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Impact of economic uncertainty in a small open economy: the case of Chile

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ABSTRACT

We construct the first news-based economic uncertainty index for Chile, which allowed us to rebuild 23 years of the history of economic uncertainty in the country and quantify its impact on the economy. We find that an increase in economic uncertainty conveys a fall in GDP, investment, and employment, even after accounting for the small open economy nature of Chile. In contrast to previous studies for big and developed economies, we do not find evidence of an over-shooting effect when uncertainty dissipates; therefore, increases in economic uncertainty have negative effects on the economy, even in the long-run. Our estimates suggest that these impacts range from 10% to 20% for aggregate investment, 2.5% to 5% for GDP, and 1.3% to 4.2% for employment. Extensions suggest that economic uncertainty affects both mining and non-mining investment, with the former showing a more pronounced decline. We also find that the bulk of effect of economic uncertainty on aggregate investment is via private investment, with some short-run impacts on public investment. Moreover, compared to the GDP response, aggregate consumption responds in almost the same way to an economic uncertainty shock.

I. Introduction

Going back at least since Keynes (1937), uncertainty played a major role in the understanding of economic cycles. However, the concrete impact of uncertainty on economic activity is not so clear. From a theoretical perspective, uncertainty could affect economic activity in a variety of ways. For instance, some argue that uncertainty pressures investors to delay investment decisions, resulting in postponed increases in production and hiring decisions. This argument, known as *real options*, follows from the intuition that facing an uncertain world and in the presence of important irreversible costs, 'wait-and-see' becomes the best option for investors. After uncertainty dissipates, (i) investors have an incentive to make investments and (ii) firms have an incentive to hire and make production decisions, implying a rapid recovery of economic activity after an uncertainty shock (Bernanke 1983; Bloom 2009).

Uncertainty could also contribute to the so-called *risk premium effect* (Arellano et al. 2012; Gilchrist, Sim, and Zakrajšek 2014). As the name suggests, it refers to the increase in the risk premium due to higher uncertainty. For example, suppose that banks in a world of certainty know which borrowers will repay and those who will not. In this case, banks will lend only to those who will repay for sure and will charge them accordingly. Further, suppose that there is an uncertainty shock. As uncertainty increases, banks are unsure if the borrowers who were surely going to pay previously will be able to repay their debt, and thus are resilient to make loans. In response to this new scenario, banks will increase the interest rate to include the greater risk to which they are exposed. Consequently, the cost of funding increases and it becomes more expensive to start a new project, thus decreasing investment.

Nonetheless, uncertainty may also enhance economic activity. For example, there is a *growth options* effect (e.g. Bernanke 1983; Kraft, Schwartz, and Weiss 2013). In the presence of higher uncertainty, the returns on a given investment become more volatile. This possibility allows for higher returns on an investment, although with low probability, than in a 'normal' world where volatility is

relatively low. This increase in potential gains creates incentives for firms to invest and hence to expand production. As Bloom (2014) argues, this could explain the dot-com bubble: the dispersion in gains contributed to the massive entry of new firms that expanded aggregate investment and production in the years before the dot-com bubble exploded.

The conflict between possible theoretical explanations of the effects of uncertainty in macro aggregates is somewhat in line with their empirical counterpart.[1] In a now-seminal article, Bloom (2009) shows that uncertainty shocks – using the volatility index of the Chicago Board Options Exchange (VIX) as a measure of uncertainty and building from a model with a time-variant second moment – lead to a short-run decline in aggregates such as investment and employment, but that after a few periods, these aggregates show a strong recovery, thereby confirming the real options idea of the *rebound effect* after uncertainty dissipates. Other works use the implied volatility uncertainty measure to analyse, for example, its effects on unemployment (Leduc and Liu 2012; Caggiano, Castelnuovo, and Groshenny 2014) and industrial production (Ferrara and Guérin 2015).

Other studies rely on surveys to compute uncertainty, which for simplicity, we refer to as *survey-based uncertainty* (e.g. Popescu and Smets 2010; Bachmann, Elstner, and Sims 2013). Specifically, surveys allow researchers to investigate the discrepancies between agents about future scenarios. If agents tend to converge in their expectation, then one can infer that there is a low degree of uncertainty present in the economy. Conversely, high discrepancies among agents could reflect a high degree of uncertainty. Studies that use this kind of uncertainty measure tend to find no impact of uncertainty shocks on economic activity (see Bachmann, Elstner, and Sims 2013).

More recently, Baker, Bloom, and Davis (2016) introduced a news-based uncertainty index. Namely, the Economic Policy Uncertainty Index (EPU Index), which aims to capture uncertainty regarding '*who* will make economic policy decisions, *what* economic policy actions will be undertaken and when, and the economic *effects* of policy actions (or inaction) – including uncertainties related to the economic ramifications of "non-economic" policy matters, e.g. military actions' (4–5). Relying on this measure, they use a VAR model to quantify its impacts on US economic activity. They find that a 90 log-points increase in economic policy uncertainty[2] produces a 1.2% reduction in industrial production, a 0.35% reduction in employment, and a 6% reduction in gross investment.

While most empirical studies focus on the US and developed economies, fewer studies analyse the impacts of economic uncertainty in emerging economies.[3] In this study, we attempt to bridge the gap between studies for developed and small open economies (SOEs) by analysing the effects of economic uncertainty on the Chilean economy. We choose this particular country given that it fits well into the small and open economy characteristics previously described, where its capacity to influence world markets is limited and the presence of uncertainty measures is almost null.[4]

To analyse these impacts, we first develop a new index, the Economic Uncertainty (EU) Index, which aims to capture overall uncertainty in the Chilean economy. For its construction, we closely follow the methodology proposed by Baker, Bloom, and Davis (2016), who rely on text-search methods. Unlike them, however, we focus on overall economic uncertainty rather than economic policy uncertainty. To the best of our knowledge, this is the first study to implement this approach to measure economic uncertainty in a small and open economy like Chile.

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[1]We focus here on only the macroeconomic impacts of uncertainty, leaving aside the studies that evaluate the impact of uncertainty at the firm level, such as those that rely on panel data information.

[2]This is the change in the EPU Index from its average in 2005–2006 to its average in 2011–2012. Note that the first period did not show important levels of uncertainty, while the second shows high levels of uncertainty.

[3]For instance, Carrière-Swallow and Cèspedes (2013) is the only work that analyses these impacts in the context of emerging countries. Using the VXO as a measure of uncertainty, they support Bloom's (2009) finding for a large panel of developed and emerging economies. They find that after an uncertainty shock, emerging countries compared to developed countries exhibit on average (i) larger drops in investment, (ii) higher recovery times, and (iii) a stronger fall in private consumption.

[4]The only uncertainty measure that we are aware of is that by Albagli and Luttini (2015), who use microdata to construct the index of business confidence (IMCE). However, its availability, from November 2003 onwards, posits a constraint in studying interesting episodes in the Chilean economy, such as the Asian crisis during the late 1990s. Additionally, this survey covers only four sectors: manufacturing, commerce, mining, and construction, for a total of 610 firms. Instead, our index can overcome the first issue given that its availability starts at least from January 1992. We also overcome the second issue by looking at general economic uncertainty and not at a specific subset of firms' beliefs about economic conditions.

We then use this index to analyse its impacts on relevant macro aggregates. We start by studying its effects on GDP, aggregate investment, and employment. To do so, we implement a VAR estimation procedure, imposing reasonable restrictions on the contemporaneous effect between the endogenous variables to identify the impulse-response functions. Next, we control for the SOE nature of Chile using the first two principal components of relevant external variables as exogenous covariates.[5] Further, we investigate whether these results change when we include a measure of consumer confidence.

We also provide three extension exercises to gain some insights about what drives our previous findings. As extensive literature suggests, uncertainty affects aggregate investment, although it is composed of several items that it may affect in different ways. We exploit this fact in two directions. First, we split aggregate investment into a mining and non-mining component because the Chilean economic environment is dominated by the commodity cycle, specifically the copper cycle, which represents almost half of the country's total exports. As such, mining and non-mining investment could indeed react differently to economic uncertainty. Second, we also divide aggregate investment into a public and private component to see whether public investment reacts in the same way to an uncertainty shock as, in principle, private investment does. Finally, the VAR model in our baseline results includes both GDP and aggregate investment. This may be problematic in the sense that investment is part of GDP and the relationship we find could be mechanical. To see that this is not the case, we replace GDP by aggregate consumption and analyse whether our previous results hold under this setting.

Our main results may be summarized as follows. We find evidence that economic uncertainty has negative impacts on aggregate investment, GDP, and employment. This is more pronounced for investment than for GDP and employment. Looking at the quarters where these impacts are the largest, while a 1-SD uncertainty shock entails an average reduction that ranges from 2.1% to 3.2% in aggregate investment, it is only between 0.5% and 0.9% in the case of GDP and between 0.3% and 0.7% for employment, depending on the specification

used. These, however, are short-run effects since they disappear after 11 quarters on average. Their disappearance and the fact that before disappearing they do not surpass the zero region suggests the nil presence of a rebound effect. Indeed, we cannot see that the recovery of investment, GDP, and employment is greater than zero at any quarter in our exercises. This result is striking since it suggests that after an economic uncertainty shock, macro aggregates may in fact never recover, and thus increases in economic uncertainty could have permanent effects on the economy. Indeed, our estimates suggest that the long-run declines after an economic uncertainty shock are between 10% and 20% for aggregate investment, between 2.5% and 5% for GDP, and between 1.3% and 4.2% for employment. It also contrasts with studies in large, developed economies, where this effect is an empirical regularity (Baker, Bloom, and Davis 2016; Bloom 2014).

Turning to our extension exercises, we find that the bulk of the uncertainty effect on aggregate investment is via private investment, with some short-run impacts on public investment. Additionally, increases in economic uncertainty affect both mining and non-mining investment, with the former showing a more pronounced decline. Moreover, compared to the GDP response, aggregate consumption responds in almost the same way to an uncertainty shock, although with a slightly larger response.

The rest of this article is structured as follows. Section II describes the construction of the EU Index for the Chilean economy and discusses its behaviour. Section III analyses the impacts of economic uncertainty on the Chilean economy. Finally, Section IV concludes.

II. Measuring economic uncertainty in Chile

To investigate the role of economic uncertainty in Chile, we constructed a new index that aims to capture the evolution of this variable over the last 23 years. The index is intended to embrace this uncertainty from a broad perspective, considering uncertainty in the minds of legislators, consumers, entrepreneurs, and opinion leaders on the future of

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[5]Specifically, we include S&P 500 growth rate, real copper price, oil price (WTI real), World GDP growth rate, and Fed funds rate.

different macroeconomic and microeconomic variables.

The index construction methodology closely follows that proposed by Baker, Bloom, and Davis (2016) for their EPU Index, although we apply this methodology to a broader concept of uncertainty that the one investigated by them. Specifically, the index is based on the coverage of different topics related to economic uncertainty by the *El Mercurio* newspaper.[6] To estimate the coverage, we accessed the newspaper's digital archive, which contains all articles published by *El Mercurio* from 1993 onwards. This digital archive allowed us to count the number of articles that contained references to the economy and uncertainty. In particular, we collected articles containing the word '*uncertainty*' or '*uncertain*' and a word that begins with '*econ*', so as to include words such as *economy, economic, economist*, and *economists* in the search.[7]

It is important to note that the raw count of articles presents a clear problem: the number of articles in any newspaper varies over time, which we observed in the case of *El Mercurio*. To address this problem, we scale the raw count of articles by the total number of articles published by the newspaper during that month. Finally, the resulting series was standardized to a unit SD and normalized to a mean of 100 from January 1993 to December 2015.

Figure 1 shows the resulting EU Index for Chile. As the figure shows, the level of economic uncertainty varied considerably over the last decades, where the peaks reflect the Asian crisis, the financial crisis, and the recent contraction of the Chinese stock market. The index shows that economic uncertainty levels were relatively constant between 1993 and the last quarter of 1997, a stability that ended with the default of Russia and the subsequent contagion to other countries. The so-called Asian crisis
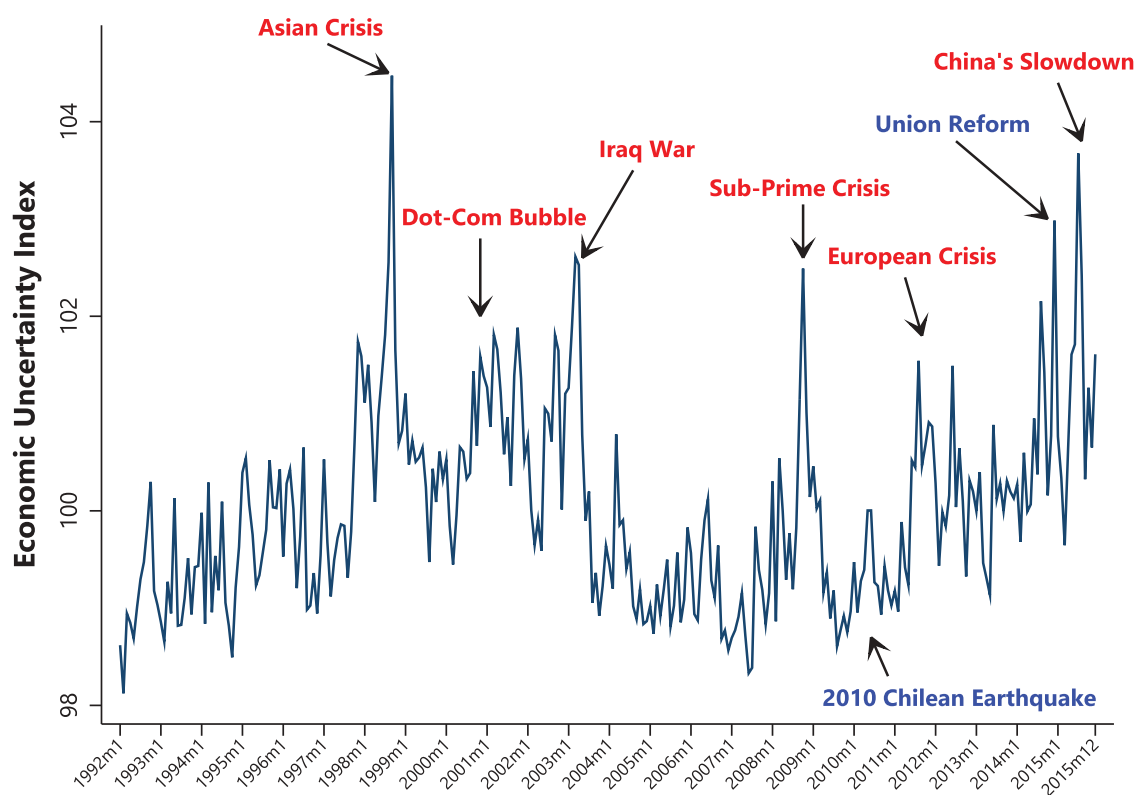

Figure 1. EU Index for the Chilean economy.
The EU Index refers to the raw count of articles in the *El Mercurio* newspaper adjusted by the total quantity of articles in a particular month. It is multiplicatively scaled to have mean 100.

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[6]The *El Mercurio* newspaper is the most recognized and widely circulated newspaper in Chile (KPMG audit, first half of 2016). However, to ensure that the index is representative, we gather data for other three newspapers – La Tercera, Estrategia and Diario Financiero – and build an index using the same methodology. The average index closely follows the *El Mercurio* index; unfortunately, we could not use this average index in the study because data for these other newspapers is only available from 2007 onwards. The average index is available upon request.
[7]The words in Spanish were *economía, económico, economista, economistas*.

skyrocketed economic uncertainty in Chile, as Figure 1 shows. During this period, the EU increased 4 SDs. By 1999, most of the economic uncertainty dissipated, although Chilean economic uncertainty did not return to the levels before the crisis. The average EU in the 5 years that followed the crisis was almost a unit SD higher than the average for the years between 1993 and 1997.[8] The first half of the 2000s were years of high economic uncertainty, marked by the dot-com bubble explosion, the Gulf Wars, and other geopolitical factors that kept the price of food and raw materials in suspense, including the copper price.[9]

In the second semester of 2003, we observe a great moderation in economic uncertainty that lasted until the collapse of international markets in 2008, a crash now referred to as the great recession. Two facts are interesting to note in the period that followed the Lehman Brothers bankruptcy: (i) the rapid disappearance of economic uncertainty in Chile and (ii) the limited and rapid reduction in economic uncertainty that followed the earthquake of 2010. Both facts are interesting to study as they present anomalies regarding what is generally observed in other studies. Natural disasters are a common source of wide economic uncertainty (Baker and Bloom 2013) and the financial crisis led to a period of several quarters of high uncertainty in many countries (Carrière-Swallow and Cèspedes 2013; Baker, Bloom, and Davis 2016).

The debt crisis in Europe was the next episode that shocked the levels of economic uncertainty in Chile. In 2011, Greece fell into default and concerns about the levels of debt in the major European economies arose. The EU shows a hike in economic uncertainty in the second semester of 2011, though it was smaller and more persistent than that observed during the financial crisis that started in the US.

By observing Figure 1, we see that economic uncertainty started to rise again in the last years, even surpassing the levels reached during the financial crisis. During 2013, the EU shows an average of 100, but during 2014 and 2015, the average was 100.7 and 101.1, respectively. The years 2014 and 2015 were marked by many political reforms in Chile, including tax reform, labour market reform, and the announcement of pension, constitutional, and health system reform. In 2014, the peak corresponds to the discussion and subsequent submission of the labour reform draft that addressed the country's unions. In 2015, on the contrary, though many articles continuously talked about these reforms, the peak corresponds to the month of July, where China's stock market suffered the biggest drop in 8 years. As can be seen, internal and external factors explain the levels of uncertainty in the country, so when using indices of uncertainty that only respond to external events, we are omitting an important part of the information on the total level of economic uncertainty the country faces.

In Figure 2, we compare the evolution of economic uncertainty in Chile with the most common uncertainty measure in the US, the VIX.[10] The VIX measures the market's expectation of 30-day volatility implied by the S&P 500 stock index option prices. An obvious limitation of this comparison is that both indexes do not measure the same factor. The VIX mainly represents uncertainty about short-term financial returns, while the Chilean EU is not restricted to a specific time or type of economic uncertainty. Given this, we should expect a greater response by the VIX to financial events and less to other sources of economic uncertainty, such as reforms or elections.

Despite the differences in both indices and the obvious fact that one is for Chile and the other is for the US, the similarity in the movements of both indices in some periods is striking; for example, in the period between the Asian crisis and the financial crisis, the correlation between the two indices is 0.8. This similarity is probably because Chile, being a small and open economy, is heavily influenced by international events that generate shocks of economic uncertainty.

During the 1990s, both indices show similar trajectories. The rise in uncertainty caused by the Asian crisis appears in both series; although, as it can be expected, it is higher in Chile because this crisis affected more Latin American countries than the US. For instance, in 1999,

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[8]The average between January 2000 and December 2004 was approximately 100.4, while it was 99.6 between January 1993 and December 1997.
[9]It is worth noting that Chile is one of the main copper exporters worldwide. This commodity represents, as of 2012, 53% of Chilean total exports.
[10]As we discussed in Section I, Chile – and Latin American countries in general – does not have an index of this sort because its financial markets are underdeveloped compared to those in developed economies and the financial sector represents only a small fraction of the overall economic activity in this country.
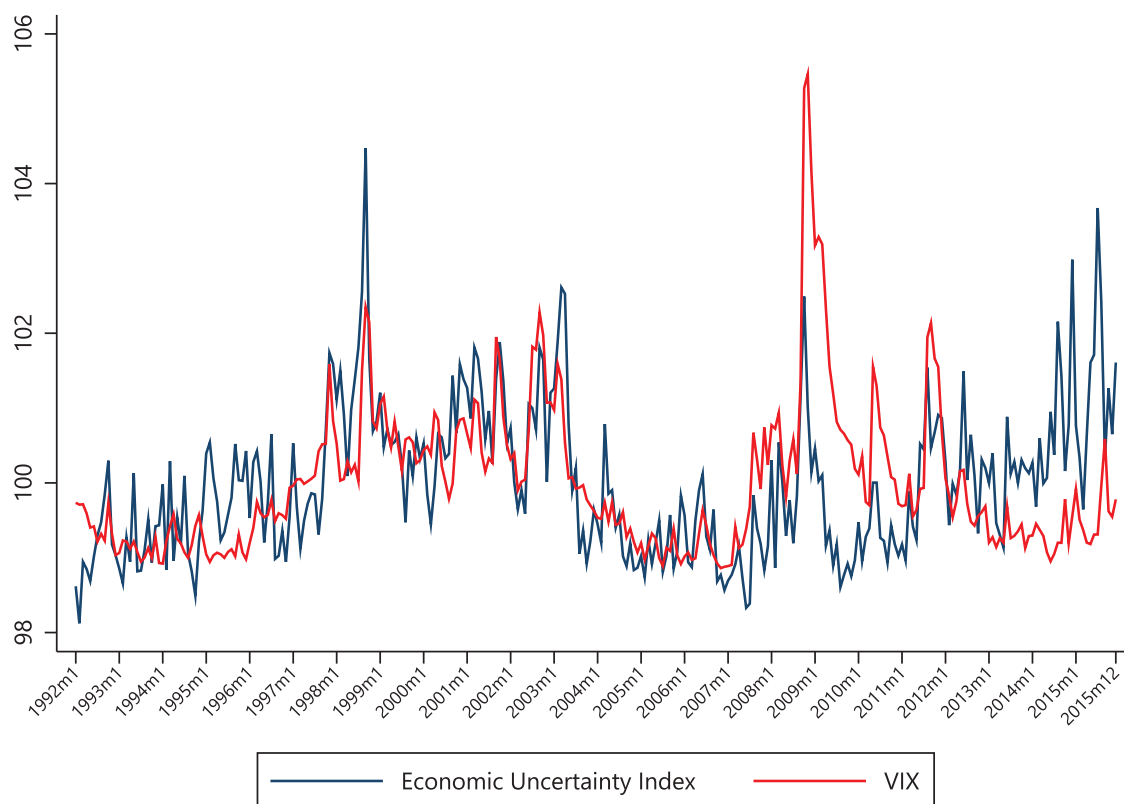
Figure 2. EU Index and VIX.
The VIX (clear line) represents the VIX. The EU Index (dark line) refers to the raw count of articles in the *El Mercurio* newspaper adjusted by the total quantity of articles in a particular month. Both indices are multiplicatively scaled to have mean 100.

the contraction in Chilean GDP was 0.5% compared to a GDP growth of 4.7% for the US economy. After the crisis, both indices show decreasing levels of uncertainty, and similar movements for the WorldCom fraud and the Gulf War, and a similar moderation between 2003 and 2007, prior to the Lehman Brothers collapse. At this point, the stories bifurcate: the VIX rose considerably more than the EU did during the financial crisis. As said earlier, we should expect a greater response by the VIX than by the EU, considering that this event had a clear financial connection, which started in the US and hit that economy harder. In 2009, the US economy contracted 2.8%, compared to a contraction of only 1% in Chilean GDP. In 2011, both indices realigned, though only momentarily. Since 2014, we start to see an upward trend in the EU, which contrasts with the relatively flat trajectory of the VIX. According to the index, concerns about China, the lower price of copper, the economic reforms, and the announcement of the process to create a new constitution are all major factors driving the rise in uncertainty in these last years.

The comparison between the two indices suggests two important issues. First, the Chilean economy, in terms of uncertainty, is highly exposed to international shocks, so at various periods, the observed shocks are external. Second, even though Chile is a small and open economy, Chilean economic uncertainty is not only the result of external shocks, internal events also affect uncertainty levels strongly. This is an important result because it suggests that is not enough to look at external indicators such as the VIX to assess local economic uncertainty; on the contrary, it is important to have indicators of domestic economic uncertainty, such as we present in this work.

To see how much of the changes in economic uncertainty in Chile are explained by international shocks quantitatively, we performed a VAR with the EU and the VIX as variables, and calculated the variance decomposition. In addition, the VAR includes the Monthly Index of Consumers' Expectation (IPEC) a consumer confidence index,[11] as a way to ensure that the uncertainty indicator is
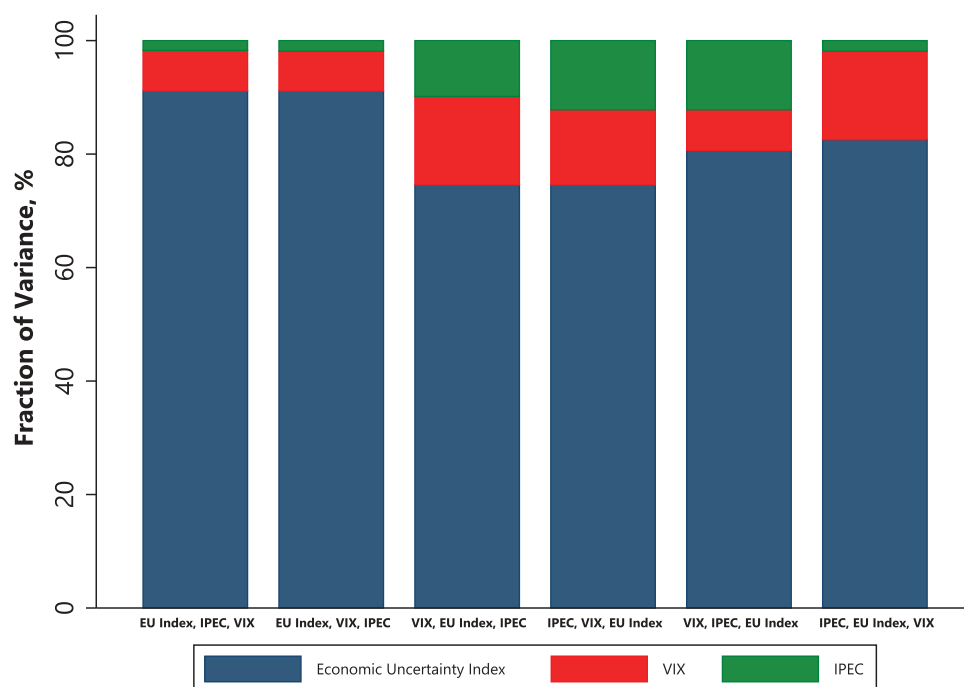
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[11]The IPEC is computed monthly by Adimark.

Figure 3. Fraction of variance EU Index.

This figure shows a variance decomposition for the EU Index after fitting a VAR(1) model, using the EU Index, IPEC (an index of Chilean consumer confidence), and VIX, 20 quarters after the shock. As such, this variance decomposition may be thought of as a steady-state variance decomposition. Each bar differs in the Cholesky ordering used to identify the variance decomposition. The Cholesky ordering is indicated below each bar. For instance, the ordering EU Index, VIX, and IPEC take the EU Index contemporaneously exogenous to both VIX and IPEC.

not capturing variations in this variable, a common concern in the uncertainty literature.

Figure 3 shows the variance decomposition of the VAR with the EU, VIX, and IPEC as variables. Each bar reflects a different ordering of the variables in the VAR. The exercise concludes that the VIX explains between 7% and 15% of the movements in the domestic indicator of uncertainty; on the other hand, only between 2% and 12% of the EU movements are explained by the confidence index. These results support our earlier findings regarding the importance of domestic indicators of uncertainty because even in a small and open economy like Chile, a significant portion of the uncertainty shocks are linked to internal events.

III. VAR estimation

The previous section suggests that our EU Index is capturing an important fraction of the Chilean internal economic uncertainty that the VIX and confidence do not explain. With this in hand, we assess the impact of economic uncertainty, measured by

EU, on investment, GDP, and employment. We do so by dividing this section into two subsections. The first analyses these impacts controlling for confidence and relevant external conditions. The other analyse what is behind the results found in the previous subsection by providing three extension exercises.

Baseline cases

We estimate five different VAR models to assess the impacts of economic uncertainty on Chilean macro aggregates using quarterly data from 1992Q1 to 2015Q4. These models differ both in their variables and in the order by which we identify the impulse response functions. Formally, we implement models of the following form:

$$
\begin{aligned}
\mathbf{Y_t} = \mathbf{b} &+ \mathbf{\Phi_1 Y_{t-1}} + \mathbf{\Phi_2 Y_{t-2}} + ... + \mathbf{\Phi_p Y_{t-p}} \\
&+ \mathbf{\Gamma_0 X_t} + \varepsilon_t, \\
t &= 1, ..., T
\end{aligned} \tag{1}
$$

where $\mathbf{Y_t} = (y_{1t}, y_{2t}, ..., y_{nt})'$ is an $n \times 1$ vector of the time-series endogenous variables, $\mathbf{b}$ is an $n \times 1$

coefficient vector, $\mathbf{\Phi}_j$ are $n \times n$ coefficient matrices, $\mathbf{X_t} = (x_{1t}, x_{2t}, ..., x_{mt})'$ is an $m \times 1$ vector of time-series exogenous variables, $\mathbf{\Gamma_0}$ is an $m \times m$ coefficient matrix, and ε_t is an $n \times 1$ white noise vector process.

In each specification, we present results using one lag of each endogenous variable, so $p = 1$ for each model after following the recommendations outlined in Ivanov and Kilian (2005).[12]

Our first, baseline model uses the following set of endogenous variables: EU (*EU*), 1–3 years interest rate (*r*), investment growth (*I*), employment growth (*L*), and GDP growth (*GDP*). We compute all growth rates as annual growth rates to avoid seasonality issues. In vector notation, this model may be written as $\mathbf{Y_t} = (EU_t, r_t, I_t, L_t, GDP_t)'$. We identify the impulse response function to a 1-SD EU shock by the Cholesky decomposition using this same order.

This baseline case, however, does not account for the small and open economy nature of Chile. We include this feature in our second model using a procedure similar to that by Albagli and Luttini (2015). In particular, we measure relevant external conditions for the Chilean economy by taking the first two principal components of the following variables: S&P 500 growth, Copper price (real), Oil price (WTI real), Fed funds rate, and world GDP growth rate. We use these two variables as exogenous covariates in our baseline case such that now $\mathbf{X_t} = (PC_t^1, PC_t^2)'$ is a vector of exogenous variables that contain the first (PC^1) and second (PC^2) principal component.

Our third model incorporates the VIX as an exogenous covariate to evaluate whether the impact of economic uncertainty is driven mainly by international uncertainty events. So $\mathbf{X_t} = (PC_t^1, PC_t^2, VIX_t)'$ for this model.

Finally, a main concern in the literature is the close relationship between uncertainty and confidence. We address this issue by including the IPEC as a measure of consumer confidence about economic activity as an endogenous variable, for which we have enough data available. In this case, we implement two different orderings in the Cholesky decomposition to assess the impact of economic uncertainty. First, we consider a model in which economic uncertainty is contemporaneously exogenous to the confidence measure; that is, our vector of endogenous variables is $\mathbf{Y_t} = (EU_t, IPEC_t, r_t, I_t, L_t, GDP_t)'$ and where the Cholesky decomposition uses the same ordering. Second, to analyse whether our previous impulse-response function is driven by this particular ordering, we reverse the order between the EU and the IPEC, considering that the IPEC is now contemporaneously exogenous with respect to EU. In this case, $\mathbf{Y_t} = (IPEC_t, EU_t, r_t, I_t, L_t, GDP_t)'$.

Following the impulse-response functions, we present the results obtained after a 1-SD EU shock, representing the average response. We omitted the confidence intervals for each impulse-response function for the sake of graph clarity. Moreover, we present five different impulse-response functions for GDP, investment, and employment. These correspond to the specifications outlined earlier.

Figure 4 shows the impulse-response function of investment. First, note that the economic uncertainty shock generates an immediate positive response in investment slightly above the zero region in all the specifications. However, they do differ in their mid-run responses. For instance, consider the baseline model, which shows its largest drop in the fourth quarter after the shock, with a decline of 3.2%. If we look at the other impulse-response functions, all show their largest drop in the third quarter after the shock and exhibit, to some degree, fairly similar magnitudes between them. For example, when we include the principal components, the largest drop in investment is around 2.7% (dashed black line). If we also include the confidence measure, the largest drop in investment is between 2.6% and 2.3%, depending on whether we consider uncertainty as contemporaneously exogenous with respect to consumer confidence or vice versa, respectively.

The smallest drop in investment is found when we control for the VIX and the principal components. Quantitatively, it shows a drop of 2.1% in the third quarter after the shock. This suggests that the mid-run negative effect of an uncertainty shock on investment lies somewhere between 2.1% and 2.6%. Interestingly, the impulse-response functions do not

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[12]Given the nature and length of our data set, the *best* information criteria to distinguish between models is the SIC.
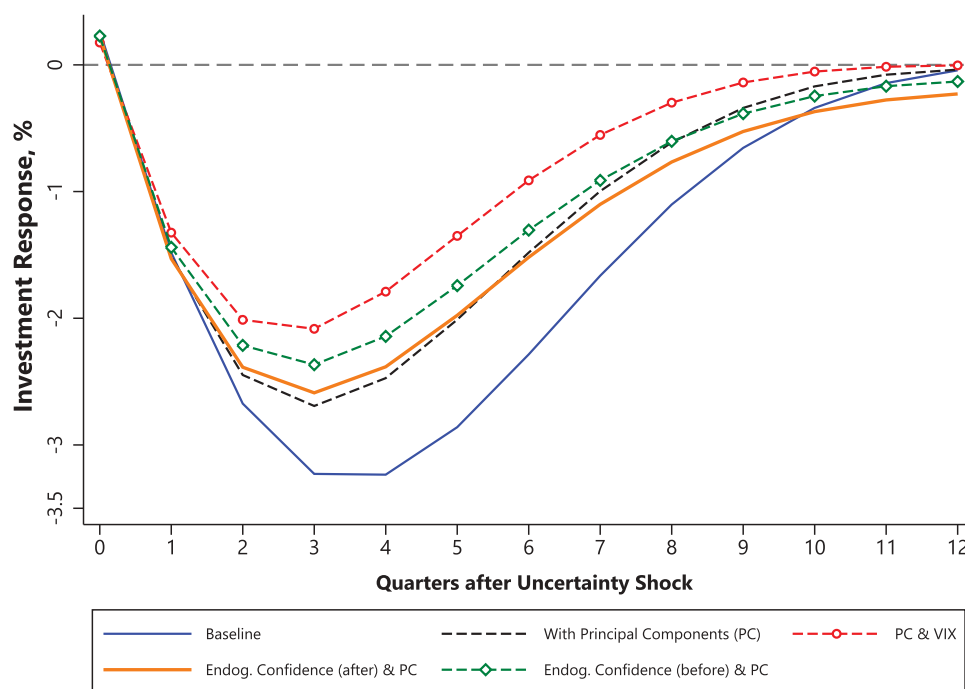
Figure 4. Response to an EU shock: investment.

Investment response to a 1-SD EU shock. The baseline scenario corresponds to a specification with the following endogenous variables: EU Index, 1–3 years interest rate, investment, employment, and GDP (used throughout all specifications); and no exogenous controls. The Principal Components (PC) specification includes the two principal components of the following external variables: S&P 500 growth, Copper price (real), Oil price (WTI real), Fed funds rate, and world GDP growth rate, as exogenous covariates in the VAR model. All others models that include 'PC' indicate that they control for these two components. The PC & VIX line shows the impulse-response function of a model that also uses the VIX as an exogenous covariate. The Endog. Confidence (after) & PC line shows the impulse-response function of a VAR model that includes a variable for consumer confidence as an endogenous variable and assumes that consumer confidence is placed after EU in the Cholesky ordering. Finally, the Endog. Confidence (after) & PC specification also includes an index of consumers' confidence, but places this variable before the EU Index in the Cholesky ordering, i.e. economic uncertainty is contemporaneously affected by consumers' confidence, but not vice versa.

show any sign of an overshooting effect. That is, we do not see a statistically significant signal that investment surpasses the zero region after the economic uncertainty shock. This differs from the expected behaviour of investment under theoretical settings with capital adjustment costs (Bloom 2009), and partially supports the empirical findings of Carrière-Swallow and Cèspedes (2013) that emerging economies, in contrast to developed economies, do not show this feature. More importantly, the nil presence of an overshooting effect points to a non-transitory overall effect of economic uncertainty on investment; that is, after an economic uncertainty shock, investment may in fact never recover.

Figure 5 shows the impulse-response functions of GDP. We can see that the immediate responses lie around the zero regions, where the model with principal components and confidence that considers it contemporaneously exogenous to the EU represents the lower bound and the baseline model represents the upper bound. We see that the largest

impacts of uncertainty occur in different quarters depending on the model used. For instance, this occurs in the second quarter in the model with principal components and VIX, and principal components only. The remaining models show their largest drop in the third quarter. Quantitatively, these impacts range from −0.5% to −0.9%, where the models that represent the lower and upper bound correspond to that with principal components and VIX and the baseline, respectively. Note that the GDP response does not show any over-shooting effect after reaching its trough, which implies a probably permanent effect of uncertainty on GDP similar to the results for investment.

Figure 6 plots the impulse-response functions of employment. All models show an immediate decline of around 0.1%. All models show their largest drop in the fourth quarter, except when we control for principal components and VIX. Quantitatively, these effects range from −0.3% to −0.7%. As was the case for GDP and investment, the impulse-response
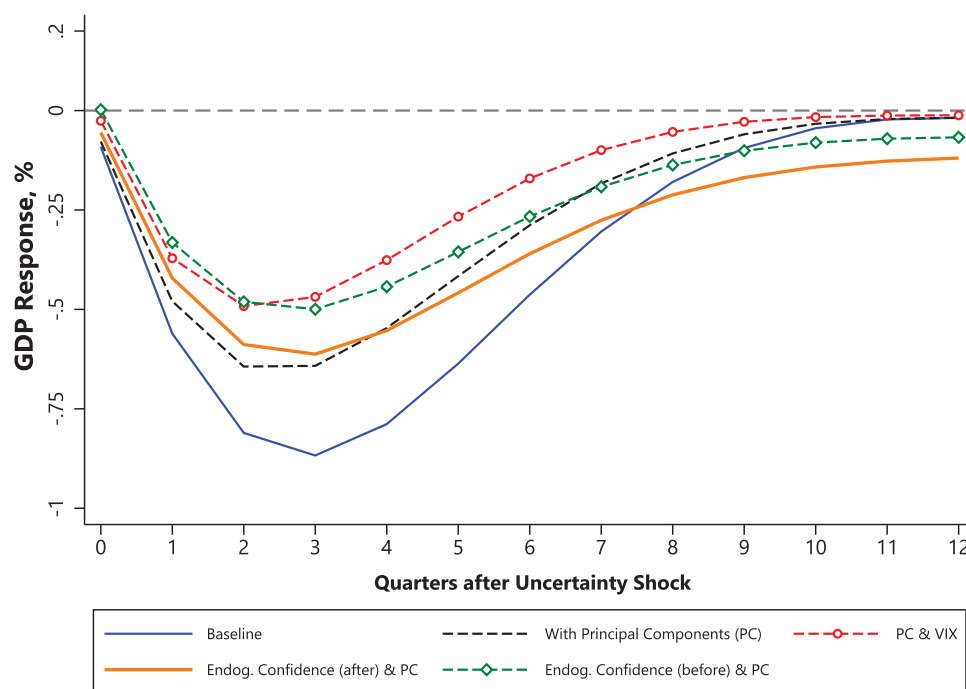
Figure 5. Response to an EU shock: GDP.

GDP response to a 1 SD EU shock. The baseline scenario corresponds to a specification with the following endogenous variables: EU Index, 1–3 years interest rate, investment, employment, and GDP (used throughout all specifications); and no exogenous controls. The PC specification includes the two principal components of the following external variables: S&P 500 growth, Copper price (real), Oil price (WTI real), Fed funds rate, and world GDP growth rate, as exogenous covariates in the VAR model. All other models that include 'PC' indicate that they control for these two components. The PC & VIX line shows the impulse-response function of a model that also uses the VIX as an exogenous covariate. The Endog. Confidence (after) & PC line shows the impulse-response function of a VAR model that includes a variable for consumer confidence as an endogenous variable and assumes that consumer confidence is placed after EU in the Cholesky ordering. Finally, the Endog. Confidence (after) & PC specification also includes an index of consumers' confidence, but places this variable before the EU Index in the Cholesky ordering, i.e. economic uncertainty is contemporaneously affected by consumers' confidence, but not vice versa.

function of employment does not show any signs of an overshooting effect.

The previous findings suggest that the Chilean economy does not seem to generate an overshooting effect along the lines of, for example, Bloom (2009) and Baker, Bloom, and Davis (2016). If this is true, then the cumulative effect of economic uncertainty on these aggregates should, in principle, be negative, even in the long-run. Figure 7 shows the cumulative response for aggregate investment, GDP, and employment for the different specifications previously outlined. The dashed lines correspond to 90% confidence intervals. Note that this figure roughly corresponds to the steady-state cumulative response since this is the cumulative response 20 quarters after the economic uncertainty shock. Clearly, both GDP and investment present cumulative responses that are statistically significant at the 90% level. The impact on investment ranges from −10% to −20% when we look at its average response. For GDP, these same impacts range from −2.5% to −5%. While

employment also shows an average cumulative decline, its confidence intervals do not allow us to assert statistically that they are different from zero. In addition, its average cumulative response ranges from −1.3% to −4.2%.

Extensions

In this section, we conduct three extensions exercises. All VAR models in this section by default include the two principal components constructed in the previous subsection as exogenous covariates, the IPEC as an endogenous regressor, and 1 lag of each endogenous variable. Again, all impulse-response functions are obtained after a 1-SD EU shock and represent the average response.

Chile is a commodity-dependent SOE: its main exported resource is copper, which represents almost a half of its total exports. While in the previous sub-section we controlled for its SOE nature, we did not capture the
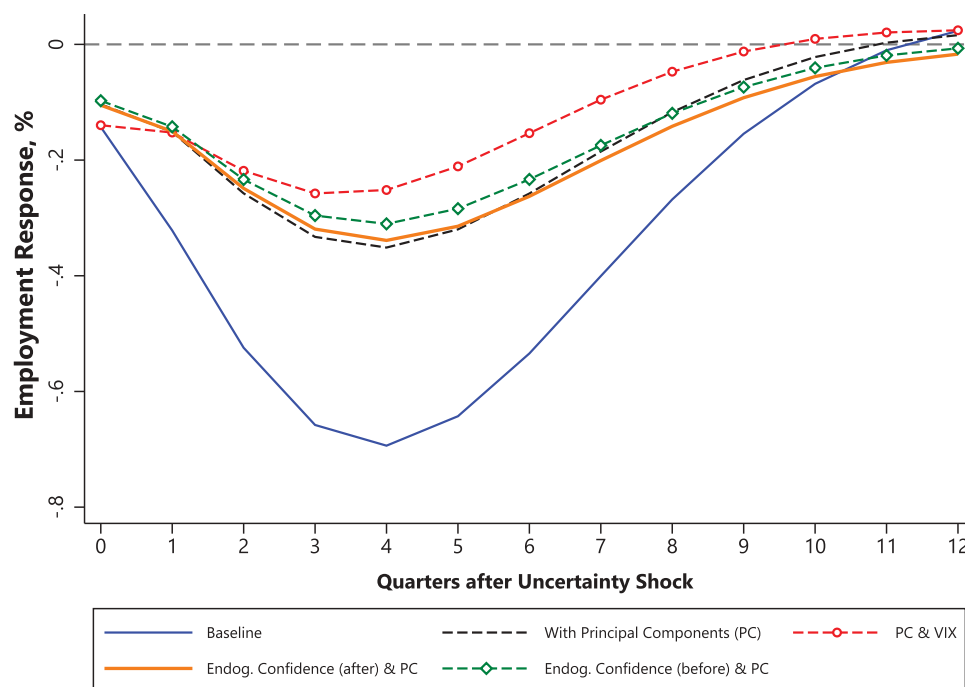
Figure 6. Response to an EU shock: employment.

Employment response to a 1-SD EU shock. The baseline scenario corresponds to a specification with the following endogenous variables: EU Index, 1–3 years interest rate, investment, employment, and GDP (used throughout all specifications); and no exogenous controls. The PC specification includes the two principal components of the following external variables: S&P 500 growth, Copper price (real), Oil price (WTI real), Fed funds rate, and world GDP growth rate, as exogenous covariates in the VAR model. All other models that include 'PC' indicate that they control for these two components. The PC & VIX line shows the impulse-response function of a model that also uses the VIX as an exogenous covariate. The Endog. Confidence (after) & PC line shows the impulse-response function of a VAR model that includes a variable for consumer confidence as an endogenous variable and assumes that consumer confidence is placed after EU in the Cholesky ordering. Finally, the Endog. Confidence (after) & PC specification also includes an index of consumers' confidence, but places this variable before the EU Index in the Cholesky ordering, i.e. economic uncertainty is contemporaneously affected by consumers' confidence, but not vice versa.

different investment dynamics of the mining sector, which is closely related to copper, relative to the non-mining sector, as was documented elsewhere (see, for instance, Fornero and Kirchner 2014; Fornero, Kirchner, and Yany 2015; Albagli and Luttini 2015).

Methodologically, we take two approaches to account for this fact and implement two VAR models. First, we split aggregate investment into mining (I^M) and non-mining (I^{NM}).[13] To identify the impulse-response, we use the following order: EU, $IPEC$, r, I^{NM}, I^M, GDP, L. Second, instead of splitting aggregate investment, we include the growth rate of mining investment in Australia, the CAPEX, as a proxy for Chilean mining investment as an exogenous covariate. We then identify the impulse-response functions by imposing the following Cholesky ordering: EU, $IPEC$, r, I, GDP, L.

Figure 8 shows the impulse response associated with aggregate, mining, and non-mining investment. Three things are worth noting about this figure. First, the mining investment drop is quantitatively larger than its non-mining counterpart: the largest drop in mining investment occurs in the third quarter after the shock and conveys a reduction of around 5.5%; non-mining investment, on the other hand, shows a drop of around 1.6% at its trough. Second, non-mining investment shows a sort of overshooting effect: it surpasses the zero region after the seventh quarter and remains there at least until the twelfth quarter. Although this effect is not statistically different from zero, it points to the vague possibility of an overshooting effect in sectors outside of the mining sector. Mining investment, on the other hand, do not show evidence of this effect and is indeed well below the

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[13]These series are not publicly available at a quarterly frequency, so we have to construct them. We do so by following the procedure outlined by Albagli and Luttini (2015) and implement the Chow-Lin method to convert annual series into quarterly series. As a proxy for the mining investment cycle, we use the CAPEX, which represents Australian mining investment. This series is highly correlated with its Chilean annual counterpart, as Fornero and Kirchner (2014) shows. We then identify non-mining investment as the part of investment that is not mining-related, such that $I^{NM} = I - I^M$.
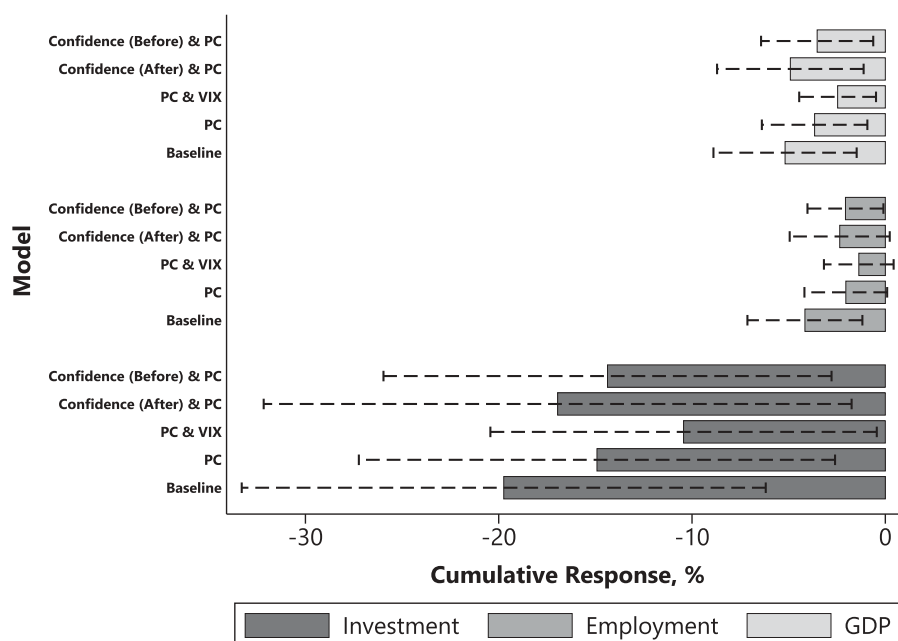
Figure 7. Cumulative response after an EU shock.

Cumulative responses 20 quarters after the EU shock. The baseline scenario corresponds to a specification with the following endogenous variables: EU Index, 1–3 years interest rate, investment, employment, and GDP (used throughout all specifications); and no exogenous controls. The PC specification includes the two principal components of the following external variables: S&P 500 growth, Copper price (real), Oil price (WTI real), Fed funds rate, and world GDP growth rate, as exogenous covariates in the VAR model. All other models that include 'PC' indicate that they control for these two components. The PC & VIX bars show the cumulative response of a model that also uses the VIX as an exogenous covariate. The Endog. Confidence (after) & PC bars show the cumulative response of a VAR model that includes a variable for consumer confidence as an endogenous variable and assumes that consumer confidence is placed after the EU Index in the Cholesky ordering. Finally, the Endog. Confidence (after) & PC specifications also include an index of consumer confidence, but places this variable before the EU Index in the Cholesky ordering, i.e. economic uncertainty is contemporaneously affected by consumers' confidence, but not vice versa.

zero region over the 12 quarters in the figure after the uncertainty shock. Third, the response of aggregate investment, after controlling for the mining cycle, remains almost unchanged, where the largest drop occurs in the third quarter, with a magnitude of 2.1%, in line with our findings in the previous subsection. Thus, these findings partially suggest that (i) the aggregate investment response is driven by both components; (ii) the mining sector is in the absolute more affected by and economic uncertainty shock and does not present signs of an overshooting effect, in contrast to the non-mining sector; and (iii) the aggregate investment response is not solely driven by the commodity cycle.

As discussed in the Sections I and II, most of the economic uncertainty literature points to a negative effect of rising uncertainty on investment plans. While this may be true for private investment, it is not clear whether this same impact applies to public investment. For instance, if the higher uncertainty environment is

due to reforms driven by the government, then it is perfectly possible that public investment may indeed increase in this scenario: the government would want to send a signal to private investors by increasing their public investment. Figure 9 shows the impulse-response function of both private and public investment.[14] It is clear that most of the trend observed in the results section for aggregate investment come from the private side. While we see some negative short-run effects on public investment, this effect vanishes rapidly, such that we cannot distinguish this from zero after the second quarter in a statistically significant way. This evidence suggests that increases in economic uncertainty affect the private component of investment more than the public component.

We are aware that some of the previous results may be mechanical in the sense that investment is part of GDP. To see whether this explains our findings, we replace GDP by aggregate consumption. Figure 10 shows the impulse response function of

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[14]We identify the impulse response function with the following order: *EU, IPEC, r, I^{Private}, I^{Public}, GDP, L.*
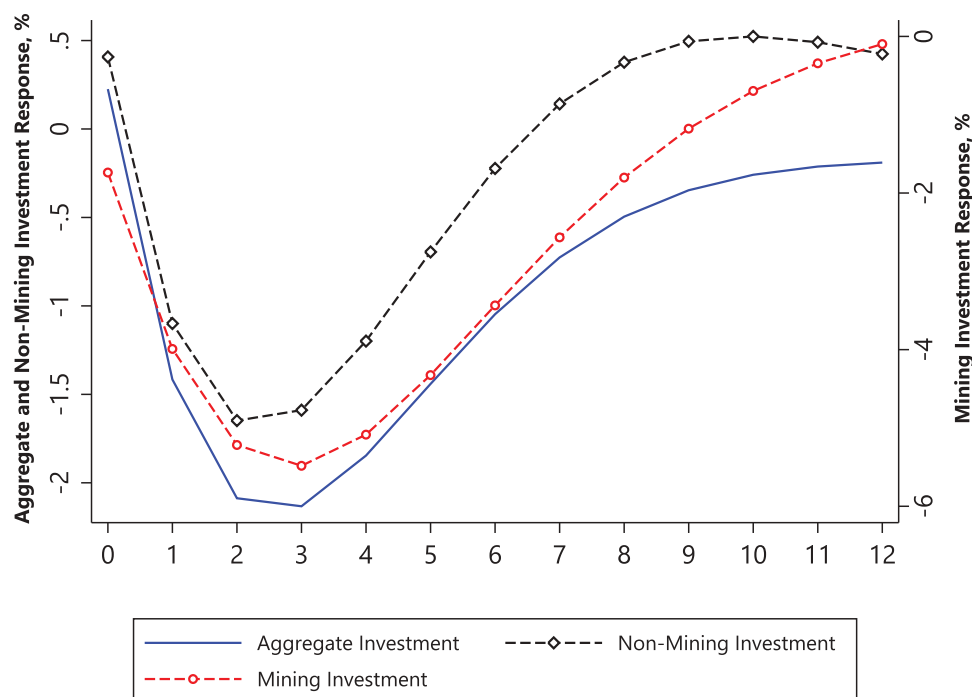
Figure 8. Response to an EU shock: aggregate, mining, and non-mining investment.

Aggregate, mining, and non-mining investment response to a 1-SD EU shock. All models include the two principal components as exogenous covariates, IPEC as an endogenous regressor, and 1 lag of each endogenous variable. Recall that the exogenous variable used to construct the principal components were the S&P 500 growth, Copper price (real), Oil price (WTI real), Fed funds rate, and world GDP growth rate. For the aggregate response, the endogenous variables were *EU, IPEC, r, I, GDP, L* and the exogenous covariate set also includes the growth rate of mining investment in Australia (CAPEX). For mining and non-mining investment, the set of endogenous variables includes *EU, IPEC, r, I^{NM}, I^M, GDP, L*, where the same ordering was used to identify the impulse-response functions (no other exogenous covariate except for the principal components was used).

aggregate consumption and aggregate investment.[15] This figure shows that the results in the previous section remain unchanged for the aggregate investment response. Additionally, the consumption response is somewhat in line with the response observed for GDP in the previous section. This provides evidence that our previous results were not mechanical and that increases in economic uncertainty do indeed depress aggregate investment.

IV. Conclusion

We constructed a new index of economic uncertainty for the Chilean economy based on a monthly count of articles published by the *El Mercurio* newspaper, one of the most important Chilean newspapers. This allowed us to rebuild 23 years of economic uncertainty history. To our knowledge, this is the first attempt to measure economic uncertainty for this country. As extensive literature suggests, having measures of this

phenomena is of tremendous importance in empirically analyses of its effect on economic variables such as investment, production, or consumption (Bloom 2014; Baker, Bloom, and Davis 2016). While measures of uncertainty have been readily available for developed countries, including even economic policy uncertainty measures, there is not much evidence for emerging or small and open economies. In this study, we move one step forward in filling this gap.

Having constructed the index, we then evaluated its impacts on the Chilean economy. We provide evidence that increases in economic uncertainty have negative impacts on common macroeconomic aggregates, such as aggregate investment, GDP, and employment, even after accounting for its small and open economy characteristics, such as its inability to affect world prices and its important exposure to external business cycles related to commodity markets and the world financial system. Quantitatively, our estimates for the

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[15]Impulse-response functions are identified by imposing the following Cholesky ordering: *EU, IPEC, r, I, C, L*, where *C* stands for consumption.
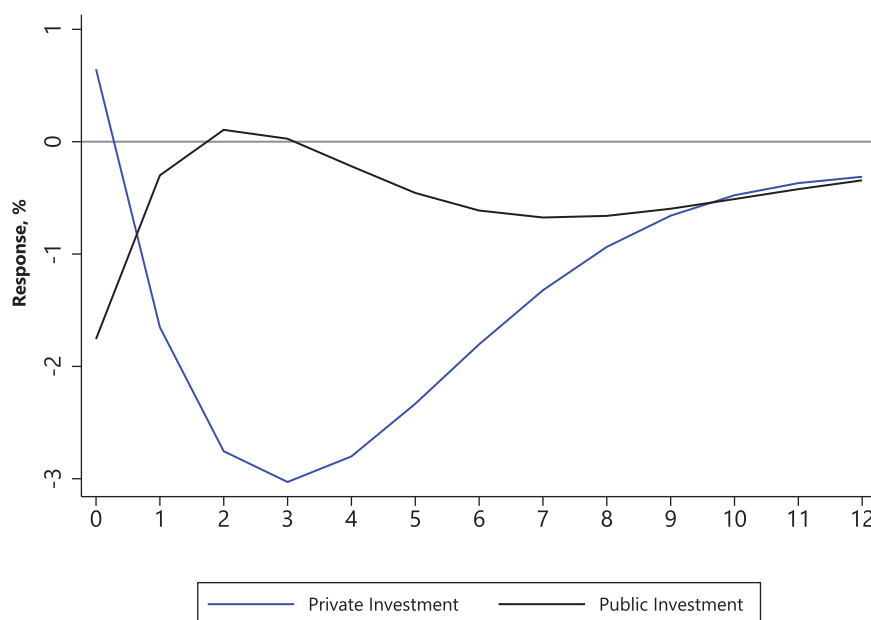
Figure 9. Response to an EU shock: private and public investment.

Private and public investment response to a 1-SD EU shock. The endogenous variables used were *EU, IPEC, r, I^{Private}, I^{Public}, GDP, L*. The exogenous covariates set includes two principal components of the following set: S&P 500 growth, Copper price (real), Oil price (WTI real), Fed funds rate, and world GDP growth rate. The impulse-response in each case, private and public investment, were identified using the same endogenous variables ordering outlined earlier.
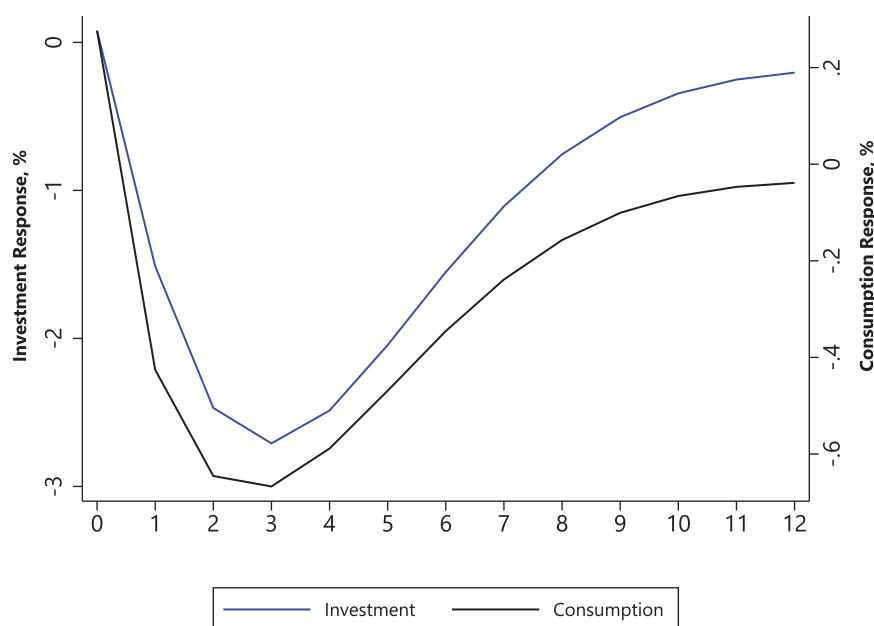

Figure 10. Response to an EU shock: aggregate consumption and investment.

Aggregate consumption and investment response to a 1-SD EU shock. The following set of endogenous variables was used to compute the VAR (1) model: *EU, IPEC, r, I, C, L*. We also include the two principal components used throughout all specifications as exogenous covariates. Impulse-responses were identified using the same ordering outlined earlier when listing the endogenous variables.

investment response point to a 2.1–3.2% decline in investment in the mid-run, while we do not find evidence of an overshooting effect. Additionally, we find evidence that the bulk response is explained by the decline in private investment, with some short-run impacts of uncertainty on public investment. Moreover, we extend these results by finding that increases in economic

uncertainty affect both mining and non-mining investment, with the former showing a more pronounced decline. On the other hand, our estimates for the GDP response show a decline that ranges from 0.5% to 0.9%. For employment, we find a decline between 0.3% and 0.7%.

Importantly, the nil presence of an overshooting effect in all impulse-response function shows that economic uncertainty may in fact have permanent effects on macroeconomic aggregates. As such, this contrasts with the predominant theoretical literature that argues that after an economic uncertainty shock, economic activity should exhibit an overshooting effect (Bloom 2009), partially supporting Carrière-Swallow and Cèspedes' (2013) finding in the context of emerging economies. These effects can be sizeable, with investment falling between 10% and 20% after an economic uncertainty shock. We see our results as a robust complement to Carrière-Swallow and Cèspedes (2013) since we explicitly constructed a local index for the Chilean economy, which falls into their category of an emerging economy, without relying on any common global uncertainty shock to identify the response of macro aggregates, though we find similar results for the Chilean economy.

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Disclosure statement

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