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Communication of Credit Rating Agencies and Financial Markets

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Abstract

The ability of credit rating agencies (CRAs) to influence financial markets has been widely debated in the academic literature, policy circles and general press. While some commentators think that CRAs' announcements have relevant effects on the markets, others reckon that they may simply follow investor opinion. To address the issue, the empirical literature has mainly employed the event study methodology, analyzing the behavior of financial markets around rating change announcements. Following a recent trend that has emphasized the use of high-frequency data to achieve credible identification in macroeconomics, in this paper, we use the instrumental variable-local projection (IV-LP) methodology to obtain the effect of structural shocks to CRAs' communication on financial markets. Applying this approach to Mexico, we find that CRAs' communication about the sovereign has statistically significant effects on CDS spreads, interest rates and the exchange rate.

Keywords: credit rating agencies, financial markets, instrumental variable

JEL Classification: G14, F40.

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1. Introduction

The ability of credit rating agencies (CRAs) to assess risk has been widely discussed in the academic literature, policy circles and general press (Ashcraft et al., 2011; Bank for International Settlements, 2008; Demyanyk and Van Hemert, 2011; Opp et al, 2013; Stanton and Wallace, 2017; Tomlinson and Evans, 2007). CRAs have been blamed for not signaling risk in advance, for instance, before the subprime crisis in the US (Bank for International Settlements, 2008; Krugman, 2010; White, 2010). They have been also criticized from the opposite end, for having too much influence on sovereign spreads in the Euro crisis of 2010-11 (Holden et al, 2018). Related to this point, some observers think that CRAs have relevant impacts on financial markets, while others believe that their importance is exaggerated since they "are as much following investor opinion as leading it" (Brealey and Myers, 2003).

A related question is whether CRAs affect market valuations or they simply follow the market (Binici and Hutchison, 2018). Conceptually speaking, there are several reasons why CRAs can affect financial markets, including the existence of asymmetric information, regulation and their ability to coordinate economic agents in a setup of multiple equilibria (Altman and Rijken, 2004; Boot et al, 2005; Millon and Thakor, 1985). From an empirical point of view, the literature has relied on the event study methodology to assess whether financial markets, specifically credit default swap spreads and bond interest rates, respond to announcements of CRAs (Binici and Hutchison, 2018; Binici, Hutchison and Miao, 2020; Cantor and Packer, 1996; Finnerty et al, 2013).

However, addressing this question empirically generates great challenges because traditional methods produce answers that are subject to important omitted variable and reverse causality concerns. In this paper, we propose an alternative empirical approach, employing the instrumental variable-local projection methodology (IV-LP) to analyze the effect that CRAs' communication about Mexican sovereign debt has on financial markets. After discussing the advantages that this methodology offers, we show that, within this framework, CRAs' communication has statistically significant effects on sovereign CDS and interest rate spreads. It also affects interest rate spreads on Mexican corporates' bonds and the exchange rate. This is compatible with previous contributions highlighting the importance of CRAs for emerging markets (Alsakka and Gwilym 2012).

Traditionally, the theoretical literature has emphasized that CRAs can play a meaningful role in markets subject to asymmetric information and moral hazard (Altman and Rijken, 2004; Millon and Thakor, 1985; Opp et al, 2013). Millon and Thakor (1985), in their seminal contribution, showed that in a setting in which insiders have more information regarding the value of their firms than outsiders, CRAs can engage in the production of information and gain from sharing it. The role of CRAs in disseminating private information, however, has been put in doubt on several occasions due to their delay in signaling rising default risk (Kiff et al, 2012; White, 2010).[1] In this context, additional mechanisms have been proposed. First, CRAs provide certification services. Ratings are used to categorize bonds as investment or non-investment grade, which influences institutional demand and market liquidity (Kiff et al, 2012; White, 2010). Ratings are also used to calculate the risk-weights that are employed for

[1] White (2010) highlights the delays in the case of the Enron, WorldCom and Lehman Brothers' bankruptcies.

regulatory purposes (Kiff et al, 2012). Second, ratings can serve as coordinating mechanisms in markets subject to multiple equilibria. Boot et al (2005) consider a model of self-fulfilling equilibria in which, when markets expect a firm to undertake a risky project, they require a high interest rate, thereby incentivizing the firm to indeed take excessive risk. However, if a sufficient portion of investors take ratings into account, this bad equilibrium can be eliminated. Holden et al (2018) consider a model of self-fulfilling sovereign debt crises, showing that CRAs can indeed help investors coordinate around one equilibrium, but in a pro-cyclical rather than an anticyclical manner, thereby increasing sovereign default risk.

Empirical contributions have mostly considered event studies, following the approach initially proposed by Weinstein (1977), Pinches and Singleton (1978), Cantor and Packer (1996) and Hull et al (2004). These studies consider several time intervals around the rating change and test the statistical significance of the response of the financial variable of interest, usually CDS spreads, bond interest rates or stock market values.[2] The time intervals often also include days prior to the announcements to assess to what extent CRAs decisions are discounted by the markets in advance. Using this approach, older contributions tended to find ambivalent results. Weinstein (1977), e.g., finds no statistically significant effect of rating decisions on corporate bond prices. Cantor and Packer (1996), instead, suggest that, though markets and CRAs make similar assessments of default risk,[3] CRAs have additional effects on market prices of non-investment-grade issuers. More recently, most studies find that CRAs rating decisions have significant effects on the markets. Binici et al (2020) and Finnerty et al (2013), e.g., find that rating decisions significantly affect CDS spreads, especially after considering prior outlook or watch status. Similarly, Alsakka and Gwilym (2012) find that CRAs sovereign credit signals affect the country's exchange rate, especially in emerging markets.

As explained by Gürkaynak and Wright (2013), event studies with high-frequency data are one of the best tools for achieving identification with macroeconomic and financial data. To ensure proper identification, however, i) the time interval around the event must be small and ii) market expectations about the event have to be controlled for. Regarding i), the event study approaches described above consider several time intervals, both small (often a two-days window around the CRA's announcement) and large (encompassing several days before and after the announcement). Results based on the large intervals, while interesting, may be subject to omitted variable or reverse causality bias.[4] Concerning ii), these studies often test the statistical significance of the response of the variable of interest to a rating decision, comparing it to some benchmark.[5] To do so, for instance, they test if the CDS responds more

[2] Throughout the paper, we refer to rating, outlook or watch decisions simply as rating decisions.

[3] In particular, both CRAs and the markets tend to consider mostly publicly available information to assess risk, which suggests that the part of ratings explained by CRAs' private information is quantitatively less important.

[4] Some papers, e.g., consider days prior to the announcement to understand if the markets discount CRAs' announcements in advance. In principle, other shocks in this time window may cause market volatility and, at the same time, induce the CRAs to adjust the rating. In addition, CRAs may observe market behavior and decide to adjust ratings in response, rather than the other way around.

[5] Often, the return on the asset under analysis is compared to the return on a basket of similar assets not affected by the CRA's decision. In the case of the sovereign rating, the benchmark is often the CDS of other similar countries.

negatively, in comparison with the benchmark, to a downgrade. However, to the extent that rating decisions are discounted in advance, this approach can lead to attenuation bias (Gürkaynak and Wright, 2013), i.e., the effect of rating announcements can be biased downwards.

In this paper, we take an alternative route. Instead of testing if downgrades (upgrades) significantly increase (decrease) the CDS, we simply use the change of the CDS on the day of CRAs' rating announcements as an indirect measure of how much each announcement affects market perceptions.[6] Then, we use this measure as an instrument in an IV-LP model to obtain impulse response functions to a structural shock to CRAs' communication, that is, variation in CRAs' communication not discounted in advance by the market. Conceptually, while the event studies discussed above are interested in measuring the effect of specific rating decisions on market outcomes, we follow the approach more common in the macroeconomic literature of obtaining responses to unexpected structural shocks.

Time series analysis with instrumental variables, such as instrumental variable VARs (IV-VARs) and IV-LPs, has recently been used to achieve credible identification of monetary policy (Gertler and Karadi, 2015), fiscal policy (Mertens and Ravn, 2013), and political risk shocks (Balduzzi et al, 2020), among others.[7] The approach often consists in identifying structural shocks with high frequency data. Gertler and Karadi (2015) use the change in the price of FED funds rate future contracts on the days of monetary policy announcements as an instrument to identify monetary policy shocks. Similarly, Kanzig (2018) uses high-frequency market data to identify oil supply news shocks. An approach more similar to ours is that of Balduzzi et al (2020) who use the change in the CDS on days of important political events as an instrument to identify political risk shocks.

As in all contributions in the IV-VAR and IV-LP literature, we use the change in the CDS on days of CRAs' rating announcements as an instrument for the structural shocks to CRAs' communication, and not as a measure of the structural shock itself. Indeed, as CRAs communicate their opinions, directly or indirectly, also on other occasions, using the change in the CDS as a direct measure of the structural shock would lead to measurement error.[8] CRAs, in fact, release interviews and publish research notes that can have effects on the markets also on days in which no rating decision is communicated.[9] Further, CRAs rating decisions on a debtor transmit information about other similar debtors (Gande and Parsley, 2005).[10]

[6] Notice that the surprise is not necessarily in the same direction as the rating change. E.g., a change from stable to negative outlook can in principle cause a decrease in the CDS if the markets were discounting a rating downgrade. Another advantage of our approach is that we can also use those announcements in which neither the rating nor the outlook is changed.

[7] For a discussion of the advantages and disadvantages of IV-VARs in comparison with IV-LPs, see Stock and Watson (2018).

[8] A similar problem emerged in seminal contributions that used external series as a measure of monetary policy shocks, such as Romer and Romer (1989, 2004). As Mertens and Ravn (2013) show, these external series are only a noisy measure of the true shock, and for this reason should be used as instruments.

[9] See, for example, S&P Global Ratings (2018).

[10] For example, sovereign rating decisions have spillover effects on other similar sovereigns (Gande and Parsley, 2005; Brooks et al, 2004), in particular in emerging markets (Ismailescu and Kazemi, 2010).

Contrary to what is common in microeconometric studies, in IV-VARs and IV-LPs, the shock, i.e., the "instrumented" variable, is not observed (Stock and Watson, 2018; Mertens and Ravn, 2013; Balduzzi et al, 2020). Consequently, as we explain in detail below, the scale of the shock must be normalized, and an indicator variable has to be chosen (Stock and Watson, 2018). Following Balduzzi et al (2020), we run a first stage regression in which the daily change in the CDS, which we use as indicator variable, is regressed against the instrument, i.e., a variable equal to the daily change in the CDS on days of CRAs' announcements and equal to zero on other dates. In the second stage, we regress the predicted value of the first stage on several financial variables for various horizons. To ensure that our instrument is exclusively correlated with our structural shock of interest and not with other shocks, we control for several global and domestic financial variables.

In this paper, we apply this methodology, which is used more frequently in the macroeconomics than in the finance literature, to the case of an emerging market economy. We use it to analyze the response of Mexican financial markets to CRAs' communication about its sovereign debt. The results show that a CRA communication shock has a statistically significant effect on sovereign CDS, interest rate spread of government bonds and the exchange rate. It also affects private sector variables, including the stock market and private bond interest rates. A CRA's communication shock that increases the sovereign CDS by 1 basis points has a more than proportional effect on sovereign and corporate interest rates.

Our results add to previous contributions that highlight the importance of CRAs' decisions in emerging markets. In these countries, the response of sovereign CDS and interest rates to rating decisions has been shown to be statistically significant (Ismailescu and Kazemi, 2010). Further, sovereign ratings have important consequences on bank flows from developed to emerging market economies (Kim and Wu, 2011) and affect exchange rates disproportionately in emerging markets (Alsakka and Gwilym, 2012). Our empirical methodology allows us to obtain impulse response function to not only study the statistical significance of the effect of CRAs' communications shocks on financial variables, but also analyze its dynamics over time. Our results show that the importance of CRAs emphasized in event studies survives when adopting an empirical approach that is more common in macroeconomic studies.

The rest of the paper is organized as follows. Section 2 presents the methodology used for the estimation of the effect of CRAs' communication on financial variables. Section 3 describes the data used for the estimation. Section 4 presents the results and Section 5 concludes.

2. Methodology

To study the impact of CRAs' communication on financial variables, the IV-LP methodology relies on identification of structural shocks, i.e. random variation in CRAs' communication that is uncorrelated with market developments. As noted in Stock and Watson (2018), if the structural shock $\epsilon_{ra,t}$ were observed, its effect on financial variable Y_i at horizon h, $\Theta^i_{r,h}$, could consistently be estimated by OLS regression:

(1) $$Y_{i,t+h} = \Theta^i_h \epsilon_{ra,t} + u_{i,t+h},$$

with $E(u_{i,t+h}, \epsilon_{ra,t}) = 0$. In this context, a possibility is to use information on CRAs' decisions on sovereign rating and outlook decisions as a direct measure of the structural shock. However, this option is inconvenient for two reasons: i) these decisions capture only partially communication from CRAs; and ii) they are not exogenous because they incorporate publicly available market information.

Concerning i), CRAs communicate information about the sovereign in other ways. In particular they also communicate either explicitly, e.g., through interviews and research notes, or implicitly through rating decisions on systemic firms or on other sovereigns with similar characteristics.[11] Thus, using rating decisions as a direct measure of the structural shock generates the econometric problems associated with measurement error. However, these decisions are most likely correlated with the structural shock and this enables us to use them as an instrument in the context of an IV-LP approach (Stock and Watson, 2018; Balduzzi et al, 2020). More formally, denoting by Z_t the information on CRAs' decisions on rating and outlook, it is reasonable to believe that $E(Z_t, \epsilon_{ra,t}) \neq 0$. That is, this information is likely to satisfy the *relevance condition* for an instrument.

In contrast to standard IV regressions, however, the IV-LP approach faces the additional problem that the shock is not observed, which implies that Θ_h^i can only be identified up to a scaling constant (Stock and Watson, 2018). This problem can be resolved by adopting a normalization for the scale of $\epsilon_{ra,t}$, assuming that a unit increase in $\epsilon_{ra,t}$ is associated with an increase of a unit in an indicator variable, $Y_{1,t}$ (i.e., $\Theta_0^1 = 1$). As our indicator variable, we use the daily change in the sovereign Mexican CDS. This enables us to write the outcome variables in terms of an observable regressor in the following manner:[12]

(2) $$Y_{i,t+h} = \Theta_h^i Y_{1,t} + u_{i,t+h}^*.$$ [13]

Concerning ii), only part of rating decisions depends on the private information or evaluation of the CRAs. To the extent that they also incorporate publicly known information, these decisions will not be exogenous. Moreover, since rating decisions respond to market conditions, Z_t does not satisfy the *contemporaneous exogeneity* requirement for an instrument, i.e., it is correlated with other structural shocks $\epsilon_{-ra,t}$,[14] $E(Z_t, \epsilon_{-ra,t}) \neq 0$. This problem can be partly addressed as one uses daily frequency data. CRAs are unlikely to make a decision on a particular day based on that same day market information.

However, even with daily data, it is not possible to exclude the possibility that Z_t be correlated with lags of the structural shocks, thereby not satisfying the *lead-lag exogeneity*

[11] In the case of Mexico, it is important to highlight the role of rating and outlook decisions on the government-owned oil enterprise, Pemex.

[12] To be more precise, this assumption allows expressing the indicator variable as the sum of the structural shock of interest and a linear combination of other contemporaneous and past structural shocks, $\{\epsilon_{-ra,t}, \epsilon_{ra,t-1}, \epsilon_{-ra,t-1}, \dots\}$, $Y_{1,t} = \epsilon_{ra,t} + \{\epsilon_{-ra,t}, \epsilon_{ra,t-1}, \epsilon_{-ra,t-1}, \dots\}$.

[13] $u_{i,t+h}^*$ is a linear combination of contemporaneous structural shocks, $\epsilon_{ra,t}$ excluded, and the leads and lags of all structural shocks, i.e., $u_{i,t+h}^* = \{\epsilon_{ra,t+h}, \epsilon_{-ra,t+h}, \dots, \epsilon_{-ra,t}, \epsilon_{ra,t-1}, \epsilon_{-ra,t-1}, \dots\}$.

[14] $\epsilon_{-ra,t}$ is the vector of all structural shocks apart from $\epsilon_{ra,t}$.

condition, i.e. $E(Z_t, \epsilon_{t+j}) \neq 0$ for $j \neq 0$, where $\epsilon_t = [\epsilon_{ra,t}\ \epsilon_{-ra,t}]$.[15] Intuitively, the rating decision may take place following a period of market volatility due to which using Z_t as an instrument raises the risk of confounding the effect of market volatility for the effect of CRAs' communication. In this context, the evidence does indeed show that CRAs decisions are discounted by the markets in advance (Cantor and Packer, 1996; Hull et al, 2004).

This concern can be addressed including suitable control variables in regression (2) (Stock and Watson, 2018). Defining the vector of control variables W_t:

$$(3) \qquad Y_{i,t+h} = \Theta_h^i Y_{1,t} + \delta W_t + u_{1,t+h}^{*\perp}$$

where $x_t^{\perp} = x_t - \text{Proj}(x_t \mid W_t)$ for some variable x_t and δ is a vector of coefficients. In particular, orthogonalizing the instrument with respect to the control variables allows it to satisfy the three conditions for a valid IV-LP:

$i)$ $E\left(\epsilon_{\text{ra},t}^{\perp} Z_t^{\perp}\right) = \beta \neq 0$ (relevance);

$ii)$ $E\left(\epsilon_{-\text{ra},t}^{\perp} Z_t^{\perp}\right) = 0$ (contemporaneous exogeneity);

$iii)$ $E\left(\epsilon_{t+j}^{\perp} Z_t^{\perp}\right) = 0$ for $j \neq 0$ (lead-lag exogeneity).

Intuitively, after controlling for W_t, the rating decision must constitute relevant CRAs' communication and must be unpredictable with contemporaneous and lagged market information.[16] In practice, the latter is not an easy task: CRAs' decisions happen infrequently (Altman and Rijken, 2004) and the evidence suggests that the markets begin discounting them several weeks in advance (Cantor and Packer, 1996). In our daily dataset, this would require controlling for a large number of lags of market variables. To avoid this complication, instead of using the rating itself as the instrument, we follow the approach of Balduzzi et al (2020) and use the end-of-day daily change in the sovereign CDS on the days in which the rating decision is communicated to the market.[17] As market discounting is reflected in the level of the CDS, the change in the CDS on the days of the announcements is likely to be a good measure of the extent to which CRAs' decisions surprise the markets. Control variables further ensure that this is the case.

In practice, as in Balduzzi et al (2020), (3) can be estimated by IV regression, instrumenting our indicator variable, the daily change in the CDS, with our instrument, a variable that is equal to the daily change in the CDS on the dates of CRAs' announcements and zero on all other dates. With this approach, our estimated parameters of interest are:

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[15] The lead-lag exogeneity condition also requires that the instrument is not correlated with future structural shocks. As argued by Stock and Watson (2018), given the definition of structural shocks as unpredictable innovations, this requirement is automatically satisfied if the instrument is a contemporaneous or lagged variable.

[16] Moreover, including controls in the regression reduces the sampling variance of the error term, in turn diminishing the sampling variance of the estimator.

[17] Balduzzi et al. (2020) use this approach to measure the effect of political risk shocks. An additional complication of using the rating as instrument arises from their categorical nature. While a categorical variable could still be used as instrument, the effect of rating changes on the market is likely to be non-linear. Plausibly, e.g., rating changes may have stronger effects than outlook changes. The effect also depends on the initial rating as well as on the sign of the rating or outlook adjustment (Binici and Hutchinson, 2018). Using the change in the CDS on the day of the announcements allows bypassing these difficulties, as it is likely to be bigger in the case of rating adjustments that the market perceives as more important.

$$(4) \qquad \Theta_h^i = \frac{E(Y_{i,t+h}^{\perp} Z_t^{\perp})}{E(Y_{1t}^{\perp} Z_t^{\perp})};$$

which is the impulse response function of variable Y_i to a structural shock $\epsilon_{ra,t}$.

We consider a baseline empirical specification and an extended one. In the baseline specification, we only include the first difference of the sovereign CDS in Y_t. In the extended one, we also include in Y_t the CDS spread of PEMEX (the government-owned oil enterprise), the EMBI+ and the CEMBI spreads (capturing the difference between the interest rate on Mexican sovereign and corporate dollar bonds over US treasury bonds, respectively), all expressed in first differences, as well as the Mexican peso-USD exchange rate and the Mexican stock market index IPC, both expressed in log first differences. To ensure that conditions ii) and iii) are satisfied, in both empirical specifications, we introduce several controls. In particular, W_t includes past realizations of Y_t and Z_t, as well as contemporaneous and past realizations of the CBOE Volatility Index (VIX), the Brent crude oil spot price (both in log-differences) and an average of the sovereign CDS spreads of other emerging market and middle income economies (in first differences).[18] As we explain in detail below, these global controls help ensure that our instrument is not correlated to global shocks that affect Mexican financial markets. Following Balduzzi et al (2020), we introduce four lags of the endogenous variables and three lags of the instrument and global controls.

After the estimation, we accumulate impulse response functions and construct confidence intervals with the block-bootstrap method proposed by Kilian and Kim (2011). To ensure that our results capture CRAs' communication shocks instead of other confounding factors, we run placebo tests: specifically, we run 2000 estimations using as instrument the daily change in the CDS on random dates, instead of dates of CRAs' announcements.

3. Data Sources

We use several sources to construct our dataset. The five-year maturity CDS spreads on Mexico's sovereign debt, PEMEX and the other emerging markets were obtained from IHS Markit.[19] The Mexican Stock Market Index IPC, the Mexican peso-USD exchange rate, the EMBI+ Mexico Sovereign Spread, the CEMBI Corporate EMBI Mexico Blended Spread, the CBOE implied volatility index (VIX) and Brent crude oil spot price were taken from Bloomberg.

To construct our instrument, we identify dates of CRAs' rating announcements on Mexico's sovereign 5-year maturity dollar debt. We consider all the rating and outlook decisions of the three major CRAs, i.e. Fitch Ratings, Moody's, and Standard & Poor's, made from January 4, 2010 to December 31, 2019.[20] Over this period, the CRAs made 38 rating

[18] Emerging and middle-income economies follow the definition of the IMF, see appendix for the complete list.

[19] We use the five-year maturity US dollar CDS contract.

[20] Excluding the global financial crisis and the Covid-19 pandemic from the estimation period makes identification more credible, as periods of high market volatility are not considered. This is particularly relevant, given that three rating and outlook decisions on Mexico were taken in March and April 2020, in the midst of severe market volatility. Our data source for the CDS of the sovereign and of Pemex is Markit, whose dataset covers the period 2010-2021. Notice that no watch decision was taken by any of the three CRAs in the period covered by our estimation.

and outlook decisions in total: 15 were from Fitch Ratings, 5 from Moody's and 18 from Standard & Poor's. Of these decisions, 25 were rating confirmations (no change in outlook nor rating), 4 were outlook upgrades, 6 were outlook downgrades, 2 were rating upgrades, and 1 was a rating downgrade.[21] Using the note that CRAs publish on the day of rating announcements, we were able to distinguish the announcements that were made before market closing time from those that were made after.[22]

Then, we construct our instrument as the change in the CDS spread between the end of the day in which the CRAs make the announcement and the end of the previous day. For the cases in which the announcement was made after market closing time, we use the change in the CDS spread of the following day. Figure 1 shows the instrument, along with the direction of the CRAs' announcement (bold and light red arrows indicate rating and outlook downgrades respectively, bold and light green arrows rating and outlook upgrades. Events without arrows are rating confirmations).

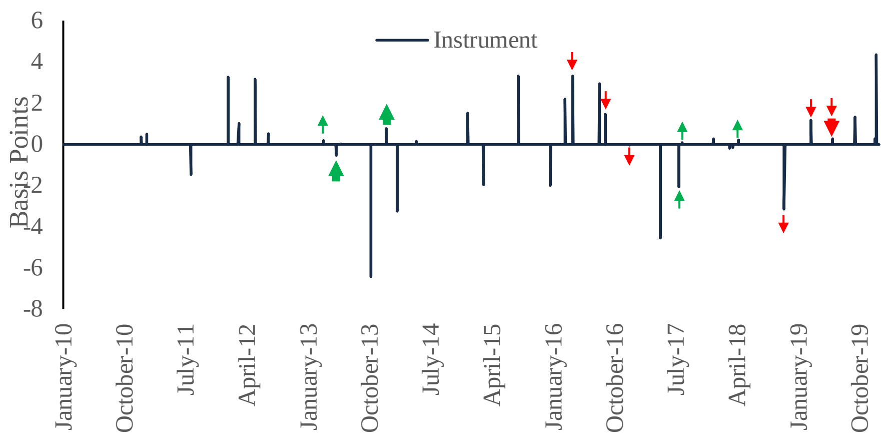

Figure 1 - Source: Elaborated with data from IHS Markit, Fitch Ratings, Moody's, and Standard & Poor's. The instrument, plotted as slim blue bars, is the daily change in the closing sovereign CDS spread of Mexico with respect to the previous day, on the days on which CRAs take decisions about the sovereign rating. The dates were obtained from online publications on the CRAs websites.

A reading of CRAs' notes published on days of announcements suggests that CRAs incorporate public information on both macroeconomic and financial developments in their decisions. For instance, Moody's explained its decision to upgrade Mexico's rating in 2014 by referring to "*a spending cap on primary current expenditures*". Similarly, Fitch rating justifies its decision to confirm Mexico's rating on March, 16th 2018 by highlighting the resilience of the Mexican economy to multiple shocks such as "*weaker economic growth* [and] *lower-than-budgeted oil production*". Of course, the fact that CRAs incorporate public

[21] In total, the dates with rating decisions are 36, since in two days of our sample there were simultaneous decisions. The first date is October 31st, 2018, when Fitch Ratings made a negative outlook change and Standard & Poors confirmed its previous rating. The second is June 5th, 2019, when Fitch ratings downgraded its rating and Moody's made a negative change of outlook.

[22] More precisely, given that CDS contracts are traded in OTC markets, we use as closing time the hour in which Markit collects and publish CDS data from several markets. We were not able to identify the time at which the announcement was made in 14 cases and assigned the announcement to the day of publication. This is unlikely to affect the results: in fact, of the announcements of which we were able to identify publication time, only one was after closing time.

information in their decisions, e.g. information that financial market already know, suggests that market agents could discount these decisions in advance.

In this context, it is interesting to notice that the change in the CDS on the days of announcements does not always go in the same direction as the rating decision, suggesting that indeed the markets may be sometimes surprised positively (negatively) by negative or neutral (positive or neutral) CRAs' announcements.

4. Results

As mentioned, we consider a baseline empirical specification and an extended one. In the first, we only include the sovereign CDS as endogenous variable and discuss the role that the exogenous controls, i.e. the VIX, Brent price and CDS of other EMEs, have in ensuring identification. In the second, we also include among endogenous variables the CDS of Pemex, the EMBI+ and the CEMBI spreads, the exchange rate and the stock market index. To discuss differences between our approach and the event study methodology more commonly used in the literature, however, we first present the results obtained with the latter approach.

a) Event study

To carry out the event study, we follow Binici et al (2020). We consider an event window that starts eight weeks before the CRA's rating decision and ends three weeks after. Within this window we also consider five smaller windows: 8 to 3 weeks before the event, 3 weeks to 1 day before the event, the day of the event itself, the day of the event and the following day and 2 days to 3 weeks after the event.

The methodology requires computing the daily abnormal return on Mexico's CDS over a benchmark, defined as the return on the average CDS spread of EMEs. In particular:

$$(5) \qquad AR_t = r_t - \alpha - \beta R_t$$

where AR_t is the abnormal return on day t, r_t is the daily change in Mexico's CDS spread and R_t is the daily change in the average of EMEs' CDS spreads.[23] For each CRA's decision, α and β are estimated OLS using data over the six months prior to the beginning of the event window. The daily abnormal returns AR_t are then summed over the event window as well as over each of the smaller windows to obtain the cumulative abnormal returns $CAR_{\mathrm{w}}^{\mathrm{a}}$ for an event a in the window w (that is, we estimate six different CARs for every event: one for the entire window and five for the sub-periods). We normalize the CAR_w^a so that their standard deviation is $s = 1$ and obtain the standardized cumulative abnormal return, $SCAR_w^a$.

We divide the announcements into two categories: rating or outlook upgrades and rating or outlook downgrades.[24] We group all the events of the same type and calculate the t statistic

[23] Binici et al (2020) consider the percentage daily change instead. We use the daily change to be consistent with the CDS variable that we use in the IV-LP model.

[24] In principle, we could consider four categories: rating upgrades, rating downgrades, outlook upgrades and outlook downgrades. However, that would substantially reduce degrees of freedom and cannot be done for rating downgrades due to the fact that there is only one event in this category in our dataset. We also discard all the events in which neither the rating nor the outlook is changed.

(6) $$t_{C,w} = \frac{\overline{SCAR}_{C,w}}{\sqrt{\frac{1}{N(N-1)}\sum_{j=1}^{N}\left(SCAR_{C,w,j}-\overline{SCAR}_{C,w,j}\right)^2}}$$

where C is the event category, N is the number of events in said category, and $\overline{SCAR}_{C,w}$ is the average standardized cumulative abnormal return for the events in category C. The statistic $t_{C,w}$ follows a t-distribution with $N-1$ degrees of freedom, and it is tested against the null hypothesis that announcements of type C are not significantly related to the cumulative abnormal returns of the Mexican CDS in a window of length w.

Table 1 reports the results of the event study. Concerning upgrades, the markets tend to move in advance: the SCAR is negative and statistically significant in the windows from 8 to 3 weeks (-0.40 standard deviations of the abnormal return in the 6 months before the event, std henceforth) and from 3 weeks to one day (-0.98 std) before the event. No statistically significant effect is identified on the day of the event. From 2 days to 3 weeks after the event, the CDS spread increases more than the benchmark (the SCAR is 1.17 std), which suggests that upgrades are only temporarily related to positive market perceptions. Concerning downgrades, in contrast, the SCAR is positive and statistically significant on the day of the event (0.65 std) and in the window comprising the day of the event and the day after (0.46 std). Downgrades are not preceded by statistically significant market movements in prior weeks.

Type of event	Window	SCAR (average)	t
Upgrade	*8 weeks before - 3 weeks after*	-0.16	-0.63
	Day of event	0.11	0.65
	8-3 weeks before	-0.40***	-5.63
	3 weeks - 1 day before	-0.98**	-2.60
	Day of event - day after event	0.04	0.19
	2 days - 3 weeks after	1.17**	3.04
Downgrade	*8 weeks before - 3 weeks after*	0.20	0.40
	Day of event	0.65***	5.13
	8-3 weeks before	0.17	0.42
	3 weeks - 1 day before	-0.18	-0.43
	Day of event - day after event	0.46**	3.06
	2 days - 3 weeks after	0.14	0.39

Table 1: Event study. Upgrade refers to rating and outlook upgrades. Downgrade refers to rating and outlook downgrades. SCAR refers to the standardized cumulative abnormal return defined as the accumulated change in the CDS in the window minus the change predicted by an OLS regression of it against the average of the CDS change of a group of EMEs in the six months before the event. The reported SCAR is the average of the SCAR across the events of each type. T is the t-statistics. *** statistically significant at the 1% level. ** statistically significant at the 5% level.

As mentioned in the introduction, these results cannot be easily interpreted as causal. For example, rather than capturing expectations of an upgrade, a lower SCAR before these events may be observed by the CRAs, pushing them to increase the rating (*reverse causality* bias). Also, other events may at the same time cause the CDS spread to fall and the CRA to upgrade the rating (*omitted variable* bias). These problems can be tackled by considering the smaller windows, for instance the day of event (Gürkaynak and Wright, 2013), as CRAs are unlikely to make a decision on a particular day based on that same day market information.

However, the day of event window may be subject to *attenuation bias* (Gürkaynak and Wright, 2013). For instance, the absence of a statistically significant effect of upgrades on the day of the event, rather than implying that the CRAs do not affect market perceptions, may only be due to the markets reacting in advance. For similar reasons, in downgrade events, the event study results may be substantially underestimating the quantitative effect of these decisions on the markets. In this sense, the event study may be interpreted as the average effect of a rating decision, rather than as the effect of CRAs' communication.

Our IV-LP model allows tackling this problem through an alternative approach. Instead of testing the statistical significance of the CDS change on the day of the event, the IV-LP uses it as an instrument to identify structural shocks to CRAs' communication. This takes into account attenuation bias, recognizing that CRAs' communication does not only take place on dates of rating announcements and therefore that CDS changes on that day may underestimate its effect.[25] Through scale normalization, we identify the effect of CRAs' communication on financial markets relative to the size of the shock.

In addition, while event studies have to discard CRAs' decisions in which both the rating and the outlook are confirmed, this needs not be the case in IV-LPs. In fact, to the extent that confounding factors are appropriately controlled for, the CDS change on the day of these events is linked to CRAs' communication and increases the amount of information that can be used to identify its effect.

b) Baseline model

As a first step, we consider the model with the sovereign CDS as endogenous variable and without global controls.[26] Even though our dataset only contains 36 dates with CRAs' announcements over a sample of 2513 days, the coefficient on our instrument in the first stage regression is positive and highly significant. The t-statistics is 19 and the F statistics is 12.57, which is larger than the critical value of 10 usually considered in the literature (see, e.g., Gertler and Karadi 2015; Stock, Wright and Yogo, 2002). These statistics suggest that our instrument is sufficiently correlated with our indicator variable as to be used in our regressions and that our empirical model is likely to satisfy the *relevance* requirement for a good instrument.

Figure 2 shows the impulse response of the sovereign CDS to a CRAs' communication shock with 95% confidence bands. As explained in the previous section, the IV-LP methodology requires a scale normalization of the impact response of the sovereign CDS, which we set to 1 basis point. The effect on the CDS increases to almost twice the shock three days after and remains statistically significant more than one week.[27] This is compatible with previous literature highlighting the role that CRAs have in influencing market

[25] Of course, this approach still requires that the instrument be relevant, i.e. that the CDS change on the day of the event is correlated with the structural shock. In practice, though the latter correlation cannot be proved, the literature usually uses an F-test on the first stage regression to suggest that this could be the case. As we show in the following section, the F-test suggests that our instrument is good.

[26] As explained in section 2, we also include four lags of the sovereign CDS and of the instrument as controls.

[27] More precisely, the impulse response is significant up to six business days after the shock.

perceptions about the sovereign, especially in emerging markets (Alsakka and Gwilym, 2012).

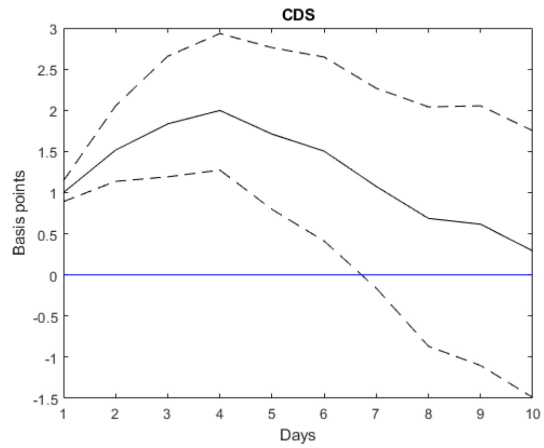

Figure 2 – impulse response of the sovereign CDS in the baseline model, with only the daily change of the CDS as endogenous variable and no exogenous control. Four lags of the daily change of the CDS and three lags of the instrument are included. The dashed lines represent the 95% block-bootstrapped confidence bands.

Without additional controls, however, our empirical specification may not satisfy the *contemporaneous* and *lead-lag exogeneity* conditions. E.g., estimation may be biased by global financial shocks.[28] Likely candidates are shocks to the appetite for risk of global investors, to market perceptions about EMEs and to oil prices. As for other EMEs, in fact, bouts of risk aversion in global markets usually result in higher risk premia on Mexico's sovereign debt. Similarly, Mexican financial markets are exposed to specific emerging market factors that cause co-movement among the sovereign CDS of these countries (see, e.g., Binici, Hutchison and Miao 2020). Controlling for oil prices is also important, given that oil revenues represent an average of 25% of total government revenues in our sample. Bias may emerge from the fact that CRAs take into account these factors in their rating decisions.[29] As mentioned in section 2, to control for these shocks, we use the VIX, an average of the CDS of EMEs and the Brent crude oil price.[30]

Figure 3 shows the impulse response functions of the CDS in the model with the VIX (left panel), the Brent oil price (central panel) and the average of the CDS of EMEs (right panel) as controls. Full lines are the impulse responses and the dashed lines the 95% confidence bands. In all specifications, the impulse response function remains positive and statistically significant for more than one week, with an effect of more than twice the shock in the models with the VIX and the CDS of EMEs as controls.[31]

[28] Of course, also non-financial shocks, e.g. shocks to output or sovereign debt, may in principle bias the results. However, such shocks are unlikely to do so at a daily frequency.

[29] Specifically, e.g., CRAs may internalize the fact that higher risk aversion and/or EMEs' specific risk perceptions can raise sovereign interest rates and funding cost and decide for a rating downgrade. As these shocks usually also cause increases in the CDS, a mis-specified empirical model may assign the latter effect to the CRAs announcement. A similar bias may emerge for oil price shocks.

[30] As explained in section 2, we include contemporaneous and three lags of these variables.

[31] The F statistics are 9.67, 14.23 and 18.09 in the model with the VIX, the Brent and the average CDS of EMEs as controls, respectively.

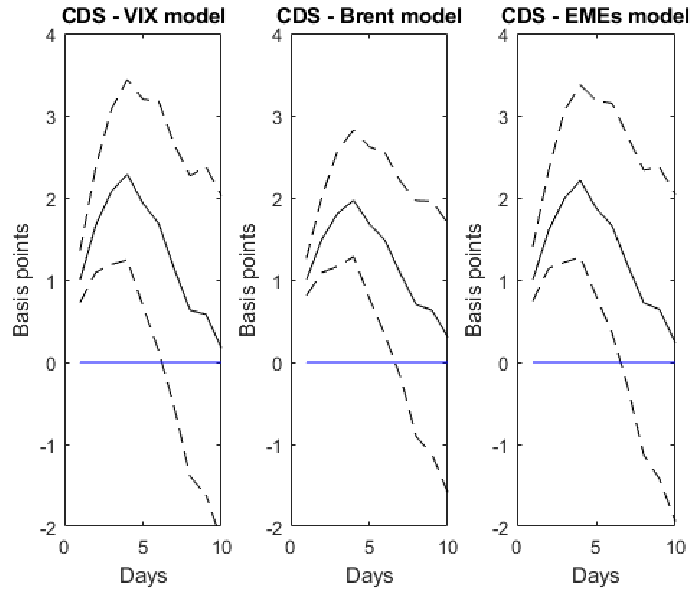

Figure 3 – The left panel reports the impulse response function of the sovereign CDS in the model with the contemporaneous and three lags of the daily change in the log of the VIX as controls and only the daily change of the CDS as endogenous variable. The central panel reports the impulse response function of the sovereign CDS in the model with the contemporaneous and three lags of the daily change in the log of Brent price as controls and only the daily change of the CDS as endogenous variable. The right panel reports the impulse response function of the sovereign CDS in the model with the contemporaneous and three lags of the daily change of an average of the CDS of EMEs as controls and only the daily change of the CDS as endogenous variable. In all models, four lags of the daily change of the CDS and three lags of the instrument are included. Full lines are the impulse responses and the dashed lines the 95% confidence bands.

In the last step, we also estimate a specification including the VIX, the Brent price and the average CDS of EMEs as controls at the same time. Figure 4 shows the impulse response of the sovereign CDS with 95% confidence bands.[32] As in the model without controls, the effect of the CRAs' communication shock on the sovereign CDS is significant for more than one week. The CDS increases to more than twice the shock on day 3 and remains above the initial shock until day 7.

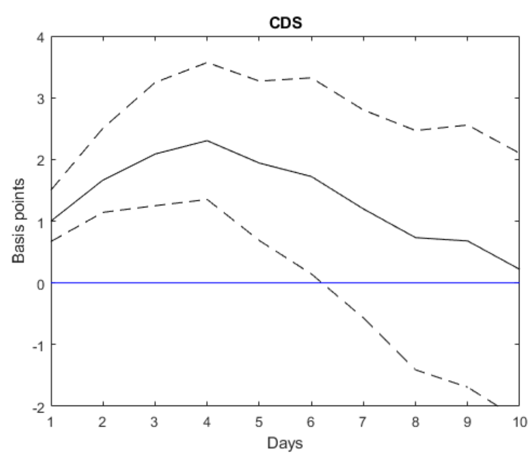

Figure 4 - impulse response of the sovereign CDS in the model with the daily change of the log of the VIX, the daily change of the log of Brent oil price and the daily change of the average CDS of EMEs as controls and only the daily change of the

[32] In this model, the F statistic is 16.87.

CDS as endogenous variable. Three lags of the controls and of the instrument and four lags of the CDS are included. Dashed lines are the bootstrapped 95% confidence bands.

c) Extended model

CRAs may affect other important financial variables, apart from the sovereign CDS. Though the literature on sovereign ratings has mainly considered this latter variable, the exchange rate and public and private sector borrowing costs have also been analyzed (Alsakka and Gwilym, 2012; Ismailescu and Kazemi, 2010). The IV-LP methodology can easily be used to analyze the effect of CRAs' communication on these variables in a unified framework.

Hence, in our extended model, in addition to the global controls, we include the CDS of PEMEX, the EMBI+ and CEMBI spreads, the peso-USD exchange rate and the stock market index.[33] The coefficient on our instrument in the first stage regression is positive and significant (the t-statistics is 5.8 and the F statistics is 11.3, larger than 10). In Figure 5, we present the impulse response functions to a CRAs' communication shock with 95% confidence bands. Similar to the baseline model, the effect on the CDS is statistically significant for more than one week and increases to more than twice the shock after three days. This is compatible with previous literature highlighting the role that CRAs have in influencing market perceptions about the sovereign, especially in emerging markets (Alsakka and Gwilym, 2012). Interestingly, the shock has an effect of similar magnitude on the CDS of PEMEX: the response on impact is similar and reaches more than twice the size of the shock after three days.

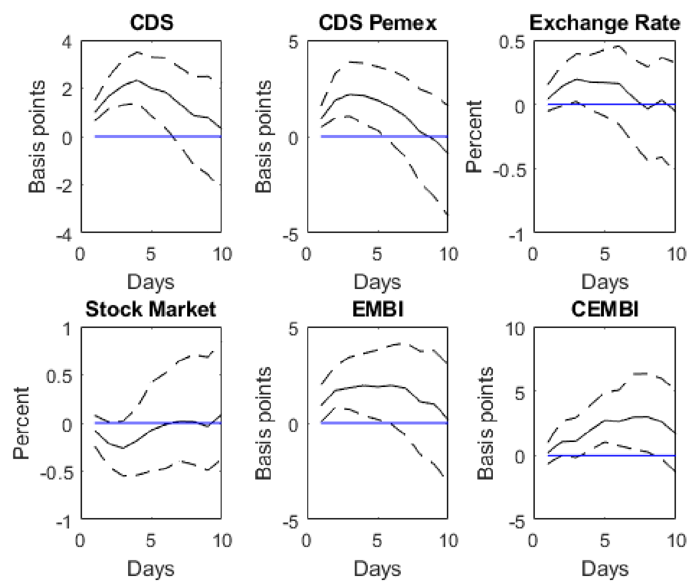

Figure 5 – Impulse responses in the extended model with the daily change of the CDS, the CDS of PEMEX, the EMBI+ and CEMBI spreads and the daily change of the log of peso-USD exchange rate and of PCI Mexican stock markets index as endogenous variables. The daily change of the average of the CDS of EMEs and the daily change of the log of the VIX and of the Brent oil price are included as controls. Four lags of the endogenous variables and three lags of the controls and of the instrument are included. The continuous black line represents the impulse response function after a CRAs'

[33] Following Balduzzi et al (2020), we include four lags of these endogenous variables and the contemporaneous value and three lags of the exogenous controls.

communication shock that generates an increase in the Sovereign CDS of 1 basis point. Dotted lines represent the 95% block-bootstrap confidence interval.

The EMBI+ spread response is close in magnitude and persistence to that of the sovereign CDS and it is interesting to note that the effect on the borrowing cost of Mexican corporates (CEMBI spread) is somewhat larger and more persistent, though it is more sluggish and becomes statistically significant later.[34] This result highlights how CRAs' communication about the sovereign has important implications for private borrowers. This is compatible with previous evidence. As Corsetti et al (2013) shows, in fact, worsening perceptions about the sovereign are not only usually reflected into higher sovereign interest rates, but also affect private borrowing costs. Given the systemic relevance of the sovereign, in fact, government debt is often used as benchmark for pricing private sector assets (Wooldridge, 2001). The sluggishness of the response may be due to lower liquidity in corporate debt markets.

Finally, the shock also causes a depreciation of the peso-USD exchange rate, while the response of the stock market is not significant at the 95% level.[35] The response of the exchange rate is quantitatively strong (around 0.02% for a shock of 1 bp to the CDS), though statistically significant only the third day after the shock. The significance of the response of the exchange rate suggests that CRAs communication can not only have important effects on the borrowing cost of the private and public sector, but also have wider macroeconomic consequences.

In this context, it is important to note that, even though the effect of the shock tends to die out within two weeks for all variables, this may be a consequence of the sample we use. In this sample, there is only one rating downgrade and Mexico retains investment grade with all CRAs. In the presence of non-linearities in the effect of CRAs' communication, arising for instance when bond rating is close to losing investment grade, both the interest rate and the exchange rate may react more strongly and for longer (Cantor and Packer, 1996).

d) Placebo tests

Our identification strategy is based on the assumption that on the dates in which CRAs make a rating decision, no other shock occurs that is systematically correlated with our instrument, conditional on our set of controls. In other words, our controls have to span the space of all background shocks that could be correlated with the daily change in the sovereign CDS on the days of CRAs' announcements.

To ensure that this is the case, we follow Balduzzi et al. (2020) and run a standard placebo test. In particular, we estimate our empirical model using as instrument the daily change in the sovereign CDS spread on randomly selected dates, instead of the dates of CRAs' announcements. We repeat this procedure 2000 times and present the 97.5 and 2.5 percentiles as confidence intervals. If our controls do indeed span the space of all background shocks, these intervals should include the zero.

Concerning the placebo test on the baseline model without global controls (Figure 6 in the appendix), this is not the case: in particular, the intervals do not cover the zero in the first

[34] More precisely, it is not significant on impact and becomes significant after one (three) business days with 90% (95%) confidence bands.

[35] However, both are significant with 90% confidence bands.

four days after the shock, suggesting that controls are indeed needed to ensure identification. Adding the Brent oil price to the model does not affect the statistical significance of the responses (Figure 7, central panel). In fact, the interval does not include the zero in the first four days after the shock, as in the model without controls. However, including the VIX and, especially, the average CDS of EMEs substantially improves the results. When we control for the VIX, in fact, the interval does not include the zero for only three days after the shock, rather than four (Figure 7, left panel). Finally, controlling for the average CDS of EMEs ensures that the placebo interval includes the zero at all horizons, apart from the contemporaneous response (Figure 7, right panel). As emphasized by Balduzzi et al (2020), the significance of the placebo test at horizon zero is not surprising, as we are basically regressing the CDS on itself on a subset of dates. In this sense, the model with the average CDS of EMEs satisfactorily controls for background shocks. A similar result is obtained when including all global controls at the same time (Figure 8).

Concerning the extended model, the placebo test shows that the zero is included in the intervals for all variables, apart from the contemporaneous response of the CDS of the sovereign and of PEMEX (Figure 9). Given the close relationship between the two CDS, the significance of the contemporaneous response of the CDS of PEMEX is not surprising either. The placebo test demonstrates that we are satisfactorily controlling for background shocks and are correctly identifying CRAs' communication shocks.

5. Conclusion

The ability of CRAs to influence financial markets is a widely debated topic. Some commentators argue that CRAs are able to affect market assessment of sovereign and corporate risk, as well as have an impact on the stock and FX markets. Others, on the other hand, reckon that CRAs mainly follow investor opinion and, therefore, have limited effects on the markets (Brealey and Myers, 2003). The academic literature that has considered the issue mainly employs the event study methodology, using it to compute the effect of rating changes on several variables, such as CDS spreads, interest rates, stock markets values and exchange rates. However, while this methodology allows obtaining the average effect of CRAs' rating decisions, it raises relevant concerns of omitted variable and reverse causality if interpreted as the causal effect of CRAs' communication on financial markets.

In this paper, we have employed the IV-LP approach, which has already been used to achieve credible identification of monetary policy, fiscal policy, oil supply and political risk shocks (Gertler and Karadi, 2015; Mertens and Ravn, 2013; Kanzig, 2018; Balduzzi et al, 2020), to identify the effect of structural shocks to CRAs' communication about the Mexican sovereign on financial markets. In particular, we use as instrument the change of the sovereign CDS on days of CRAs' rating announcements. After controlling for several domestic and global financial variables, in fact, this variable only responds to CRAs' announcements, satisfying the relevance, contemporaneous and lead-lag exogeneity requirements for an instrument. With this technique, we show that CRAs' communication has statistically significant effects not only on sovereign CDS spreads and interest rates, but also on the funding cost of the private sector, as well as on the exchange rate.

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Appendix

List of Emerging and Middle-Income Countries

The average CDS spread of emerging markets and middle-income countries is calculated following the definition of the International Monetary Fund presented in its *Fiscal Monitor*. From this list, we use the 22 countries for which there is available their five-year contract CDS Spread in US dollars on IHS Markit. We use only the countries that have data available from the starting date of our sample, January 4, 2010, in order to avoid distortions in the average value from incomplete data series. These countries and their tickers are presented in the next table.

Country	**IHS Markit Ticker**
Poland	POLAND\SNRFOR\USD\CR14\5Y\100
Romania	ROMANI\SNRFOR\USD\CR14\5Y\100
Croatia	CROATI\SNRFOR\USD\CR14\5Y\100
Kazakhstan	KAZAKS\SNRFOR\USD\CR14\5Y\100
Russian Federation	RUSSIA\SNRFOR\USD\CR14\5Y\100
Brazil	BRAZIL\SNRFOR\USD\CR14\5Y\100
Chile	CHILE\SNRFOR\USD\CR14\5Y\100
Colombia	COLOM\SNRFOR\USD\CR14\5Y\100
Dominican Republic	DOMREP\SNRFOR\USD\CR14\5Y\100
Turkey	TURKEY\SNRFOR\USD\CR14\5Y\100
South Africa	SOAF\SNRFOR\USD\CR14\5Y\100
Saudi Arabia	SAUDI\SNRFOR\USD\CR14\5Y\100
Peru	PERU\SNRFOR\USD\CR14\5Y\100
Indonesia	INDON\SNRFOR\USD\CR14\5Y\100
Philippines	PHILIP\SNRFOR\USD\CR14\5Y\100
Thailand	THAI\SNRFOR\USD\CR14\5Y\100
Uruguay	URUGAY\SNRFOR\USD\CR14\5Y\100
Egypt	EGYPT\SNRFOR\USD\CR14\5Y\100
Qatar	QATAR\SNRFOR\USD\CR14\5Y\100
United Arab Emirates	UAE\SNRFOR\USD\CR14\5Y\100
China	CHINA\SNRFOR\USD\CR14\5Y\100
Malaysia	MALAYS\SNRFOR\USD\CR14\5Y\100

Placebo test

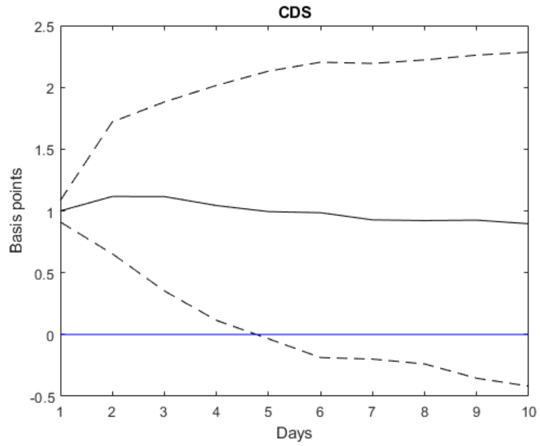

Figure 6 – Placebo test. Impulse response of the sovereign CDS in the baseline model, with only the daily change of the CDS as endogenous variable and no exogenous control. Four lags of the daily change of the CDS and three lags of the instrument are included. The model is estimated using as instrument the daily change in the sovereign CDS spread on randomly selected dates. We repeat this procedure 2000 times. The dashed lines are the 97.5 and 2.5 percentiles.

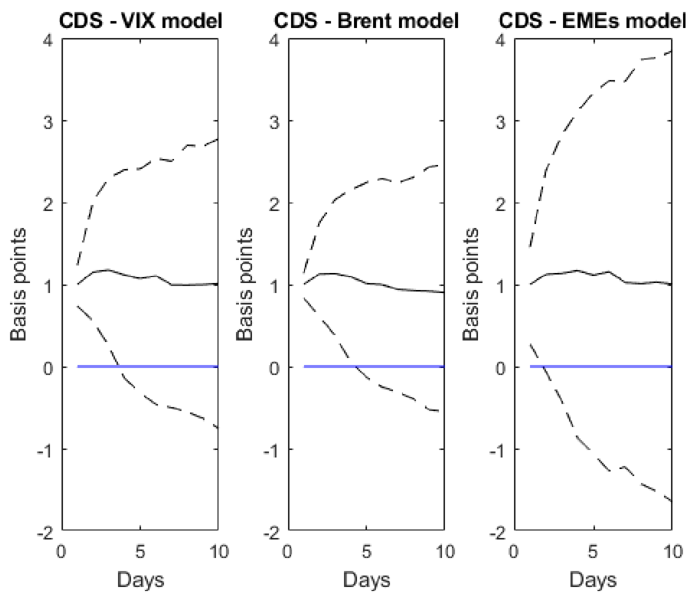

Figure 7 – Placebo test. The left panel reports the impulse response function of the sovereign CDS in the model with the contemporaneous and three lags of the daily change in the log of the VIX as controls and only the daily change of the CDS as endogenous variable. The central panel reports the impulse response function of the sovereign CDS in the model with the contemporaneous and three lags of the daily change in the log of Brent price as controls and only the daily change of the CDS as endogenous variable. The right panel reports the impulse response function of the sovereign CDS in the model with the contemporaneous and three lags of the daily change of an average of the CDS of EMEs as controls and only the daily change of the CDS as endogenous variable. In all models, four lags of the daily change of the CDS and three lags of the instrument are included. The model is estimated using as instrument the daily change in the sovereign CDS spread on randomly selected dates. We repeat this procedure 2000 times. The dashed lines are the 97.5 and 2.5 percentiles.

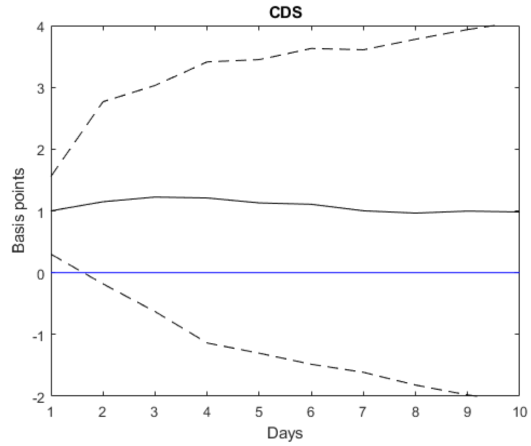

Figure 8 – Placebo test. Impulse response of the sovereign CDS in the model with the daily change of the log of the VIX, the daily change of the log of Brent oil price and the daily change of the average CDS of EMEs as controls and only the daily change of the CDS as endogenous variable. Three lags of the controls and of the instrument and four lags of the CDS are included. The model is estimated using as instrument the daily change in the sovereign CDS spread on randomly selected dates. We repeat this procedure 2000 times. The dashed lines are the 97.5 and 2.5 percentiles.

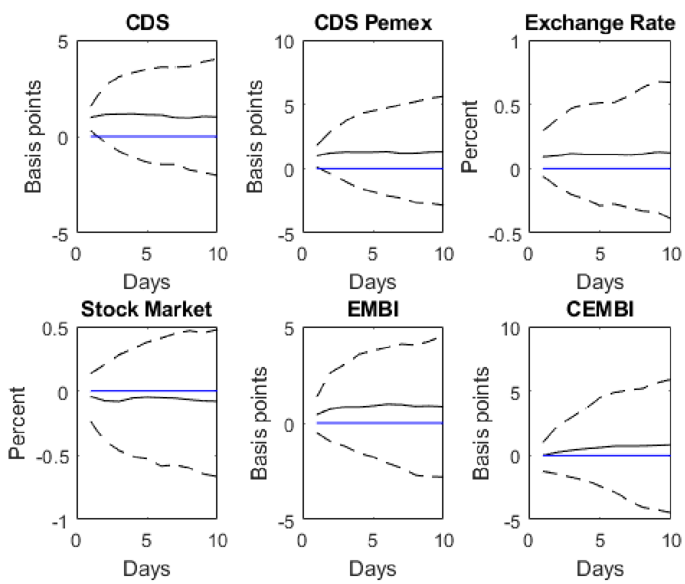

Figure 9 – Placebo test. Impulse responses in the extended model with the daily change of the CDS, the CDS of PEMEX, the EMBI+ and CEMBI spreads and the daily change of the log of peso-USD exchange rate and of PCI Mexican stock markets index as endogenous variables. The daily change of the average of the CDS of EMEs and the daily change of the log of the VIX and of the Brent oil price are included as controls. Four lags of the endogenous variables and three lags of the controls and of the instrument are included. The continuous black line represents the impulse response function after a CRAs' communication shock that generates an increase in the Sovereign CDS of 1 basis point. The model is estimated using as instrument the daily change in the sovereign CDS spread on randomly selected dates. We repeat this procedure 2000 times. The dashed lines are the 97.5 and 2.5 percentiles.