction		-0.272		-0.021**
			(0.371)		(0.009)
	x Non-traded		-1.111*		-0.019
			(0.561)		(0.014)
	x Natural resources		-0.174***		-0.007***
			(0.037)		(0.001)
№ active mines 21-150 km		-0.248**		-0.009**	
		(0.104)		(0.004)	
№ active mines 21-150 km	x Traded		-0.278**		-0.010**
			(0.106)		(0.004)
	x Construction		-0.346***		-0.012**
			(0.124)		(0.005)
	x Non-traded		-0.143		-0.003
			(0.087)		(0.003)
	x Natural resources		-0.365***		-0.017***
			(0.084)		(0.006)
Average luminosity within a		0.056**	0.066**	0.051*	0.061**
20 km radius at t-2		(0.025)	(0.026)	(0.027)	(0.029)
Average luminosity within a		-0.147*	-0.142*	-0.093	-0.084
20 to 150 km band at t-2		(0.082)	(0.071)	(0.073)	(0.072)
№ gas flares within 150 km		-0.878**	-0.834*	-0.875**	-0.854*
(= 0 within 20km)		(0.333)	(0.436)	(0.330)	(0.439)
Country-Year-Sector FE		Yes	Yes	Yes	Yes
Firm controls		Yes	Yes	Yes	Yes
Controls for inactive mines		Yes	Yes	Yes	Yes
Observations		22,150	20,812	22,150	20,812
R-squared		0.274	0.289	0.272	0.287

Notes: This table shows OLS regressions to estimate the impact of local mining activity on firms' business constraints. In columns 3-4 mining activity is measured by the sum of NTL emitted within a 1 km radius around mines. Robust standard errors are clustered by country-year-sector and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. All specifications include firm controls (size, age, international exporter, and ownership) and controls for inactive mines in the vicinity of firms. Constant included but not shown. Table A1 in the Appendix contains all variable definitions and data sources while Table A2 contains summary statistics.