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Does Corruption in Exporter and Importer Country Influence International Trade?

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ABSTRACT: We investigate whether bilateral exports of goods flowing from Vietnam to its 46 top trading partners are affected by corruption over the period 2000–2014. We capture the effects of corruption of Vietnam and her trade partners, separately using the corruption perception index (CPI) developed by Transparency International. The CPI captures both bureaucratic and political corruption perceptions. Our key results are as follows. We find that corruption in Vietnam has discouraged its bilateral export flows. The negative effect of corruption is highly significant in the long-run. In driving Vietnam's exports, perceptions of corruption in Vietnam are found to be more potent than perceptions in importer countries. We find that the sign effects of corruption in Vietnam or trading partner countries (or importers) are not dependent on whether trading partners are developed or developing. However, we do find that corruption discourages developing countries more than developed countries from importing goods from Vietnam. We confirm the robustness of our results using the control of corruption (COC) measure of corruption extracted from the World Bank Database.

KEY WORDS: bilateral exports, corruption perception, developed trading partners, developing trading partners, gravity model, Vietnam

JEL: F13

This article examines the influence of corruption on Vietnam's bilateral export growth. There is a strong consensus among different sources, namely, International Transparency[1] and the World Bank, that corruption is a long-standing problem in Vietnam (also see Alan, Dao, and Hoang 2013). Corruption is seen as the abuse of public power or violating government rule and/or circumventing prescribed government procedures for personal benefit (Bardhan 1997; Mauro 1995). A World Trade Organization (2013) report notes that corruption in Vietnam is a result of a lack of public accountability (see Section 2 for more detail).

Since the Vietnamese government implemented economic reforms, known as "Doi Moi" (translated as "renovation") in 1986, significant efforts have been made to encourage international trade through trade liberalization and export promotion. Trade liberalization efforts have led to the country embracing free trade agreements (both bilateral and multilateral) through membership of the ASEAN since 1995 and the WTO since 2005 (see Narayan and Nguyen 2016; World Trade Organization 2013). Such engagements have been supported by trade reforms and modernization of the national legal system. However, the conduct and governance of trade regulations and policies in Vietnam remain relatively inefficient (World Trade Organization 2013). 'Vietnam's hierarchy of legal documents comprises 12 levels, which is determined by the type of legislation and the issuing institution and requires co-operation between agencies to ensure the smooth running of activities' (World Trade Organization 2013, 6). However, consistencies do not always exist between legislation passed by a lower state and the legal documents of the higher states, causing different interpretations (World Trade Organization 2013). Communication between departments and states, which relies on paper-based official documents, prevents prompt decision-making, creates conflicts, and significant time is wasted clarifying issues and inconsistencies

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(World Trade Organization 2013).[2] The Vietnamese government made an effort to replace time-consuming administrative processes with "one-stop-shop" systems, but their application in trade-related ministries and agencies is limited.[3] "Vietnam National Single Window", a one-stop-shop for customs procedures, for example, only covers procedures for some seaborne imported/exported goods with participation from 10 out of 14 ministries. Foreign businesses continue to indicate that the procedures required for investment and company registration are complex.[4]

Unfortunately, several programs introduced since 1986 to support industrialization and growth in exports also came with inefficient administrative processes. The industrial parks and export processing zones, for example, are working under capacity. Similarly, a rebate refund scheme was established to encourage exports; however, time-consuming and complex procedures made this scheme less accessible to small enterprises (Athukorala 2006). In all, a lack of simplicity, transparency, and consistency of regulations and policies relating to trade in Vietnam supports traditionally endemic corrupt behaviors.

The economic impact of corruption has been extensively studied. Several authors show corruption as a deterrent to economic growth and development, including exports (see D'agostina, Dunne, and Pieroni 2016; Gray and Kaufmann 1998; Johnson, Kaufmann, and Zoido-Lobaton 1998; Kaufmann and Wei 1999). Resource allocation theories exploit the rent-seeking behavior of bureaucrats to show corruption as a cost within the supply-demand framework. Overall, corruption is seen as a tax which raises the cost of transaction and affects the pattern of resource allocation and the distribution of income within a society (see Gupta, Davoodi, and Alonso-Terme 1998; Lenway, Morck, and Yeung 1996; Shleifer and Vishny 1993).[5] That corruption impedes growth and development is known as "the-sand-in-the-wheels" hypothesis (Abotsi 2016).

Corruption and economic growth (including export growth) may also assume a positive relationship (Acemoglu and Verdier 1998; Leff 1964; Meon and Weill 2010).[6] Inefficient government rules and procedures may delay transactions and thus slow down economic activity (Batabyal and Yoo 2007). In such situations, illegal payments can make matters move more quickly, and favorably, through the state bureaucracy (Amundsen 2000). Similarly, corruption in the form of theft of publicly owned assets, may lead to an increase in output if the new proprietors of the asset exploit it more efficiently. Related to these arguments is the "greasing the wheel" hypothesis. It postulates that corruption is beneficial for growth and development because it allows the circumvention of administrative impediments, making processes more efficient.

The World Bank Productivity and Investment Climate Enterprise Survey (2005) and Vietnam's Governmental Provincial Competitiveness Surveys (2005) demonstrate that corruption negatively impacts private businesses, but not State companies (Nguyen and Van Dijk 2012). Furthermore, Rand and Tarp (2012) draw on their 2005 and 2007 surveys of 2,600 Vietnamese enterprises, to show that the probability that a firm uses bribes varies according to firm size, which is determined by employment, profit per employee, formality of legal ownership, and company location. Further, a positive relationship between a corrupt environment and innovation in firms was revealed by Nguyen et al. (2016). By contrast, Dang (2016) found that corrupt behaviors hinder economic development, such as increases in investment, employment, and GDP per capita at province level, but have no influence on income distribution among regions.

Against this background, we examine the effects of the perceptions of corruption in Vietnam on her exports to 46 trade partners. While this will be the first study on Vietnam's trade, there is some evidence that the abuse of public power has negative effects on trade. de Jong and Bogmans (2011), for example, demonstrate that corruption, with the exception of customs procedures, discourages exports and imports. By applying the gravity model, Thede and Gustafson (2012) illustrate that both corruption in general and in customs have a negative effect on trade and a more substantial effect than income and distance elasticity. Lambsdorff (1998), on the other hand, suggests that bribery in importing countries may impact on exporting countries differently because corrupted behaviors in trading partners may hamper some countries but benefit exports for others.

We contribute to this strand of the literature by providing more insights into the relationship between trade and corruption. First, we consider bilateral trade relations rather than aggregate trade, allowing us to model the changes in trade relations across trading partners. Second, our focus is on exports by Vietnam to her top 46 trading partners, grouped for the study by their level of development to identify whether there are any differences in the effects of corruption by this categorization. Freckleton, Wright, and Craigwell (2012) suggest that the link between corruption and economic growth varies for developed and developing countries. We check whether the corruption effects on exports from a developing country to developed and developing trading partners are different. A developed country is more equipped, technically and financially, to deal with a corrupt system than a developing country is. Further, there is some evidence that corruption exacerbates the differences between the rich and poor, for instance, Gupta, Davoodi, and Alonso-Terme (2002) found that corruption increases income inequality and poverty. Hence, we expect corruption to be more disruptive for developing trading partners than for developed countries. Indeed, we find that corruption is more disruptive for developing than developed country trading partners.

Third, we examine the long-term impact of corruption on trade. We are motivated by Freckleton, Wright, and Craigwell (2012) who showed that for a panel of developed and developing nations the corruption (as identified by the World Bank) effects on economic growth are short-term, not long-term. The authors, therefore, conclude that long-term economic growth is driven by government-directed incentives, institutions, human-capital effectiveness and the desire to make profit.

Unlike the work of Freckleton, Wright, and Craigwell (2012), our analysis is concerned with the effects of corruption on trade with developed or developing nations. However, Freckleton, Wright, and Craigwell (2012) make a relevant point that the effects of corruption may be permanent (long-term) or transitory (short-term). Our analysis, using data sourced from Transparency International, shows that corruption in Vietnam left a permanent impression on importers from developed and developing nations, working against her exports to these nations over the period 2000–2014. Further, when we use the corruption measure sourced from the World Bank, we notice only transitory effects of corruption on trade with developed nations, but permanent effects in the case of trade with developing nations.

Fourth, in addition to corruption in Vietnam, this study examines the trade implications of corruption in trading partner countries. Most studies investigate economic implications of domestic corruption (see Gyimah-Brempong 2002; Mo 2001; Mauro 1995). However, Lambsdorff (1998) and later de Jong and Bogmans (2011) go further by studying the influence on trade of corruption in both importing and exporting countries. Such an inclusion is important in that it allows both sides of the corruption story to be explored. The approach adopted by de Jong and Bogmans (2011) is similar to ours in terms of using perception of corruption as one of the measurements of corruption in driving export flow. The point of difference is that we use bilateral exports rather than total export data. Over our study period (2000–2014), perceptions of corruption on average are lower for the 46 trading countries than for Vietnam, although eight developing countries in our sample are reportedly more corrupt than Vietnam (see part 4).

In what follows, we explain the empirical model for Vietnam's exports with her 46 trading partners. In Section 2, we explain our data, including the corruption perception index (CPI) for Vietnam and her trading partners. We discuss the estimation methods and results in Section 3. In Section 4, we perform additional tests to examine the robustness of our findings. The final section concludes the study with policy implications and suggestions for future research in this area.

1. Empirical Model

While there have been many works on gravity models since Tinbergen (1962), remarkably only a few of these focus on Vietnamese exports or trade (Narayan and Nguyen 2016, 2019; Nguyen 2010; Thai 2006). Thai (2006) reveals that Vietnam's trade with 23 European countries from 1993 to 2004 can be explained by changes in the joint GDP of Vietnam and her partners, population of the countries, and the exchange rate. However, distance is found to be insignificant.

Narayan and Nguyen (2016) applied the gravity model to explain Vietnam's trade flow with 54 major partners from 1986 to 2010, but more comprehensively to (1) check the sensitivity of the gravity model by grouping the panel data into different categories of partners, and (2) detect and avoid unit roots and multicollinearity problems of the sample. In the long-run, they illustrate that trade has a reverse relationship with product of incomes and a converse trend with distance. However, the magnitudes of the influence of explanatory factors, particularly those of distance, are more responsive to high-income partners than middle- and low-income groups. On the other hand, the results for partners' currencies exchange rate against the Dong and trading multilateral agreements, particularly in a short-run model, are mixed. Narayan and Nguyen (2016) also show the positive impacts of Vietnamese openness and the opposite effects of her partners' openness, which is defined as the proportion of total import and export of merchandised goods over GDP (also see Narayan and Nguyen 2019).

Nguyen (2010) takes the gravity model further, applying it to the context of Vietnam's exports by considering both static and dynamic effects. Nguyen (2010) concludes that the two approaches yield different levels of influence but similar directions of the impacts of independent variables on Vietnam's exports, namely economic mass and exchange rate have positive coefficients, by contrast, geographic distance and ASEAN integration have negative signs for elasticity.

By focusing on impacts of corruption on Vietnam's exports we fill a gap in extant academic research. We consider influences of corruption in both original and destination countries. Further, we examine the models for three different panel settings: bilateral trade between Vietnam and her 46 trading partners; between Vietnam and its developed trading partners; and between Vietnam and her developing trading partners.[7]

We estimate the following export gravity model in two stages, following the work of Cheng and Wall (2005). Step 1 estimates the effect of the time variant determinants of exports:

$$lnREX_{ijt} = \alpha_0 + \alpha_1 lnCPI_{it} + \alpha_2 lnCPI_{jt} + \alpha_3 lnY_t + \alpha_4 lnRER_{ijt} + \alpha_5 lnFTA_{ijt} + se_{ij1} + \varepsilon_1 \qquad (1)$$

Here, ln refers to natural logarithm. $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4,$ and α_5 are the parameters to be estimated. The residuals ε_1 capture all the statistical error and unobserved factors influencing bilateral trade. The dependent variable is REX_{ijt}, a bilateral export value of Vietnam (country i) to country j in period t.

CPIs, CPI_i and CPI_j represent community perceptions, particularly of businesses, about corruption in Vietnam (i) and her trading partners (js). The construct of the indices are explained in the data section. The $CPIs$ vary from 0 (highly corrupted in public service) to 10 (no noticeable misuse of public power for private benefit). This means a lower CPI implies a higher level of corruption. An increase in a CPI indicates that perceived corruption in that country has fallen. In the literature, corruption might harm or support economic development (see Section 1), hence α_1 and α_2 may be either positive or negative.

Y_t captures income of Vietnam and trading partner countries. We represent income in three ways, namely, as real GDP ($RGDP$), per capita real GDP ($PRGDP$), or difference in $PRGDP$ between trading partners and Vietnam.[8] Model (a) incorporates $RGDP_i$ and $RGDP_j$ are real GDP of Vietnam (i) and the trading partners (js). These two variables, respectively, capture the supply and demand factors influencing trade. Model (b) captures $PRGDP_i$ and $PRGDP_j$, which are GDP per capita of Vietnam (i) and the trading partners (js) used to capture the scale of the economies. Model (c) covers $DGDP_{ij}$, which is the difference in GDP per capita between Vietnam and her partners over time. The Heckscher-Ohlin theory states that the difference in resources between countries will encourage trade, implying that $DGDP_{ij}$ will have a positive impact on bilateral exports. In contrast, Linder (1961) predicts a negative relationship between $DGDP_{ij}$ and exports, implying that two similar countries are likely to trade more.

RER_{ij} refers to the bilateral real exchange rate between partner js currency and Vietnamese currency (Dong) after accounting for inflation in Vietnam and the trading partner.[9] The RER is expressed as Dong in terms of trading partner currency. Increase in the RER, therefore, indicates depreciation of the trading partner currency against Dong, which should reduce the demand for Vietnamese exports. In other words, RER and exports have a converse relationship, and as a result, α_4 is anticipated to be negative.

The model also captures the effect of free trade agreements, FTA_{ij}, to reflect the influence of bilateral or multilateral free trade agreements Vietnam is party to. Vietnam became a member of ASEAN, including the ASEAN free trade agreement, in 1995. The ASEAN block signed free trade agreements with Japan and China in 2002. Vietnam and the US established a bilateral trade agreement in 2000 (which came into effect from 2001). For this study FTA has the value of one for all ASEAN countries (Laos,[10] Cambodia, Thailand, Singapore, Malaysia, the Philippines, and Indonesia) for every year. Further, FTA receives the value of one for the US from 2001 and for China and Japan from 2002. Vietnam officially joining the WTO in 2007 is also captured by giving all WTO members the value of one since that year. In 2007, most trading partners were already members of the WTO.[11,12] The only exceptions are Ukraine, which joined the WTO in 2008; the Russian Federation, which joined in 2012; and Laos, which joined in 2013. Ukraine and Russia take a value of one from the year they became members of WTO.[13] Otherwise, FTA is assigned the value of 0. This variable is included in Step 1 as the variables for most trading partner countries are 1 and 0 over the study period.

se_{ij} captures the time-invariant individual effects extracted from Equation (1). These specific effects are used in the second stage to estimate the influence of time-invariant variables on trade:

$$se_{ij} = \delta_{ij} + \gamma_{ij} lnD_{ij} + \varepsilon_{ij2} \qquad (2)$$

Here, distance D_{ij} acts as proxy of transport costs; with the competitiveness of Vietnam's goods affected negatively by distance.

Equations (1) and (2) make up the long-run models, which are best estimated using the two-stage fixed effect method. The long-run models are estimated after establishing cointegration between the variables expressed in Equations (1) and (2). Our short-run models include variables in stationary form or $I(1)$ form and with a one-year lagged error correction term (extracted from Equation (1)) if model one is found to be valid. We also estimate different versions of Equations (1)and (2). We estimate models with and without CPI, to test the relative importance of the CPI variable.

2. Data and Preliminary Analysis

CPIs, CPI_i and CPI_j, are sourced from Transparency International. Corruption, according to Transparency International, is the abuse of entrusted power for private gain. The $CPIs$ account for both political and bureaucratic corruption in the public sector. As a result, this index captures corruption involving public officials, civil servants, and/or politicians. Further, the type of corruption covered includes bribery of public officials, kickbacks in public procurement, embezzlement of public funds, and the strength and effectiveness of anti-corruption efforts in the public sector. The scores of individual questions are combined to develop the CPI for a country. The lower the score, the higher the perception of corruption.[14]

The data on nominal income-related variables, exports and exchange rate, are sourced from the World Bank database. For all bilateral export relations captured, we use sea-based distance from port to port, except for the land-locked trading partner Laos. Distance in kilometers is measured by the sea-based gap, which involves adding land-based distance from Hanoi, the capital of Vietnam, to Hanoi's closest port in Haiphong, with sea distance from Haiphong port to the port that is closest to the capital city of the partner and land-based distance from the destination country port to the partner's capital.[15] For Laos, which has

no seaport, the distance between Vietnam and Laos is calculated by the geographic distance along the surface of the earth from Hanoi to Vientiane, Laos' capital city.

In Table 1, we present the mean of the variables by country and trading partner-related groups, which we refer to as the full sample, developed, and developing countries. We display the averages under the full study period (2000–2014); and two periods: 2000–2009 and 2010–2014. The sole political party in Vietnam is the Communist Party and its government launched numerous anti-corruption campaigns over the period studied. In recent years, these have culminated in significant improvement in the perception of corruption in Vietnam (see Figure 1).

The first significant attempt to combat corruption in Vietnam came in the form of the Law of Anti-Corruption imposed in 2005. This was amended in 2007 and 2012.[16] The Law of Anti-Corruption is a vital legal foundation to prevent, control, investigate, and solve corruption in the country. In 2009, the national strategy on preventing and combating corruption toward 2020 was produced.[17] In the same year, the highest ranked leaders in Vietnam ratified the United Nations' Convention Against Corruption, further demonstrating their willingness to cooperate internationally in combating corrupt behaviors. In 2013, the Communist Party established the Office of the National Steering Committee on Anti-Corruption to decide annual key working programs and plans on anti-corruption to further implement the strategy.

Corruption perception in Vietnam during the review period 2000–2014 was significantly higher than for the developed and other developing countries. The average corruption index of Vietnam during the study period was ranked low at 2.7, which is less than half of the mean of all 46 trading partners at 5.5 (Table 1). During the same period, developed country partners, in particular, had corruption perception rankings which averaged 7.2 and varied in the range of 4.1–9.4 suggesting less

Table 1. Mean values of the dependent and independent variables.

	$REX_{iUS\$}$	$RGDP_{i, j}$ US\$	$PRGDP_{i,jUS}$ \$	$DRGDP_{ijUS}$ \$	$RER_{ijjs \text{ currency}/}$ Dong	CPI_t	FTA	D_{ij}
Vietnam								
2000–2014		9.90×10^{10}	1,164.070			2.707		
2000–2009		8.35×10^{10}	1,014.716			2.570		
2010–2014		1.30×10^{11}	1,462.779			2.980		
Panel 1: Full sample								
2000–2014	1,247,550	1.22×10^{12}	23,946.200	21.268	0.027	5.526	0.619	12,747.630
2000–2009	747,823	1.15×10^{12}	23,575.520	23.542	0.026	5.537	0.433	12,747.630
2010–2014	2,205,723	1.34×10^{12}	24,656.930	16.909	0.031	5.505	0.991	12,747.630
Panel 2: Developed countries								
2000–2014	1,483,138	1.54×10^{12}	37,123.040	33.028	0.003	7.156	0.578	14,621.530
2000–2009	929,511	1.50×10^{12}	36,488.890	36.463	0.003	7.197	0.367	14,621.530
2010–2014	2,565,785	1.62×10^{12}	38,363.150	26.312	0.004	7.076	1.00	14,621.530
Panel 3: Developing countries								
2000–2014	901,965	7.45×10^{11}	4,616.933	4.018	0.063	3.135	0.677	10,084.719
2000–2009	476,831	6.42×10^{11}	4,314.906	4.271	0.059	3.062	0.526	10,084.719
2010–2014	1,694,057	9.39×10^{12}	5,179.657	3.546	0.069	3.271	0.979	10,084.719

This table presents averages of the series relating to Vietnam (country i) and trading partners (country js) over three periods: 2000–2014; 2000–2009; and 2010–2015. The variables include: real export (REX_{ij}) from Vietnam to a trading partner at time t; real gross domestic product of Vietnam ($RGDP_i$) and those of her partners ($RGDP_j$); real per capita income of Vietnam ($PRGDP_i$) and partners ($PRGDP_j$); the gap in the per capita income between Vietnam and her partners ($DRGDP_{ij}$); real exchange rate between local currency of partners and the Dong, Vietnam's currency (RER_{ij}); corruption perception index of Vietnam (CPI_i) and her partners (CPI_j); D_{ij} is geographic distance between Vietnam and country j; FTA_{ij} is the dummy variable to incorporate the influence of bilateral free trade agreements, FTA is assigned the value 1 if a bilateral trade agreement exists between Vietnam and the trade partner has been in effect or zero otherwise.
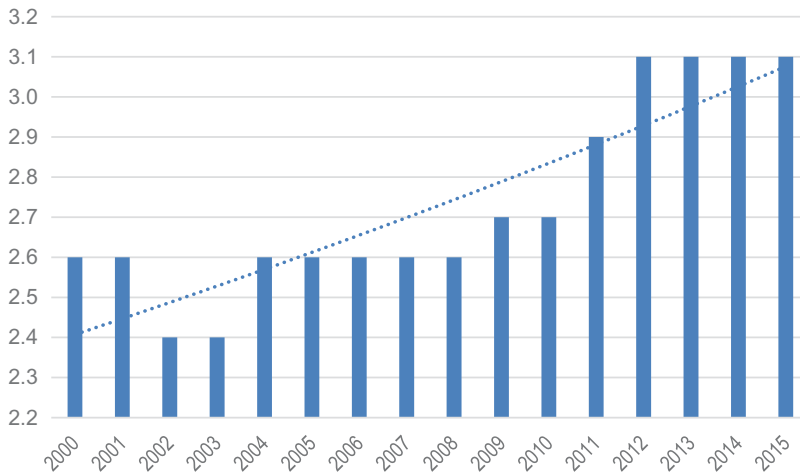
Figure 1. Vietnam's corruption perception index**.**
This figure captures Vietnam's corruption perception index, sourced from International Transparency (http://www.transparency.org/research/cpi/overview). The index ranges from 1 to 10.

corruption in these countries than in Vietnam (see Table 1 and Supplementary Table S1). In comparison, CPIs in developing country partners averaged 3.1 and ranged between 2.0 and 4.9. Thus, while average corruption perceptions were better than Vietnam's, in our developing country sample, there are eight (namely Bangladesh, Cambodia, Cote d'Ivoire, Indonesia, Laos, Pakistan, Russia, and Ukraine) which are more corrupt than Vietnam.

From Table 1, we also learn that corruption perception in Vietnam on average improved from 2.6 in the period 2000–2009 to 3.0 in the period 2010–2014. In developed countries, corruption perception was better than those in the developing trading partners or in Vietnam. However, for developed countries, corruption perception deteriorated from 7.2 to 7.1 in the same period, while in developing countries, perception of corruption improved from 3.1 to 3.3.

Hence, while in an absolute sense, corruption perception in Vietnam is among the highest, when considered relative to the improvements seen in developing and developed trading partners between the periods 2000–2009 and 2010–2014, improvements in perceptions of corruption in Vietnam has been higher. This suggests that Vietnam's major anti-corruption initiatives (the Law on Anti-Corruption of 2005; the Strategy on Anti-Corruption implemented in 2009; and the National Committee on Anti-Corruption in 2013) have been effective in improving the perception of Vietnamese corruption. However, progress is rather slow. When the Law on Anti-Corruption was introduced in 2005 perceptions about power abuse in Vietnam took a score of 2.6 (Figure 1). In 2008, the CPI remained at 2.6 out of a score of 10, only to improve slightly in 2009 to 2.7. Similarly, the Strategy on Anti-Corruption implemented in 2009 did not lead to immediate improvement, as the following year, 2010, had the same score. The scores improved to 3.1 out of 10 in 2012 and remained at this level during 2012–2014, suggesting that the National Committee on Anti-Corruption formed in 2013 did not significantly contribute to fighting corrupt behaviors.

The other variable of key interest is bilateral exports. The real exports between Vietnam and the developed partners are higher than those with developing partners (Table 1). However, average real exports figures in the period 2000–2009 compared to those of 2010–2014 suggest that the average growth of Vietnamese exports to developing trading partners in recent years has been greater than those to developed countries. The top five developed trading partners are the United States, Japan, Australia, Korea, and Germany. The top five developing trading partners are China, Malaysia, Thailand, Cambodia, and Indonesia.

To test time series properties of variables, we applied three different unit root tests developed by Levin, Lin, and Chu (LLC, 2002), Im et al. (IPS, 2003), and Maddala and Wu (ADF-Fisher,s 1999) (see discussion of these tests in Narayan and Nguyen 2019). The null hypothesis of all three methods is that the panels are non-stationary. Nonetheless, the tests are developed on the basis of different assumptions. For instance, the Levin, Lin, and Chu (2002) test presumes that the panels have a shared autoregressive structure for all the series while the other two tests assume that each series may have individual autoregressive coefficients. The tests are conducted with different options: individual intercept only, and both individual effects and individual linear trends. The results for variables are presented in Table 2. Overall, the majority of the tests establish that most variables are $I(1)$. Vietnam's income variables, namely, real GDP ($RGDP_i$) and real GDP per capita ($PRGDP_i$), which are repeated in the panel setting, are confirmed to be $I(1)$ processes by at least one of the reported tests. Consequently, in the short-term model, all variables appear in first difference form while the variables appear in level form or $I(0)$ in the long-run models.

Table 3 presents the pairwise correlation between the income variables. We recognize that some income variables, namely, *DRGDP* and *RGDP* of trading partners, are strongly and significantly correlated (also see Footnote 9). To avoid the multi-collinearity problem, we examine bilateral exports under three models (a–c) accounting for the income variables separately.

3. Impacts of Corruptions in Vietnam's Exports: Empirical Evidence

3.1. Evidence of Cointegration between Gravity Export Variables and Corruption

We begin by testing the long-run cointegration relationships between variables in Equation (1) for the full sample and the panels with developed and developing trading partners of Vietnam. Since all the panels comprise $I(1)$ variables, they are all suitable for two proposed panel cointegration tests: the tests of Kao (1999) and Pedroni (1999, 2004). Kao (1999) is a residual-based panel test that applies the Dickey–Fuller and Augmented Dickey–Fuller type test and considers homogeneous properties across individuals. The Kao test accounts for both strict endogenous regressors and strict exogenous regressors. The Pedroni test, unlike Kao's, allows for heterogeneity among individual units of the panel and no exogeneity requirements are

Table 2. Unit root test results.

	Full sample			Developed countries			Developing countries		
	LLC	IPS	ADF-Fisher	LLC	IPS	ADF-Fisher	LLC	IPS	ADF-Fisher
REX_i	−3.45***	4.91	50.18	−0.77	4.75	21.36	−4.56***	1.98	28.82
$RGDP_j$	−3.25***	2.78	55.43	−4.92***	0.86	35.96	−1.28	3.29	19.47
$RGDP_i$	−15.01***	−2.42***	101.07	−11.50***	−1.85**	59.33	−9.65***	−1.55*	41.75
$PRGDP_j$	−3.06***	1.43	70.31	−5.10***	−0.06	45.90	−1.26	2.30	24.42
$PRGDP_i$	−15.19***	−2.60***	104.35	−11.64***	−1.99**	61.25	−9.76***	−1.67**	43.10
$DRGDP_{ij}$	−1.45*	5.45	44.22	−0.27	5.84	9.17	−2.50**	1.53	35.06
RER_{ij}	−1.82**	2.02	64.50	−0.54	2.31	31.75	−2.30**	0.40	32.75
CPI_{jt}	−1.88**	−0.08	88.36	−1.87**	0.35	48.32	−0.75	−0.52	40.05
CPI_{it}	4.51	7.25	10.97	3.45	5.55	6.44	2.90	4.66	4.53

This table presents the outcomes of unit root tests for the levels of real export (REX_i) from country i, Vietnam, to country j, real gross domestic product of Vietnam, country i ($RGDP_i$) and those of her partners, country j ($RGDP_j$), real per capita income of Vietnam ($PRGDP_i$) and partners ($PRGDP_j$), the gap in the per capita income between Vietnam and her partners ($DRGDP_{ij}$), and the exchange rate between local currency of partners and Vietnam's currency (RER_{ij}). The three methods, namely, LLC, IPS, and ADF-Fisher, are employed with individual effect. *, **, and *** denote significance at 10, 5, and 1%, respectively.

Table 3. Correlation between income variables.

Panel 1: Full sample

	$RGDP_j$	$DRGDP_{ij}$	$PRGDP_j$	$PRGDP_i$	$RGDP_i$
$RGDP_j$	1.00				
$DRGDP_{ij}$	0.52***	1.00			
	15.87				
$PRGDP_j$	0.53***	0.99***	1.00		
	16.55	163.38			
$PRGDP_i$	0.09**	−0.09**	0.07*	1.00	
	2.48	−2.37	1.81		
$RGDP_i$	0.09**	−0.09**	0.07*	1.00	1.00
	2.48	−2.38	1.81		

Panel 2: Developed countries

	$RGDP_j$	$DRGDP_{ij}$	$PRGDP_j$	$PRGDP_i$	$RGDP_i$
$RGDP_j$	1.00				
$DRGDP_{ij}$	0.29***	1.00			
	6.14				
$PRGDP_j$	0.35***	0.90***	1.00		
	7.47	40.84			
$PRGDP_i$	0.08*	−0.34***	0.11**	1.00	
	1.66	−7.34	2.13		
$RGDP_i$	0.08*	−0.34***	0.11**	1.00***	1.00
	1.66	−7.36	2.12	3019.88	

Panel 3: Developing countries

	$RGDP_j$	$DRGDP_{ij}$	$PRGDP_j$	$PRGDP_i$	$RGDP_i$
$RGDP_j$	1.00				
$DRGDP_{ij}$	0.54***	1.00			
	10.66				
$PRGDP_j$	0.56***	0.97***	1.00		
	11.27	71.24			
$PRGDP_i$	0.12**	−0.06	0.17***	1.00	
	2.06	−1.07	2.86		
$RGDP_i$	0.12**	−0.06	0.17***	1.00***	1.00
	2.06	−1.07	2.86	2530.64	

This table captures the unconditional correlations between the three income variables, $RGDP$, $PRGDP$, and $DGDP$, used in the gravity model. $RGDP_i$ and $RGDP_j$ are the income variables entering the equation as the products of GDP of country i, Vietnam, and trade partner j at time t. Similarly, $PRGDP_i$ and $PRGDP_j$ are the products of per capita GDP of i and j. $DRGDP_{ij}$ is the difference between Vietnam's per capita income and trading partner j's per capita income at time point t. All the variables are in logarithmic form. *, **, and *** denote significance at 10, 5, and 1%, respectively.

imposed on the regressors in the cointegrating regressions. Of these tests, the Pedroni (1999, 2004) test allows cross-sectional dependence.

We report results relating to models (a–c) with or without *CPI* for the three samples (full list, developed, and developing countries) in Tables 4 and 5. The Pedroni test is not able to show an overwhelming support for cointegration in models (a–c), with or without *CPI*, across the samples. Two to four tests out of seven Pedroni tests show support for the cointegrating relationship between the variables expressed in models (a–c), with or without *CPI* for most panels. In the case of the developing sample, only one of the Pedroni tests is able to reject the null of no cointegration under the model (b) with *CPI*. The Kao test, on the other hand, suggests co-integration for models across all three samples. Given that there is some evidence of a cointegrating relationship between the variables covered in models (a–c), with or without *CPI*, across the samples, we proceed with the estimation of the long- and short-run models.

3.2.   Relationships between Trade and Corruption in the Short- and Long-run

We present full sample, and developed and developing country sample results, respectively, in Tables 6–8. The long-run models correspond to Equations (1) and (2), while the short-run models incorporate all variables in Equations (1) and (2) in first difference form and include a one-period lagged error correction term (*ECT*). Our results show that the one-year lagged *ECT* is negatively and significantly related to bilateral

Table 4. Co-integration results: full sample.

Models	Without CPI			With CPI		
	A	**B**	**C**	**A**	**B**	**C**
Panel 1: Pedroni Residual Cointegration Test						
Alternative hypothesis: common AR coefficients (within-dimension)						
Panel v-Stat	−0.589	0.486	−0.168	−2.504	−0.578	−2.611
	0.722	0.313	0.567	0.994	0.718	0.996
Panel rho-Stat	3.457	2.604	3.586	6.497	5.312	6.498
	1.000	0.995	1.000	1.000	1.000	1.000
Panel PP-Stat	−3.020*	−0.811	−2.950*	−2.635*	−3.679*	−2.706*
	0.001	0.209	0.002	0.004	0.000	0.003
Panel ADF-Stat	−3.061*	−2.338*	−3.437*	1.341	−1.369	0.926
	0.001	0.010	0.000	0.910	0.086	0.823
Alternative hypothesis: individual AR coefficients (between-dimension)						
Group rho-Stat	6.205	5.182	6.147	8.800	7.316	8.712
	1.000	1.000	1.000	1.000	1.000	1.000
Group PP-Stat	−7.904*	−4.607*	−8.427*	−18.403*	−13.569*	−20.205*
	0.000	0.000	0.000	0.000	0.000	0.000
Group ADF-Stat	−5.114*	−3.171*	−5.614*	−2.069*	−1.004	−2.413
	0.000	0.001	0.000	0.019	0.158	0.008
Panel 2: Kao Residual Cointegration Test						
ADF	−5.580*	−2.7943*	−5.031*	−4.965*	−5.616*	−4.659*
	0.000	0.000	0.000	0.000	0.000	0.000

This table presents the cointegration test results for the period 2000–2014. The tests cover variables expressed in Equation (1). The results are estimated with and without the corruption measure, *CPI*. Columns A, B, and C refer to models with *RGDP, PRGDP*, and *DRGDP*, respectively. Panel 1 reports the Pedroni test results. This test's null hypothesis is that of no cointegration. The test allowed for: 1 lag length and no deterministic trend; and used Newey–West automatic bandwidth selection and Barlett kernel. Panel 2 reports the Kao test results. This test also has a null hypothesis of no cointegration. No deterministic trend is assumed. Lag length of 1 is chosen with Newey–West automatic bandwidth selection and Bartlett kernel. * denotes significance at 5% or better.

Table 5. Co-integration results: sub-samples.

	Developed trading partners						Developing trading partners					
	Without CPI			With CPI			Without CPI			With CPI		
Models	A	B	C	A	B	C	A	B	C	A	B	C
Panel 1: Pedroni Residual Cointegration Test												
Alternative hypothesis: common AR coefficients (within-dimension)												
Panel v-Stat	-1.756	-0.414	-1.703	-0.163	0.835	-0.200	-1.681	-0.375	-1.854	-0.623	-0.033	-0.040
	0.960	0.661	0.956	0.565	0.202	0.579	0.954	0.646	0.968	0.733	0.513	0.516
Panel rho-Stat	5.684	4.667	5.734	2.959	2.369	3.119	3.435	2.830	-1.854	1.875	1.330	1.899
	1.000	1.000	1.000	0.999	0.991	0.999	1.000	0.998	0.968	0.970	0.908	0.971
Panel PP-Stat	1.423	0.154	1.604	-0.651	-0.110	-0.514	-5.564*	-5.184*	3.399	-3.870*	-0.859	-3.894*
	0.923	0.561	0.946	0.258	0.456	0.304	0.000	0.000	1.000	0.000	0.195	0.000
Panel ADF-Stat	2.046	-0.621	1.786	-1.095	-2.593*	-1.576*	-0.216	-1.289	-5.855*	-3.136*	-0.903	-3.189*
	0.980	0.267	0.963	0.137	0.005	0.058	0.415	0.099	0.000	0.001	0.183	0.001
Alternative hypothesis: individual AR coefficients (between-dimension)												
Group rho-Stat	7.529	5.889*	7.466	5.562	4.304	5.497	4.595	4.343	4.531	2.881	2.888	2.874
	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.998	0.998	0.998
Group PP-Stat	-14.564*	-12.103*	-16.127*	-3.690*	-2.774*	-4.277*	-11.278*	-6.385*	-12.188*	-8.472*	-4.056*	-8.548*
	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Group ADF-Stat	-3.176*	-1.332	-3.327*	-4.357*	-3.081*	-4.670*	0.908	0.145	0.526	-2.696*	-1.135	-3.119*
	0.001	0.091	0.000	0.000	0.001	0.000	0.818	0.558	0.701	0.004	0.128	0.001
Panel 2: Kao Residual Cointegration Test												
ADF	-3.320*	-3.136*	-3.132*	-3.501*	-2.762*	-3.299*	-4.594*	-4.176*	-4.291*	-5.367*	-2.131*	-5.103*
	0.000	0.001	0.001	0.000	0.003	0.001	0.000	0.000	0.000	0.000	0.017	0.000

This table presents the cointegration test results for developed and developing trading partners for the period 2000–2014. The tests cover variables expressed in Equation (1). The results are estimated with and without the corruption measure, CPI. Columns A, B, and C refer to models with RGDP, PRGDP, and DRGDP, respectively. Panel 1 reports the Pedroni test results. This test null hypothesis is that of no cointegration. The tests allowed for: 1 lag length and no deterministic trend; and used Newey–West automatic bandwidth selection and Barlett kernel. Panel 2 reports the Kao test results. This test also has a null hypothesis of no cointegration. No deterministic trend is assumed. Lag length of 1 is chosen with Newey–West automatic bandwidth selection and Bartlett kernel. * denotes significance at 5% or better.

Table 6. Gravity model estimation's results for Vietnam's exports: full sample (2000–2014).

Models	Panel 1: Short-run results						Panel 2: Long-run results					
	Without CPI			With CPI			Without CPI			With CPI		
	A	B	C	A	B	C	A	B	C	A	B	C
$ECT(-1)$	−0.236***	−0.231***	−0.110***	−0.229***		−0.143***						
	−9.810	−9.719	−5.967	−9.120		−6.212						
$RGDP_j$	1.881***			1.686***			0.823***			0.772***		
	4.112			3.481			4.564			3.903		
$RGDP_i$	5.543***			7.580***			2.359***			1.824***		
	2.732			3.357			14.464			9.267		
$PRGDP_j$		2.011***			1.858***			0.018			0.088	
		4.694			4.091			0.101			0.440	
$PRGDP_i$		4.839**			6.736***			3.543***			2.707***	
		2.391			3.010			20.871			12.057	
$DRGDP_{ij}$			2.135***			2.020***			−2.002***			−1.010***
			4.756			4.338			−9.329			−4.952
RER_{ij}	−0.478***	−0.512***	−0.667***	−0.535***	−0.556***	−0.763***	−0.114	−0.230*	0.114	−3.366***	−0.466***	−0.775***
	−3.276	−3.528	−4.499	−3.603	−3.757	−5.024	−0.890	−1.778	0.647	−2.683	−3.383	−5.090
FTA_{ij}	0.121***	0.110***	0.075***	0.112***	0.104***	0.075***	0.349***	0.283***	1.104***	0.394***	0.357***	0.794***
	4.207	3.970	2.857	3.473	3.278	2.318	5.417	4.315	14.503	6.013	5.359	12.320
CPI_j				−0.049	−0.049	−0.083				0.048	0.240	0.654***
				−0.426	−0.422	−0.687				0.294	1.453	3.595
CPI_i				0.233	0.184	0.011				2.167***	2.246***	5.789***
				1.324	1.047	0.065				5.064	5.205	15.532
D_{ijA}	0.134***	0.128***	0.125***	0.127***	0.124***	0.137***	−2.578***	−1.825***	2.644*	−3.415***	−2.855***	−2.489***
	4.955	4.051	3.705	4.622	3.882	3.831	−7.997	−3.778	1.977	−8.114	−5.245	−3.484
$\bar{R}^2$	0.219	0.221	0.192	0.206	0.211	0.201	0.929	0.926	0.862	0.930	0.923	0.910

This table displays the fixed effect estimations of the gravity model to identify factors influencing Vietnam's exports. The long-run regression analysis covers Equations (1) and (2). The short-run analysis covers all the variables in Equations (1) and (2) in first difference form, and includes a one-year lagged error correction term (ECT). The results are estimated with and without the corruption measure, CPI. Columns A, B, and C refer to models with $RGDP$, $PRGDP$, and $DRGDP$, respectively. $RGDP_i$ and $RGDP_j$ denote real gross domestic product of Vietnam and the trading partners; $PRGDP_i$ and $PRGDP_j$ are gross domestic products per capita of Vietnam and those of her partners; $DRGDP_{ij}$ refers the income per capita gap between exporters, Vietnam, and its trade partners; RER_{ij} refers to the bilateral exchange rate between partner j's currency and Vietnamese currency (Dong). CPI_i and CPI_j are the corruption perception index of country i, namely Vietnam and country j; D_{ij} is geographic distance between Vietnam and country j; FTA_{ij} is a binary variable that is assigned the value 1 if a bilateral trade agreement between Vietnam and the partner is in effect, or zero otherwise. The developed countries are listed in Supplementary Table S1. *, **, and *** denote significance at 10, 5, and 1% levels, respectively.

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Table 7. Gravity model estimation's results for Vietnam's exports: developed countries (2000–2014).

| | Panel 1: Short-run results | | | | | | Panel 2: Long-run results | | | | | |
| | Without CPI | | | With CPI | | | Without CPI | | | With CPI | | |
Models	A	B	C	A	B	C	A	B	C	A	B	C
$ECT(-1)$	-0.136***	-0.142***	-0.103***	-0.135***	-0.143***	-0.102***						
	-4.371	-4.554	-3.644	-4.104	-4.389	-3.279						
$RGDP_j$	1.893***			1.701***			0.918***			0.747**		
	3.197			2.706			3.367			2.568		
$RGDP_i$	3.939			5.629**			2.160***			1.603***		
	1.603			2.122			11.342			7.083		
$PRGDP_j$		1.871***			1.754***			-0.773***			-0.352	
		3.639			3.195			-3.104			-1.253	
$PRGDP_i$		3.999*			5.399**			3.301***			2.430***	
		1.696			2.118			16.901			9.378	
$DRGDP_{ij}$			2.124***			2.070***			-2.480***			-1.530***
			4.125			3.802			-12.628			-6.417
RER_{ij}	-0.236	-0.264	-0.367**	-0.269	-0.281	-0.402**	0.191	0.059	0.433**	-0.063	-0.127	-0.136
	-1.371	-1.545	-2.179	-1.535	-1.616	-2.305	1.203	0.381	2.577	-0.367	-0.741	-0.750
FTA_{ij}	0.122***	0.119***	0.088***	0.115***	0.113***	0.091***	0.184**	0.162**	0.558***	0.259***	0.240***	0.520***
	3.893	3.967	3.223	3.252	3.264	2.654	2.358	2.056	7.428	3.351	3.068	7.273
CPI_{jt}				0.003	-0.014	-0.006				-0.193	0.145	0.529*
				0.0157	-0.085	-0.035				-0.672	0.512	1.787
CPI_{it}				0.197	0.142	-0.049				2.166***	2.086***	3.637***
				1.000	0.719	-0.254				4.225	4.012	7.290
D_{ij}	0.062	0.049	0.048	0.056	0.044	0.044	-1.521***	-1.048	-1.350	-1.963***	-1.481	-1.350
	1.440	0.971	0.909	1.318	0.891	0.834	-2.990	-1.048	-1.305	-4.363	-1.706	-1.305
$\overline{R^2}$	0.152	0.159	0.121	0.142	0.151	0.108	0.941	0.940	0.926	0.943	0.943	0.935

This table displays the fixed effect estimations of the gravity model to identify factors influencing Vietnam's exports to developed countries. The long-run regression analysis covers Equations (1) and (2). The short-run analysis covers all the variables in Equations (1) and (2) in first difference form and includes a one-year lagged error correction term (ECT). The results are estimated with and without the corruption measure, CPI. Columns A, B, and C refer to models with $RGDP$, $PRGDP$, and $DRGDP$, respectively. $RGDP_i$ and $RGDP_j$ denote real gross domestic product of Vietnam and the trading partners; $PRGDP_i$ and $PRGDP_j$ are gross domestic products\per capita of Vietnam and those of her partners; $DRGDP_{ij}$ refers the income per capita gap between exporters, Vietnam, and its trading partners; RER_{ij} refers to the bilateral exchange rate between partner js currency and Vietnamese currency (Dong). CPI_i and CPI_j are corruption perception index of country i, namely Vietnam and country j; D_{ij} is geographic distance between Vietnam and country j; FTA_{ij} is a binary variable that is assigned the value 1 if a bilateral trade agreement between Vietnam and the partner is in effect, or zero otherwise. The developed countries are listed in Supplementary Table S1. *, **, and *** denote significance at 10, 5, and 1% levels, respectively.

Table 8. Gravity model estimation's results for Vietnam's exports: developing countries (2000–2014).

Models	Panel 1: Short-run results						Panel 2: Long-run results					
	Without CPI			With CPI			Without CPI			With CPI		
	A	B	C	A	B	C	A	B	C	A	B	C
$ECT(-1)$	−0.341***	−0.341***	−0.104***	−0.329***	−0.330***	−0.158***						
	−7.868	−7.777	−3.416	−7.132	−7.046	−3.769						
$RGDP_j$	1.834**			1.668**			−0.558*			−0.629*		
	2.544			2.161			−1.807			−1.921		
$RGDP_i$	8.486**			10.989***			3.620***			3.290***		
	2.502			2.761			11.773			9.280		
$PRGDP_j$		1.811**			1.645**			−0.860***			−0.996***	
		2.530			2.145			−2.916			−3.220	
$PRGDP_i$		8.678**			10.968***			4.522***			4.111***	
		2.503			2.716			15.109			11.235	
$DRGDP_{ij}$			1.823**			1.711**			−2.541***			−1.908***
			2.304			2.078			−5.553			−5.398
RER_{ij}	−0.528**	−0.518**	−0.982***	−0.607**	−0.606**	−1.068***	−0.160	−0.230	−0.115	−0.342*	−0.446**	−0.905***
	−2.085	−2.042	−3.668	−2.314	−2.302	−3.921	−0.823	−1.186	−0.368	−1.664	−2.161	−3.767
FTA_{ij}	0.107*	0.097*	0.022	0.091	0.080	0.015	0.611***	0.586***	1.748***	0.640***	0.618***	1.117***
	1.794	1.794	0.413	1.457	1.296	0.229	6.120	5.961	13.445	6.223	6.099	13.445
CPI_j				0.028	0.021	−0.067				−0.017	0.041	0.360
				0.151	0.110	−0.332				−0.084	0.208	1.562
CPI_i				0.211	0.198	0.049				1.521**	1.588**	6.485***
				0.635	0.600	0.145				2.286	2.430	12.159
D_{ij}	0.200***	0.192***	0.164***	0.157***	0.151***	0.150***	−0.867	−1.140	1.489	−1.382	−1.762*	−2.451*
	5.706	4.870	3.720	3.812	3.417	3.207	−0.880	−1.423	1.002	−1.327	−2.072	−2.030
$\overline{R}^2$	0.279	0.279	0.118	0.256	0.254	0.125	0.927	0.929	0.814	0.928	0.930	0.901

This table displays the fixed effect estimations of the gravity model to identify factors influencing Vietnam's exports to developing countries. The long-run regression analysis covers Equations (1) and (2). The short-run analysis covers all the variables in Equations (1) and (2) in first difference form and includes a one-year lagged error correction term (ECT). The results are estimated with and without the corruption measure, CPI. Columns A, B, and C refer to models with $RGDP$, $PRGDP$, and $DRGDP$, respectively. $RGDP_i$ and $RGDP_j$ denote real gross domestic product of Vietnam and the trading partners; $PRGDP_i$, and $PRGDP_j$ are gross domestic products\per capita of Vietnam and those of her partners; $DRGDP_{ij}$ refers the income per capita gap between exporters, Vietnam, and its trading partners; RER_{ij} refers to the bilateral exchange rate between partner js currency and Vietnamese currency (Dong). CPI_i and CPI_j are corruption perception index of country i, namely Vietnam and country j; D_{ij} is geographic distance between Vietnam and country j; FTA_{ij} is a binary variable that is assigned the value 1 if a bilateral trade agreement between Vietnam and the partner is in effect, or zero otherwise. The developed countries are listed in Supplementary Table S1. *, **, and *** denote significance at 10, 5, and 1% levels, respectively.

exports in all models across all samples, confirming that the relationships depicted in our models are stable in the long-run (see Tables 6–8).

Of key interest is the link between trade and corruption in Vietnam (country i) and trading partner (j) countries. The importance of the corruption indices to Vietnam's exports can be examined by comparing the adjusted R^2 of the models with and without the *CPIs*. The adjusted R^2 statistic is always stronger in the long-run models with the corruption indices than those without these indices. This implies that corruption is an important determinant of Vietnam's bilateral exports in the long-run.

In the full sample (Table 6, Panel 1), corruption in country i and js does not seem to matter for bilateral trade in the short-run. However, in the long-run, corruption is an important determinant of bilateral trade (Table 6, Panel 2). We find that a perception of less corruption in Vietnam and trading partner countries is responsible for some increase in trade. The long-run effect is consistently positive across models (a–c). A 1% increase in the corruption index, which indicates that corruption has lessened, increases exports in the range of 2.2–5.8% (Table 6, Panel 2). The effect of corruption in Vietnam is mostly significant and is greater in magnitude than that of the trading partner countries. What is also interesting is that the effects of corruption in Vietnam are mainly more important for trade in the long-run than the effect of some of the key gravity trade variables such as real GDP of Vietnam and partners and the difference in real GDP per capita.

It may be argued that our results are driven by the trading partners included in the study. Hence, we divided our results by trading partners' level of income. This division is motivated by Narayan and Nguyen (2016) who show that income of trading partners matters in the determination of the gravity trade model. However, instead of dividing, the countries by high-, low-, and middle-income countries, as in Narayan and Nguyen (2016), here we take a different approach by dividing the countries into developing and developed country groups (also see Narayan and Nguyen 2019).

Results by developed and developing trading partners are reported in Tables 7 and 8. We find that corruption effects seen in the full sample seems to hold in the developed and developing panels. Exports of goods to both the developed and developing trade partners increase with a fall in corruption. This corruption effect is significant only in the long-run. Similar to the full sample results, we find that corruption in Vietnam, unlike corruption in the trading partner country, is a significant determinant of her exports. Further, with the exception of *PRGDP* of Vietnam in model (b), the effect of corruption is always found to be stronger than the other gravity variables.

Between the developed and developing countries, we notice that corruption in Vietnam can be more disruptive for Vietnam's trade with developing countries than with developed nations. The marginal change of bilateral exports to developed countries is between 2.2 and 3.6 percentage points (Table 7, Panel 2). In comparison, if Vietnam's *CPI* grows by 1%, Vietnam's exports to developing countries increase by approximately 1.6–6.5 percentage points (Table 8, Panel 2).

Overall, we can say that the effect of corruption is consistent across developed and developing trading partners, at least in sign and significance, both in the short- and long-run. In terms of the magnitude of the effect, corruption in Vietnam can be more disruptive for Vietnam's exports to developing countries than to developed countries. We find that like corruption in Vietnam, all export gravity variables display a stronger influence on Vietnam's exports to developing trade partners than to developed partners (see discussion in section 4.3).

Our finding, that corruption discourages trade, is somewhat inconsistent with Anh, Minh, and Tran-Nam (2016) who applied the same measure of corruption as ours to show a positive impact of corruption on domestic investment and human capital (captured via education) in Vietnam between 2000 and 2012. However, in their evaluation of the impact of corruption on economic growth at large, Anh, Minh, and Tran-Nam (2016) show that the Vietnamese economy, which is heavily reliant on trade, suffers in the presence of corruption.

3.3.   Relationships between Trade and Gravity Variables in the Short- and Long-run

Here we briefly examine the link between bilateral exports of Vietnam with her trading partners and the other variables. The key findings from the short-run models are as follows.

All the income-related coefficients are positive and significant across all short-run models, suggesting that an increase in internal and external demand and supply factors, including size of Vietnamese and trading partners' economies, improves bilateral export flows from Vietnam to the trading partners.

Similar to the effect of corruption, the impacts of Vietnam's real GDP and real RGDP per capita are significantly greater than those of trading partners. For example, coefficients of $RGDP_j$ in the short-run of the full sample are approximately 1.7 or 1. 9 percentage points while marginal effects of $RGDP_i$ are between 4.8 and 6.7 percentage points (Table 6, Panel 1). We also find that Vietnam's exports to developed partners are less sensitive to changes in income factors than those to developing countries. For instance, Vietnam's income elasticity of the export flow to developed countries is from 3.6 to 5.6 (Table 7, Panel 1) while for developing partners, it ranges from 8.4 to 11.0 (Table 8, Panel 1).

The differences in endowments between the countries improve exports, suggesting the prevalence of the Heckscher-Ohlin theory (Table 6). In terms of magnitude, if the ratio of real income per capita gap increases by 1%, the ratio of bilateral trade rises by about 2% (Table 6, Panel 1). In the long-run, sign effects of income variables are the same as those in the short-run, except the difference in RGDP ($DRGDP$) which takes a significant and negative effect, suggesting that in the long-run, the Linder hypothesis prevails with a difference in endowment discouraging export growth (Table 6, Panel 2).

While the short-run result is consistent with Narayan and Nguyen (2016), the long-run results are part of new evidence on Vietnam. The key long-run findings are as follows. An increase in trading partners' income per capita lowers Vietnam's bilateral exports in the long-run for all three samples. By contrast, the trade partners' economic size has the opposite effects between groups. Increase in economic scale supports Vietnam's bilateral exports to developing country partners, but discourages the trade flow to developed countries in the long-run.

Real exchange rate has the expected negative and significant effect on bilateral exports in the short- and long-run. This is true across all models (a–c) and all three samples (full, developed, and developing nations). This result implies that exchange rate is indeed an important determinant of export competitiveness. An increase in RER, or appreciation of the Vietnamese Dong against the trading partner currency, reduces export demand. The impact of RER is more strongly felt on Vietnam's exports to developing nations than to developed nations.

Free trade agreements have a positive and significant effect in the short- and long-run for most models in the full sample. The developed country sample shows similar results while the developing sample shows a positive and significant result in the long-run only. The effects of FTA are always found to be stronger in the long-run, suggesting that the positive effect is persistent. Further, the effect of FTA is felt more by exports to developing nations than to developed nations.

Distance has an unexpected positive and significant impact in the short-run, suggesting that an increase in distance increases exports, although in the long-run, we see that distance has a negative impact on exports for all three sample groups (Tables 6–8). Like all other gravity export factors and Vietnam's corruption index, the impact of distance is more strongly felt by Vietnamese exports to developing nations than to developed nations.

4.   Some Additional Tests

Thus far, we have examined the implications of exporter/importer corruption on trade, conditioning these relationships with gravity determinants of exports. In this section, we examine the influence of a new measure of corruption, the control of corruption (COC), which is one of six Worldwide Governance Indicators available from the World Bank database.[18] The COC captures "perception of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as
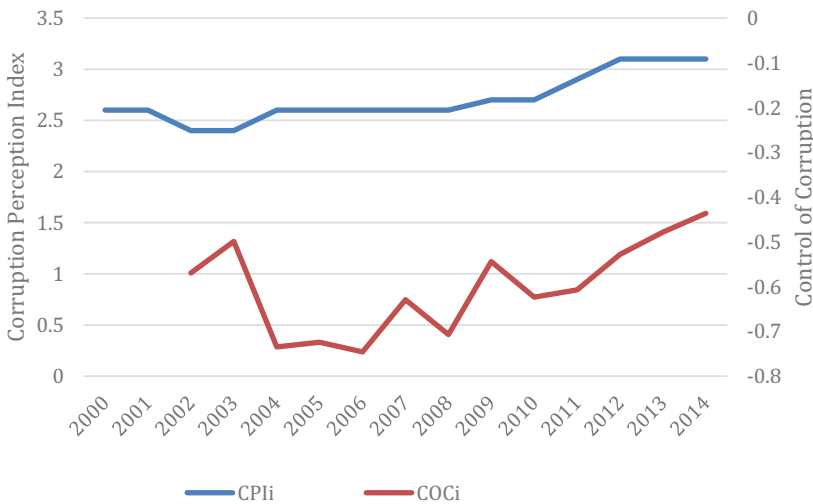
Figure 2. Vietnam's CPI and COC measures of corruption.
This figure compares the corruption perception index (*CPI*), (http://www.transparency.org/research/cpi/overview) with the control of corruption (*COC*) index. The CPI and COC indices are sourced from International Transparency and the World Bank, respectively. The CPI index ranges from 1 to 10 while the COC index ranges from −2.5 to 2.5.

well as "capture" of the state elites and private interests".[19] Like the *CPI*, low *COC* implies high corruption and vice versa. Looking at the two measures of corruption we can see that the *COC* for Vietnam displays more short-term variability than the *CPI* measure over the period (Figure 2).

We present the results of testing for *COC* in Supplementary Tables S2–S5 as part of our supplementary material. The *COC* measure for Vietnam, like *CPI*, has a positive and significant effect. In other words, our result that it is corruption in Vietnam (exporter) nation, rather than corruption in trading partner nations (importers), that is the significant determinant of Vietnam's exports is robust. Further when we look at the results by developed and developing nations, the *CPI* of Vietnam had the ability to have stronger impact on exports to developing nations than developed nations. With the *COC*, we find stronger evidence of corruption having a greater impact on developing nations than developed nations. For all models, corruption, measured as *COC*, has a stronger impact on developing nations than developed nations (Supplementary Table S5).

We also notice some differences in the influence of *COC* and *CPI* on exports. First, the *CPI* of Vietnam has significant long-term effects on exports across all our panels (full sample, developed, and developing), but, the *COC* of Vietnam has a short-run impact in the case of the full sample and the developed nations panel and both long- and short-term impact on exports to developing nations. Between the developed and developing nations, the corruption effects are only short-term in the case of developed nations and long-term in the case of developing nations (Supplementary Tables S4 and S5).

In the models we also indicate which trade partners share a border with Vietnam (*Bij*) (Supplementary Tables S4 and S5). Conventionally, apart from distance, trade gravity studies include other factors, namely, common language or common borders. There is no common language between Vietnam and all her 54 trade partners, but three of the Asian trade partners in our sample share a border with Vietnam. We found that this variable is an insignificant determinant of Vietnam's exports.

5.   Concluding Remarks

Our study examined the effects of corruption on bilateral exports by Vietnam to 46 developed and developing trade partners. We summarize the results and discuss the implications.

One of the key results relating to corruption revealed here is that a fall in corruption in Vietnam and in her trading partners has a positive impact on trade in the long-run. Further, corruption in Vietnam has a more robust impact on bilateral exports in the long-run than corruption in trading partner countries.

Our *CPI*-related results suggest that in the long-run, trade flows from Vietnam to developing country trading partners can be impacted more by corruption in Vietnam than trade flows to developed countries. The *COC*-related findings indicate that while Vietnam's exports to developing nations experienced long-term effects of corruption in Vietnam similar to *CPI*, the developed nations may have experienced short-term, not long-term, effects of corruption in Vietnam. Both measures of corruption consistently show that for exports to developing nations, corruption in Vietnam has a long term impact. This finding does not seem very surprising as developing trading partners, unlike developed trade partners, are less endowed, both in terms of funds and expertise, making them less able to navigate through a corrupt and inefficient bureaucracy effectively and to seek quick turn-arounds of their import contracts. Our result suggests that developing nation trade partners may be disadvantaged by a corrupt system. Consequently, reducing the high levels of corruption in Vietnam, by way of fair and standard trade practices may possibly assist in improving Vietnamese export performance to developing, more than developed, nations.

Our results also show that the perception of corruption in Vietnam (which is the highest compared to her trading partners) is more important than perceptions of corruption in trading partner countries (which is always lower than Vietnam) in driving exports. This result suggests that for Vietnamese exports, corruption in Vietnam, unlike corruption in her trading partners, is like 'sand-in-the-wheels'. Whether these results are similar for other exporting nations, particularly those with corruption levels far less than that of Vietnam, is left for future research.

Supplementary material

Supplemental data for this article can be accessed here.

Notes

1. International Transparency (http://www.transparency.org/) is an independent organization aiming to fight corruption worldwide. The organization has published corruption perception indices (CPIs) since 1995 for a large number of countries. In 2014, for example, 175 countries had CPIs.

2. The Weberian approach to the analysis of state involvement in the economy also emphasizes the quality of bureaucratic organization and suggests that corruption does not depend on what bureaucrats do but how they do it (Brown, Earle, and Gehlbach 2009; Duvanova 2014). In a study of the link between state regulation involvement in the country and bureaucratic corruption, Duvanova (2014) uses a business survey of 25 post-communist countries data to show that the mechanisms of regulatory implementation, rather than heavy handed regulatory policy, are responsible for bureaucratic corruption. The source of corruption, according to Duvanova (2014), lies in bureaucrats' ability to generate red tape, which creates additional, unofficial costs for economic agents.

3. According to the World Trade Organization (2013, 9), "(t)he Ministry of Industry and Trade plays a leading role on international trade issues, although many other ministries and agencies also deal with trade-related matters. The National Committee for International Economic Co-operation serves as a coordinating body between the ministries and line agencies."

4. See: http://vietnamnews.vn/society/300731.scheme-to-speed-up-national-single window.html#ZHcKX%WLrVRpkZee.97.

5. See Jain (2001) for an excellent review on this literature.

6. Meon and Weill (2010) find that corruption is less detrimental to efficiency in a panel of 69 developed and developing countries where institutions are less effective.

7. We first identified 50 major importers based on their total value of imports from Vietnam between 2000 and 2014. However, four countries, namely Cuba (ranked 38th), Ghana (ranked 50th), Iraq (ranked 36th), and Slovak Republic (ranked 42th) were dropped due to lack of data. The list of the 46 trading partners is captured in Supplementary Table S1.

8. These income variables are highly correlated (Table 3). To prevent multi-collinearity problems in this equation, we follow Narayan and Nguyen (2016) and estimate model (1) three times with each income type represented one at a time.

9. We first derive the exchange rate between trading partners and Dong from two exchange rate series, namely, USD expressed in terms of trading partner currency and US expressed in terms of Dong, that we call nominal exchange rate, NER. We derive real exchange rate as $RER_{ijt} = NER_{ijt} * \left(\frac{GDP\ Deflator_{it}}{GDP\ DEflator_{jt}} \right)$.

10. Laos is officially known as the Lao People's Democratic Republic.

11. See Narayan and Nguyen (2016) for a discussion on the importance of the WTO to Vietnam.

12. Vietnam also signed bilateral and/or multilateral free trade agreements with some other countries, such as Japan, Korea, India, Australia, New Zealand, and Chile. These agreements came into effect after 2007. These are captured by the FTA variable.

13. Note that Laos already had a value of one because it is a member of ASEAN.

14. See http://www.transparency.org/cpi2015.

15. See https://www.searates.com.

16. See http://luatvietnam.vn/default.aspx?tabid=651&id=893AE326-D43C-415B-8C35-A50876517AC4&rurl=%2fVL%2f662%2fLuat-sua-doi-bo-sung-mot-so-dieu-cua-Luat-Phong-chong-tham-nhung-cua-Quoc-hoi-so-272012QH13%2f893AE326-D43C-415B-8C35-A50876517AC4%2fdefault.aspx.

17. See the following websites: https://thuvienphapluat.vn/van-ban/Bo-may-hanh-chinh/Nghi-quyet-21-NQ-CP-chien-luoc-quoc-gia-phong-chong-tham-nhung-den-nam-2020-88368.aspxhttp://luatvietnam.vn/default.aspx?tabid=754&id = EB4340DD-302F-4613-B2DD-4F48AD3A7994&rurl=%2fVL%2f727%2fResolution-No-21NQCP-of-May-12-2009-promulgating-the-national-strategy-against-corruption-up-to-2020%2fEB4340DD-302F-4613-B2DD-4F48AD3A7994%2fdefault.aspx.

18. We thank an anonymous reviewer for suggesting an additional test.

19. For the development of the indicator refer to http://info.worldbank.org/governance/wgi/index.aspx#doc. Also see Kaufmann, Kraay, and Mastruzzi (2010).

References

Abotsi, A. K. 2016. Theory of foreign direct investment and corruption. *International Journal of Asian Social Science* 6 (6):359–78. doi:10.18488/journal.1.

Acemoglu, D., and T. Verdier. 1998. Property rights, corruption and the allocation of talent: A general equilibrium approach. *The Economic Journal* 108 (450):1381–403. doi:10.1111/1468-0297.00347.

Alan, D., L. T. Dao, and X. C. Hoang. 2013. Criminalising corruption: A study of international practices and application for Viet Nam. http://www.undp.org/content/dam/vietnam/docs/Publications/Final_Report_PenalCode_InternationalExperiences&VietNam_ENG.PDF

Amundsen, I. 2000. Corruption: Definitions and concepts. Working Paper. Chr. Michelsen Institute Development Studies and Human Rights.

Anh, N. N., N. N. Minh, and B. Tran-Nam. 2016. Corruption and economic growth, with a focus on Vietnam. *Crime, Law and Social Change*65:1–18.

Athukorala, P.-C. 2006. Trade policy reforms and the structure of protection in Vietnam. *The World Economy* 29 (2):161–87. doi:10.1111/twec.2006.29.issue-2.

Bardhan, P. 1997. The economist's approach to the problem of corruption. *World Development* 34 (2):341–48. doi:10.1016/j.worlddev.2005.03.011.

Batabyal, A. A., and S. J. Yoo. 2007. Corruption, bribery, and wait times in the public allocation of goods in developing countries. *Review of Development Economics* 11 (3):507–17. doi:10.1111/rode.2007.11.issue-3.

Brown, D. J., J. S. Earle, and S. Gehlbach. 2009. Helping hand or grabbing hand? State bureaucracy and privatization effectiveness. *American Political Science Review* 103:264–83. doi:10.1017/S0003055409090182.

Cheng, I.-H., and H. J. Wall. January/February 2005. Controlling for heterogeneity in gravity models of trade and integration. *Federal Reserve Bank of St. Louis Review* 87(1):49–63.

D'agostina, G., J. P. Dunne, and L. Pieroni. 2016. Government spending, corruption and Economic growth. *World Development* 84:190–205. doi:10.1016/j.worlddev.2016.03.011.

Dang, Q. V. 2016. The impact of corruption on provincial development performance in Vietnam. *Crime, Law and Social Change* 65 (4–5):325–50. doi:10.1007/s10611-016-9608-8.

de Jong, E., and C. Bogmans. 2011. Does corruption discourage international trade? *European Journal of Political Economy* 27 (2):385–98. doi:10.1016/j.ejpoleco.2010.11.005.

Duvanova, D. 2014. Economic regulations, red tape, and bureaucratic corruption in post-communist economies. *World Development* 59:298–312. doi:10.1016/j.worlddev.2014.01.028.

Freckleton, M., A. Wright, and R. Craigwell. 2012. Economic growth, foreign direct investment and corruption in developed and developing countries. *Journal of Economic Studies* 39 (6):639–52. doi:10.1108/01443581211274593.

Gray, C. W., and D. Kaufmann. 1998. Corruption and development. *Finance & Development* 35 (1):7.

Gupta, S., H. Davoodi, and R. Alonso-Terme (1998). *Does corruption affect inequality and poverty?* International Monetary Fund. WP/98/76.

Gupta, S., H. Davoodi, and R. Alonso-Terme. 2002. Does corruption affect income inequality and poverty? *Economics of Governance* 3 (3):23–45. doi:10.1007/s101010100039.

Gyimah-Brempong, K. 2002. Corruption, economic growth, and income inequality in Africa. *Economics of Governance* 3 (3):183–209. doi:10.1007/s101010200045.

Im, K. S., M. H. Pesaran, and Y. Shin. 2003. Testing for unit roots in heterogeneous panels. *Journal of Econometrics* 115 (1):53–74. doi:10.1016/S0304-4076(03)00092-7.

Jain, A. K. 2001. Corruption: A review. *Journal of Economic Surveys* 15 (1):71–121. doi:10.1111/joes.2001.15.issue-1.

Johnson, S., D. Kaufmann, and P. Zoido-Lobaton. 1998. Regulatory discretion and the unofficial economy. *The American Economic Review* 88 (2):387–92.

Kao, C. 1999. Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics* 90 (1):1–44. doi:10.1016/S0304-4076(98)00023-2.

Kaufmann, D., A. Kraay, and M. Mastruzzi. 2010. The worldwide governance indicators, methodology and analytical issues, World Bank Policy Research Working Papers, 5430.

Kaufmann, D., and S. J. Wei. 1999. Does" grease money" speed up the wheels of commerce? No. w7093. National bureau of economic research. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1682130

Lambsdorff, J. G. 1998. An empirical investigation of bribery in international trade. *The European Journal of Development Research* 10 (1):40–59. doi:10.1080/09578819808426701.

Leff, N. H. 1964. Economic development through bureaucratic corruption. *American Behavioral Scientist* 8 (3):8–14. doi:10.1177/000276426400800303.

Lenway, S., R. Morck, and B. Yeung. 1996. Rent seeking, protectionism and innovation in the American steel industry. *The Economic Journal* 106 (March):410–21. doi:10.2307/2235256.

Levin, A., C. F. Lin, and C. S. J. Chu. 2002. Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics* 108 (1):1–24. doi:10.1016/S0304-4076(01)00098-7.

Linder, S. B. 1961. *An essay on trade and transformation.* New York, USA: John Wiley and Son.

Maddala, G. S., and S. Wu. 1999. A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics* 61 (S1):631–52. doi:10.1111/obes.1999.61.issue-S1.

Mauro, P. 1995. Corruption and growth. *The Quarterly Journal of Economics* 110 (3):681–712. doi:10.2307/2946696.

Meon, P.-G., and L. Weill. 2010. Is corruption an efficient grease? *World Development* 38 (3):244–59. doi:10.1016/j.worlddev.2009.06.004.

Mo, P. H. 2001. Corruption and economic growth. *Journal of Comparative Economics* 29 (1):66–79. doi:10.1006/jcec.2000.1703.

Narayan, S., and T. T. Nguyen. 2016. Does the trade gravity model depend on trading partners? Some evidence from Vietnam and her 54 trading partners. *International Review of Economics & Finance* 41 (January):220–37. doi:10.1016/j.iref.2015.08.010.

Narayan, S., and T. T. Nguyen. 2019. Are exports more responsive to clean or dirty energy? The case of Vietnam's exports to 54 countries. *Energies* 12:1558–79. doi:10.3390/en12081558.

Nguyen, B. X. 2010. The determinants of Vietnamese export flows: Static and dynamic panel gravity approaches. *International Journal of Economics and Finance* 2 (4):122. doi:10.5539/ijef.v2n4p122.

Nguyen, N. A., Q. H. Doan, N. M. Nguyen, and B. Tran-Nam. 2016. The impact of petty corruption on firm innovation in Vietnam. *Crime, Law and Social Change* 65:1–18. doi:10.1007/s10611-016-9610-1.

Nguyen, T. T., and M. A. Van Dijk. 2012. Corruption, growth, and governance: Private vs. state-owned firms in Vietnam. *Journal of Banking and Finance* 36 (11):2935–48. doi:10.1016/j.jbankfin.2012.03.027.

Pedroni, P. 1999. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics* 61 (1):653–70. doi:10.1111/1468-0084.61.s1.14.

Pedroni, P. 2004. Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric Theory* 20 (03):597–625. doi:10.1017/S0266466604203073.

Rand, J., and F. Tarp. 2012. Firm-level corruption in Vietnam. *Economic Development and Cultural Change* 60 (3):571–95. doi:10.1086/664022.

Shleifer, A., and R. W. Vishny. 1993. Corruption. *The Quarterly Journal of Economics* 108 (3):599–617. doi:10.2307/2118402.

Thai, T. D. 2006. A gravity model for trade between Vietnam and twenty-three European countries. Masters Thesis, Dalarna University. http://www.diva-portal.org/smash/get/diva2:518029/fulltext01.pdf

Thede, S., and N. Å. Gustafson. 2012. The multifaceted impact of corruption on international trade. *The World Economy* 35 (5):651–66. doi:10.1111/j.1467-9701.2012.01436.x.

Tinbergen, J. 1962. *Shaping the world economy; suggestions for an international economic policy.* New York: Twentieth Century Fund.

World Trade Organization. 2013. Trade policy review: Viet Nam. https://www.wto.org/english/tratop_e/tpr_e/tp387_e.htm