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Trade Openness and
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On the Relationship between Trade Openness and Government Size

Abstract

Does trade openness systematically imply bigger governments, as proposed by [Rodrik \(1998\)](#)? This paper presents a novel and more refined explanation for when and why international trade may enlarge the public sector. We propose that trade openness is associated with bigger governments if (i) the price volatility of a country's export basket is substantial and (ii) the country is democratic. The first condition satisfies the prior that open trade barriers indeed introduce uncertainty and external risk – something that is not necessarily the case for all trade. The second condition ensures that the people's desire for greater economic security can be realized through government spending. Empirical evidence for 143 countries (accounting for approximately 96 percent of world population) from 2000-2016 is consistent with this hypothesis. Exploring areas of public spending, we find intuitive patterns: Consistent with the compensation hypothesis, government spending on economic affairs and housing increases significantly with trade openness, whereas public spending on education, health care, and the military are not immediately concerned. As with our general result, this is only the case in democracies that are subject to high price volatility on the global market.

JEL-Codes: F140, F410, H100.

Keywords: economic globalization, trade openness, government size, export price volatility, democracy.

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1 Introduction

The empirical evidence on the link between trade openness and government size remains divided. [Cameron \(1978\)](#) and [Rodrik \(1998\)](#) propose trade openness, usually measured as the sum of exports and imports divided by GDP, as a systematic driver of government spending (also see [Ram, 2009](#)). They argue that trade openness exposes economies to external risk, which requires state spending to ensure appropriate protection and compensation mechanisms in place. However, subsequent studies have produced mixed empirical results for the *compensation hypothesis*. Some analyses find no relationship ([Liberati, 2007](#); [Benarroch and Pandey, 2008](#); also see [Dreher et al., 2008](#)), whereas others suggest at least a weak positive relationship for some areas of government spending ([Shelton, 2007](#); [Benarroch and Pandey, 2012](#)) or in different samples and time periods ([Jetter and Parmeter, 2015](#)). Thus, a consensus regarding the *compensation hypothesis* has remained elusive, even though [Figure 1](#) tells us that both trade openness and government size (both measured as shares of GDP) have been climbing up consistently over the past decades.

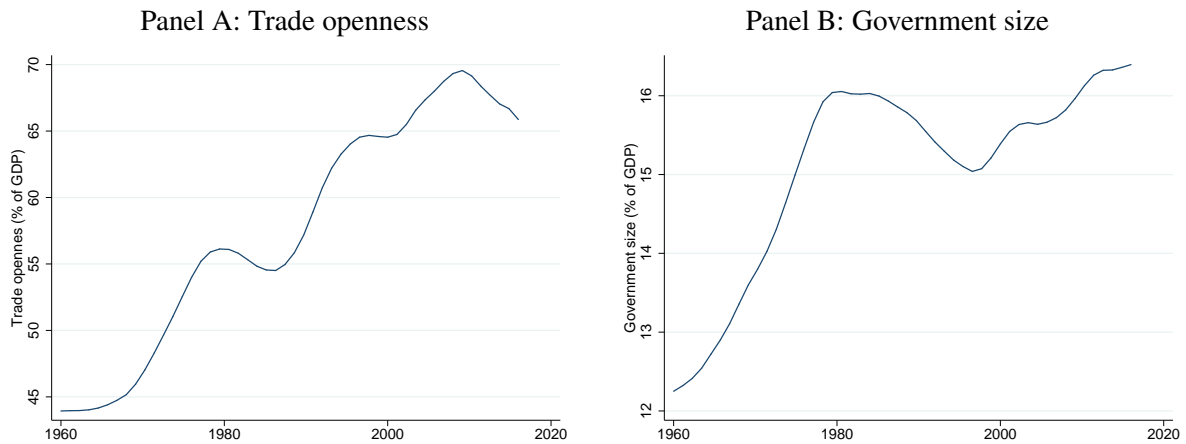


Figure 1: Average trade openness and government size for countries that exhibit continuous data from 1960 to 2016 (86 countries for trade openness; 70 countries for government size).

In the following pages, we propose an explanation of when and why trade openness may systematically affect the size of government. We hypothesize that two conditions need to be fulfilled for trade openness to induce bigger governments. First, the country’s export basket needs to be subject to substantial price volatility – otherwise, the external risk assumption put forward by [Rodrik \(1998\)](#) remains

unfulfilled. Second, we stretch beyond the economic sphere by identifying an important political economy component in the mechanics between trade openness and government size: The role of regime type. Intuitively, [Rodrik's \(1998\)](#) envisioned dynamics can hold in democratic countries, where constituents can directly influence the dimensions of government spending through elections and other democratic processes. [Figure 2](#) presents a first hint at the importance of regime form, plotting the correlation between trade openness and government size for democracies (left) and non-democracies (right).

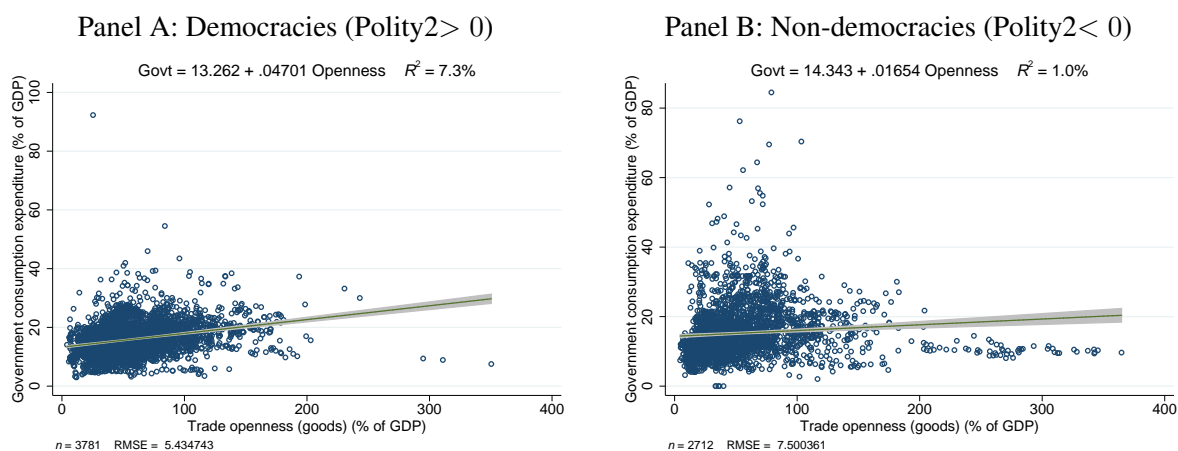


Figure 2: Correlation between trade openness and government size for democracies (left) and non-democracies (right), using an unbalanced sample of 162 countries from 1960 – 2016.

We first introduce a data set of export price volatility, accessing export unit values at the HS 6-digit level.¹ We construct a country-specific measure of annual export price volatility exploiting more than 80 million bilateral export unit values in 179 countries from 2000 to 2016. In particular, we calculate the three-year rolling standard deviation of each good's world export price before weighting that number by the country's export basket. Intuitively, the resulting value indicates how much volatility the country's export is facing presently and in the immediate past. We then regress government size on trade openness, export volatility, and an interaction term between both. Indeed, neither trade openness nor volatility by itself matters; however, the interaction term turns positive and statistically significant at the one percent level in democratic countries. Thus, trade openness may indeed enlarge governments – but only under increasingly volatile world prices of a democracy's exports.

¹We access the CEPII international trade unit values database ([Berthou and Emlinger, 2011](#)) that has recently been used in various studies, such as [Blonigen \(2015\)](#), [Cadot and Gourdon \(2016\)](#), and [Chen and Juvenal \(2016\)](#).

To further dig into underlying channels, we then study areas of government expenditure. If our empirical results indeed picked up the dynamics envisioned by [Rodrik \(1998\)](#), democracies should exhibit a rise in those areas of public spending that aim to address the volatility of global economic forces after an opening of trade barriers. Using data on the components of public spending from the World Development Indicators (WDI, [World Bank, 2018](#)) and the OECD ([OECD, 2018](#)), we do find supporting evidence. Trade openness is associated with more public expenditure on economic affairs, housing, and social protection when export price volatility is high in democracies. However, and confirming our intuitive priors, government expenditure related to the military, education, or health care appear less affected.

Overall, this paper aims to contribute to three distinct areas of research. First, we advance our understanding of what drives the size of government (e.g., see [Shelton, 2007](#)). As public spending relative to GDP has been growing consistently throughout the world, on average, it becomes more important to understand the underlying drivers of those developments. Our findings suggest that economic globalization indeed matters – but only under distinct conditions of (i) substantially volatile export prices and (ii) democratic structures. We therefore complement studies that consider political polarization and democracy in the context of explaining government size (e.g., see [Mulligan et al., 2004](#), [Avelino et al., 2005](#), and [Lindqvist and Östling, 2010](#)).

Second, understanding the consequences of economic globalization now matters more than ever, after recent political events, such as Brexit (e.g., see [Colantone and Stanig, 2018a](#)), US-Chinese trade relationships ([Owen and Quinn, 2016](#)), and many other developments that directly or indirectly refer to globalization (e.g., see [Autor et al., 2016](#), and [Colantone and Stanig, 2018b](#)). Policymakers, researchers, and the public need to better understand the domestic consequences of opening up trade barriers. We hope our results can help us to better anticipate what may happen after such developments.

Third and final, our paper informs the debate on what may happen if global goods markets become more volatile. One consequence of volatile prices may be larger governments in a particular group of countries (democracies that are open to international trade) but not in others. As such, our results are related to those from [Blattman et al. \(2007\)](#) and [Bazzi and Blattman \(2014\)](#) who find empirical support for the hypothesis that the price volatility of exports can substantially affect domestic incomes, investment, consumption, and even conflict.

2 Data and Methodology

Our raw data are derived from five sources: UNComtrade (UNSD, 2018), CEPII (Berthou and Emlinger, 2011), the WDI (World Bank, 2018), the OECD (OECD, 2018) and the Polity IV project (Marshall and Jaggers, 2017). Table 1 documents summary statistics, whereas detailed variable definitions and sources are referred to Table A1.

Table 1: Summary Statistics for all country-year observations between 2002 and 2016.

Variables	Obs	Mean	(Std. Dev.)	Min	Max
Government size (gov't consumption % of GDP)	1,857	15.90	(4.92)	2.05	35.48
Trade openness (goods trade, % of GDP)	1,857	68.75	(38.05)	6.46	345.42
Export price volatility index ^a	1,857	24	(75)	3	1,846
Population (in thousand)	1,857	49,962	(164,092)	446	1,378,665
Real GDP per capita	1,857	14,760	(19,970)	218	111,968
Polity2 (-10 to +10)	1,857	4.85	(5.88)	-10	10
Democracy (0 to +10)	1,834	6.28	(3.67)	0	10

Notes: ^aSection 2.1 presents a detailed description of how we derive the export price volatility index.

2.1 Data on the Volatility of Exports

First, we describe how we construct our measure of price volatility of a country's export basket from annual data for 179 countries from 2000 to 2016.² To do so, we use over 80 million product- and country-specific export unit values at the HS 6-digit level from the CEPII international trade unit values database (Berthou and Emlinger, 2011). We first derive global prices for each good. To calculate product and country export shares, we access product-country-year data from the World Integrated Trade

²Although we constructed our export price volatility index for 179 countries, unavailability of data on government expenditure, trade openness, and other control variables limit the analysis for 143 countries between 2002 and 2016 (i.e. 1,857 observations on country-year-specific government size, trade openness and other variables).

Solutions database (WITS), available from the United Nations International Trade Statistics Database (UN Comtrade) (UNSD, 2018). We now briefly describe the derivation of our measure for export price volatility.

2.1.1 Global Export Price Index

To facilitate notation, we ignore time subscripts as all values are taken in year t . Let us assume product k is exported by country i to country j with $j \neq i$: p_{ij}^k . We take the geometric mean of i 's exports of good k to all its trade partners who buy k in the given year from i to derive

$$p_i^k = \left(\prod_{j=1}^n p_{ij}^k \right)^{\frac{1}{n}}. \quad (1)$$

Then, we calculate country i 's global share in exporting k as

$$s_i^k = \frac{x_i^k}{X^k}, \quad (2)$$

where x_i^k represents the total export value of product k for country i . X^k represents the total world export value of product k , calculated as $X^k = \sum_{i=1}^n x_i^k$.

Next, we calculate the weighted average world export unit price of product k as

$$P^k = \sum_{i=1}^n p_i^k \times s_i^k. \quad (3)$$

Since prices are denoted in nominal US\$, we convert them to constant 2010 US\$ through the US consumer price index, CPI_t (2010=100). Finally, we construct a world export price index by indexing each price series to 100 for the year 2010.

2.1.2 Price Volatility of Export Baskets

With a global price P_t^k for year t , we measure k 's global export price volatility (v_t^k) as the standard deviation of the world export unit price index (P_t^k) from year $t - 2$ to t as

$$v_t^k = \sqrt{\frac{1}{3} \sum_{\tau=1}^3 (P_\tau^k - \bar{P}_s^k)^2}, \quad (4)$$

where P_τ^k is the world export price index for product k in year τ within the period $s = t - 2, t - 1, t$, and $\bar{P}_s^k = \frac{1}{3} \sum_{\tau=1}^3 P_\tau^k$.

Next, we calculate product k 's share in country i 's exports in year t as

$$w_{i,t}^k = \frac{x_{i,t}^k}{X_{i,t}}, \quad (5)$$

where $x_{i,t}^k$ represents the total export value of product k and $X_{i,t}$ represents all exports of country i , calculated as $X_{i,t} = \sum_{k=1}^n x_{i,t}^k$.

Finally, we construct the price volatility of i 's export basket ($V_{i,t}$) as the weighted average of i 's exports in the given year:

$$V_{i,t} = \sum_{k=1}^n v_t^k \times s_{i,t}^k. \quad (6)$$

In the empirical estimations, we use $V_{i,t}$ as our proxy for the volatility of a country's export basket. By using lagged values from $t - 2$, $t - 1$, and t , we also reduce the possibility of reverse causality, i.e., the chance that government spending in its own right may somehow affect the volatility of a country's export basket.

2.2 Data on Government Size, Trade Openness, Democracy, and Covariates

Consistent with the literature (e.g., see [Meltzer and Richard, 1981](#), [Ram, 1986](#), and [Shelton, 2007](#)), we predict the share of government consumption in GDP as a proxy for government size.³ Similarly,

³We consider general government final consumption expenditure here. According to the World Bank national accounts data definition, general government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government

the share of merchandise trade (the sum of exports and imports of all goods) in GDP denotes trade openness, following [Rodrik \(1998\)](#), [Shelton \(2007\)](#), and [Ram \(2009\)](#), among others. Our regression analysis also includes population size and GDP per capita as important covariates that may independently affect government spending and may confound the role of trade openness, if ignored. Specifically, we take the natural logarithm of both variables, following [Alesina and Wacziarg \(1998\)](#), [Rodrik \(1998\)](#), and [Shelton \(2007\)](#). We refer to [Alesina and Wacziarg \(1998\)](#), [Ram \(2009\)](#), and [Jetter and Parmeter \(2015\)](#) for the importance of population size, whereas Wagner's law and the ratchet effect form traditional hypotheses related to the role of income levels in explaining government size (e.g., see [Ram, 1987](#), [Heller and Diamond, 1990](#), and [Rodrik, 1998](#)). These variables are derived from the World Bank Development Indicators (WDI) ([World Bank, 2018](#)).

Trade openness is often measured as the share of trade in GDP, where trade is the sum of exports and imports of goods and services. However, we calculate trade openness as the share of the sum of exports and imports of *merchandise goods* in GDP. This is mainly because our export price volatility index is constructed using only the export unit price of all merchandise goods exported at the HS 6-digit level. Therefore, calculating trade openness using only merchandise trade as the share of GDP reflects the more accurate channel through which volatile export prices could affect the association between government size and trade openness. In 2017, merchandise goods export account for approximately 77 percent of total world exports ([WTO, 2018](#)).

Finally, the democratic status of a country plays an important mediating role in our analysis. We access the prominent *polity2* variable provided by the Polity IV index ([Marshall and Jaggers, 2017](#)), as well as the sub-indicator focusing on democracy (variable *democ*). To facilitate the comparison of coefficients, we standardize all variables.

capital formation ([World Bank, 2018](#)). We exclude observations for which government expenditure is valued at more than 100 percent of its GDP. Specifically, we omit three observations of Timor-Leste for 2000-2002, when its real GDP was contracted by one third, and a strong effort was made to put institutions in place and addressing severe poverty mainly with the help of foreign assistance following its independence ([Lundahl and Sjöholm, 2006](#)).

2.3 Empirical Methodology

Our empirical strategy builds on a conventional regression format, predicting government size as a share of GDP with trade openness, export price volatility, and an interaction term between both variables. The availability of export price data allows us to analyze this relationship in a panel setting of 143 countries for the period 2000 to 2016. Our baseline estimation takes the following form:

$$Gov't\ size_{i,t} = \beta_0 + \beta_1 Open_{i,t} + \beta_2 V_{i,t} + \beta_3 Open_{i,t} \times V_{i,t} + \beta_4 \mathbf{Z}_{i,t} + \gamma_i + \lambda_t + \varepsilon_{i,t}, \quad (7)$$

where $Gov't\ size_{i,t}$ and $Open_{i,t}$ measure government size and trade openness for country i in year t . $V_{i,t}$ stands for the country-specific export price volatility introduced in Section 2.1. $\mathbf{Z}_{i,t}$ constitutes a vector of time-varying covariates representing observable country characteristics that may carry an independent effect on government size. Specifically, we include measures for population size and GDP per capita, as suggested by the corresponding literature predicting government size (see Section 2.2). Further, country- and time-fixed effects are captured by γ_i and λ_t , whereas $\varepsilon_{i,t}$ represents the usual idiosyncratic error term. One would be concerned about time-varying factors that are correlated with both government size and export price volatility, as [Bazzi and Blattman \(2014\)](#) note that prices of a broad basket of consumption goods are positively associated with export prices of an individual country. To address such a possible delayed effect of volatile export earnings, we construct our price volatility index considering export prices from years $t - 2$ until t . Year-fixed effects account for potential biases from global developments, such as the Global Financial Crisis. Throughout our estimations, we report standard errors clustered at the country level, although our findings are not sensitive to alternative clustering strategies.

After estimating equation 7 for the full sample, we then consider democratic country-year observations only. In our main estimations, we choose a cutoff of $polity2 > 0$ to proxy for democratic governments. Nevertheless, our conclusions are consistent when applying stricter definitions of democracy (e.g., only considering observations with $polity2 > 5$, as suggested by the Polity IV Codebook). Core to our estimation strategy is the interaction between trade openness and country export price volatility ($Open_{i,t} \times V_{i,t}$). If our hypothesis was correct, we would expect a positive and statistically significant coefficient β_3 , indicating that trade openness would enlarge governments more if the respective country's

export basket was exposed to a higher level of price volatility. In other words, democratic governments, and by extension the electorate, may choose to shield itself from external shocks through increased compensatory spending.

Finally, after our main regressions following equation 7, we also investigate particular segments of government spending, using the same set of covariates from equation 7.

3 Main Results

Table 2 documents our main results. In column (1), we first provide a reference point of regressing government size on trade openness alone, using the *full* WDI sample, i.e., all country-year observations for which data on both variables are available since 1960. Trade openness emerges as a positive and marginally statistically significant predictor of government size. In column (2), we include the covariates discussed in equation 7, as well as country- and year-fixed effects. Now, trade openness is not meaningfully different from zero in predicting government size, reflecting much of the empirical results by other studies since Rodrik (1998), such as Liberati (2007), Benarroch and Pandey (2008), and Jetter and Parmeter (2015).

In column (3), we replicate that same regression for our 2002-2016 sample, i.e., all country-year observations in which our volatility measure is available. Again, trade openness remains statistically and economically irrelevant, which shows that our subsample of data from 2002 to 2016 produces results that are comparable to those from going back to 1960. Thus, any results we derive from here on with the shorter sample are less likely to be explainable by particular time periods alone. In column (4), we introduce the volatility measure of the country's export basket, as well as an interaction term with trade openness. If trade openness and export price volatility were sufficient to unveil a potentially underlying link between openness and government size, column (4) should produce promising results. However, that is not the case.

In column (5), we turn to the specification we propose by focusing on those country-year observations with a *polity2* score above zero. Indeed, we now observe strong statistical power on the interaction term at the one percent level. Thus, a generic regression of government size on trade openness masks two

Table 2: Main regression results predicting government size. All variables are standardized to facilitate quantitative comparisons.

	(1)	(2)	(3)	(4)	(5)	(6)
Years:	1960-2016				2002-2016	
Countries:	All	All	All	All	<i>Democracies</i>	<i>Autocracies</i>
<i>Dependent variable: Government size</i>						
Trade openness	0.208*	0.052	-0.007	-0.007	0.106	-0.053
	(0.117)	(0.070)	(0.101)	(0.099)	(0.108)	(0.096)
Export price volatility				-0.032**	-0.108	-0.020
				(0.014)	(0.089)	(0.014)
Trade openness × export price volatility				0.047	0.230***	-0.028
				(0.050)	(0.075)	(0.035)
Ln (Population), Ln(GDP/cap), country- and time-fixed effects		yes	yes	yes	yes	yes
# of countries	159	157	143	143	115	51
# of years	57	57	15	15	15	15
<i>N</i>	6,611	6,447	1,857	1,857	1,399	429

Notes: Standard errors clustered at the country level are displayed in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1% levels. Democracies capture country-year observations in which *polity2* > 0 (column 5), whereas autocracies refer to those observations where *polity2* < 0 (column 6).

necessary moderators: The regime form in which Rodrik’s (1998) envisioned dynamics can unfold and the volatility of the respective country’s export basket.

Figure 3 visualizes the derived coefficients from column (5) relative to other covariates. Since all variables have been standardized before our estimations, we can conveniently compare magnitudes. First, neither openness nor export price volatility matter statistically by themselves; and even economically, the corresponding magnitudes would be smaller than that associated with the interaction term between both. These results indicate that a one standard deviation increase in openness and volatility would be associated with a rise in government size by approximately 23 percent of a standard deviation. This result is markedly different from zero (p-value of 0.003; full calculation: $0.106 - 0.108 + 0.230 = 0.228$). The coefficient on the right of Figure 3 then plots the relationship of GDP per capita with government spending and we also derive a coefficient that remains indistinguishable from zero in statistical terms (p-value of 0.317).

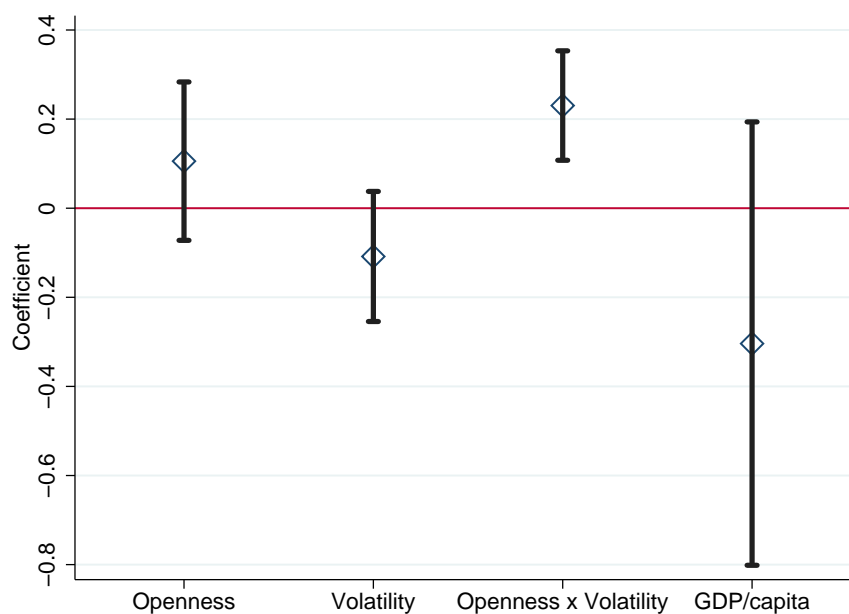


Figure 3: Visualizing the coefficients from column (5) of Table 2. Two-sided 95 percent confidence intervals are displayed.

Finally, in column (6) of Table 2 we check whether the corresponding results are indeed different if we explore autocracies, restricting our sample to those observations with a *polity2* score below zero.

As expected, the corresponding coefficient for the interaction term remains ineffective, both statistically (p-value of 0.434) and economically (coefficient of -0.028, compared to 0.230 for democracies). With these results in mind, we now turn to a series of alternative specifications to explore the robustness of these findings.

4 Robustness Checks

In Table 3, we present results from several robustness checks following the general structure of equation 7. In column (1), we apply the natural logarithm of government size as our dependent variable, consistent with Ram (2009) and Jetter and Parmeter (2015), among others. In column (2), we also use the natural logarithm of trade openness (following Rodrik, 1998, and Ram, 2009), and in column (3), volatility is also transformed by taking the natural logarithm. We want to understand whether our findings are artifacts of how we measure the main variables or whether extreme observations can explain our results. Applying the natural logarithm insulates the corresponding variables from such possibilities. In all three specifications, the interaction term remains a positive and statistically powerful predictor of government size.

Column (4) documents findings from a stricter definition of democracy, applying the cutoff recommended by the *Polity IV* Codebook with only using *polity2* values above five. In column (5), we further refine our sample by accessing the pure democracy variable in the *Polity IV* database (variable *democ*) since the *polity2* indicator also incorporates characteristics pertaining to autocracy. Here as well, we find a positive coefficient associated with the interaction term that is statistically significant at the five percent level.

Finally, column (6) displays results from a subsample that only includes those country-year observations with a democracy score below five on the zero-to-ten scale of democratic features. As expected, we find no meaningful predictive power for the interaction term of trade openness and export price volatility in such regimes, both from a statistical and an economic perspective.

Table 3: Robustness checks.

	Democracies (<i>Polity2</i> > 0)			Stronger democracies (<i>Polity2</i> > 5) (<i>Democ</i> > 5)		Stronger autocracies (<i>Democ</i> > 5)
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Dependent variable: Government size</i>						
Trade openness	0.100 (0.100)			0.070 (0.116)	0.064 (0.115)	-0.098 (0.131)
Export price volatility	-0.100 (0.080)	-0.153* (0.079)		-0.162 (0.132)	-0.169 (0.132)	-0.049*** (0.015)
Trade openness × export price volatility	0.217*** (0.056)			0.262** (0.105)	0.264** (0.108)	-0.003 (0.048)
Ln(trade openness)		0.095 (0.100)	0.084 (0.097)			
Ln(trade openness) × export price volatility		0.217*** (0.054)				
Ln(export price volatility)			-0.037* (0.019)			
Ln(trade openness) × export price volatility			0.075*** (0.028)			
Ln (Population), Ln(GDP/cap), country- and time-fixed effects	yes	yes	yes	yes	yes	yes
# of countries	115	115	115	100	103	59
# of years	15	15	15	15	15	15
<i>N</i>	1,399	1,399	1,399	1,203	1,235	536

Notes: Standard errors clustered at the country level are displayed in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1% levels.

5 Components of Government Expenditure

We now test which components of government expenditure are mostly affected. Following the *compensation hypothesis*, we should expect public spending on social safety nets to react to trade openness, for example. Several previous studies examine the possibility of an underlying link between openness and specific components of government expenditure and produce mixed results (e.g., see [Rodrik, 1998](#), [Shelton, 2007](#), [Dreher et al., 2008](#), and [Epifani and Gancia, 2009](#)). For example, [Rodrik \(1998\)](#), in explaining the relationship between open economies and government consumption, finds that social security spending is considerably more sensitive to external risk than other public expenditure. [Shelton \(2007\)](#) reports a positive association between openness and government size; however, he finds no evidence that the increase is owed to ‘social insurance’ expenditure. [Epifani and Gancia \(2009\)](#) also find that “openness is unrelated to public transfer” ([Epifani and Gancia, 2009](#), p.654). [Dreher et al. \(2008\)](#) conclude no statistically significant association between globalization and the components of government spending.

5.1 Global Sample of Democracies (WDI)

We first explore various categories of government expenditure from the World Bank’s WDI for the country-year observations from 2002 to 2016 with a *polity2* score greater than zero. In particular, we access four categories: Education, health care, military, and the remaining expenditures. The final category is calculated as the difference between total government expenditure and the sum of government expenditure on education, health care, and the military, and includes all types of social security and public transfer spending.

For each category, we re-estimate the baseline regression from column (5) of [Table 2](#). The corresponding results are displayed in [Figure 4](#) where we only plot the coefficient related to the interaction term between trade openness and export price volatility.⁴ Although we derive positive coefficients for predicting all four types of government spending, only the remainder (labeled ‘rest’) emerges as statistically different from zero (p-value of 0.003). Thus, public transfer payments supporting social security

⁴Not all categories are available for all country-year observations and [Table A4](#) documents the full estimation results, where we also predict total government spending for the respective subsamples. Overall, the number of observations varies between 863 and 1,367.

and welfare appear to be sensitive to trade openness in democratic countries that face substantial export price volatility.

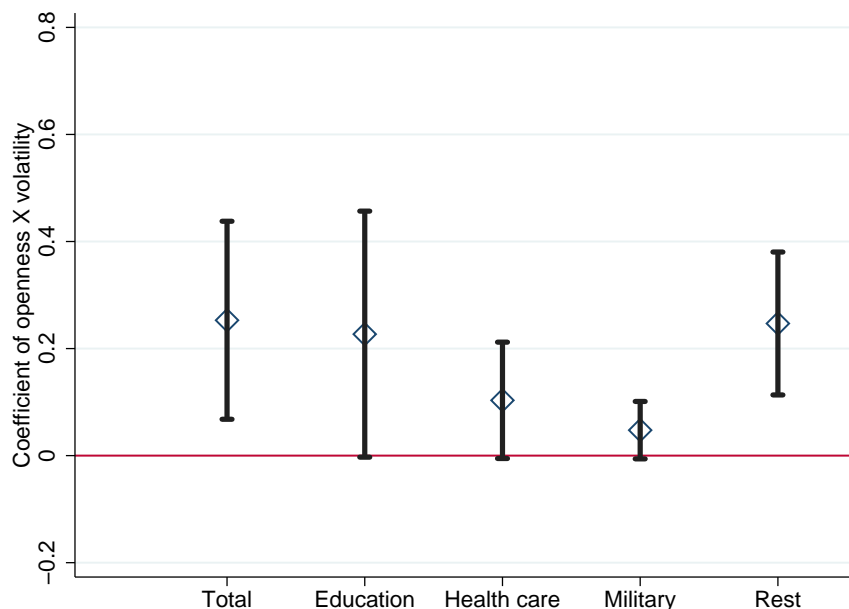


Figure 4: Visualizing regression coefficients pertaining to the interaction term between trade openness and export price volatility. Each estimate comes from a separate regression, where we predict (i) total government spending as a reference point, as well as government spending on (ii) education, (iii) health care, (iv) the military, and (v) the ‘rest’ (total government spending minus spending on education, health care, and the military). All regressions include the full set of covariates from column (5) of Table 2. Two-sided 95 percent confidence intervals are displayed.

5.2 OECD Sample of Democracies

In our final set of estimations, we turn to data on democracies from the OECD (OECD, 2018) that exhibit more detailed government categories. The OECD database reports expenditures according to the *Classification of the Functions of Government* (COFOG) and provides consistent time series data for all ten first-level COFOG expenditure groups for 30 OECD countries. The first COFOG level splits expenditure data into ten sub-sectors of expenditures (such as economic affairs, education, and social protection), whereas the second COFOG level further splits each group into up to nine sub-groups. For different first and second-level COFOG groups, we refer to Table A2, whereas Table A3 documents all

OECD sample countries included in our analysis. The OECD data allow us to run separate regressions to predict government spending in the corresponding democracies on (i) education, (ii) health care, (iii) the military, (iv) economic affairs, (v) environmental protection, (vi) housing, (vii) public order and safety, (viii) recreation, culture, and religion, (ix) public services, and (x) social protection.⁵ However, public spending on economic affairs is systematically expanded when our interaction term is larger.

Figure 5 displays the resulting coefficients for our familiar interaction term, whereas the full results are referred to appendix Table A5. We start with predicting total government consumption expenditure in column (1), deriving a positive and statistically significant relationship (p-value of 0.015). Thus, analyzing a sample of democracies that are part of the OECD provides conclusions that are consistent with those from analyzing the global sample of democracies in Table 2.

We then find modest evidence for public spending on education, health care, and the military to be correlated with our interaction term. Government expenditure on economic affairs, housing, and social protection are positively associated (p-values of 0.005 and 0.065), whereas we find no evidence in statistical terms for spending on public order and recreation. The housing category represents a traditional area of social welfare transfers, along with social protection. Further, a detailed look into expenditures grouped under economic affairs shows that all grants, loans, or subsidies to support general economic and commercial policies, as well as different economic sectors including agriculture, forestry and fishing, fuel and energy, mining, manufacturing and construction, and other industries fall in this group. Recalling the *compensation hypothesis*, these would be areas in which external risk, captured through volatile export prices, may play a particular role. On the other hand, it is not surprising to see public spending on recreation, for example, unaffected. In sum, the evidence from studying an alternative dataset with detailed categories for government spending are consistent with our hypothesis, i.e., that trade openness is associated with larger governments in democracies that face substantial volatility in the global prices of their exports.

⁵The OECD countries with at least one country-year observation of *polity2* > 0 are: Australia, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, South Korea, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

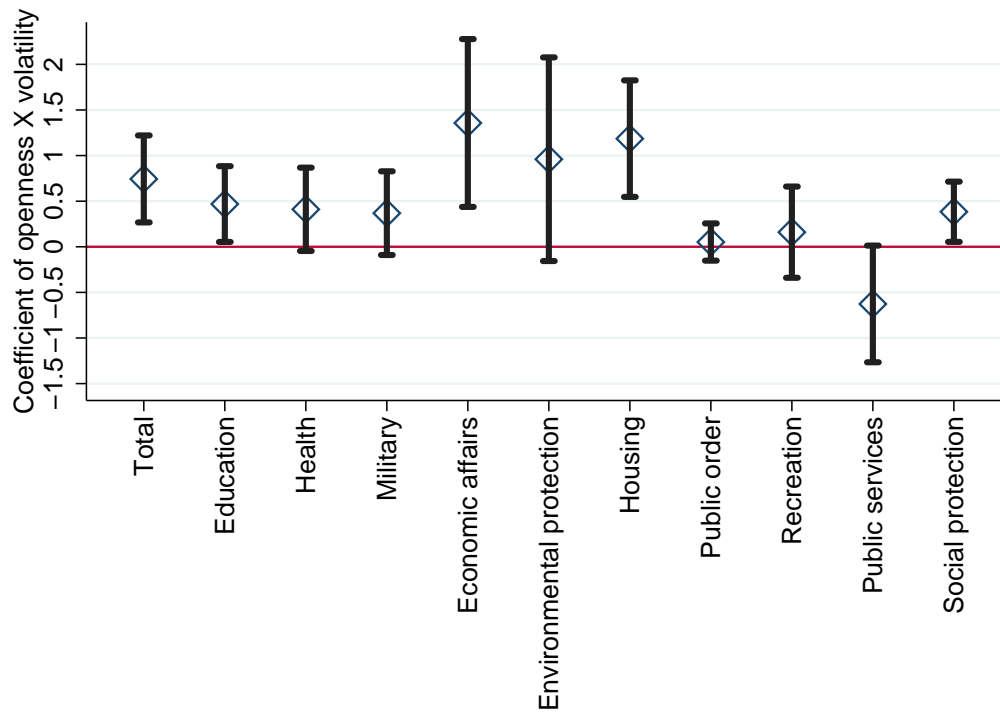


Figure 5: Visualizing regression coefficients pertaining to the interaction term between trade openness and export price volatility when predicting different categories of public spending in democracies that form part of the OECD. Each estimate comes from a separate regression where we predict public spending on the respective categories. Two-sided 95 percent confidence intervals are displayed.

6 Conclusion

This paper presents an explanation why previous studies on the link between trade openness and government size may have produced ambiguous conclusions. We posit that two conditions need to be fulfilled for the *compensation hypothesis* to hold: The country faces substantial volatility in the prices of its exports and the country is democratic. First, more exposure to international trade only raises external risk if the associated trade basket is sufficiently volatile. Exporting goods that fetch the same, consistent price per unit over years are unlikely to introduce substantial economic turmoil into the domestic economy. However, trading in volatile global markets is more likely to produce the effects envisioned by [Rodrik \(1998\)](#). And second, [Rodrik's \(1998\)](#) envisioned dynamics via a populace that demands more public insurance against external shocks can systematically unfold under democratic structures.

We first derive a country-year-specific measure of the volatility of export prices from 2000 to 2016. We do so by calculating the standard deviation of the global export prices of a weighted country's export basket over years $t-2$ until t . We then run regressions to predict government size. Indeed, we *only* derive results that are meaningful in statistical and economic terms when we study democracies *and* incorporate an interaction term between trade openness and export price volatility. Corresponding magnitudes are sizeable but realistic: Assuming a one standard deviation increase in trade openness and export price volatility is associated with an increase in government spending by 23 percent of a standard deviation, which is equivalent to 1.13 percentage points of GDP. Our results are robust to a series of alternative estimations.

Finally, we turn to specific segments of government spending to understand the underlying dynamics. Exploring a global dataset of democracies, as well as a sample of OECD democracies that provides more detailed categories, the empirical evidence is consistent with the *compensation hypothesis*. Spending on economic affairs, housing, and social protection are up significantly when trade openness increases in volatile export markets. However, we find little-to-no evidence of other sectors being affected, such as spending on recreation.

Overall, we hope this analysis enriches our understanding of whether and when trade openness may indeed enlarge governments. Understanding the consequences of economic globalization has become

crucial in the age of isolationist movements, such as Brexit or US developments toward erecting trade barriers through tariffs and other regulations. Future studies may be able to explore more micro-level settings to better understand the underlying mechanisms. Understanding these may provide valuable insights into the forces of globalization, of globally volatile markets, and reactions by democratic citizens.

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Appendix

Table A1: Definitions and variable sources.

Variable	Definition and Construction	Source
Country size	Total population.	Authors' construction using data from the World Development Indicators (WDI) (World Bank, 2018).
Real GDP per capita	Ratio of GDP (in constant 2010 US\$) to population.	
Government Size	General government final consumption expenditure (% of GDP)	
Trade openness	Merchandise trade is the sum of exports and imports of goods measured as a % of GDP	
Export value	Merchandise exports (in current US\$)	Authors' construction using data from UNComtrade (UNSD, 2018), and CEPII (Berthou and Emlinger, 2011)
Export share	Exports value measured as a % of total export	
Export price volatility index	Export price volatility index measured as rolling standard deviation for last 3 years	
Polity Score	'polity2' variable from Polity IV Project Dataset (scale from -10 to +10)	Derived from Polity IV Project Dataset (Marshall and Jaggers, 2017)
Democracy	'democ' variable from Polity IV Project Dataset (scale from 0 to +10)	
<i>Components of government expenditure for global sample of democracies:</i>		
Education	General government expenditure on education (current, capital, and transfers) is expressed as a % of GDP.	Authors' construction using data from the World Development Indicators (WDI) (World Bank, 2018).
Health care	Public expenditure on health from domestic sources as a share of the economy as measured as a % of GDP.	
Military	Military expenditures according to the NATO definition, includes all current and capital expenditures on the armed forces. Excluded are civil defense and current expenditures for previous military activities, expressed as a % of GDP.	
Rest	The remaining expenditures which is calculated as the difference between total government expenditure and the sum of government expenditure on education, health care, and the military, and includes all types of social security and public transfer spending.	
<i>Components of government expenditure for OECD sample of democracies:</i>		
Ten first-level COFOG expenditure groups	The first COFOG level splits expenditure data into ten sub-sectors of expenditures on (i) education, (ii) health care, (iii) the military, (iv) economic affairs, (v) environmental protection, (vi) housing, (vii) public order and safety, (viii) recreation, culture, and religion, (ix) public services, and (x) social protection. For details on COFOG groups, we refer to Table A2 .	Authors' construction using data from the OECD (OECD, 2018).

Table A2: First- and second-level COFOG.

First-level	Second-level
Education	<ul style="list-style-type: none">- Pre-primary and primary education- Secondary education- Post-secondary non-tertiary education- Tertiary education- Education not definable by level- Subsidiary services to education- R&D education- Education n.e.c.
Health care	<ul style="list-style-type: none">- Medical products, appliances and equipment- Outpatient services- Hospital services- Public health services- R&D health- Health n.e.c.
Defence	<ul style="list-style-type: none">- Military defence- Civil defence- Foreign military aid- R&D defence- Defence n.e.c.
Economic affairs	<ul style="list-style-type: none">- General economic, commercial and labour affairs- Agriculture, forestry, fishing and hunting- Fuel and energy- Mining, manufacturing and construction- Transport- Communication- Other industries- R&D economic affairs- Economic affairs n.e.c.
Environmental protection	<ul style="list-style-type: none">- Waste management- Waste water management- Pollution abatement- Protection of biodiversity and landscape- R&D environmental protection- Environmental protection n.e.c.

Notes: n.e.c.: not elsewhere classified.

Table A2 cont.: First- and second-level COFOG.

First-level	Second-level
Housing and community amenities	<ul style="list-style-type: none">- Housing development- Community development- Water supply- Street lighting- R&D housing and community amenities- Housing and community amenities n.e.c.
Public order and safety	<ul style="list-style-type: none">- Police services- Fire-protection services- Law courts- Prisons- R&D public order and safety- Public order and safety n.e.c.
Recreation, culture and religion	<ul style="list-style-type: none">- Recreational and sporting services- Cultural services- Broadcasting and publishing services- Religious and other community services- R&D recreation, culture and religion- Recreation, culture and religion n.e.c.
General public services	<ul style="list-style-type: none">- Executive and legislative organs, financial and fiscal affairs, external affairs- Foreign economic aid- General services- Basic research- R&D general public services- General public services n.e.c.- Public debt transactions- Transfers of a general character between different levels of government
Social protection	<ul style="list-style-type: none">- Sickness and disability- Old age- Survivors- Family and children- Unemployment- Housing- Social exclusion n.e.c.- R&D social protection- Social protection n.e.c.

Notes: n.e.c.: not elsewhere classified.

For more details about the COFOG classifications and related definitions, we refer to [UNSD \(2000\)](#).

Table A3: Country list.

Afghanistan ¹	Djibouti	Lao PDR	Russian Federation ¹
Albania ¹	Dominican Republic ¹	Latvia ^{1,2}	Rwanda ¹
Algeria ¹	Ecuador ¹	Lebanon ¹	Saudi Arabia ¹
Angola ¹	Egypt, Arab Republic ¹	Lesotho	Senegal ¹
Argentina ¹	El Salvador ¹	Liberia	Serbia
Armenia ¹	Equatorial Guinea	Libya ¹	Sierra Leone ¹
Australia ^{1,2}	Eritrea	Lithuania ^{1,2}	Singapore ¹
Austria ^{1,2}	Estonia ^{1,2}	Luxembourg ^{1,2}	Slovak Republic ^{1,2}
Azerbaijan ¹	Ethiopia ¹	Macedonia, FYR ¹	Slovenia ^{1,2}
Bahrain ¹	Fiji ¹	Madagascar ¹	Solomon Islands
Bangladesh ¹	Finland ^{1,2}	Malaysia ¹	South Africa ¹
Belarus ¹	France ^{1,2}	Mali ¹	Spain ^{1,2}
Belgium ^{1,2}	Gabon ¹	Mauritania ¹	Sri Lanka ¹
Benin ¹	Gambia, The ¹	Mauritius ¹	Sudan ¹
Bhutan ¹	Georgia ¹	Mexico ¹	Suriname ¹
Bolivia ¹	Germany ^{1,2}	Moldova ¹	Swaziland ¹
Botswana ¹	Ghana ¹	Mongolia ¹	Sweden ^{1,2}
Brazil ¹	Greece ^{1,2}	Montenegro	Switzerland ^{1,2}
Bulgaria ¹	Guatemala ¹	Morocco ¹	Syrian Arab Republic ¹
Burkina Faso ¹	Guinea ¹	Mozambique ¹	Tajikistan
Burundi ¹	Guinea-Bissau ¹	Myanmar ¹	Tanzania ¹
Côte d'Ivoire ¹	Guyana ¹	Namibia ¹	Thailand ¹
Cambodia ¹	Haiti	Nepal ¹	Timor-Leste ¹
Cameroon ¹	Honduras ¹	Netherlands ^{1,2}	Togo ¹
Canada ¹	Hungary ^{1,2}	New Zealand ¹	Tunisia ¹
Cape Verde ¹	India ¹	Nicaragua ¹	Turkey ¹
Central African Republic	Indonesia ¹	Niger ¹	Turkmenistan
Chad	Iran, Islamic Republic ¹	Nigeria ¹	Uganda ¹
Chile ^{1,2}	Iraq ¹	Norway ^{1,2}	Ukraine ¹
China ¹	Ireland ^{1,2}	Oman ¹	United Arab Emirates ¹
Colombia ¹	Israel ^{1,2}	Pakistan ¹	United Kingdom ^{1,2}
Comoros ¹	Italy ^{1,2}	Panama ¹	United States ^{1,2}
Congo, Democratic Republic	Jamaica ¹	Papua New Guinea ¹	Uruguay ¹
Congo, Republic ¹	Japan ^{1,2}	Paraguay ¹	Uzbekistan
Costa Rica ¹	Jordan ¹	Peru ¹	Venezuela ¹
Croatia ¹	Kazakhstan ¹	Philippines ¹	Vietnam ¹
Cuba ¹	Kenya ¹	Poland ^{1,2}	Yemen ¹
Cyprus ¹	Korea, Republic ^{1,2}	Portugal ^{1,2}	Zambia ¹
Czech Republic ^{1,2}	Kuwait ¹	Qatar ¹	Zimbabwe ¹
Denmark ^{1,2}	Kyrgyz Republic ¹	Romania ¹	

Notes: This table lists all 159 countries in the sample used in the initial regression for the 1960-2016 period and presented in column (1) of Table 2. ¹Indicates that the country is among the 143 countries included in the regressions presented in columns (3) and (4) of Table 2.

²Indicates the country is an OECD member.

Table A4: Regression results for different components of government expenditure (global sample of democracies).

	A		B		C		D	
General government expenditure (% of GDP)	Total (1)	Education (2)	Total (3)	Health care (4)	Total (5)	Military (6)	Total (7)	Total- (Educ+Health+Military) (8)
Trade openness	0.087 (0.133)	0.103 (0.163)	0.130 (0.122)	-0.061 (0.103)	0.107 (0.109)	0.012 (0.032)	0.099 (0.148)	0.131 (0.142)
Export price volatility	-0.148 (0.137)	-0.165 (0.109)	-0.089 (0.093)	-0.099 (0.076)	-0.107 (0.089)	-0.044* (0.023)	-0.149 (0.140)	-0.048 (0.146)
Trade openness × export price volatility	0.253** (0.112)	0.227 (0.140)	0.214*** (0.078)	0.103 (0.066)	0.229*** (0.075)	0.048 (0.033)	0.266** (0.104)	0.247*** (0.081)
Ln (Population), Ln(GDP/cap), country- and time-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
# of countries	101	101	114	114	110	110	98	98
# of years	15	15	15	15	15	15	15	15
N	953	953	1,240	1,240	1,367	1,367	863	863

Notes: Standard errors clustered at the country level are displayed in parentheses. *, **, and *** indicate significance at the 10, 5, and 1% levels. Columns (1), (3), (5), and (7) consider total government expenditure observations for which we have data on the respective categories. Expenditure on Education includes public spending (current, capital, and transfers) on the education sector from local sources, as well as expenditure funded by transfers from international sources to government. Health expenditure includes public spending on health care from domestic sources. Military expenditures data are compiled according to the NATO definition, which includes all current and capital expenditures on the armed forces but excludes civil defense and current expenditures for previous military activities. The residual is calculated as the difference between total government expenditure and the sum of government expenditures on education, health care, and military.

Table A5: Regression results for different components of government expenditure (OECD sample of democracies).

General government	Total	Education	Health care	Military	Economic affairs	Environmental protection	Housing and community	Public order and safety amenities	Recreation, culture, and religion	Public services	Social protection
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Trade openness	-0.008 (0.165)	0.083 (0.171)	0.129 (0.172)	-0.135 (0.107)	0.290 (0.297)	0.140 (0.155)	0.554** (0.203)	0.025 (0.049)	-0.031 (0.163)	-0.246 (0.181)	-0.097 (0.133)
Export Price Volatility	-0.439*** (0.149)	-0.579*** (0.114)	-0.716*** (0.189)	-0.209 (0.157)	-0.585 (0.369)	-0.056 (0.337)	-0.228 (0.252)	-0.165*** (0.054)	-0.060 (0.212)	0.631*** (0.181)	-0.243* (0.136)
Trade openness × export price volatility	0.744** (0.289)	0.469* (0.252)	0.411 (0.277)	0.369 (0.278)	1.357** (0.558)	0.960 (0.677)	1.186*** (0.388)	0.052 (0.124)	0.160 (0.303)	-0.627 (0.388)	0.384* (0.200)
Ln (Population), Ln(GDP/cap), country- and time-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
# of countries	31	31	31	31	31	31	31	31	31	31	31
# of years	15	15	15	15	15	15	15	15	15	15	15
N	450	450	450	450	450	450	450	450	450	450	450

Notes: Standard errors clustered at the country level are displayed in parentheses. *, **, and *** indicate significance at the 10, 5, and 1% levels. Columns (1), (3), (5), and (7) consider total government expenditure observations for which we have data on the respective categories. Expenditure data are derived from the OECD *National Accounts Statistics* database, which are based on the *System of National Accounts* (SNA), a set of internationally agreed concepts, definitions, classifications and rules for national accounting. Data on expenditures are disaggregated according to the classification of the Functions of Government (COFOG), which divides expenditures into ten functions: general public services; defence; public order and safety; economic affairs; environmental protection; housing and community amenities; health; recreation, culture and religion; education; and social protection. Further information about the types of expenditures included is available in Table A2 in the Appendix.