

Which Emerging Markets and Developing Economies Face Corporate Balance Sheet Vulnerabilities?

A Novel Monitoring Framework

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Abstract

This paper introduces a novel corporate financial vulnerability index that tracks financial conditions of the non-financial corporate sector. Using the balance sheet information of 14,207 listed non-financial firms in 69 emerging markets and developing economies, the index shows that, at the global level, corporate vulnerability sharply increased since 2013 and stabilized in 2016. Regional trends are more heterogeneous, pointing to significant corporate vulnerabilities in Eastern Europe and Central Asia, as well as a deterioration of firms' financial conditions in Latin America, the

Middle East and North Africa, and Sub-Saharan Africa in recent years. The energy sector has exhibited the fastest deterioration, especially since 2014, in part driven by the decline in oil prices. However, if currently relatively benign global funding conditions and higher commodity prices endure, companies may have an opportunity to strengthen their balance sheets. The paper also finds that the index has leading indicator properties for socioeconomic outcomes, such as a rise in unemployment and an economic recession, and outperforms a commonly used "debt at risk" approach.

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1 Introduction

Corporate debt in many emerging markets and developing economies (EMDEs) has risen significantly since the global financial crisis¹ (IMF 2015), raising concerns about financial stability and spillover risks to the real sector. This paper introduces the Corporate Vulnerability Index (CVI), a novel country monitoring framework that tracks financial conditions of the non-financial corporate sector in EMDEs. Using readily available balance-sheet information of listed non-financial firms, the CVI is based on seven indicators² which capture four key dimensions of firms' financial vulnerabilities: debt service capacity, leverage, rollover risk, and economic performance.

In recent years, a growing literature has attempted to quantify corporate financial vulnerabilities in EMDEs (Financial Stability Board, 2015; IMF, 2015, 2016a, 2017; IIF 2015 and 2017; World Bank, 2016; Beltran et al, 2016). While most of these studies assess vulnerabilities in terms of the interest coverage ratio (ICR) and leverage, some also consider corporate vulnerability along other dimensions, such as maturity mismatches (e.g. Gonzalez-Miranda, 2012; Rodrigues Bastos et al, 2015; Alfaro et al, 2017), and find that firms have changed their leverage and maturity structure between 2000 and 2013 to take advantage of benign global financial conditions. However, this literature focuses on a relatively small sample of firms in a select number of countries.

Our paper is related and contributes to the literature in several respects. First, we propose a novel vulnerability index which extends the widely-used concept of "Debt at Risk" (see for example IMF, 2016a). Debt at risk is the total amount of debt in a country (or industry) associated with firms which are deemed financially vulnerable, typically for firms with an ICR below a threshold. Our contribution is to apply this concept across multiple financial vulnerability indicators since firms can be financially vulnerable across multiple dimensions at the same time. The CVI appears to have leading indicator qualities; an increase in the CVI tends to be associated with a future economic recession and an increase in unemployment. Our findings also suggest

¹ See World Bank (2016), IMF (2015), IIF (2015), IS (2015) and Geneva Report (2015).

² The seven indicators are: Interest Coverage Ratio (ICR), Leverage ratio, Net debt to EBIT ratio, Current liabilities to Long-term liabilities ratio, Quick ratio, Return on Assets (ROA), and Market to Book ratio.

the CVI is more informative for future socio-economic outcomes compared to the commonly used Debt at Risk approach based on ICR (IMF, 2017; FSB, 2015).

The CVI is related to a large literature on corporate default modeling based on accounting data (e.g. Altman, 1968) and distance-to-default or contingent claim models based on market prices inspired by Merton (1974). Unlike the CVI, these models however require default and price data which are not readily available for a wide range of countries and/or firms. Another important advantage of our balance-sheet-based approach is that it can easily be extended to cover non-listed firms.

We also add to the “early warning” literature which suggests corporate debt overhangs can be a leading indicator of crises and growth slowdowns as well as having the effect of amplifying shocks (for Europe: Goretti and Souto, 2013; Aiyar et al., 2015; Bergthaler et al. 2015; for emerging markets: IMF, 2015; Lindner and Jung, 2014). Finally, unlike many previous studies that are based on small samples or individual countries, our paper is based on a large sample of 14,207 listed firms, spanning 11 years (2006 to 2016) and 69 EMDEs; this should make our findings more representative.

At the global level, the CVI suggests that vulnerabilities have risen sharply since 2013, but have stabilized in 2016. This global trend is caused by an increase in leverage and a deterioration of both profitability and debt service capacity. However, regional trends are heterogeneous as corporate vulnerabilities in Eastern Europe and Central Asia (ECA) have been elevated since 2007, while Latin America (LAC) shows a rapid increase in vulnerability since 2013. In 2016, most regions have stabilized except the Middle East and North Africa (MENA) and Sub-Saharan Africa (SSA), whose corporate sector’s vulnerabilities have risen. A key finding is that energy-linked sectors have shown an increase in financial vulnerabilities, especially since 2014, in conjunction with the decline in oil prices.

This paper is organized as follows. Section 2 describes recent trends in non-financial corporate sector debt in EMDEs and discusses the methodology to construct the CVI. Section 3 describes the data used for the construction of the index. Section 4 presents the main results. Section 5 describes robustness tests and extensions. Section 6 concludes.

2 Methodology

2.1 Trends in Non-Financial Corporate Debt in EMDEs

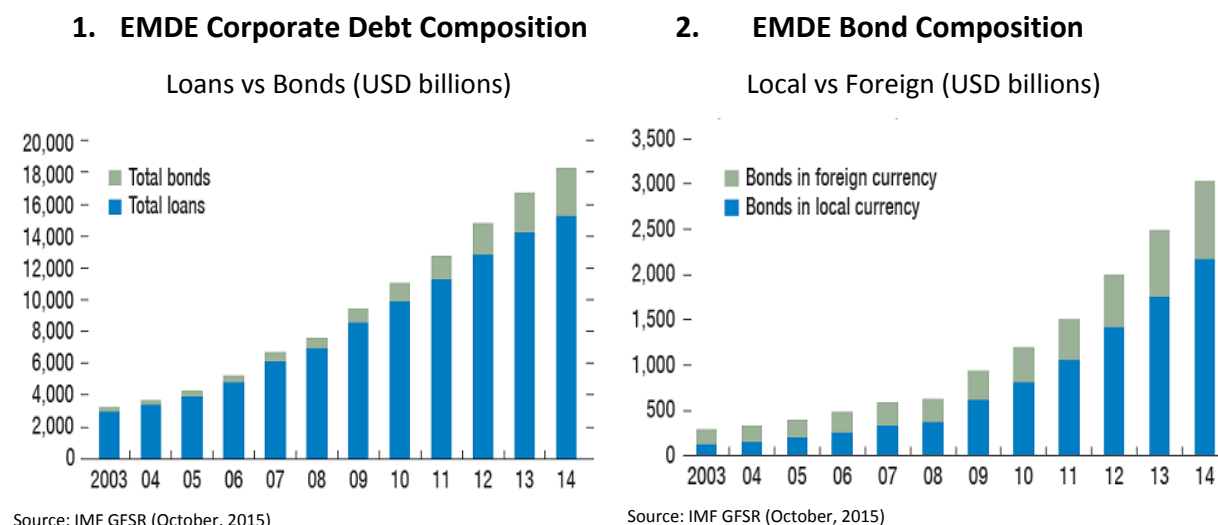
Non-financial corporate sector debt in many EMDEs has risen significantly since the global financial crisis³ (Figure 1.1). Moreover, given unprecedented accommodative monetary policies in the developed world, EMDE corporates have raised significant volumes of financing from global capital markets, mostly denominated in foreign currencies and typically not fully (naturally) hedged. This has had the effect of changing the composition of corporate debt in EMDEs away from bank credit and towards debt securities, with bond issuance from EMDE corporates more than doubling since 2010 (Figure 1.2).⁴

With the sharp decline in commodity prices since 2014 and the downward revisions to growth prospects across EMDEs, both firms' profitability and debt service capacity has trended down in those countries. Consequently, financial risks from the EMDE non-financial corporate sector have emerged, which have been reflected by the widening of corporate Credit Default Swaps (CDS) spreads across regions, the rise of non-performing loans in the EMDE banking sector, and the significant declining of corporate bond issuance since 2015.

³ See World Bank (2016), IMF (2015), IIF (2015), BIS (2015) and Geneva Report (2015).

⁴ Becker and Ivanshina (2014), Cortina, Didier and Schmukler (2016). For details on the evolution and financial threats of corporate indebtedness, see Acharya et al (2015).

Figure 1: EMDE Corporate Debt Evolution



In the current global environment, questions have been raised about the financial stability risks of the corporate sector in EMDEs and the potential spillover effects on their financial sectors as corporations may face tightening in the global financial conditions and/or lower and more volatile commodity prices.

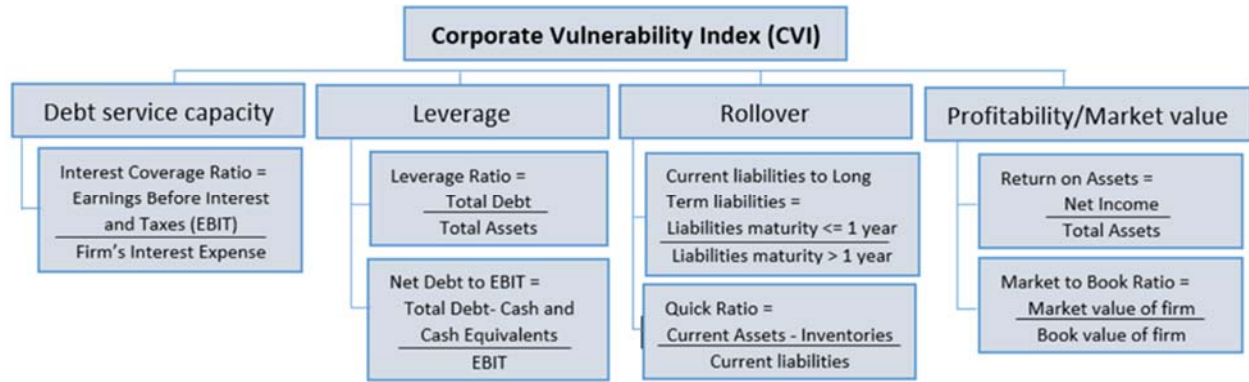
2.2 The Corporate Vulnerability Index

The CVI is a composite indicator that assesses non-financial corporate vulnerability in emerging and developing economies (EMDEs). Based on corporates' balance-sheet information, the CVI measures four key aspects⁵ of financial vulnerability that have been identified by the literature as leading indicators of corporate financial distress: Debt Service Capacity, Leverage, Rollover Risk, and Profitability/Market value. As shown in Figure 2, these four aspects of corporate vulnerability are measured using seven indicators for which data are readily and sufficiently available across a broad range of EMDEs: Interest Coverage Ratio (ICR), Leverage Ratio, Net Debt to EBIT Ratio, Current Liabilities to Long-term Liabilities Ratio, Quick Ratio, Return on Assets (ROA), and Market to Book Ratio. This set represents a diverse mix of indicators which are based

⁵ We recognize that other variables such as currency risks are important as well. However, as we explain in the Data section, data limitations prevent us from including them in our framework.

on both flow and stock data; it makes our approach more robust compared to, for example, the common “ICR-only” approach which could just flag a transient issue since the ICR is solely based on flow data. Indeed, although some of our indicators are conceptually correlated through basic accounting identities, empirically the pairwise correlations between the indicators are statistically significant, but relatively low across the four broad factors (Table 1) suggesting they capture different corporate vulnerability aspects and collectively can produce a more reliable result.

Figure 2: Structure of Corporate Vulnerability Index



The CVI is based on the concept of “Debt at Risk” (DaR), the total amount of outstanding debt in a country (or industry) associated with firms that are deemed financially vulnerable. DaR is an attractive concept to track corporate vulnerabilities since it exposes both the risk and magnitude present in the tail of the firm’s distribution, as opposed to other methodological approaches such as calculating averages or medians of (normalized) firm vulnerability indicators. Specifically, we define DaR_Y as the share of corporate debt in a country that is considered vulnerable according to indicator Y at time t and country c :⁶

$$(DaR_Y)_{ct} = \frac{\text{Total debt firms financially vulnerable in indicator } Y, \text{ country } c \text{ time } t}{\text{Total debt of all firms, in country } c \text{ and time } t}, \quad (6)$$

⁶ The CVI can be calculated at country-industry level. In that case, all calculations described in this section are conducted using information of corporate debt at country-industry level. Given that thresholds are calculated by industry, they are not modified when the VI at country-industry level is calculated.

where Y denotes one of our seven indicators. For each of the indicators, firms are classified as financially vulnerable if an indicator breaches an indicator-specific threshold at time t (Table 2).

Table 1: Firm-Level Correlations

	ICR	Leverage	Net Debt	Curr/Long Liab	Quick	ROA
ICR	1					
Leverage	-0.1777*	1				
Net Debt	-0.0286*	0.0035	1			
Curr/Long Liabilities	0.0115*	-0.0545*	-0.0199*	1		
Quick	0.1307*	-0.2482*	-0.0394*	-0.0175*	1	
ROA	0.2078*	-0.2897*	0.0306*	-0.0226*	0.0951*	1
Market to Book	0.0566*	0.0035	-0.0285*	0.0374*	-0.0006	0.0671*

Note: Financial Indicators of 14,207 listed non-financial firms in 69 countries. Annual Information from 2006 to 2016. Variables winsorized at 1%.

*Significance level 5%

Table 2: Thresholds to classify a firm as financially vulnerable

Indicator	"At risk" Thresholds
* Interest Coverage Ratio	< 1 (profits less than interest expenses)
* Leverage Ratio * Net Debt to EBIT * Current liabilities to Long-term liabilities	> 90 th percentile value of the indicator for all firms within the same industry , for the whole sample 2006-2016 . One threshold per industry
* Quick Ratio * Return on Assets * Market to Book Ratio	< 10 th percentile value of the indicator for all firms within the same industry , for the whole sample 2006-2016 . One threshold per industry

Note: Our sample includes financial information from 14,273 listed non-financial firms in 96 Emerging and Developing Economies, for years 2006 to 2016. A representativeness restriction is imposed in which countries with at least 5 firms in the sample are considered in the calculations. Therefore, the adjusted sample includes 14,207 firms from 69 countries.

We use 1 as a threshold for ICR since firms with profits less than interest expenses are immediately highly vulnerable. This threshold is more conservative than those in other studies, but we find that a value of 1 provides consistent results. For Leverage Ratio, Net Debt to EBIT Ratio, and Current to Long-Term Liabilities, the vulnerability thresholds correspond to the 90th percentile value of the respective indicators for all firms within the same industry and across countries. By pooling by industry and across time (2006-2016) and countries, we focus on industry-specific effects and abstract from time and country effects. Similarly, for Quick Ratio,

Return on Assets, and Market to Book Ratio, the respective thresholds are equal to the 10th percentile value of the indicator by industry.

We extend the notion of DaR_Y to multiple indicators which allows us to measure the “intensity” of debt at risk. We do so by focusing on debt of firms for which *multiple* indicators signal financial vulnerability *at the same time*. The underlying assumption is that debt that is associated with firms that are contemporaneously vulnerable according to multiple indicators is more risky. We operationalize this notion by defining $DaR_{\geq X}$. The $DaR_{\geq X}$ captures the proportion of total corporate debt in a country that is held by firms that are vulnerable according to X or more indicators at the same time, where $X \in [0,7]$:

$$(DaR_{\geq X})_{ct} = \frac{\text{Total debt firms financially vulnerable according to } X \text{ or more indicators, country } c \text{ time } t}{\text{Total debt of all firms, in country } c \text{ and time } t} \quad . \quad (7)$$

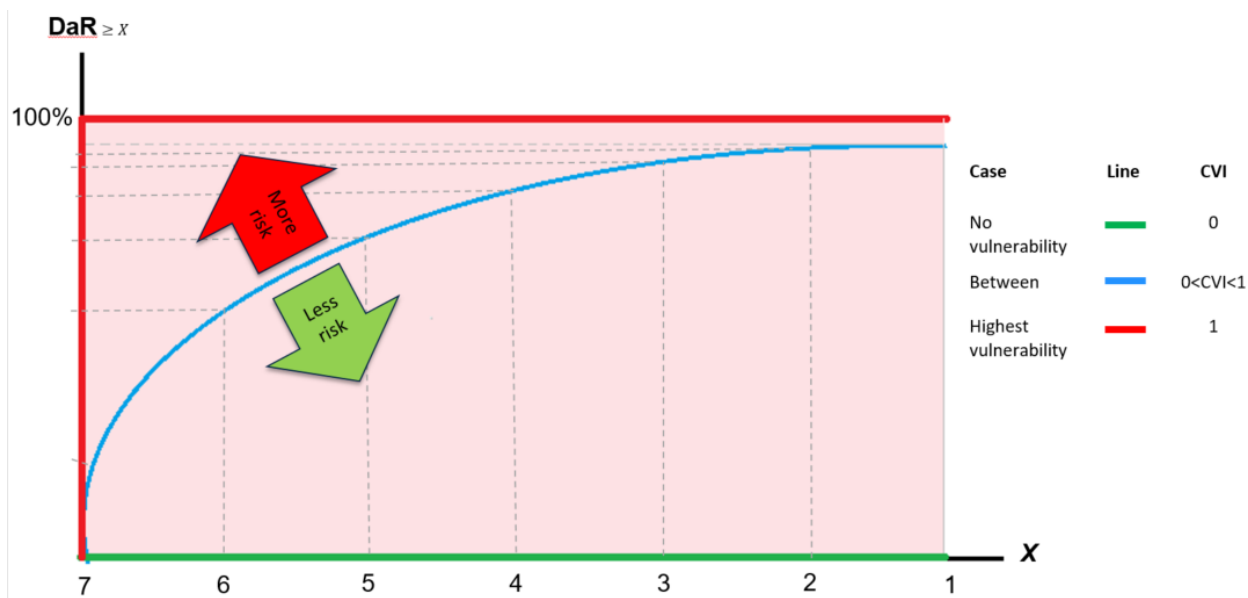
$DaR_{\geq X}$ is designed to exhibit a stronger signal-to-noise ratio compared to DaR_Y . The CVI is calculated as the average of $DaR_{\geq X}$ for country c and time t :

$$CVI_{ct} = \frac{1}{7} \sum_{X=1}^7 (DaR_{\geq X})_{ct} \quad , \quad (8)$$

where $0 \leq CVI_{ct} \leq 1$.

The definition has an intuitive graphical interpretation. As illustrated in Figure 3, the CVI is equivalent to the normalized area under the $DaR_{\geq X}$ curve (the area under blue line). At the extremes, if no firm is financially vulnerable according to any indicator, then the value of the area under the curve (and the CVI) is equal to zero (i.e. equivalent to the area under the green line). In contrast, if *all* firms are financially vulnerable with respect to *all* seven indicators, then the area under the curve (and the value of CVI) would be equal to one (i.e. equivalent to the area under the red line). In practice and as expected, the CVI has values well below one; the sample mean is 0.11 with a maximum of 0.51.

Figure 3: Corporate Vulnerability Index and Area Under the Curve



Our framework is underpinned by simplifying assumptions. The $DaR_{\geq x}$ concept does not differentiate between indicators and treats them as interchangeable and of equal weight. While the credit scoring literature referenced earlier focuses on assessing indicator weights, these models are typically applied to a specific country or industry and require corporate default data. In the absence of such data for a large sample of countries, and to ensure wide applicability and transparency of the CVI, our approach is more pragmatic. Note also that the CVI *de facto* applies a greater weight on the debt of more vulnerable firms since the area under the curve is cumulative (i.e. $DaR_{\geq 0}$ is always 100 percent). In other words, the debt of a firm which is vulnerable according to seven indicators weighs seven times more than the debt of a firm that is vulnerable according to only one indicator.

3 Data

We use balance-sheet information of 14,273 listed non-financial companies from 8 industries and 96 EMDE countries between 2006 and 2016 for the construction of the CVI. Bloomberg is the

source (see Figures 4.1 and 4.2).⁷ We exclude countries with fewer than five firms, which reduces our sample to 14,207 firms in 69 countries.⁸

It is important to highlight a few data limitations. First, our sample only covers listed non-financial firms. In most EMDEs listed firms are usually the biggest companies (by assets) and/or have better access to funding sources. This may bias our results, but we believe that information from listed companies, which generally also follow better accounting practices, nevertheless provides a good proxy of the general health of the overall non-financial corporate sector, in particular with regards to potential banking distress.⁹ Second, we do not have information about corporates' financial information by currency and are therefore not able to accurately assess currency risks and external vulnerabilities. This is a general concern, as neither Bloomberg nor any other data source consistently collects this type of information on a cross-country basis. Finally, our data set does not contain information on derivatives, other risk management tools and counterparties which could be helpful to better understand exposures and transmission channels of corporate risk.

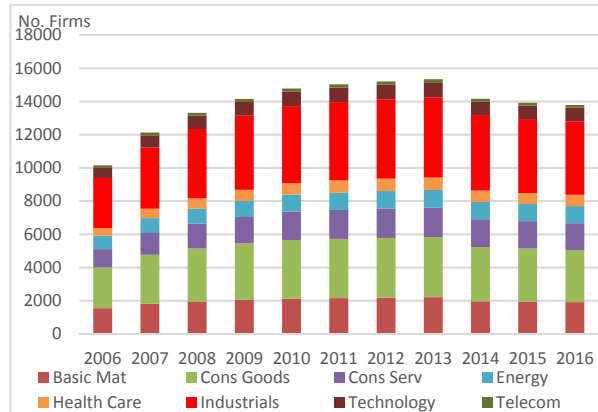
⁷ Coverage across regions and industries is heterogeneous: 38% of companies in the dataset are from EAP region, 26% from ECA, 17% from SA, 7.4% from MENA, 6.7% from LAC, 4.3% from SSA. In addition, 31.3% of the sample are firms from Industrials, 22.5% from Consumer Goods, 13.5% from Basic Materials, 11.6% from Consumer Services, 7.2% from Energy, 5.6% from Technology, 4.7% from Health Care, and 1.2% from Telecommunications.

⁸ The representativeness restriction of at least 5 firms in the database was not considered for calculating the VI at the country-industry level.

⁹ For instance, Gabaix (2011) highlights the importance of the firm's size to explain shocks to the aggregate output. This author states that idiosyncratic shocks to large firms can lead to nontrivial aggregate shocks as modern economies are dominated by large corporations.

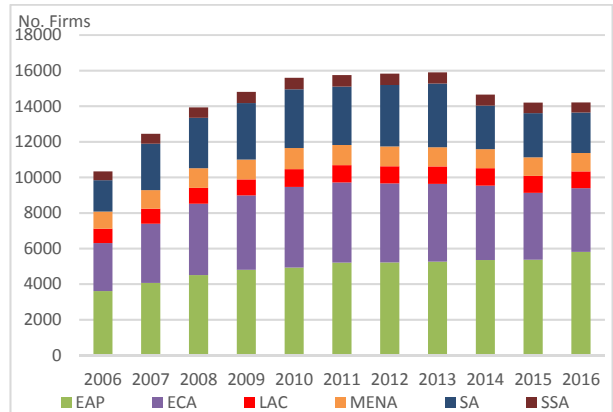
Figure 4: Data Coverage and Representativeness

1. Number of EMDEs' companies per region



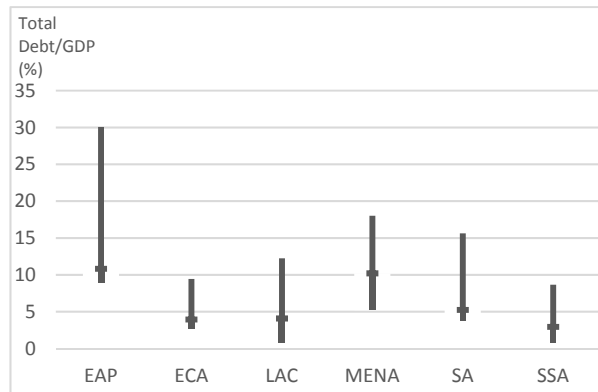
Source: Bloomberg

2. Number of EMDEs' companies per industry



Source: Bloomberg

**3. Reported total corporate debt
(% GDP)**

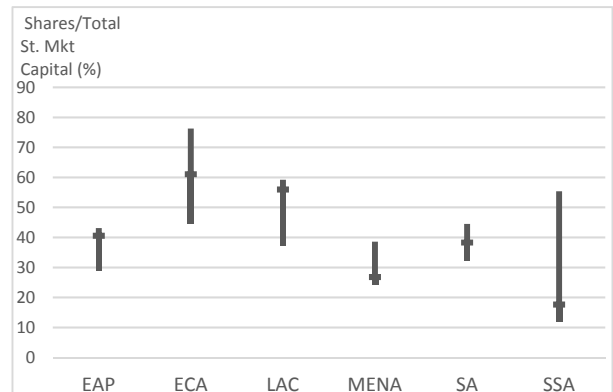


Median per region, 75th and 25th percentiles.

GDP available as of 2015.

Source: Bloomberg, WB-World Development Indicators

**4. Common shares of firms covered
(% Stock market capitalization)**



Median per region, 75th and 25th percentiles.

Stock market capitalization available as of 2015.

Source: Bloomberg, WB-Finstats

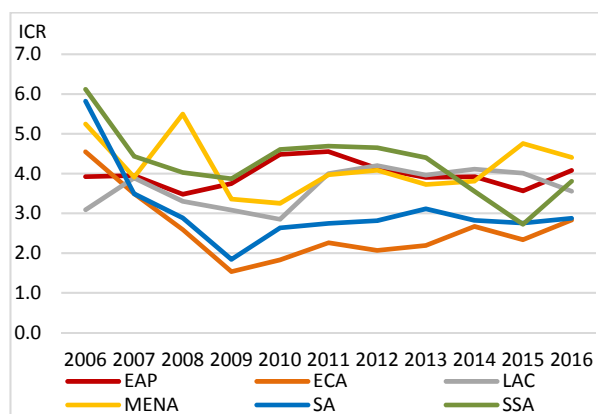
Our sample is not homogenous across regions (see Figure 4.3). The regional median of total corporate debt (% of GDP) ranges from 2.9 percent of GDP for SSA to 10.8 percent of GDP for EAP. The companies covered in our data set are nevertheless an important part of EMDEs' capital markets as the median value of their common shares (i.e. % of stock market capitalization) ranges from 17.6 percent in SSA to 61 percent in ECA (see Figure 4.4).

The financial indicators for listed non-financial firms in our sample show downward trends in debt service capacity, profitability, and market valuation across all regions (Figures 5.1, 5.2, and 5.3). In addition, leverage has increased in most regions except South Asia (SA) and EAP, where leverage has been high, but decreasing. LAC and SSA have experienced a steep increase in leverage since 2011/2012 (Figure 5.4). Based on an increasing Quick Ratio, rollover risk has declined since the Global Financial Crisis, but ECA, SA, and SSA may be vulnerable to adverse liquidity shocks as the quick ratio has been persistently below one (Figure 5.5).

Figure 5: Financial Indicators, 2006-2016

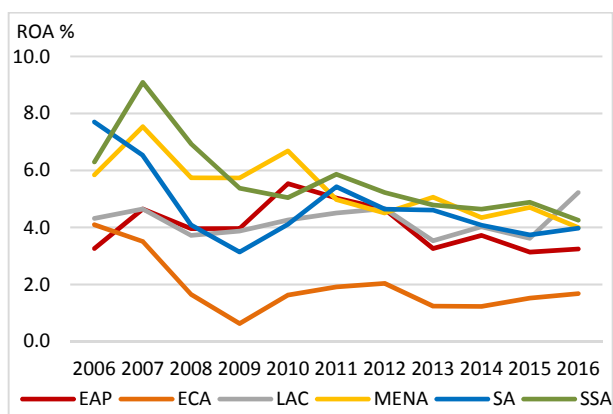
Country medians per region

1. Interest Coverage Ratio



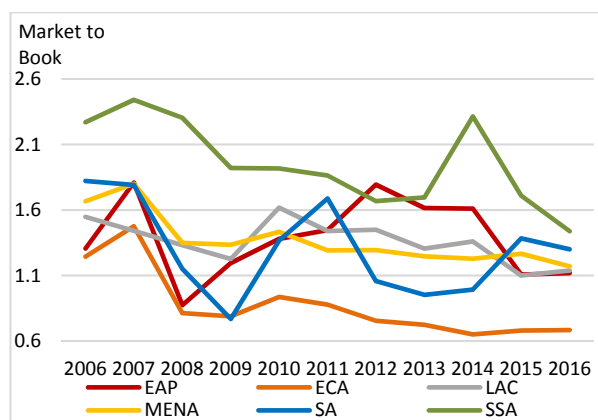
Note: Interest Coverage Ratio (ICR): Earnings Before Interest and Taxes/Interest Expenses. Source: Bloomberg, own calculations

2. Return on Assets



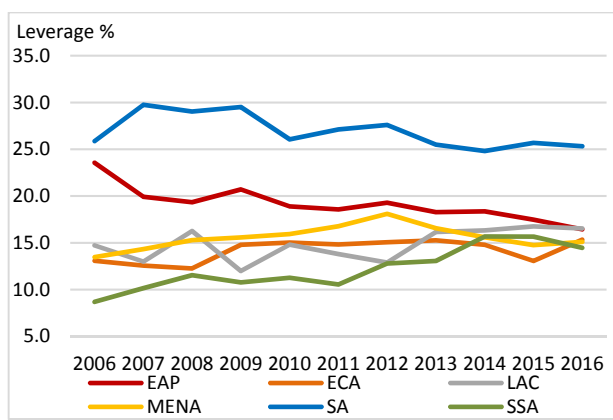
Source: Bloomberg, own calculations

3. Market to Book Ratio



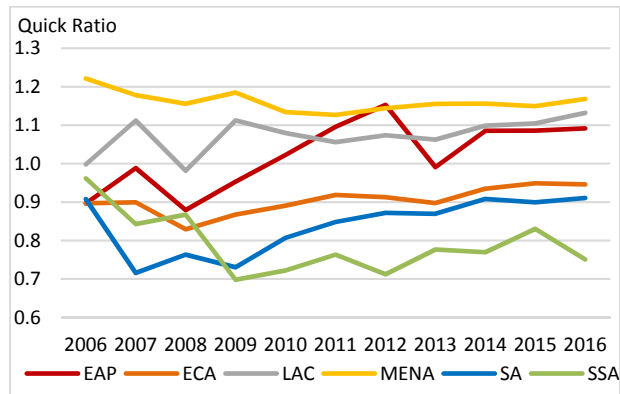
Source: Bloomberg, own calculations

4. Leverage Ratio



Note: Leverage Ratio: Total Debt/Total Assets. Source: Bloomberg, own calculations

5. Quick Ratio



Note: Quick Ratio: (Current Assets-Inventories)/Current liabilities.

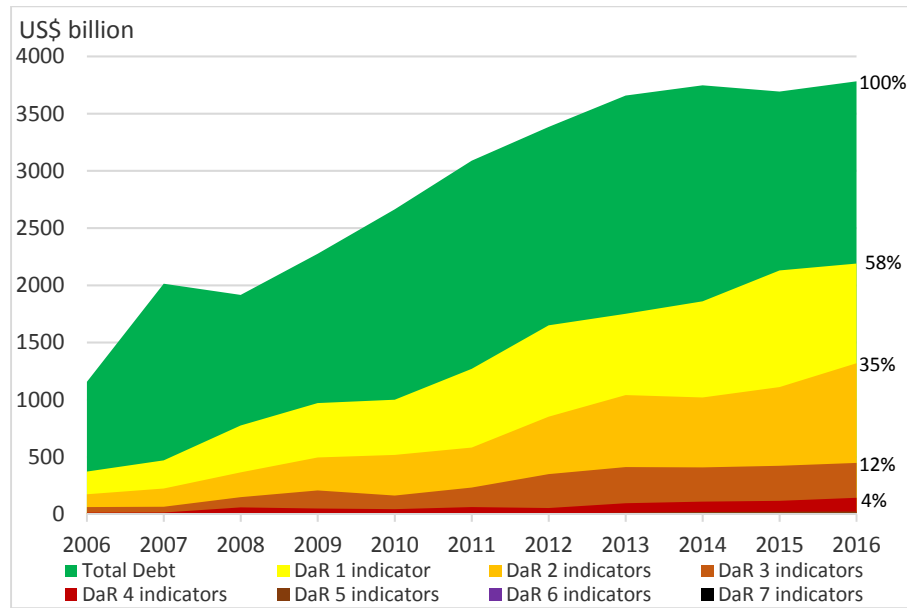
Source: Bloomberg, own calculations

4 Results

4.1 Trends in the Corporate Vulnerability Index

Debt of non-financial listed firms in EMDEs has increased in both level and riskiness (Figure 6): EMDEs' corporate debt increased by 46 percent, from \$2.6 trillion to \$3.8 trillion between 2010 and 2016. Over the same period, debt in the hands of firms considered vulnerable based on at least one indicator grew by 120 percent, from US \$1 trillion to US \$2.2 trillion. In 2016, about 58 percent of debt was considered 'at risk' based on at least one indicator; 35 percent according to two or more indicators; 12 percent based on three or more indicators; and 4 percent according to four or more indicators.

Figure 6: Corporate Debt at Risk
(US\$ Billion)

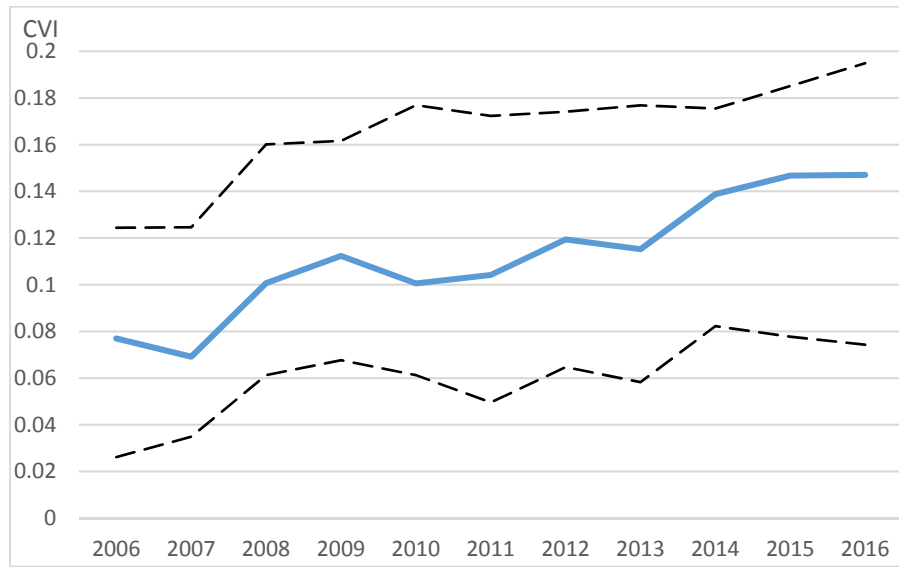


Note: DaR refers to 'Debt at Risk'. Source: Bloomberg, own calculations

At the global level, corporate vulnerability has increased sharply since 2013 according to our CVI¹⁰, although the speed of deterioration has moderated, especially in 2016 (see Figure 7). The global increase in corporate vulnerability has been driven by a rise in leverage ratios, and deteriorations in profitability and debt service capacity. Corporate vulnerability has also deepened: the country median value of $\text{DaR}_{\geq 1}$ increased by 10.3 percentage points from 2013 to 2016, while $\text{DaR}_{\geq 2}$, $\text{DaR}_{\geq 3}$, and $\text{DaR}_{\geq 4}$ rose by 8.6, 2.7, and 0.14 percentage points, respectively (Figure 8).

¹⁰ See Appendix for a CVI ranking at the country-level.

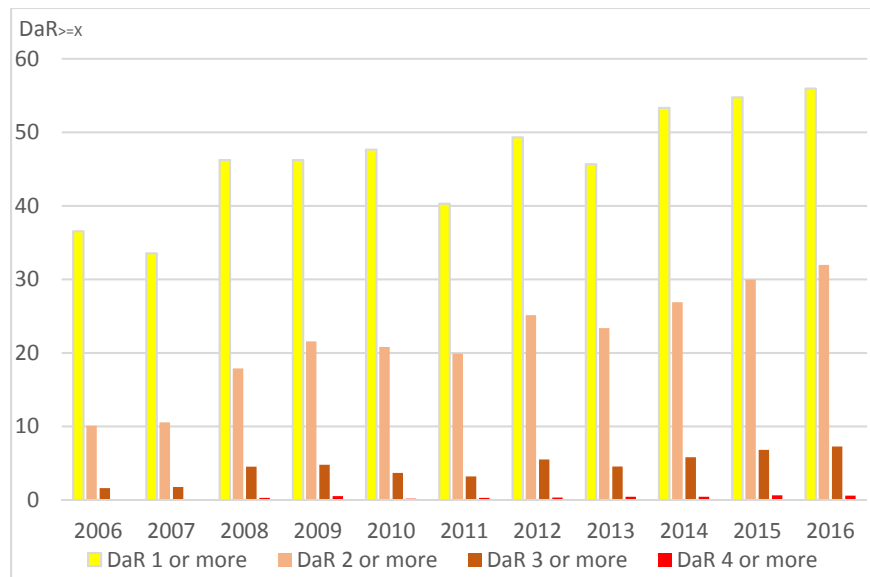
Figure 7: Global Corporate Vulnerability Index



Global country median. 75th and 25th percentiles in dotted lines. Source: Own calculation

Figure 8: Intensity of Corporate Vulnerability

Debt at Risk for X or more indicators (DaR_{>=x})

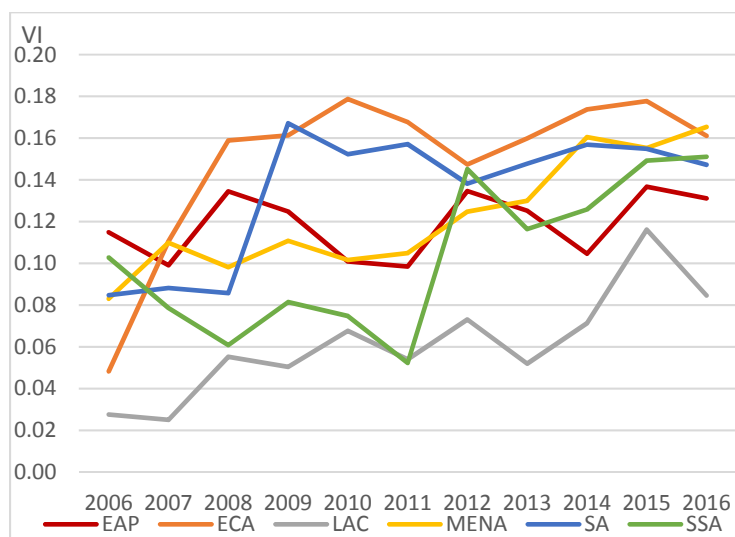


Global country median. Source: Own calculations

Trends across regions have not been uniform. In ECA, corporate vulnerability increased significantly in 2007 and has remained elevated since, while LAC experienced a steep rise in

vulnerability since 2013. Corporate vulnerability in EMDEs was stable in 2016, but MENA and SSA experienced some deterioration (Figure 9). The rise in corporate vulnerability in ECA has been associated with low profitability, deteriorating debt service capacity, high leverage, and increasing rollover risk. In LAC and MENA, increasing leverage ratios and deteriorating ICRs were the main drivers of vulnerabilities since 2013/2014. In SSA, low profitability drove the rise in corporate vulnerability between 2014 and 2016. Figure 10 shows the intensity of corporate vulnerabilities by region. The country median value of $DaR_{\geq 1}$ increased for all regions between 2007 and 2016. ECA, SA, and SSA also experienced a rapid increase in the country medians of $DaR_{\geq 2}$ and $DaR_{\geq 3}$, particularly between 2013 and 2016. In SA, ECA, and EAP, the country median of $DaR_{\geq 4}$ has increased, reaching values of 5.7%, 2.3%, and 1.7%, respectively.

Figure 9: Regional Trends in Corporate Vulnerability



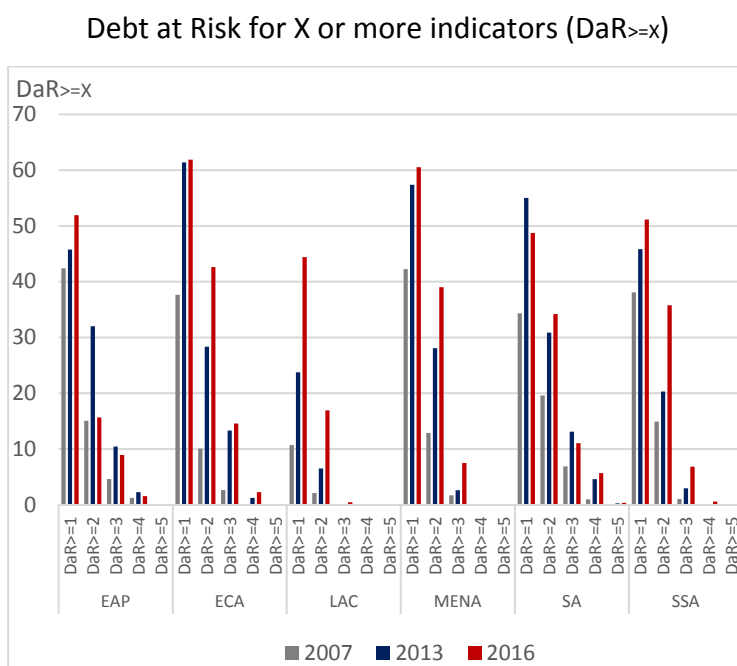
Country median by region. Source: Own calculations

At the country level, nine ECA countries are in the top 25 most vulnerable countries: companies in those countries are characterized by high levels of DaR by indicators Leverage Ratio, Return on Assets, and Quick Ratio. In addition, six MENA countries are in the top 25 most vulnerable countries: firms in those countries are highly vulnerable due to their important levels of DaR

associated with Leverage (i.e. high DaR by both Leverage and Net Debt to EBIT ratios) and debt service capacity (i.e. DaR based on the ICR).¹¹

The CVI has increased for several countries between 2009 and 2016: the median rise of the CVI is 2.9 percentage points in that period. The non-financial corporate sectors of some regionally important EMDEs such as Brazil, India, the Russian Federation, Nigeria, China, and Indonesia have also shown weaker conditions, with a median CVI growth of 6 percentage points in the period 2009-2016.

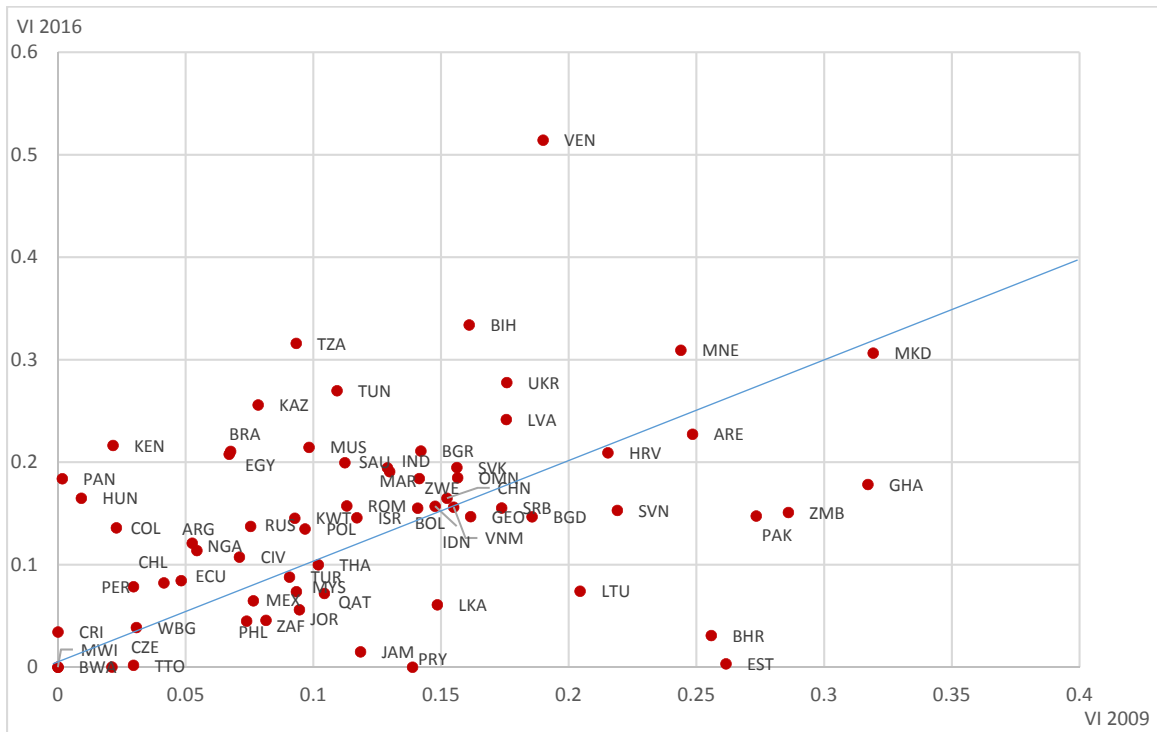
Figure 10: Intensity of corporate vulnerability by region



Regional country medians. Source: Own calculations

¹¹ An analysis by industry shows that corporate financial vulnerability in MENA countries is highly concentrated in the Energy sector. Debt at Risk by both Leverage and Net Debt to EBIT are above 95% of the total sectorial debt in 3 MENA countries, while Debt at Risk by ICR is above 60% of the total sectorial debt also in 3 MENA countries.

Figure 11: Corporate Vulnerability Index 2009 vs 2016

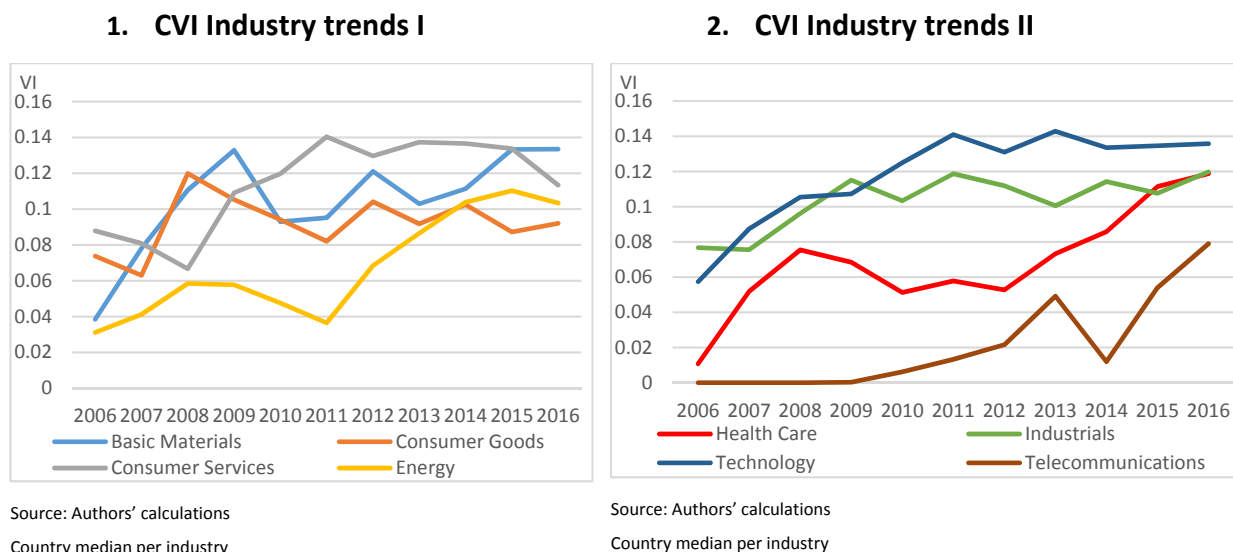


Note: Scatter plot of the Vulnerability Index of 2009 versus 2016 showing that any country at the north of the 45-degree line has seen their corporate vulnerability position deteriorated during this period.

Source: Own calculations

At the industry level, corporate vulnerability has evolved unevenly over time: companies in basic materials, consumer goods, consumer services, and industrials increased their vulnerabilities during the financial crisis and this has continued since then. Energy, health care, and telecommunications firms have faced sharp deterioration of their financial conditions since 2011-2012, a period characterized by accommodative financial conditions and increasing corporate leverage (Figure 12). Since 2014, with the end of the commodity super-cycle, financial conditions for energy companies worsened and their CVI has been high.

Figure 12: Corporate Vulnerability Index by Industry



4.2 Association between the Corporate Vulnerability Index and Socio-Economic Outcomes

Financial vulnerability in the non-financial corporate sector can have significant macroeconomic consequences as corporate distress may adversely impact the financial sector (e.g. through increases in non-performing loans, larger volatility of asset prices, rise of borrower risk); the public sector (e.g. through lower tax revenues, potential public support in case of public non-financial firms); other firms (e.g. through financial and/or trade interlinkages); and households (e.g. through the labor market).¹²

This section investigates the leading indicator properties of the CVI with regards to socio-economic outcomes. We use weighted logit regression models to establish whether an increase in unemployment; a GDP recession; or a reduction in welfare is associated with an increase in the Corporate Vulnerability Index CVI_t , subject to controls (X_j):

$$\Pr(Y_i = 1 \mid CVI_{t-1}, X_{j,t})$$

The respective dependent variables of the three logit regressions are three dummy variables that respectively take the value of 1 if (1) the unemployment rate increases from one year to the next;

¹² See Gray et al (2006), and Ruscher and Wolff (2012).

(2) the annual GDP growth rate is negative (i.e., GDP recession); or (3) the annual per capita GDP is negative (i.e., Welfare reduction), and zero otherwise.

The independent variables are the CVI and a set of control variables. We also include year dummies and weigh each observation by the ratio of the total sum of common shares of the firms in our sample to stock market capitalization in each country, which we use as a proxy for the representativeness of the CVI in a country. The CVI and control variables enter the regression lagged by one period to ameliorate endogeneity concerns.

The macro-economic control variables are the current account balance, general government balance, government debt, real GDP per capita, and inflation rate. We further control for the commonly used DaR based on the ICR to test whether the CVI contains additional information.

Table 2A: Descriptive Statistics

Variable	Obs	Mean	Std.	p25	p75	Min	Max
Prob (Unemployment rise) (%)	300	21.7	18.0	0.0	36.4	0.0	54.5
Prob (Recession) (%)	367	7.5	9.6	0.0	9.1	0.0	36.4
Prob (Welfare reduction) (%)	367	14.4	13.6	0.0	18.2	0.0	54.5
Corp. Vulnerability Index (0 to 1 index)	367	0.11	0.07	0.06	0.16	0.00	0.36
DaR ICR (% Reported Total Corporate Debt)	367	19.0	16.9	6.4	26.0	0.0	89.3
Unemployment Rate (%)	300	9.0	6.1	5.5	10.1	0.7	34.9
GDP growth (yoy, %)	367	4.0	3.6	2.2	6.1	-7.8	18.0
GDP per capita growth (yoy, %)	367	2.5	3.7	0.5	4.9	-15.1	13.6
GDP per capita level (US\$ constant 2010)	367	10051	11000	2981	12223	454	7468
Current Account Balance (% GDP)	353	-1.5	7.1	-5.4	2.5	-25.5	30.4
General Government Balance (% GDP)	362	-2.4	4.8	-4.8	-0.6	-16.5	22.2
General Government Debt (% GDP)	367	42.0	22.8	26.5	56.0	1.6	142.0
Inflation Rate (yoy, %)	350	5.7	4.3	2.7	7.9	-1.0	26.2

Note: Prob (X) is the unconditional probability that event X happens in a particular country between years 2006 and 2016.

Unemployment rise: Dummy variable 1 if unemployment rate increases, 0 otherwise

Recession: Dummy variable 1 if GDP growth is negative, 0 otherwise

Welfare reduction: Dummy variable 1 if GDP per capita growth is negative, 0 otherwise

Sources: WB World Development Indicators, IMF International Financial Statistics, Macro-Financial Initiative

Table 2B: Pairwise Correlations

	Unemploy ment Rise	Recession	Welfare Reduction	Corporate Vulnerabil ity Index	DaR ICR	Current Account Balance	General Governme nt Balance	General Governme nt Debt
Unemployment Rise	1							
Recession	0.3487*	1						
Welfare Reduction	0.3912*	0.6074*	1					
Corporate Vulnerability Index	0.1244*	0.1059*	0.1315*	1				
DaR based on ICR	0.0474	0.0246	0.0729	0.7121*	1			
Current Account Balance	0.0381	0.0408	0.0411	-0.0258	-0.1204*	1		
General Government Balance	-0.2109*	-0.1438*	-0.0826	-0.1069*	-0.2255*	0.4284*	1	
General Government Debt	0.0738	0.0307	0.0068	-0.016	0.1016	-0.2174*	-0.5510*	1
Inflation Rate	-0.0098	-0.0647	0.0139	-0.0291	-0.1518*	-0.2369*	-0.0224	-0.0014

Unemployment rise: Dummy variable 1 if unemployment rate increases, 0 otherwise

Recession: Dummy variable 1 if GDP growth is negative, 0 otherwise

Welfare reduction: Dummy variable 1 if GDP per capita growth is negative, 0 otherwise

*Significance level 5%

Table 3 presents our logit regressions. Panel A shows that the CVI is positively and statistically significantly associated with future socio-economic outcomes. Panel B indicates that, once the DaR based on ICR is included, the estimated coefficient of the CVI is still positive and statistically significant in most cases. Importantly, the DaR based on ICR is not statistically significant, suggesting that CVI has stronger predictive power for socio-economic outcomes. The CVI is correctly signed in all model specifications and, with the exception of the welfare specification, remains significant even when including macroeconomic controls.¹³

The first three columns of Panel A directly test the predictive power of the CVI. Panel A Column 1 shows that, based on the results of the marginal effects on the median, a one-unit increase of CVI from the median is associated with a rise in the probability of unemployment by 1.78 percentage points one year later.¹⁴ In other words, if CVI goes from its median value of 0.15 to 0.16, the probability of unemployment rise will increase 0.0178 percentage points. Column 1 also shows the area under the Receiver Operating Characteristic (ROC) curve (AUC) of 0.73, which means that the CVI has reasonable predictive accuracy for a future rise in unemployment.¹⁵

The results of Panel A Column 2 show that a one-unit increase of CVI from the median is associated with an increase in the probability of a recession next year by 0.91 percentage points. The AUC is 0.86 suggesting that the CVI has strong predictive accuracy power. Finally, Panel A

¹³ Information for Macedonia is not included in the logit estimations for unemployment rise as the dynamics of unemployment in that country in recent years are explained by policies targeting vocational training and on-the-job training under different government stimulus programs. As explained by the IMF's Article IV (2016b), Macedonia has one of the highest unemployment rates in emerging Europe (25.4% in 2016), mostly reflecting skills shortage and mismatch resulting from emigration of skilled workers and low level of education. Since 2008, overall unemployment rate has declined by 10 percentage points, with lower unemployment rates in groups like workers with vocational training and tertiary education.

¹⁴ In logit models, as the sign and significance of the estimated coefficients are important to determine the statistical relationship between the probability of the outcome (in this case unemployment rise) and the independent variables, the values of the coefficients have a difficult interpretation in economic terms. The coefficients of the marginal effects have an economic interpretation as they measure the change in predicted probability of outcome when the independent variables change in one unit.

¹⁵ The area under the Receiver Operating Characteristic (ROC) curve (AUC) is a measure that reflects how well a model is able to correctly classify a binary outcome variable. The ROC compares the proportion of cases in which the model specification correctly predicts the result of the outcome variable (i.e. true positive rate) versus the proportion of cases in which the model specification incorrectly predicts the result of the outcome variable (i.e. false positive rate). The AUC goes from 0 to 1, where the value 0 represents that the true positive rate is 0 percent and the false positive rate is 100 percent, and a value of 1 represents that the true positive rate is 100 percent and the false positive rate is 0 percent. The closer the AUC is to 1, the better the model. The AUC of a random classifier is 0.5.

Column 3 establishes that the probability of welfare reduction (i.e., fall in GDP per capita) goes up by 0.78 percentage points when the lagged CVI rises one unit from the median. The AUC is 0.81.

The last three columns of Panel A control for macroeconomic variables. The results indicate that the coefficients of CVI are still positive and statistically significant. In other words, our CVI captures relevant features related to the corporate sector which are distinct from general macroeconomic conditions. As shown in Panel A column 4, the probability of a future rise in unemployment increases by 1.36 percentage points when the CVI rises one unit from its median value. Similarly, Panel A column 5 shows that the probability of a recession rises 1.02 percentage points when CVI goes up one unit from its median. The AUC increase to a very high 0.9 when macroeconomic variables are included. Finally, Panel A column 6 shows that the probability of a welfare reduction rises 0.66 percentage points with a change in CVI in one unit from the median. Interestingly, the AUC is only marginally affected by the inclusion of macroeconomic controls, suggesting that the model's predictive classification power is mostly derived from the CVI.

Panel B shows that the coefficients of CVI are still positive and statistical significant after including the commonly used DaR based on ICR which is insignificant in all specifications. This finding suggests that the CVI contains empirically relevant additional information compared to the DaR based on ICR. Note that the correlation between DaR based on ICR and the CVI is relatively high (0.71). However, the size of the CVI coefficient and statistical significance do not change dramatically (with the exception of Column 6) due to the inclusion of the DaR based on ICR, suggesting collinearity is not an overriding concern.

5 Sensitivity Analysis to Different ICR Thresholds

Our results are consistent under different thresholds for ICR. Using ICR thresholds 1.5, 2, and 3, we recalculated the CVI to evaluate how sensitive our results are to thresholds commonly used in the literature (FSB, 2015; IMF, 2017).

As shown in the Appendix, Table B1, the country ranking does not have much variability under different ICR thresholds, particularly for both the top 10 and the bottom 15 countries. In addition, Tables B2, B3, and B4 show the logit regressions for unemployment rise, recession, and welfare reduction, respectively, using the CVI modified by different levels of ICR thresholds. The results show that the estimated coefficient for the CVI is positive and statistically significant in all cases.

Table 3: Corporate Vulnerability Index and Socio-economic Outcomes
Logit Regressions, 2006-2016

Panel A: Corporate Vulnerability Index

Variables	Unemployment rise ^a	Recession	Welfare reduction	Unemployment rise ^a	Recession	Welfare reduction
L. Vulnerability Index (CVI)	8.880*** (2.220)	9.825*** (3.229)	6.509*** (1.915)	6.835** (2.673)	11.06*** (3.816)	5.832** (2.307)
Constant	-3.661*** (1.004)	-3.111*** (0.899)	-3.738*** (0.639)	-3.036*** (0.979)	-4.770*** (1.320)	-4.940*** (1.059)
Macro Controls [^]	No	No	No	Yes	Yes	Yes
Observations	294	281	367	287	232	340
ROC (Area under the curve)	0.734	0.857	0.810	0.717	0.896	0.841
Marginal Effects at Median	1.776***	0.912***	0.780***	1.359**	1.016***	0.657***

Panel B: Including DaR based on ICR

Variables	Unemployment rise ^a	Recession	Welfare reduction	Unemployment rise ^a	Recession	Welfare reduction
L. Vulnerability Index (CVI)	12.97*** (4.124)	11.68** (4.922)	9.496*** (3.673)	9.045*** (3.448)	10.84** (5.066)	5.214 (4.147)
L.DaR ICR	-2.430 (1.914)	-0.922 (1.581)	-1.483 (1.398)	-1.352 (1.529)	0.107 (2.035)	0.308 (1.731)
Constant	-3.442*** (0.897)	-3.133*** (0.896)	-3.720*** (0.607)	-2.962*** (0.978)	-4.772*** (1.325)	-4.946*** (1.056)
Macro Controls [^]	No	No	No	Yes	Yes	Yes
Observations	294	281	367	287	232	340
ROC (Area under the curve)	0.745	0.859	0.815	0.720	0.895	0.841
Marginal Effects at Median	2.541***	1.072***	1.125***	1.790***	0.998**	0.590

Unemployment rise: Dummy variable 1 if unemployment rate increases, 0 otherwise. Recession: Dummy variable 1 if GDP growth is negative, 0 otherwise. Welfare reduction: Dummy variable 1 if GDP per capita growth is negative, 0 otherwise. ROC denotes Receiver Operating Characteristic, a common indicator that captures the ability of the specified model to replicate the results of the outcome variable.

Unit of observation: country-year.

[^] Macro controls: Current Account Balance (%GDP), General Government Balance (% GDP), Government Debt (%GDP), real GDP per capita, Inflation rate.

a. Information for Macedonia not included

Weights: Sum of value common shares for all firms in sample/Stock market capitalization. Information of Stock market capitalization available for 33 countries. Calculations per country-year.

Year dummies included, errors clustered at country level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

6 Conclusion

Using firms' balance-sheet information for 69 Emerging Markets and Developing Economies (EMDEs), this paper introduces the Corporate Vulnerability Index (CVI) which provides a framework to monitor financial conditions of the non-financial corporate sector. The CVI employs seven indicators for which data are readily available that capture four aspects of firms' financial vulnerabilities: debt service capacity, leverage, rollover risk, and return-to-market value.

The Corporate Vulnerability Index suggests that vulnerabilities have increased sharply since 2013, but have stabilized in 2016. At the global level, increased leverage ratio and deteriorations in profitability and debt service capacity were the main drivers behind corporate vulnerability. But global trends mask regional diversity. Corporate vulnerability in Eastern Europe has been elevated since 2007, while Latin America experienced a steep increase in vulnerability since 2013. Corporate vulnerability in EMDEs has been stable in 2016, but the Middle East and Sub-Saharan Africa have shown deterioration. Relative to 2009, financial conditions in the non-financial corporate sector have deteriorated in several EMDEs. However, if currently relatively benign global funding conditions and higher commodity prices endure, companies may have an opportunity to strengthen their balance sheets.

At the industry level, we find that energy-linked sectors in particular have experienced rising financial vulnerabilities; especially since the 2014 peak in global oil prices. We also find that debt of non-financial listed firms in EMDEs has increased both in level and in riskiness: EMDEs' corporate debt rose by 46 percent, from US \$2.6 trillion in 2010 to US \$3.8 trillion in 2016. Over the same period, debt in the hands of firms that are considered financially vulnerable in at least one indicator grew by 120 percent, from \$1 trillion to \$2.2 trillion. In 2016, approximately 58 percent is considered at risk according to at least one indicator.

Logit regressions suggest that the CVI has some leading indicator qualities: an increase in the CVI is positively associated with a future rise in unemployment and an economic recession. Results are robust to controlling for macroeconomic conditions. The CVI also outperforms the commonly used Debt at Risk measure based on the Interest Coverage Ratio (ICR).

As financial vulnerabilities in non-financial corporate sectors of many EMDEs appear to be growing, it seems important to consider the efficiency of the EMDEs' institutional and policy frameworks to monitor vulnerabilities and to deal with distressed firms in case adverse shocks materialize. For instance, it is unknown whether recently established macroprudential frameworks to monitor corporate debt are effective. In addition, inadequate regulatory frameworks like deficient insolvency regimes, poor financial institutions to deal with non-performing loans in the banking sector, or macro policies that discourage hedging of firms' foreign currency positions might work as amplifiers of adverse shocks. Consequently, policies aimed at minimizing corporate vulnerabilities and controlling their spillover effects as well as the legal framework providing a diverse "menu" of options for ailing firms to obtain efficient financial restructuring, are vital elements of a strategy to improve the resilience of EMDEs' corporate sector to adverse shocks.

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8 Appendix

Table A1: Country Ranking 2016 based on Corporate Vulnerability Index (CVI)

Ranking	Country	CVI		Reported Total Debt (%GDP)*	DaR=>x (% of Total Debt)							DaR (% of Total Debt)							Total Firms
		Value	YoY Change (%)		1	2	3	4	5	6	7	ICR	Lever age	Net Debt	Curr/Ig liab	Quick	ROA	Market Book	
1	Venezuela, RB	0.51	82.7	-	96.4	90.6	86.9	86.1	0.0	0.0	0.0	91.1	0.0	0.8	86.1	86.1	0.6	95.3	20
2	Bosnia and Herzegovina	0.33	-1.5	10.9	91.8	72.9	41.2	27.9	0.0	0.0	0.0	53.4	40.4	31.2	1.3	29.2	19.9	58.4	303
3	Tanzania	0.32	-14.5	0.5	57.5	55.8	55.8	52.2	0.0	0.0	0.0	55.8	57.5	0.0	0.0	52.2	55.8	0.0	10
4	Montenegro	0.31	0.4	20.8	82.0	70.7	62.1	1.7	0.0	0.0	0.0	5.2	60.4	8.8	0.1	64.9	59.9	17.5	91
5	Macedonia	0.31	15.6	3.5	94.7	73.6	27.2	19.1	0.0	0.0	0.0	40.8	19.1	64.5	0.0	37.8	8.7	43.6	37
6	Ukraine	0.28	15.2	11.2	80.0	69.4	26.8	18.3	0.0	0.0	0.0	23.3	66.0	9.4	4.5	25.0	63.8	2.5	339
7	Tunisia	0.27	46.2	31.8	95.9	83.8	7.7	1.4	0.0	0.0	0.0	82.3	16.3	7.0	0.1	4.8	78.3	0.1	55
8	Kazakhstan	0.26	105.2	1.2	68.2	56.8	41.0	13.2	0.0	0.0	0.0	22.8	59.1	13.4	3.8	36.0	39.6	4.5	47
9	Latvia	0.24	2.2	3.0	60.1	58.0	51.0	0.0	0.0	0.0	0.0	26.1	30.9	33.0	0.0	24.0	28.9	26.2	30
10	United Arab Emirates	0.23	0.5	12.2	59.4	54.3	45.4	0.0	0.0	0.0	0.0	50.9	48.4	51.0	1.2	0.4	2.7	4.5	47
11	Kenya	0.22	22.8	8.7	88.4	32.0	29.8	1.3	0.0	0.0	0.0	32.0	28.2	0.5	0.2	7.5	30.5	52.6	42
12	Mauritius	0.21	84.9	21.8	66.5	59.4	24.3	0.0	0.0	0.0	0.0	64.4	2.1	59.2	0.0	9.0	0.2	15.4	56
13	Bulgaria	0.21	3.3	3.8	67.3	58.2	19.5	2.6	0.0	0.0	0.0	57.0	18.1	14.5	0.5	10.7	39.3	7.5	132
14	Brazil	0.21	33.2	21.0	74.0	57.7	10.9	4.7	0.2	0.0	0.0	62.7	17.9	5.5	0.1	2.6	15.3	43.4	268
15	Croatia	0.21	11.9	9.6	63.0	48.7	19.8	8.1	3.9	3.0	0.0	37.4	26.9	23.4	4.1	17.1	23.2	14.4	133
16	Egypt, Arab Rep.	0.21	0.6	5.0	73.4	42.8	27.0	2.3	0.0	0.0	0.0	43.2	44.9	46.0	1.0	4.2	3.5	2.8	158
17	Saudi Arabia	0.20	15.2	22.0	74.5	54.3	10.8	0.0	0.0	0.0	0.0	15.8	49.9	69.4	0.3	3.6	0.6	0.0	111
18	Slovak Republic	0.19	-1.6	1.1	67.7	64.7	2.1	1.9	0.0	0.0	0.0	37.3	39.6	47.7	0.6	3.0	7.8	0.5	48
19	India	0.19	5.1	25.7	55.6	42.5	24.8	10.6	2.7	0.0	0.0	34.6	38.3	29.1	0.5	16.8	5.1	11.9	1651
20	Morocco	0.19	3.9	7.8	61.6	39.4	32.6	0.0	0.0	0.0	0.0	36.1	23.6	6.7	0.6	1.0	33.0	32.6	50
21	Oman	0.18	-0.2	10.1	80.0	48.4	0.7	0.3	0.1	0.0	0.0	9.9	52.6	5.6	1.1	29.9	16.1	14.3	83
22	Zimbabwe	0.18	n.a.	7.1	51.1	45.0	24.0	8.7	0.0	0.0	0.0	44.1	7.2	6.6	0.0	22.5	23.7	24.8	58
23	Panama	0.18	-7.1	10.5	63.6	61.2	3.9	0.0	0.0	0.0	0.0	4.3	61.1	60.8	0.7	1.5	0.4	0.0	14
24	Ghana	0.18	-38.1	0.8	56.0	50.3	17.4	0.7	0.4	0.0	0.0	46.7	29.4	0.5	5.3	21.6	21.3	0.0	26
25	China	0.16	7.3	10.7	66.7	37.5	9.6	1.6	0.0	0.0	0.0	27.9	32.2	32.4	3.2	16.8	2.9	0.0	2904
26	Hungary	0.16	-6.8	3.2	57.8	56.9	0.8	0.0	0.0	0.0	0.0	56.7	0.4	0.9	0.0	0.0	56.8	0.6	26
27	Romania	0.16	-35.5	1.8	74.7	20.1	8.1	4.0	3.1	0.0	0.0	31.7	14.2	3.0	3.5	33.0	6.0	18.6	138
28	Indonesia	0.16	0.1	9.0	51.9	30.8	17.7	8.4	0.9	0.3	0.0	24.2	20.4	15.9	0.5	14.7	15.6	18.5	393
29	Vietnam	0.16	7.6	8.6	58.0	39.2	9.3	2.7	0.1	0.0	0.0	15.2	33.9	36.5	5.0	8.5	3.5	6.8	1002
30	Serbia	0.16	-12.9	9.2	55.6	36.5	16.0	0.5	0.2	0.0	0.0	5.1	25.7	22.8	6.8	17.0	19.8	11.6	458
31	Bolivia	0.16	0.1	0.5	54.1	54.1	0.4	0.0	0.0	0.0	0.0	44.9	9.2	53.6	0.4	0.4	0.0	0.0	12
32	Slovenia	0.15	-12.9	8.8	77.9	27.1	1.2	0.9	0.0	0.0	0.0	7.6	7.4	52.8	0.1	14.2	0.1	24.9	28
33	Zambia	0.15	n.a.	3.3	62.0	43.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	49.4	53.8	13
34	Pakistan	0.15	-15.1	5.3	41.8	29.6	18.4	13.4	0.1	0.0	0.0	27.8	23.2	8.5	0.5	24.8	12.6	5.8	229
35	Georgia	0.15	-0.5	0.5	60.7	25.7	16.5	0.0	0.0	0.0	0.0	22.4	54.5	6.1	0.0	2.5	17.4	0.0	72

* Data as of 2015. GDP for Venezuela, BR is not available.

The Corporate Vulnerability Index (CVI) ranges from 0 (i.e., firms are not financially vulnerable in any of the 7 indicators) to 1 (i.e., all firms are financially vulnerable in all 7 indicators). The CVI calculated for 69 countries, covering 14,207 firms. For CVI calculation, countries require to have 5 or more firms in the database.

YoY Change of CVI: percentage change of CVI between 2015 and 2016. Red: change of CVI in the highest tercile across countries. Green: change of CVI in the lowest tercile across countries. DaR >=X denotes the Debt at Risk in "X or more indicators": debt of financially vulnerable firms in X or more indicators as a share of reported total corporate debt, where X=1,2,...,7. DaR denotes the Debt at Risk regarding a particular indicator. Source: Bloomberg; own calculations.

Table A1: Country Ranking 2016 based on Corporate Vulnerability Index (CVI) (continued)

Ranking	Country	CVI		Reported Total Debt (%GDP)*	DaR _{max} (% of Total Debt)							DaR (% of Total Debt)							Total Firms
		Value	YoY Change (%)		1	2	3	4	5	6	7	ICR	Lever age	Net Debt	Curr/lg liab	Quick	ROA	Market Book	
36	Bangladesh	0.15	8.0	2.3	59.8	38.7	3.7	0.5	0.0	0.0	0.0	6.4	38.6	40.0	0.9	12.7	1.4	2.8	200
37	Israel	0.15	14.1	21.0	72.4	15.4	6.9	3.7	3.7	0.0	0.0	14.4	23.1	55.3	0.2	0.0	4.9	4.1	287
38	Kuwait	0.15	5.9	10.3	50.9	38.6	11.4	0.8	0.0	0.0	0.0	21.5	26.5	33.4	0.5	10.6	2.0	7.3	74
39	Russian Federation	0.14	-6.3	21.5	57.3	19.6	10.4	7.2	1.9	0.0	0.0	11.9	27.0	13.0	1.2	7.5	10.3	25.3	763
40	Colombia	0.14	0.0	13.6	52.9	42.4	0.0	0.0	0.0	0.0	0.0	9.0	1.4	42.3	0.1	0.1	42.3	0.1	49
41	Poland	0.13	27.9	6.4	51.2	28.1	13.1	1.9	0.2	0.0	0.0	37.9	4.3	10.0	0.4	4.1	25.1	12.7	584
42	Uruguay	0.13	-17.8	0.4	93.3	0.0	0.0	0.0	0.0	0.0	0.0	53.5	0.0	39.9	0.0	0.0	0.0	0.0	6
43	Mongolia	0.13	-4.1	10.5	91.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90.3	0.6	0.0	0.9	0.0	0.0	26
44	Argentina	0.12	272.3	2.7	44.4	38.5	1.8	0.1	0.0	0.0	0.0	5.9	37.0	34.8	0.1	0.7	4.5	1.7	84
45	Nigeria	0.11	-52.9	1.8	45.8	25.0	6.8	1.7	0.4	0.0	0.0	37.1	11.8	1.0	0.4	5.3	23.1	1.1	105
46	Côte d'Ivoire	0.11	-4.1	2.9	39.4	35.8	0.0	0.0	0.0	0.0	0.0	24.4	21.4	29.4	0.0	0.0	0.0	0.0	30
47	Thailand	0.10	21.5	26.7	43.9	15.7	8.9	1.6	0.0	0.0	0.0	4.7	23.5	22.6	1.6	15.1	2.3	0.2	541
48	Turkey	0.09	13.3	8.4	30.2	15.5	10.9	5.0	0.0	0.0	0.0	15.7	18.5	13.1	0.3	2.6	10.0	1.3	301
49	Ecuador	0.08	19.9	0.5	59.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.2	0.0	0.0	28
50	Chile	0.08	-41.9	47.2	39.2	16.3	2.1	0.0	0.0	0.0	0.0	3.5	12.5	35.6	0.0	2.3	1.1	2.6	156
51	Peru	0.08	-32.4	12.4	33.2	21.2	0.5	0.0	0.0	0.0	0.0	8.6	16.7	14.5	0.1	6.8	2.8	5.5	118
52	Lithuania	0.07	1.3	2.4	30.4	7.0	7.0	6.0	1.6	0.0	0.0	6.6	4.4	20.3	6.3	7.0	2.4	5.2	31
53	Malaysia	0.07	-17.7	38.4	36.5	10.9	2.9	1.1	0.2	0.0	0.0	12.4	14.8	12.3	0.7	3.0	2.9	5.6	783
54	Qatar	0.07	1.8	15.1	26.2	24.1	0.1	0.0	0.0	0.0	0.0	0.1	26.2	24.0	0.0	0.1	0.0	0.0	20
55	Mexico	0.06	-40.5	12.2	17.9	16.9	8.8	1.7	0.0	0.0	0.0	10.5	14.6	9.7	1.3	2.9	6.4	0.0	100
56	Sri Lanka	0.06	-20.1	5.2	27.4	10.3	3.2	0.7	0.5	0.5	0.0	13.1	2.8	5.5	0.7	14.4	1.7	4.4	196
57	Jordan	0.06	-11.0	6.2	21.4	10.6	7.3	0.0	0.0	0.0	0.0	17.8	7.0	3.3	0.8	1.4	6.5	2.5	108
58	South Africa	0.05	-20.5	17.5	21.5	9.0	1.0	0.6	0.0	0.0	0.0	11.4	9.5	7.8	0.2	0.4	1.6	1.3	204
59	Philippines	0.05	-2.9	30.1	26.1	2.8	2.4	0.2	0.0	0.0	0.0	2.8	6.5	1.5	0.2	0.9	1.0	18.6	159
60	Palestine	0.04	15.0	3.4	23.4	3.4	0.1	0.1	0.0	0.0	0.0	20.4	0.0	2.8	0.1	3.4	0.2	0.1	24
61	Costa Rica	0.03	7.8	1.7	13.9	10.2	0.0	0.0	0.0	0.0	0.0	10.2	0.4	9.8	0.0	3.6	0.0	0.0	6
62	Bahrain	0.03	72.0	3.2	7.6	7.1	7.1	0.0	0.0	0.0	0.0	0.0	7.1	0.0	0.5	7.1	7.1	0.0	18
63	Jamaica	0.01	-5.8	2.8	5.3	5.1	0.1	0.0	0.0	0.0	0.0	5.3	0.0	4.5	0.0	0.1	0.6	0.0	36
64	Estonia	0.00	-83.7	4.0	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.8	0.8	0.0	12
65	Trinidad & Tobago	0.00	-97.8	6.2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	19
66	Czech Republic	0.00	-60.5	3.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	13
67	Paraguay	0.00	-99.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24
68	Botswana	0.00	n.a.	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13
69	Malawi	0.00	n.a.	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5

Table B1: Sensitivity Analysis of CVI Country Ranking 2016 using different ICR thresholds

Country	CVI Country Ranking				Average	St Deviation
	Benchmark	ICR<=1.5	ICR<=2	ICR<=3		
Venezuela, RB	1	1	1	1	1.0	0.00
Bosnia and Herzegovina	2	2	2	2	2.0	0.00
Tanzania	3	3	3	4	3.3	0.50
Montenegro	4	4	5	5	4.5	0.58
Macedonia	5	5	4	3	4.3	0.96
Ukraine	6	6	6	7	6.3	0.50
Tunisia	7	8	9	9	8.3	0.96
Kazakhstan	8	10	8	6	8.0	1.63
Latvia	9	7	7	8	7.8	0.96
United Arab Emirates	10	12	16	12	12.5	2.52
Kenya	11	13	19	22	16.3	5.12
Mauritius	12	17	14	16	14.8	2.22
Bulgaria	13	16	21	25	18.8	5.32
Brazil	14	15	15	15	14.8	0.50
Croatia	15	14	17	17	15.8	1.50
Egypt, Arab Rep	16	19	12	13	15.0	3.16
Saudi Arabia	17	20	22	26	21.3	3.77
Slovak Republic	18	11	13	19	15.3	3.86
India	19	18	18	20	18.8	0.96
Morocco	20	23	25	27	23.8	2.99
Oman	21	22	10	10	15.8	6.65
Zimbabwe	22	25	29	23	24.8	3.10
Panama	23	9	11	11	13.5	6.40
Ghana	24	21	27	28	25.0	3.16
China	25	26	26	24	25.3	0.96
Hungary	26	29	34	37	31.5	4.93
Romania	27	34	37	32	32.5	4.20
Indonesia	28	30	33	33	31.0	2.45
Vietnam	29	27	23	21	25.0	3.65
Serbia	30	32	38	40	35.0	4.76
Bolivia	31	31	36	41	34.8	4.79
Slovenia	32	33	20	14	24.8	9.29
Zambia	33	36	35	35	34.8	1.26
Pakistan	34	28	31	31	31.0	2.45
Georgia	35	38	42	44	39.8	4.03

Country	CVI Country Ranking				Average	St Deviation
	Benchmark	ICR<=1.5	ICR<=2	ICR<=3		
Bangladesh	36	35	32	34	34.3	1.71
Israel	37	39	39	42	39.3	2.06
Kuwait	38	37	40	38	38.3	1.26
Russian Federation	39	40	41	43	40.8	1.71
Colombia	40	42	24	18	31.0	11.83
Poland	41	41	43	39	41.0	1.63
Uruguay	42	24	28	30	31.0	7.75
Mongolia	43	43	44	47	44.3	1.89
Argentina	44	44	30	29	36.8	8.38
Nigeria	45	45	46	46	45.5	0.58
Côte d'Ivoire	46	46	45	48	46.3	1.26
Thailand	47	47	48	51	48.3	1.89
Turkey	48	50	51	45	48.5	2.65
Ecuador	49	52	53	57	52.8	3.30
Chile	50	49	49	50	49.5	0.58
Peru	51	53	52	53	52.3	0.96
Lithuania	52	54	55	59	55.0	2.94
Malaysia	53	51	47	49	50.0	2.58
Qatar	54	48	50	36	47.0	7.75
Mexico	55	56	56	56	55.8	0.50
Sri Lanka	56	57	57	55	56.3	0.96
Jordan	57	55	54	58	56.0	1.83
South Africa	58	58	58	60	58.5	1.00
Philippines	59	59	59	52	57.3	3.50
Palestine	60	60	60	62	60.5	1.00
Costa Rica	61	61	61	63	61.5	1.00
Bahrain	62	62	62	64	62.5	1.00
Jamaica	63	63	63	65	63.5	1.00
Estonia	64	64	64	54	61.5	5.00
Trinidad & Tobago	65	65	65	68	65.8	1.50
Czech Republic	66	67	67	69	67.3	1.26
Paraguay	67	68	68	66	67.3	0.96
Botswana	68	66	66	61	65.3	2.99
Malawi	69	69	69	67	68.5	1.00

Source: Own calculations.

Sensitivity Analysis of Association between CVI and social outcomes, using different ICR thresholds
Logit Regressions, 2006-2016

Table B2: Unemployment Rise

Variables	Benchmark	ICR<=1.5	ICR<=2	ICR<=3
L. Vulnerability Index (CVI)	6.835** (2.673)	5.606** (2.232)	5.898*** (2.146)	5.737*** (1.932)
Constant	-3.036*** (0.979)	-2.981*** (0.982)	-3.044*** (0.993)	-3.154*** (1.013)
Macro Controls [^]	Yes	Yes	Yes	Yes
Observations	287	287	287	287
ROC	0.717	0.718	0.722	0.720
Marginal Effects at Median	1.359**	1.114**	1.174***	1.145***

Unemployment rise: Dummy variable 1 if unemployment rate increases, 0 otherwise.
Information for Macedonia not included

Table B3: Recession

Variables	Benchmark	ICR<=1.5	ICR<=2	ICR<=3
L. Vulnerability Index (CVI)	11.06*** (3.816)	9.182*** (3.491)	8.588** (3.369)	8.837** (3.635)
Constant	-4.770*** (1.320)	-4.509*** (1.276)	-4.492*** (1.236)	-4.680*** (1.171)
Macro Controls [^]	Yes	Yes	Yes	Yes
Observations	232	232	232	232
ROC	0.896	0.887	0.886	0.887
Marginal Effects at Median	1.016***	0.889***	0.833**	0.855**

Recession: Dummy variable 1 if GDP growth is negative, 0 otherwise.

Table B4: Welfare Reduction

Variables	Benchmark	ICR<=1.5	ICR<=2	ICR<=3
L. Vulnerability Index (CVI)	5.832** (2.307)	4.803** (2.235)	4.712** (2.121)	4.419* (2.360)
Constant	-4.940*** (1.059)	-4.825*** (1.035)	-4.850*** (1.042)	-4.862*** (1.053)
Macro Controls [^]	Yes	Yes	Yes	Yes
Observations	340	340	340	340
ROC	0.841	0.840	0.839	0.838
Marginal Effects at Median	0.657***	0.549**	0.538**	0.508*

Welfare reduction: Dummy variable 1 if GDP per capita growth is negative, 0 otherwise

Unit of observation: country-year.

[^] Macro controls: Current Account Balance (%GDP), General Government Balance (% GDP), Government Debt (%GDP), real GDP per capita, Inflation rate.

Weights: Sum of value common shares for all firms in sample/Stock market capitalization. Information of Stock market capitalization available for 33 countries. Calculations per country-year.

Year dummies included, errors clustered at country level. Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Source: Own calculations.