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Estimating the Impact of External Shocks on the ECCU: Application to the COVID-19 Shock

by Vivian Parlak, Gonzalo Salinas and Mauricio Vargas

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Estimating the Impact of External Shocks on the ECCU:

Application to the COVID Shock

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Authorized for distribution by Sònia Muñoz

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Abstract

We measure the impact of frequent exogeneous shocks on small ECCU economies, including changes to global economic activity, tourism flows, oil prices, passport sales, FDI, and natural disasters. Using Canonical-Correlation Analysis (CCA) and dynamic panel regression analysis we find significant effects of most of these shocks on output, while only fluctuations in oil prices have significant effects on inflation. Results also suggest a significant impact of FDI and passport sales on the external balance, a link that CCA identifies as the strongest among all analyzed relations. The model also shows how Covid-19 related shocks lead to substantial contractions in output in all ECCU countries and deterioration of the current account balance in most of them, depending on countries' tourism dependency.

JEL Classification Numbers: C33, C38, F43, F47

Keywords: Forecasting, ECCU, COVID-19, Growth, Panel-Data.

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I. INTRODUCTION

Volatility is the name of the game in small economies such as the ECCU (see Easterly and Kraay, 1999). Therefore, understanding the dynamics of those economies requires understanding the impact of the shocks that frequently shake them. The COVID-19 crisis has exceptionally shown how direct and indirect shocks from the pandemic strongly hit economic activity in these tourism-dependent countries. Those shocks are not only a concern for the immediate disruption they trigger, but also for the impact of volatility on long-term output growth (see for example, Ramey and Ramey, 2005; Hnatkovska and Loayza, 2003; Haddad and others 2012). Despite the central relevance of external shocks to ECCU economies, there is a rather limited quantitative understanding of their impact. Estimating the sensitivity of main macroeconomic variables to the most significant and frequent shocks to these countries is far from an academic endeavor, as it is crucial for the management of macroeconomic policies.

This paper aims to understand the economic impact of major external and exogeneous shocks to ECCU economies, including foreign direct investment and passport (Citizen-by-Investment programs) sales that have not been analyzed before. Using Canonical-Correlation Analysis (CCA) and dynamic panel regression analysis (panel VAR-X) we quantify the impact of these shocks on main macroeconomic variables. We find economically and statistically significant effects of all these shocks on output, while only fluctuations in oil prices have significant effects on the overall consumer price index. Results also suggest a significant impact of FDI and passport sales on the external balance, a link that CCA identifies as the strongest among all analyzed relations. Point estimates and a slightly modified specification that aims to isolate the tourism sector's effect on economic activity are then used to project the impact of the ongoing COVID-19 shock through expected transmission channels. A Covid-19 related combined shock to tourism arrivals, the global economy, oil prices, and FDI inflows is projected to lead to substantial contractions in output depending on the economic contribution of tourism, as well as to deteriorations in the current account balance in most countries.

The paper first discusses, in Section II, the literature on the impact of external shocks on ECCU and other small state economies, noting the absence of a comprehensive quantification of all shocks on the main macro variables affected. After describing, in Section III, the evolution of headline macroeconomic statistics in ECCU countries following several positive and negative external shocks, Section IV describes our statistical approach to estimate the economic impact of exogenous shocks, the data employed, and the main elements of the CCA and dynamic panel regression analysis. Section V presents the results of our CCA model, which helps determine the strength of correlation among the several variables studied and describes the econometric estimates of the impact of changes in exogenous variables on the headline macroeconomic variables mentioned above. Section VI develops an alternative model, specially tailored to capture the COVID-19 shock, and finally, Section VII presents conclusions and policy implications.

II. BACKGROUND AND LITERATURE REVIEW

Several exogenous factors generate higher volatility in small states than in larger ones. With a limited-by-size production capacity, small states rely on international trade to a larger extent than larger countries. This external dependence makes them particularly subject to external shocks. Economic activity is mainly granular in these countries, and single events like an FDI construction project or the hosting of an international event can have a systemic impact. Moreover, most small states are affected by particularly frequent and devastating natural disasters.

The small population and arable land of ECCU countries narrow their ability to produce much of the varied set of items that are commonly part of modern production and consumption baskets. These elements make them particularly subject to import price volatility, including the volatility generated by fluctuations in its real effective exchange rate. Unlike the case in some other small states, territorial areas of ECCU countries do not contain fossil fuel underneath and their energy supply is quite vulnerable to fluctuations in international prices of oil and gas.

With superlative natural assets, ECCU's production factors are largely devoted to tourism, a sector that can be particularly volatile due to high competition from other similarly well-endowed neighboring countries and economic fluctuations in source countries. Consequently, ECCU economies are sensitivity to the construction of large hotels and to revenues from passport sales, events that are much less consequential in larger countries. Furthermore, being located across the North Atlantic tropical cyclone paths, on top of seismic plates, and amidst volcanic ridges, ECCU economies are frequently affected by related natural disasters, which can occasionally be devastating[2].

Higher volatility of ECCU economies likely can also affect their long-term growth. Several cross-country studies have identified significant long-term harm from volatility on output growth. In a sample of 92 countries and a sub-sample composed of OECD countries, Ramey and Ramey (1995) estimated a negative correlation between output volatility and long-term growth, a relation that appeared stronger in regressions that included relevant controls. Hnatkovska and Loayza (2005) further found statistical evidence of causality from volatility to long-term growth, quantifying the impact as a 1.3 percentage point drop in real GDP growth from a one standard deviation rise in output volatility (higher than the half percentage point estimated in Ramey and Ramey, 1995). Interestingly, this paper also finds that this link is stronger in poorer countries and, as expected, in those less able to conduct counter-cyclical policies. Other studies have relatedly found adverse effects on long-term growth from volatility in other macroeconomic variables such as exchange rate volatility (Aghion and others, 2006), as well as from aid volatility (Tressel and Prati, 2006) and macroeconomic policy volatility (Fatás and Mihov, 2006).

The ECCU and other small states' intrinsic volatility has prompted extensive research to better understand the sources of their economic instability. Part of this research has

[2] A recent example of a devastating event was the passing of Hurricane Maria over Dominica, causing a real GDP contraction of near 10 percent and economic damage equivalent to 270 percent of its GDP.

concentrated on domestic factors, including on the impact of fiscal shocks on growth in the Caribbean (Narita, 2014) and in the ECCU (Gonzalez-Garcia and others, 2013), as well as on the economic impact of financial sector developments (examples in the ECCU include Beaton, Myrvoda and Thompson, 2016; and Komatsuzaki and Brito, 2019).

While domestic factors contribute to volatility in ECCU countries, external shocks are likely more prominent in these and other small countries, and several studies have focused on some of them. For instance, some studies have looked at the impact of oil price fluctuations on small state economies and all, expectedly, find a substantial impact. For Caribbean countries, McIntyre and others (2016) estimate that real oil price changes explain, on average, 7 percent of real GDP growth variation in the Caribbean.[3] The point estimate of the elasticity coefficient implies that a 10 percent increase in real oil prices reduces real GDP growth by about 0.5 percentage points over five years in tourism-intensive small states like the ECCU.[4] Roopnarine and others (2019) estimate the effect of oil price changes on oil-exporting Trinidad and Tobago finding an expected significant positive impact on its GDP, but this is not a good reference for oil-importing ECCU countries. Roach (2014) analyzes oil price shock effects on Jamaica and finds that increases in oil prices motivated by global aggregate demand have a positive effect on GDP, while those related to increases in precautionary holdings of oil or declines in oil supply have a negative effect on GDP. And for small states in the Pacific Ocean, Jayaraman and Choong (2009) find a negative relationship between oil price shocks and real GDP growth.

Other econometric studies have focused on estimating the impact of increases in international food prices on Caribbean countries, most of which are small states that substantially depend on food imports. For example, following a substantial rise in international food prices in the mid-2000s, CEPAL (2008) estimated the impact of such fluctuations on Caribbean economies, finding a significant impact on CPI inflation, the imports bill, the trade balance, poverty and indigence rates, as well as on equity.

Given their high import and export dependence, small states' economies are considerably affected by economic activity in their partner countries, as determined in several studies. For the ECCU, Sun and Samuel (2009) find that these economies are susceptible to both temporary and permanent movements in the U.S. economy. Interestingly, their statistical analysis does not identify a statistically strong impact from U.S. monetary policy, but it does find an important effect of tourist arrivals from that country.

Indeed, tourism activity appears to be a major shocker for the ECCU and other Caribbean economies. Through growth regressions, Thacker and others (2012) estimate that a 10 percent increase in tourist arrivals per capita to Caribbean countries raises their economic growth by about 0.2 percentage points. Browne and others (2009) similarly identify a

[3] They find considerable variation in this estimate across countries, ranging from 15 percent in Dominica to less than 1 percent in Guyana.

[4] This paper also finds that a 10 percent increase in oil prices could appreciate the REER by 2.8 percentage points over five years in tourism-intensive economies. In fixed exchange rate countries like the ECCU, this increase occurs through an increase in domestic prices.

significant impact on overall output from shocks to the Caribbean tourism industry, though finding that this impact tends to be temporary rather than permanent. Of course, long-lasting shocks to tourism, like the one that followed the Global Financial Crisis, bring about long-lasting effects.

For sure, the most economically devastating shocks to small states economies result from major natural disasters, and several studies estimate their economic impact. However, while the wealth impact is enormous, the output growth impact does not always appear to be severe partly because natural disasters are many times followed by a significant reconstruction-related economic rebound. Fomby and others (2013) provide clarity on this issue showing that while some moderate disasters might have small, sometimes positive impact on GDP growth, severe disasters of any type always have a negative growth impact. More recent literature has aimed to shed light on the output impact of natural disasters on specific subgroups of countries based on their geographical location as opposed to their income level (such as Acevedo, 2014, for Caribbean countries), and few have narrowed in ECCU countries (Cantelmo and others, 2019; Guerson, 2020).

There is a need to gauge the impact of shocks on other relevant macroeconomic variables of the ECCU beyond overall output, as well as estimating the impact from other relevant shocks not much studied (notably from FDI and passport sales). This could improve macroeconomic policy planning to better reduce the impact of volatility. This paper seeks to fill this gap.

III. Stylized Facts

A glance at the evolution of main macroeconomic variables following notable shock events is very instructive to set up our analysis. In this section, we describe how external shocks have impacted the ECCU economies in the past.

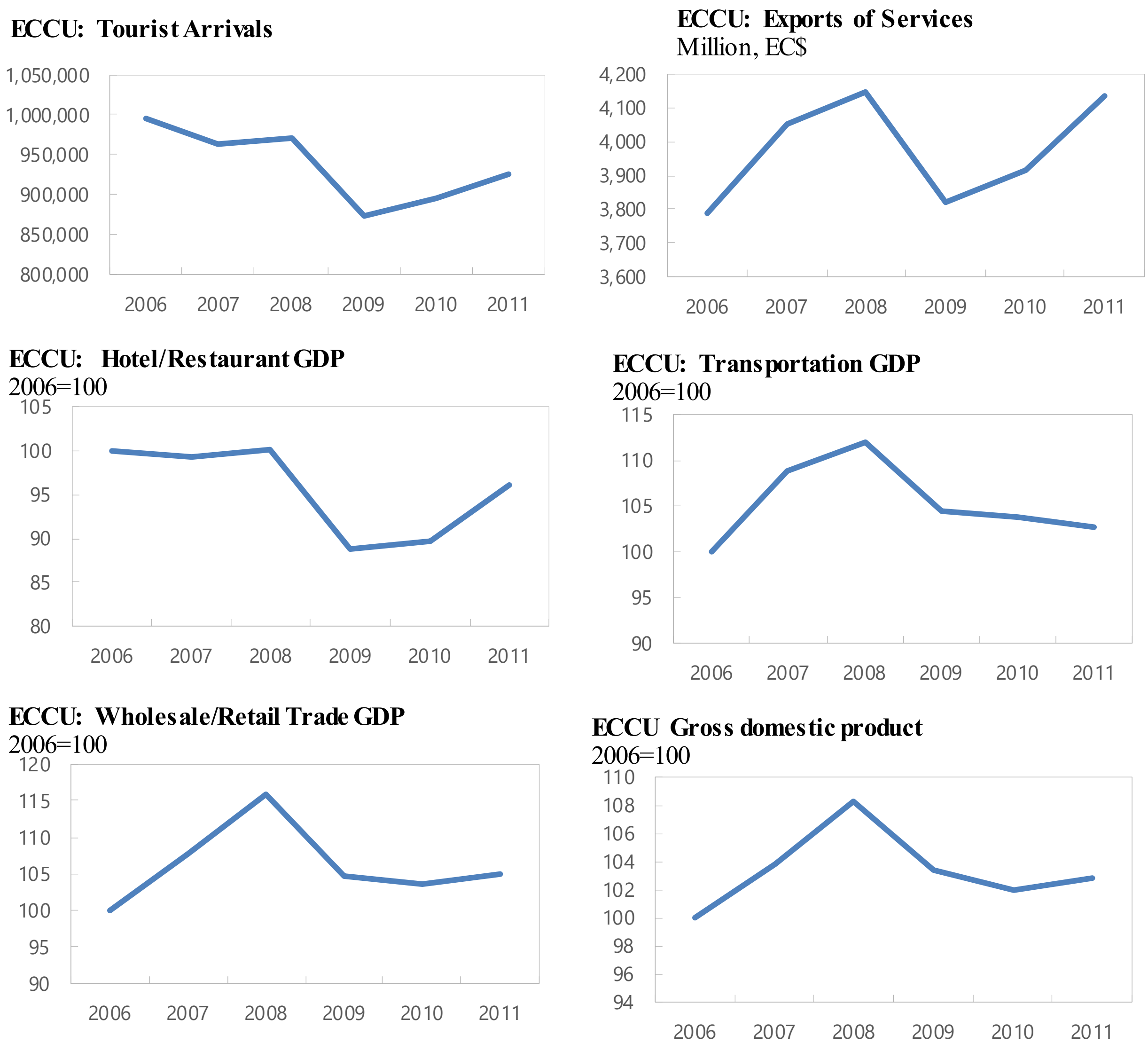
A. Global Economic Activity

Frequent large shocks to ECCU economies come from the United States business cycle, and as suggested in Sun and Samuel (2011) the single main channel of transmission is tourism. We can appreciate the working of this channel by analyzing the impact of one of the most significant shocks related to U.S. economic activity, the one resulting from the global financial crisis (GFC).

The GFC and its impact on the United States and global economic activity resulted in a severe decline in world tourism, including to ECCU countries, as seen in Figure 1. With tourism being the main export from these countries we can see a significant contraction in total Services Exports that lasted a few years. This external shock directly affected hotels and restaurants' real GDP, declining by more than ten percent between 2008 and 2009, and real GDP of transportation, contracting by about seven percent between those years. Tourism decline coupled with the global slowdown affected other economic sectors, notably wholesale and trade, which fell by about ten percent between 2008 and 2011. Overall real GDP contracted by about five percent between 2008 and 2011.

This shock on tourism was primarily motivated by an economic slowdown, pointing to the need to analyze the impact of output changes in source tourism countries. However, there are shocks such as the 9/11 attacks in the United States or the current COVID-19 shock that have an effect on tourism demand that is separate from the income-driven effect. Therefore, the statistical quantification of the impact of external shocks on ECCU countries need to distinguish between the economic slowdown in source tourism countries and changes in tourism demand driven by other factors.

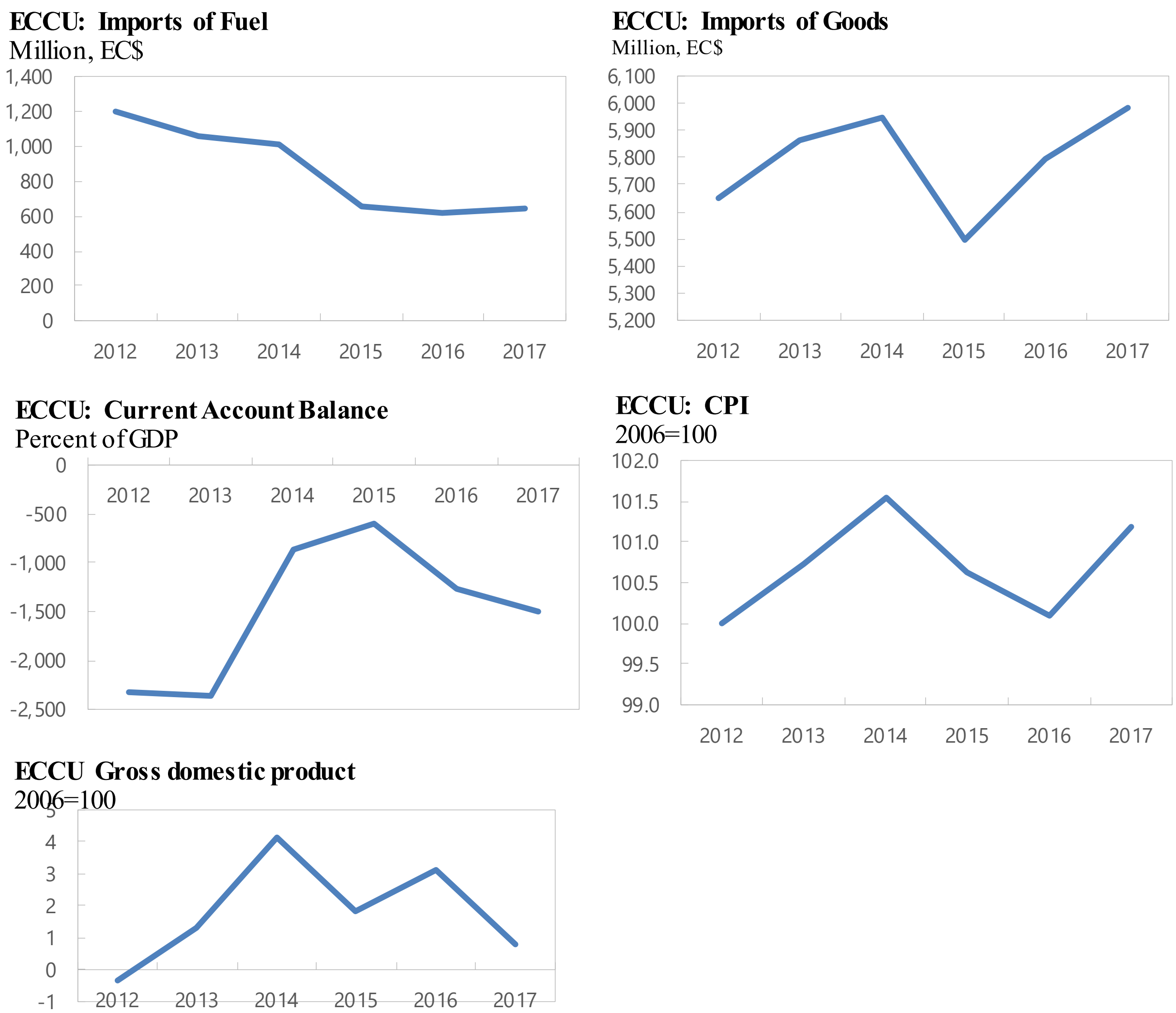
Figure 1. Impact of 2009 Tourism Shock



B. Oil Prices

Fluctuations in oil prices are another significant and common shock to these island countries and, like the tourism shock, tends to be correlated with the U.S. and world economic activity. For example, international oil prices grew significantly in the run-up to the GFC and likely negatively affected ECCU economies. Identifying this effect, which is not as strong as the effect through the tourism channel as we will see later, is complicated by the simultaneous positive effects of growing global demand. The 2014 large decline in oil prices, on the other hand, was a supply-driven shock that did not occur amidst a major change in world GDP growth and therefore allows to better appreciate the pure effect of oil price fluctuations on the ECCU. [5]

Figure 2. Impact of Oil Price Slump in 2014-15



In the context of relatively stable fuel demand from ECCU countries, the approximately fifty percent decline in international oil prices between 2014 and 2015 translated into a similarly large decline in the value of their fuel imports. This in turn contributed to a ten percent decline in ECCU total goods imports, reversing its previously growing trend in the aftermath of the GFC, resulting in a significant narrowing of ECCU current account balance. The large oil price decline also led to overall deflation in consumer prices in the ECCU. But despite the

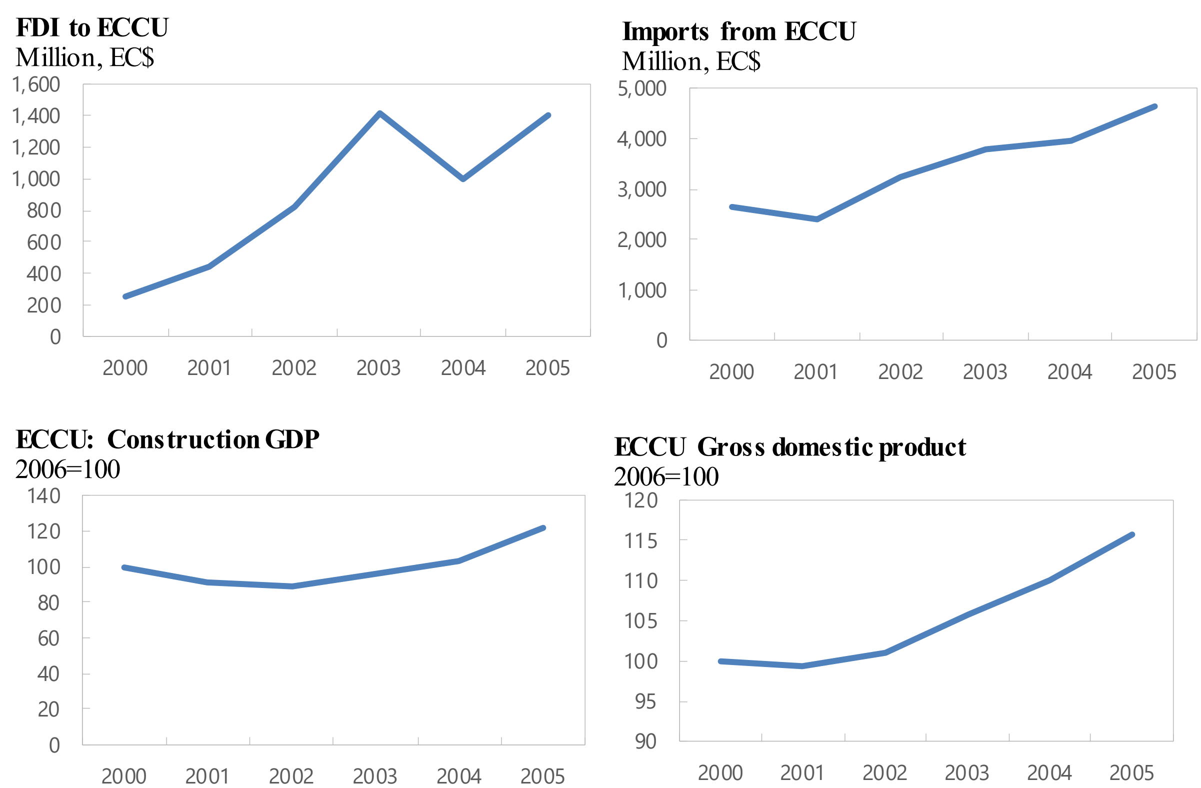
[5] The 2014 drop in crude petroleum prices was largely related to rapidly growing oil supply mainly from the United States, following advances in hydraulic fracturing and horizontal drilling technologies and shifting OPEC policies.

large magnitude of the decline and its likely accelerating effect on economic activity, ECCU real output decelerated in 2015 relative to 2014. Only through the econometric analysis in the following section we are able to identify the effect of oil price changes on output.

C. Foreign Direct Investment

Fluctuations in FDI have also an impact on ECCU economic activity and tend to be simultaneous to world demand and tourism swings. Surges in FDI, sometimes related to a handful of projects, can clearly accelerate these small economies. Hence, output growth projections in these countries are commonly mindful of the FDI outlook, including projects in the pipeline. One of the most significant upswings in FDI was experienced in the early 2000s when it shot up across the region from about EC$ 200 million in 2000 to EC$ 1,400 million in 2003. This higher than one billion increase in FDI contributed to an almost EC$ 2 billion increase in imports as investments in these countries have a very high imported component. As suggested by the below chart showing real construction GDP in the early 2000s, FDI is likely to have contributed to a more than twenty percent growth in this sector between 2002 and 2004. This partly contributed to an overall acceleration in economic activity in the first years of the 2000s. Nonetheless, there were likely other contributing factors related to the upswing in the global economy during those years.

Figure 3. Impact of FDI Windfall in Early 2000s



D. Natural Disasters

We can most dramatically appreciate the economic impact of natural disasters by observing the aftermath in Dominica of the 2015 Tropical Storm Erika and 2017 category 5 Hurricane Maria. While these two events substantially affected economic activity, the impact of Maria was, as expected, much stronger than that of Erika. Both disasters had a notable impact on critical sectors: agriculture, tourism, and transportation. However, while overall output considerably recovered in 2016, significantly due to reconstruction works, Maria's shock was not significantly reverted by 2018 despite significant reconstruction in that year.

The damage on agriculture and tourism from these events is also reflected in declines in exports of goods and services. Noteworthy, while service exports did recover the year after Erika despite no recovery in GDP of hotels and restaurants, goods exports did not recover despite a pick-up in Agriculture GDP, hinting that the recovery in agriculture was mainly related to production for local consumption. The recovery in service exports was reversed by Maria and continued to decline in 2018 as the destructed tourism infrastructure was not significantly restored within a year. As a result of these contractions in exports and increased imports needed for reconstruction, the current account balance vastly deteriorated, especially following Maria.

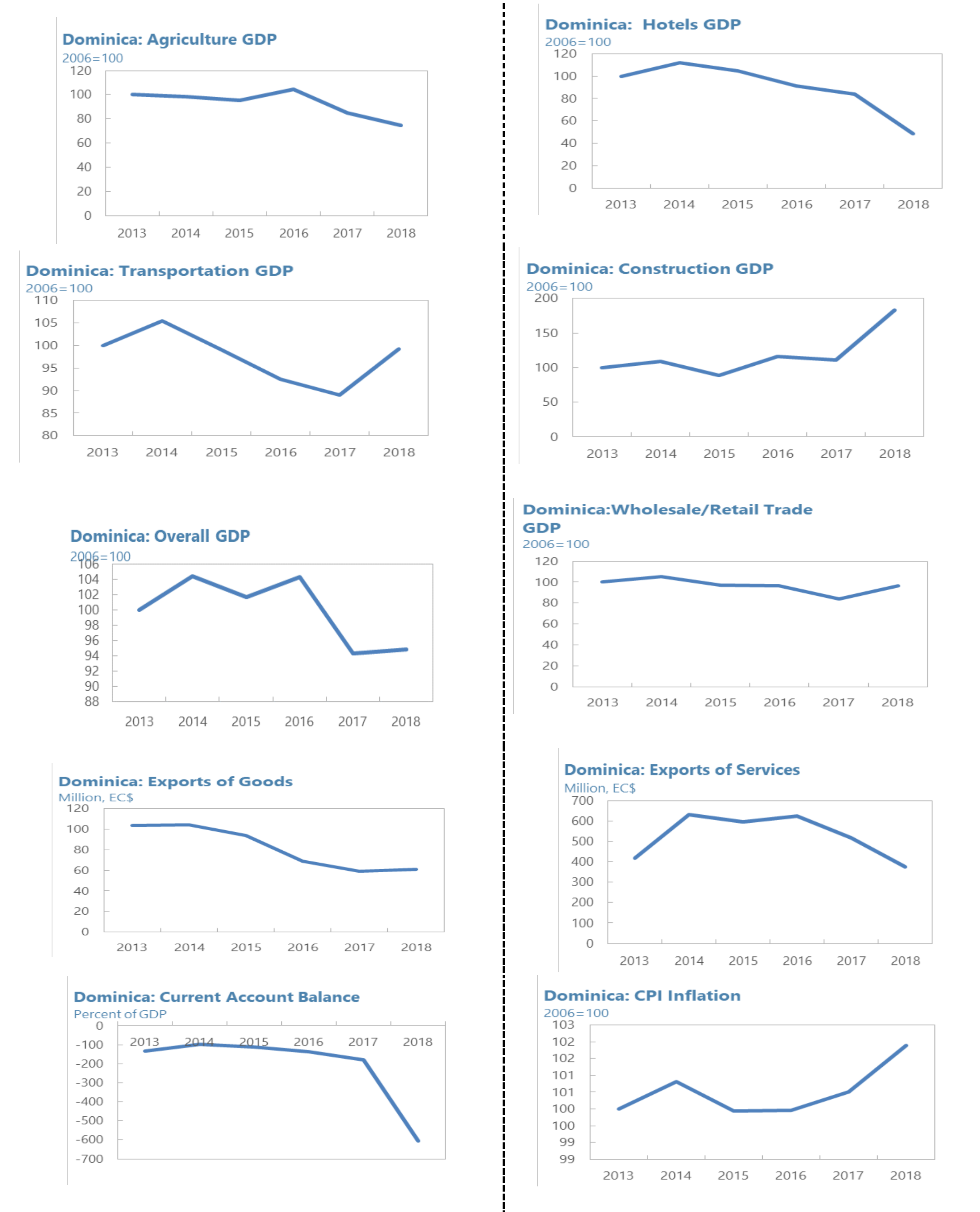
These events do not show a clear pattern on the evolution of consumer prices in the aftermath of disasters. Consumer prices considerably declined in 2015, but this was related more to the oil price slump than to local supply/demand. Despite the contraction in agriculture, overall food prices increased only moderately (by 0.7 percent) that year. Food prices did accelerate following Maria, with the food CPI growing by 6.1 percent, but its impact on the overall CPI was offset by a similarly large decline in international fuel prices.

E. Citizen-by-Investment programs

As Citizen-by-Investment (CBI) programs have become a major source of fiscal revenues and investment in some ECCU countries over the last decade, they also have become a principal source of economic volatility as demand for passports tends to fluctuate substantially[6]. The windfall of passport demand in St. Kitts and Nevis illustrates essential aspects of the economic impact of CBI flows. As CBI fees increased from about two percent of GDP in 2010 to twelve percent in 2013 there was a rapid increase in FDI and public investment, the former growing by approximately 70 percent between 2010-2012 and 2013. The boost in FDI brought a significant increase in imports of goods. Simultaneously, the net effect on the current account balance was influenced on the upside by CBI related exports of services and on the downside by the FDI-related increase in imports. Reserves accumulated in 2013-2014, although not notably more than in previous years as part of the increased foreign exchange inflows was spent in imported items. Reserves then declined since 2016 as CBI revenues declined.

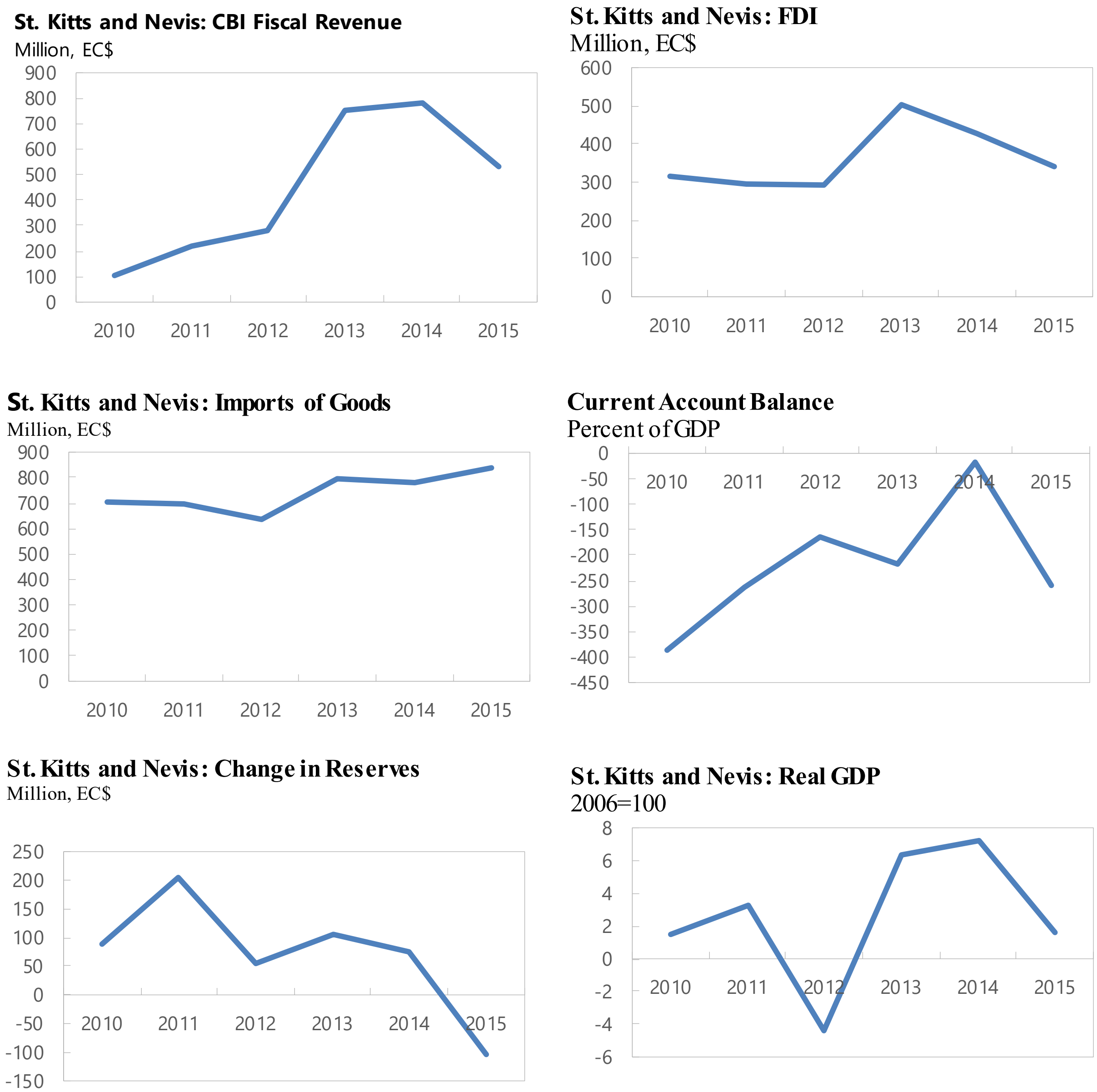
[6] CBI programs are government schemes that provide local citizenships/passports to individuals that make economic contributios to the country, commonly in the form of donations to the government or investment in real estate.

Figure 4. Impact of Storm Erika (2015) and Hurricane Maria (2017) in Dominica



The FDI injection and the increase in public investment accelerated real GDP growth from about to around 6 percent of GDP in 2013-2014, a rate considerably higher than in the previous five years in the aftermath of the GFC. Remarkably, the CBI-boosted real GDP growth in 2013-2014 was much higher than the average 3 percent annual growth experienced in 2000-2008, a period that also witnessed an upsurge in FDI although not linked to passport sales. Real output growth decelerated in the years after the 2013-14 CBI surge as these revenues declined down to about 6 percent of GDP in 2016-2017.

Figure 5. Impact of CBI Windfall in St. Kitts and Nevis



IV. Data and Methodology

A. Data

The econometric analysis is based on annual data covering the periods between 1980 and 2017 from the WEO-IMF database and additional sources. Table 1 provides the definition and sources of the variables included in our statistical analysis. We organized the variables in two groups: a) local or internal economic outcomes, and b) external shocks. Regarding national (internal) statistics, data availability in the ECCU countries is a common constraint for macroeconomic analysis, especially high frequency information. Most ECCU countries do not publish quarterly GDP data nor monthly economic activity indicators regularly. GDP-by-expenditure time series are not available, and existing GDP and external accounts (Balance of Payments) information is subject to delays and revisions, making comparisons with similar past studies less straightforward.

Table 1. Data Deninition and Sources

	Variable	Source
Internal	Real GDP of ECCU countries	WEO
	Price Level (WEO)	WEO
	Real Effective Exchange Rate (REER)	IMF
	Reserves as percent of GDP	WEO
	Current Account as percent of GDP	WB
External	Number of Tourist Arrivals	ECCB/CTO
	Real GDP of US/UK/CAN	WEO
	Oil Prices	WEO
	FDI inflows	WB
	Citizen by Investment Revenues	WEO
	Natural Disaster (Cost in percent of GDP)	EM-DAT and WEO

B. Methodology

We applied two complementary multivariate techniques. First, an exploratory approach using CCA, and second, an econometric estimation method: dynamic panel data regressions (panel VAR-X). The CCA analyses multiple-X multiple-Y correlations and is preferable to calculate the strength of association between two constructs because it creates an internal structure. For this study, X and Y groups represent external and internal variables, respectively.[7] A canonical correlation coefficient measures the strength of association between two canonical variates (CV). A CV is the weighted sum of the variables in the analysis. For multiple X and Y the canonical correlation analysis constructs two variates $CV_{X1} = a_1x_1 + a_2x_2 + a_3x_3 + \ldots + a_nx_n$ and $CV_{Y1} = b_1y_1 + b_2y_2 + b_3y_3 + \ldots + b_my_m$. The canonical weights $a_1 \ldots a_n$ and $b_1 \ldots b_n$ are chosen to maximize the correlation between the canonical variates CV_{X1} and CV_{Y1}. This step is repeated to generate additional duplets of canonical variates (orthogonal to the previous duplet) until the cut-off value = $min(n,m)$ is reached, in our case $m=n=5$.

[7] For CCA, all variables are included in their stationary expression (e.g. real GDP is included as growth rates, and not in levels).

CCA is a powerful tool to provide an initial exploratory statistical multivariate motivation for the econometric approach. First, it confirms the merit of the set variables included in the analysis. Second, it explicitly identifies and ranks the strongest connecting threads between and within internal and external variables. The CCA provides straightforward results because it simplifies the problem's dynamic structure and captures only contemporaneous relationships. However those simplifications, while useful to highlight and understand the model's major connections, make the CCA model unsuitable to make projections.

Including time-dimension information in the analysis is a natural extension to the CCA. Thus, to complement the canonical correlations results, we estimate the relationship between the two groups of variables (Y and X) using panel data regressions. We take advantage of the availability of panel data by adding dynamics to the proposed multi-equation structure. Our general specification is as follows:

$$Y_{i.t} = A_0 + A_1 Y_{i.t-1} + B_0 X_{i,t} + B_1 X_{i,t-1} + v_i + \varepsilon_{i,t}$$

Where X and Y are defined as in the CCA case; v represents individual fixed effects, and ε is an error term. Adding lags to the specification allows to control for dynamics between the variables and has the advantage to provide explicit impulse response functions and dynamic multipliers.[8]

V. MAIN RESULTS

Disentangling the multiple connections between internal outcomes and external shocks is challenging, especially when the goal is to provide forecasts and a comprehensive interpretation for public policy purposes.[9] We aim not only at constructing a model that can accurately provide projections but also providing visible connections behind those projections. With that in mind, the setup of our problem is depicted in Figure 6. We define six exogenous (external) variables that are expected to affect five internal (domestic) aggregates. Two of the six external variables, tourist inflows and GDP of main tourist source countries, are highly collinear. As we explain later, the decision of which one to include will rely on the type of shock we consider for the simulations.

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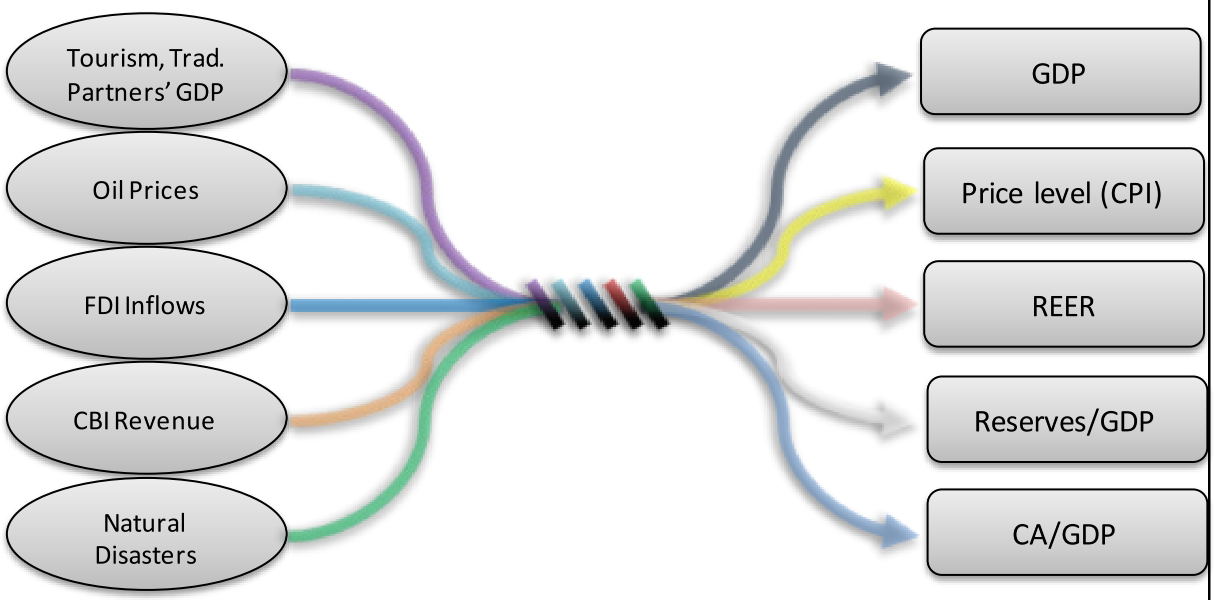
[8] Impulse response functions show the response of an endogenous variable to another endogenous variable in the set Y. On the other hand, dynamic multipliers reflect the response of an endogenous variable (one element of Y) to a change in an exogenous one (one element of X).

[9] The rise of projection models using Artificial Intelligence and Machine Learning algorithms pose a trade-off between the accuracy of projections and their interpretability and implications for public policy.

Figure 6. Problem Setup



The CCA results are shown in Table 2. Statistically, they suggest at least four significant relationships between the sets of external and internal variables.

Table 2. Canonical Correlation Analysis-Standardized Coefficients

	Internal Variables a/				
Variable / Canonical Variate	1	2	3	4	5
GDP Growth	**0.30**	**0.41**	**0.87**	0.02	-0.11
Inflation	**0.25**	**-0.27**	-0.04	**0.85**	0.46
REER	0.11	-0.14	0.18	**-0.54**	0.89
Reserves/GDP	-0.11	**0.89**	-0.18	0.12	0.49
CA/GDP	**-0.86**	**-0.33**	**0.32**	**0.51**	-0.15
	External Variables a/				
Variable / Canonical Variate	1	2	3	4	5
GDP Growth (US/UK/CAN)	-0.14	**0.25**	**1.08**	-0.12	0.33
Oil Price Growth	**0.50**	-0.11	**-0.35**	**0.96**	-0.36
FDI Inflows/GDP	**0.67**	**0.60**	-0.08	-0.41	0.19
CBI/GDP	**-0.37**	**0.80**	-0.02	0.32	-0.44
Disaster Damage/GDP	-0.11	0.09	**-0.45**	0.40	0.82
Canonical Correlations:	0.71	0.53	0.44	0.28	0.01

a/ In bold, statistically significant values at 10%.

- The highest significant correlation (0.71) – among the potential 5 – captures mostly fluctuations in the current account balance, which appear to be linked, not surprisingly, to external flows: oil imports (through oil prices), FDI inflows, and CBI receipts.
- An external identity also explains the second strongest relationship (0.53): the level of reserves is strongly associated to FDI inflows and CBI receipts.
- The third most significant correlation (0.44) measures the association of a local canonical variate defined mainly by GDP growth. It shows that GDP growth is positively correlated with trade partners' GDP (U.S., U.K., and Canada) and negatively affected by higher oil prices and the cost of natural disasters.
- Finally, the fourth statistically significant correlation (0.28) mainly captures the relationship between oil prices (the major component of the external canonical variate) and internal prices (CPI), CA balance and REER, (the three statistically significant compounding factors of the fourth internal canonical variate).

Note also that the first two canonical correlations do not only reflect external accounts' identities but also how external flows can affect local GDP growth. Indeed, the first three internal canonical variates include GDP growth as an essential component, which can be interpreted as a strong dependence of local economic activity to each of the five external shock sources. Thus, the CCA results help confirm the importance of external shocks for local economic activity.

A. Baseline Econometric Results

Based on information for all six ECCU countries, our baseline econometric model was estimated using individual fixed-effects regressions. Our results suggest statistically significant effects of external shocks on local aggregates. While the coefficients represent elasticities and semi-elasticities of the dependent variables to internal and external shocks, our focus stays on the responses of local variables to external shocks only. Table A1 shows detailed results from our preferred specification. The model is rich in the number of connections between internal and external factors and offers the possibility of numerous simulation exercises. The following discussion is illustrative and provides an application of the model to a few plausible and recurrent shocks relevant for Caribbean countries.

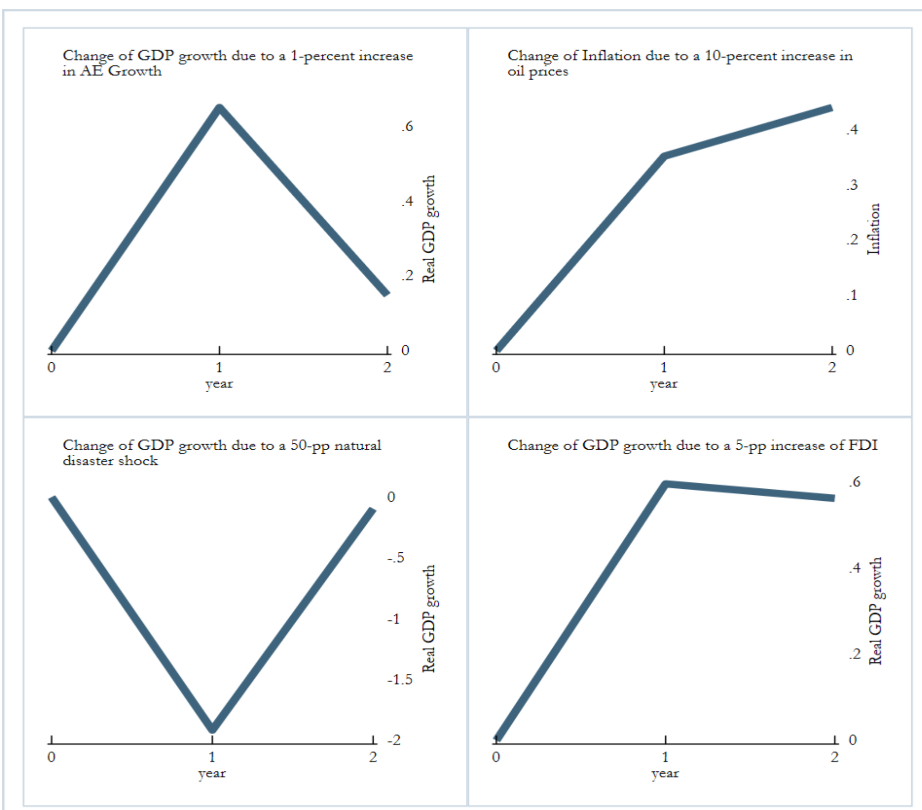
An acceleration of economic activity in tourism source countries. As mentioned earlier, several studies have identified economic activity in advanced economies as a direct determinant of GDP in Caribbean islands. Our model allows to quantify the size of this effect on ECCU economies. We found that a 1-percent increase in GDP in the set of major tourist source countries (U.S., U.K. and Canada) would imply an increase of about 0.5 percent in the GDP of ECCU countries. This elasticity is not only capturing the tourism sector channel but also other commercial relationships, such as remittances, which are not included explicitly in the model. The top left chart in Figure 7 shows the dynamic adjustment of a 1-percent positive shock in the index of real GDP of foreign economies.

An upswing in oil prices. According to our model, a ten percent increase in oil prices is associated with a 0.15 p.p. reduction in real GDP growth , as well as to a sizable effect on internal prices (CPI). An increase of 10 percent in oil prices, a relatively common variation, would increase inflation by around 0.3 p.p. in the same year of the shock (see Figure 7, top right chart.) Since the panel VAR-X model internalizes the dynamic of GDP and the other endogenous (local) variables at the same time, this elasticity not only captures the initial shock but also the second-round effects on inflation due to lower economic activity.

A natural disaster hit. Our model simulations predict a 1.8 percent fall of GDP after a hurricane with a destructive power of about 50 percent of GDP. This is a reasonable result. For instance, it predicts that the 270 percent of GDP damage from 2017 Hurricane Maria would result in an 8 percent economic contraction (10 percent below its potential output growth rate), which is close to the actual 10 percent contraction in that year.

A windfall of FDI inflows. Given the reduced size of ECCU economies, an FDI/GDP fluctuation of around 5 p.p. is not unusual. We simulated such a shock and found that it could boost GDP by around 0.8 p.p. (see bottom left chart in Figure 7). Conveniently, our model can also help to predict the average imported component of FDI inflows, through its impact in the current account balance. Indeed, we calculated that a 5-pp positive shock of FDI would translate into a lower current account balance by 2.5 percent of GDP (implicitly, a 50 percent imported component of FDI).

Figure 7. Selected Dynamic Multipliers



B. Extensions/Robustness Checks

Our baseline model explains well the volatility of the endogenous variables.[10] We tested our results for robustness of the coefficients and compliance with standard econometric assumptions. Regarding the time-series dimension of our data and recognizing that some of our variables might not be stationary,[11] we tested for cointegration between the endogenous variables to discard a potential spurious correlation. Our results cannot reject the null hypothesis of existence of at least one cointegration vector. We report the cointegration tests in the Annex (Table A5). In addition, as it is well-known, panel data dynamic models with fixed effects are susceptible to have biased coefficients (Nickell, 1981). We contrasted our results with those from alternative estimation methods and found no substantial differences (the results are reported in Annex, Table A6). Specifically, we compared the results between Pooled-OLS, Fixed-Effects and Arellano-Bond estimates. Our preferred specification, fixed-effects, considers that some methods to correct the Nickell bias (e.g. GMM instrumentation, as in Arellano-Bond (1991)) provide less stability of the coefficients.[12]

In the next section, we adapt the baseline model to consider a novel shock for the region, reflecting the total halt of tourist arrivals associated with the lockdowns and airline route interruptions associated with the COVID-19 pandemic.

VI. An Application to the COVID-19 Shock

Given the high contribution of the tourism sector to the overall economy, it is not surprising that Caribbean countries depend heavily on the number of visitors to the islands. Most frequent shocks to the ECCU tourism sector derive from a slowdown of the global economy, which could be relatively well captured by including a set of advanced economies GDP in the model as an explanatory variable, similar to our baseline specification. However, as discussed earlier, the 2020 pandemic was a different kind of shock with an impact of tourism that went beyond the income-driven effect, as travelling can be a major source of virus transmission. The COVID-19 effect on Caribbean economies thus has been disproportionate and might not be correlated, in the same magnitude, with the historical GDP of AE partners. This situation requires an alternative approach that could explicitly integrate a transmission channel from the number of tourist arrivals to the level of local economic activity.

In order to quantify this type of shocks, we propose a slightly different specification which includes in the vector of external/foreign variables, explicitly, the contribution of tourist arrivals to GDP (proxied by the sectoral GDP of *Hotels and Restaurants*)[13]. Given that both, GDP of advanced economies and tourist arrivals flows have been historically highly

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[10] The goodness of fit for each individual regression is notable except for that of the level of International Reserves (as percent of GDP).

[11] In tables A3 and A4 in the Annex, we show that our model mixes stationary and non-stationary (integrated of order 1) variables.

[12] This is related with characteristics of the data rather than weaknesses in the methodology. The construction of instruments, with variables with scarce variability (natural disasters) or no volatility at all (CBI receipts for some ECCU countries that don't offer CBI programs), needed for GMM estimation, lead to less robust estimates.

[13] We assume that the number of tourist arrivals has a 1:1 relation with the contribution of "Hotels & Restaurants" to GDP.

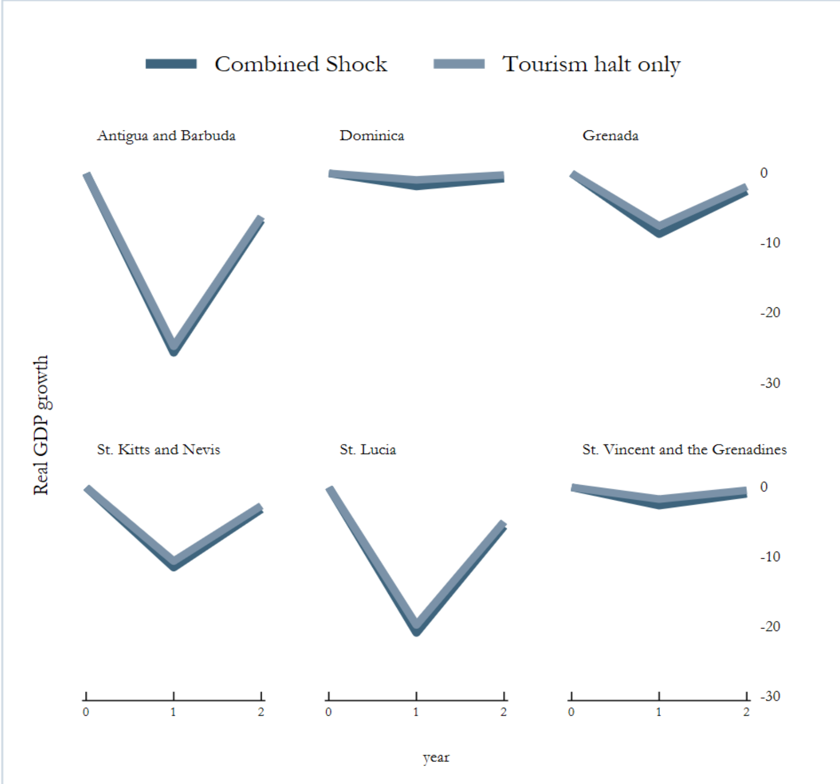
correlated, simultaneously including them posed concerns on multicollinearity of the model and stability of the estimates. To overcome that complication, we orthogonalized the two series, assuming that the main effect on local GDP is driven first by the number of tourists to the islands, reflected on the sectoral GDP of Hotels & Restaurants, and second by the remaining effect derived from the slowdown in advanced economies. Our estimates for this alternative model are reported in Table A2. Most of the estimated coefficients remain robust with respect to our benchmark specification.

It is worth to note that, beyond the direct impact on the tourism sector, the ongoing Covid-19 shock is having implications on all the external shocks analyzed in this paper, except natural disasters:

- The global halt in economic activity implied a significant contraction in the GDP of source countries that several analysts were quick to provide forecasts for and which can feed the projected impact of this shock.
- COVID-19 was particularly punitive on the contact-intensive tourism industry and therefore it makes sense to estimate the impact of a tourism shock that is orthogonal to the slowdown in global economic activity. For 2020, as Covid-19 practically fully shutdown tourism in these countries for three quarters, the decline in tourism arrivals could be expected to be of about three quarters of the 2019 level.
- FDI could also be expected to contract mainly because the uncertain outlook of the tourism industry. Forecasters can look at the evolution of FDI during past tourism shocks to project what its evolution could be during the Covid-19 shock, but of course shocks can have different implications on FDI depending on several considerations. Alternatively, government officials and other analysis could also enquire with foreign investors about the outlook of their investments.
- Oil prices have already fluctuated significantly in 2020 and forecasts are constantly being updated so that they can well inform their projected impact on CBI economies.
- It is not clear though how CBI revenues can be affected by the Covid-19 shock. Higher uncertainty from the potentially systemic changes that Covid-19 brings in the short-to-long run could either deter potential CBI investors from spending in this expensive service, but also could prompt them to value more the international mobility that ECCU passports provide. Thus far, monthly data indicates that there is no significant change in CBI demand since the start of the pandemic.

Considering the mechanisms described in the previous bullets, we simulated the effects on GDP under two sets of shocks: i) a combined shock, including a halt of tourism, a contraction in the global economy, a reduction of oil prices, and a reduction of FDI inflows; and ii) a tourism halt shock only.

Figure 8. GDP Growth Response to the COVID-19 Shock
(in percent)



The combined shock scenario provides a better simulation of reality as empirical evidence suggests such type of global variables are historically correlated. The model, internally, separates the impact of each single factor, and the prediction process merges them as a simultaneous multi-shock.[14] The second scenario helps to isolate and gauge the direct effect of the tourism sector contraction under a lockdown situation. As we already analyzed in more detail the impact of FDI and oil prices in the previous section, this distinction provides additional clarity to the analysis.

Figure 8 summarizes the effects under both scenarios. The collapse of GDP predicted by the model is broadly in line with projections provided by international and national organizations,[15] and show how much of the GDP decline is associated to the fall in the number of tourists and how much is derived from additional negative global factors. The model mainly reflects the varying importance of tourist arrivals on economic activity across

[14] In addition, the orthogonalization of multi-collinear shocks that we explained in the previous paragraphs minimizes the risk of double-counting.

[15] In all the simulations included in this paper, we assume shocks materialize in just one period (t=1), and the economy comes back to its previous state in the next periods. The model is flexible enough to provide more realistic simulations, including multi-period shocks.

the ECCU countries. Those countries with a lower share of tourism as percent of GDP will mechanically be less affected by a tourism shock (e.g. Dominica, St. Vincent and the Grenadines). The opposite happens in countries where tourism is more developed, and represents a major share of the economy (e.g. Antigua and Barbuda or St. Lucia). In parallel, the model allows to predict the effect of the global lockdown on the current account balance.

Figure 9. Response of Current Account Balance to the COVID-19 shock
(in percent of GDP)

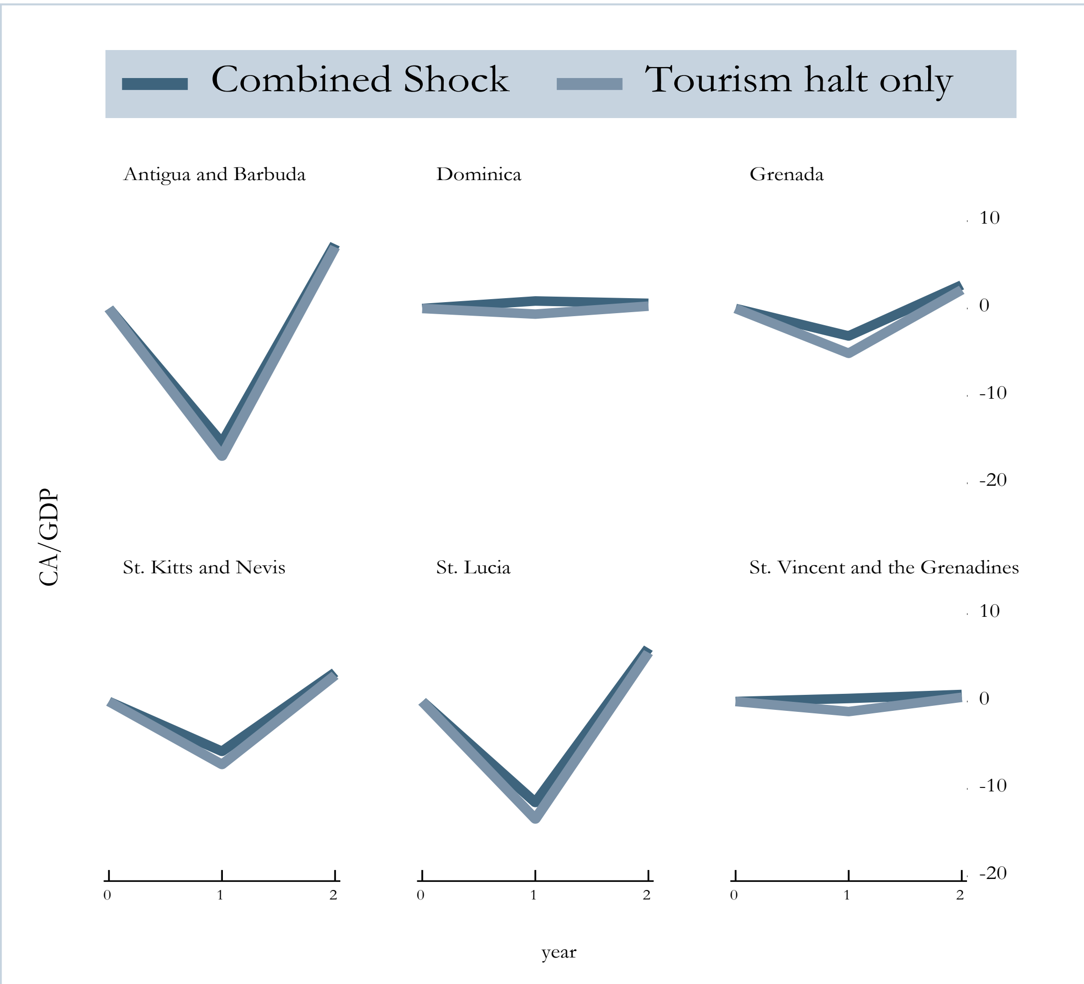


Figure 9 shows the dynamic multipliers of that simulation. Similarly to the simulations of GDP growth, the current account balance predictions allow to identify three groups of countries: the most affected, St. Lucia and Antigua and Barbuda; the moderately affected countries, St. Kitts and Nevis and Grenada; and mildly affected countries, St. Vincent and the Grenadines, and Dominica. All ECCU countries are projected to see a deteriorating external position as a result of the assumed combinations of shocks linked to the pandemic.

Note though that not all major shocks to world economic activity are expected to deteriorate the external position of ECCU countries. For instance, historically, oil prices and global economic activity have been positively correlated. It is possible that a decline in oil prices might be large enough to offset a deterioration of the CA balance through remittances and tourism channels associated with sluggish global economic activity. In the current COVID-19 simulation, the direct effect from the fall of tourist arrivals clearly offsets any positive external developments (such as lower oil prices), but the opposite was the case in the aftermath fo the Global Financial Crisis. This highlights the importance of analyzing the impact of external shocks through all the most important transmission channels as our econometric model seeks to do. Combined global shocks provide the possibility to produce many potential outcomes, in terms of internal economic activity, prices and external position.

Finally, it is noteworthy to mention that our simulations provide differentiated effects for each of the countries included in the analysis. This is possible because the coefficient associated to the external shock of the number of tourists is expressed as a semi-elasticity, thus preserving scale effects, and relative importance of tourism sector across the countries in our sample. This distinction might not be important for relatively average sized shocks, but it is key for those that are exceptionally large, such as the 2020 pandemic. According to information up to October 2020, the average reduction in the number of tourist arrivals to the Caribbean is around 70 percent (y-o-y), a contraction rarely observed in the region.[16]

VII. Concluding Remarks

We simulated the effects of long-standing and recurrent external shocks to the ECCU economies, and also the effect of the novel COVID-19 shock. Our results allow to predict country-specific magnitudes of impact, according to the level of dependence to the tourism sector. While the overall deceleration of the global economy, volatility of oil prices and abundance of external resources (for example, those inducing FDI inflows) are important as transmission channels from the current pandemic, most of the variability of the collapse in the ECCU countries is explained by the abrupt halt in the number of visitors to the islands. This is especially relevant because travel restrictions, including prohibitions and costly travel

[16] The 9/11 and Global Financial Crisis affected the tourism industry vigorously. However, they represented just a fraction of what was observed in 2020, in terms of duration and in terms of reduction of number of tourists. For instance, the 9/11 episode reduced the number of visitors to ECCU countries by around 50 percent in the first month (September) and most of the shock waned after 3 months. The effects of the GFC on the tourism sector lasted for at least one year but the reduction in the number of tourists was less dramatic (-11 percent, annually). The current collapse in tourism is anticipated to disrupt the tourism sector for at least 2-3 years.

protocols, can be implemented internally or externally. While Caribbean countries can choose the level of protection of their borders, they do not directly influence the variation in the number of tourists associated with lockdowns, travel restrictions in tourist source countries, and changes in leisure travel preferences.

Despite unavailability of high frequency data and structural breaks in the external sector data (related to the implementation of BPM6 methodology), CCA and dynamic panel regressions identify the impact of most external shocks to ECCU countries broadly in line with a priori based on economic theory and empirical studies the region. Future availability of higher frequency data and methodologically homogenous external data could allow improvements in the precision and statistical significance of estimated elasticities. Of course, they can also allow for a better understanding of the dynamics following external shocks, at higher frequency and incorporating more variables.

ECCU countries usually face simultaneous external shocks and therefore projecting the expected combination of shocks would be valuable to forecasters. The ECCU Discussion on Common Policies, IMF (2021) provides such forecast through statistical analysis of the historic interrelatedness among some of the external variables presented in this paper (mainly of global growth, tourism demand, and oil prices) with global financial factors.

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Annex I. Econometric Results

Table A1. Panel VAR-X

VARIABLES	(1) Log of GDP in USD (constant prices)	(2) CPI (log)	(3) REER (log)	(4) Reserves/GDP	(5) Current Account/GDP
Log of GDP in USD (constant prices) = L,	0.8577***	0.0713**	0.0225	-7.7285*	-5.9678
	(0.00)	(0.03)	(0.74)	(0.09)	(0.25)
CPI (log) = L,	-0.1047**	0.8857***	0.0441**	9.9079	22.2350**
	(0.01)	(0.00)	(0.03)	(0.12)	(0.01)
REER (log) = L,	0.0267	-0.0281	0.8599***	9.1385	-9.2097
	(0.53)	(0.24)	(0.00)	(0.14)	(0.31)
Reserves/GDP = L,	-0.0001	-0.0001	0.0001	-0.2454**	0.0539
	(0.78)	(0.46)	(0.88)	(0.03)	(0.59)
Current Account/GDP = L,	0.0012***	0.0001	-0.0000	-0.0641	0.4660***
	(0.00)	(0.65)	(0.98)	(0.38)	(0.00)
Real GDP Index (US,UK,CAN; log)	0.6495***	-0.0655	-0.5923***	32.7268	14.4709
	(0.01)	(0.25)	(0.00)	(0.31)	(0.23)
Real GDP Index (US,UK,CAN; log) = L,	-0.4180**	0.0330	0.4860***	-30.6725	-30.2870*
	(0.02)	(0.51)	(0.00)	(0.34)	(0.06)
Oil price (log)	-0.0156***	0.0330***	-0.0084	-3.5074	-2.2259
	(0.00)	(0.00)	(0.45)	(0.14)	(0.39)
Oil price (log) = L,	0.0160**	-0.0186***	0.0121	4.1399	1.5302
	(0.03)	(0.00)	(0.22)	(0.17)	(0.62)
FDI inflows/GDP	0.0012**	0.0001	0.0001	0.0606	-0.5659***
	(0.02)	(0.81)	(0.87)	(0.51)	(0.00)
FDI inflows/GDP = L,	0.0008	0.0001	-0.0007	-0.0342	0.1165
	(0.26)	(0.55)	(0.46)	(0.72)	(0.16)
CBI revenue/GDP	-0.0012	0.0001	0.0005*	1.5149***	0.3784
	(0.20)	(0.74)	(0.08)	(0.00)	(0.18)
CBI revenue/GDP = L,	0.0012*	-0.0005	-0.0004	-1.0296	0.0139
	(0.09)	(0.49)	(0.65)	(0.20)	(0.97)
Natural disaster costs/GDP	-0.0004***	0.0000	-0.0001	0.0242	0.0255
	(0.00)	(0.66)	(0.29)	(0.63)	(0.49)
Natural disaster costs/GDP = L,	0.0003	0.0000	0.0001	-0.0050	-0.0593**
	(0.11)	(0.99)	(0.25)	(0.90)	(0.03)
Constant	-0.7316	0.7820***	0.9387**	-99.3339**	10.3734
	(0.14)	(0.00)	(0.02)	(0.04)	(0.87)
Observations	210	210	210	210	204
R-squared	0.9919	0.9960	0.8544	0.3085	0.6461
Number of ifs_code	6	6	6	6	6

Robust pval in parentheses

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

Source: Authors' calculations. Esimated using fixed effects.

Table A2. Fixed Effects Panel VAR-X (With Tourism Sector GDP)

VARIABLES	(1) Log of GDP in USD (constant prices)	(2) CPI (log)	(3) REER (log)	(4) Reserves/GDP	(5) Current Account/GDP
Log of GDP in USD (constant prices) = L,	0.9179***	0.0537*	-0.0135	-10.4255	-9.2144**
	(0.00)	(0.06)	(0.73)	(0.15)	(0.02)
CPI (log) = L,	0.0215	0.8362***	0.0486	17.4740*	11.5749*
	(0.72)	(0.00)	(0.30)	(0.05)	(0.09)
REER (log) = L,	-0.0629	0.0384	0.7783***	3.4789	4.0538
	(0.25)	(0.22)	(0.00)	(0.52)	(0.67)
Reserves/GDP = L,	0.0003	-0.0001	0.0005	-0.1952*	0.0875
	(0.57)	(0.77)	(0.35)	(0.05)	(0.35)
Current Account/GDP = L,	0.0014**	0.0001	-0.0001	-0.1919*	0.4216***
	(0.02)	(0.72)	(0.86)	(0.09)	(0.01)
Real GDP Index (US,UK,CAN; orthog)	0.0395	0.0445*	0.0002	0.7129	---
	(0.61)	(0.10)	(1.00)	(0.93)	---
Real GDP Index (US,UK,CAN; orthog) = L,	-0.0319	-0.0680*	0.0644	-1.8972	---
	(0.67)	(0.07)	(0.37)	(0.79)	---
Hotels & Rest. real GDP	0.0009**	0.0003**	-0.0005	0.0272	0.0605
	(0.04)	(0.02)	(0.17)	(0.46)	(0.27)
Hotels & Rest. real GDP = L,	-0.0007*	-0.0003*	0.0005	-0.0311	-0.0467
	(0.07)	(0.07)	(0.16)	(0.47)	(0.37)
Oil price (log)	0.0222*	0.0311***	-0.0639***	-2.2616	-5.2620*
	(0.06)	(0.00)	(0.00)	(0.30)	(0.10)
Oil price (log) = L,	-0.0236*	-0.0028	0.0425***	1.2383	3.5935
	(0.08)	(0.61)	(0.01)	(0.65)	(0.34)
FDI inflows/GDP	0.0026***	0.0000	0.0001	0.0827	-0.4870***
	(0.00)	(1.00)	(0.93)	(0.35)	(0.00)
FDI inflows/GDP = L,	0.0000	0.0001	-0.0005	-0.1047	0.0011
	(0.95)	(0.75)	(0.54)	(0.26)	(0.99)
CBI revenue/GDP	-0.0008	-0.0002	-0.0001	1.5583***	0.3480
	(0.59)	(0.46)	(0.92)	(0.00)	(0.39)
CBI revenue/GDP = L,	-0.0001	-0.0004	0.0002	-1.0278	-0.0099
	(0.96)	(0.68)	(0.84)	(0.18)	(0.99)
Natural disaster costs/GDP	-0.0002*	0.0000	-0.0002*	0.0236	0.0396
	(0.06)	(0.75)	(0.05)	(0.65)	(0.41)
Natural disaster costs/GDP = L,	0.0003*	0.0000	-0.0000	-0.0088	-0.0466**
	(0.07)	(0.79)	(0.69)	(0.81)	(0.02)
Constant	0.1628	0.4853**	0.8942**	-93.0637*	-73.5204*
	(0.60)	(0.03)	(0.01)	(0.07)	(0.07)
Observations	168	168	168	168	162
R-squared	0.9801	0.9937	0.8145	0.3456	0.7023
Number of ifs_code	6	6	6	6	6

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculations. Esimated using fixed effects.

Table A3. Unit Root Tests of Panel-Data Variables

Variable/ Unit Root Tests*	Levels		First differences	
	Im-Pesaran-Shin	Fisher	Im-Pesaran-Shin	Fisher
GDP	0.1553	0.1096	0.0000	0.0000
GDP Tourism Contribution	0.6338	0.8559	0.0000	0.0000
CPI	0.0000	0.0000	0.0188	0.0068
REER	0.1020	0.1734	0.0000	0.0000
Reserves/GDP	0.0000	0.0000	0.0000	0.0000
Current Account/GDP	0.0000	0.0000	0.0000	0.0000
FDI/GDP	0.0000	0.0000	0.0000	0.0000
CBI/GDP	a/	0.1129	0.0000	0.0000
Nat. Disaster Costs/GDP	0.0000	0.0000	0.0000	0.0000

Source: Authors' calculations

* Reporting P-values, H0: All panels contain unit roots; HA: Some panels are stationary

a/ Insufficient number of time periods to compute

Table A4. Unit Root Tests of Time-Series Variables

Variable/ Unit Root Tests*	Levels		First differences	
	DF	PP	DF	PP
GDP (US-UK-CAN)	0.8802	0.7634	0.0001	0.0004
Oil Price	0.0640	0.0878	0.0100	0.0000

* Reporting P-values, H0: The variable contains a unit root; HA: The variable is stationary

Table A5. Cointegration Tests

Pedroni test for cointegration

Ho:	No cointegration	Number of panels=	6
Ha:	All panels are cointegrated	Avg. number of periods=	35
Cointegrating vector:	Panel specific		
Panel means:	Included	Kernel:	Bartlett
Time trend:	Not included	Lags:	3.00 (Newey-West)
AR parameter:	Panel specific	Augmented lags:	1 (BIC)

	Statistic	p-value
Modified Phillips-Perron t	2.0517	0.0201
Phillips-Perron t	0.9328	0.1755
Augmented Dickey-Fuller t	1.2573	0.1043

Kao test for cointegration

Ho:	No cointegration	Number of panels=	6
Ha:	All panels are cointegrated	Avg. number of periods=	34
Cointegrating vector:	Same		
Panel means:	Included	Kernel:	Bartlett
Time trend:	Not included	Lags:	2.50 (Newey-West)
AR parameter:	Same	Augmented lags:	1 (BIC)

	Statistic	p-value
Modified Dickey-Fuller t	-1.2553	0.1047
Dickey-Fuller t	-2.0811	0.0187
Augmented Dickey-Fuller t	-2.7424	0.003
Unadjusted modified Dickey	-3.0836	0.001
Unadjusted Dickey-Fuller t	-2.9078	0.0018

Table A6. Robustness Checks

Log of GDP in USD (constant prices)	(1) Pooled OLS	(2) Fixed-Effects	(3) Arellano-Bond
Log of GDP in USD (constant prices) = L,	1.0042***	0.8577***	0.8664***
	(0.00)	(0.00)	(0.00)
CPI (log) = L,	-0.0855**	-0.1047**	-0.0933***
	(0.01)	(0.01)	(0.00)
REER (log) = L,	0.0559	0.0267	0.0250
	(0.25)	(0.53)	(0.49)
Reserves/GDP = L,	0.0000	-0.0001	-0.0000
	(0.99)	(0.78)	(0.93)
Current Account/GDP = L,	0.0012***	0.0012***	0.0011***
	(0.00)	(0.00)	(0.00)
Real GDP Index (US,UK,CAN; log)	0.6529***	0.6495***	0.6653***
	(0.01)	(0.01)	(0.00)
Real GDP Index (US,UK,CAN; log) = L,	-0.6137**	-0.4180**	-0.4504***
	(0.01)	(0.02)	(0.00)
Oil price (log)	-0.0110**	-0.0156***	-0.0164***
	(0.02)	(0.00)	(0.00)
Oil price (log) = L,	0.0203***	0.0160**	0.0159***
	(0.01)	(0.03)	(0.00)
FDI inflows/GDP	0.0012**	0.0012**	0.0012***
	(0.02)	(0.02)	(0.00)
FDI inflows/GDP = L,	0.0004	0.0008	0.0007
	(0.47)	(0.26)	(0.17)
CBI revenue/GDP	-0.0009	-0.0012	-0.0012*
	(0.16)	(0.20)	(0.06)
CBI revenue/GDP = L,	0.0006	0.0012*	0.0011**
	(0.20)	(0.09)	(0.01)
Natural disaster costs/GDP	-0.0003***	-0.0004***	-0.0004***
	(0.00)	(0.00)	(0.00)
Natural disaster costs/GDP = L,	0.0003*	0.0003	0.0003**
	(0.05)	(0.11)	(0.03)
Constant	-0.0716	-0.7316	-0.6935*
	(0.77)	(0.14)	(0.05)
Observations	210	210	206
R-squared	0.9960	0.9919	
Number of ifs_code		6	6

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A6. Robustness Checks (…cont.)

CPI (log)	(1) Pooled OLS	(2) Fixed-Effects	(3) Arellano-Bond
Log of GDP in USD (constant prices) = L,	0.0120**	0.0713**	0.0604**
	(0.02)	(0.03)	(0.03)
CPI (log) = L,	0.9607***	0.8857***	0.8663***
	(0.00)	(0.00)	(0.00)
REER (log) = L,	-0.0086	-0.0281	-0.0292
	(0.64)	(0.24)	(0.22)
Reserves/GDP = L,	-0.0002	-0.0001	-0.0002
	(0.22)	(0.46)	(0.14)
Current Account/GDP = L,	-0.0001	0.0001	0.0001
	(0.38)	(0.65)	(0.29)
Real GDP Index (US,UK,CAN; log)	-0.1095*	-0.0655	-0.0923*
	(0.09)	(0.25)	(0.05)
Real GDP Index (US,UK,CAN; log) = L,	0.0852	0.0330	0.0840*
	(0.23)	(0.51)	(0.08)
Oil price (log)	0.0352***	0.0330***	0.0344***
	(0.00)	(0.00)	(0.00)
Oil price (log) = L,	-0.0259***	-0.0186***	-0.0182***
	(0.00)	(0.00)	(0.00)
FDI inflows/GDP	0.0001	0.0001	0.0000
	(0.73)	(0.81)	(0.91)
FDI inflows/GDP = L,	0.0002	0.0001	0.0002
	(0.47)	(0.55)	(0.19)
CBI revenue/GDP	0.0003	0.0001	0.0001
	(0.38)	(0.74)	(0.87)
CBI revenue/GDP = L,	-0.0009	-0.0005	-0.0004
	(0.28)	(0.49)	(0.56)
Natural disaster costs/GDP	0.0001	0.0000	0.0000
	(0.28)	(0.66)	(0.56)
Natural disaster costs/GDP = L,	0.0000	0.0000	0.0000
	(0.35)	(0.99)	(0.46)
Constant	0.3138**	0.7820***	0.7559***
	(0.04)	(0.00)	(0.00)
Observations	210	210	206
R-squared	0.9960	0.9960	
Number of ifs_code		6	6

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A6. Robustness Checks (…cont.)

REER (log)	(1) Pooled OLS	(2) Fixed-Effects	(3) Arellano-Bond
Log of GDP in USD (constant prices) = L,	-0.0043	0.0354	0.0277
	(0.39)	(0.53)	(0.57)
CPI (log) = L,	0.0507***	0.0466**	0.0450***
	(0.01)	(0.03)	(0.00)
REER (log) = L,	0.8264***	0.8244***	0.8476***
	(0.00)	(0.00)	(0.00)
Reserves/GDP = L,	0.0005	0.0006	0.0003
	(0.45)	(0.42)	(0.61)
Current Account/GDP = L,	-0.0001	-0.0001	0.0001
	(0.72)	(0.79)	(0.76)
Real GDP Index (US,UK,CAN; log)	-0.5822***	-0.5669***	-0.5739***
	(0.00)	(0.00)	(0.00)
Real GDP Index (US,UK,CAN; log) = L,	0.5555***	0.4975***	0.4740***
	(0.00)	(0.00)	(0.00)
Oil price (log)	-0.0245*	-0.0240*	-0.0116
	(0.07)	(0.06)	(0.21)
Oil price (log) = L,	0.0074	0.0090	0.0113
	(0.44)	(0.36)	(0.14)
FDI inflows/GDP	0.0005	0.0005	0.0002
	(0.41)	(0.49)	(0.67)
FDI inflows/GDP = L,	-0.0010	-0.0011	-0.0009
	(0.41)	(0.32)	(0.35)
CBI revenue/GDP	0.0003	0.0003	0.0004*
	(0.54)	(0.34)	(0.07)
CBI revenue/GDP = L,	-0.0006	-0.0006	-0.0006
	(0.62)	(0.57)	(0.50)
Natural disaster costs/GDP	-0.0001	-0.0001	-0.0001
	(0.17)	(0.16)	(0.12)
Natural disaster costs/GDP = L,	0.0000	0.0000	0.0001
	(0.77)	(0.51)	(0.14)
Constant	0.7713**	0.9984***	0.9783***
	(0.01)	(0.00)	(0.00)
Observations	197	197	196
R-squared	0.8759	0.8423	
Number of ifs_code		6	6

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A6. Robustness Checks (…cont.)

Reserves/GDP	(1) Pooled OLS	(2) Fixed-Effects	(3) Arellano-Bond
Log of GDP in USD (constant prices) = L,	0.0892	-7.7285*	-7.1796***
	(0.93)	(0.09)	(0.01)
CPI (log) = L,	-0.3041	9.9079	10.2865**
	(0.88)	(0.12)	(0.03)
REER (log) = L,	3.5527	9.1385	8.8258**
	(0.34)	(0.14)	(0.04)
Reserves/GDP = L,	-0.2306**	-0.2454**	-0.2420***
	(0.04)	(0.03)	(0.00)
Current Account/GDP = L,	-0.0237	-0.0641	-0.0679
	(0.70)	(0.38)	(0.23)
Real GDP Index (US,UK,CAN; log)	41.0652	32.7268	33.2455
	(0.17)	(0.31)	(0.19)
Real GDP Index (US,UK,CAN; log) = L,	-41.0273	-30.6725	-32.0078
	(0.16)	(0.34)	(0.21)
Oil price (log)	-3.8306	-3.5074	-3.5321*
	(0.11)	(0.14)	(0.05)
Oil price (log) = L,	5.2368*	4.1399	4.1418*
	(0.08)	(0.17)	(0.07)
FDI inflows/GDP	0.0825	0.0606	0.0526
	(0.31)	(0.51)	(0.47)
FDI inflows/GDP = L,	-0.0018	-0.0342	-0.0448
	(0.98)	(0.72)	(0.56)
CBI revenue/GDP	1.5049***	1.5149***	1.5099***
	(0.00)	(0.00)	(0.00)
CBI revenue/GDP = L,	-0.9413	-1.0296	-1.0301*
	(0.20)	(0.20)	(0.09)
Natural disaster costs/GDP	0.0153	0.0242	0.0241
	(0.75)	(0.63)	(0.56)
Natural disaster costs/GDP = L,	-0.0084	-0.0050	-0.0038
	(0.83)	(0.90)	(0.90)
Constant	-18.8894	-99.3339**	-95.5251***
	(0.26)	(0.04)	(0.00)
Observations	210	210	206
R-squared	0.2963	0.3085	
Number of ifs_code		6	6

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A6. Robustness Checks (…cont.)

Current Account/GDP	(1) Pooled OLS	(2) Fixed-Effects	(3) Arellano-Bond
Log of GDP in USD (constant prices) = L,	0.9102	-5.7111	-5.9962
	(0.12)	(0.36)	(0.22)
CPI (log) = L,	14.7680***	23.2737***	21.7671***
	(0.00)	(0.01)	(0.00)
REER (log) = L,	-13.4369*	-8.5754	-9.2134
	(0.06)	(0.26)	(0.12)
Reserves/GDP = L,	0.0278	0.0162	0.0086
	(0.66)	(0.81)	(0.89)
Current Account/GDP = L,	0.5414***	0.5001***	0.5011***
	(0.00)	(0.00)	(0.00)
Real GDP Index (US,UK,CAN; log)	20.5603	13.7844	11.6937
	(0.16)	(0.28)	(0.19)
Real GDP Index (US,UK,CAN; log) = L,	-38.5162**	-29.8382*	-26.4463*
	(0.03)	(0.09)	(0.06)
Oil price (log)	-2.2277	-2.0278	-1.9100
	(0.38)	(0.40)	(0.33)
Oil price (log) = L,	2.1462	1.2879	1.3407
	(0.45)	(0.66)	(0.57)
FDI inflows/GDP	-0.5483***	-0.5671***	-0.5853***
	(0.00)	(0.00)	(0.00)
FDI inflows/GDP = L,	0.1689*	0.1342	0.1221*
	(0.08)	(0.14)	(0.06)
CBI revenue/GDP	0.5302**	0.5259***	0.5112***
	(0.02)	(0.01)	(0.00)
CBI revenue/GDP = L,	-0.2196	-0.2909	-0.2747
	(0.34)	(0.21)	(0.12)
Natural disaster costs/GDP	0.0044	0.0122	0.0123
	(0.87)	(0.63)	(0.55)
Natural disaster costs/GDP = L,	-0.0631**	-0.0589**	-0.0541***
	(0.02)	(0.03)	(0.00)
Constant	73.7893*	4.8043	8.3274
	(0.07)	(0.93)	(0.85)
Observations	210	210	206
R-squared	0.6669	0.6517	
Number of ifs_code		6	6

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1