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Corruption and assortative matching of partners in international trade

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Abstract: While the effects of corruption on bilateral trade have been relatively well explored, its effect on the composition of trading partners has not been studied. In this paper, we argue that corruption in a country is likely to impose asymmetric costs on its trading partners depending on their characteristics. As a result, as the level of corruption in a country changes, its trade flows from some of its trading partners change more than others depending on the latter's characteristics, causing a change in the composition of its trading partners. We focus on two characteristics of trading partners: the level of corruption and membership in the Organisation for Economic Co-operation and Development Convention on Combating Bribery of Foreign Public Officials in International Business Transactions. Using the gravity model, we find evidence of negative assortative matching in international trade with respect to corruption: that corruption in a country is negatively associated with trade flows from highly corrupt countries and positively associated with trade flows from signatories to the Convention. Our main results also confirm the findings of previous studies that both origin and destination country corruption discourage bilateral trade.

Key words: corruption, international bribery, international trade, OECD Convention

JEL classification: D73, F14, K20

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1 Introduction

The negative effects of corruption on several outcomes, such as investment and economic growth (Mauro 1995), foreign direct investment (FDI) (Cuervo-Cazurra 2006; Wei 2000; Habib and Zurawicki 2002), and financial development (Cooray and Schneider 2018), are well documented. While several studies have investigated the effect of corruption on international trade (Anderson and Marcouiller 2002; De Jong and Bogmans 2011; Dutt and Traca 2010; Lambsdorff 1998; Musila and Sigue 2010), its effect on the composition of a country's trading partners has not been studied. In this paper we investigate whether the level of corruption in a country influences the composition of its trading partners. This is plausible because corruption in a country is likely to impose asymmetric costs on its trading partners depending on their characteristics. Accordingly, we focus on two such characteristics: (1) the level of corruption in the trading partner, and (2) the trading partner's membership status in relation to the Organisation for Economic Co-operation and Development (OECD) Convention on Combating Bribery of Foreign Public Officials in International Business Transactions (henceforth the OECD Convention). The focus on the OECD Convention is due to the fact that it requires member countries to declare international bribery illegal and take action to combat its prevalence (discussed in detail below).

The focus on the level of corruption in the trading partner is motivated by the literature on assortative matching. In 1973, Gary Becker put forward the concept of assortative matching in relation to the marriage market. Becker (1973) distinguishes between positive and negative assortative matching. In positive assortative matching, two individuals or groups with similar characteristics form an alliance; an alliance by two individuals or groups with opposite characteristics is known as negative assortative matching. This theory has since been applied to several contexts, including international trade.[1] To the best of our knowledge, no study has been undertaken on assortative matching in international trade with respect to corruption. The present paper fills this gap in the literature by investigating whether positive or negative assortative matching exists in international trade with regard to corruption. We argue that a country's level of corruption has an impact not only on its volume of bilateral trade, but also on the composition of its trading partners because it imposes heterogeneous costs on different trading partners depending on the aforementioned two characteristics.[2] Consequently, corruption in a country is likely to impact bilateral trade flows from some trading partners more than others depending on their level of corruption, resulting in a change in the composition of its trading partners. Therefore, we investigate the relationship between the level of corruption in a country and the level of corruption in its trading partners, and how this relationship determines the volume of trade between them. In other words, we seek to answer the following question: Do highly corrupt countries trade more or less with one another?

A second issue that we investigate is whether the level of corruption in a country impacts its trade flows with signatories to the OECD Convention differently from those of non-signatories and thereby the composition of its trading partners. This is plausible because by requiring signatories to take action against bribery overseas, the OECD Convention affects their capacity to deal with

[1] Group lending (Guttman 2008), labour markets and firm hiring (Eeckhout and Kircher 2018; Hagedorn et al. 2017), international acquisitions (Rappoport et al. 2017), and international trade (Sugita et al. 2017).

[2] Cuervo-Cazurra (2006) makes such arguments in the case of FDI. There could, of course, be other characteristics of the trading partner that might affect the volume of international trade between the two countries. For instance, countries with similar institutions may engage in greater trade with each other (De Groot et al. 2004; Lavallée 2005). This study focuses on corruption.

corruption in trading partner countries. As a result, changes in the level of corruption in a country will likely impose different costs on signatories to the OECD Convention compared with non-signatories, causing an asymmetric effect on the volume of bilateral trade from different countries depending on whether or not they are signatories to the OECD Convention. Therefore, as the level of corruption in a country changes, the composition of its trading partners (signatories versus non-signatories to the OECD Convention) will likely change. To explore whether this is the case, we examine whether corruption in a country plays a role in determining the volume of trade flows from different trading partners depending on their status in relation to the OECD Convention. To the best of our knowledge, neither of these two issues has been investigated by earlier studies.

The most important contribution of our study is that it is the first to shed light on how corruption in both the importing and exporting countries affects their trading relationship. While some earlier studies have controlled only for the level of corruption in the importing country (e.g. Lambsdorff 1998), others have investigated corruption levels in both the importing and exporting countries in relation only to the cost of trade (e.g. Musila and Sigue 2010). Existing studies have not looked at the interaction effect in which the level of corruption in a country plays a role in determining whether it attracts more trade flows from countries with high corruption or low corruption. To the best of our knowledge, this is the first study that provides evidence on the interactive effect of corruption in trading partners on bilateral trade flows between the two countries in addition to their individual effects.

The second important contribution of our study is to provide further insights into the effects of anti-bribery laws in international transactions on the volume of trade, and evidence that the effects of such laws depend on the trading partners' level of corruption. The first such law, known as the Foreign Corrupt Practices Act (FCPA), was passed by the United States in 1977. The FCPA prohibits US firms and individuals from using bribery in international business deals. The act was recently criticized by US President Donald Trump, who reportedly tried to scrap it, arguing that it hurt American companies' competitiveness overseas (Rucker and Leonnig 2020: 170–71). The OECD Convention, another law against international bribery, was signed by 29 OECD member countries and 5 non-OECD member countries on 17 December 1997 and came into effect on 15 February 1999.[3] As of today, 44 countries are signatories to the Convention (36 OECD members and 8 non-OECD members).

By making international bribery illegal and subject to legal sanctions, such laws make engaging in international bribery more costly, affecting various outcomes related to businesses overseas. Several studies (e.g. Cuervo-Cazurra 2006, 2008; Dass et al. forthcoming; Geo-Jala and Mangum 2000) have documented the effects of such laws on various business outcomes. The closest study to ours, Cuervo-Cazurra (2006), finds that signatories to the OECD Convention have reduced their investment in corrupt countries. To the best of our knowledge, this is the first study to examine whether being a signatory to the OECD Convention is a factor in determining trade flows to and from corrupt countries.

We investigate these two hypotheses using a large dataset from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) on bilateral trade flows covering 193 UN member countries over the period 1996–2014. We perform a number of robustness checks to ensure the validity of our results and the reliability of our estimates. First, we utilize different estimation techniques including the pooled OLS and the Poisson Pseudo-Maximum Likelihood (PPML) methods. Second, we control for a number of confounding factors to minimize the possibility of

[3] http://www.oecd.org/corruption/Anti-Bribery-Convention-Timeline-2017.pdf

an omitted variable bias. Third, we check the robustness of our results using alternative corruption indices. Finally, we check the sensitivity of our results using an alternative trade data source, the World Integrated Trade Solution (WITS), which allows us to exclude fuel-related trade to ensure that our results are not driven by, and are not contingent on, trade involving fuel.

We find evidence in support of negative assortative matching in international trade. We find that as corruption levels in a country increase, the volume of trade from highly corrupt countries decreases. Further, we find that as a country becomes more corrupt, it receives more trade flows from signatories to the OECD Convention than from non-signatories. Our results also indicate that countries that have signed the OECD Convention generate more trade flows than non-signatory countries. Further, in accord with the findings of previous studies (e.g. Musila and Sigue 2010), we find that the levels of corruption in both importing and exporting countries have impacts on trade. Our study thus provides important insights into the effect of corruption on the composition of a country's trading partners that have been absent from the literature until now.

Another important implication of our findings is that they could shed light on why there is a lack of unanimous evidence on the effect of corruption on trade flows (compare, for instance, Lambsdorff 1998 with Musila and Sigue 2010). Our study clearly demonstrates that not only does corruption in the exporting and importing countries matter for bilateral trade (Musila and Sigue 2010), but the levels of corruption in the two countries also jointly influence the volume of trade. The mixed evidence found by the earlier studies might be a result of the omission of this interaction effect.

The rest of this paper is structured as follows. In the next section, we discuss the related literature and present the theoretical foundations for our hypotheses by placing them within the larger literature on corruption and trade. In Section 3, we present the empirical methodology and discuss the control variables and data sources. Section 4 presents the results and Section 5 describes the robustness checks we carried out. The final section concludes, highlighting the implications and significance of our findings.

2 Literature review and hypothesis development

There are two popular arguments regarding the effects of corruption on economic activity. According to the first one—the 'sand the wheels' hypothesis—a high level of corruption makes a country less attractive to trade by increasing risk, thereby raising the vulnerability of trading partners to hidden transaction costs. The reasons why corrupt countries are less attractive to trade include the absence of a proper legal system and lack of transparency (Anderson and Marcouiller 2002), the absence of suitable economic policies (Anderson and Marcouiller 2002), corruption in customs processes (De Jong and Bogmans 2011; Gatti 1999), tax evasion through the under-reporting of imports (Fisman and Wei 2004), and weak and unpredictable institutions (De Jong and Bogmans 2011). According to this view, higher levels of corruption in a country reduce the incentive for other countries to trade with it. The alternative argument—the 'grease the wheels' hypothesis—is that corruption can promote economic activity by acting as a hedge against bad policy (Leff 1964; Nye 1967; Wedeman 1997). Therefore, countries with weak institutions may attract more trade if bribery of officials can be used to speed up the process of obtaining licences and permits (Shleifer and Vishny 1993).

Although the relationship between corruption and international trade has been explored extensively, empirical evidence on this relationship is ambiguous, some studies finding a negative association (Anderson and Marcouiller 2002; De Jong and Bogmans 2011; Dutt and Traca 2010;

Musila and Segue 2010), while others find no association or even a positive association (Dutt and Traca 2010; Lambsdorff 1998). Anderson and Marcouiller (2002) argue that unobserved transaction costs tend to be higher in the absence of strong institutions due to corruption, which arises because of that very absence. The importance of institutions for international trade has also been highlighted by De Groot et al. (2004), who argue that poor governance increases transaction costs by increasing uncertainty and opportunism in market exchange. Accordingly, the authors find that strong institutions and governance are good for bilateral trade. In a study of African countries using data for 1998–2007, Musila and Sigue (2010) find that corruption both in African countries and in their trading partners adversely influences the flow of exports and imports. Dutt and Traca (2010) find that corruption reduces trade in low-tariff environments.

In the spirit of the 'grease the wheel' hypothesis, other studies argue that corruption may increase the volume of trade flows under certain conditions and provide evidence in support of this argument. For instance, Dutt and Traca (2010) argue that corruption may be trade-enhancing in the presence of high tariffs if corrupt officials allow exporters to evade tariffs.[4] On the other hand, trade may be negatively impacted by corruption if officials in importing countries extort bribes from exporters. De Jong and Bogmans (2011) find that while corruption (measured at the country level) discourages international trade, bribes paid to customs officials are associated with greater imports. In a study of 19 exporting countries, Lambsdorff (1998) finds that while the exports of five countries are positively associated with the level of corruption in the importing country, the exports of two countries exhibit a statistically significant negative association with the level of corruption in importing countries.

The mixed evidence on the relationship between corruption and international trade indicates that the effect of corruption on trade may be contingent on other factors such as institutions, tariffs, and waiting time at the border (De Jong and Bogmans 2011; Dutt and Traca 2010). Another factor that might determine the effect of corruption on trade between two countries is the interaction between the levels of corruption in the two trading partners, which is what we study in this paper.

2.1 Corruption at the destination and the composition of trading partners

None of the above-mentioned studies has considered the joint effect of corruption levels in both trading partners in determining bilateral trade between them. That is, while some of the previous studies (e.g. Musila and Sigue 2010) have controlled for both trading partners' levels of corruption, none has looked at the interaction between the levels of corruption in trading partners that could have implications for the level of trade flows between the two countries and, in turn, for the composition of trading partners.

Importantly, such possibilities have been hypothesized, explored, and found to be significant in the context of FDI. Cuervo-Cazurra (2006), for instance, argues that host country corruption not only reduces FDI but also influences the country of origin of FDI because not all foreign investors share the same concerns about corruption in the host country. Accordingly, he finds that more corrupt countries attract greater volumes of FDI from countries that have higher levels of corruption.

[4] It is important to note in this context that not all types of trade-related costs can be reduced by the use of bribery, even though they might negatively impact trade volumes between two countries. Consider, for instance, tariffs versus transportation costs: trade flows are more elastic with respect to the former than the latter (Besedeš and Cole 2017); therefore, it may be easier to evade tariffs than transport costs in the presence of corruption.

It is important to note, however, that there are important differences between FDI and international trade and hence the effects of corruption on the two might be very different. FDI is a long-term commitment, as opposed to bilateral trade. Unlike trade, FDI involves large sunk costs and cannot easily be withdrawn (Helpman et al. 2004). As a result, FDI is more sensitive to corruption levels in a country than trade. Moreover, with FDI, investors are exposed to corruption in the destination country all the time (because the business operates in the host country), while exposure to destination country corruption is much more limited in the case of international trade. This study extends this line of inquiry by investigating whether corruption in the destination (importing) country influences the composition of its trading partners in bilateral international trade by imposing asymmetric costs on different trading partners (exporters), based on their corruption levels.

We hypothesize that the cost imposed by corruption in a country on its trading partner will depend on whether the latter has a low or high level of corruption. Therefore, the level of corruption in a country will determine its trade with different trading partners depending on the latter's corruption level: a highly corrupt country will trade more with other highly corrupt countries if the *costs* of trade with such countries as a consequence of corruption in the trading partner are *lower* than those with countries with low corruption, and vice-versa. Alternatively, a highly corrupt country will trade more with other highly corrupt countries if the *gains* from trade (as a result of corruption) with such countries are *higher* than those from trading with countries with low corruption, and vice-versa. There are circumstances under which both of these hypotheses will hold, i.e. positive assortative matching where highly corrupt countries will trade with each other and negative assortative matching where countries with low corruption will trade with those with high levels of corruption. Therefore, an empirical analysis is warranted to ascertain which of these two tendencies pertains in international trade.

A highly corrupt country will engage in greater trade with more corrupt countries if firms in the highly corrupt country have a comparative advantage in dealing with corrupt government officials in partner countries due to expertise and experience in dealing with corruption in their own countries (Cuervo-Cazurra 2006). Firms in highly corrupt countries may find bribery a normal part of doing business and hence will be more inclined to trade with other corrupt countries than with countries with low corruption (Godinez and Garita 2015).[5] Based on this discussion, our first hypothesis can be stated as follows:

> H1(a): There exists positive assortative matching in international trade with regard to corruption. That is, highly corrupt countries trade more with one another.

On the other hand, negative assortative matching would occur when highly corrupt countries trade more with less corrupt countries. There are primarily two reasons that negative assortative matching in international trade might result. First, that firms in highly corrupt countries are able to extract greater rents when trading with less corrupt countries than with highly corrupt countries. This possibility arises because officials and firms in highly corrupt countries have experience of dealing with corruption in their own countries (Cuervo-Cazurra 2006), which gives them an edge in bargaining for rents when dealing with counterparts from countries with low corruption. To see this, consider a simple bargaining game between two countries for the distribution of rent arising from trade between them. In it, a highly corrupt country can trade either with a another highly corrupt country or with a less corrupt country. The total rent generated from trade is x and can be shared by both parties, but the representatives of both trading partners wish to maximize their

[5] This argument is found to hold in other contexts. For instance, De Groot et al. (2004) and Lavallée (2005) find that countries with similar institutions tend to trade more with one another.

rent. Suppose first that the two trading partners are equally corrupt. *Ceteris paribus*, the trading partners will share the rent equally, each of them seizing *x/2*. Now contrast this with the case where one of the trading partners is a highly corrupt country while the other country is a less corrupt country. In this scenario, a payoff of greater than *x/2* goes to the highly corrupt country due to its expertise in dealing with corruption. In an extreme case where one of the countries is corruption-free, the total amount of rent, *x,* is kept by the corrupt partner country.[6] Thus, we can see that the highly corrupt trading partner is able to extract a greater rent due to its expertise in dealing with less corrupt importing countries *ceteris paribus*. Further, since part of the bribes paid to foreign public officials and politicians go to the employees of the bribing firms (Lambsdorff 1998), the representatives of a corrupt country will have an incentive to trade more with less corrupt countries so as to maximize their share, as less will have to be paid in bribes to representatives of the less corrupt trading partner.

Further, the bargaining process for the distribution of rent will take longer when both trading partners are either highly corrupt countries or countries with low corruption than in the case where a highly corrupt country trades with a less corrupt country (Rubinstein 1982). Consequently, the trade flow between a highly corrupt country and a less corrupt country will be higher than between corrupt countries and less corrupt countries. It is easier to see this in the case of two highly corrupt countries: Corrupt officials and representatives of both these countries want to extract the greatest rents for themselves and hence the bargaining process takes longer and the net present value of the benefits from trade is lower. What about a pair of countries with low corruption? As long as there is bargaining for rents from trade, since both partners lack experience of dealing with corruption, the bargaining process is likely to take longer than if one of the trading partners is a highly corrupt country while the other is a less corrupt country, where the bargaining process takes less time because it is easier to agree on the distribution of rents.[7] Figure 1 shows the gains from trade in the case of a lengthy bargaining process.

Figure 1: Bargaining for rents and the gains from trade with discounting

		Destination country	
		High corruption	Low corruption
Origin country	High corruption	Low	High
	Low corruption	High	Low

Source: authors' illustration.

The second possibility that might result in negative assortative matching in international trade relates to the transaction cost argument. Musila and Sigue (2010), for instance, hold that corruption in both trading partners will determine the cost of doing business between them. Clearly, when two highly corrupt countries trade with each other, transaction costs will be very high because rents will be extracted by representatives (employees of firms and government officials) of *both* countries. On the other hand, transaction costs will be higher when both trading partners have low corruption than when one has low corruption while the other is highly corrupt because, in the latter scenario, bribes can be used to speed up the process and even to avoid tariffs and other regulatory costs in the highly corrupt country. In a scenario where both trading partners have low

[6] This happens because representatives of the less corrupt country would simply not participate in corrupt practices but still engage in trade. Therefore, in such a scenario, the entire rent will be generated and extracted by the highly corrupt country. Note that not only public firms but also private firms may be corrupt, and both of these jointly determine the total value of trade. Employees of firms in corrupt countries may falsify their books to generate rents for themselves (Lambsdorff 1998).

[7] The intuition here is that the bargaining process depends on the interaction of two groups with varying levels of experience in dealing with corruption.

corruption, compliance costs will be higher because bribes cannot be used in either country to evade regulations and transaction costs, causing the trade volume to be higher in the first case than in the latter two (Figure 2).[8]

Figure 2: Transaction costs of trade

		Destination country	
		High corruption	Low corruption
Origin country	High corruption	High	Low
	Low corruption	Low	High

Source: authors' illustration.

This leads us to our second hypothesis:

> H1(b): There exists negative assortative matching in international trade with regard to corruption. That is, highly corrupt countries trade less with one another.

In sum, since *a priori* a country's bilateral trade could increase or decrease in response to the level of corruption of its trading partner, this issue needs to be resolved empirically. Our study is the first to do so and provide evidence in favour of negative assortative matching.

2.2 Laws against bribery and the composition of trading partners

Some countries may face different costs in trading with corrupt countries than others due to (anticorruption) regulations or policies specific to those countries, affecting their ability to deal with corruption relative to other countries. In this case, a change in the level of corruption will have a differential impact on bilateral trade in countries that are subject to such laws or policies vis-à-vis those that are not, leading to a change in the composition of trading partners.

Many studies have examined the effects of the FCPA and the OECD Convention on several international business outcomes. For instance, Geo-Jala and Mangum (2000) find that the law supported ethical US firms through the reduction of unfair competition among other American firms. In a similar vein to our hypothesis, a recent study by Dass et al. (forthcoming) finds that, following the passage of the FCPA, firms in more corrupt US states that export to more corrupt countries experienced a greater decline in performance. Cuervo-Cazurra (2008) finds that the FCPA led to a decline in US investment to corrupt countries. Exploring the effect of the OECD Convention on the flow of FDI, Cuervo-Cazurra (2006) finds that corrupt countries receive relatively lower FDI from countries that are signatories to the OECD Convention. We investigate whether corruption in a country matters for bilateral trade with countries that are signatories to the OECD Convention. Specifically, we investigate whether a country's trade flows with signatories to the OECD Convention change differently from trade with non-signatories as its corruption levels change.

According to the OECD Convention, member countries should deem the bribing of foreign officials to be illegal. Further, the Convention requires signatory countries to provide mutual legal assistance in investigations and facilitate extraditions. It also sets strict accounting standards and requires that signatories introduce national laws to meet those standards. Thus, the Convention increases both the probability of detection of bribery by mutual monitoring mechanisms and the

[8] Notice that the argument put forth here is in the spirit of the 'grease the wheels' hypothesis and similar to those made by several earlier studies in different contexts. These studies argue that corruption can be used to lessen the effects of long waiting times at the border (De Jong and Bogmans 2011) or high tariffs (Dutt and Traca 2010).

cost of bribery by imposing penalties. Consequently, countries that have signed the Convention may trade less with countries that are highly corrupt because of the higher costs (in terms of bribe amount, penalty, and the loss of image) associated with corrupt behaviour (Cuervo-Cazurra 2006; OECD 2011). On the other hand, it is possible that these countries may trade *more* with highly corrupt countries because they are able to credibly argue that their hands are tied by the Convention, thus evading bribery requests (Cuervo-Cazurra 2006). As a result, signatories to the OECD Convention would bear a lower cost from high corruption in their trading partners relative to non-signatory countries, which cannot credibly argue the same. Hence, as a country's corruption level rises, its trade flow from signatories to the Convention will be affected less than that from non-signatories. Moreover, firms in more corrupt countries will have a greater incentive to trade with signatories to the Convention because they can seize the entire rent that they generate by fudging their own books. It is, therefore, again unclear whether countries that are signatories to the OECD Convention will trade more with more corrupt countries or less corrupt countries. Hence, we empirically check which of the following two hypotheses is supported by the data.

> H2(a): Countries that are signatories to the OECD Convention trade less with highly corrupt countries.
>
> H2(b): Countries that are signatories to the OECD Convention trade more with highly corrupt countries.

Evidence supporting hypothesis H2(a) will suggest the existence of positive assortative matching, in which countries that abide by anti-bribery laws in international transactions (i.e. in this analysis the OECD Convention) trade more with less corrupt countries. On the other hand, if hypothesis H2(b) holds, negative assortative matching exists because countries that are committed to anti-international-bribery trade more with more corrupt countries.

In the light of the above discussion, the present paper seeks to explore how corruption influences the composition of a country's trading partners and aims to provide important insights regarding the matching or mismatching of trading partners with respect to corruption and adherence to the Convention prohibiting international bribery. To the best of our knowledge, this is the first paper to examine how corruption influences the composition of a country's trading partners depending on (1) the level of corruption in the destination country, and (2) whether the destination country is a signatory to the OECD Convention.

3 Research design and data

3.1 Research design

We employ two gravity models to examine our hypotheses. The origin of the gravity model dates back to Tinbergen (1962), who explained bilateral trade flows in terms of country size (GDP) and distance between the two countries. The theoretical foundations of the gravity model were developed much later, following its empirical success, in seminal works by Anderson (1979), Bergstrand (1985, 1989), Eaton and Kortum (2002), and Anderson and Van Wincoop (2003). The gravity model specifications used in this paper are similar to those used in Dutt and Traca (2010) and Cuervo-Cazurra (2006), and are augmented by corruption variables.

$$\ln(F_{ijt}) = \alpha + \beta_1 HC_{it} + \beta_2 C_{jt} + \beta_3 C_{jt} \times HC_{it} + X_{ijt}\Theta + \mu_i + \pi_j + \vartheta_t + \varepsilon_{ijt} \qquad (1)$$

$$\ln(F_{ijt}) = \delta + \gamma_1 BL_{it} + \gamma_2 C_{jt} + \gamma_3 C_{jt} \times BL_{it} + X_{ijt}\Theta + \mu_i + \pi_j + \vartheta_t + \varepsilon_{ijt} \qquad (2)$$

where i, j and t represent the origin (exporting) country, destination (importing) country, and year, respectively; F_{ijt} denotes real trade flow in US dollars from i to j in year t; and C_{jt} reflects the corruption level at the destination. High corruption (HC_{it}) is a dummy variable that takes a value 1 if corruption in the origin country i is greater than the median value of the corruption index in year t, and 0 otherwise. Bribery Law (BL_{it}) is a dummy variable that takes a value 1 if the origin country is a signatory to the OECD Convention and has enacted legislation to enforce the Convention in year t or earlier and 0 otherwise. X_{ijt} is a vector of control variables. μ_i, π_j, and ϑ_t represent origin, destination, and year fixed effects that may be correlated with trade flows and control variables. ε_{ijt} is the uncorrelated error term.

Our primary variables of interest are the interaction terms between (1) corruption in the destination country and a high corruption dummy in the origin country (β_3), and (2) corruption in the destination country and a dummy indicating whether the origin country is a signatory to the OECD Convention (γ_3). Notice that we do not make an *a priori* assumption about the direction of the effects when investigating these two hypotheses. Instead, we analyse the data to learn this. Thus, our coefficients of interest, β_3 and γ_3, can be positive or negative. A positive β_3 implies positive assortative matching, indicating that highly corrupt countries trade more with more corrupt countries. On the other hand, a negative β_3 provides evidence in favour of negative assortative matching, in which highly corrupt countries trade more with less corrupt countries. Similarly, a positive γ_3 indicates that OECD Convention signatories trade more with more corrupt countries and a negative γ_3 implies that these countries trade less with more corrupt countries, indicating negative and positive assortative matching, respectively. We estimate these equations using different econometric methods to ensure the robustness of our results.

The gravity model is conventionally estimated in the log-linear form where the dependent variable (trade flows) and some of the control variables (such as GDP and distance between the trading partners) enter the model in log form (see equations 1 and 2). This leads to two problems: (1) a log-linear model is subject to sample-selection bias (Dutt and Traca 2010) given that a large proportion of bilateral trade values are zero, which drop out in the log form; and (2) the log-linear gravity model yields severely biased and inconsistent estimates in the presence of heteroscedastic errors, as demonstrated by Silva and Tenreyro (2006), who therefore propose using a Poisson Pseudo Maximum Likelihood (PPML) estimation method. With this method, estimates are consistent in the presence of heteroscedastic errors and the gravity model is estimated in a multiplicative form, where trade flow variables enter the model in its original form and not in logs. Hence, the PPML method overcomes the sample selection bias by including zero trade values. Given its superiority, our primary estimation procedure is the PPML method, and the dependent variable, F_{ijt}, enters the model in its original form. However, as a robustness check, we also estimate our models in a log-linear form using pooled OLS. Each of our estimated models controls for origin, destination, and year fixed effects. The reported standard errors are robust to heteroscedasticity and adjusted for clustering by country pair.

3.2 Data

Bilateral trade flows

The bilateral trade flow (F_{ijt}) data come from the TRADHIST CEPII database compiled by Fouquin and Hugot (2016).[9] Each observation in this dataset represents the trade flow from an origin country to a destination country at a given time. The data cover the period from 1827 to

[9] www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=32

2014. The primary source for these data from 1948 onwards is the Direction of Trade Statistics (International Monetary Fund); the authors compiled the data for the earlier periods from various primary sources. The data refer to merchandise trade and exclude trade in services, bullion, and species (Fouquin and Hugot 2016). This dataset, which is our final dataset, is an unbalanced panel with the number of origins and destinations increasing over time. The data are reported in British pounds sterling. To be consistent with other studies in this literature, we convert the data to their dollar equivalents using the historical exchange rates provided by Fouquin and Hugot (2016). We limit our sample to 193 UN member countries due to data availability. Given that our primary data on corruption, the World Bank's Control of Corruption Index (CCI), is available only from 1996, we also limit our data coverage period to 1996–2014. Missing trade flow observations are treated as zeros. The bilateral trade flow observations are deflated to real terms using the US import price deflator for all commodities, the base year being 2010. The import price deflator data come from the Bureau of Labor Statistics (retrieved on 31 August 2018).

Corruption variables

We choose the CCI as our primary measure of corruption because it has a higher coverage of countries than any other corruption measure used in the empirical literature. It is computed from the perceptions regarding corruption in the country of firms, households, business analysts, non-governmental organizations (NGOs), and public sector agencies. The survey questions capture respondents' perceptions about the existence of corruption in different sectors, including various branches of the government (judiciary, customs, taxes) as well as the political arena.[10]

The CCI ranges from -2.5 (most corrupt) to 2.5 (least corrupt). To make the interpretation easier and more straightforward, we adjust all the corruption indices such that higher values imply higher levels of corruption. The high corruption (HC_{it}) dummy variable takes a value 1 if the CCI for the origin country is greater than the median value of the CCI in the worldwide sample in year *t*, and 0 otherwise.

We use two other widely used measures of corruption for robustness checks. The first is the International Country Risk Guide (ICRG) corruption index, which provides data on corruption from as early as 1984.[11] The ICRG index ranges from 0 (most corrupt) to 6 (least corrupt). The second is the Corruption Perception Index (CPI) published by Transparency International (TI), a leading anti-corruption NGO.[12] The CPI's values range from 0 (most corrupt) to 100 (least corrupt). Again, we adjust all the corruption indices in the regression specifications such that higher values imply higher levels of corruption.

Bribery law measures

The bribery law variable comes from the OECD Convention website.[13] The Convention requires that signatory countries (1) make bribery of international officials illegal, (2) provide mutual legal assistance in investigations of international bribery, and (3) facilitate extraditions. Bribery law (BL_{it}) for the origin takes a value 1 if the origin country is a signatory to the OECD Convention and has introduced legislation to enforce the Convention in year *t* and 0 otherwise. For example, Canada signed the Convention on 17 December 1997 but introduced legislation to ratify the Convention

[10] Interested readers may refer to Kaufmann et al. (2011) for further details on how the CCI is computed.

[11] Visit www.prsgroup.com/wp-content/uploads/2012/11/icrgmethodology.pdf for details.

[12] The details on CPI can found at https://www.transparency.org/research/cpi/overview.

[13] www.oecd.org/daf/anti-bribery/countryreportsontheimplementationoftheoecdanti-briberyconvention.htm

only in February 1999; therefore, the bribery law variable takes a value of 1 only from 1999 onwards. Only four countries—Austria, Greece, Iceland, and the United States—enforced the legislation in 1998 and none in 1997. Hence, the bribery law data cover the period 1998–2014.

Baseline control variables

The baseline control variables include the standard gravity variables used in the literature. As mentioned earlier in the empirical model section, the gravity literature explains bilateral trade flows in terms of country size and proximity of trading partners. Hence, our baseline control variables include GDP, as a measure of economic size, measured in millions of constant 2010 US dollars for both partners. Following convention, the GDP variable enters the regression model in logarithmic form (De Groot et al. 2004; De Jong and Bogmans 2011; Dutt and Traca 2010). We include the population (in millions) of each bilateral trading partner as an additional measure of country size (Bandyopadhyay and Roy 2007). The data on GDP and population come from the World Development Indicators.[14] Our model includes the geographical distance (in kilometres) between the trading partners as a measure of proximity. This variable comes from the CEPII GeoDist database[15] and is calculated using the great circle formula, which takes the latitudes and longitudes of the most populated cities. Studies also show that countries that are contiguous, have colonial ties, and share a common language tend to trade more with each other (Anderson and Marcouiller 2002; Dutt and Traca 2010; Thede and Gustafson 2012). Hence, our set of baseline control variables includes dummy variables to capture whether trading partners are contiguous, have the same official language, and were ever in a colonial relationship. Data on these standard gravity variables also come from the CEPII GeoDist database. It is further established in the literature that landlocked countries tend to trade less (Dutt and Traca 2010; Paudel and Cooray 2018). Hence, we include a dummy variable in the model that takes a value 1 if either of the trading partners is landlocked. Some trading partners have agreements that permit preferential treatment (Anderson and Marcouiller 2002). Hence, we take into account the existence of any regional bilateral and multilateral trading arrangements that apply to trading partners. The data on regional trade agreements come from the Mario Larch RTA Database (Egger and Larch 2008) and cover bilateral and multilateral trading agreements over the period 1950–2015. This variable is coded as 1 if any bilateral or multilateral trading arrangements apply to the two trading partners, and 0 otherwise.

Additional control variables

Additionally, we use a number of other control variables for robustness checks. It is well established in the literature that protectionism is detrimental to trade flows (see, for example, Anderson and Marcouiller 2002; Bandyopadhyay and Roy 2007; De Jong and Bogmans 2011; Thede and Gustafson 2012). We therefore control for the aggregate tariff rates of the origin and destination countries as measures of trade protectionism. The rate is a weighted mean of tariff rates applied to all products and is expressed as a percentage. The data on the aggregate tariff rate come from the World Development Indicators.[16] The quality of institutions is another important determinant of bilateral trade between countries (De Groot et al. 2004; Dutt and Traca 2010; Lavallée 2005). To account for the heterogeneity of institutions across countries, we include the Polity IV index of the origin and destination countries. The Polity index is a broad measure of institutional quality and takes values between 10 (strongly democratic) and -10 (strongly

[14] https://databank.worldbank.org/source/world-development-indicators (accessed 31 July 2018).

[15] www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=6 (retrieved 21 September 2018).

[16] The data were extracted on 31 July 2018.

autocratic). We also control for relative factor endowments (RFE), calculated as the absolute difference between the per capita incomes of the two trading partners. The positive (negative) coefficient on RFE implies that countries with different endowments will trade more (less) with each other, supporting the Heckscher-Ohlin (Linder) hypothesis (see Paudel and Cooray 2018 for a discussion). Finally, we control for the per capita income growth rates of both trading partners to see whether increased trade is driven by higher growth rates. Table 1 reports summary statistics for the variables used in the study.

Table 1: Summary statistics

	No.	Mean	SD	Min.	Max.
Real trade flows (in $ millions)	632,073	330.818	4068.799	0.000	428,973.81
High corruption (Origin)	523,832	0.531	0.499	0.000	1.000
Bribery law (Origin)	565,969	0.182	0.386	0.000	1.000
Corruption (D)	529,509	0.081	1.004	-2.470	1.869
Real GDP (in $ millions, O), in logs	607,730	10.127	2.426	3.154	16.601
Real GDP (in $ millions, D), in logs	612,773	10.248	2.334	3.154	16.601
Population (in millions, O)	631,552	35.090	131.652	0.009	1364.27
Population (in millions, D)	631,827	36.237	133.011	0.009	1364.27
Distance, in logs	626,651	8.744	0.778	2.349	9.899
Contiguity (=1)	626,651	0.017	0.130	0.000	1.000
Common official language (=1)	626,651	0.152	0.359	0.000	1.000
Colony (if ever in a colonial relationship=1)	626,651	0.011	0.106	0.000	1.000
Regional trading agreement (=1)	632,073	0.161	0.367	0.000	1.000
Landlocked (=1)	632,073	0.349	0.477	0.000	1.000
Mean tariff rate (in %, O)	441,956	7.289	10.840	0.000	421.50
Mean tariff rate (in %, D)	457,111	7.341	11.022	0.000	421.50
Polity (O)	532,476	3.341	6.500	-10.00	10.000
Polity (D)	550,205	3.343	6.485	-10.00	10.000
Relative factor endowment, in logs	589,150	8.711	1.674	-5.917	11.624
Per capita GDP growth rate (in %, O)	605,984	2.677	6.374	-62.225	140.501
Per capita GDP growth rate (in %, D)	611,235	2.709	6.355	-62.225	140.501

Source: authors' illustration based on data sources provided in Section 3.

4 Results

Table 2 reports PPML estimation results with the dependent variable being trade flows in millions of real dollars. All the specifications include origin, destination, and year dummies to ensure that our results are not biased due to the omission of origin-, destination-, or year-specific factors that might be correlated with the error term. The baseline estimates presented in column 1 point to a statistically significant negative association between corruption at destination and real trade flows. A statistically significant negative coefficient on the high corruption dummy for origin countries indicates that highly corrupt countries experience lower trade than countries with low corruption. In the next column, we add the interaction term between the high corruption dummy for origin countries and corruption in destination countries to investigate whether trade flows from highly corrupt countries to corrupt destinations are systematically different from those between countries with low corruption. In column 2, the coefficient of the interaction term is negative and statistically

significant at conventional levels, indicating that highly corrupt countries' trade volume decreases with increases in the trading partner's level of corruption. This finding points to the existence of negative assortative matching in bilateral trade, supporting hypothesis 1(b).

Table 2: Corruption and assortative matching in Trade: PPML estimation

	Dependent variable: real trade flows (in $ millions)				
	(1)	(2)	(3)	(4)	(5)
High corruption (Origin)	-0.051**	-0.146***	-0.164***	-0.180***	-0.137***
	(0.024)	(0.043)	(0.050)	(0.051)	(0.051)
Corruption (Destination)	-0.143***	-0.110**	-0.130***	-0.130***	-0.144***
	(0.046)	(0.051)	(0.048)	(0.049)	(0.049)
High corruption (O) × corruption (D)		-0.109**	-0.134***	-0.136***	-0.089*
		(0.044)	(0.045)	(0.045)	(0.046)
Log (real GDP) (O)	1.038***	1.052***	0.912***	0.917***	0.917***
	(0.091)	(0.089)	(0.091)	(0.091)	(0.091)
Log (real GDP) (D)	1.076***	1.091***	1.056***	1.062***	1.063***
	(0.097)	(0.100)	(0.112)	(0.112)	(0.112)
Log (distance)	-0.638***	-0.634***	-0.617***	-0.613***	-0.615***
	(0.033)	(0.033)	(0.032)	(0.032)	(0.032)
Population (O)	-0.002**	-0.002**	-0.001*	-0.001*	-0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Population (D)	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Contiguous	0.428***	0.453***	0.482***	0.486***	0.490***
	(0.086)	(0.083)	(0.081)	(0.081)	(0.080)
Common language	0.067	0.063	0.074	0.072	0.084
	(0.081)	(0.080)	(0.082)	(0.082)	(0.080)
Colony	0.292***	0.308***	0.232**	0.231**	0.211**
	(0.100)	(0.098)	(0.093)	(0.093)	(0.092)
RTA	0.385***	0.410***	0.443***	0.444***	0.451***
	(0.057)	(0.058)	(0.058)	(0.059)	(0.059)
Landlocked	-0.242	-0.229	-0.208	-0.210	-0.217
	(0.190)	(0.190)	(0.196)	(0.196)	(0.198)
Mean tariff rate (O)			-0.016***	-0.016***	-0.016***
			(0.005)	(0.005)	(0.005)
Mean tariff rate (D)			-0.008	-0.008	-0.008
			(0.006)	(0.006)	(0.006)
Polity (O)				-0.010**	-0.011**
				(0.005)	(0.005)
Polity (D)				-0.008*	-0.008*
				(0.004)	(0.004)
Log (RFE)					0.031*
					(0.016)
Per capita GDP growth rate (O)					0.001
					(0.001)
Per capita GDP growth rate (D)					-0.000
					(0.002)
N	486,072	486,072	287,745	232,239	232,239
R-squared	0.842	0.847	0.862	0.862	0.864
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Origin fixed effects	Yes	Yes	Yes	Yes	Yes
Destination fixed effects	Yes	Yes	Yes	Yes	Yes

Note: robust standard errors clustered by country pair in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Constant is not reported.

Source: authors' estimation based on data sources provided in Section 3.

These results are consistent with the arguments that, when trading with less corrupt countries, highly corrupt countries may be able to extract greater rents for themselves due to their experience in dealing with corruption (Cuervo-Cazurra 2006), incentivizing them to trade more with less corrupt countries. Further, these results lend credence to our arguments presented in Figure 1, that gains from trade will be higher when a highly corrupt country trades with a less corrupt country than with a more corrupt country because of a shorter bargaining period for sharing the rent; and in Figure 2 that transaction costs will be lower when a highly corrupt country and a less corrupt country trade with each other than when the trade takes place between either two highly corrupt countries or two less corrupt countries.

In the next columns, we control for a number of additional variables to minimize the possibility of omitted variable bias. In column 3, we control for tariff rates in the origin and destination countries. In column 4, we include the polity indices of the origin and destination countries as control variables. Finally, in the last column, we include the RFE, as measured by the absolute difference between the per capita incomes of the origin and destination countries. In all these columns, both corruption variables remain negative and statistically significant at conventional levels, indicating that corruption discourages trade. More importantly, the coefficient of the interaction term between corruption in the destination country and the high corruption dummy variable in the origin country remains negative and statistically significant in each of these columns. These results provide support for our hypothesis that corruption not only impacts the volume of trade but also alters the composition of a country's trading partners. We find strong evidence of negative assortative matching: as the level of corruption in a country goes down, its trade volume with highly corrupt countries rises. Interestingly, earlier studies have found evidence of positive assortative matching in international trade with respect to the quality of institutions and found that countries with similar institutions tend to trade more with one another (De Groot et al. 2004; Lavallée 2005). An important implication of our results, therefore, is that findings in one institutional context cannot be extrapolated to other contexts.

Taking a look at the control variables, GDP in both destination and origin countries has a positive significant effect on trade, suggesting that larger economies engage in grater trade (in line with Bandyopadhyay and Roy 2007; Dutt and Traca 2010). Similarly, contiguity and trade agreements have a positive and statistically significant effect on real trade flows, which is consistent with the findings of previous studies (Anderson and Marcouiller 2002; Dutt and Traca 2010; Thede and Gustafson 2012). As in the findings of Dutt and Traca (2010) and Paudel and Cooray (2018), the coefficient on the distance between the trading partners is negative and statistically significant, suggesting that a greater distance between countries leads to a fall in trade volume. While being landlocked discourages trade, as shown by a negative coefficient, the variable is not statistically significant. As expected, the mean tariff rates in both destination and origin countries affect trade adversely (see Anderson and Marcouiller 2002; Bandyopadhyay and Roy 2007; De Jong and Bogmans 2011; Thede and Gustafson 2012). The coefficient on the Polity index in the destination country is negative and significant, which is consistent with the findings of Dutt and Traca (2010). Furthermore, RFE is positively and significantly associated with bilateral trade volume, which lends support to the Heckscher-Ohlin hypothesis, that countries with different endowments trade more with each other, and is consistent with the findings of Paudel and Cooray (2018). Moreover, while population in the origin country is negatively associated with trade volume, population in the destination country is not significantly associated with trade flows. Finally, the growth rate of neither the origin nor the destination country is significantly associated with trade flows.

Table 3 presents the results of the same specifications as in Table 2, except that the high corruption origin dummy is replaced by a bribery law origin dummy and the interaction term between corruption at the destination and the high corruption dummy for the origin country is replaced by that between corruption in the destination country and a dummy variable for origin countries that

have signed the OECD Convention, to investigate whether the Convention matters for trade with corrupt countries.

Table 3: OECD Convention, corruption, and trade: PPML estimation

	Dependent variable: real trade flows (in $ millions)				
	(1)	(2)	(3)	(4)	(5)
Bribery law (Origin)	0.091***	0.178***	0.279***	0.277***	0.226***
	(0.028)	(0.050)	(0.052)	(0.052)	(0.052)
Corruption (Destination)	-0.145***	-0.194***	-0.236***	-0.238***	-0.213***
	(0.044)	(0.051)	(0.051)	(0.051)	(0.052)
Bribery law (O) × corruption (D)		0.082**	0.103***	0.105***	0.062*
		(0.037)	(0.038)	(0.038)	(0.038)
Log (real GDP) (O)	1.006***	1.022***	0.871***	0.875***	0.875***
	(0.089)	(0.088)	(0.087)	(0.087)	(0.087)
Log (real GDP) (D)	1.117***	1.104***	1.076***	1.080***	1.092***
	(0.097)	(0.098)	(0.108)	(0.108)	(0.107)
Log (Distance)	-0.642***	-0.641***	-0.624***	-0.619***	-0.620***
	(0.033)	(0.033)	(0.032)	(0.032)	(0.032)
Population (O)	-0.002**	-0.002**	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Population (D)	0.001	0.001	0.001	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Contiguous	0.424***	0.436***	0.468***	0.472***	0.480***
	(0.086)	(0.085)	(0.083)	(0.083)	(0.081)
Common language	0.066	0.065	0.075	0.073	0.086
	(0.082)	(0.082)	(0.083)	(0.083)	(0.081)
Colony	0.293***	0.304***	0.230**	0.229**	0.207**
	(0.100)	(0.098)	(0.093)	(0.093)	(0.092)
RTA	0.379***	0.399***	0.436***	0.437***	0.447***
	(0.058)	(0.060)	(0.059)	(0.059)	(0.059)
Landlocked	-0.235	-0.225	-0.203	-0.206	-0.213
	(0.191)	(0.190)	(0.196)	(0.197)	(0.199)
Mean tariff rate (O)			-0.011**	-0.011**	-0.011**
			(0.005)	(0.005)	(0.004)
Mean tariff rate (D)			-0.007	-0.007	-0.007
			(0.006)	(0.006)	(0.006)
Polity (O)				-0.009*	-0.009*
				(0.005)	(0.005)
Polity (D)				-0.006	-0.006
				(0.004)	(0.004)
Log (RFE)					0.037**
					(0.016)
Per capita GDP growth rate (O)					0.001
					(0.001)
Per capita GDP growth rate (D)					-0.001
N	460,175	460,175	281,098	226,717	226,717
R-Squared	0.843	0.846	0.860	0.860	0.863
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Origin fixed effects	Yes	Yes	Yes	Yes	Yes
Destination fixed effects	Yes	Yes	Yes	Yes	Yes

Note: robust standard errors clustered by country pair in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Constant is not reported.

Source: authors' estimation based on data sources provided in Section 3.

Consistent with the results reported in Table 2, a negative relationship between corruption in the destination country and trade is observed in Table 3. Furthermore, we find that countries that are signatories to the OECD Convention engage in higher levels of trade with corrupt countries than countries that are not.

Next, we find that the coefficient of the interaction term between the bribery law origin dummy and corruption in the destination country is positive in all the columns of Table 3, indicating a greater volume of trade from countries that have signed the OECD Convention to more corrupt countries. This finding is consistent with hypothesis H2(b), that firms in OECD Convention countries may be able to convince corrupt countries that their hands are tied and they cannot pay bribes because international bribery is punishable in their countries, effectively shielding themselves from corruption in highly corrupt countries. Non-signatories of the OECD Convention cannot credibly argue the same and hence are subject to greater costs due to corruption in their trading partner. As a result, non-signatories face a greater cost in trading with corrupt countries than signatories, resulting in the latter engaging in a greater volume of trade with more corrupt countries. This finding also indicates the existence of negative assortative matching, in which countries that are signatories to the Convention trade more with more corrupt countries than those that are non-signatories. The results on the control variables are akin to those in Table 2 and are therefore not discussed.

It is noteworthy that our results are in contrast to those of Cuervo-Cazurra (2006) in the context of FDI. His findings suggest that, as a country becomes more corrupt, it receives less FDI from countries that are signatories to the OECD Convention and more FDI from countries with high levels of corruption. We find the exact opposite: as a country becomes more corrupt, its volume of trade with countries that are signatories to the OECD Convention rises, while its volume of trade with highly corrupt countries falls. Considering that FDI is a long-term commitment, where the origin country is exposed to corruption for as long as the money is invested in the destination country, whereas exposure to corruption is much more limited in international trade, differences in the findings in these two contexts are not surprising.

5 Robustness checks

5.1 Robustness with alternative estimation method

Next, we check the robustness of our estimates using pooled OLS estimation. The results are reported in Table 4. As previously, we control for origin, destination, and year fixed effects. Columns 1 and 3 report regression results without our variables of interest. Subsequently, we add our variables of interest to the empirical specification: the interaction term between corruption in the destination country and the high corruption dummy for the origin country in column 2 and the interaction term between corruption in the destination country and the bribery law dummy for the set of origin countries in column 4. All the key variables are statistically significant at conventional levels and appear with signs that are consistent with those reported in Tables 2 and 3. Overall, these results indicate that corruption in the destination country not only discourages trade but also impacts the composition of the country's trading partners, i.e. influences where the trade is coming from. In support of hypothesis H1(b), the results show that highly corrupt countries trade less with more corrupt countries, indicating negative assortative matching. Furthermore, in support of hypothesis H2(b), a positive and statistically significant coefficient on the interaction term between the bribery law dummy and corruption at destination indicates that signatories to the OECD Convention trade more with more corrupt countries than non-signatories.

Table 4: Corruption and assortative matching in trade: pooled OLS estimation

	Dependent variable: real trade flows (in $ millions) (in logs)			
	(1)	(2)	(3)	(4)
High corruption (Origin)	-0.059***	-0.065***		
	(0.020)	(0.020)		
Corruption (Destination)	-0.160***	-0.138***	-0.164***	-0.177***
	(0.024)	(0.026)	(0.025)	(0.026)
High corruption (O) × corruption (D)		-0.050**		
		(0.019)		
Bribery law (Origin)			0.250***	0.248***
			(0.022)	(0.022)
Bribery law (O) × corruption (D)				0.043**
				(0.020)
Log (real GDP) (O)	0.771***	0.775***	0.852***	0.855***
	(0.048)	(0.048)	(0.051)	(0.051)
Log (real GDP) (D)	1.033***	1.036***	1.106***	1.102***
	(0.039)	(0.039)	(0.042)	(0.042)
Log (distance)	-1.559***	-1.560***	-1.573***	-1.575***
	(0.021)	(0.021)	(0.021)	(0.021)
Population (O)	0.005***	0.005***	0.005***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Population (D)	0.007***	0.007***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Contiguous	0.653***	0.660***	0.644***	0.647***
	(0.098)	(0.098)	(0.099)	(0.098)
Common language	0.853***	0.852***	0.859***	0.857***
	(0.039)	(0.039)	(0.040)	(0.040)
Colony	0.956***	0.957***	0.943***	0.941***
	(0.092)	(0.092)	(0.093)	(0.093)
RTA	0.440***	0.453***	0.442***	0.451***
	(0.031)	(0.031)	(0.031)	(0.032)
Landlocked	-0.681***	-0.682***	-0.675***	-0.673***
	(0.081)	(0.081)	(0.082)	(0.082)
N	323,565	323,565	306,709	306,709
R-Squared	0.721	0.721	0.723	0.724
Year fixed effects	Yes	Yes	Yes	Yes
Origin fixed effects	Yes	Yes	Yes	Yes
Destination fixed effects	Yes	Yes	Yes	Yes

Note: robust standard errors clustered by country pair in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Constant is not reported.

Source: authors' estimation based on data sources provided in Section 3.

5.2 Sensitivity to alternative corruption indices

In Table 5, we replicate the PPML estimation results using the baseline specifications presented in column 2 of Tables 2 and 3 using two alternative corruption measures—the ICRG corruption index (columns 1, 2, and 4) and CPI (columns 3 and 5). The ICRG index takes values in the range of 1 to 6, with higher values indicating lower levels of corruption. Recall that we rescale the index such that a greater value of the index implies a higher corruption level. The first column covers the period 1996–2014 to be consistent with the results reported in the previous section, while column 2 reports the results that cover the entire period for which ICRG corruption data are available (1984–2014). The coefficient of the ICRG corruption index at destination, though negative, is not statistically significant in either of the first two columns. Our variable of interest, the interaction term, however, is negative and statistically significant in both the columns, suggesting that highly corrupt countries trade less with more corrupt countries—consistent with hypothesis H1(b) and the results reported in the previous section. In column 4, the variable of

interest is the interaction between corruption in the destination country and the dummy for origin countries that are signatory to the OECD Convention.

Table 5: Corruption and assortative matching in trade: sensitivity to alternative corruption measures

	Dependent variable: real trade flows (in $ millions)				
	(1)	(2)	(3)	(4)	(5)
High ICRG index (O)	-0.171*	-0.137			
	(0.093)	(0.091)			
ICRG index (D)	-0.009	0.003		-0.067***	
	(0.013)	(0.011)		(0.023)	
High ICRG index (O) * ICRG index (D)	-0.048*	-0.050**			
	(0.025)	(0.024)			
High CPI (O)			-0.182*		
			(0.094)		
High CPI (D)			-0.007***		-0.009***
			(0.002)		(0.002)
High CPI (O) * CPI (D)			-0.002		
			(0.002)		
Bribery law (O)				0.376***	0.359***
				(0.108)	(0.115)
Bribery law (O) * ICRG index (D)				0.074***	
				(0.028)	
Bribery law (O) * CPI (D)					0.004**
					(0.002)
Log (real GDP) (O)	1.112***	1.081***	1.002***	1.042***	1.018***
	(0.097)	(0.092)	(0.097)	(0.091)	(0.090)
Log (real GDP) (D)	1.090***	0.919***	1.001***	1.165***	1.094***
	(0.102)	(0.098)	(0.108)	(0.100)	(0.101)
Log (distance)	-0.625***	-0.613***	-0.622***	-0.635***	-0.632***
	(0.032)	(0.031)	(0.032)	(0.033)	(0.033)
Population (O)	-0.002**	-0.000	-0.001*	-0.002**	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Population (D)	0.001	0.001	0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Contiguous	0.449***	0.465***	0.446***	0.443***	0.446***
	(0.083)	(0.080)	(0.083)	(0.085)	(0.084)
Common language	0.071	0.083	0.070	0.069	0.071
	(0.080)	(0.077)	(0.081)	(0.081)	(0.081)
Colony	0.268***	0.258***	0.267***	0.289***	0.293***
	(0.100)	(0.096)	(0.098)	(0.099)	(0.097)
RTA	0.398***	0.413***	0.410***	0.404***	0.414***
	(0.057)	(0.054)	(0.057)	(0.058)	(0.059)
Landlocked	-0.237	-0.281	-0.249	-0.214	-0.228
	(0.199)	(0.190)	(0.187)	(0.196)	(0.189)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Origin fixed effects	Yes	Yes	Yes	Yes	Yes
Destination fixed effects	Yes	Yes	Yes	Yes	Yes
N	340883	470666	349915	397567	414527
R-Squared	0.847	0.844	0.850	0.849	0.849

Note: robust standard errors clustered by country pair in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Constant is not reported. In column 1, data are restricted to 1996–2014 to be consistent with the results reported in the previous sections. Column 2 uses data for the entire period for which the ICRG index is available.

Source: authors' estimation based on data sources provided in Section 3.

Again, consistent with hypothesis H2(b) and the results reported in Table 3, the coefficient on the interaction term is positive and statistically highly significant, indicating that countries that are signatories to the OECD Convention trade more with corrupt countries than countries that are not signatories to the Convention. Additionally, the estimates presented in this table, consistent with those presented earlier, show that signatories to the OECD Convention engage in greater trade with more corrupt countries than non-signatories.

In columns 3 and 5, we investigate these hypotheses using the CPI. While the coefficient on the interaction between the high corruption dummy in the origin country and corruption in the destination country is statistically not significant in column 3, the interaction term between the bribery law dummy for the origin country and corruption in the destination country is positive and statistically significant in column 5. Note that the results using the CPI as the measure of corruption must be treated with caution because, according to the publisher of the CPI, Transparency International, the index is not comparable across time before 2012.[17] Hence, the use of the CPI may not be appropriate for a pooled data analysis. This could also be the reason behind the insignificance of the interaction term between the high corruption origin dummy and corruption in the destination country. Overall, however, these results support hypotheses 1(b) and 2(b).

5.3 Sensitivity to alternative measures of trade flows

Our final robustness check involves the use of an alternative dataset on trade flows—the WITS dataset. This is provided by the World Bank in collaboration with the United Nations Conference on Trade and Development (UNCTAD). The available data refer to merchandise trade reported by more than 170 countries. One of the primary advantages of using WITS is that it breaks down trade flow data by industry and product. This allows us to check the robustness of our results by excluding trade flows involving mineral fuels, oils, and products of distilleries (fuels). This is important because a few countries dominate world exports of such products—mainly Saudi Arabia, Russia, Iraq, UAE, Canada, US, and Nigeria. An importer may not have a choice but to trade with these oil-exporting countries regardless of their levels of corruption, hence biasing our estimates. Highly fluctuating oil prices could also impact the reliability of our estimates (Paudel and Cooray 2018). Hence, we also check the robustness of our estimates by using the WITS data excluding fuel-related trade. All the dependent variables are reported in real values in Table 6 (total trade flows in columns 1 and 4, fuel trade flows in columns 2 and 5, and trade flows excluding fuel in columns 3 and 6). We limit our sample to the 193 UN member countries and the period 1996–2014. As with the CEPII TRADEHIST data, our final sample is an unbalanced panel. Missing trade flow observations are treated as zeros. The bilateral data on aggregate trade flows, fuel trade flows, and non-fuel trade flows are deflated to their real values using the import price deflator for all commodities, import price deflator for fuels, and import price deflator for non-petroleum products of the US, respectively.[18] The base year for each price index is 2010.

[17] Footnote 1 of the document is available at https://www.transparency.org/files/content/pressrelease/2012_CPIUpdatedMethodology_EMBARGO_EN.pdf (accessed 3 August 2020).

[18] Ideally, non-fuel trade should be deflated by the deflator for non-fuel products, but the data for the latter are available only from 2001, which would cause a substantial loss of observations.

Table 6: Corruption and assortative matching in trade: fuel vs. non-fuel trade

	Dependent variable: real value of trade flows (in $ millions)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Aggregate	Fuel	Non-fuel	Aggregate	Fuel	Non-fuel
High corruption (Origin)	-0.132***	-0.014	-0.160***			
	(0.044)	(0.067)	(0.047)			
Corruption (Destination)	-0.108**	-0.002	-0.090*	-0.193***	-0.012	-0.218***
	(0.053)	(0.097)	(0.053)	(0.051)	(0.086)	(0.051)
High corruption (O) × corruption (D)	-0.102**	-0.000	-0.140***			
	(0.043)	(0.077)	(0.044)			
Bribery law (Origin)				0.179***	0.093	0.243***
				(0.049)	(0.087)	(0.054)
Bribery law (O) × corruption (D)				0.077**	-0.035	0.124***
				(0.036)	(0.072)	(0.038)
Log (real GDP) (O)	1.063***	0.646***	0.932***	1.030***	0.629***	0.896***
	(0.087)	(0.114)	(0.094)	(0.084)	(0.111)	(0.090)
Log (real GDP) (D)	1.082***	0.971***	1.154***	1.096***	0.987***	1.164***
	(0.107)	(0.157)	(0.113)	(0.104)	(0.157)	(0.109)
Log (distance)	-0.619***	-1.239***	-0.573***	-0.625***	-1.231***	-0.577***
	(0.032)	(0.062)	(0.029)	(0.032)	(0.063)	(0.029)
Population (O)	-0.002***	-0.000	-0.001	-0.002***	0.001	-0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Population (D)	0.001	0.003***	-0.001	0.001	0.004***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Contiguous	0.429***	0.323**	0.428***	0.412***	0.326**	0.414***
	(0.082)	(0.157)	(0.078)	(0.084)	(0.155)	(0.080)
Common language	0.072	0.117	0.103	0.072	0.115	0.103
	(0.079)	(0.149)	(0.078)	(0.080)	(0.149)	(0.080)
Colony	0.286***	0.552***	0.294***	0.284***	0.547***	0.295***
	(0.094)	(0.147)	(0.092)	(0.094)	(0.147)	(0.092)
RTA	0.403***	0.224**	0.470***	0.394***	0.222**	0.469***
	(0.059)	(0.107)	(0.057)	(0.060)	(0.109)	(0.058)
Landlocked	-0.123	-1.173***	-0.030	-0.116	-1.176***	-0.022
	(0.174)	(0.336)	(0.169)	(0.174)	(0.339)	(0.169)
N	428,410	428,410	428,410	413,494	413,494	413,494
R-Squared	0.854	0.735	0.879	0.853	0.735	0.879
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Origin fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Destination fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: robust standard errors clustered by country pair in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Constant is not reported.

Source: authors' estimation based on data sources provided in Section 3.

Table 6 reports PPML results using WITS data. In the first three columns, our variable of interest is the interaction term between the high corruption dummy for origin countries and destination country corruption. Our conjecture seems to be correct here, as the results show that for fuel trade corruption levels do not matter (column 2). This is true for all corruption variables—origin and destination countries' corruption levels as well as their interaction. On the other hand, while it is shown that the coefficient of the interaction variable is negative and statistically significant for both aggregate (including fuel) and non-fuel trades, the coefficient is bigger for non-fuel trades. These results echo our findings using the TRADHIST CEPII data, that highly corrupt countries trade more with less corrupt countries. In columns 4–6, our variable of interest is the interaction variable between the OECD Convention signatory dummy for origin countries and corruption in the destination country. Again, the results are as expected and consistent with those reported

earlier. An insignificant coefficient on the interaction variable for fuel trade in column 5 indicates that being a signatory to the OECD Convention has no effect on fuel trade; but being a signatory to the Convention is shown to matter for aggregate trade and non-fuel trade, as the coefficient of the interaction variable is positive and highly statistically significant in columns 4 and 6. This indicates that the trade volume of OECD Convention signatory countries rises with increases in corruption at destination. In sum, the results reported in Table 6 corroborate our findings in the previous section by providing evidence of negative assortative matching with trading partners. Moreover, it is shown that our results are not driven by and are not contingent on fuel trade.

6 Conclusion

The primary objective of this study was to investigate how corruption at the destination affects the composition of a country's trading partners based on the latter's characteristics. We find evidence of negative assortative matching in international trade, whereby a highly corrupt origin country trades more with a less corrupt destination country. We offer some possible explanations for this finding that relate to the transaction costs and gains from trade (as a consequence of corruption) and the share of rent appropriated by representatives of the trading countries, respectively. First, as discussed in the hypothesis development, transaction costs will be lower when one of the trading partners is highly corrupt while the other is a country with low corruption as compared with the cases where both trading partners are either highly corrupt or less corrupt, causing the gains from trade to be greatest when a highly corrupt country trades with a less corrupt country. Second, the bargaining process for sharing the rent generated from trade will take longer when both countries are either highly corrupt or less corrupt as compared with the case when one of the trading partners is a highly corrupt country while the other is characterized by a low level of corruption. A longer bargaining process discounts the gains from trade (Rubinstein 1982), discouraging trade between two countries with similar (either high or low) levels of corruption. Third, the share of rents appropriated by the representatives of a country rises as corruption in the trading partner falls because only the former has experience of dealing with corruption (Cuervo-Cazurra 2006), incentivizing them to trade more with less corrupt countries.

Negative assortative matching is also present in the trade between signatories to the OECD Convention and countries with varying levels of corruption. We find that countries that are signatories to the OECD Convention trade more with more corrupt countries than non-signatory countries. This finding lends credence to the conjecture that signatories to the OECD Convention may face lower costs imposed by corruption in the destination country than non-signatories because they can credibly argue that their hands are tied, as the OECD Convention subjects them to penalties for bribery in international transactions. Additionally, we find that high corruption in both importing and exporting countries hurts trade, which is consistent with the findings of earlier studies (Anderson and Marcouiller 2002; Musila and Sigue 2010) and that signatories to the OECD Convention engage in more trade with corrupt countries than non-signatories.

The findings of our study have important policy implications. First, we show that corruption not only discourages international trade but also changes the composition of trading partners. It is therefore important to combat corruption at home.[19] Second, our findings show that signing an international anti-bribery convention can reduce a country's exposure to corruption in partner

[19] Studies have identified several cultural, democratic, economic, and institutional factors (see for instance, Escresa and Picci, 2020; Jha and Panda 2017; Treisman 2000) determining corruption across countries that can be used as a guide by policy-makers in combating corruption.

countries. Implementing anti-bribery laws may therefore prove to be effective in shielding a country from corruption in trading partners because they might allow the firms of the country to argue that their hands are tied (Cuervo-Cazurra 2006).

There are two other important implications of our study. The first implication is that corruption can have different impacts on outcome variables in the arena of international economics. Our findings indicate that corruption in the destination country has opposite effects on the composition of FDI to the composition of trading partners: while Cuervo-Cazurra (2006) finds that a corrupt country attracts less FDI from countries with low corruption than from highly corrupt countries, we find that it is exactly opposite in international trade, where a highly corrupt country trades more with less corrupt countries. Similarly, while Cuervo-Cazurra (2006) finds that signatories to the OECD Convention invest less in more corrupt countries than in less corrupt countries, we find that signatories to the OECD Convention trade more with more corrupt countries. While this might sound surprising at first, we provide a strong rationale to explain this result: signatories to the OECD Convention can credibly argue that their hands are tied and therefore may evade bribery requests more effectively than non-signatories. Hence, corruption in a trading partner country imposes a lower cost on signatories to the Convention than non-signatories, causing a positive association between corruption in a country and its trade flows with OECD Convention countries.

The second implication stems from the difference in the findings from studies on institutions: while previous studies have found evidence of positive assortative matching concerning institutions (De Groot et al. 2004; Lavallée 2005), our findings indicate negative assortative matching with respect to corruption. Our results, therefore, suggest that policy-makers and researchers should be careful in extrapolating the findings of corruption in one international sector to another, even if the two are closely related, because the results could be completely different. The same applies to different dimensions of institutions.

Finally, our results may also help explain the mixed evidence on the effect of corruption in the destination country on trade (Lambsdorff 1998), because we show that not only does the level of corruption in the origin and destination countries matter for the volume of trade between two countries (per Musila and Sigue 2010) but their interaction also plays an important role.

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