Economics Bulletin

Volume 39, Issue 3

Economic complexity and sovereign risk premia

M. Utku Özmen
Central Bank of the Republic of Turkey

Abstract

This paper analyses the impact of economic complexity, measured by the Economic Complexity Index (ECI), on sovereign risk premia. The results reveal that, after controlling for relevant macroeconomic variables, global factors and institutional indicators, economic complexity has a significantly negative impact on sovereign risk premia, captured by sovereign CDS spreads. This finding is valid both for advanced and emerging economies. An economy's ability to produce complex goods, which requires bringing in different sorts of know-how and capabilities together, might serve as an indicator of economy's resilience to shocks and thus, helps reduce the country risk.

This research has been conducted while the author was a seconded economist at the OECD and contributed to the 2018 Economic Survey of Turkey. The views expressed in this study do not necessarily represent those of the Central Bank of the Republic of Turkey or the OECD. Author thanks Rauf Gonenc for guidance and helpful suggestions.
Citation: M. Utku Özmen, (2019) "Economic complexity and sovereign risk premia", *Economics Bulletin*, Volume 39, Issue 3, pages 1714-1726
Contact: M. Utku Özmen - utkuozmen@gmail.com.
Submitted: December 06, 2018. **Published:** July 07, 2019.

1. Introduction

Sovereign risk premium is a measure associated with the probability of a country's inability to pay its sovereign debt as perceived by the markets. The impact of a country's credit risk is, however, not only limited to its effect on public debt but it also translates into borrowing cost of the productive sector of the economy (Augustin et al., 2018). Accordingly, understanding the determinants of risk premia is important for policymakers.

Macroeconomic performance is an important determinant of a country's ability to repay the debt. Therefore, while assessing the riskiness of a country, the creditors keep macro indicators such as growth rate, inflation, current account balance and government's debt level in sight. In addition, common global factors such as global liquidity conditions, search for yield and global uncertainties may also have an impact on sovereign risk premia. The recent empirical literature has documented that risk premia are affected by domestic macroeconomic indicators; by international factors; or by both (e.g. Hilscher and Nosbusch, 2010; Longstaff et al., 2011; Dieckmann and Plank, 2012; Liu and Spencer, 2013; Ertugrul and Ozturk, 2013; Erdem and Varli, 2014; Doshi, Jacobs and Zurita, 2017; Stolbov, 2017).

From an institutional point of view, governance and institutional capacity may also matter for a country's observed riskiness. The efficiency and fairness of the judicial system, quality of the regulatory institutions and political stability are among such issues that may weigh on sovereign credit risk. In this regard, several studies analyze the impact of political indicators (Baldacci, Gupta and Mati, 2011), inflation targeting credibility (Ciro and de Mendonça, 2016), adaptation of inflation targeting (Balima et al., 2017), reform policies regarding data transparency (Choi and Hashimoto, 2018), governance effectiveness (Jeanneret, 2018), structural reforms (Findlay et al., 2016) and environmental, social and governance-related factors (Crifo, Diaye and Oueghlissi, 2017) on sovereign risk premia or borrowing cost.

In addition to macroeconomic and institutional factors, investors may also be looking deeper at the productive capacity of a country. A country's ability to produce complex goods that require bringing in different sorts of know-how may be an indication of the economy's resilience to shocks and thus may affect the riskiness of the country. On this ground, the Economic Complexity Index (ECI) measures the level of sophistication of the supply structure of an economy by combining the information on the products exported by a country with information on other countries that are able to export these products. An initial look at the data reveals that higher ECI figures are associated with lower CDS premia, both for emerging and advanced economies (Figure 1).

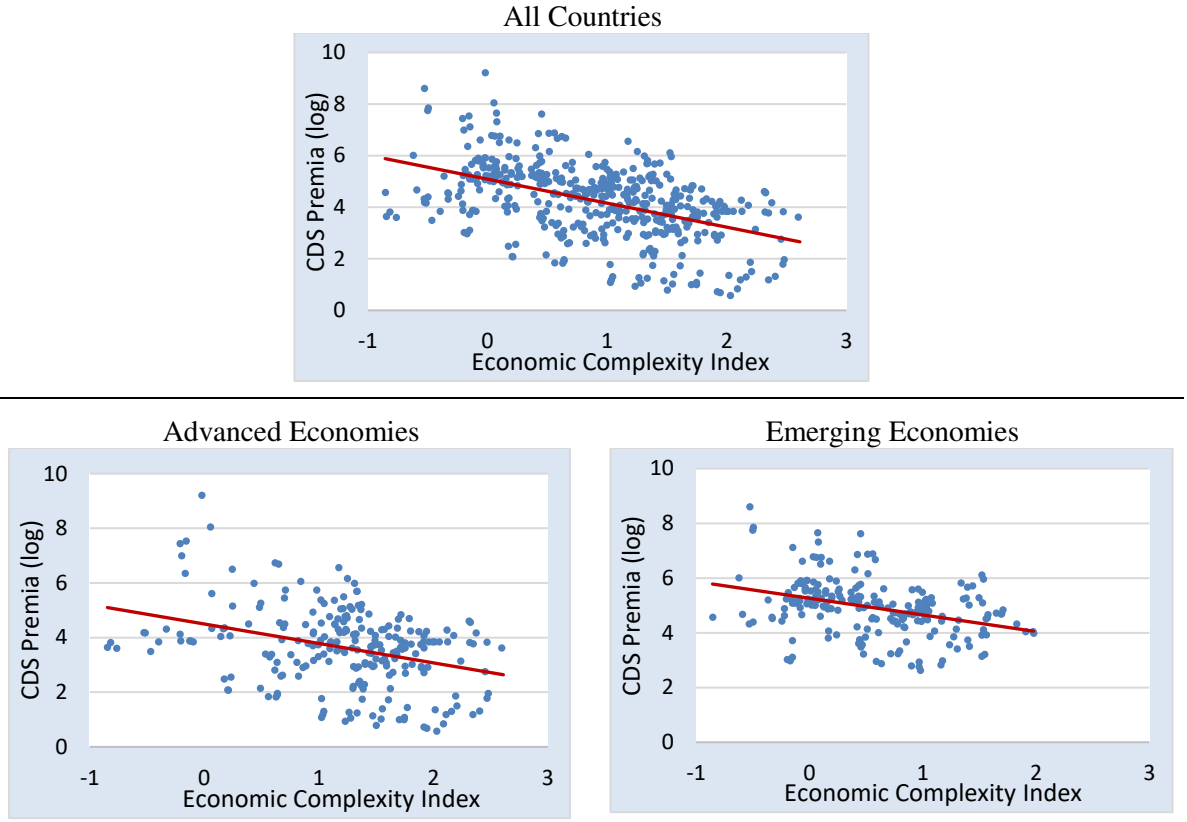
As argued by Hidalgo and Hausmann (2009) and by Hausmann and Hidalgo (2011), the sophistication in an economy deepens through the accumulation of capabilities. In this perspective, ECI was shown to be a robust indicator of the supply structure of the economy. Hausmann, Hidalgo et al. (2014) show that ECI is a better predictor of future growth than commonly used indicators of competitiveness, human capital or governance. Gala, Rocha and Magacho (2018) reaffirm that ECI helps explain the divergence between the growth performances of countries. Brito, Magud and Sosa (2018) find that the investment decisions of firms in response to exchange rate shocks depend on the level of ECI. Meanwhile, Hartmann et al. (2017) reveal that ECI is a negative predictor of income inequality.

Contributing to the growing literature on economic complexity, this study analyses whether the sovereign risk premia are related to ECI, after controlling for macroeconomic, institutional and global indicators.[1] The results reveal that an increase in ECI reduces the risk premia, which is also the case when advanced and emerging economies are analyzed separately.

---

[1] This research is an extended version of the analysis carried out by the author in OECD (2018), Box 4.

Figure 1: ECI and CDS premia



Notes: The horizontal (vertical) axis shows the ECI (log CDS) values for all the countries in the samples and over all the years. The solid line shows the fitted values of the linear regression of log CDS on the ECI.

2. Economic Resilience and Complexity

The economic resilience refers to how an economy responds to a shock and how and how fast it recovers. Martin and Sunley (2015) make a great effort to put the concept of economic resilience on to more concrete grounds. They argue that several characteristics of economies help understand the variation between the resilience of different economies and regions. Among these factors, Martin and Sunley (2015) mention the industrial and business structure, agency and decision making, and governance arrangements as well. Also, they argue that focusing on knowledge and technology-intensive sectors and enhancing innovative industries serve for building up economic resilience.

Many empirical studies applied the idea of economic resilience to different countries and regions. Martin et al. (2016) show that industrial structure plays a role in economic resilience in the UK. Giannakis and Bruggeman (2017) find that education is an important determinant of economic resilience across both large and small regional European economies. Similarly, Han and Goetz (2019) show that higher education is associated with higher economic resilience across the US counties. Focusing on the Italian economy, Di Caro (2017) acknowledges the importance of a wide set of region-specific factors and interactions in determining how economic resilience differs across regions. On this ground, Di Caro shows that higher economic diversification, higher external trade performance and better endowments of human and social capital increase economic resilience. Bristow and Healy (2018) find that innovation capacity is positively associated with resilience to economic shocks across European economies. Meanwhile, Svoboda, Ibl and Břízková (2016) argue that economic complexity may be a good predictor of the resilience of a regional economy in the face of an economic downturn. Han and Goetz (2015) also argue that economic complexity covers not

only the number of interactions between economic units but also the resulting synergies from these interactions. In that sense, economies with a more complex structure may be more resilient.

The notion of economic complexity, as it is based on the ability to accumulate knowledge, skills, and capabilities in order to produce more complex products, inherently captures the industrial structure, diversification, improved human capital, investment in knowledge-intensive technologies, innovation capacity and enhanced interaction among economic agents. In that sense, economic complexity may have a direct link with economic resilience and this link may also serve as a factor reducing the risk premia in a way which is not directly captured by macroeconomic variables or indicators related to global financial conditions.

3. Economic Complexity Index

The methodology of ECI is available in the Observatory of Economic Complexity (OEC), MIT, (https://atlas.media.mit.edu/en/resources/methodology/). Accordingly, the ECI builds on the idea of Revealed Comparative Advantage (RCA) in order to make countries and products comparable. In this context, a country has a revealed advantage in a product if its share in the exports of the country is higher than the share of that product in total world trade. Thus, RCA is defined as:

$$RCA_{cp} = \frac{X_{cp}}{\sum_c X_{cp}} / \frac{\sum_p X_{cp}}{\sum_{c,p} X_{cp}}$$

where X_{cp} is the quantity of export of product p by country c in USD terms. Then, a matrix is constructed connecting countries and products:

$$M_{cp} = 1 \; if \; RCA_{cp} \geq 1 \; and \; M_{cp} = 0 \; otherwise$$

The economic complexity is linked with "multiplicity of knowledge" that the economy enjoys. The main idea of complexity is that the only way for a society to widen its base of knowledge is to facilitate the interaction of individuals through complex networks. As a result of this interaction, products are made. Building on this, the economic complexity can be measured by analyzing the products made and countries which are able to produce these products. Therefore, complexity captures the structures enabling the combination of knowledge as well as a country's output composition.

Summing over the rows and columns of the M_{cp} matrix, "diversity" and "ubiquity" measures can be calculated. Diversity is related to the number of products that a country is connected to and ubiquity is related to the number of countries that a product is connected to (Hausmann, Hidalgo et al., 2014).

$$Diversity = k_{c,o} = \sum_p M_{cp} \; ; \quad Ubiquity = k_{p,o} = \sum_c M_{cp}$$

The information that diversity and ubiquity carry for each other can be corrected through a recursive process:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_p M_{cp} k_{p,N-1} \; ; \quad k_{p,N} = \frac{1}{k_{p,0}} \sum_p M_{cp} k_{c,N-1}$$

Then by inserting equations into the other and rearranging:

$$k_{c,N} = \sum_{c'} \widetilde{M}_{cc'} k_{c',N-2} \; ; \quad where \; \widetilde{M}_{cc'} = \sum_p \frac{M_{cp} M_{c'p}}{k_{c,0} k_{p,0}}$$

Finally, the ECI is defined as:

$$ECI = \frac{\vec{K} - average(\vec{K})}{stdev(\vec{K})}$$

where $\vec{K}$ is the eigenvector of $\widetilde{M}_{cc\prime}$ associated with the second largest eigenvalue. By construction, those countries which are less complex than the average, in a given period, will have negative values for the ECI; while those countries which are above the average will have a positive figure for ECI. For the calculation of RCA and ECI, simultaneously countries with a population greater than or equal to 1.25 million; countries whose traded value is greater than or equal to 1 billion USD; products whose traded value is greater than or equal to 10 million USD are considered as pointed out by OEC, MIT.

4. Data and Methodology

The sovereign Credit Default Swap (CDS) spreads are used as the credit risk indicator as recently have been proposed (i.e. Longstaff et al., 2011; Dieckmann and Plank, 2012). CDS spreads for five-year bonds are considered and the data are collected from the Bloomberg. Regarding macroeconomic variables that have an impact on risk premia, inflation rate, real GDP growth rate, current account balance/GDP ratio, gross government debt/GDP ratio and GDP per capita are considered. The macroeconomic variables are collected from the IMF's World Economic Outlook database. Rule of law, regulatory quality, corruption control and political stability indicators from World Banks's World Governance Indicators are used in the study to control for institutional factors. Global financial conditions are captured by the MSCI World (a proxy for global equity) and VIX (a proxy for risk perception) indices, which are retrieved from the Bloomberg. We also consider sovereign credit ratings in the analysis. For this purpose, the Standard&Poor's ratings are used. Finally, the economic complexity (ECI) data are collected from MIT's Observatory of Economic Complexity. The study is carried out for a sample of 37 countries (21 advanced and 16 emerging economies) and the yearly data covers 2001 (earliest availability for CDS) - 2016 (latest availability for ECI) period.[2] The detailed data description and sources are provided in the Appendix, Table A1.

In order to test the impact of ECI on the risk premia, panel regressions are carried out. To determine the correct model specification, first, a set of stationarity tests are performed. In this study, the Fisher test for panel unit root -using the Phillips-Perron test- is executed. The results reveal that many of the time series are not stationary in levels, but all of them are panel stationary in first differences (Appendix, Table A2). Accordingly, the chosen empirical specification relates changes in the CDS premia to changes in its determinants:

$$\Delta \ln(CDS)_{i,t} = \alpha + \beta \Delta ECI_{i,t} + \sum_{j=1}^{k} \theta_j \Delta M_{i,t,j} + \sum_{j=1}^{k} \gamma_j \Delta G_{i,t,j} + \sum_{j=1}^{k} \delta_j \Delta I_{i,t,j} + \varepsilon_{i,t} \quad (1)$$

where $ECI_{i,t}$ is the economic complexity index of country i at time t; vector $M_{i,t,j}$ represents j macroeconomic variables (inflation, GDP growth, current account balance, and gross government debt); vector $G_{i,t,j}$ represents the global financial indicators common to all countries (MSCI and VIX) and vector $I_{i,t,j}$ represents the institutional variables (rule of law, regulatory quality, corruption control, and political stability). The estimations are carried out for three different samples: the full sample (including advanced and emerging economies) and for the sample of emerging and advanced economies separately. The descriptive statistics of the variables used in regression samples are given in the Appendix, Tables A3-A5.

[2] The emerging economies sample includes Argentina, Brazil, Chile, China, Czech Republic, Hungary, India, Indonesia, Korea Republic, Malaysia, Mexico, Poland, Russia, South Africa, Thailand and Turkey. The advanced economies sample includes Australia, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the US.

5. Estimation Results

The specification (1) is estimated as a fixed effects panel regression. The results for the sample of all countries are provided in Table 1. In the first column, changes in the risk premia are regressed on the ECI. In the second column, we control for institutional factors, while the third column adds relevant macroeconomic variables. The final three columns additionally control for changes in GDP per capita, credit ratings and both. In all columns, the global financial conditions indicators (MSCI and VIX) are included as common control variables as they are the major determinants of sovereign risk premia.

Table 1: Estimation Results: Fixed effects panel regression – All Countries

Dependent variable: Changes in Log CDS						
Changes in:						
ECI	-0.388*	-0.538**	-0.410**	-0.410**	-0.379**	-0.378**
	(0.214)	(0.221)	(0.181)	(0.181)	(0.174)	(0.174)
Regulatory Quality		-1.855***	-1.485***	-1.462***	-1.478***	-1.439***
		(0.371)	(0.296)	(0.292)	(0.301)	(0.300)
Corruption Control		-0.218	-0.202	-0.220	-0.104	-0.131
		(0.327)	(0.332)	(0.323)	(0.342)	(0.338)
Political Stability		-1.187*	-1.059	-1.061	-1.102*	-1.107*
		(0.621)	(0.634)	(0.637)	(0.649)	(0.655)
Rule of Law		0.294	0.710	0.640	0.758*	0.637
		(0.459)	(0.438)	(0.443)	(0.420)	(0.431)
Inflation			0.0264**	0.0268**	0.0239**	0.0246**
			(0.0115)	(0.0115)	(0.0110)	(0.0109)
Gross Government Debt			0.0181***	0.0187***	0.0126**	0.0134**
			(0.00378)	(0.00381)	(0.00562)	(0.00588)
Current Account Balance			-0.0145	-0.0133	-0.0201**	-0.0180*
			(0.0102)	(0.0100)	(0.00922)	(0.00948)
GDP Growth			-0.00254	-0.00334	-0.00174	-0.00312
			(0.00603)	(0.00631)	(0.00605)	(0.00622)
GDP per capita (log)				0.134		0.236
				(0.230)		(0.224)
S&P Credit Rating					-0.235**	-0.243***
					(0.0898)	(0.0881)
MSCI_W	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
VIX	0.025***	0.026***	0.026***	0.025***	0.027***	0.026***
	(0.0041)	(0.0035)	(0.0032)	(0.0033)	(0.0032)	(0.0034)
Constant	0.213***	0.187***	0.169***	0.164***	0.170***	0.162***
	(0.0083)	(0.0097)	(0.012)	(0.012)	(0.013)	(0.012)
Observations	406	406	406	406	406	406
R-squared	0.579	0.633	0.661	0.662	0.677	0.678

Notes: The explanatory variables are in first differences. Clustered standard errors are in parenthesis. ***, ** and * denote statistical significance at 1, 5 and 10 percent respectively. Gross government debt and current account balance are in terms of ratios to GDP. S&P credit ratings are defined in terms of rating groups as described in the data sources in the appendix.

In this setting, first, the estimation results reconfirm the existing literature on the impact of macroeconomic and institutional variables on risk premia. Regarding macroeconomic variables, increases in inflation rate and government debt to GDP ratio increases the risk premia, while increases in current account balance reduce the risk premia. On the global financial conditions side, increases in MSCI and decreases in VIX are associated with decreases in countries' sovereign risk premia. Indeed, global factors help explain a sizeable

portion of the variation in CDS premia, as also documented by Amstad, Remolona and Shek (2016). Improvements in regularity quality and political stability -important institutional factors- also reduce risk premia.

What is new to this analysis is the significant impact of economic complexity on risk premia, after controlling for main macroeconomic, global and institutional factors. The results also hold when changes in GDP per capita and credit ratings are controlled for.

As an economy enhances the complexity of its production side, the CDS spreads regarding its sovereign debt also goes down. The improvements in economic complexity may help reduce the risk premia through several channels. First one is through the ability of the ECI to predict future growth. Hausmann, Hidalgo et al. (2014), the pioneers of economic complexity, empirically show that economic complexity is able to significantly predict future growth even with the presence of the initial income and the interaction of income with the ECI in the regression specification. The idea is, as put forward by the authors, that countries which have a level of complexity higher than expected given the level of income, would grow faster than countries whose income is higher than what their complexity implies. Thus, they argue that ECI is a driver of economic prosperity. In a similar manner, in our specifications, the impact of ECI is significant even when controlling for the concurrent GDP growth. Moreover, annual GDP growth may be driven by cyclical factors as well, while complexity is a broader structural concept embracing the ability of a society to bring together different sorts of knowledge and capabilities. In this framework, the investors may associate enhanced economic complexity with further future growth potential, which increases the probability of payment of sovereign debt and leads to an improvement in risk premia.

In a related fashion, as pointed out by Hausmann, Hidalgo et al. (2014), although based on trade data, economic complexity is not about trade openness, export-driven growth and export diversification or country size. Hausmann, Hidalgo et al. (2014) reveal that the future-growth predicting ability of economic complexity is still robust even when export growth, export share or concentration related indicators are included in the regression. Therefore, it is not surprising that ECI has a robust impact even when the current account is controlled in the regression in our specification. Even though, on the face value, increased complexity indicates that a country is able to export more complex goods, which are also exported by a few numbers of other complex economies, economic complexity has deeper roots connected to an economy's ability to accumulate knowledge, skills and capabilities in order to produce more complex products. In this regard, an increased complexity inherently implies a better organization of production structure, diversification, and investment in knowledge-intensive technologies, innovation capacity and human capital along with enhanced interaction among economic agents. Such an improvement in the ability to bring together knowledge and capabilities might also lead to better policy designs that would enhance the strength of the economy. Thus, ECI not only signals future economic growth but it also increases the relative resilience of the economy to shocks, as suggested by the findings of the literature on economic resilience as well.

A third and technical channel may also be discussed here. By its design, ECI is a relative index, suggesting that improvements in the complexity of an economy take place at the expense of other economies. Eventually, improved complexity brings an extra benefit regarding the reduction in risk premia through this relativity channel. As some other countries witness a deterioration in their economic complexity, countries with enhanced complexity become even less risky relatively. The finding that ECI still significantly reduces the risk premia even when the changes in credit ratings are also considered, may be reflecting this additional impact. Because, usually, when the country's credit rating is upgraded, the credit ratings of other countries are not downgraded because of that increase. However, in the case of the ECI, an improvement in a country by definition reduces the level of complexity of some other countries.

The impact of economic complexity on risk premia remains solid when the samples of advanced and emerging economies are analyzed separately (Table 2 and 3). Regarding the impact of variables, several differences are observed. First, the impact of changes in ECI on changes in risk premia is stronger in the sample of advanced countries due to observed heterogeneity across countries (Figure 1). For instance, Greece has a high risk premia and low complexity, meanwhile, Germany or Switzerland has high complexity and low risk premia. Also, countries like Greece, Portugal, and Spain have experienced deteriorations in their complexity over the past decade accompanied by increases in the risk premia. Meanwhile, countries in the emerging economies sample are less heterogeneous, with relatively high risk premia and moderate complexity shared by most of them on average (Figure 1).

Table 2: Estimation Results: Fixed effects panel regression – Advanced Economies

Dependent variable: Changes in Log CDS						
Changes in:						
ECI	-0.531	-0.639*	-0.623**	-0.586*	-0.602**	-0.548**
	(0.388)	(0.356)	(0.286)	(0.296)	(0.255)	(0.257)
Regulatory Quality		-2.296***	-1.611***	-1.519***	-1.418***	-1.274**
		(0.433)	(0.440)	(0.457)	(0.438)	(0.456)
Corruption Control		-0.0807	0.110	0.0144	0.273	0.148
		(0.588)	(0.582)	(0.541)	(0.522)	(0.497)
Political Stability		-1.759*	-1.786*	-1.704	-1.958*	-1.853
		(0.972)	(0.975)	(1.015)	(1.042)	(1.080)
Rule of Law		2.008	1.906	1.463	1.819*	1.183
		(1.579)	(1.332)	(1.431)	(1.038)	(1.094)
Inflation			0.0726*	0.0681*	0.0759**	0.0698*
			(0.0377)	(0.0378)	(0.0346)	(0.0351)
Gross Government Debt			0.0136***	0.0146***	0.00582	0.00674
			(0.00333)	(0.00322)	(0.00647)	(0.00676)
Current Account Balance			-0.00461	-0.00157	-0.0219	-0.0188
			(0.0236)	(0.0238)	(0.0215)	(0.0228)
GDP Growth			-0.000250	-0.000690	0.00422	0.00390
			(0.0144)	(0.0142)	(0.0137)	(0.0134)
GDP per capita (log)				0.497		0.707**
				(0.424)		(0.326)
S&P Credit Rating					-0.327**	-0.349**
					(0.144)	(0.143)
MSCI_W	-0.002***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
VIX	0.012*	0.016***	0.014***	0.011***	0.014***	0.010***
	(0.0061)	(0.00485)	(0.0037)	(0.0037)	(0.0039)	(0.00344)
Constant	0.284***	0.248***	0.229***	0.226***	0.229***	0.225***
	(0.0088)	(0.0119)	(0.0121)	(0.0117)	(0.0109)	(0.0124)
Observations	216	216	216	216	216	216
R-squared	0.552	0.633	0.660	0.663	0.685	0.690

Notes: The explanatory variables are in first differences. Clustered standard errors are in parenthesis. ***, ** and * denote statistical significance at 1, 5 and 10 percent respectively. Gross government debt and current account balance are in terms of ratios to GDP. S&P credit ratings are defined in terms of rating groups as described in the data sources in the appendix.

Table 3: Estimation Results: Fixed effects panel regression – Emerging Economies

Dependent variable: Changes in Log CDS						
Changes in:						
ECI	-0.473**	-0.582**	-0.407*	-0.401*	-0.398*	-0.395*
	(0.227)	(0.225)	(0.220)	(0.220)	(0.217)	(0.217)
Regulatory Quality		-0.846**	-0.755**	-0.739**	-0.883**	-0.864**
		(0.379)	(0.371)	(0.370)	(0.369)	(0.370)
Corruption Control		-0.442	-0.400	-0.374	-0.332	-0.319
		(0.386)	(0.370)	(0.370)	(0.366)	(0.366)
Political Stability		-0.886	-0.505	-0.527	-0.432	-0.451
		(0.629)	(0.611)	(0.610)	(0.602)	(0.603)
Rule of Law		-0.152	0.149	0.230	0.206	0.256
		(0.545)	(0.535)	(0.538)	(0.528)	(0.531)
Inflation			0.0126*	0.0111	0.0105	0.00958
			(0.00749)	(0.00757)	(0.00743)	(0.00750)
Gross Government Debt			0.0208***	0.0168**	0.0179**	0.0154*
			(0.00737)	(0.00800)	(0.00735)	(0.00792)
Current Account Balance			-0.0238**	-0.0255**	-0.0254**	-0.0265***
			(0.0101)	(0.0101)	(0.00992)	(0.0100)
GDP Growth			-0.0144**	-0.0121*	-0.0144**	-0.0129*
			(0.00663)	(0.00685)	(0.00653)	(0.00677)
GDP per capita (log)				-0.270		-0.180
				(0.211)		(0.212)
S&P Credit Rating					-0.165**	-0.154**
					(0.0671)	(0.0684)
MSCI_W	-0.002***	-0.002***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
VIX	0.039***	0.040***	0.039***	0.040***	0.040***	0.040***
	(0.0042)	(0.0041)	(0.0042)	(0.0042)	(0.0041)	(0.0042)
Constant	0.127***	0.113***	0.109***	0.125***	0.113***	0.124***
	(0.023)	(0.023)	(0.023)	(0.026)	(0.023)	(0.026)
Observations	190	190	190	190	190	190
R-squared	0.702	0.721	0.754	0.757	0.763	0.764

Notes: The explanatory variables are in first differences. Clustered standard errors are in parenthesis. ***, ** and * denote statistical significance at 1, 5 and 10 percent respectively. Gross government debt and current account balance are in terms of ratios to GDP. S&P credit ratings are defined in terms of rating groups as described in the data sources in the appendix.

Among the macroeconomic variables, inflation and gross government debt stand out for advanced economies, while the effect of current account balance and real GDP growth on risk premia are significant for emerging markets economies, as well as gross government debt. From an investors' perspective, fiscal outlook, growth performance and current account dynamics of emerging economies are kept under sight as they constitute important aspects of the ability to pay the sovereign debt. The special focus on current account balance stems from the ability to pay foreign liabilities and from the increased use of imported inputs in domestic production in most emerging economies, which makes them more sensitive to global financial conditions. In this regard, all these variables are found to be significant in the analysis. Beirne and Fratzscher (2013) also find that emerging market economies' bond yields and CDS premia are much more sensitive to public debt, current account and GDP growth than advanced (Euro Area) countries, suggesting that financial markets are more attentive to changes in fiscal and current account outlook in emerging economies. Yet, Beirne and Fratzscher (2013) argue that the European debt crisis directed more attention to the fiscal position of the advanced economies as well. In that regard, and parallel to their findings, we find that gross government

debt has a significant impact on sovereign risk premia in advanced economies. In a related fashion, the changes in credit ratings have a higher impact on the risk premia in advanced economies sample.

On the institutional variables ground, the favorable impact of better regularity control is observed in both samples, meanwhile, political stability is only significant in advanced economies sample. Global financial indicators' impact on risk premia also differs across country groups. Relatively, MSCI has a higher impact on risk premia in advanced economies, whereas, VIX has a stronger impact on risk premia in emerging economies. Similarly, Badshah (2018) finds that the spillover of the VIX index to financial markets is stronger in emerging markets than in developed economies.

6. Conclusion

Overall, the evidence presented in the study strongly supports the favorable impact of economic complexity on sovereign risk premia which is a contribution to the growing literature on the macroeconomic impacts of economic complexity. Policies directed to enhancing skills and creating habitats enabling the coexistence and interaction of different capabilities will help reduce risk premia by strengthening the complexity of the economy.

References

Amstad, M., Remolona, E. and Shek, J. (2016) "How do global investors differentiate between sovereign risks? The new normal versus the old" *Journal of International Money and Finance* **66**, 32-48.

Augustin, P., Boustanifar, H., Breckenfelder, J. and Schnitzler, J. (2018) "Sovereign to corporate risk spillovers" *Journal of Money, Credit and Banking* **50**, 857-891.

Badshah, I. U. (2018) "Volatility spillover from the fear index to developed and emerging markets" *Emerging Markets Finance and Trade* **54**, 27-40.

Baldacci, E., Gupta, S. and Mati, A. (2011) "Political and fiscal risk determinants of sovereign spreads in emerging markets" *Review of Development Economics* **15**, 251-263.

Balima, W.H., Combes, J.L. and Minea, A. (2017) "Sovereign debt risk in emerging market economies: Does inflation targeting adoption make any difference?" *Journal of International Money and Finance* **70**, 360-377.

Beirne, J. and Fratzscher, M. (2013) "The pricing of sovereign risk and contagion during the European sovereign debt crisis" *Journal of International Money and Finance* **34**, 60-82.

Bristow, G. and Healy, A. (2018) "Innovation and regional economic resilience: an exploratory analysis" *The annals of regional science* **60**, 265-284.

Brito, S., Magud, M.N.E. and Sosa, M.S. (2018) "*Real exchange rates, economic complexity, and investment"* IMF Working Paper No. 18/107, International Monetary Fund.

Choi, S. and Hashimoto, Y. (2018) "Does transparency pay? Evidence from IMF Data Transparency Policy reforms and emerging market sovereign bond spreads" *Journal of International Money and Finance* **88**, 171-190.

Ciro, J.C.G. and de Mendonça, H.F. (2016) "Inflation targeting credibility and sovereign risk: evidence from Colombia" *Applied Economics Letters* **23**, 984-990.

Crifo, P., Diaye, M.A. and Oueghlissi, R. (2017) "The effect of countries' ESG ratings on their sovereign borrowing costs" *The Quarterly Review of Economics and Finance* **66**, 13-20.

Di Caro, P. (2017) "Testing and explaining economic resilience with an application to Italian regions" *Papers in Regional Science* **96**, 93-113.

Dieckmann, S. and Plank, T. (2012) "Default risk of advanced economies: An empirical analysis of credit default swaps during the financial crisis" *Review of Finance* **16**, 903-934.

Doshi, H., Jacobs, K. and Zurita, V. (2017) "Economic and financial determinants of credit risk premiums in the sovereign CDS market" *The Review of Asset Pricing Studies* **7**, 43-80.

Erdem, O. and Varli, Y. (2014) "Understanding the sovereign credit ratings of emerging markets" *Emerging Markets Review* **20**, 42–57.

Ertugrul, H. M. and Ozturk, H. (2013) "The drivers of credit default swap prices: Evidence from selected emerging market countries" *Emerging Markets Finance and Trade* **49**, 228–249.

Findlay C., Sorescu S. and Dajud, C.U. (2016) "Markets are smart! structural reforms and country risk" CEPII Research Center Working Papers 2016-23.

Gala, P., Rocha, I. and Magacho, G. (2018) "The structuralist revenge: economic complexity as an important dimension to evaluate growth and development" *Brazilian Journal of Political Economy* **38**, 219-236.

Giannakis, E. and Bruggeman, A. (2017) "Determinants of regional resilience to economic crisis: a European perspective" *European Planning Studies* 25**,** 1394-1415.

Han, Y. and Goetz, S. J. (2015) "The economic resilience of US counties during the Great Recession" *The Review of Regional Studies* **45**, 131-149.

Han, Y. and Goetz, S. J. (2019) "Predicting US county economic resilience from industry input-output accounts" *Applied Economics* **51**, 2019-2028.

Hartmann, D., Guevara, M.R., Jara-Figueroa, C., Aristarán, M. and Hidalgo, C.A. (2017) "Linking economic complexity, institutions, and income inequality" *World Development* **93**, 75-93.

Hausmann, R. and Hidalgo, C.A. (2011) "The network structure of economic output" *Journal of Economic Growth* **16**, 309-342.

Hausmann, R., Hidalgo, C.A., Bustos, S., Coscia, M., Simoes, A. and Yildirim, M.A. (2014) *The atlas of economic complexity: Mapping paths to prosperity*. MIT Press.

Hidalgo, C.A. and Hausmann, R. (2009) "The building blocks of economic complexity" *Proceedings of the national academy of sciences* **106**, 10570-10575.

Hilscher, J. and Nosbusch, Y. (2010) "Determinants of sovereign risk: Macroeconomic fundamentals and the pricing of sovereign debt" *Review of Finance* **14**, 235-262.

Jeanneret, A. (2018) "Sovereign credit spreads under good/bad governance" *Journal of Banking & Finance* **93**, 230-246.

Liu, Z. and Spencer, P. (2013) "Modelling sovereign credit spreads with international macro-factors: The case of Brazil 1998–2009" *Journal of Banking & Finance* **37**, 241-256.

Longstaff, F.A., Pan, J., Pedersen, L.H. and Singleton, K.J. (2011) "How sovereign is sovereign credit risk?" *American Economic Journal: Macroeconomics* **3**, 75-103.

Martin, R. and Sunley, P. (2015) "On the notion of regional economic resilience: conceptualization and explanation" *Journal of Economic Geography* **15**, 1-42.

Martin, R., Sunley, P., Gardiner, B. and Tyler, P. (2016) "How regions react to recessions: Resilience and the role of economic structure" *Regional Studies* **50**, 561-585.

OECD (2018) "*OECD Economic Surveys: Turkey 2018"* OECD Publishing, Paris.

Stolbov, M. (2017) "Determinants of sovereign credit risk: the case of Russia" *Post-Communist Economies* **29**, 51-70.

Svoboda, O., Ibl, M. and Břízková, M. (2016) "Measuring complexity and economic regional resilience" *Proceedings of the 11th International Scientific Conference Public Administration 2016*, University of Pardubice, Pardubice, Czech Republic.

Appendix

Table A1: Data description

Variable	Definition	Source
CDS*	5 Years Sovereign Credit Default Swap value	Bloomberg
ECI**	Economic Complexity Index	Observatory of Economic Complexity (MIT)
Inflation	Year-on-year changes, the annual average	IMF World Economic Outlook Database 2017
Gross Government Debt	General Gross Government Debt, Percent of GDP	IMF World Economic Outlook Database 2017
Current Account Balance	Percent of GDP	IMF World Economic Outlook Database 2017
GDP Growth	GDP at constant prices, the year-on-year change	IMF World Economic Outlook Database 2017
MSCI World	Morgan Stanley Capital International World Index, a broad global equity index	Bloomberg
VIX	Chicago Board Options Exchange SPX Volatility Index	Bloomberg
Regulatory Quality; Corruption Control; Political Stability; Rule of Law	Worldwide Governance Indicators	World Bank, 2017
GDP per capita	Gross domestic product per capita, in current U.S. dollars per person	IMF World Economic Outlook Database 2017
S&P Credit Rating***	Sovereign credit ratings	Standard & Poor's Global Ratings, www.worldgovernmentbonds.com

*Start date of the CDS data differs across countries (ranges from 2001 to 2009), while all are available up to date.
**Available up to 2016.
***Ratings are transformed into numerical classes as 1. In default; 2. Extremely speculative; 3. Substantial risk; 4. Highly speculative; 5. Speculative; 6. Lower medium grade; 7. Upper medium grade; 8. High medium grade; 9. Premium grade

Table A2: Fisher Test for panel unit root using Phillips-Perron test

Variable in:	Level		First difference	
	chi2	p-value	chi2	p-value
Log CDS	80.09	0.294	172.78	0.000
ECI	27.38	1.000	213.20	0.000
Inflation	226.64	0.000	842.81	0.000
Gross Government Debt	106.33	0.008	216.69	0.000
Current Account Balance	73.99	0.479	425.95	0.000
GDP Growth	328.12	0.000	796.70	0.000
MSCI_W	11.23	1.000	225.62	0.000
VIX	76.16	0.409	244.09	0.000
Regulatory Quality	148.04	0.000	382.09	0.000
Corruption Control	155.33	0.000	389.17	0.000
Political Stability	194.80	0.000	648.24	0.000
Rule of Law	89.15	0.111	233.20	0.000
Log GDP per capita	94.78	0.052	192.88	0.000
S&P Credit Rating	86.46	0.153	318.53	0.000

Notes: Fisher test for panel unit root -using Phillips-Perron test- with 1 lag is performed. The null hypothesis is that the process is panel non-stationary. Gross government debt and Current account balance are in terms of ratios to GDP.

Table A3: Descriptive statistics – All countries

Changes in:	Obs.	Mean	Std. Dev.	Min	Max
Log CDS	406	0.073	0.615	-1.261	2.813
ECI	406	-0.014	0.095	-0.415	0.472
Inflation	406	-0.246	2.293	-19.797	7.708
Gross Government Debt	406	1.242	5.329	-27.635	25.846
Current Account Balance	406	0.106	1.981	-8.129	9.284
GDP Growth	406	-0.086	3.484	-20.354	17.188
MSCI_W	406	56.594	163.363	-349.180	218.770
VIX	406	-0.664	5.821	-8.573	14.395
Regulatory Quality	406	-0.009	0.069	-0.318	0.227
Corruption Control	406	0.005	0.050	-0.333	0.333
Political Stability	406	-0.006	0.036	-0.133	0.125
Rule of Law	406	0.000	0.030	-0.167	0.167
Log GDP per capita	406	0.037	0.112	-0.413	0.403
S&P Credit Rating	406	-0.030	0.357	-2.000	1.000

Notes: The descriptive statistics are provided for the first differences of the variables. Gross government debt and Current account balance are in terms of ratios to GDP.

Table A4: Descriptive statistics – Advanced Economies

Changes in:	Obs.	Mean	Std. Dev.	Min	Max
Log CDS	216	0.131	0.682	-1.261	2.813
ECI	216	-0.020	0.089	-0.415	0.472
Inflation	216	-0.136	1.360	-4.795	4.078
Gross Government Debt	216	2.375	6.315	-27.635	25.846
Current Account Balance	216	0.169	1.819	-7.592	9.284
GDP Growth	216	0.005	3.422	-20.354	17.188
MSCI_W	216	54.335	163.234	-349.180	218.770
VIX	216	-0.653	5.765	-8.573	14.395
Regulatory Quality	216	-0.010	0.076	-0.318	0.182
Corruption Control	216	0.005	0.044	-0.083	0.250
Political Stability	216	-0.005	0.036	-0.125	0.125
Rule of Law	216	0.001	0.014	-0.083	0.167
Log GDP per capita	216	0.011	0.089	-0.265	0.212
S&P Credit Rating	216	-0.088	0.382	-2.000	1.000

Notes: The descriptive statistics are provided for the first differences of the variables. Gross government debt and Current account balance are in terms of ratios to GDP.

Table A5: Descriptive statistics – Emerging Economies

Changes in:	Obs.	Mean	Std. Dev.	Min	Max
Log CDS	190	0.006	0.524	-0.954	1.937
ECI	190	-0.007	0.102	-0.403	0.204
Inflation	190	-0.371	3.023	-19.797	7.708
Gross Government Debt	190	-0.047	3.515	-11.827	11.204
Current Account Balance	190	0.036	2.152	-8.129	7.558
GDP Growth	190	-0.189	3.559	-13.069	16.044
MSCI_W	190	59.162	163.903	-349.180	218.770
VIX	190	-0.677	5.898	-8.573	14.395
Regulatory Quality	190	-0.009	0.060	-0.182	0.227
Corruption Control	190	0.005	0.057	-0.333	0.333
Political Stability	190	-0.007	0.036	-0.133	0.106
Rule of Law	190	-0.001	0.041	-0.167	0.167
Log GDP per capita	190	0.067	0.128	-0.413	0.403
S&P Credit Rating	190	0.037	0.315	-1.000	1.000

Notes: The descriptive statistics are provided for the first differences of the variables. Gross government debt and Current account balance are in terms of ratios to GDP.