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Financial Conditions and Growth at Risk in the ECCU

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Financial Conditions and Growth at Risk in the ECCU

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Abstract

We study the growth determinants in the Eastern Caribbean Currency Union (ECCU), using the Growth at Risk (GaR) framework with a focus on financial variables. We find that excessive bank credit growth is associated with lower future real GDP growth in the medium term especially on the low quantiles of growth distribution. Moreover, worsening of both global financial conditions and external conditions are associated with lower future growth in the short term, especially at the high quantiles of growth distribution. Country-specific results are broadly in line with ECCU-wide results, with some variation potentially due to the strong Citizenship-By-Investment program inflows and lack of credit union data. The establishment of a macroprudential framework in the ECCU would need to pay close attention to credit growth not only of banks but also credit unions and continue to monitor global and external conditions.

I. INTRODUCTION

The Eastern Caribbean Currency Union (ECCU) comprises six independent countries and two British Overseas Territories with a total population around 630,000. Its common currency has been pegged to the U.S. dollar since 1976, and the Eastern Caribbean Central Bank (ECCB) secures the peg by maintaining a very high foreign reserve coverage of the monetary base (typically over 90 percent). Consequently, the ECCB does not conduct an active domestic monetary policy.

ECCU countries have a large banking system relative to the size of the economy, and banks' activities likely play an important role in economic growth. Banks' performance has also fluctuated substantially over time in terms of both credit provision to the economy and financial soundness indicators (Figure 1). More specifically, credit to the private sector exhibited a double-digit growth in 2005-08 after decelerating until 2004, mainly due to the increase in credit to the tourism sector and related construction, as favorable conditions of the global economy boosted the momentum in tourism. The strong global economy also supported robust real GDP growth, especially in 2003-07. The NPL ratio increased in 2003-04 but had decreased by 2007 to the level seen in 2000. As the Global Financial Crisis erupted and deepened, real GDP growth slowed in 2008 and turned negative in 2009, credit growth decelerated sharply in 2009 and subsequently turned negative, and the NPL ratio increased as the quality of construction, tourism, and consumer loans deteriorated. In more recent years, the real GDP growth turned positive again but stayed at relatively low levels, while the credit growth remained negative. The regulatory capital to risk-weighted assets ratio stayed well above the regulatory minimum of 8 percent throughout but decreased in 2014 before recovering again. Despite these fluctuations in real GDP growth and financial variables, however, the macro-financial relations in the ECCU have not been studied extensively. Attempts are few, with Beaton and others (2016) being a notable exception.[2]

Figure 1. ECCU: Selected Real and Financial Variables
(Percent)

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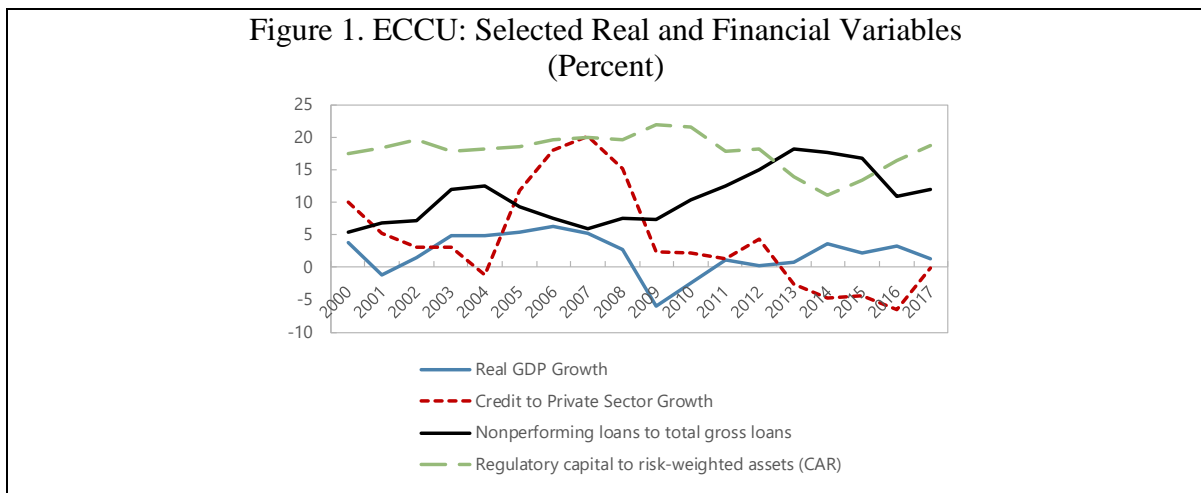
[2] Beaton and others (2016) assessed the determinants of NPLs in the ECCU and the feedback loop between the NPLs and economic activity. They found that banks with stronger profitability and lower exposure to the construction sector and household loans tend to have lower NPLs and that foreign owned banks tend to have lower NPLs. They also found macrofinancial feedback loops.

These small economies are also subject to large exogenous shocks. All of them rely on tourism demand from advanced economies, especially the U.S., and growth in those economies are likely to be important growth drivers. Supply of tourist accommodations are substantially financed externally by foreign direct investment, which are affected by global financial conditions. The ECCU is also subject to frequent natural disasters, which also impact real GDP growth. Therefore, when attempting to assess the relationship between the financial sector and real GDP growth, these other determinants of growth also need to be considered.

The financial sector and output growth generally have a complicated relationship. Credit growth would allow for additional financing of consumption and investment and could boost growth in the short term. However, excessive credit growth could also increase vulnerabilities of the financial sector, leading to the materialization of risks and low growth eventually. Relative strengths of these short- term and medium to long-term effects are an empirical matter.

Our paper aims to establish a framework to relate contemporary economic conditions with future real GDP growth in the ECCU in the short and medium-term, with a focus on financial variables. The paper makes use of a new methodological innovation that combines dimension-reducing techniques, quantile regressions, and the local projection method. This allows us to include a large number of financial variables, estimate real GDP growth at different points of the growth distribution, and trace dynamic response of GDP growth over time, distinguishing between short and medium-term.

Our baseline specification establishes that excessive bank credit growth is associated with lower future real GDP growth in the medium term especially on the low quantiles of growth distribution, while domestic financial soundness indicators have limited correlation with future growth. Worsening global financial conditions are associated with lower future growth in the short term, while weak external real conditions are associated with lower future growth both in the short-term and in the medium-term, especially at the high quantiles of growth distribution. Natural disasters are not associated with future growth. Country-specific results are broadly in line with ECCU-wide results although there was some country-specific variation, potential due to the strong Citizenship-By-Investment program inflows and non-inclusion of credit unions from the financial sector due to data unavailability.

One of the contributions of this paper is to inform growth projections in these small island economies subject to large exogenous shocks. Although there have been some efforts to establish growth determinants in these economies, past studies largely focused on external factors, especially external real conditions. This study attempts to broaden growth determinants and include a larger number of external and domestic financial factors. The inclusion of the financial factors enhances our understanding of macro-financial relationship in these economies. Moreover, the use of the new Growth-at-Risk (GaR) methodology allows for measurements of risks to the central growth projection. It also has implications on micro and macroprudential policy. Analysis in our paper could play a useful role as the ECCB works toward augmenting microprudential policies and establishing macroprudential

policies, highlighting the need to pay close attention to credit growth and expand data coverage to include credit unions. Lastly, the analysis also highlights that improvement in national account statistics are warranted.

The rest of the paper is organized as follows. Section II reviews literature. Section III describes the methodology and data, and section IV contains results. Section V concludes.

II. LITERATURE REVIEW

Our paper draws on the literature that identifies growth determinants in the ECCU and more generally.

Natural Disasters and Growth

The effect of natural disasters on future growth has not been firmly established. Cavallo and Noy (2011) and others suggest that there are immediate negative effects on economic activities from natural disasters, but that the results vary widely depending on the empirical methodology and the sample selection. On the Caribbean region, Rasmussen (2006), Cashin and Sosa (2013) and Acevedo (2014) studied the effects of natural disasters on the Caribbean region, using different data, country coverage, and empirical specification. They all find that natural disasters lead to an immediate loss in output (the year that the natural disasters happened). Regarding future growth, results are inconclusive. Rasmussen (2006) documented macroeconomic stylized facts around the time of disasters and did not find a higher growth in year t+1, t+2, etc. In Cashin and Sosa (2013), negative output effect was temporary, and the effect on the level of real output disappears in year t+1 or t+2. Results are similar in Acevedo (2014); while GDP growth recovered somewhat in year t+1, the cumulative response of the level of GDP continued to be negative. Moreover, these results were not statistically significant in Acevedo (2014).

Financial Soundness Indicators (FSIs) and the Macroeconomy

FSIs were developed in the late 1990s and early 2000s by the IMF together with the international community, with the aim of supporting analysis and assessing strengths and vulnerabilities of the financial system. Literature has established contemporaneous correlation between FSI and macroeconomic variables such as growth and banking crisis (Cihak and Schaeck (2010), Babihuga (2007), Navajos and Theresa (2013), Creel, Hubert, and Labondance (2015), and Prochniak and Wasiak (2017)), but attempts to use FSIs for forecasting are limited. Cihak and Schaeck (2010) and Navajos and Theresa (2013) found that ROE was a significant leading indicator of the banking crisis, but not the other core FSIs. Separately, Espinoza and Prasad (2010), Nkusu (2011), and Klein (2013) estimated the macro-financial feedback using VAR methodology for Gulf Cooperative Council countries, advanced economies, and Central, Eastern and South-Eastern European countries, respectively, and found that an increase in NPLs had statistically-significant negative effects on real GDP growth. This relationship was not statistically significant for the ECCU, however, according to Beaton and others (2016).

Business Cycle in the ECCU

Sun and Samuel (2009) studied the effects of US business cycle on the ECCU, using a common trend and cycle approach and VARs, with country-level annual data. They found that the ECCU economies were very sensitive to movements in the U.S. economy, but concluded that the transmission channel was unclear. Our paper broadens the growth predictors, including domestic and external financial conditions, and natural disasters.

III. METHODOLOGY AND DATA

A. Methodology

We adopt the methodology used in Adrian and others (2018), Adrian and others (forthcoming), and IMF (2017). Variables are adjusted given the different set of variables that are important in the ECCU countries. First, growth predictors are summarized into user-specified partitions using dimension reduction techniques (principal components analysis). Next, quantile regressions are run separately for different horizons in the future. For a set of horizons $h \in \{1,4,8,12\}$ where h represents the quarters ahead and at quantiles $\tau \in \{0.1, 0.25, 0.5, 0.75, 0.9\}$, the following specification are estimated:

$$y_{t+h} = \alpha_h^{\tau} + \sum_{i \in I} \beta_{i,h}^{\tau} X_{i,t} + \grave{\mathrm{o}}_h^{\tau}$$

For each of the h-period ahead, τ quantile regressions, y_{t+h} represents future growth, $X_{i,t}$ is growth predictor (partition) i at time t, $\beta_{i,h}^{\tau}$, the variable of interest, is the coefficient for partition i which represents that future real GDP growth increases by $\beta_{i,h}^{\tau}$ in response to one-unit increase in partition i, α_h^{τ} is the associated constant and $\grave{\mathrm{o}}_h^{\tau}$ is the residual. Both y_{t+h} and $X_{i,h}$ are z-scored (normalized to zero mean and standard deviation one), so that $\beta^{\tau}_{i,h}$ can be directly comparable across different partitions as the effect on real GDP of a typical (one standard deviation) shock to each partition.

B. Data

Growth predictors

Table 1 illustrates the predictors for real GDP growth. They are partitioned into the following categories, guided by literature that identified these categories as important growth predictors:

(i) growth of bank credit to the private sector;
(ii) FSIs;

(iii) external real condition;
(iv) global financial conditions (global Financial Conditions Index as documented in the IMF's Global Financial Stability Report);
(v) natural disasters (total damage in percent of GDP as documented by EM-DAT) and;
(vi) lag of real GDP growth.

Data sources are listed in annex I. (ii) and (iii) include multiple variables. In these cases, the set of variables are reduced to a representative index by dimension-reduction techniques (principal component analysis).

Table 1: RHS variables and partition					
Credit Growth	**FSI**	**External Real**	**Global Financial**	**Persistence**	**Natural Disasters**
credit_growth	npl	US_growth	global_fci	lag_gdp_g	nd_gdp
	capital	oil_price			
	tier_capital				
	roe				
	roa				

The choice of growth predictors generally follows growth determinants considered to be important to these economies in the literature described before. The choice of financial variables is guided by Prasad et al. (2019), but adjusted by replacing price of risk variables by FSIs. While the prices of risk may be more ideal as growth predictors since it is more forward-looking, as used in IMF (2017), those prices do not exist in the ECCU region.[3]

GDP growth

Quarterly GDP (QGDP) data are not consistently available in these economies. Consequently, QGDP series are estimated using the method of Chow and Lin (1971), as in Gonzalez-Garcia et al. (2013) and Narita (2014) (Annex II). For countries in which the authorities construct actual QGDP for recent years (Grenada and St. Lucia), actual GDP replaces estimated GDP whenever available. The estimation periods is 2001-2017 and is dictated by the availability of FSI. The use of estimated QGDP adds general uncertainty to our regression results, including because the some of the variables used to estimate QGDP are also used as RHS variables of the regression.
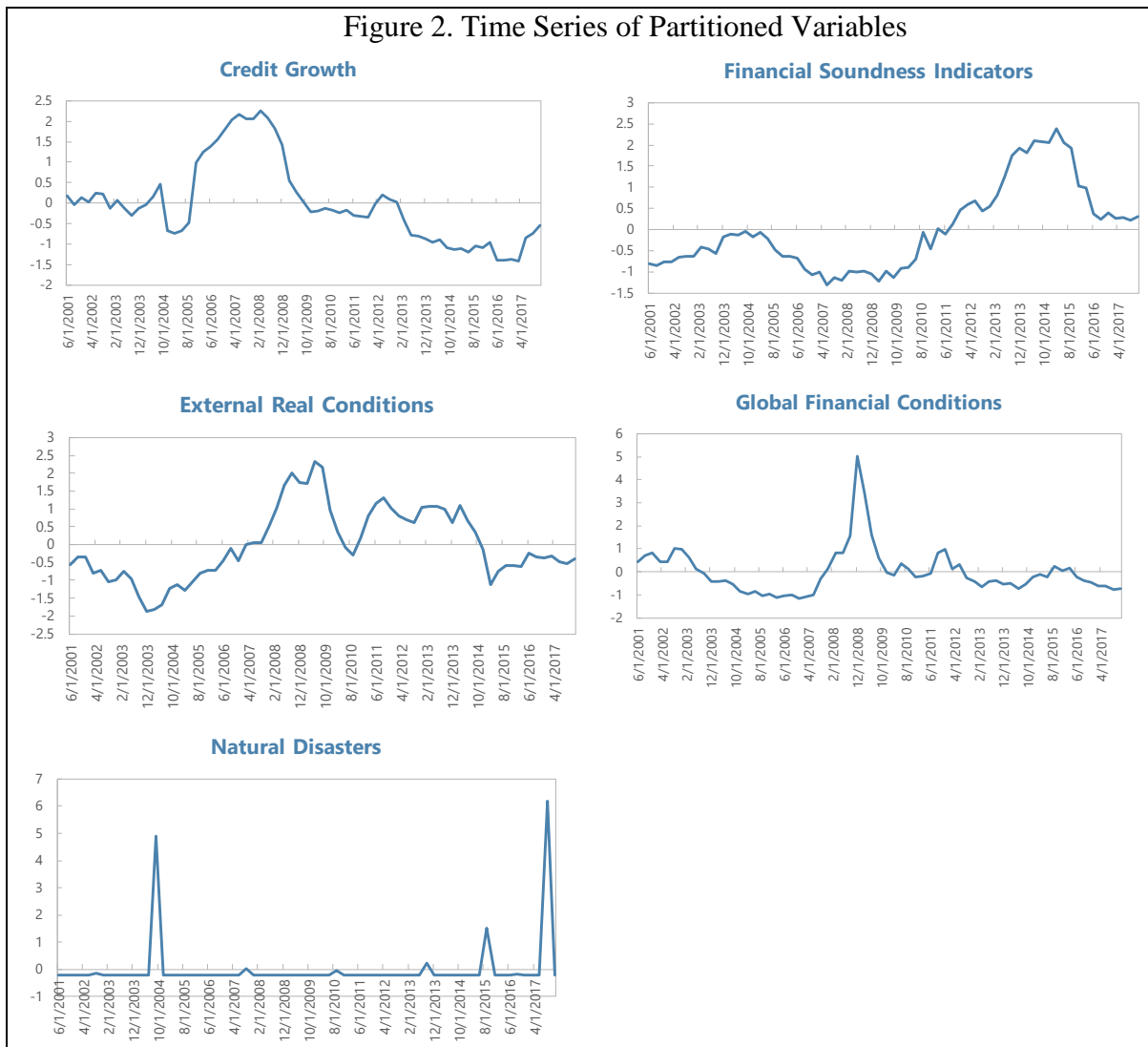
We first estimate the ECCU as an aggregate and then the six independent countries of the ECCU separately. The ECCU conveniently produces macro and financial variables for both the ECCU as an aggregate and for its individual members, which we used as input.

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[3] IMF (2017) show that domestic prices of risk has negative effects on the growth, and especially increases the downside risk, using the data for a sample of advanced economies and large emerging markets economies. While it would be ideal to follow a similar approach, but there are no indicators of domestic price of risk in the ECCU that show enough variability.
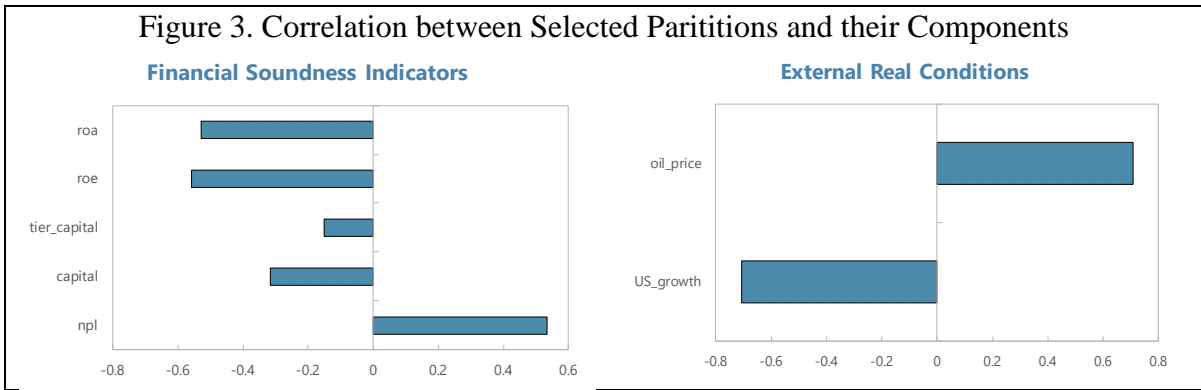
IV. RESULTS

A. ECCU-wide Results

Time series of each partition appear to be consistent with historical events (Figure 2), and for those partitions that are composed of multiple variables, relationship between the partition and its components are reasonable (Figure 3). For example, the global financial conditions partition peaks at the end of 2008 and are much lower before and after the peak, suggesting that its increase represents its worsening. The external real conditions partition is positively correlated with higher oil prices and negatively correlated with the U.S. growth, jumps up in 2008 and jumps down in 2014. Therefore, an increase in external real conditions index should be interpreted as a worsening in real external conditions. Similarly, FSI partition is positively correlated with NPL ratio and negatively correlated with capital ratios, ROA, and ROE, suggesting that its increase represents a worsening in FSI.
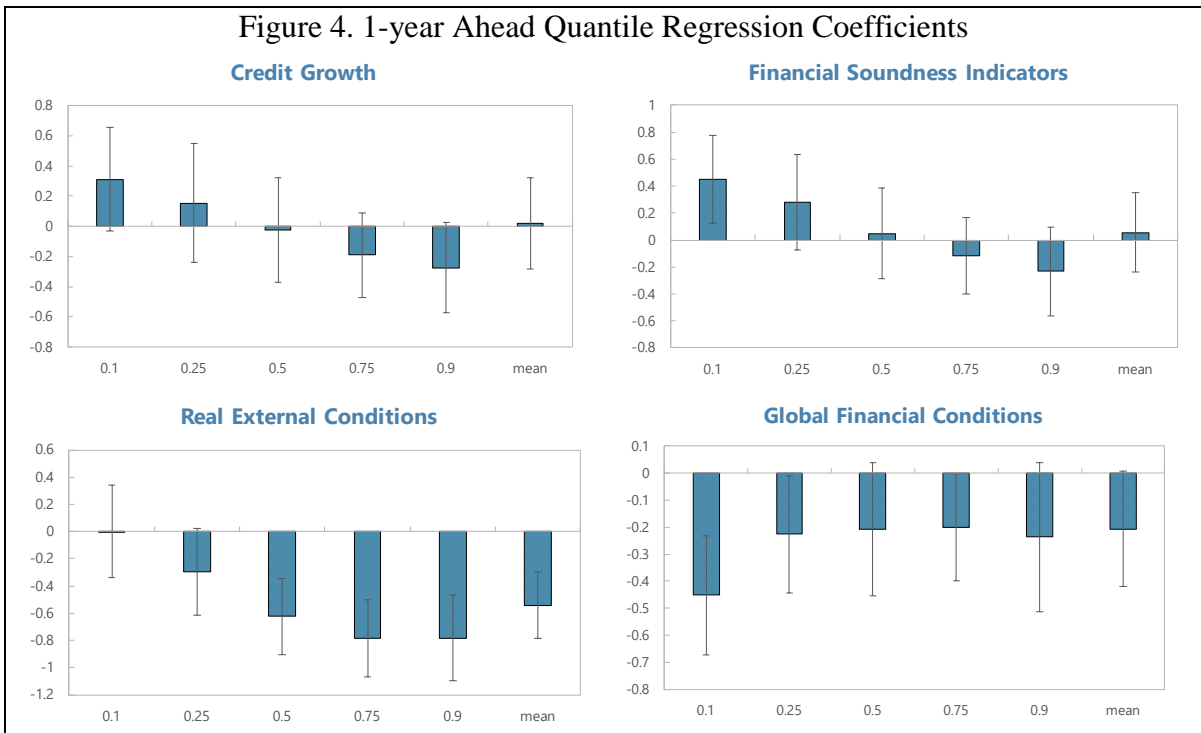

Figure 2. Time Series of Partitioned Variables

Note: Time-series of partitioned variables, normalized to mean zero and standard deviation one.

Figure 3. Correlation between Selected Paritions and their Components

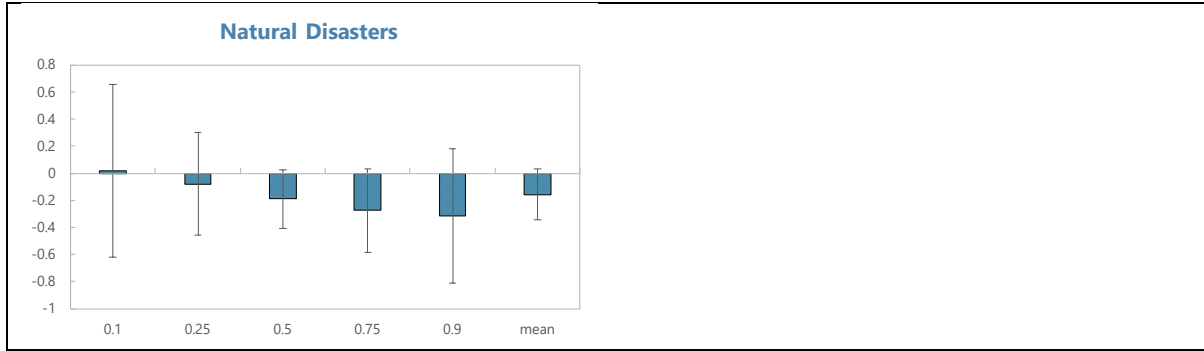**Financial Soundness Indicators**

External Real Conditions

1-year Ahead Forecasts (Figure 4)

The worsening of external conditions and global financial conditions are uniformly associated with negative effects on growth, while the effects of credit growth, FSI, and natural disasters are ambiguous. In terms of size, external real conditions are most important, i.e. among typical (one standard deviation) shock for each partition, external real conditions would have the strongest effects on growth.

Figure 4. 1-year Ahead Quantile Regression Coefficients

Credit Growth

Financial Soundness Indicators

Real External Conditions

Global Financial Conditions
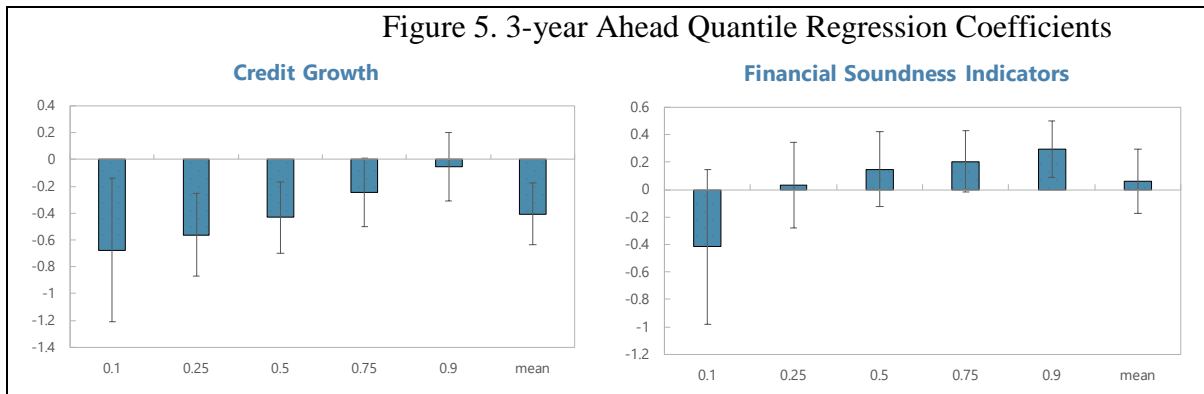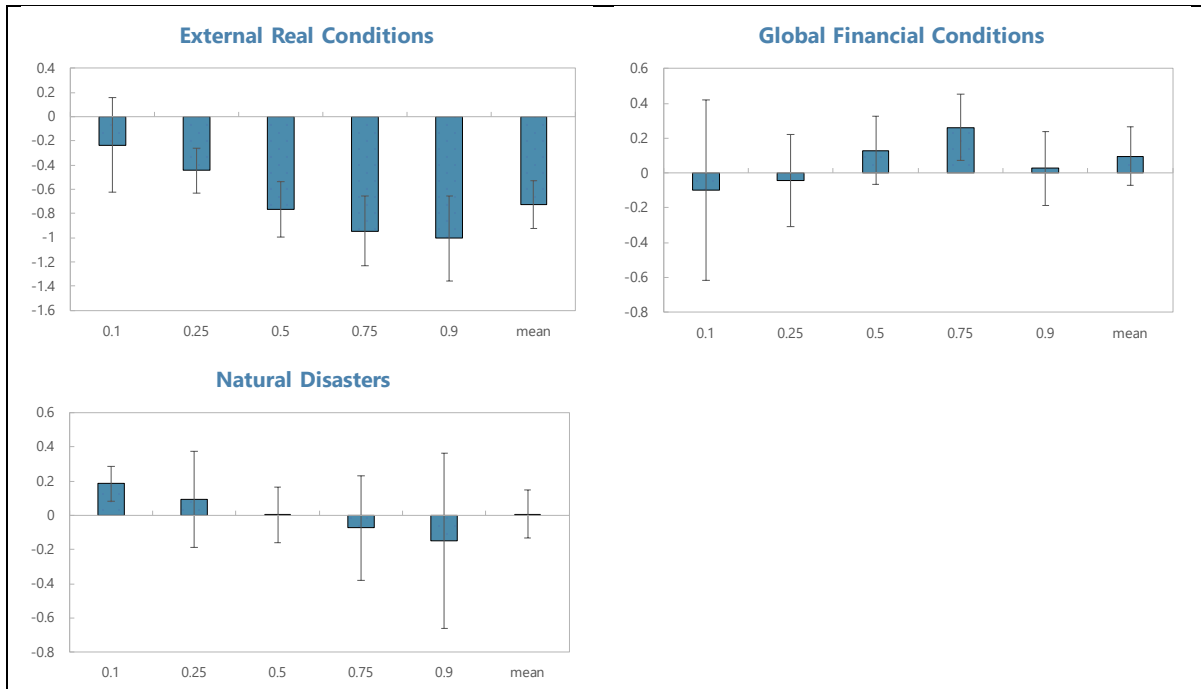
Natural Disasters

Note: The columns are regression coefficients that represents a percentage point change in the 4 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

3-year Ahead Forecasts (Figure 5)

The worsening of external real conditions and increase in credit growth are uniformly associated with negative effects on growth, while the effect of FSI, global financial conditions, and natural disasters are ambiguous. Larger coefficients for lower percentiles for credit growth suggests that there are stronger downside risks from the credit growth than the OLS estimates would suggest. In terms of size, credit growth has the largest effects at the lower percentile (10th percentile and 25th percentile) and external real conditions have the largest effects at the higher percentiles.

Figure 5. 3-year Ahead Quantile Regression Coefficients

Credit Growth

Financial Soundness Indicators

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

Historical Time Series of GaR

Figure 6 documents the historical time series of 1-year ahead GaR at 5th, 50th, and 95th percentiles to illustrate how this model would have predicted the growth distribution over time. The historical GaR is derived by combining the time series of partitioned variables (Figure 2) and 1-year ahead quantile regression coefficients (Figure 4).

As demonstrated in Figure 4, different partitions affect upper and lower conditional quantiles differently. Large coefficients for external real condition at the higher quantiles and for global financial condition at the lower quantiles suggest that 95th percentile is especially affected by the external condition and 5th percentile by the global financial conditions. In addition, credit growth has positive growth effects at lower quantiles but has negative growth effects at higher quantiles. This suggests that high credit growth will be followed by the narrowing of the distance between 5th percentile and 95th percentile. The decline in the downside risk in 2009, and increase in upside risk in 2005, 2010, and 2017, narrowing the distance between 5th and 95th percentiles in 2004, and widening of the distance between 5th percentile and 95th percentile in 2016 can be understood in this context.
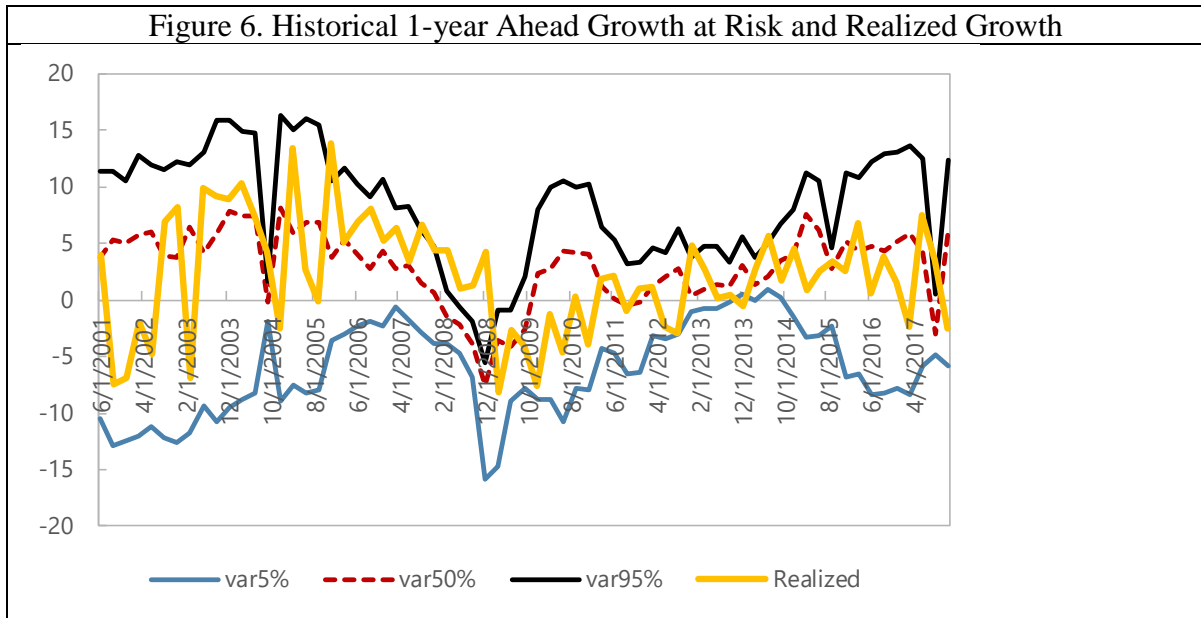
Figure 6. Historical 1-year Ahead Growth at Risk and Realized Growth

Note: The figure plots the Growth at Risk at 5 percentile, 50 percentile, and 95 percentile, along with the realized growth.

Discussion

The importance of external real conditions and global financial conditions in the short term are plausible and are consistent with the past literature (Sun and Samuel (2009)).[4] The strong negative effect of credit growth in the medium term suggests that credit quality tends to deteriorate overtime when credit growth accelerates, lowering lending standards and worsening the quality of bank balance sheets. Rapid credit growth does not always imply lowering lending standards and worsening balance sheets of banks. For example, if the initial level of private credit is low, financial deepening generates a positive association between private credit and long-term growth (Arcand and others (2015)). However, current level of private credit is generally high in the ECCU countries and there is concern of overbanking (Samuel and others (2013)). Also, a short-to medium run relationship between financial depth and economic growth, which is the focus of our paper, could be negative while the same variables could have a positive relationship in the long run (Loayza and Ranciere (2006)).

The non-effect of FSI confirms that FSIs are backward-looking indicators and therefore they are not strongly associated with future growth. It is also consistent with Beaton et al. (2016), who found that the NPL increase will have negative effect on the future GDP growth but was not statistically significant. Having said that, there are studies that showed clear negative effects of NPLs on GDP growth when studying other regions.

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[4] The strong effect of global financial conditions as a forecaster of the short-term real GDP growth has been documented for other countries (IMF (2017)), but not for ECCU countries.

The non-effect of natural disasters on short and medium-term growth implies that the likely immediate effect of negative economic activity is not compensated by the higher growth in the future. There is no clear consensus in the literature on the effect of natural disasters on future growth, but the results are at least consistent with Rasmussen (2006) and Cashin, Sosa (2013), and Acevedo (2014). In any case this issue should be revisited once more countries in the sample start producing quarterly GDP including historical series, since our estimated quarterly GDP series do not fully incorporate the impact of natural disasters.

B.   Country-specific Results

The main results from the ECCU-wide regression hold broadly for the country-specific estimations (Annex III). For example, faster credit growth is associated with lower real GDP growth 3-year ahead for most countries, while financial soundness indicators generally have limited associations with future growth. External conditions generally have statistically significant and sizable growth effects for both short- and medium-term. Natural disasters are not associated with future growth.

There are some notable heterogeneities, however. For example, external conditions do not appear to be strongly associated with 1-year ahead real GDP growth, and a worsening of FSI is associated with a higher real GDP growth in the short and medium-term, in St. Kitts and Nevis. Also, the association of credit growth with the 3-year ahead real GDP growth and the global financial conditions with the 1-year ahead real GDP growth are weaker in some countries.
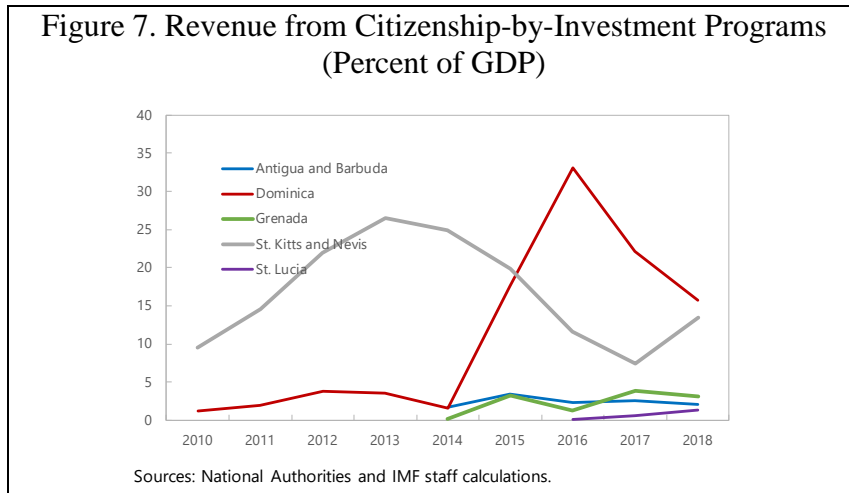
St. Kitts and Nevis received sizable CBI inflows in the 2010s, which were considered to have affected the economic growth substantially (Figure 7). Therefore, we further control for the government receipts of CBI in percent of GDP as an additional control variable.[5] As expected, CBI inflows have a strong association with real GDP growth in the 1-year horizon. The inclusion of the CBI partition also partially alters and further sheds lights on the counterintuitive results between FSIs and real GDP growth in the baseline specification. First, the association between FSIs and 1-year ahead real GDP growth disappears once the CBI variable is included, consistent with the ECCU-wide results and other country-specific results. Second, the association between the worsening FSIs and higher real GDP growth 3-year ahead, which remains after the inclusion of the CBI partition, appears to be influenced by the events in 2009-14. FSIs worsened in 2009-11 after the GFC and the GDP growth was subdued during those periods. Subsequently, the CBI revenue, which was negligible until 2009, grew strongly in 2011-13, accompanied by the high GDP growth in 2012-14, consistent with the strong association between the CBI and 1-year ahead real GDP growth. Given that the 2012-14 growth acceleration also reflects the lack of the CBI in the earlier

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[5] While CBI revenue was not added to the other countries with the CBI program due to the short periods in which CBI program was prominent, the conjecture is that similar to St. Kitts and Nevis results, the CBI is likely an important growth driver in the other ECCU countries with the substantial CBI program, and it would be worthwhile to revisit this issue once longer time-series data of the CBI revenue becomes available.

years, the association between the FSIs and 3-year ahead real GDP growth is at least partially spurious, influenced by factors not foreseen when the FSIs worsened.

A caveat to the results is that credit unions play an important role for financial intermediation in addition to banks in some countries in the ECCU. Therefore, it would be ideal to include credit union data at least for some countries in analyzing the effects of the credit growth and FSIs. Unfortunately, data with sufficiently high frequency and length are not available.

Figure 7. Revenue from Citizenship-by-Investment Programs (Percent of GDP)

Sources: National Authorities and IMF staff calculations.

C. Components of FSIs as Growth predictor

Literature has identified NPL and ROE as the potentially useful indicators that predict future growth and banking crisis. We test the usefulness of these indicators in the context of the ECCU and GaR by rerunning the estimation while including NPL ratio and ROE as the sole indicator in the FSI partition.

In sum, neither NPL nor ROE is strongly associated with future real GDP growth in the short-term or medium-term. The role of the other partitions, including external conditions and credit growth remains broadly unchanged from the baseline estimation. (Table 2 and Figures 8-10 for NPL ratio, Table 3 and Figures 11-13 for ROE)

NPL ratio as the sole FSI indicator

Table 2: RHS variables and partition						
Credit Growth		**FSI**	**External Real**	**Global Financial**	**Persistence**	**Natural Disasters**
credit_growth		npl	US_growth	global_fci	lag_gdp_g	nd_gdp
			oil_price			

Figure 8. Time Series of Partitioned Variables

Financial Soundness Indicators
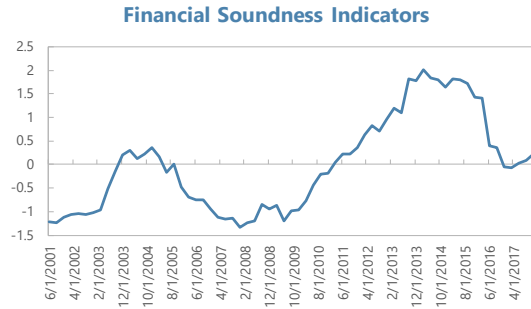
Figure 9. 1-year Ahead Quantile Regression Coefficients

Credit Growth

Financial Soundness Indicators

External Real Conditions

Global Financial Conditions

Natural Disasters

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.
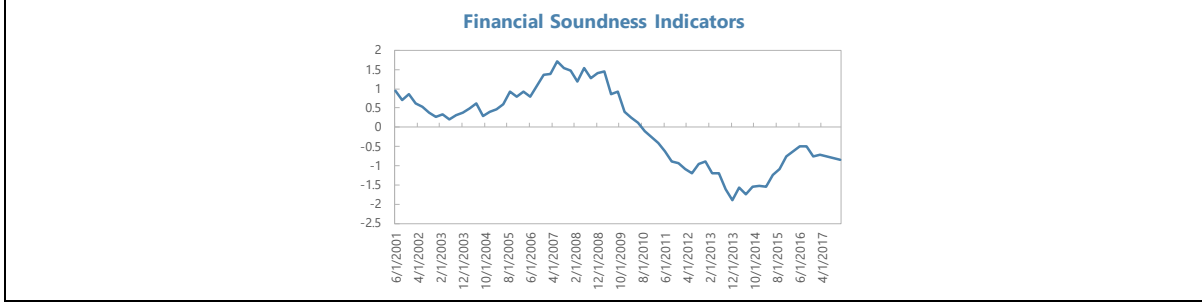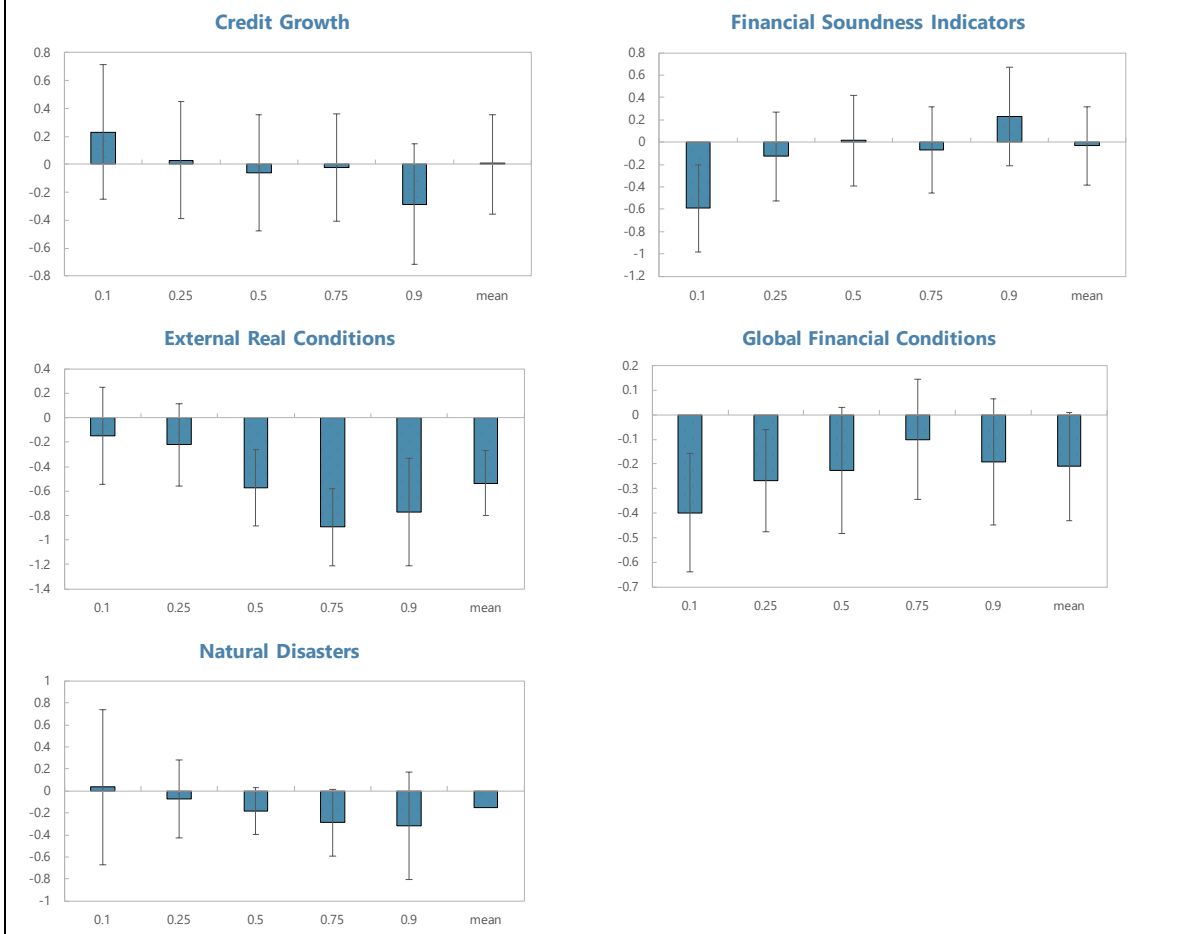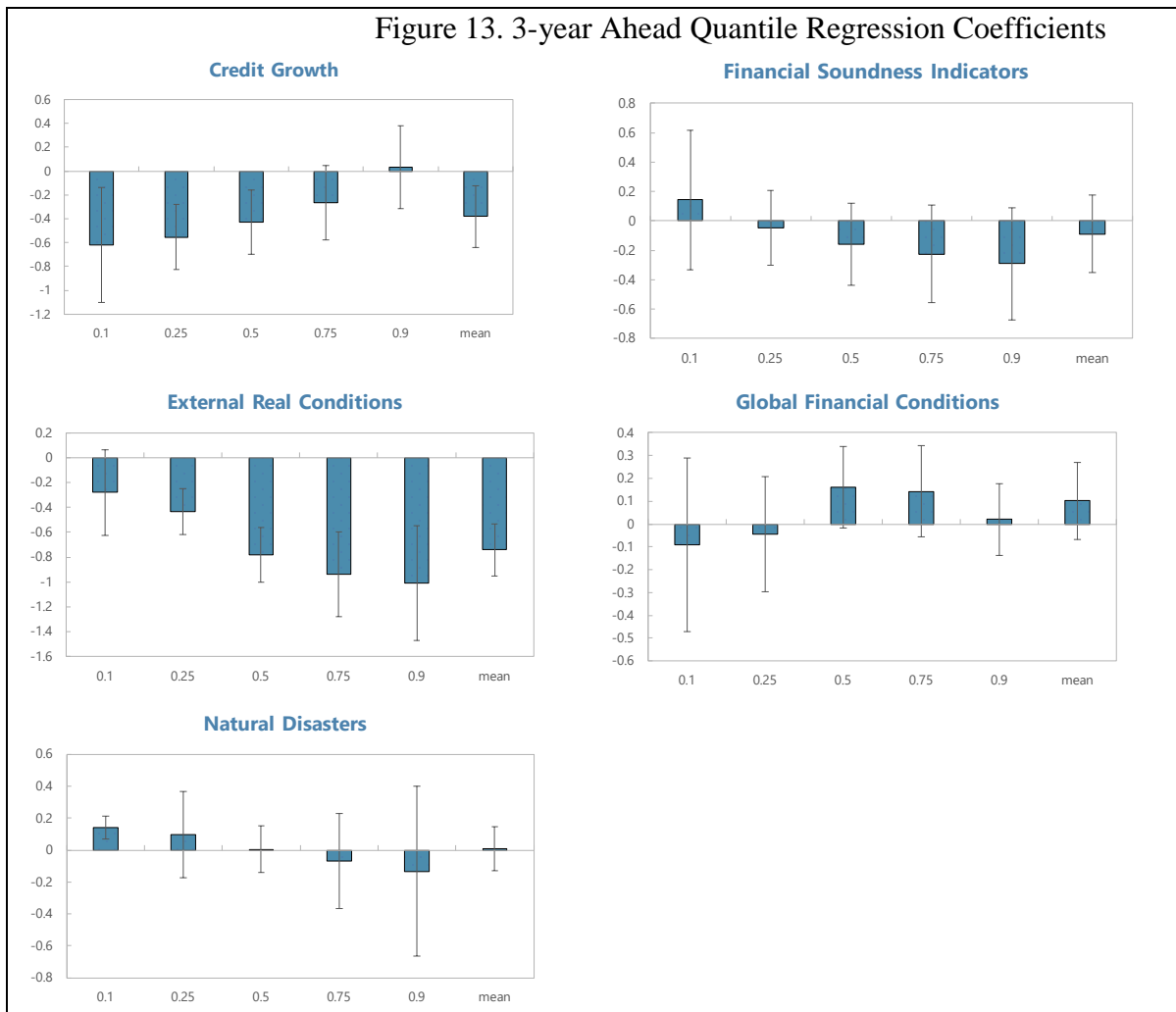
Figure 10. 3-year Ahead Quantile Regression Coefficients

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

ROE as sole FSI indicator

Table 3: RHS variables and partition

Credit Growth	FSI	Real External	Global Financial	Persistence	Natural Disasters
credit_growth	roe	US_growth	global_fci	lag_gdp_g	nd_gdp
		oil_price			

Figure 11. Time Series of Partitioned Variables

Financial Soundness Indicators

Figure 12. 1-year Ahead Quantile Regression Coefficients

Credit Growth

Financial Soundness Indicators

External Real Conditions

Global Financial Conditions

Natural Disasters

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

Figure 13. 3-year Ahead Quantile Regression Coefficients

Credit Growth

Financial Soundness Indicators

External Real Conditions

Global Financial Conditions

Natural Disasters

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

V. CONCLUSION

We studied the determinants of growth in the Eastern Caribbean Currency Union (ECCU), using the Growth at Risk (GaR) framework and with a focus on financial variables.

While there have been some efforts to establish growth determinants in these economies, past efforts largely focused on external factors, especially external and real conditions. This study attempts to broaden growth determinants and include external and domestic financial factors. The inclusion of the financial factors enhances our understanding of macro-financial relationship in these economies. Moreover, the use of the new GaR methodology allows for grasping risks to the central growth projection.

Our results show that excessive bank credit growth is associated with negative real GDP growth in the medium term especially on the tail end of growth distribution in the ECCU. Domestic FSIs, mainly backward looking indicators, have limited association with future growth. However, the health of the banking system would have a direct effect on credit provision to the economy and therefore on economic growth. As expected, the worsening of global financial conditions are associated with lower future growth in the short term, while the worsening of external conditions are associated with lower future growth both in the short-term and in the medium-term, especially at the higher end of growth distribution. Natural disasters are not associated with future growth one way or the other. Country-specific results are broadly in line with ECCU-wide results although there was some country-specific variation, potential due to the strong Citizenship-By-Investment program inflows and non-inclusion of credit unions from the financial sector due to data unavailability. Given that credit unions play an important role for financial intermediation in addition to banks in some countries in the ECCU, it would be ideal to include credit union data at least for those countries in analyzing the forecasting power of the credit growth and FSI.

The paper implies strengthening banking supervision, making progress toward implementing Basel II/III, and working toward establishing a financial stability and macroprudential policy framework by enhancing institutional arrangements and developing indicators to support financial stability assessment. Given the rapid credit growth of credit unions, the inclusion of these institutions in financial sector assessments is key. Lastly, the analysis also highlights that improvement in national account statistics are warranted.

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Annex I. List of Variables and Data Sources

List of Variables	Data Source
Annual Real GDP Growth	WEO Database
Growth of Credit to the Private Sector	ECCB
FSI	ECCB
Global Financial Condition	October 2017 and April 2018 GFSR
US Output Growth	WEO Database
Oil Price	WEO Database
Damage from Natural disasters	EM-DAT

Annex II. Quarterly GDP estimation by Chow and Lin (1971) method

While all countries in the sample produce real GDP annually, only some of them produce quarterly real GDP, and none of them produces quarterly real GDP that goes back to 2001, start of the sample period. Therefore, we estimate quarterly real GDP by the method developed by Chow and Lin (1971) where necessary. The idea of the method is to find the best unbiased linear interpolator by using a set of variables that are available quarterly (henceforth called real GDP predictors) to estimate quarterly real GDP and by enforcing a consistency constraint to ensure that the sum of quarterly real GDP equals annual real GDP. Specific steps are the following.

First, establish the relationship between the real GDP and its predictors at an annual frequency by OLS (equation (1)). Second, use the real GDP predictors (which are available at quarterly frequency) and the annual regression coefficients to generate estimates for quarterly GDP (equation (2)). Error terms from equation (1) are distributed within year to ensure that the sum of estimated quarterly GDP matches the annual GDP. We made a simplified assumption that errors from the quarterly regressions are serially uncorrelated and distributed the residuals from equation (1) equally into four quarters within a year (equation (3)).

$$y_t^A = X_t^A \hat{\beta}^A + \hat{u}_t^A \quad (1)$$

$$\hat{y}_t^Q = X_t^Q \hat{\beta}^A + \hat{u}_t^Q \quad (2)$$

$$\hat{u}_t^Q = \frac{1}{4} \hat{u}_t^A \otimes \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \quad (3)$$

y_t^A, X_t^A, and u_t^A are real GDP, a list of real GDP predictors, and residuals at an annual frequency, and $\hat{y}_t^Q$ are *estimated* real GDP, the list of real GDP predictors, and *estimated* residuals at a quarterly frequency, and $\otimes$ is a Kronecker product.
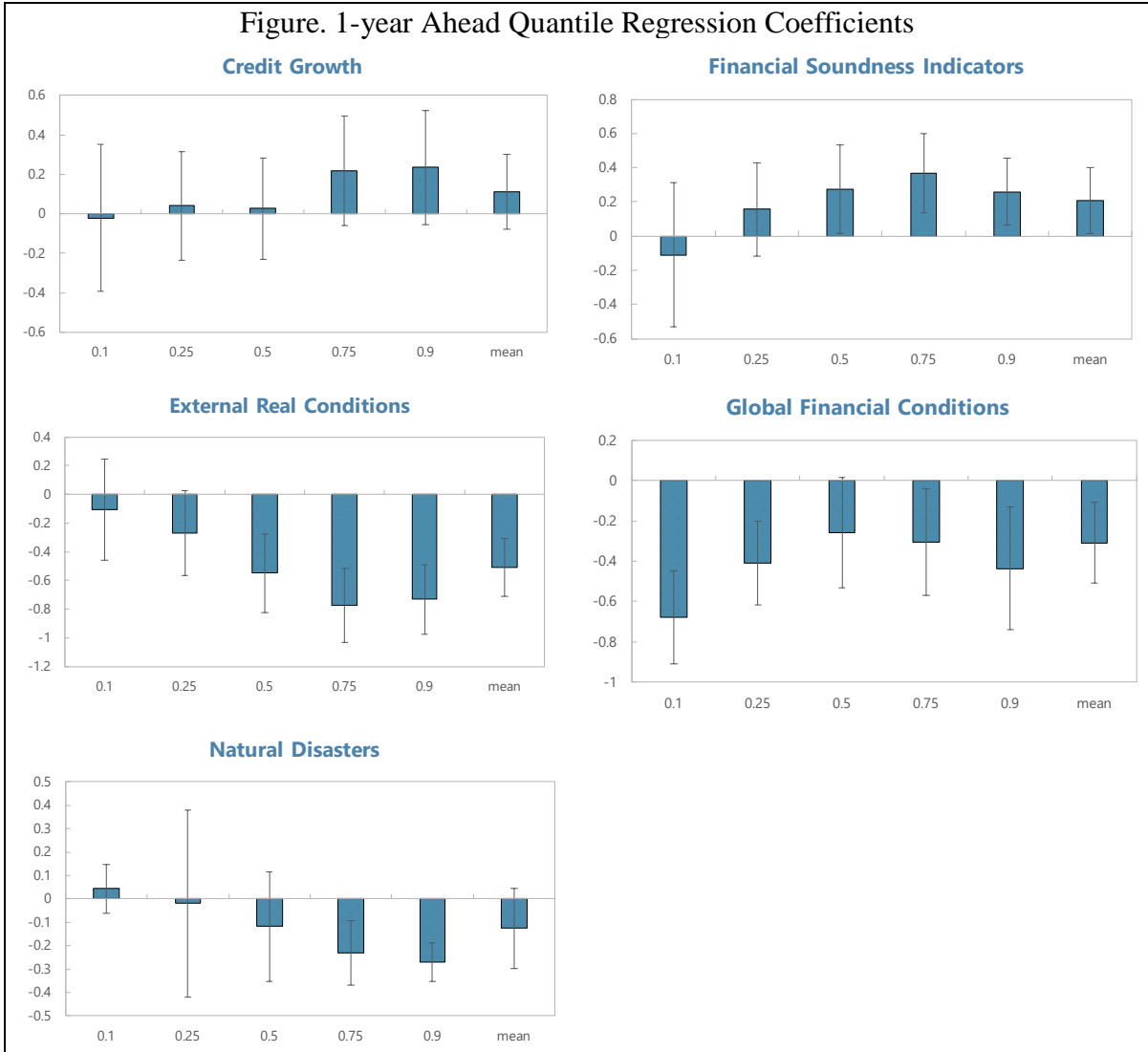
The choice of real GDP predictors X_t follows Gonzalez-Garcia and others (2013) and include both country-specific domestic variables (number of stayover tourists, credit to the private sector) and external variables (US real GDP, US real compensation to employees, and the U.S. index of industrial production).
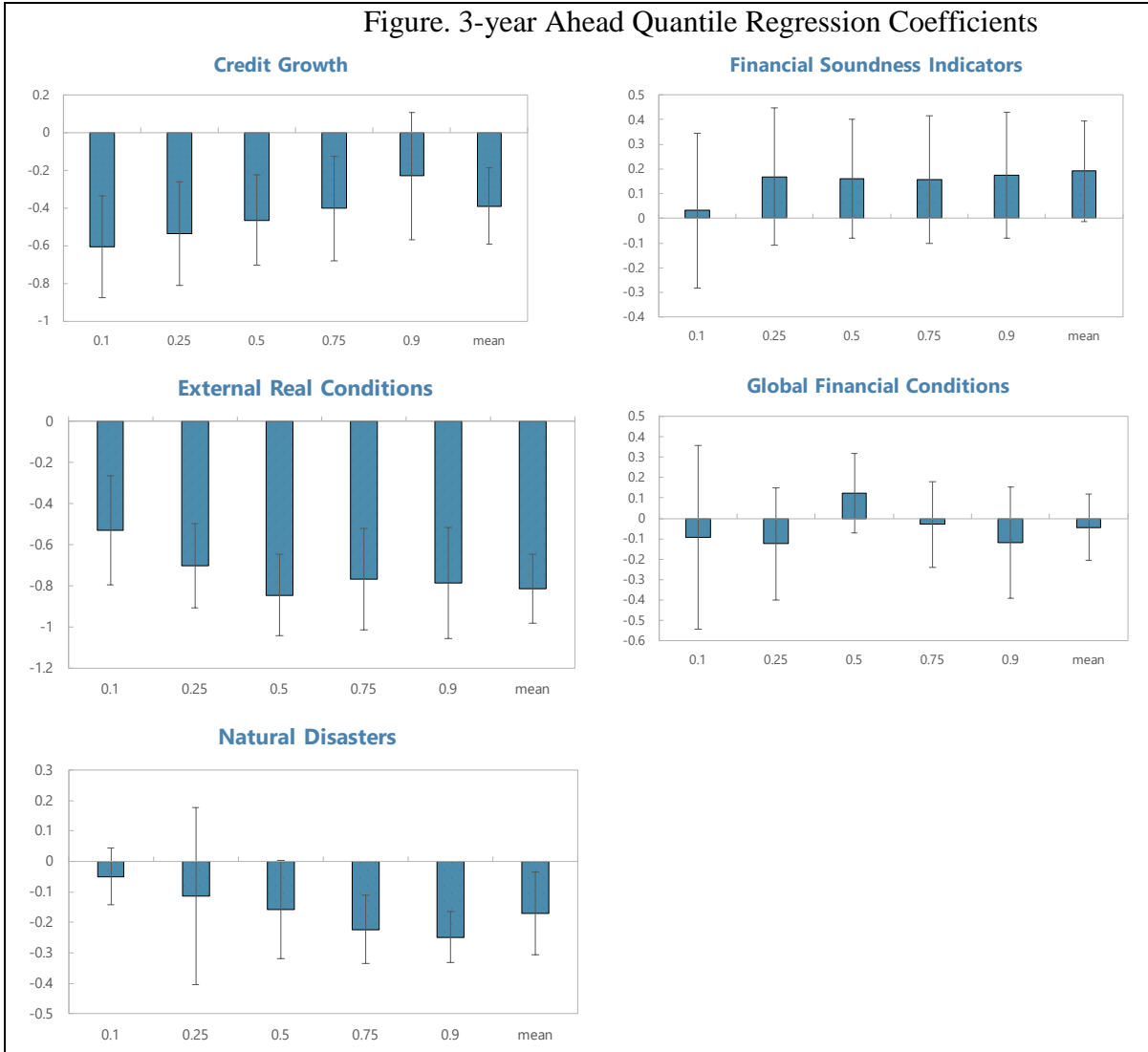
Annex III. Country-Specific Results

Antigua and Barbuda

Figure. Time Series of Partitioned Variables

Figure. Correlation between Selected Parititions and their Components

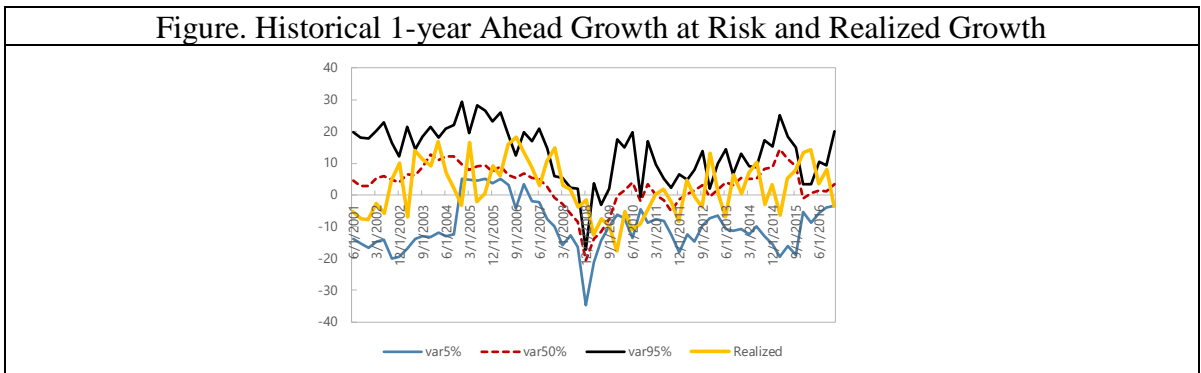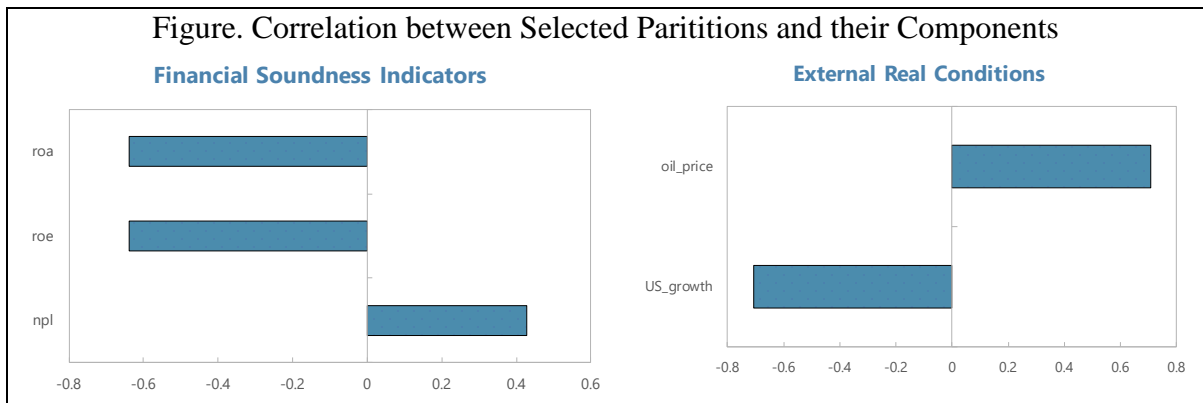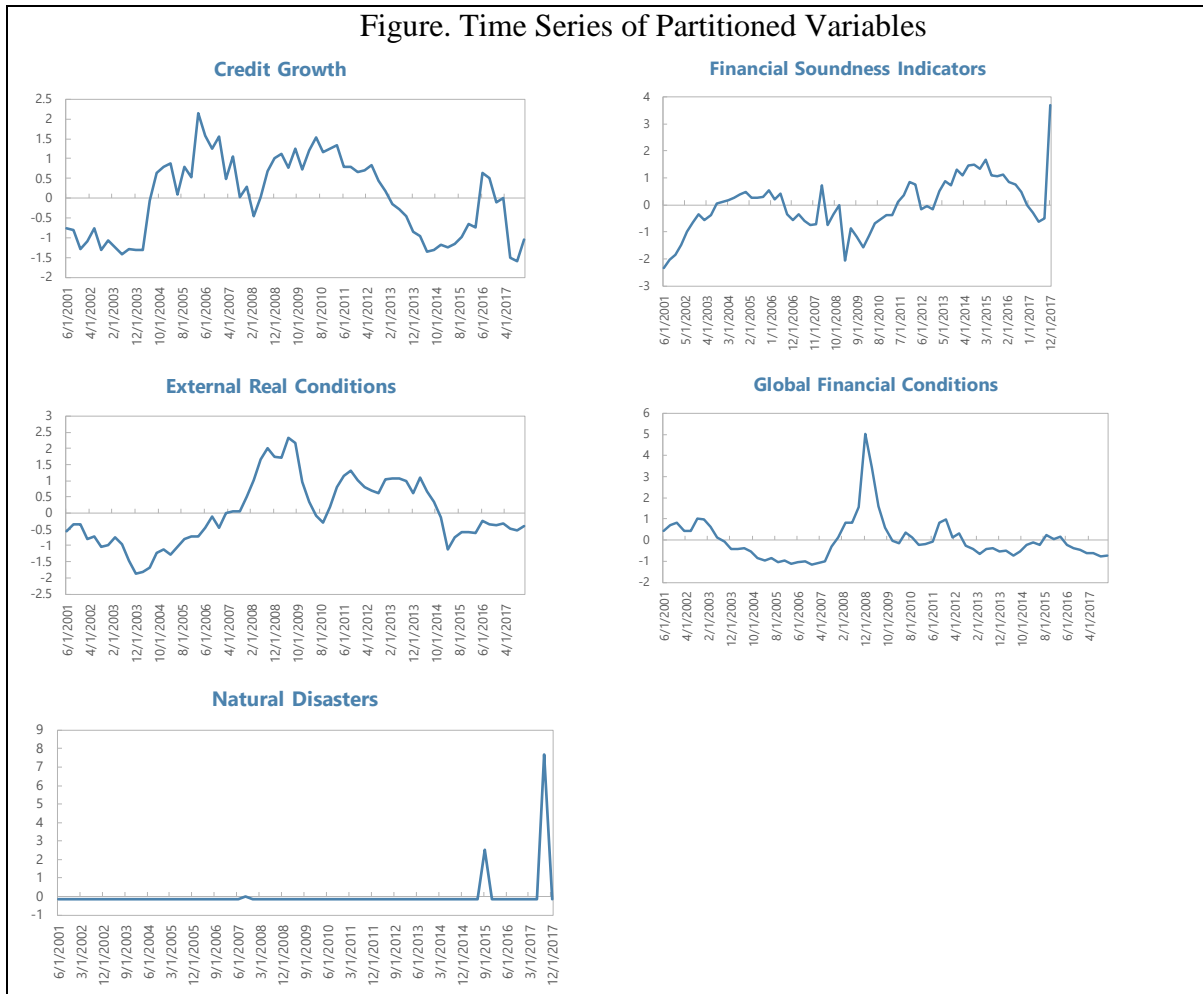Figure. 1-year Ahead Quantile Regression Coefficients

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.
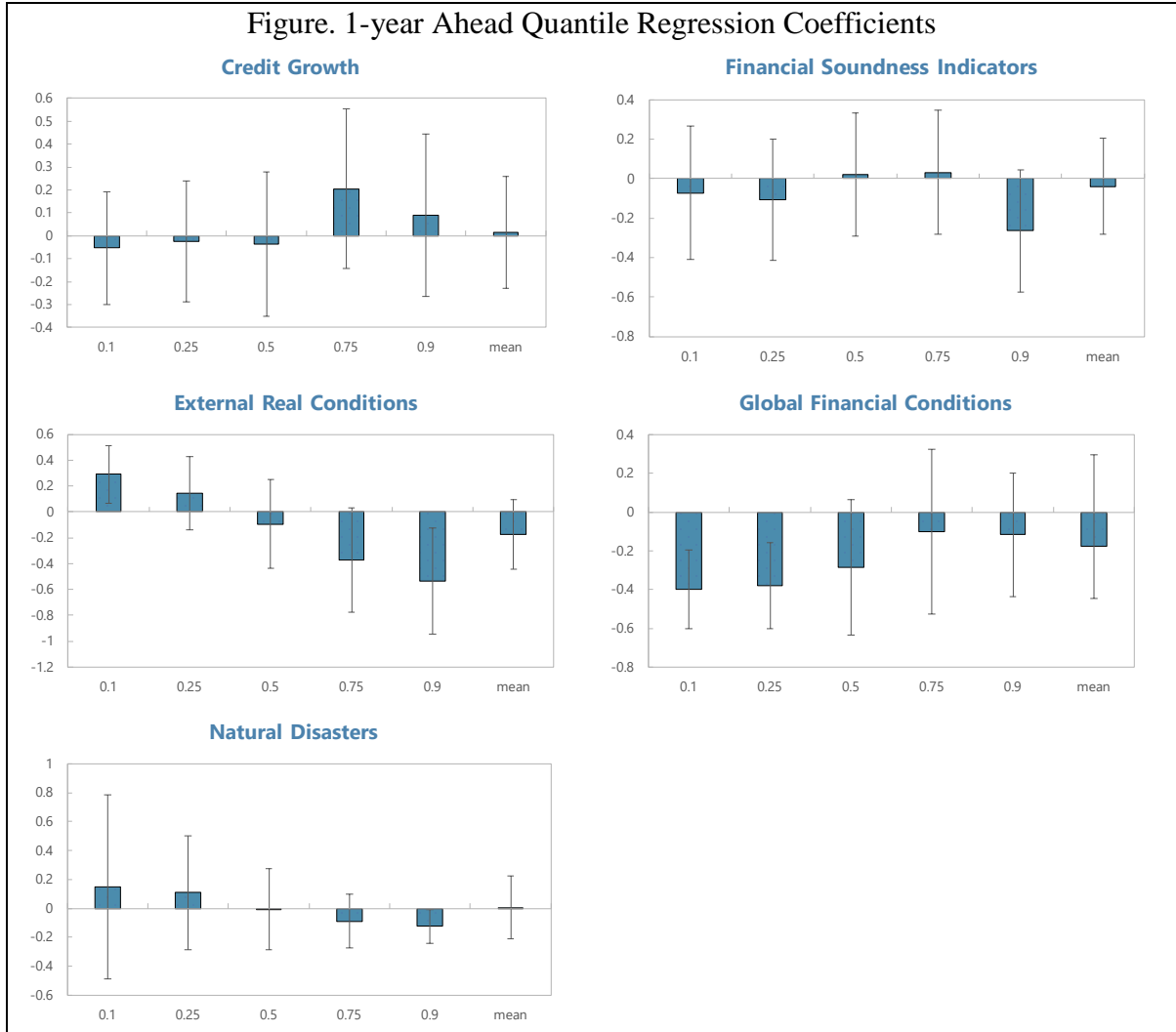
Figure. 3-year Ahead Quantile Regression Coefficients

Credit Growth

Financial Soundness Indicators

External Real Conditions

Global Financial Conditions

Natural Disasters

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

Figure. Historical 1-year Ahead Growth at Risk and Realized Growth

Note: The figure plots the Growth at Risk at 5 percentile, 50 percentile, and 95 percentile, along with the realized growth.

Dominica[6]

Figure. Time Series of Partitioned Variables

Credit Growth

Financial Soundness Indicators

External Real Conditions

Global Financial Conditions

Natural Disasters

Figure. Correlation between Selected Paritions and their Components

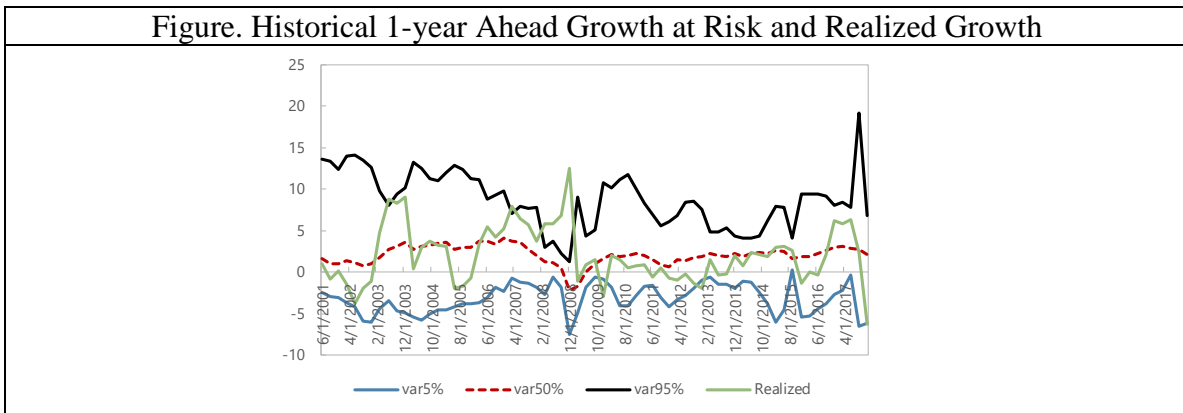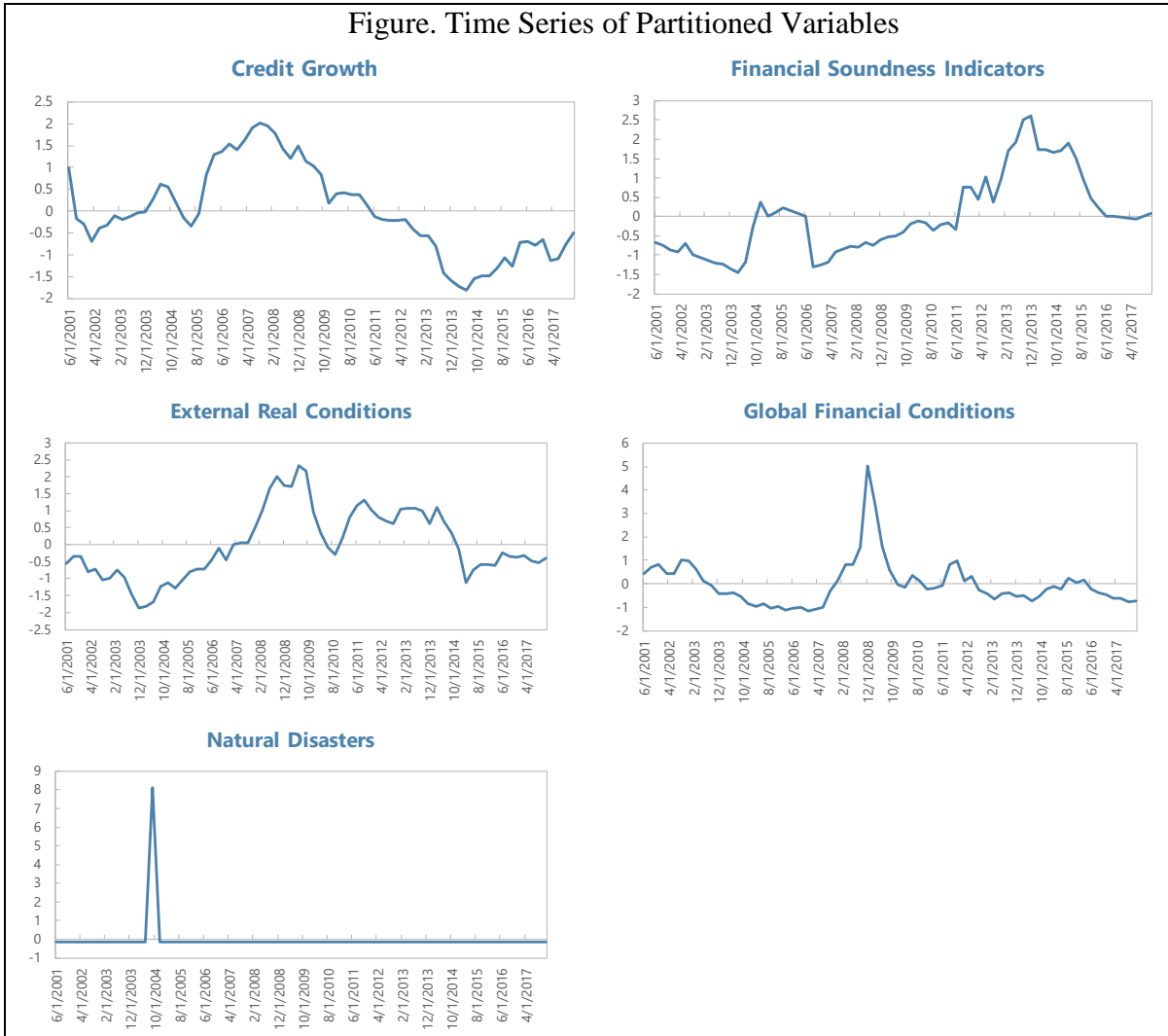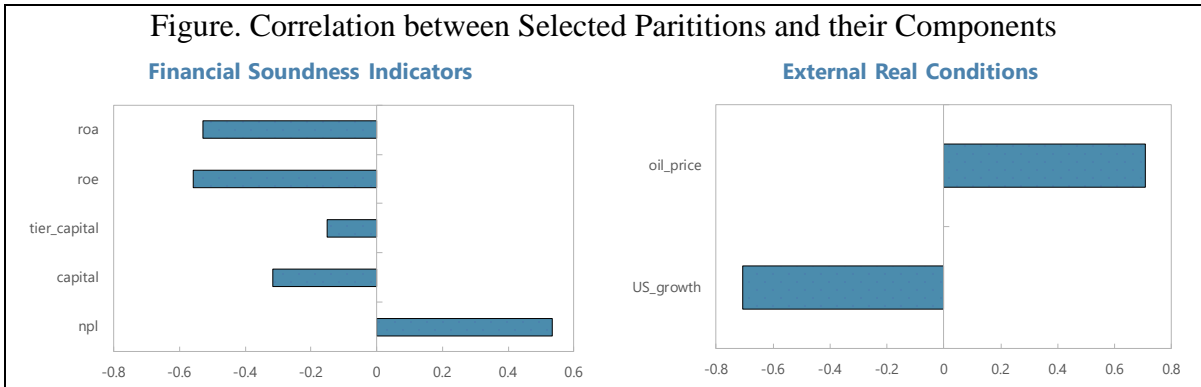Financial Soundness Indicators

External Real Conditions

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[6] Capital ratios are excluded from FSI given their unavailability prior to 2005, to secure the same length of time series as other countries.

Figure. 1-year Ahead Quantile Regression Coefficients

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

Figure. 3-year Ahead Quantile Regression Coefficients

Credit Growth

Financial Soundness Indicators

External Real Conditions

Global Financial Conditions

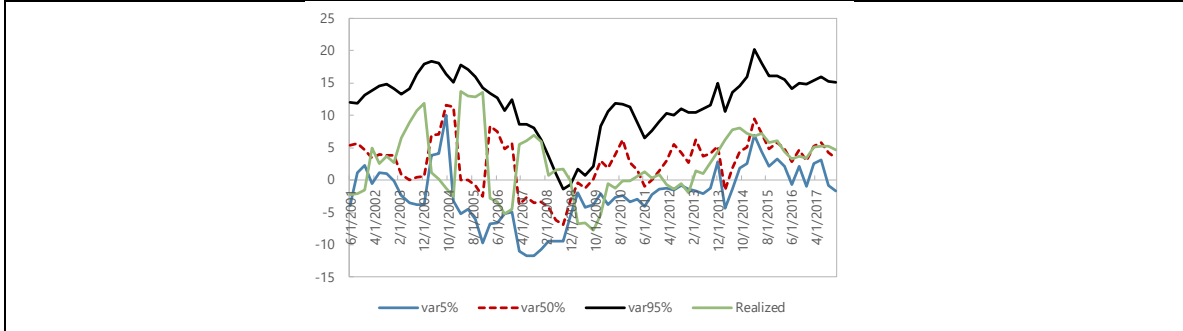### Natural Disasters

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.
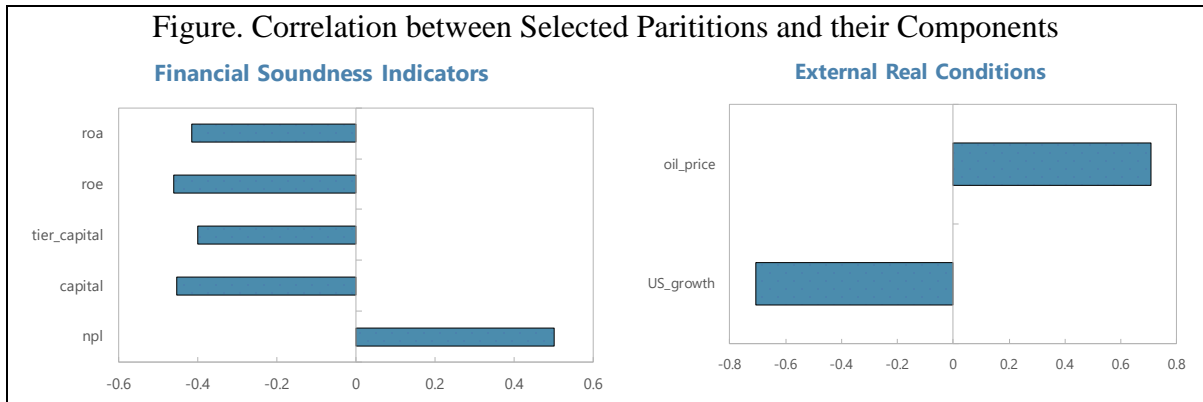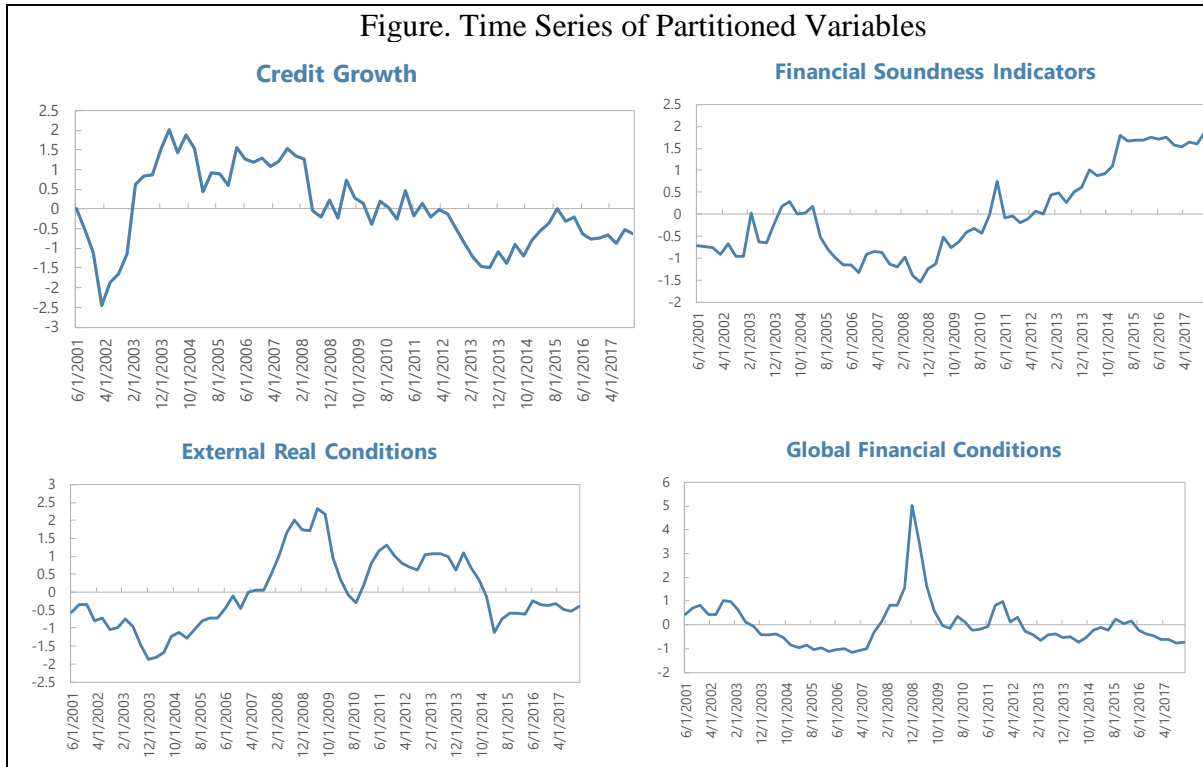
Figure. Historical 1-year Ahead Growth at Risk and Realized Growth

Note: The figure plots the Growth at Risk at 5 percentile, 50 percentile, and 95 percentile, along with the realized growth.

Grenada

Figure. Time Series of Partitioned Variables

Figure. Correlation between Selected Paritions and their Components

Figure. 1-year Ahead Quantile Regression Coefficients

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

Figure. 3-year Ahead Quantile Regression Coefficients

Credit Growth

Financial Soundness Indicators

External Real Conditions

Global Financial Conditions

Natural Disasters

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

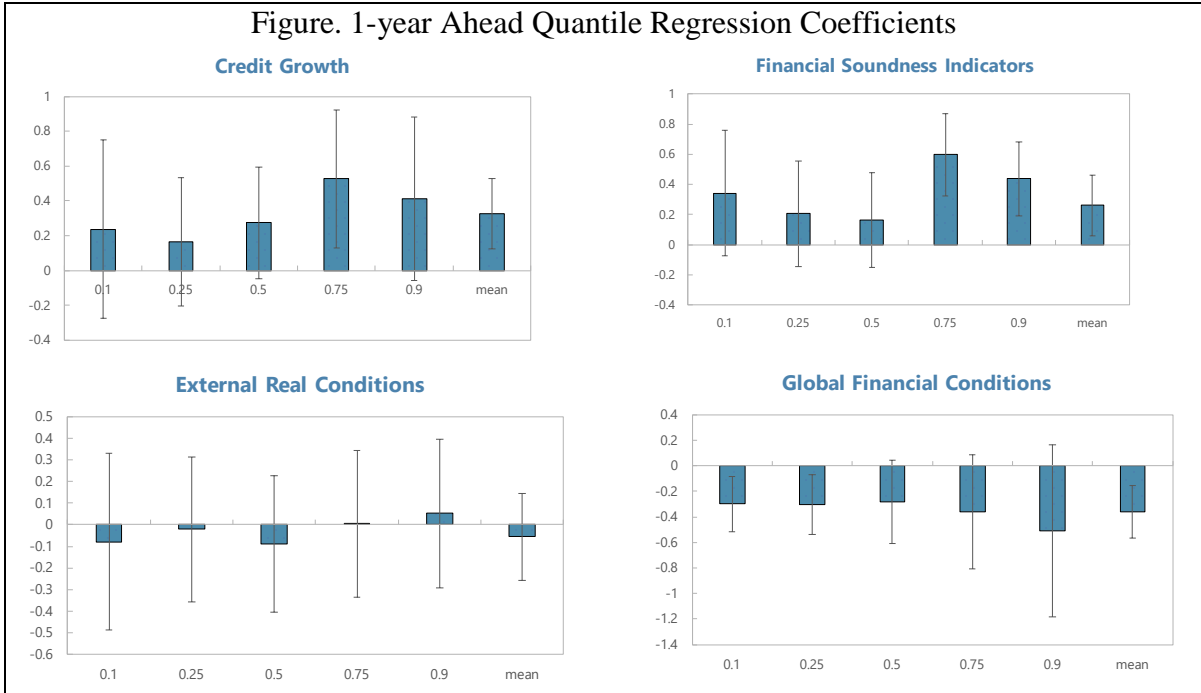## Figure. Historical 1-year Ahead Growth at Risk and Realized Growth

Note: The figure plots the Growth at Risk at 5 percentile, 50 percentile, and 95 percentile, along with the realized growth.
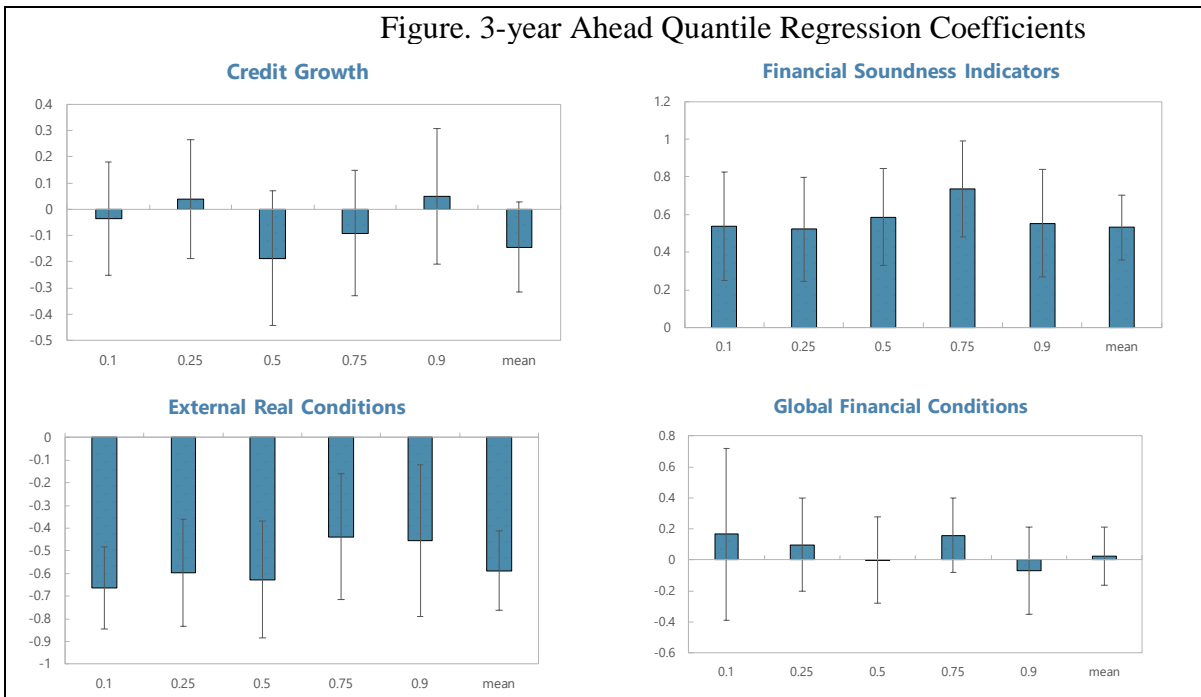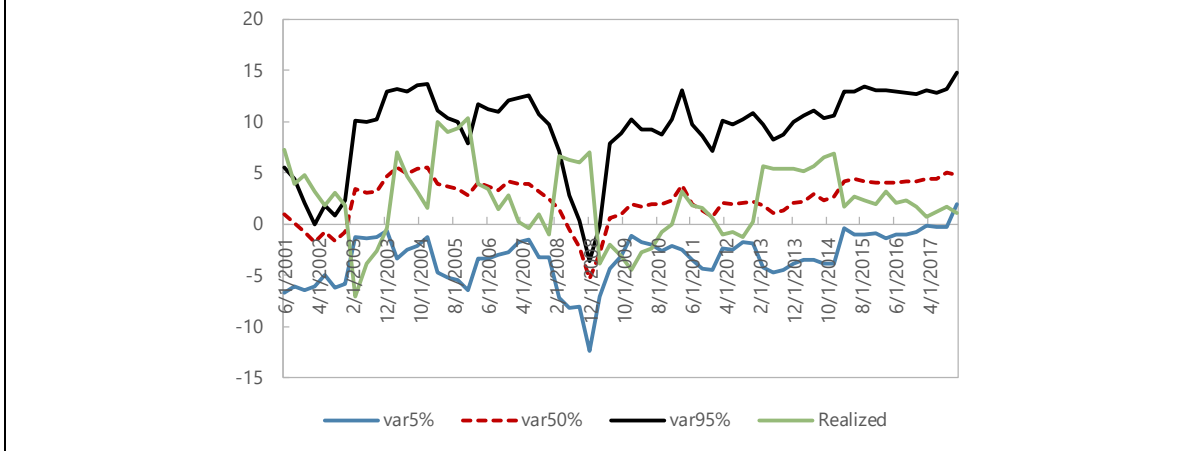
St. Kitts and Nevis[7]

Figure. Time Series of Partitioned Variables

Figure. Correlation between Selected Paritions and their Components

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[7] Natural disaster dimension is not considered because there are no recorded natural disasters in EM-DAT between 2001-17 in St. Kitts and Nevis.

Figure. 1-year Ahead Quantile Regression Coefficients

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

Figure. 3-year Ahead Quantile Regression Coefficients

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.
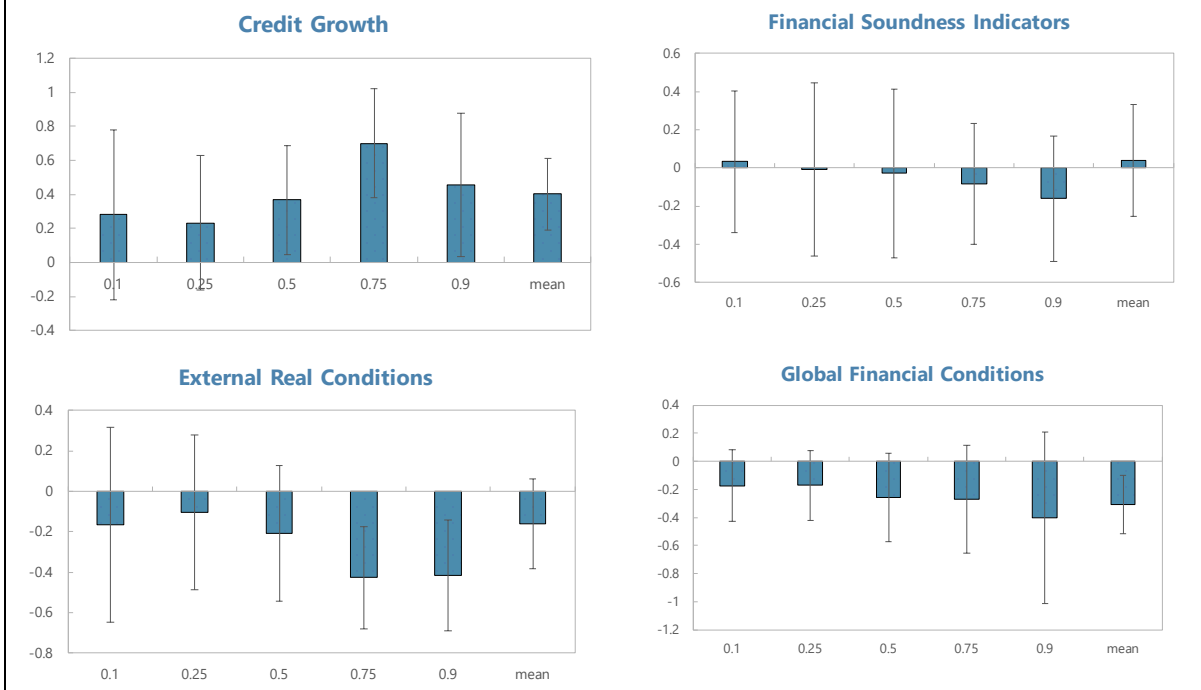
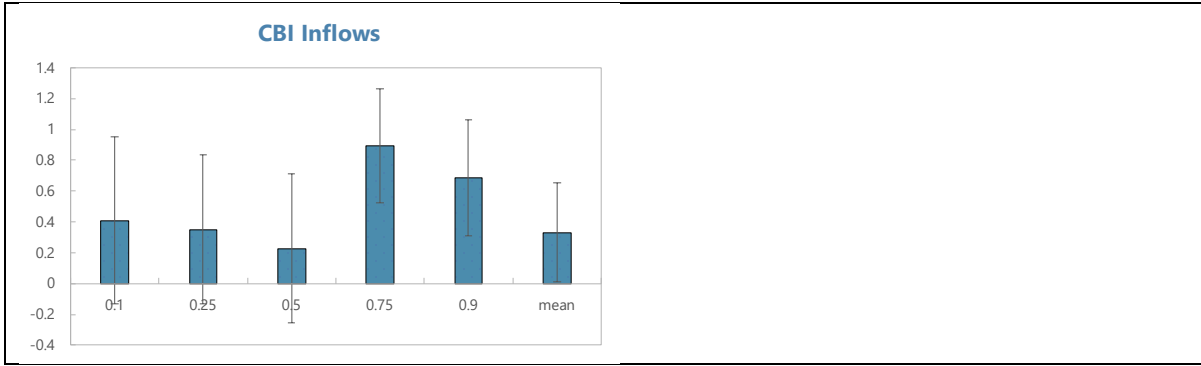## Figure. Historical 1-year Ahead Growth at Risk and Realized Growth

Note: The figure plots the Growth at Risk at 5 percentile, 50 percentile, and 95 percentile, along with the realized growth.
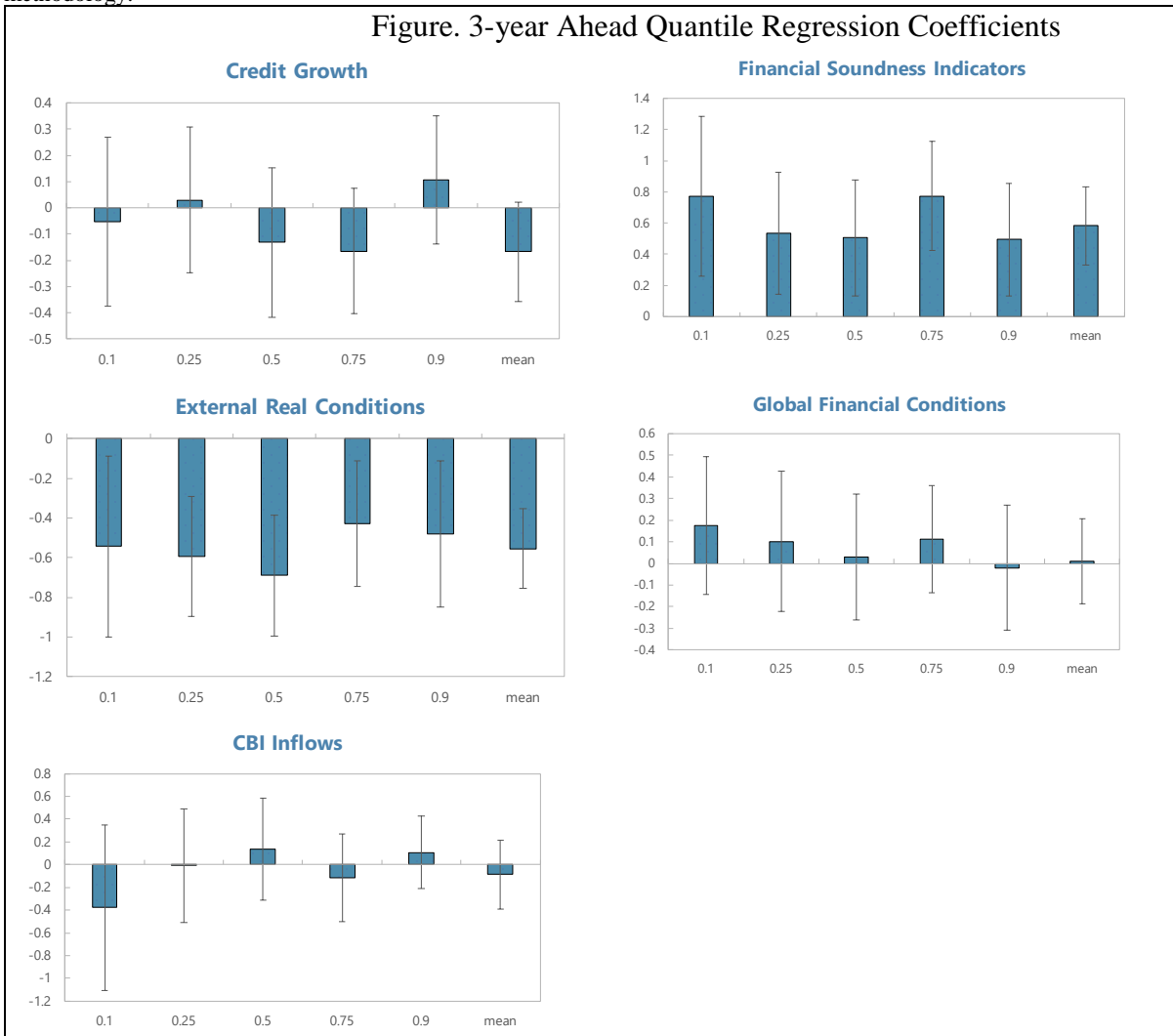
St. Kitts and Nevis, with CBI revenue as additional growth predictor

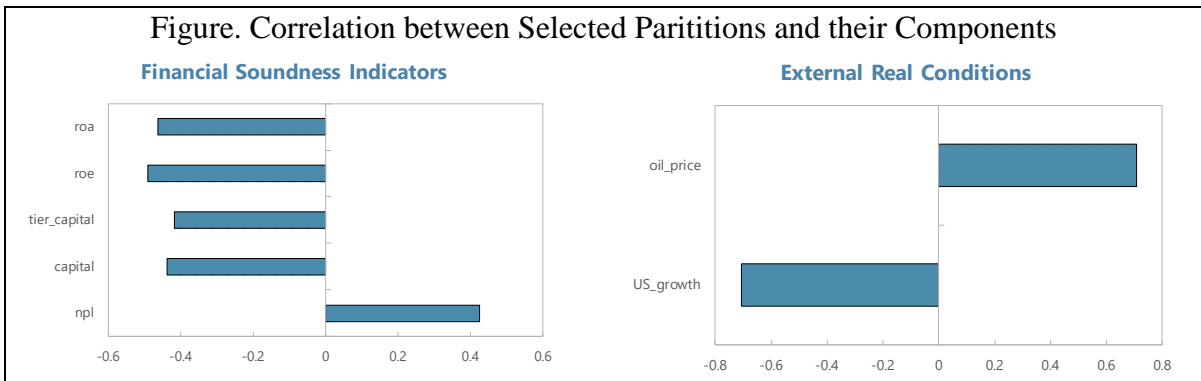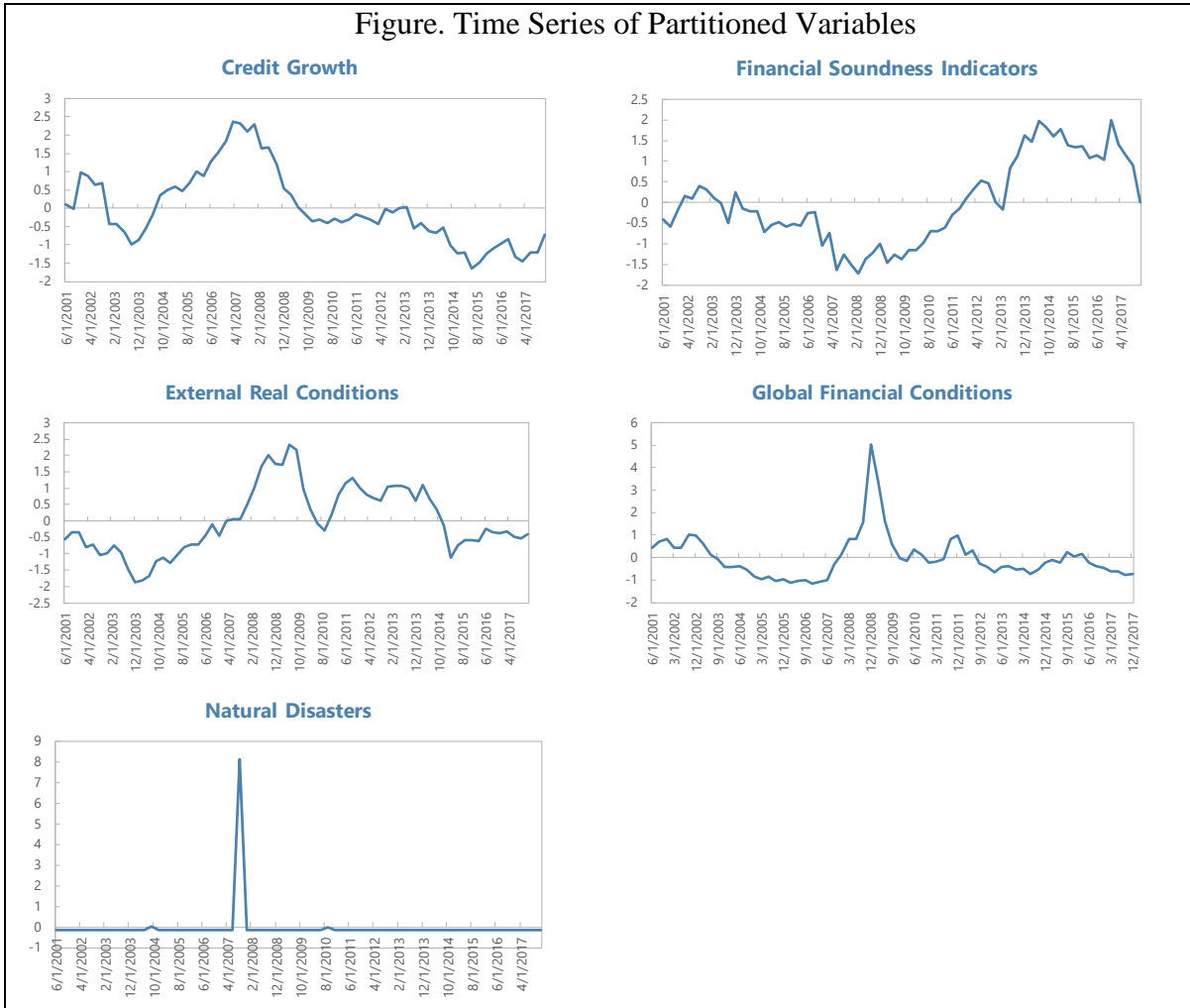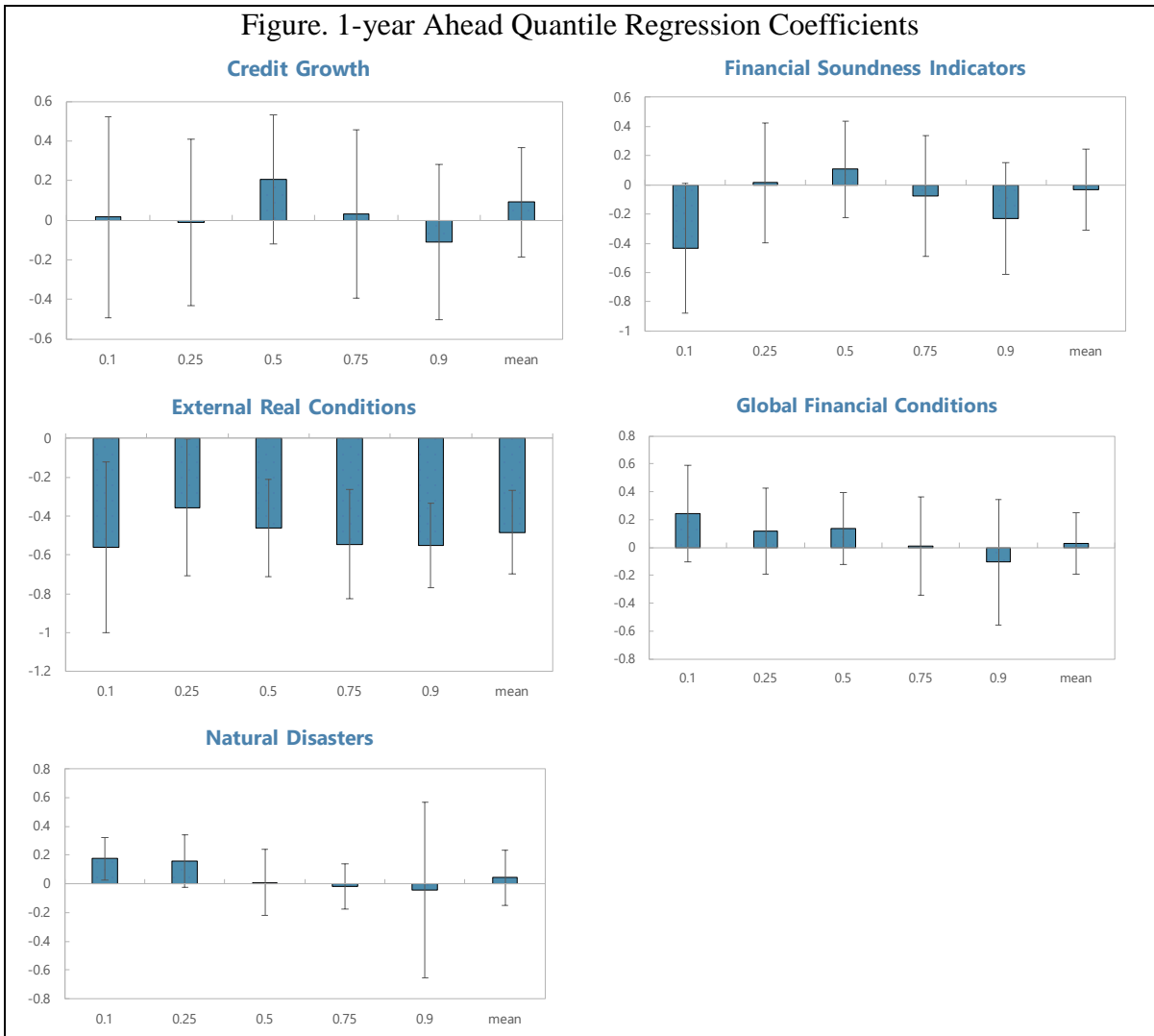## Figure. 1-year Ahead Quantile Regression Coefficients

CBI Inflows

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

Figure. 3-year Ahead Quantile Regression Coefficients

Credit Growth

Financial Soundness Indicators

External Real Conditions
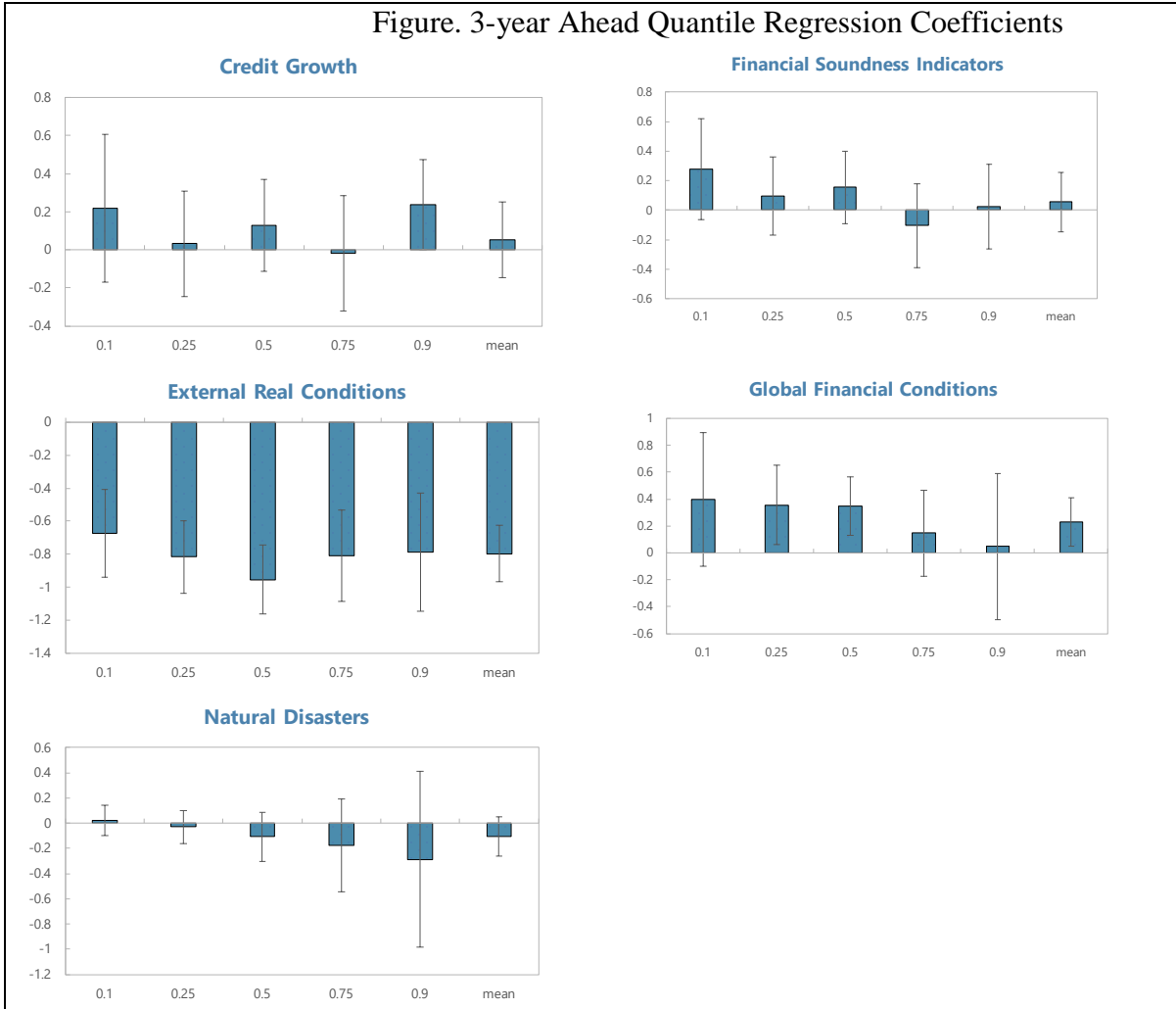
Global Financial Conditions

CBI Inflows

Note: The columns are regression coefficients that represents a percentage point change in the 12 quarters ahead real GDP growth forecast associated with a one standard deviation increase in bank credit growth rate, at different quantiles (for quantiles regression) and by OLS estimation. Real GDP growth is measured in annualized quarterly compounded growth rate. The error bars represent 10 percent confidence intervals. See IMF WP/19/36 for further description of empirical methodology.

St. Lucia

Figure. Time Series of Partitioned Variables

Figure. Correlation between Selected Paritions and their Components

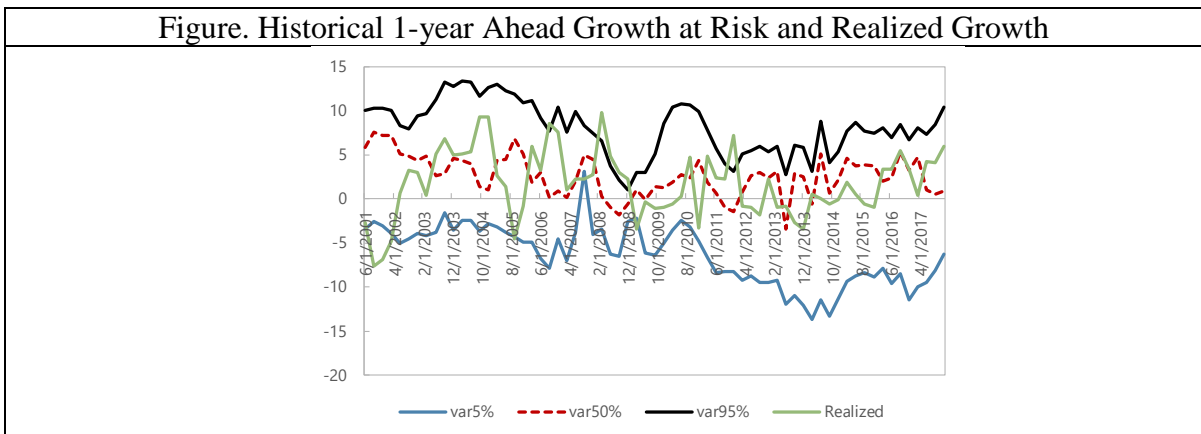Figure. 1-year Ahead Quantile Regression Coefficients

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Figure. Historical 1-year Ahead Growth at Risk and Realized Growth

Note: The figure plots the Growth at Risk at 5 percentile, 50 percentile, and 95 percentile, along with the realized growth.

St. Vincent and the Grenadines

Figure. Time Series of Partitioned Variables

Credit Growth

Financial Soundness Indicators

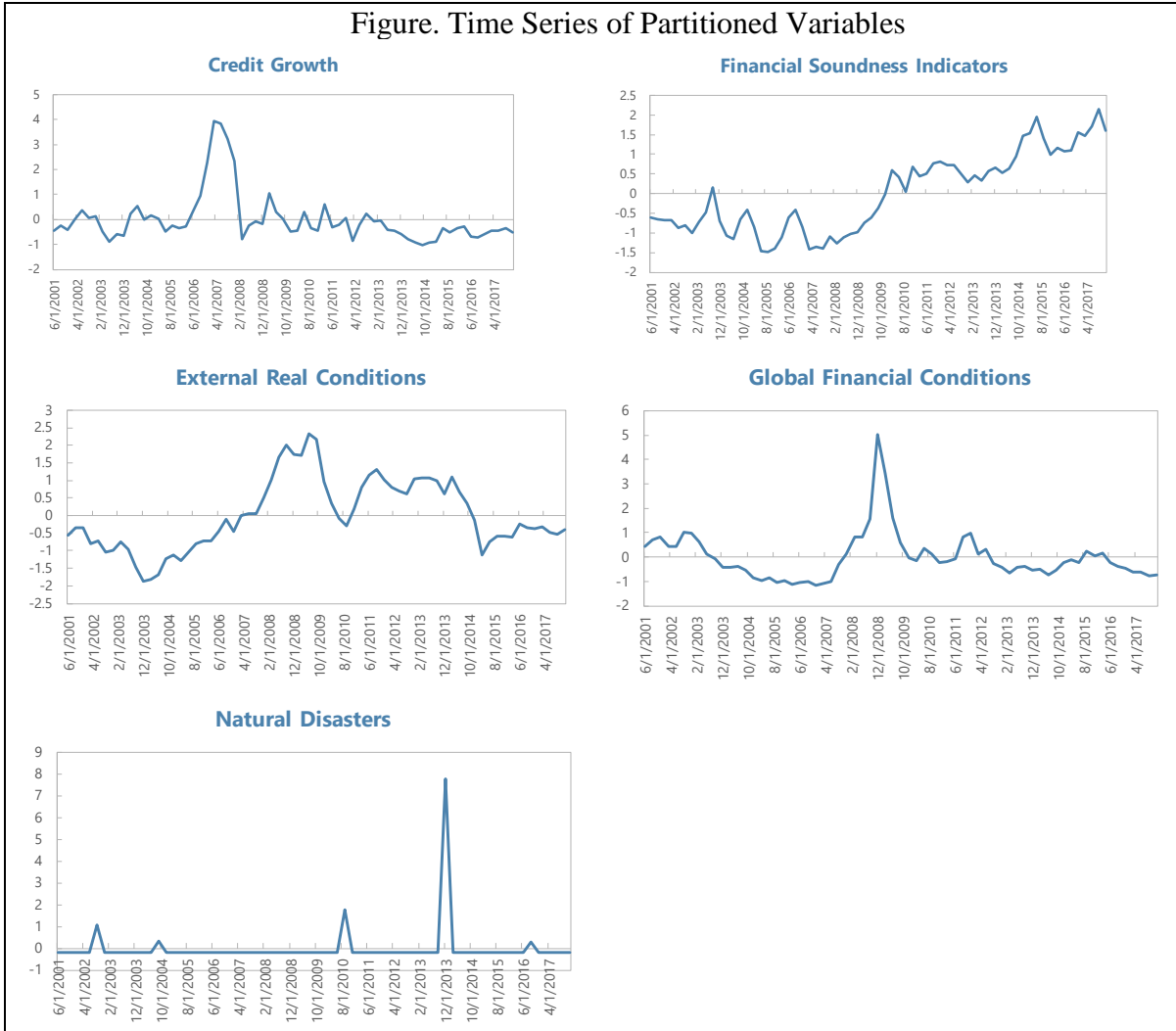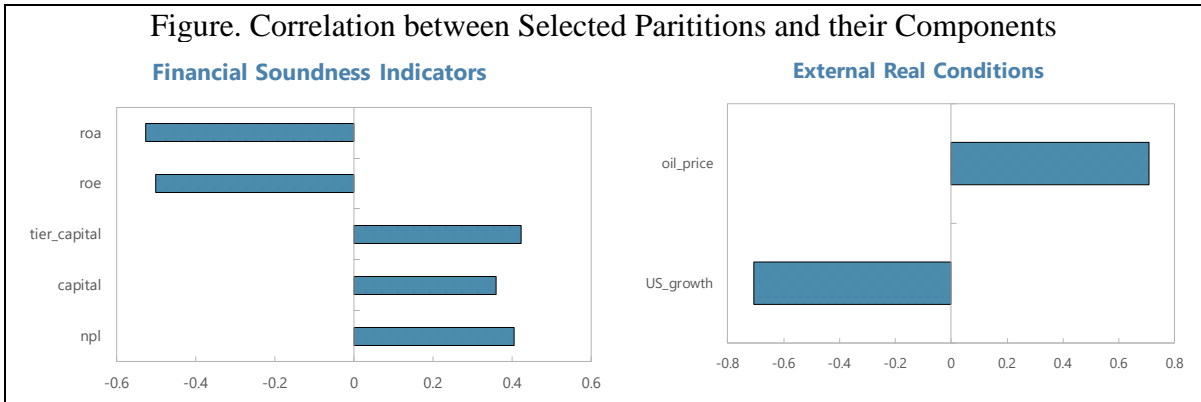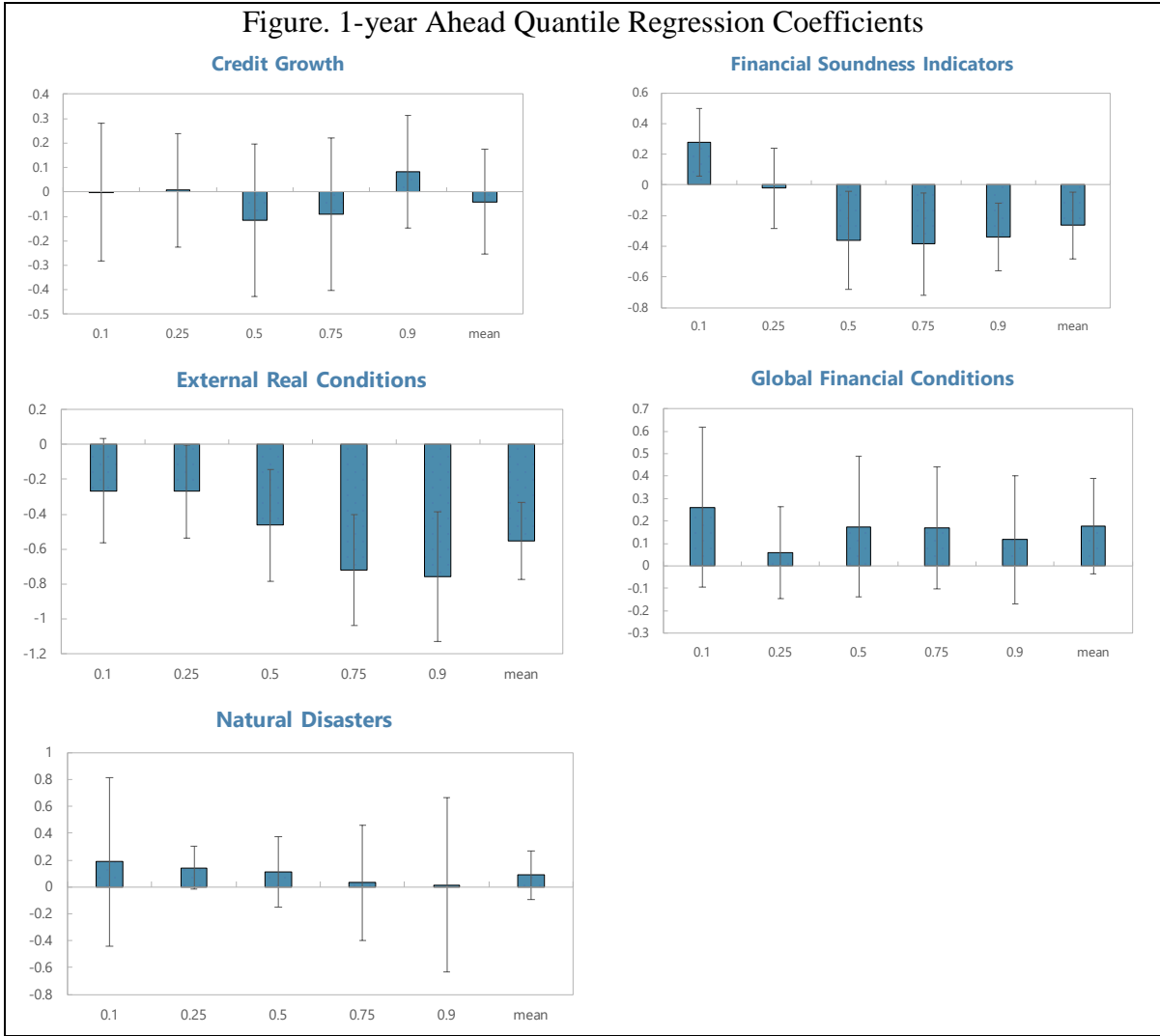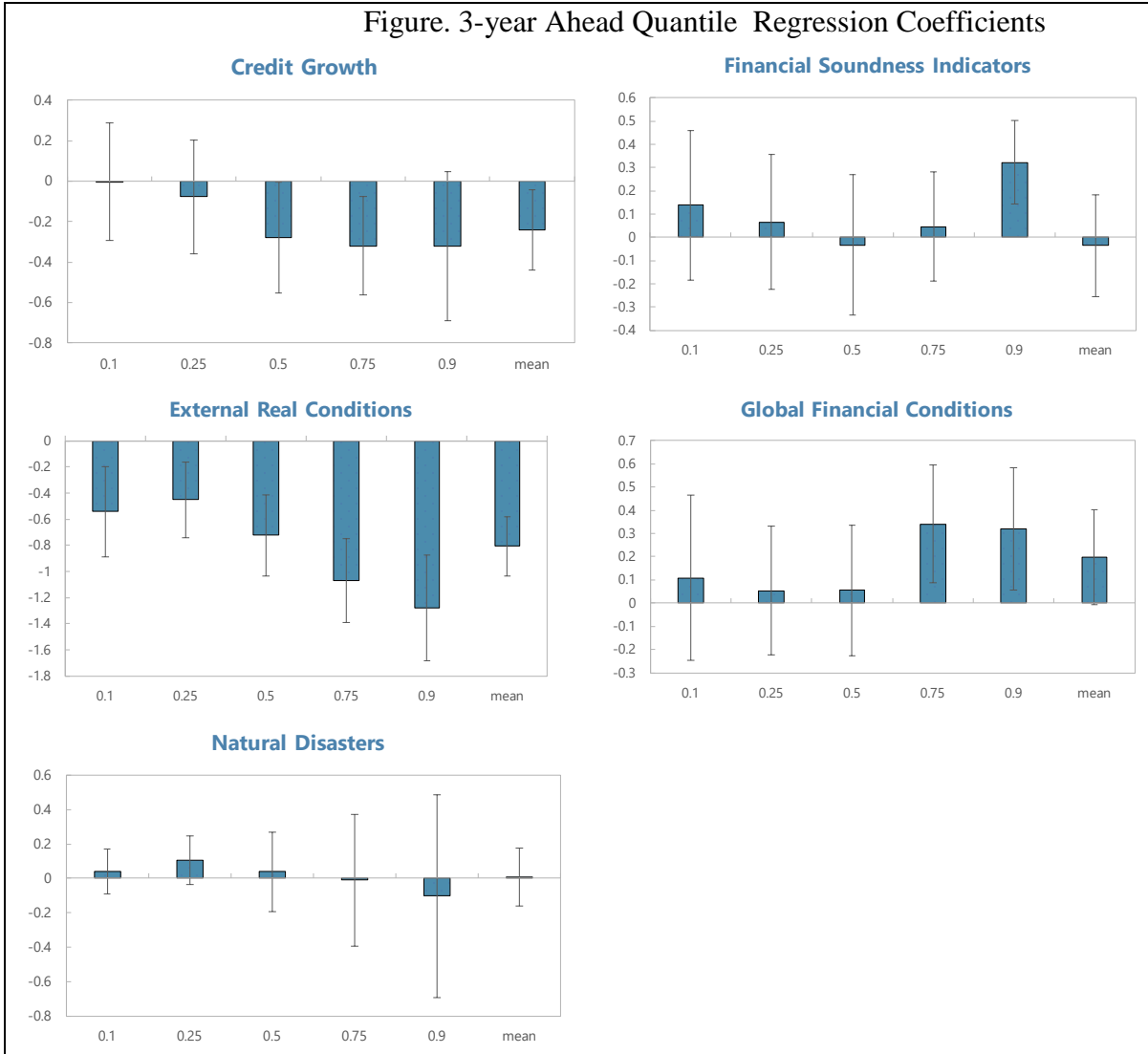External Real Conditions

Global Financial Conditions

Natural Disasters

Figure. Correlation between Selected Paritions and their Components

Financial Soundness Indicators

roa
roe
tier_capital
capital
npl

External Real Conditions

oil_price
US_growth

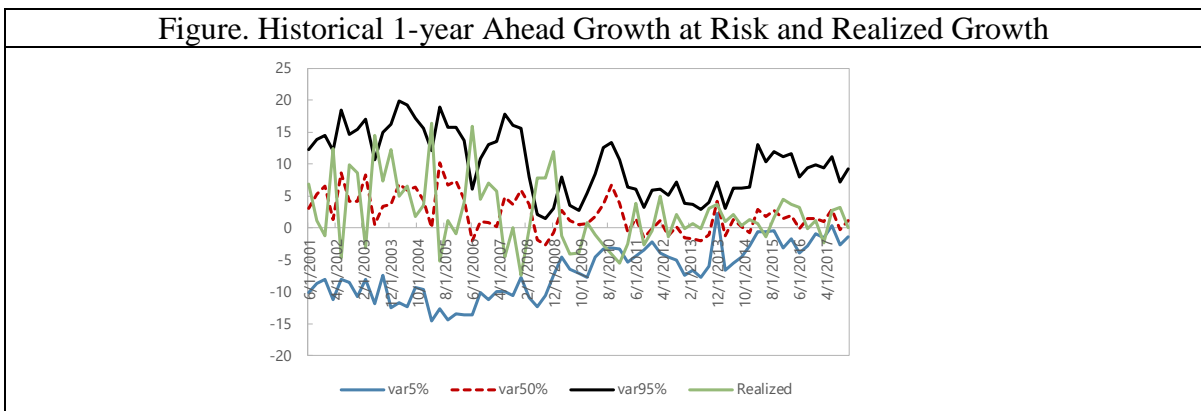Figure. 1-year Ahead Quantile Regression Coefficients

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Credit Growth

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External Real Conditions

Global Financial Conditions

Natural Disasters

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