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External Debt and Economic Vulnerability: An International Evidence

Nam Huong Dau[1], Thanh Pham[2], Hiep Ngoc Luu[2], and Dinh Trung Nguyen[2+]

[1]*Ho Chi Minh National Academy of Politics, Hanoi, Vietnam*
[2]*VNU University of Economics and Business, Vietnam National University, Hanoi, Vietnam*

Abstract This paper examines the influence of external debt on economic vulnerability. Using an international sample of 96 countries over the period from 1990 to 2018, we find that external debts contribute to spurring economic vulnerability. In particular, we show that a higher level of external debt is associated with a greater economic vulnerability through accelerating the scale and the likelihood of external shocks in the economy. However, this finding is only hold for long-term external debt. Short-term external debt, on the other hand, can actually reduce economic vulnerability. We further examine the distribution of external debt and find that public external debt has a negative impact on economic stability, while private external debt appears to have no apparent impact. Overall, our results have important implications for authorities responsible for ensuring the resilience of the economy.

Keywords: External Debt, Economic Vulnerability

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I. Introduction

External debt has conventionally been viewed as a vital source of financing that could help a country to balance budget deficits (Dawood et al., 2021), smooth consumption (Kharusi and Ada, 2018), and absorb advanced production technology (Lin and Sosin, 2001). Altogether, these can contribute to stimulating economic growth, especially for countries with restrained capital budget and savings (Abbas and Wizarat, 2018; Kharusi and Ada, 2018). However,

+Corresponding Author: Dinh Trung Nguyen
Lecturer, VNU University of Economics and Business, Vietnam National University, 144 Xuan Thuy Street, Hanoi, Vietnam. E-mail: ndtrung@vnu.edu.vn
Co-Author: Nam Huong Dau
Deputy Director, Center for International Knowledge Exchange, Ho Chi Minh National Academy of Politics, Hanoi, Vietnam. E-mail: dauhuongnam@hcma.edu.vn
Co-Author: Thanh Pham
Lecturer, VNU University of Economics and Business, Vietnam National University, Hanoi, Vietnam. E-mail: phamthethanh@vnu.edu.vn
Co-Author: Hiep Ngoc Luu
Lecturer, VNU University of Economics and Business, Vietnam National University, Hanoi, Vietnam. E-mail: hiepln@vnu.edu.vn

external debt also has its own problems. The dependence on external debt can place a lot of pressure on the national tax system (Arellano and Bai, 2017), increase the reliance on other countries (Beck, 2003) and lead to the incidence of public debt crisis (Changyong et al., 2012). These negative externalities go beyond the scope of economic growth, which therefore raises the question of how external debt really affects the economy. Against this backdrop, this paper aims at providing a more complete picture of the effect of external debt on the economy. Specially, we examine a simple, yet important, question: "Does external debt contribute to economic vulnerability?"

Previous studies tend to focus on only on the growth or the development aspect of the economy when it comes to assessing the role of external debt (Abbas and Wizarat, 2018; Kharusi and Ada, 2018; Guei, 2019). However, how external debt affects economic vulnerability remains largely unexplored. This is surprising given that economic vulnerability refers to the risk and susceptibility of an economy to unforeseen exogenous shocks or hazardous events (Guillaumont, 2004; Briguglio et al. 2009; Virendra, 2014) and the high level of economic vulnerability can be detrimental to economic development (Guillaumont, 2010). Thus, understanding how external debts affect economic vulnerability is an important line of research and also a matter for wider policy reform.

In this paper, we exploit the Economic Vulnerability Index (EVI) developed by Feindouno and Goujon (2016) as a measure of economic vulnerability. We test the impact of external debt on economic vulnerability using data from 99 countries over the period from 1990 to 2018. Overall, we find that the dependence on external debts leads to higher level of economic vulnerability. This finding therefore provides support to the view that external debt can put a great pressure on a country's balance of payment with its debt obligations, lead to a decline in economic output, and subsequently can cause potential debt payment interruptions and possibly, future crisis (Abdullah, 1985; Lin and Sosin, 2001; Malik et al., 2010; Frankel and Saravelos, 2012).

To gain more of an understanding of the extent to which external debt affects economic vulnerability, we assess how external debt affects a country's exposure to economic shocks, as well as the size and magnitude of such shocks. We find that external debt hampers the resilience of the economy through accelerating the scale and likelihood of external shocks in the economy. External debt obligations can cause negative effects on a currency's value (Ajayi and Choi, 1993) and a nation's welfare (Gros, 2013), leading to potential economic shock. Altogether, these are consistent with previous literature that the dependence on external debt can lead to payment default and future crises (Abdullah, 1985; Frankel and Saravelos, 2012).

We further examine the impact of debt maturity on economic vulnerability and find a strong support to the view that long-term debt can lead to significant debt burdens which harm economic stability (Gros, 2013; Lorenzoni and Schmukler, 2013; Alfaro and Kanczuk, 2009).

For short-term external debt, we actually find a contradictory result. That is, short-term external debt can in fact help to improve the resilience of the economy. Compared with long-term debt, short-term debt is better managed and controlled (Calomiris and Kahn, 1991), providing greater welfare (Alfaro and Kanczuk, 2009; Broner et al., 2013), and should not be considered an indicator of crisis (Benmelech and Dvir, 2013).

Finally, we examine the distribution of external debt and find that, while public debt has a negative impact on economic stability (i.e., through increasing economic vulnerability), private debt appears to have no apparent impact. This result highlights the vulnerability of the economy due to the dependence on external public debt, consistent with the suggestions of Eberhardt and Presbitero (2015) and Drine and Nabi (2010) on the negative impact of public debt to the economy.

The rest of the paper is structured as follows: Section 2 presents data and model specification; Section 3 discusses our baseline results; Section 4 provides additional analyses; and Section 5 concludes the paper.

II. Data and Model Specification

A. Model specification

To examine the impact of external debt on economic vulnerability, we adopt the following model specification:

$$Economic\ \ Vulnerability = \beta_0 + \beta_1 External\ \ Debt_{it} + Controls_{it} + \epsilon_{it} \quad (1)$$

where $Economic\ Vulnerability_{it}$ reflects the level of economic vulnerability in country i at time t. *External Debt* is the main independent variable of interest. It captures the level of external debt held by a country in a given year. Following the extant literature, we measure *External Debt* as the ratio of total external debts to GDP (Ramzan and Ahmad, 2014; Sheng and Sukaj, 2021). $Controls_{it}$ is a set of country-specific factors that could affect the level of economic vulnerability. ϵ_{it} is the robust standard error.

One empirical challenge facing the evaluation of external debt is endogeneity. Arguably, the level of external debt held by a country is hardly exogenous, and in fact can be determined by many other factors (Chipalkatti and Rishi, 2001; Ariani and Cahyadin, 2019). If it is the case, a simple OLS estimation can lead to spurious results. To deal with this problem, we follow the common practice in the previous literature (i.e., Ullah et al., 2018) and estimate model (1) using the two-step system GMM estimator. The two-step system GMM estimator

is an appropriate technique to deal with endogeneity concerns because it can use instrumental variables to account for the correlation between independent variables and the error term. In addition, the two-step system GMM approach has a distinct benefit over some other common approaches to deal with endogeneity like the IV-2SLS method because it can address endogeneity issues using internal instruments (i.e. the appropriate lag length) rather than relying solely on external instruments or natural experiments, which are not always readily available. Additionally, the GMM approach allows for explicit modeling of the dynamic relationship between external debt and economic vulnerability by including past vulnerability levels as one of the regression variables when possible.

B. Measuring the level of economic vulnerability

In this paper, we follow Feindouno and Goujon (2015), Nguyen and Su (2020), and Nguyen and Su (2021) and measure economic vulnerability using the Economic Vulnerability index (*EVI*). The computation of the EVI is based on the concept of structural economic vulnerability. It refers to the risk that the development of a country is hindered by unforeseen events (or exogenous shocks), which could be "natural" (such as earthquakes, typhoons, droughts, etc.) or external shocks (such as fluctuations in world commodity prices, or a fall in external demand), and instabilities (such as unexpected political change) (Guillaumont, 2010). The term "structural" here means that this economic vulnerability must be caused by persistent factors, independently of the choice of recent economic and political policies of a country. In 1999, the first version of the economic vulnerability index (EVI) was proposed by the Committee for Development Policy (CDP) for the purpose of identifying the Least Developed Countries (LDCs); however, this version of the index is still heavily influenced by the previously used Economic Diversification Index (EDI) (UN, 1999). Since the 2000s, this index has been revised and updated every three years by the CDP, making it incomparable over time. Therefore, scholars at the 'Fondation pour les Etudes et Recherches sur le Développement International' (FERDI) have made several attempts to reconcile these data inconsistencies and have provided a large database of retrospective EVI for the academics (Cariolle and Guillaumont, 2011; Feindouno and Goujon, 2016). The most recent version of the EVI database, calculated by Feindouno and Goujon 2016, covers 145 developing countries (with 48 LDCs) for the period from the 1970s to 2018.

According to FERDI, the EVI is a weighted index of instabilities from trade activities, agricultural production, natural disasters, environmental issues, economic structures, populations, and the remoteness of sub-regions in a country. We chose to adopt this EVI measure in our model for two main reasons. First, this measure can largely reflect the "structural economic vulnerability" since it excludes the policy-related "resilience" component which captures to what

extent a country could respond to shocks. Second, in line with our research objectives, this measure focuses on the economic vulnerability while other measures focus more on geographic vulnerability (Turvey, 2007) or environmental vulnerability (Kaly et al., 2005).[1] Third, the FERDI EVI is arguably the most comprehensive database of them all in terms of both the number of countries (145) and the period covered (1970s to 2018).

C. Other controls

We follow the previous literature and incorporate into the baseline model (1) a number of control variables that could possibly affect the level of economic vulnerability (Cordina, 2004; Guillaumont, 2010; Wu et al., 2010; Barrot et al., 2018; Nguyen and Su, 2021). Specifically, we control for the economic condition of the country using the annual GDP growth rate (*GDP Growth*) and the natural logarithm of real GDP per capita (*GDPpc*). Guillaumont (2010) argues that low-income developing countries (LDCs) and small island developing states (SIDSs) often suffer from high levels of "primary instabilities" in their own climate, export (terms of trade), and politics. Additionally, countries with a higher output growth rate are associated with lower levels of economic vulnerability (Nguyen and Su, 2021), possibly because it allows them to build and implement effective strategies for economic and financial development, in particular the urbanization policies, to enhance their economic resilience (Douglass, 2002; Cordina, 2004; Wu et al., 2018).

We also consider the openness of the economy using the ratio of exports plus imports to GDP (*Openness*). Arguably, a country with higher trade openness makes it more susceptible to international shocks, especially in the global commodity market, thus leading to higher economic vulnerability (Loayza and Raddatz, 2007; Barrot et al., 2018; Gnangnon, 2016).

We further control for the population size using the natural logarithm of total population per sq. km of land area (*Population Density*). The extant literature documents that the negative effects of economic shocks are expected to be magnified in small countries (measured by population size) due to the diseconomies of scale (which make it more challenging for them to diversify their economies), the relatively larger and costly scale of government activities, and social polarization (Guillaumont, 2010).

We further take into account the level of government expenditure, measured as the ratio of total government expenditure to GDP (*Government Expenditure*). Although the effect of

1) There is also a newly developed hierarchical multimetric vulnerability-resilience index (NVRI) proposed by Angeon and Bates (2015). This index integrates all five dimensions of sustainable development, which are economic, governance, social, environmental, and peripheral. However, this measure is much more complicated to calculate, and it is also largely experimental at this stage. The United Nations is also developing the multidimensional vulnerability index, but this is still a work-in-progress with no data available for the academics (Guillaumont and Wagner, 2021).

government expenditures on economic vulnerability is rather ambiguous since it could stimulate economic growth (Landau, 1983; Wu et al., 2010), excessive and inefficient government spending could lead to fiscal, and ultimately, economic vulnerability (Hemming and Petrie, 2000).

We consider the level of infrastructure development using the share of total population that has access to electricity (*Electricity*), as well as the level of domestic investment, measured as the ratio of gross fixed capital formation to GDP (*Domestic Investment*). Domestic investment and infrastructure development could ease economic vulnerability since higher levels of investment could improve a country's resilience (Cordina, 2004), and sufficient infrastructure could contribute to enhance competitiveness and economic growth (Palei, 2015).

Finally, we follow Nguyen and Su (2021) and take into account the level of financial development. Prior literature shows that the degree of the financial development could also contribute to reducing vulnerability by facilitating economic development by easing financial constraints (Al Mamun et al., 2018) or improving the resource allocation efficiency (King and Levine, 1993a, 1993b), alleviating income inequality (Zhang and Naceur, 2019), and promoting environmental improvements (Zhao et al., 2019). To measure financial development, we retrieve the financial development index from the International Monetary Funds (IMF). This index represents the overall development level of financial system in a country, which is the weighted average of the access, depth, and efficiency dimensions of both financial institutions and financial markets.

D. Data and sample overview

We conduct our empirical analysis based on data retrieved from two sources. First, to proxy for economic vulnerability, we retrieve data on economic vulnerability index as suggested by Feindouno and Goujon (2016) from the Foundation for Studies and Research on International Development (FERDI) (https://ferdi.fr/en). The EVI is a synthetic index of structural vulnerability, which is composed of the likelihood and magnitude of shocks as well as the exposure to shocks, and it is independent of resilience. It is a weighted index of instabilities from trade activities, agricultural production, natural disasters, environmental issues, economic structures, populations, and the remoteness of sub-regions in a country. The index has values ranging from 0 to 100, with the higher values reflecting the greater magnitude of shocks and exposure to shocks (Feindouno and Goujon, 2016). Due to its premises in capturing different aspects of economic vulnerability as well as being available for a large number of countries, the EVI has been used extensively in recent empirical economic research (Gnangnon, 2017; Gnangnon, 2018; Nguyen and Su, 2021).

Second, we collect data on external debts, along with most of other macroeconomic variables from the World Development Indicators database provided by the World Bank. In addition, we collect the financial development index from the International Monetary Funds (IMF). Other

control variables (*GDP Growth, GDPpc, Openness, Population Density, Government Expenditure, Electricity, Domestic Investment*) are retrieved from the World Development Indicators (WDI). We conduct our empirical analysis based on a sample comprising a maximum of 1,885 country-year observations of 96 countries over a long period of time from 1990 to 2018. Our analysis starts in 1990 because this is the earliest year from which EVI data is available to collect, while 2018 is the latest year from which EVI data is available.

III. Empirical Results

A. Descriptive statistics

Table 1 provides a summary of the main variables used for empirical analysis. In general, the level of economic vulnerability (*EVI*) for the countries in our sample, measured by the economic vulnerability index (scaled by 100), is relatively low. It is reflected by a mean value of 0.335 and a standard deviation value of 0.11. On average, external debts (*External Debt*) held by countries in our sample account for approximately 51% of GDP.

Table 1. *Variable Definitions and Summary Statistic*

Variable	Definition	N	Mean	Std.	Min	p25	p50	p75	Max
EVI	The economic vulnerability index, scaled by 100	1,885	0.333	0.109	0.083	0.245	0.316	0.401	0.710
External Debt	The ratio of total external debt to GDP	1,885	0.502	0.382	0.001	0.252	0.392	0.645	4.333
GDP Growth	The annual change in real GDP	1,885	0.042	0.039	-0.364	0.024	0.044	0.063	0.336
GDPpc	The natural logarithm of GDP per capita	1,885	7.360	1.077	4.739	6.540	7.363	8.211	11.974
Openness	Sum of total exports and total imports to GDP	1,885	0.699	0.365	0.013	0.435	0.599	0.902	3.043
Population Density	The natural logarithm of people per sq. km of land area	1,885	4.030	1.312	0.434	3.122	4.099	4.913	7.450
Electricity	The ratio of people that have access to electricity to total population	1,885	0.623	0.332	0.005	0.314	0.715	0.942	1.000
Government Expenditure	The ratio of government expenditure to GDP	1,885	0.136	0.059	0.009	0.103	0.134	0.163	0.842
Domestic Investment	The ratio of domestic investment to GDP	1,885	0.227	0.084	0.028	0.175	0.213	0.265	0.810
Financial Development	The financial development index	1,885	0.194	0.130	0.019	0.098	0.150	0.269	0.735

Note. This table provides the variable definitions and the descriptive statistics of the variables used in the paper. Data was retrieved from two sources, including the Foundation for Studies and Research on International Development (FERDI)'s website and the World Development Indicators. The period of study spans from 1990 to 2018. The numbers of observations (N), means (Mean), standard deviations (Std.), minimum (Min), 25th percentiles (p25), medians (p50), 75th percentiles (p75) and maximum (Max) are reported.

With regard to the other control variables, the average annual economic growth rate, measured

by the annual change in real GDP (*GDP Growth*) is 4.2%. Trade openness (*Openness*), represented by the ratio of total imports and total exports to GDP, has an average value of 0.7. The mean value of population density (*Population Density*), measured by the natural logarithm of people per sq. km of land area, is 4.020. On average, 61.8% of each population in the sample countries have access to electricity (*Electricity*). Finally, government expenditure (*Government Expenditure*) generally accounts for 13% of GDP, while the share of domestic investment (*Domestic Investment*) to GDP is 22.6%.

Table 2 presents the correlation matrix of the main variables used for empirical analysis. As can be seen from the table, external debts and economic vulnerability are positively correlated, as reflected by the positive correlation coefficient (i.e., 0.184) between *EVI* and *External Debt*. In terms of the other variables, while GDP growth, trade openness and government expenditure are positively correlated with economic vulnerability, population density, electricity, domestic investment, and financial development are all negatively correlated with economic vulnerability.

Table 2. *Correlation Matrix*

		1	2	3	4	5	6	7	8	9	10	VIF
1	*EVI*	1.000										
2	*External Debt*	0.184	1.000									1.31
3	*GDP Growth*	0.002	-0.028	1.000								1.12
4	*GDPpc*	-0.383	-0.201	-0.070	1.000							3.47
5	*Openness*	0.175	0.277	0.080	0.219	1.000						1.36
6	*Population Density*	-0.144	-0.211	0.043	-0.024	-0.119	1.000					1.28
7	*Electricity*	-0.466	-0.068	-0.065	0.796	0.211	0.165	1.000				3.53
8	*Government Expenditure*	0.127	0.007	-0.137	0.137	0.264	-0.208	0.045	1.000			1.21
9	*Domestic Investment*	-0.085	-0.016	0.202	0.195	0.297	-0.085	0.177	0.179	1.000		1.21
10	*Financial Development*	-0.499	-0.073	0.038	0.578	0.122	0.165	0.629	0.121	0.166	1.000	1.80

Note. This table reports the correlation coefficients of all the main variables used in our study, along with the result of the VIF test. Variable definitions are provided in Table 1.

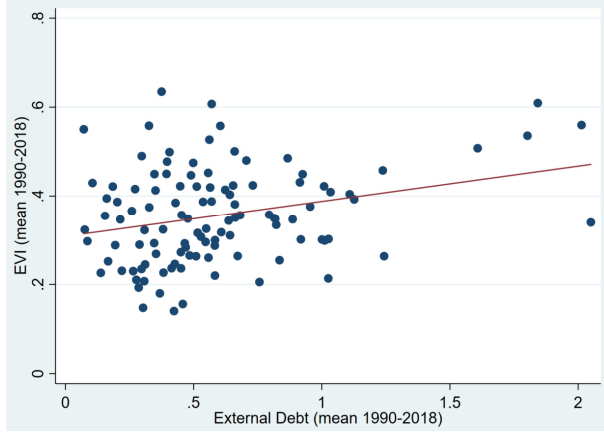
The correlations among the control variables are relatively low. The highest correlation coefficient is 0.696 between *Electricity* and *GDPpc*. We also conduct a VIF test to detect the possible multicollinearity problem. Given that all the VIF scores are very low (i.e., less than 5), multicollinearity does not appear to be a concern that drives our empirical estimation bias.

B. A preliminary analysis

To obtain a preliminary analysis on the external debt - economic vulnerability nexus, we first plot a scatterplot together with a linear prediction line showing the association between

our main dependent (*External Debt*) and explanatory variables (*EVI*) (Figure 1). The sample period is from 1990 to 2018. As can be seen from Figure 1, external debt appears to be positively associated with economic vulnerability, indicating that an expansion in the size of external debt could spur the structural economic vulnerability in a country.

Figure 1. External debt - Economic vulnerability nexus



C. Baseline results

The result of the baseline model that examines the impact of external debt on economic vulnerability is presented in Table 3.[2] Column 1 shows the result of the full sample, covering the period from 1990 to 2018. Column 2 reports the result for the period from 1990 to 1999. Column 3 shows the result for the period from 2000 to 2009, while the result for the period from 2010 to 2018 is presented in Column 4.

As can be seen from Column 1 of Table 3, the estimated coefficient on *External Debt* is positive and statistically significant. This illustrates that the increasing reliance on external debt could lead to a greater level of economic vulnerability. Our finding is therefore in line with the proposition that a high level of foreign debt might also negatively impact a country's economy as such a debt requires constant sufficient management and might put pressure on a country's balance of payment with its debt obligations (Lin and Sosin, 2001; Malik et al., 2010). In addition, a rapid growth rate of external debt can lead to potential debt payment

2) To verify whether the endogeneity issue actually exists, we conduct several Hausman specification tests across all the models (Hahn et al., 2011; Guo et al., 2018). Overall, since all the p-values are statistically significant, endogeneity appears to be an issue that leads to estimation bias. In this case, the two-step system GMM estimator would provide a more reliable and consistent result than the simple OLS estimator. Additionally, we also conduct Sargan and Hansen tests to check for the validity of the instruments used. The test results generally suggest that the null hypotheses of Hansen J-tests for over-identification restrictions cannot be rejected, whereas under-identification tests are all statistically significant, indicating that our selected instruments are valid.

interruptions in the future (Abdullah, 1985), and causes declines in economic output and equity market (Frankel and Saravelos, 2012). Altogether, these can arguably contribute to economic vulnerability.

Table 3. *Baseline Result*

	Full Sample (1)	1990-1999 (2)	2000-2009 (3)	2010-2018 (4)
External Debt	0.002**	0.005***	0.004**	0.005*
	(0.001)	(0.001)	(0.002)	(0.003)
EVI_{t-1}	0.962***	0.992***	0.934***	1.011***
	(0.021)	(0.010)	(0.007)	(0.012)
GDP Growth	-0.018***	-0.046***	0.002	-0.034**
	(0.005)	(0.008)	(0.009)	(0.015)
GDPpc	0.001**	0.002**	-0.001	0.001*
	(0.000)	(0.001)	(0.001)	(0.001)
Openness	0.002**	0.001	0.003**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Population Density	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Electricity	-0.007***	-0.008***	-0.007***	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Government Expenditure	0.010*	0.009	0.008	-0.001
	(0.006)	(0.008)	(0.007)	(0.006)
Domestic Investment	-0.011***	-0.006	-0.008**	-0.001
	(0.002)	(0.004)	(0.004)	(0.005)
Financial Development	-0.007	0.004	-0.013***	0.002
	(0.006)	(0.006)	(0.004)	(0.005)
Constant	0.013*	-0.008	0.026***	-0.009
	(0.007)	(0.007)	(0.006)	(0.007)
Year Dummies	YES	YES	YES	YES
Hausman Specification Test (p-value)	0.043	0.081	0.044	0.035
Sargan Test (p-value)	0.000	0.016	0.004	0.000
Hansen Test (p-value)	0.731	0.693	0.534	0.128
Number of Observations	1,885	356	736	793
Number of Countries	96	58	81	94

Note. This table reports the results of the baseline model in examining the impact of external debt on economic vulnerability. Column 1 presents the results of the full sample. Columns 2, 3 and 4 provide the results for three sub-sample: 1990-1999, 2000-2009, and 2000-2018, respectively. Across all of the columns, the dependent variable is *EVI*, which is the economic vulnerability index (scaled by 100). *External Debt* is the independent variable of interest, measured as the ratio of total external debts to GDP. The definitions of all the other variables are provided in Table 1. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

When breaking down the full sample into three different subsamples, covering the periods from 1990 to 1999, from 2000 to 2009, and from 2010 to 2018, we find strong and consistent

evidence that external debt leads to a higher economic vulnerability, evidenced by the positive and significant coefficients on *External Debt* in Columns 2 - 4. These results therefore corroborate the finding that external debt and economic vulnerability are positive associated, and this relationship is consistent over time.

The results of the other control variables also provide some important insights. As can be seen from Column 1, a higher economic growth rate is associated with lower economic vulnerability, as illustrated by the negative and significant coefficients on *GDP Growth*. We further find that a greater level of trade openness is associated with a greater economic vulnerability, indicated by the positive and statistically significant coefficient on *Openness*. This is consistent with the finding by Lane and Milesi-Ferretti (2010) that economies that were most affected by the global crisis in 2008 witnessed high levels of trade openness in the previous years. We also find that infrastructure development (measured as the share of population with access to electricity) is inversely related to economic vulnerability, illustrated by the negative and statistically significant coefficient of *Electricity*. This finding is consistent to the findings by Palei (2015) as sufficient infrastructure has proven to contribute to competitiveness and economic growth. Likewise, the greater level of domestic investment also appears to mitigate economic vulnerability, indicated by the negative and significant coefficient on *Domestic Investment*.

D. Robustness tests

In this section, we conduct additional robustness tests to reinforce our interpretation that external debt influences the economic vulnerability level. Specifically, we re-estimate the baseline model using the lag of all right-hand-side variables. This approach enables us to further mitigate the endogeneity concern in the form of reverse causality. The results of the model are presented in the first column of Table 4.

In an effort to further confirm the robustness of the debt-vulnerability nexus, we also re-estimate the baseline model using the IV-2SLS estimator to address endogeneity concerns. Arguably, finding an appropriate instrumental variable that need to be strongly correlated with the instrumented regressors, but not with the error term, is challenging. Following previous empirical economics literature, we instrument External Debt of a specific country in a given year, by utilising the mean value of the external debt level of other countries in the same subregion in the same year, and the mean value of the external debt level of other neighbour countries in the same year. The selections of such instruments are also based on the 'bandwagon effect', the phenomenon whereby a country's debt level is influenced by the general practices adopted by other neighbour countries.

Table 4. *Robustness Tests*

	Lag of all right-hand-side variables (1)	IV 2SLS (2)
External Debt	0.024***	0.285***
	(0.006)	(0.068)
GDP Growth	0.014	0.193**
	(0.056)	(0.087)
GDPpc	0.005	0.054***
	(0.004)	(0.014)
Openness	0.072***	-0.021
	(0.007)	(0.026)
Population Density	0.003	0.023***
	(0.002)	(0.006)
Electricity	-0.106***	-0.193***
	(0.012)	(0.029)
Government Expenditure	0.250***	0.391***
	(0.038)	(0.063)
Domestic Investment	-0.088***	-0.006
	(0.027)	(0.043)
Financial Development	-0.297***	-0.357***
	(0.021)	(0.033)
Constant	0.330***	-0.156
	(0.027)	(0.134)
Year Dummies	YES	YES
Number of Observations	1,815	1,885
Number of Countries	96	96

Note. This table reports the results of the model in examining the impact of external debt on economic vulnerability. Column 1 shows the results of the model estimated using the lag of all right-hand-side variables. Column 2 reports the results of the model estimated using the IV-2SLS estimator. In both columns, the dependent variable is *EVI*, which is the economic vulnerability index (scaled by 100). *External Debt* is the independent variable of interest, measured as the ratio of total external debts to GDP. The definitions of all the other variables are provided in Table 1. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Overall, the baseline results stay largely unchanged.

IV. Additional Analyses

A. Exposure to shocks and magnitude of shocks

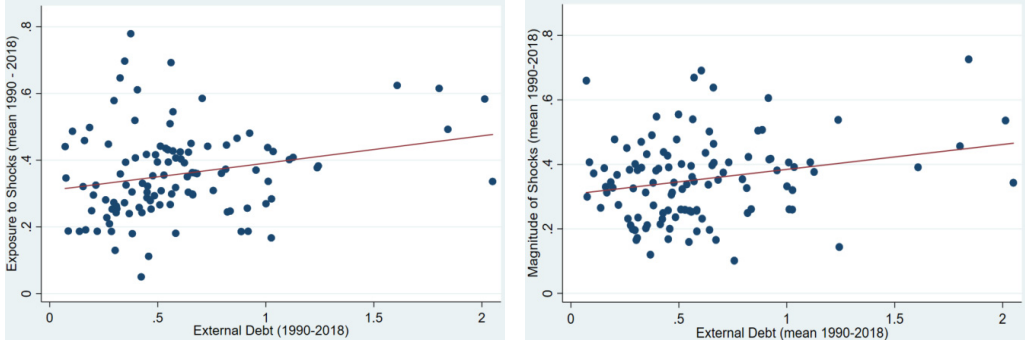
Up to this point, we have found that a high level of external debt might lead to an increase in economic vulnerability. In order to gain more insights on the debt-vulnerability nexus, we examine to what extent external debt can affect a country's exposure to economic shocks, as well as the size and magnitude of such shocks. Arguably, the current body of research suggests

that a country with substantial and increasing level of external debts could suffer a "debt overhang" issue. According to the "debt overhang" theory, high and increasing levels of external debts could reduce a country's ability to invest in productive sectors (Mankiw & Elmendorf, 1999; Navarro-Ortiz & Sapena, 2020). This could result in lower productivity, slower economic growth, and higher inflation. All of these issues could make an economy more susceptible to macroeconomic shocks, as export diversification decreases and the instability of goods increases (Mazengia et al., 2023).

To test how external debts influence economic vulnerability through affecting a country's exposure to economic shocks, as well as the size and magnitude of such shocks, we augment the baseline model (1) and sequentially replace the dependent variable EVI with two of its sub-indices *Exposure to Shocks* and the *Magnitude of Shocks.* Specifically, *Exposure to Shocks* is an index that measures the extent to which a country is affected by external shocks. It is constructed as the weighted average of 5 component indices, including population size, remoteness from world markets, export concentration, share of agriculture, forestry and fisheries in GDP, and a share of population living in low coastal areas. The index has a value ranging from 0 to 100, with 100 being more exposure to shocks.

Meanwhile, the *Magnitude* of *Shocks* is an index that captures the size and magnitude of external shocks exposed by a country. It is constructed as the weighted average of 3 component indices, including victims of natural disasters, instability in agricultural production and instability in the export of goods and services. Similar to the *Exposure to Shocks* index, the *Magnitude* of *Shocks* index has a value ranging from 0 to 100, with 100 being the most severely affected by external shocks.

Figure 2. External debt, exposure to shocks and magnitude of shocks



a: External Debt and Exposure to Shocks

b: External Debt and Magnitude of Shocks

To test how external debts influence economic vulnerability through affecting a country's exposure to economic shocks, as well as the size and magnitude of such shocks, we augment

the baseline model (1) and sequentially replace the dependent variable *EVI* with two of its sub-indices *Exposure to Shocks* and the *Magnitude* of *Shocks*. Figure 2a shows the association between *External Debt* and *Exposure to Shocks*, while Figure 2b shows the association between *External Debt* and *Magnitude of Shocks*.

Table 5. *Exposure to Shocks and Magnitude of Shocks*

	Exposure to Shocks (1)	*Magnitude of Shocks* (2)
External Debt	0.001**	0.008***
	(0.001)	(0.003)
Exposure to Shocks$_{t-1}$	1.000***	
	(0.005)	
Magnitude of Shocks$_{t-1}$		0.960***
		(0.019)
GDP Growth	0.001	-0.030***
	(0.001)	(0.010)
GDPpc	0.001***	0.000
	(0.000)	(0.001)
Openness	-0.000	-0.000
	(0.001)	(0.001)
Population Density	-0.000***	-0.000
	(0.000)	(0.000)
Electricity	0.000	-0.011***
	(0.001)	(0.003)
Government Expenditure	0.002	0.013**
	(0.002)	(0.006)
Domestic Investment	-0.010***	-0.011***
	(0.001)	(0.004)
Financial Development	-0.001	0.001
	(0.002)	(0.005)
Constant	-0.005***	0.019*
	(0.002)	(0.011)
Year Dummies	YES	YES
Hausman Specification Test (p-value)	0.026	0.009
Sargan Test (p-value)	0.002	0.000
Hansen Test (p-value)	0.336	0.656
Number of Observations	1,885	1,885
Number of Countries	96	96

Note. This table reports the results of the models when examining the impact of external debt on the exposure and magnitude of external shocks. In Column 1, the dependent variable is *Exposure to Shock*, which is an index that measures the extent to which a country is affected by external shocks. In Column 2, the dependent variable is *Magnitude of Shock*, which is an index that captures the size and magnitude of external shocks exposed by a country. In both of the columns, the independent variable is *External Debt*, which is the ratio of total external debt to GDP. The definitions of all other variables are provided in Table 1. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The result of the augmented model is presented in Table 5. As can be seen in Table 5, the estimated coefficients on *External Debt* are positive and statistically significant in both columns. This result illustrates that while external debt can exert a significant impact on the extent to which a country is affected by external shocks (by increasing the *Exposure to Shocks* index), it also hampers the resilience of the economy by accelerating the scale and likelihood of shocks in the economy (by increasing the *Magnitude of Shocks* index).

Overall, this result provides support to the prior literature that external debt can be an indicator of future crises and payment default (Abdullah, 1985; Frankel and Saravelos, 2012). In addition, since external debt might exert a negative impact on a currency's value (Ajayi and Choi, 1993), the likelihood of an economic shock caused by the instability of goods (which is covered by the *Magnitude of Shock* index) for countries relying heavily on external debt would increase accordingly. Furthermore, unlike domestic debt obligations, the interest rates on external debt mean a reduction in a nation's welfare, because resources are transferred abroad to cover the debt (Gros, 2013). This welfare loss may also contribute to the likelihood of a shock in the future.

B. Loan terms

Debts with different maturity dates may exert different effects on the economy. Extant literature documents that a short-term debt is generally cheaper than a long-term one and the benefits from this might generate higher welfare than long-term loans (Alfaro and Kanczuk, 2009; Broner et al., 2013). Benmelech and Dvir (2013) explain that short-term debts might be a ramification of crisis rather than the cause as borrowers at their limit of debt capacity would naturally stack up short-term financing. More importantly, short-term debt obligations might also encourage the officials who are responsible to repay the debt to seek optimization in their operation (Calomiris and Kahn, 1991). All together, these would help to improve the resilience of the economy.

However, short-term debt can also make borrowers more vulnerable to liquidity risk in case lenders refuse to refinance (Diamond, 1991). Short-term debt might put pressure on borrowers because of its tight payment schedule, and the demand of liquidity of the lenders. As a result, the excessive level of short-term debt is considered to be associated with a high probability of economic crisis (Brunnermeier, 2009; Tirole, 2003). Moreover, the payment pressure and re-financing risk associated with short-term debt might not allow for effective long-term investment and may even generate lower information transparency and crashes in the future (Cheng et al., 2020). These effects would collectively make the economy become more vulnerable.

Long-term debt, however, also has its own premises. Arguably, long-term debt is associated with less liquidity risk or roll-over risks. It can even reduce interest dispersion and avoid tax distortion. Unlike the short-term debt that requires a regular rollover, and is exposed to interest

volatility, long-term debt can accommodate such changes and allow for tax stability (Alfaro and Kanczuk, 2009). In this regard, long-term debt can be associated with less economic vulnerability. However, Alfaro and Kanczuk (2009) also highlight that these benefits can be outweighed by the lower cost of short-term financing and eventually result in lower welfare.

Table 6. *Long-term vs Short-term Debts*

	Long-term debt (1)	Short-term debt (2)
Long-Term Debt	0.011** (0.005)	
Short-Term Debt		-0.004*** (0.001)
EVI_{t-1}	1.020*** (0.018)	0.964*** (0.013)
GDP Growth	-0.027*** (0.007)	-0.016*** (0.005)
GDPpc	0.000 (0.000)	-0.000 (0.000)
Openness	-0.000 (0.001)	0.004*** (0.001)
Population Density	-0.000* (0.000)	-0.001*** (0.000)
Electricity	-0.002 (0.002)	-0.005*** (0.001)
Government Expenditure	0.000 (0.005)	0.009*** (0.003)
Domestic Investment	-0.007*** (0.002)	-0.010*** (0.002)
Financial Development	0.010* (0.005)	-0.005 (0.004)
Constant	-0.009 (0.007)	0.021*** (0.006)
Year Dummies	YES	YES
Hausman Specification Test (p-value)	0.000	0.000
Sargan Test (p-value)	0.000	0.000
Hansen Test (p-value)	0.740	0.731
Number of Observations	1,885	1,885
Number of Countries	96	96

Note. This table reports the result of the model when examining the impact of short-term and long-term external debt on economic vulnerability. In Column 1, *Short-term Debt* is the ratio of total debts whose original maturity is one year or less to GDP. In Column 2, *Long-term Debt* is the ratio of external debt with original maturity longer than one year to GDP. In both of the columns, the dependent variable is *EVI*, which is the economic vulnerability index (scaled by 100). The definitions of all other variables are provided in Table 1. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

To this end, how the loan term affects economic vulnerability still remains to be an open empirical question. In this section, we attempt to test our model's implication by separately replacing the independent variable *External Debt* in the baseline model (1) with two other variables capturing the volume of short-term debt and long-term debt owned by a country. Accordingly, *Short-term Debt* is the ratio of total debts whose original maturity is one year or lower to GDP. Meanwhile, *Long-term Debt* refers to the ratio of external debt with original maturity longer than one year to GDP.

The results of the models examining the impact of short-term and long-term external debts on economic vulnerability is presented in Columns 1 and 2 of Table 6. As can be seen from Column 1, when assessing the impact of long-term external debt on economic vulnerability, the estimated coefficient of *Long-term Debt* is positive and statistically significant. This illustrates that the increased reliance on long-term debt could lead to more economic vulnerability. Overall, this result corroborates our baseline finding, and provides support for the proposition that long-term debts may generate significant costs and burdens that could lead up to economic vulnerability (Gros, 2013; Lorenzoni and Schmukler, 2013; Alfaro and Kanczuk, 2009).

Interestingly, the result of the model estimating the impact of short-term debt on economic vulnerability provides a contradictory implication. As can be seen from Column 2 of Table 6, the estimated coefficient on *Short-term Debt* is negative and statistically significant. This indicates that short-term debts help to reduce economic vulnerability. These results are in accordance with the previous positions that short term debt might promote better debt management (Calomiris and Kahn, 1991), results in greater welfare affects (Alfaro and Kanczuk, 2009; Broner et al., 2013) and should not be considered to be an indicator of crisis (Benmelech and Dvir, 2013).

C. Public vs Private debt

The extant literature provides some evidence documenting a negative association between public external debt and economic growth (Eberhardt and Presbitero, 2015), especially when the level of public external debt excesses a certain threshold (Reinhart and Rogoff, 2010). The feasible explanation is that excessive stocks of public external debt may result in a tighter fiscal policy and will eventually become a hindrance to domestic businesses (Drine and Nabi, 2010).

On the other hand, it might be possible that external private debt contributes to economic stability. This is because external private debt can help to reduce the cost of credit and exert a positive impact on economic growth due to better and more cost-efficient debt management (Hallak, 2013).

We attempt to test these propositions. To do so, we augment the baseline model (1) by replacing the independent variable, *External Debt*, with two other variables that capture the level of external public debt (*Public Debt*) and external private debt (*Private Debt*) in a country.

Specifically, *Public Debt* is defined as the ratio of total external debts that are guaranteed for repayment by a public entity to GDP. Meanwhile, *Private Debt* is the ratio of total external debts that are not guaranteed for repayment by a public entity to GDP. The results of the models examining the impact of external public debt and external private debt on economic vulnerability are presented in Columns 1 and 2 of Table 7.

Table 7. *Public Debt vs Private Debt*

	Public Debt (1)	Private Debt (2)
Public Debt	0.005*** (0.002)	
Private Debt		-0.007 (0.005)
EVI_{t-1}	0.752*** (0.027)	0.921*** (0.036)
GDP Growth	-0.006 (0.005)	-0.006 (0.005)
GDPpc	0.003* (0.001)	0.001 (0.001)
Openness	0.017*** (0.003)	0.007* (0.004)
Population Density	0.000 (0.001)	-0.001* (0.001)
Electricity	-0.029*** (0.006)	-0.012*** (0.004)
Government Expenditure	0.074*** (0.014)	-0.010 (0.010)
Domestic Investment	-0.021*** (0.007)	-0.010** (0.005)
Financial Development	-0.063*** (0.011)	-0.007 (0.008)
Constant	0.071*** (0.015)	0.029* (0.017)
Year Dummies	YES	YES
Hausman Specification Test (p-value)	0.039	0.042
Sargan Test (p-value)	0.000	0.000
Hansen Test (p-value)	0.640	0.568
Number of Observations	1,885	1,198
Number of Countries	96	72

Note. reports the result of the model when examining the impact of external public debt and external private debt on economic vulnerability. In Column 1, *Public Debt* is the ratio of total external debts that are guaranteed for repayment by a public entity to GDP. In Column 2, *Private Debt* is the ratio of total external debts that are not guaranteed for repayment by a public entity to GDP. In both of the columns, the dependent variable is *EVI*, which is the economic vulnerability index (scaled by 100). The definitions of all other variables are provided in Table 1. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

As can be seen from Table 7, only external public debt exerts a significant impact on economic vulnerability, indicated by the positive and statistically significant coefficient on *Public Debt* (Column 1). This result implies that the greater reliance on external debts that are guaranteed for repayment by a public entity including the central governments, public corporations, and state-owned enterprises lead to an undesirable consequence in terms of accelerating economic vulnerability. Thus, it also provides support to the claims by Eberhardt and Presbitero (2015) and Drine and Nabi (2010) on the negative effects of public debt on the economy. External private debt, on the other hand, does not appear to relate significantly to economic vulnerability as the estimated coefficient on *Private Debt* is not statistically significant (Column 2).

V. Conclusion

External debt has been viewed as a vital source of financing that contributes to stimulate economic growth, especially for countries with restrained capital budgets and savings to attain their development goals (Chenery and Strout, 1966; Abbas and Wizarat, 2018). However, the benefits of external debt can be overwhelmed by the risk and costs associated with external debt in terms of an economic shock or even a crisis.

In this paper, we investigate the impact of external debt on economic vulnerability. We use the Economic Vulnerability Index (EVI) developed by Feindouno and Goujon (2016) as a measure of economic vulnerability. We find that the dependence on external debt hampers the resilience of the economy through accelerating the scale and likelihood of external shocks in the economy. However, this negative impact is only the case for long-term external debt. Meanwhile, short-term external debt could provide an opportunity to reinforce economic resilience. We also document that public debt has a negative impact on economic stability, while private debt appears to have no apparent impact.

Overall, our study contributes to the existing literature in a number of ways. First, the study contributes to the emerging strand of research examining the determinants of economic vulnerability, which is one of the key aspects reflecting economic development that has received much attention in recent studies (Gnangnon, 2018; Nguyen and Su, 2021). Second, it contributes to the strand of literature examining the cost of external debt for the national economy on a macro level. Our research emphasizes the negative externalities associated with external debts. In this regard, policymakers and authorities responsible for maintaining a sustainable economic development need to consider the formation, allocation, and repayment of external debts carefully in order to take advantage of the growth benefits and ensure the economic resilience of the country.

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