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The Dynamics of Investment Projects: Evidence from Peru*

Rocío Gondo and Marco Vega

Abstract

We analyse the effect of commodity price cycles on firm investment decisions at the project level, by considering the decision to delay, cancel or complete a project as initially announced. In particular, we use logit and duration models of competing risks on a novel dataset of announced investment projects in Peru from different economic sectors. The empirical framework for the timing of investment is motivated by real option models for projects that take time to build, with commodity prices used as a proxy of expected future income and their volatility as a proxy for uncertainty.

Our results suggest that both a reduction in commodity prices and an increase in volatility increase the probability to delay investment in the mining sector, with an amplification effect when both simultaneously occur. In other sectors, delays in implementation occur more often in periods of high volatility. Probability regressions under a competing risk framework suggest that higher commodity prices lead to a higher probability of completion in all sectors of the economy.

JEL Classification: E43, E51, E52
Key words: Investment projects, panel logit, Competing Risks.

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1 Introduction

Large commodity price fluctuations in the recent decade have led policymakers to focus on the macroeconomic effects of these price swings in major commodity exporting economies. This becomes especially relevant in times of falling commodity prices and tightening of financial conditions in advanced economies, where external factors play an important role in affecting variables such as investment, output and inflation in the short run.

Even though some countercyclical policies were implemented to cope in the short run, concern about long-term growth remains, given the tight link between commodity prices and aggregate investment. A key channel is through the effect of uncertainty, where commodity prices affect expected returns and risk of an investment project outcome. For instance, higher commodity prices triggered an investment cycle in construction and infrastructure (see Chapter 3, BIS (2016)). A persistent drop in investment reduces capital formation and thus potential output.

Real options models provide a theoretical framework for linking the timing of investment with uncertainty in expected future income streams. The standard model predicts that higher uncertainty reduces incentives to invest. However, these result is weakened/reversed under the following features: i) time to build with large fixed scale projects, where the opportunity cost of delay increases with uncertainty, as a firm cannot benefit if the news are good when projects are delayed (see Bar-Ilan & Strange (1996)), and/or ii) financial constraints, where higher external financing costs provide incentives to hurdle investment in the startup phase and use internal cash flows to finance new investments at a later stage (see Bolton et al (2014)).

We motivate our empirical exercises with this framework. In particular, we use commodity prices as a proxy variable of expected future income, and quantify their effect on the timing of firm investment decisions at the project level. We explore the evolution of investment projects and the decision of the firm to delay, cancel or complete the project as initially announced by using a novel dataset of more than 1109 announced investment projects in Peru from different economic sectors between 2009 and 2015.

We provide a quantification of the effects of the qualitative results predicted by real options models using this data. One key result is that we find a reversed effect of uncertainty in the mining sector, in line with the modified real options model by Bar-Ilan & Strange (1996), where a 1% increase in commodity price volatility in good times leads to a 0.55 pp reduction in probability of delay, whereas in bad times this effect falls by 0.36 pp.

We calculate the effect of commodity prices on the timing of investment, by using logit models for the probability of delay, completion and cancellation. In particular, for the mining sector, commodity prices are used as a proxy for expected future income in the real options model. In other sectors, higher wealth in the mining sector could spillover and increase expected profitability. Commodity price volatility enters as a proxy of uncertainty and we test its link to the timing of investment. We also consider the fact that, firms could decide to postpone the date of termination and/or the beginning of production/ operations.

Some key results from our analysis are listed below:

1. Revising the decision to invest is affected by both commodity price growth rates (linked to expected future income) and volatility (uncertainty), with differentiated effects when prices are high or low. A decrease in commodity prices and higher volatility in bad times leads to an increase in the probability for a project to be unconfirmed.

   As for magnitudes, a 10% increase in commodity prices leads to a 2.1 pp reduction in the probability of revision, with a slightly larger impact of 2.3 pp in the sample of mining sector projects.

2. Once an investment project implementation is ongoing, the timing of investment (given by delays during the startup phase) is also affected by the evolution of commodity prices.

   - Higher commodity prices increase expected profitability, either through its effect on revenues (mining) or through spillovers from an income/wealth effect. A 1% increase in commodity prices decreases the probability of delay in the mining sector by 0.2 pp.
   - We find evidence of the standard result for uncertainty in real options model, where a 1% increase in volatility increases the delay probability by 0.18 pp in all sectors except for mining. For the mining sector, we find a reversed effect of uncertainty, in line with modified real options model with time to build, where a 1% increase in volatility in good times reduces the delay probability by 0.55 pp, compared to 0.36 pp lower effect in bad times.

3. Commodity prices do have a negative strong and statistically significant effect on the probability of project completion in all sectors. Particularly in the mining sector.

Related Literature. Our work relates to the analysis of investment decisions under uncertainty. In particular, one strand of the literature that considers this link from a theoretical perspective is the set of models for investment that use a real options approach. Dixit & Pindyck (1994) lay the theoretical framework of a real options model, where the cost of investing varies with time and there are limited investment options in terms of expanding the current production capacity, which create put and call options whose values affect the decisions to invest. These models link the timing of investment to uncertainty about expected future income streams. A very well known result from the standard real options model is that uncertainty delays the timing to invest.

However, the link between uncertainty and timing to invest might be weakened or overturned when considering some particular features. For instance, Bar-Ilan & Strange (1996) find that, for large fixed scale projects that take time to build, uncertainty not only increases the benefit of waiting to get more information about future income, but also increases the opportunity cost of delay, given that the firm cannot benefit from higher income if the news are good. Another feature that reverses this result is the presence of financial and liquidity constraints, where Bolton et al (2014) show that the wedge between external and internal financing costs provide incentives to speed investment during the start up phase to generate internal cash flows. Our empirical work is motivated by this theoretical framework, where we use commodity prices as a proxy of expected future income streams, and we consider their effect on timing of investment and uncertainty for projects that take time to build.

There is also a group of papers that focus on the empirical counterpart of real options models. In particular, our work is related to the empirical applications that consider large investment projects that take time to build. For instance, Bromander & Åtland (2012) analyse the effect of uncertainty in the case of sequential investment with time to build, using a dataset of electrical power plants in the US. Similarly, Kaldahl & Ingebrigtsen (2014) analyse this effect using a sample of gas power plants, whereas Marmer & Slade (2015) apply the model to calculate the correlation between uncertainty and investment in a sector with irreversible time to build features, using data from the US copper mining sector. Our work considers a more diverse set of investment projects, by expanding the sample to different sectors of the economy, where we evaluate the extent of spillover and uncertainty effects from changes in prices in the mining sector to investment decisions in a variety of sectors.

The duration analysis for cancellation and completion of investment is closely related to Favero et al. (1994). They test the theoretical implications of a model of optimal investment timing and extraction rates for irreversible investment under uncertainty by using a sample of oil fields in the United Kingdom. We apply a similar methodology to our dataset of investment projects in different sectors, in particular, to obtain the effects of timing of completion and cancellation.

Finally, another strand of the literature that relates to our work is the link between terms of trade, investment and economic growth from a macroeconomic perspective that focuses on aggregate data. We complement this by using more granular data at the investment project level. For instance, Mendoza (1997) considers the negative correlation between terms of trade variability and economic growth using a stochastic endogenous growth model, whereas Basu & McLeod (1991) use an open economy stochastic growth model to find that higher uncertainty in terms of trade fluctuations lead to lower expected investment. Our results are consistent with the negative correlation between investment decisions and commodity price volatility.

The paper is organised as follows. Section 2 presents a descriptive analysis of the dataset of investment projects. Section 3 provides details on the empirical frameworks used to analyse the timing and decisions to invest. Section 4 presents the results. Section 5 concludes.

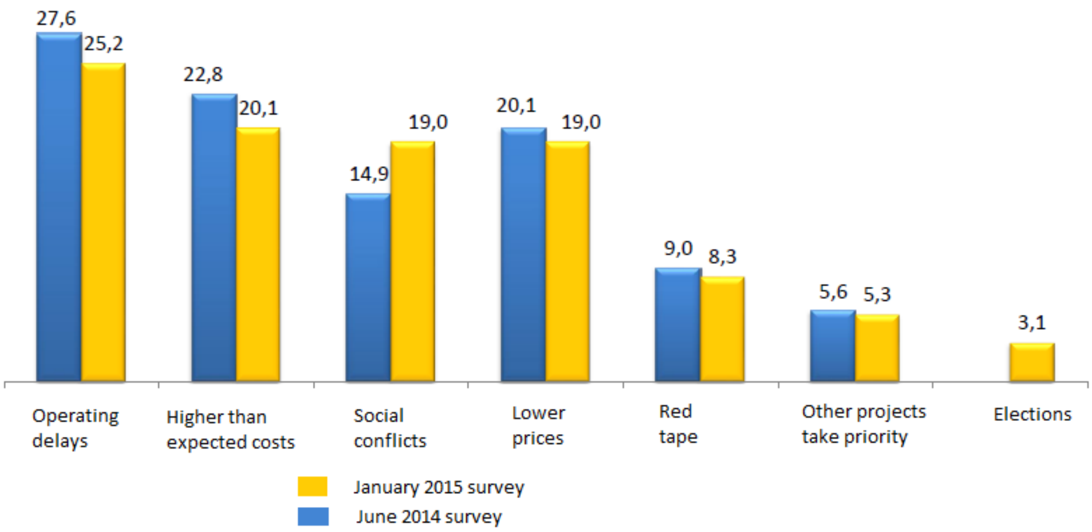
2 Descriptive analysis

The Peruvian economy is a major commodity exporter, especially in the mining sector, with metallic mining production accounting for 12 percent of GDP and mining exports representing 55 percent of total exports[1]. As the revenues of this sector are tightly linked to commodity prices, in particular to that of copper and gold, it is ex-

[1]This figure is calculated with data for 2015 and includes the refinement of mining products.

pected that not only ongoing production and export decisions are affected by commodity price movements, but also the decision to invest in new mining projects and in expanding current investment units.

A first reason why we expect this link between commodity prices and investment can be shown using information from the mining experts survey conducted by the Central Bank of Peru. The survey shows that a drop in commodity prices is perceived by mining sector experts as a very important cause of delays in new mining projects. Figure 1 shows the results from the three most important causes of delays in new mining projects, where 20 percent of experts consider commodity prices as one of the key reasons.



Source: Mining experts survey. Central Bank of Peru.

Figure 1. *Main causes of delay in new mining projects (in percent)*

In order to analyze this effect, we use a novel dataset of investment project announcements that was compiled by the Central Reserve Bank of Peru (BCRP). It considers 1109 announced projects from 2009 to October 2015. The information is obtained from media and public press releases from private firms and from surveys and interviews conducted by the BCRP. It covers investment projects in different sectors of the economy: mining, hydrocarbons, electricity, industrial, agroindustry, telecommunications and others. At each moment in time, each project is in either of four possible states: confirmed, unconfirmed, canceled and completed. We define each category as follows:

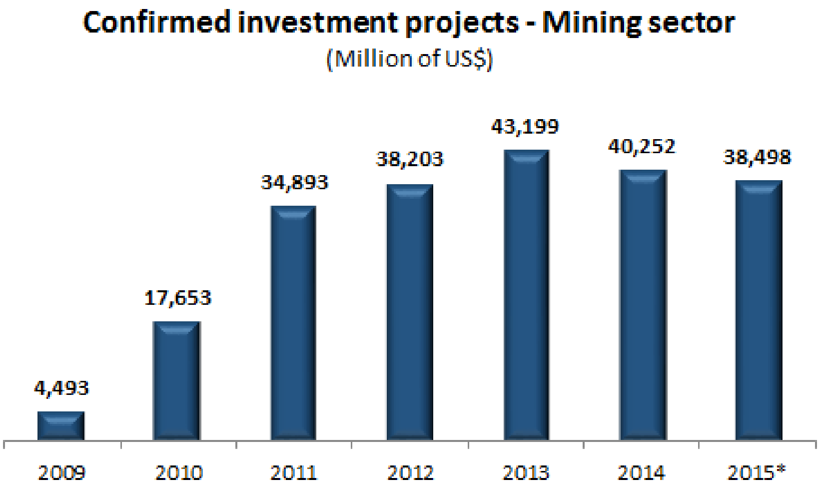
a. Confirmed projects. They have been granted permission and are about to begin implementation. This process of implementation may take some time, even years in some cases, especially for large investment projects in mining, hydrocarbons, electricity or infrastructure sectors. Once confirmed, the investor may decide to continue with its confirmed status or to revise or cancel the project. The project will change status to completed once the investor confirms the beginning of operations.

b. Unconfirmed projects. They are being considered by investors but have not began implementation or have stopped the implementation process. This state is highly linked to regulatory issues and permit requirements required for investors to begin implementation. A confirmed project might switch to unconfirmed when tighter regulatory conditions are required to be fulfilled. As shown later, very few unconfirmed projects switch back to confirmed after this.

c. Canceled projects. Investors have publicly announced that they will not continue implementation. Once canceled, the project is no longer implemented again in the sample period.

d. Completed projects. The implementation process is completed and has began operations.

It is clear that canceled and completed are absorbing states, whereas confirmed, revised and unconfirmed states may switch to each other or to one of the absorbing states. As shown in Figure 2, the amount of investment projects in the mining sector has been increasing during the period of high commodity prices, whereas it shows a slight drop in the last two years of the sample. This result partly considers the completion of some large investment projects such as Las Bambas (copper project), but also the change to unconfirmed status as well as the lack of new investment projects starting implementation.



Source: Central Bank of Peru.

FIGURE 2. *Confirmed investment projects in the mining sector (in million of USD)*

We present a summary table of descriptive statistics for the variables used in our analysis in Table 1.

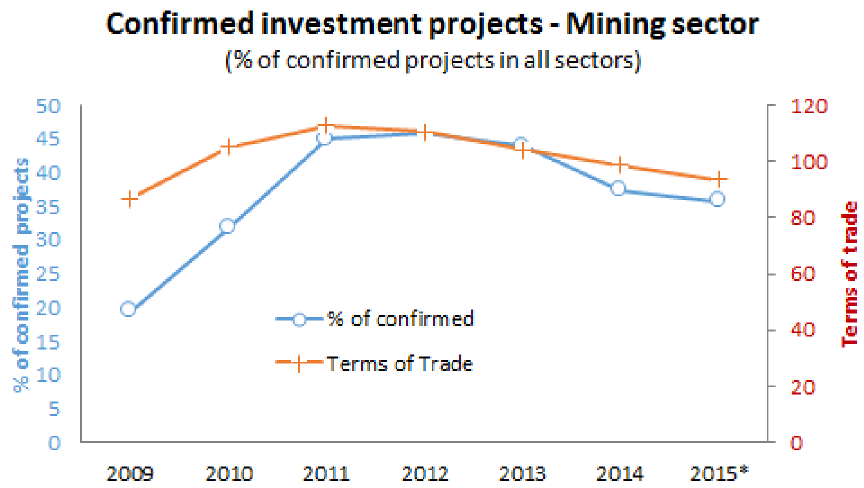
It is also important to note that besides the large drop in aggregate investment in the last two years[2], there has also been a shift in its composition. Figure 3 shows that even though investment projects in the mining sector have contracted, the contraction in confirmed investment projects in other sectors has not been quite as large. This evidence suggests that there has been some reallocation of investment from sectors directly linked to commodity exports to other sectors in the economy.

Tables 2 and Table 3 show the transition of investment projects between possible

[2]Aggregate private investment in Peru fell 2.1 and 4.4 percent in 2014 and 2015, repectively.

I. All Projects					
Variable	Units	Mean	Std. Dev.	Skewness	Kurtosis
Total financing (size)	Million of soles	366.9532	775.2048	3.9975	19.2011
Foreign investment	Million of soles	287.2809	721.2834	4.1344	20.8327
Confirmed projects	Dummy	.6330	.4822	-.5526	-1.6976
Unconfirmed projects	Dummy	.3517	.4777	.6221	-1.6159
II. Projects with time to build					
Variable	Units	Mean	Std. Dev.	Skewness	Kurtosis
Delayed projects	Dummy	.3257	.5097	1.0494	4.0731
Total financing (size)	Million of soles	442.281	916.7544	4.4502	27.1267
Commodity price growth	Yoy var	.4730	3.2403	4.1214	45.0348
Historical volatility	Std dev	2.0511	1.1921	.1655	6.5813
Foreign investment	Million of soles	38031.99	84280.13	4.6035	28.9870
Confirmed projects	Dummy	.3572	.4792	.6374	1.4063
Unconfirmed projects	Dummy	.1631	.3695	2.0687	5.2794
Mining related social conflicts	Number of conflicts	99.1429	11.2382	.5592	1.9392
Total social conflicts	Number of conflicts	279.6883	17.1970	-.3449	1.9308
Time of delay	Months	.3809	3.5989	-77.2773	6136.921
Conditional volatility	Std dev	.02307	.0085	1.3359	5.0371
Number of projects	1109				
Number of periods	77				

Table 1. *Descriptive statistics*



Source: Central Bank of Peru.

Figure 3. *Confirmed investment projects in the mining sector (as percentage of confirmed projects in all sectors)*

states for two different periods: 2012, when commodity prices were relatively high and started the downward trend, and 2015, which is the last available data. What we observe is that the percentage of confirmed investment projects has declined, with a

Initial state	Transition			
	Confirmed	Unconfirmed	Canceled	Completed
Confirmed	56.1	0.9	1.3	5.4
Unconfirmed	0.4	18.4	0.4	0.4
Canceled	0.0	0.0	4.9	0.0
Completed	0.0	0.0	0.0	11.7

Table 2. *Transition between states: 2012*

Initial state	Transition			
	Confirmed	Unconfirmed	Canceled	Completed
Confirmed	44.5	0.0	0.6	0.9
Unconfirmed	0.0	23.2	0.0	0.0
Canceled	0.0	0.0	5.5	0.0
Completed	0.0	0.0	0.0	25.3

Table 3. *Transition between states: 2015*

higher participation of unconfirmed and canceled projects. However, by looking at Table 2, we find some evidence that once commodity prices started declining, there was a change in the composition of investment strategies, with a higher concentration of projects that were transiting to a different state, besides the ones that were completed. This transition happened in both directions: considering as good news those projects that were unconfirmed and became confirmed, but also considering as bad news those which were confirmed and became unconfirmed or canceled.

In the case of confirmed projects, we also separate between the projects that suffer delays from the projects that are being implemented according to the original schedule. We track the particular months in which a firm announces a change in the completion period of the project.[3] We use this subsample of confirmed projects only to analyze the determinants of delays in investment projects. For reference, we show the evolution of delayed projects in total confirmed projects in Figure 4.

In order to analyze the determinants of the decisions to delay an ongoing invest-

[3] In order to build the dummy variable for the delayed state, we will later consider different definitions.

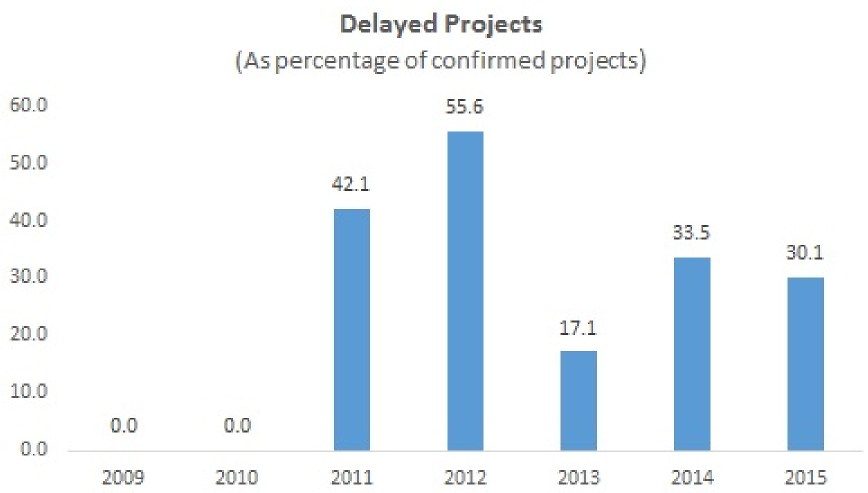
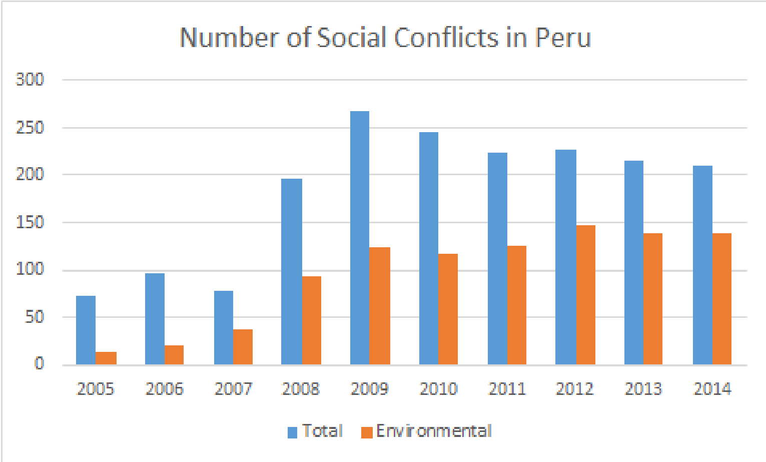


Figure 4. *Delayed projects (as percentage of confirmed projects)*

ment project, first we consider qualitative information from surveys to obtain some possible determinants. As shown in Figure 1 from the Survey of Mining Experts, the four main sources of delays are (i) operating delays, (ii) higher than expected costs, (iii) social conflicts and (iv) lower commodity prices. Given data availability limitations on cost structures by each firm, we further explore the evolution of social conflicts and commodity prices.

In the case of social conflicts, large investment projects are required to obtain several permits related to environmental and social concerns. The approval of these permits are tightly linked to the existence of social conflicts in the region, which either delay or create uncertainty on whether the investment project can be implemented to termination and whether the production process can take place. Figure 5 shows the number of total social and environmental conflicts in all regions of Peru during the sample period. It shows an upward trend in environmental conflicts, which in many cases are related to either ongoing or future projects related to the mining sector.

With regards to commodity prices, media and press releases show some preliminary evidence that mining companies have reduced production and delayed invest-



Source: Peruvian Ombudsman.

Figure 5. *Number of social conflicts in Peru*

ment in new projects due to low commodity prices. As an example, this news from October 2015: "Glencore plans to reduce the production of zinc and suspend operations in Peru: The main reason for the reduction is to preserve the value of Glencore's reserves in the ground at a time of low zinc and lead prices, which do not correctly value the scarce nature of our resources, the company said in a statement".[4]

3 Framework

Simple framework: We start with the analysis of the proportion of confirmed projects to total projects in the mining sector in terms of possible covariates suggested by the description made in the previous section. We consider monthly data from 2009.5 to 2015.10 and run regressions of the form:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 X_t \tag{1}$$

where the dependent variable y_t is the proportion of confirmed mining projects to

[4] See Crispin & Grippa (2015) for more examples of these.

total mining projects and X_t is a vector of covariates at time t. We want to measure two types of covariates. First, covariates related to commodity price fluctuations such as terms of trade, export prices, copper price or the margin between the copper price and copper production cash costs. Second, variables related to social conflicts such as total social conflicts in the country, conflicts related to environmental issues in general and the ratio of environmental to total social conflicts. This regression will provide a first view of the relationship between investment projects and commodity prices as well as the level of social conflictiveness. The drawback of the approach is that we do not account for the changes in states that occur every month. It may be possible that a reduction in commodity prices or an increasing level of social conflictivity or both induce some confirmed projects to be revised, canceled or unconfirmed and therefore explain the reduction in the ratio. But it also may be possible that the reduction in the ratio is due to confirmed projects being completed. Thus, this exercise only provides a partial and incomplete picture of confirmation dynamics.

Logit regression: Another aspect of the analysis concerns the decision to delay investment decisions. In order to do this, we use a panel logit regression with fixed effects where the dependent variable, $delay_{it}$, refers to whether project i has been announced to delay its beginning of operations in time t. It takes a value of 1 if it has been announced to be delayed in the last 12 months and 0 otherwise. The estimated equation takes the following form:

$$delay_{it} = \alpha_{0i} + \alpha_1 growth_{it} + \alpha_2 volat_{it} + \alpha_3 X_{it} \qquad (2)$$

Among the determinants, we consider two variables related to commodity price fluctuations: the year on year percentage change ($growth_{it}$) and the standard deviation of the last 12 months ($volat_{it}$) as a measure of volatility. In the case of mining projects, we consider the price of the main commodity to be extracted from each mining unit (i.e. copper, gold, silver and zinc) and for polymetallic or projects where the main mineral is not identified, we use the terms of trade index. For other sectors, we consider the terms of trade index as the commodity price for all projects.

X_{it} corresponds to a set of control variables, which include:

- $conflict_{it}$ is the number of social conflicts. In the case of mining projects, we consider the geographical location of each project, and use the number of social conflicts by region. For other sectors of the economy, we just consider the aggregate nationwide number of social conflicts.

- $financ_{it}$ is the amount of financial funding for the investment project and includes investment for all the duration of the implementation process, both the amount that has already been disbursed as well as what is expected to be required to complete the project. This variable is a proxy of the size of the investment project.

- fdi_{it} is the amount of funding that comes from foreign investors and which is categorized as foreign direct investment in the balance of payments accounts.

- $volatn_{it}$ is the volatility of commodity prices in periods of a downward trend in these prices. We add this as an extra variable to analyze if there is a differentiated effect due to uncertainty vs the willingness to speed up investment to reap on the benefits in good times.

Competing risks framework: The dataset resembles duration data, we track each project since the moment the confirmed status runs, the implementation of the confirmed project goes on until either of two terminal events or risks occur: (i) projects are completed and therefore ready to be put in operation or (ii) projects are canceled. In the dataset, some projects do not show either of these two terminal events because there is right censoring. We may only see those events if we extend the data to the future.

The implementation stage has a clear starting point, the month where it first appears in the data. It appears usually with the status of confirmed or unconfirmed. Within this implementation period confirmed/unconfirmed projects may switch to a revision status or switch to unconfirmed/confirmed status. In this first exercise we treat all this implementation period as one state. Just as the diverse symptoms a patient that just arrives at the hospital has during the course of the treatment. In this hospital example, the two terminal risks usually analyzed are the time of discharge from the hospital and the time of death.

Therefore, just like survival or duration analysis we can study the probabilities of duration until failure time but in this case, there are two competing causes that explains when a project ceases to be a project. The two workhorses in competing risk analysis are the cumulative incidence functions (CIFs) and competing risk regressions. These two objects resemble the estimation of survival functions and the Cox proportional hazard model in standard survival analysis.

The cause-specific cumulative incidence function (CIF), also known as sub-distribution function is defined for example in Lawless (2011). Let T be the project duration time until failure and let j be a cause of failure, the the CIF due to cause $J = j$ is

$$F_j(t) = Pr(T \leq t, J = j) = \int_0^t \lambda_j(u) S(u) du \tag{3}$$

where $S(t) = Pr(T \geq t) = \exp(-\Lambda(t))$, with $\Lambda(t) = \sum_j^2 \int_0^t \lambda_j(t)$. In this last expression $\lambda_j(t)$ are the cause-specific hazard ratio defined as

$$\lambda_j(t) = \lim_{\triangle t \to 0} \frac{Pr[t \leq T < t + \triangle t, J = j \mid T \geq t]}{\triangle t} \tag{4}$$

This is an instant probability of failure due to cause j conditional the project is ongoing up to time t. The CIF represents the expected proportion of projects experiencing a certain competing event over the course of time. In other words, it is the probability of failure from cause j until time t in the presence of all other possible causes. It depends on the cause-specific hazards for all other causes.

To see the effects of covariates, we put attention to two objects; cause-specific hazard modeling or sub-distribution modeling. The proportional cause-specific hazard model with covariates takes the form

$$\lambda_k(t \mid x, \beta_k) = \lambda_0(t) \cdot g_k(x, \beta_k), \qquad k = 1, 2, \quad \beta_k \in \mathbb{R}^{p_k} \tag{5}$$

where $g_k : \mathbb{R}^p \times \mathbb{R}^{p_k} \mapsto [0, \infty]$, with $g_k(1, 0) = 0$ for all x

And the sub-distribution hazard modeling starts with the definition of the CIF for cause j given covariates x

$$F_j(t \mid x) = P(T \leq t, J = j \mid x) \tag{6}$$

The analysis is done via the sub-distribution hazard function, so that

$$F_j(t \mid x) = 1 - \exp\left(- \int_0^t \lambda_j(s \mid x) ds \right) \tag{7}$$

Fine & Gracy (1999) assumes the Cox regression of the form

$$F_j(t \mid x) = 1 - \exp\left(-\Gamma_j(t) exp(x\beta_k) \right) \tag{8}$$

In sum, we are interested in estimating the shape of non-parametric CIFs as in equation 3 and sub-distribution hazard regression as in 8.

4 Results

4.1 Confirmed investment projects

We start the analysis by getting a first grasp of how fluctuations in commodity prices have directly affected the decision of firms in the mining sector to go ahead and implement their long-term investment decisions. For this, we consider the evolution of the aggregate participation of investment projects across time, and its relationship with commodity prices by sector. Table 4 presents the results of a regression considering the participation of confirmed projects in the dataset of investment projects in the mining sector as described in equation 1.

Among the regressors in X_t in equation 1 we consider three alternative social conflict variables: the total amount amount of social conflicts, the total amount of environmental conflicts and the ratio of environmental conflicts to total conflicts. We also consider two alternative variables that proxy the evolution of commodity prices. The first is the variable margin, this variable is constructed as the difference of the copper price against its average cash cost in Peru. The second is the log of the Peruvian terms of trade. A fall in copper prices is associated to a reduction of both, the price margin and the terms of trade.

The results show that reduction in copper prices or a fall in the terms of trade appears to have a negative effect in confirmed mining investment projects. These effect tend to be significant in three out of the six specifications presented in table 4. In addition, social conflictivity affects the proportion of confirmed projects but their impact in these regressions is not significant. The sign of the social conflict effect over confirmed projects is negative suggesting that a rise in the level of social conflicts

	Dependent variable:					
	y=proportion of confirmed mining projects					
	(1)	(2)	(3)	(4)	(5)	(6)
lag_y	0.894***	0.894***	0.886***	0.872***	0.884***	0.884***
	(0.054)	(0.067)	(0.059)	(0.058)	(0.069)	(0.069)
Conflicts	−0.032			−0.005		
	(0.042)			(0.041)		
Env. conflicts		0.009			−0.017	−0.017
		(0.066)			(0.054)	(0.054)
Conflict ratio			0.032			
			(0.061)			
Margin	0.012*	0.011	0.013*			
	(0.006)	(0.008)	(0.007)			
Log terms of trade				0.095*	0.087	0.087
				(0.051)	(0.058)	(0.058)
Constant	0.212	−0.002	0.024	−0.328	−0.243	−0.243
	(0.234)	(0.314)	(0.046)	(0.331)	(0.430)	(0.430)
Observations	77	77	77	77	77	77
R^2	0.811	0.809	0.810	0.810	0.810	0.810
Adjusted R^2	0.803	0.801	0.802	0.802	0.802	0.802
Residual Std. Error (df = 73)	0.032	0.032	0.032	0.032	0.032	0.032
F Statistic (df = 3; 73)	104.148***	103.203***	103.655***	103.514***	103.661***	103.661***
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 4. *The effects of commodity prices over the proportion of confirmed mining projects*

reduce the proportion of confirmed projects.

This exercise is a first exploration suggesting the importance of commodity price movements and social conflictivity on the decision of firms to confirm the execution of the investment project. However, as we will see later, the reasons behind the transition of a confirmed project to a terminal project, either to a completion or cancelation state is important.

In addition, we implement a more granular analysis of the data, by exploring the impact of commodity prices on the decisions of confirm/revise each investment project separately. For this analysis, we also consider projects in different sectors of the economy, and separate it between mining projects, which are more closely linked to commodity prices, and other sectors of the economy, which might indirectly receive spillover effects.

Basically, we consider two variables that account for the effect of commodity prices on this decision, the variation and the volatility. When considering the mining sector, we consider the price of the mining product that would be extracted at that particular project. In other cases, we consider the terms of trade index. For the measure of commodity price volatility, we consider two indicators: historical volatility, based on the standard deviation of the past 12 months, and conditional volatility, obtained by estimating a garch model[5]. The results are shown in Table 5.

If we consider all sectors in our estimation, we find that a fall in commodity prices and lower commodity price volatility increase the probability of unconfirmed projects. Higher prices lead to an increase in expected revenues and profitability of mining investment projects and create a positive spillover effect on other sectors of the economy through an income effect. The results on volatility must be considered jointly with its effect on the decision to delay. Higher uncertainty seem to be more related to larger in-

[5]We use the garch specification that provides the best fit, which in our case is given by garch(2,3) for the price of copper and garch(2,2) for the price of gold.

Prob (uncofirmed)						
	Historic volatility			Conditional volatility		
	Mining	Other	All sectors	Mining	Other	All sectors
Marginal effects						
Comm price growth	$-0.0023^{\star}$	$-5.8e-5^{\star}$	$-0.0021^{\star}$	$-0.0149^{\star}$	-0.0860	-0.0016
Comm price volatility	$-0.0499^{\star}$	$-8.3e-5^{\star}$	$-0.0062^{\star}$	$-0.1044^{\star}$	$-6.8e-5^{\star}$	$-0.0018^{\star}$
Social conflicts(total)	$0.0011^{\star}$	$4.0e-6^{\star}$	$0.0002^{\star}$	$0.0013^{\star}$	$0.0001^{\star}$	$0.0015^{\star}$
Foreign ownership	$-2.2e-6^{\star}$	$-2.0e-8^{\star}$	$-1.6e-6^{\star}$	$-5.9e-6^{\star}$	$-1.4e-6^{\star}$	$-2.0e-5^{\star}$
Total financing (size)	$0.0003^{\star}$	$2.8e-6^{\star}$	$0.0002^{\star}$	$0.0007^{\star}$	$0.0002^{\star}$	$0.0024^{\star}$
LRchi2	465.02	3196.63	2903.57	418.18	3211.44	3021.06
Obs	3080	7854	10934	3080	7854	10934
Projects	40	102	142	40	102	142

* denotes that the coefficient is statistically significant at the 5 percent level.

Table 5. *Marginal effects on the probability of unconfirmed projects in all sectors of the economy.*

centives to delay a project rather than cancel or revise the decision to invest. Another interesting feature is that social conflictivity increases the probability of revising or unconfirming an investment project, which was captured by the results from the mining expert survey. These results are robust to changes in the indicator of commodity price volatility.

When we separate the sample between investment projects in the mining sector and other sectors of the economy, as shown in Table 5, we observe that commodity price variations and volatility have larger impacts on the probability of being unconfirmed in the mining sector, as their profitability is more directly affected by commodity prices.

4.2 Delayed investment projects

Another aspect of the investment decision, especially relevant in projects that take time to build, is whether it is implemented on time. Therefore, we present the results for the determinants of delays in investment projects by sector in Table 6.

Commodity prices have a significant impact on the decision to delay an investment project, both in terms of variations and volatility. On one hand, an increase in commodity prices lead to a lower probability of delay, because the commodity price in the case of the mining sector directly affects the future profitability of the project. Higher commodity prices increase revenues when operations begin and minerals are exported, so there is an extra incentive for firms to speed up investment and benefit from a cycle of high commodity prices. In particular, an increase in commodity prices by 1 percent in the last 12 months reduces the probability of delay in the mining sector by 0.2 percent, compared to a non insignificant effect on other sectors of the economy, when considering conditional volatility measures for uncertainty.

	Historic volatility			Conditional volatility		
Prob (delay)	Mining	Other	All sectors	Mining	Other	All sectors
Marginal effects						
Comm price growth	$-0.0022^{\star}$	$-0.0069^{\star}$	$-0.0176^{\star}$	$-0.0017^{\star}$	0.0208	$-0.0135^{\star}$
Comm price volatility	$-0.0055^{\star}$	$0.0018^{\star}$	0.0016	$-0.0075^{\star}$	$-0.0011^{\star}$	$-0.0011^{\star}$
Volatility (downward)	$0.0036^{\star}$	-0.0089	0.0051	$0.0062^{\star}$	0.0001	$0.0003^{\star}$
Social conflicts(total)	$0.0002^{\star}$	$-0.0016^{\star}$	$0.0007^{\star}$	$0.0002^{\star}$	-0.0001	$0.0014^{\star}$
Foreign ownership	$1.6e-7^{\star}$	$1.3e-6$	$5.8e-7^{\star}$	$2.1e-7^{\star}$	$-6.2e-9$	$9.7e-7$
Total financing (size)	$-1.7e-5^{\star}$	$6.3e-5$	$-3.6e-5$	$-2.2e-5^{\star}$	$5.2e-5$	$-8.9e-5$
LRchi2	334.57	78.00	218.14	364.10	115.20	294.71
Obs	2900	4285	7185	2900	4285	7185
Projects	54	88	142	54	88	142

* denotes that the coefficient is statistically significant at the 5 percent level, ** at the 10 percent level.

Table 6. *Marginal effects: Probability of delay in investment projects in all sectors of the economy*

On the other hand, the effect of higher uncertainty of commodity prices depends on whether prices are on an upward or downward trend. Related literature mentions two effects of uncertainty. First, higher uncertainty create incentives for investors to wait and obtain more information before making the decision to invest, as if they have a valuable call option that is lost once the irreversible investment decision is made. However, for investment projects that take time to build and funds must be committed up front, investors also have a put option on the flexibility of the time of completion, which create incentives to speed up investment.[6] Our results show that the second effect of increasing incentives to invest dominates, as there is a lower probability of delay when volatility increases. However, the first effect of desincentivising investment is relevant for periods where commodity prices are declining.

Quantitative results for variables related to commodity price volatility show that, in times of increasing commodity price (good news), an increase in volatility by 1 percent reduces the probability of a delay in the mining sector by 0.6 percent, whereas in times of bad news the reduction in the probability of delay falls to only 0.2 percent. However, for other sectors of the economy, we only find that the higher uncertainty effect of commodity price volatility increases the probability of delay.

Additional results from the control variables show that larger projects have lower probability of delay. This might be related to the fact that these projects usually involve large sums that are irreversible and can therefore be categorized as a sunk cost. Once part of the investment has already been disbursed, firms would be less likely to delay the beginning of operations as they would like to reap on the income from the mineral extraction as soon as possible.

We also calculate the marginal effects by changing the variable related to social conflicts, by considering only the ones directly related to the mining sector, given that these are directly related to the sector. Results are robust in terms of the social conflictivity variable as well as for the price volatility indicator. This is shown in Table 7.

Now we focus our attention on mining projects only and analyse if there is a differentiated impact of commodity prices on the revised completion dates when an investment project is delayed, and whether more abrupt commodity price fluctuations

[6]See Bar-Ilan & Strange (1996). In that model the intuition is that the opportunity cost of delays increase with uncertainty because if good news take place, then the firm cannot benefit from it if it has not started the investment process.

Prob(delay) in the mining sector

	(1)	(2)	(3)	(4)
Marginal effects				
Comm price growth	$-0.0022^{\star}$	$-0.0138^{\star}$	$-0.0017^{\star}$	$-0.0098^{\star}$
Historical price volatility	$-0.0055^{\star}$	$-0.0469^{\star}$	-	-
Historical volatility (downward)	$0.0036^{\star}$	$0.0466^{\star}$	-	-
Conditional price volatility	-	-	$-0.0075^{\star}$	$-0.0040^{\star}$
Conditional volatility (downward)	-	-	$0.0062^{\star}$	$0.0062^{\star}$
Social conflicts(total)	$0.0002^{\star}$	-	$0.0002^{\star}$	-
Social conflicts(mining)	-	$0.032^{\star}$	-	$0.0028^{\star}$
Foreign ownership	$1.6e-7^{\star}$	$1.8e-6^{\star}$	$2.1e-7^{\star}$	$1.8e-6^{\star}$
Total financing (size)	$-1.7e-5^{\star}$	$-0.0002^{\star}$	$-2.2e-5^{\star}$	$-0.0002^{\star}$
LRchi2	334.57	312.42	364.10	342.57

* denotes that the coefficient is statistically significant at the 5 percent level.

Table 7. *Marginal effects: Probability of delay in investment projects in the mining sector*

lead to longer delay horizons[7]. For this, we constructed a dependent variable with the number of months between the revised expected and original dates of completion.

Mining sector: Announced delay (in number of months)

	Historic volatility			Conditional volatility	
	(1)	(2)	(3)	(4)	(5)
Comm price growth	$-0.0285^{\star}$	$-0.0076^{\star\star}$	0.0032	$-0.0074^{\star}$	0.0021
Comm price volatility	-0.0141	$-0.0612^{\star}$	$-0.0319^{\star}$	$-0.0713^{\star}$	0.0004
Comm price volatility (downward)	—	$0.0683^{\star}$	$0.0324^{\star}$	$0.0944^{\star}$	$0.0006^{\star}$
Foreign ownership	$1.9e-6$	$2.4e-6^{\star}$	$2.8e-6^{\star}$	$2.7e-6^{\star}$	$2.9E-6^{\star}$
Total financing (size)	$-0.0003^{\star}$	-0.0001	$-0.0002^{\star}$	$-0.0003^{\star}$	$-0.0025^{\star}$
Conflict (total)	$0.0030^{\star}$	$0.0025^{\star}$	-	$0.0025^{\star}$	-
Mining conflicts	-	-	$0.0134^{\star}$	-	$0.0130^{\star}$
F-test	27.35	30.54	73.33	37.71	76.17
R2	0.1020	0.0645	0.1162	0.0634	0.1202

* denotes that the coefficient is statistically significant at the 5 percent level, ** at the 10 percent level.

Table 8. *Determinants of announced delays of investment in the mining sector.*

Table 8 shows the results. A longer delay for the expected time of completion is expected following a reduction in commodity prices and an increase in commodity price volatility, consistent with the effects on the probability that an investment project is

[7]We also analysed the delay period with respect to the original date of expected completion for projects in other sectors but did not find evidence of different timings in the delays.

delayed. Therefore, the two results show that a period of falling commodity prices with sharp fluctuations not only increases the chance that the project takes more time to be implemented but it will start its operations in a much longer period of time. Regarding other project specific determinants, we find that social conflictivity increases the time of delay whereas larger projects tend to be implemented in a shorter period of time.

Another exercise that we considered is the existence of a differentiated effect between small and large investment projects. For this, we separated the projects in two groups according to the size of total financing. We established the threshold at the median of the distribution of projects in our database. We focused on the effect of commodity price growth and volatility of small and large investment projects. Table 9 shows the results.

Prob(delay)	Historic Volatility	Conditional Volatility
Marginal effects		
Comm price growth	$-0.0066^{\star}$	$-0.0029^{\star}$
Comm price growth (big)	$0.0054^{\star}$	0.0015
Comm price volatility	$-0.0051^{\star}$	$-0.0071^{\star}$
Comm price volatility (big)	-0.0011	0.0000
Comm price volatility (downward)	$-0.0027^{\star}$	$0.0031^{\star\star}$
Comm price volatility (downward, big)	$0.0085^{\star}$	$0.0038^{\star}$
Foreign ownership	$1.9e-7^{\star}$	$2.1e-7^{\star}$
Total financing (size)	$-1.9e-5^{\star}$	$-2.2e-5^{\star}$
Conflict	$0.0002^{\star}$	$0.0002^{\star}$
LR	370.68	368.86
Obs	2900	2900
Projects	54	54

* denotes that the coefficient is statistically significant at the 5 percent level, ** at the 10 percent level.

Table 9. *Marginal effects: Probability of delay. Differentiated effects between big and small projects.*

Results show the existence of differentiated effects for larger projects especially in the mining sector. The probability of a large mining project being delayed is less sensitive to commodity price fluctuations, where a one percent increase in commodity prices leads to a 0.6 percent lower probability of being delayed for small projects, but only to a 0.1 percent reduction for large projects. In the case of commodity price volatility, the size of the project is only relevant when there is a downward trend in prices, as larger projects are more sensitive to be delayed in such circumstances.

4.3 Competing risk regressions

In this part we track the project status in implementation as confirmed, unconfirmed or under revision and account for the time until either cancelation or completion time. As Table 10 show, most of the observations are censored, which means that until the end of the sample, the projects have not failed (completed or canceled) yet. Another important feature of Table 10 is that almost all of the projects belong to the sector labeled "other" which comprises for example the construction of hotels, university campuses, shopping malls and the like.

	Sector	Censored	Canceled	Completed
1	Agro-industry	40	0	3
2	Electricity	73	2	26
3	Hydrocarbon	54	1	15
4	Industry	88	2	18
5	Infrastructure	56	3	18
6	Mining	86	3	18
7	Other	483	2	75
8	Fishing	10	0	4
9	Telecom	27	0	2

Table 10. *Number of projects according to status*

On the other hand, Table 11 shows the average time of project according to status. Projects in the infrastructure and mining sectors are the ones that maintain their status of implementation for more time, consequently at the end of the sample size of 82 months, these projects are censored. Also, we can notice that mining projects have been canceled earlier.

Sectors	Censored	Canceled	Completed
Agro-industry	34.3		15.3
Electricity	36.3	16.0	38.1
Hydrocarbon	39.6	25.0	26.1
Industry	34.8	20.0	25.7
Infrastructure	43.7	7.0	25.9
Mining	45.4	38.3	26.1
Other	32.5	25.0	16.2
Fishing	35.2		16.3
Telecom	36.0		37.0

Table 11. *Average time of projects according to status*

Cumulative incidence functions: With this type of competing risk data by sectors, we first estimate the CIFs by sector as shown in Figure 6. The figure shows that probabilities of both competing risks according to project age in each sector. In all cases, completion is more likely than cancelation. In general, the probability of project cancelation is low, below ten percent and only in mining and infrastructure they rich to about five percent. In the mining sector, the probability of cancelation smoothly increases as project age grows. In the infrastructure sector, cancelation probability only rises during the initial months.

Regarding completion probabilities, the mining sector probability only rises to about 25 percent at the end of the sample. In general all completion probabilities end up at about 30 percent except the electricity sector probabilities which end up in about 60 percent after 82 months of project implementation. This feature is the result of the huge amount of censoring in the data. It is not possible to know whether the shape of the CIFs bend upwards in the next five years after the sample or if they will keep their concave pattern.

Proportional sub-distribution hazard regressions: Now we perform the regression described in equation 8. The results are shown in tables A-1 through A-10 in appendix

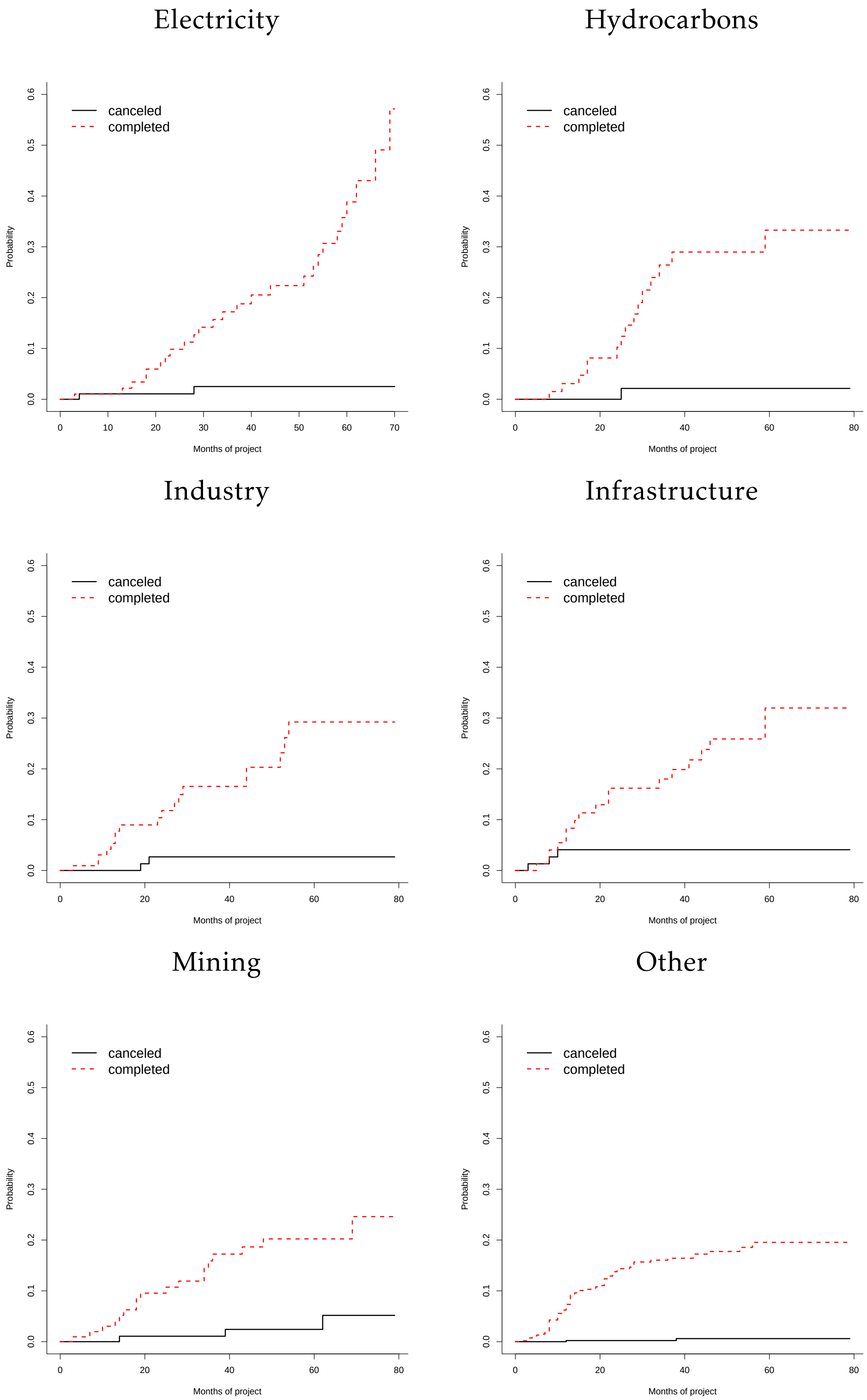


Figure 6. *Cumulative incidence function by sector*

A. Given the small number of canceled observations, the results about cancelations may not be robust. However, the results about duration of project until completion are more meaningful.

In all regressions, we used three covariates for each project. First, a variable linked to commodity price variations since the inception of the project until failure time. In the case of censoring the change is from the project inception time to the final observation. In all cases we use the logarithmic change in the general export price index except for the mining sector where the change in margins is used. The second covariate used is the size of foreign investment associated to the project at the time of failure or censoring time. The third variable is the change in the environmental conflict ratio from inception to failure or censoring.

The key result is that an fall in export prices or a fall in margins reduce the probability of completion in all sectors of the economy. This results is compatible with previous results presented in the paper and highlight the important role of export prices to speed up projects, even if the particular investment project is not directly related to the commodity sector. The fall in the completion probability may be due to delays associated with the reduction of profitability as shown in the previous subsection.

Also, an important result is that a rise in the proportion of environmental conflicts reduce significantly the probabilities of completion in all sectors except electricity. A rise in environmental conflicts may be linked to a rise in total costs associated to the project that produces delays and hinders completion.

To further examine the effect of commodity prices on the two competing events in the mining sector, we graph the predicted CIF curves under a benchmark case compared to a counterfactual situation for the values of the covariates. In the benchmark case, the covariates for the mining sector are the average levels. In the base case, foreign direct investment associated to the project is USD 527 millions, margins have decreased in 26 percent and the conflicivity ratio has increased 21 percent. In the counterfactual case we keep all based values but the margins. Specifically, margins do not fall in the counterfactual case.

The results are shown in Figure 7. As observed, if margins had not fallen, the completion probabilities would have doubled towards the end of the fifth year from 20 to 40 percent. The same happens with the cancelation probabilities but the probabilities are so small that statistically they might be the same.

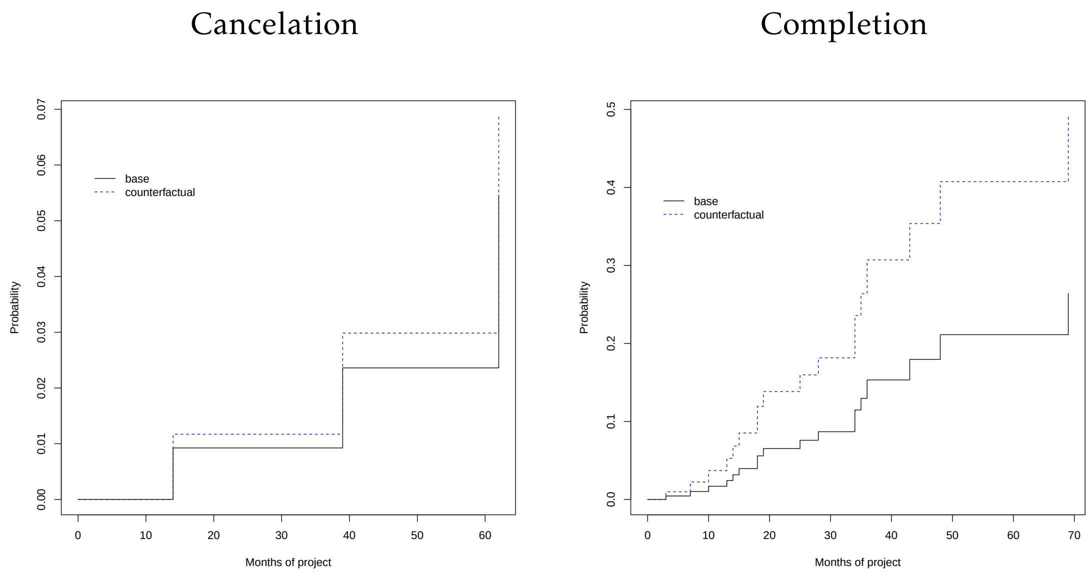


Figure 7. *Predicted CIFs under base and counterfactual case*

5 Conclusions

This paper uses a novel dataset of investment project states at the project levels across sectors in the Peruvian economy since 2009 to October 2015. A number of models are run to uncover basic features and relationships with covariates. In particular the paper is interested on the effect of commodity prices on investment projects in general and mining investments in particular.

Commodity prices are highly relevant for investment project decisions by firms, not only in sectors whose profitability is directly affected by them(ie mining sector in Peru), but also create spillover effects in other sectors of the economy as well. A decrease in commodity prices and higher commodity price volatility in bad times leads to an increase in the probability for a project to be unconfirmed. Mining projects are quantitatively more affected by commodity prices, as expected profitability in other sectors come only through spillover effects.

In the case of delays of investment projects that are already being implemented, this decision is also affected by the evolution of commodity prices, by both growth rates and volatility. In the case of volatility, higher uncertainty increases incentives to postpone projects for all sector of the economy. However, a second effect that is relevant in the case of the mining sector is that the possibility of better news than expected leads to higher incentives to start production and reap on the benefits of this in terms of higher profits.

Once an investment project implementation is ongoing, the probability that a firm chooses to delay its completion and start production is also affected by the evolution of commodity prices. For the mining sector, both commodity price growth rates and volatility matter, whereas the delay probability is only affected by volatility for other sectors. An increase in commodity prices reduce incentives to delay by affecting the expected profitability of the project. In the case of volatility, if taken as a measure of uncertainty, higher volatility leads to more incentives to postpone or delay investment. However, a second effect that is relevant in the case of the mining sector is that the possibility of better news than expected leads to higher incentives to start production and reap on the benefits of this in terms of higher profits.

Last but not least, commodity prices do have a negative strong and statistically significant effect on the probability of project completion in all sectors. Particularly in the mining sector.

Future avenues of research point to considering the transmission mechanisms that generates the spillover effect to other sectors of the economy. In particular it would be interesting to analyse the interaction between mean and volatility spillovers in the context of multivariate volatility models, following the methodology proposed by Serletis and Xu (2016, 2017). They find that VARMA, GARCH-in-Mean and BEKK models confirm the presence of spillover effects using oil, gas and coal prices. An extension of this to other types of metals that are the main commodity exports of other countries in the region, such as copper, would be of particular interest.

Also, given that commodity price volatility generates higher uncertainty and incentives to delay or cancel an investment project, identifying the transmission channel would be key to target policy recommendations that could ameliorate the effect of commodity price shocks on aggregate investment and its implications on long term growth potential. One possible channel is through the existence of input output linkages between the mining sector and other sectors of the economy, as investment in new mining units would, for instance, require complementary investment in infrastructure and electricity.

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Appendix

A Tables

	coef	exp(coef)	se(coef)	z	p-value
Foreign finance	-0.81	0.45	0.06	-12.5	0
Growth of export prices	0.67	1.95	0.03	25.0	0
Growth of conflict ratio	-8.15	0.00	0.46	-17.8	0
	exp(coef)	exp(-coef)	2.5%	97.5%	
Foreign finance	0.45	2.24	0.39	0.51	
Growth of export prices	1.95	0.51	1.85	2.06	
Growth of conflict ratio	0.00	3469.54	0.00	0.00	

Table A-1. *Electricity: Cancellation regression*

	coef	exp(coef)	se(coef)	z	p-value
Foreign finance	-0.00	0.10	0.00	-1.74	0.08
Growth of export prices	0.03	1.03	0.01	2.88	0.00
Growth of conflict ratio	-0.02	0.99	0.02	-0.93	0.35
	exp(coef)	exp(-coef)	2.5%	97.5%	
Foreign finance	1.00	1.00	1.00	1.00	
Growth of export prices	1.03	0.98	1.01	1.04	
Growth of conflict ratio	0.99	1.02	0.95	1.02	

Table A-2. *Electricity: Completion regression*

	coef	exp(coef)	se(coef)	z	p-value
Foreign finance	-0.00124	0.999	0.00106	-1.174	0.2400
Growth of export prices	-0.00778	0.992	0.04010	-0.194	0.8500
Growth of conflict ratio	-0.32661	0.721	0.10534	-3.101	0.0019
	exp(coef)	exp(-coef)	2.5%	97.5%	
Foreign finance	0.999	1.00	0.997	1.001	
Growth of export prices	0.992	1.01	0.917	1.073	
Growth of conflict ratio	0.721	1.39	0.587	0.887	

Table A-3. *Hydrocarbons: Cancelation regression*

	coef	exp(coef)	se(coef)	z	p-value
Foreign finance	-0.000565	0.999	0.000294	-1.92	0.05500
Growth of export prices	0.043446	1.044	0.011613	3.74	0.00018
Growth of conflict ratio	-0.096925	0.908	0.029413	-3.30	0.00098
	exp(coef)	exp(-coef)	2.5%	97.5%	
Foreign finance	0.999	1.001	0.999	1.000	
Growth of export prices	1.044	0.957	1.021	1.068	
Growth of conflict ratio	0.908	1.102	0.857	0.961	

Table A-4. *Hydrocarbons: Completion regression*

	coef	exp(coef)	se(coef)	z	p-value
Foreign finance	-0.000865	0.999	0.00173	-0.501	6.2e-01
Growth of export prices	0.036612	1.037	0.00887	4.126	3.7e-05
Growth of conflict ratio	-0.020403	0.980	0.04410	-0.463	6.4e-01
	exp(coef)	exp(-coef)	2.5%	97.5%	
Foreign finance	0.999	1.001	0.996	1.00	
Growth of export prices	1.037	0.964	1.019	1.06	
Growth of conflict ratio	0.980	1.021	0.899	1.07	

Table A-5. *Industry: Cancelation regression*

	coef	exp(coef)	se(coef)	z	p-value
Foreign finance	-0.000756	0.999	0.000884	-0.856	3.9e-01
Growth of export prices	0.030492	1.031	0.004457	6.842	7.8e-12
Growth of conflict ratio	-0.098769	0.906	0.033534	-2.945	3.2e-03
	exp(coef)	exp(-coef)	2.5%	97.5%	
Foreign finance	0.999	1.00	0.998	1.001	
Growth of export prices	1.031	0.97	1.022	1.040	
Growth of conflict ratio	0.906	1.10	0.848	0.967	

Table A-6. *Industry: Completion regression*

	coef	exp(coef)	se(coef)	z	p-value
Foreign finance	0.000193	1.000	0.00185	0.104	0.92000
Growth of export prices	0.041986	1.043	0.01254	3.348	0.00081
Growth of conflict ratio	-0.081508	0.922	0.03061	-2.663	0.00770
	exp(coef)	exp(-coef)	2.5%	97.5%	
Foreign finance	1.000	1.000	0.997	1.004	
Growth of export prices	1.043	0.959	1.018	1.069	
Growth of conflict ratio	0.922	1.085	0.868	0.979	

Table A-7. *Infrastructure: Cancelation regression*

	coef	exp(coef)	se(coef)	z	p-value
Foreign finance	0.000831	1.001	0.000637	1.30	1.9e-01
Growth of export prices	0.048407	1.050	0.008055	6.01	1.9e-09
Growth of conflict ratio	-0.056433	0.945	0.020004	-2.82	4.8e-03
	exp(coef)	exp(-coef)	2.5%	97.5%	
Foreign finance	1.001	0.999	1.000	1.002	
Growth of export prices	1.050	0.953	1.033	1.066	
Growth of conflict ratio	0.945	1.058	0.909	0.983	

Table A-8. *Infrastructure: Completion regression*

	coef	exp(coef)	se(coef)	z	p-value
Foreign finance	-0.000441	1.000	0.000415	-1.062	0.29
Margin	0.009080	1.009	0.012809	0.709	0.48
Growth of conflict ratio	-0.039287	0.961	0.030111	-1.305	0.19
	exp(coef)	exp(-coef)	2.5%	97.5%	
Foreign finance	1.000	1.000	0.999	1.00	
Margin	1.009	0.991	0.984	1.03	
Growth of conflict ratio	0.961	1.040	0.906	1.02	

Table A-9. *Mining: Cancelation regression*

	coef	exp(coef)	se(coef)	z	p-value
Foreign finance	0.00	1.000	0.000312	0.139	8.9e-01
Margin	0.03	1.031	0.006678	4.522	6.1e-06
Growth of conflict ratio	-0.07	0.933	0.020699	-3.343	8.3e-04
	exp(coef)	exp(-coef)	2.5%	97.5%	
Foreign finance	1.000	1.00	0.999	1.001	
Margin	1.031	0.97	1.017	1.044	
Growth of conflict ratio	0.933	1.07	0.896	0.972	

Table A-10. *Mining: Completion regression*

B Graphs

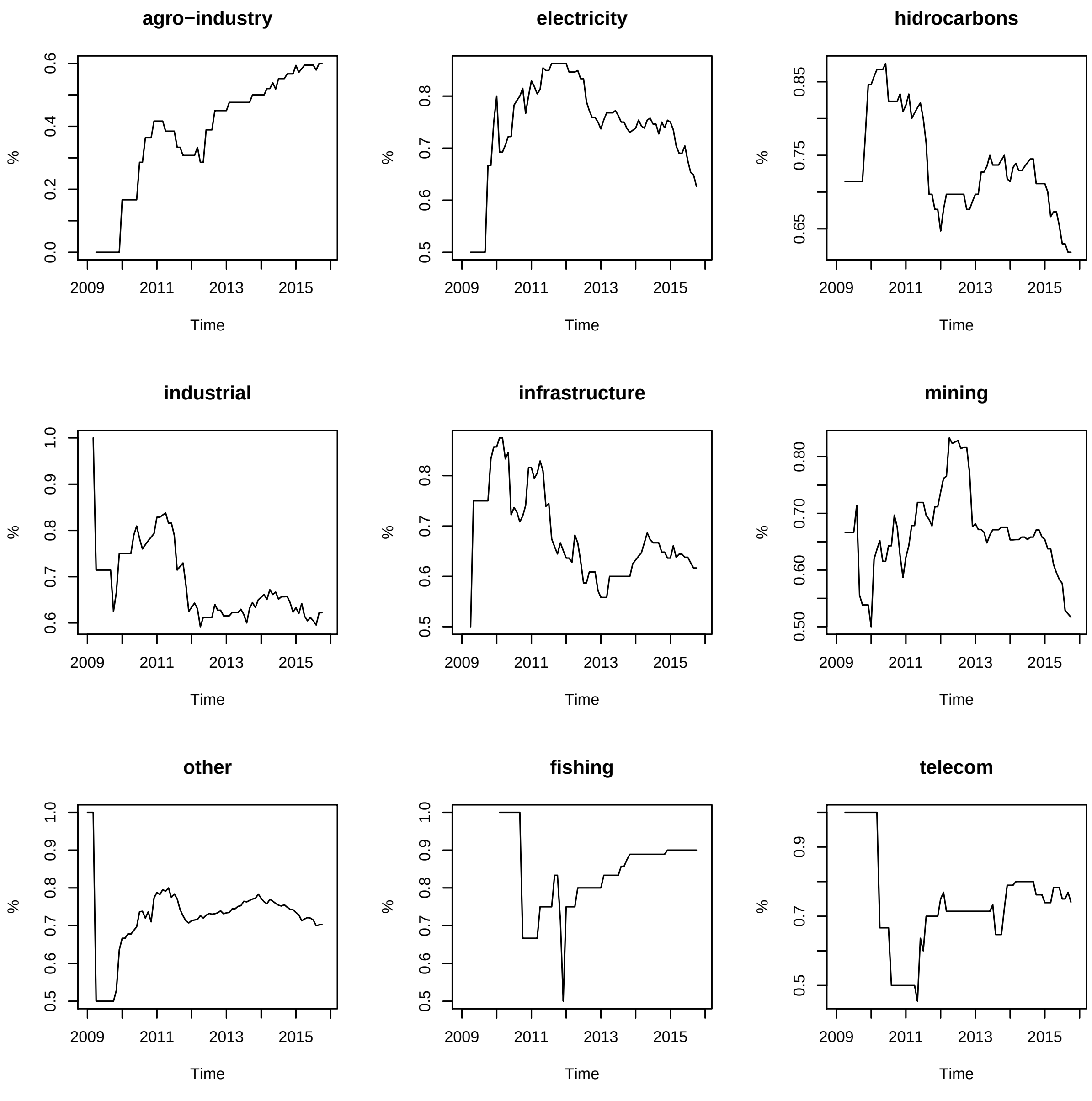

Figure B-1. *Proportion of confirmed projects to total projects in each sector*

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