REPLY TO THE REFEREE REPORT

We fully agree with all comments of the referee. We will try our best to revise the paper according to the referee’s comments to improve the quality of the paper.

MAIN REMARKS:

Comment 1: The introduction should be reorganized. The authors should separate the literature review into another paragraph and make the introduction consistent with the purpose of the work; the layout of the paper is missing.

- Revision: We reorganized the introduction and separated the literature review into another paragraph. We made the introduction consistent with the purpose of the work as follows:

Over the past 20 years, the trade performance of ASEAN countries has been gaining encouraging achievements. According to WITS statistics, between 1997 and 2017, ASEAN's two-way trade volume increased 3.52 times, from 719.6 billion USD in 1997 to 2,534.7 billion USD in 2017 (WITS, 2018). However, in the past 5 years, it can be seen that ASEAN’s international trade is somewhat fluctuating. Specifically, it decreased from 2535.5 billion USD in 2014 to 2,232.3 billion USD in 2016, then increased to 2,534.7 billion USD in 2017. In addition, the average growth rate of ASEAN’s total trade in the period of 1997-2007 is 7.58 percent per year while this figure in the period 2008-2017 is only 2.86 percent per year. This situation implies that the trade efficiency of ASEAN countries is on a decreasing trend and there must be potential barriers to ASEAN’s trade efficiency.

Potential trade is conceived of as maximum possible trade, which can be achieved under the context of completely frictionless free trade (Doan & Xing, 2018; Kumar & Prabhakar, 2017a). In contrast, actual trade is given by the existing level of restrictions and institutions. The ratio of actual trade to potential trade is then defined as trade efficiency (Doan & Xing, 2018; Peter Drysdale, Hijang, & Kalirajan, 2012; Kang & Fratianni, 2006; Nguyen & Doan, 2017). The difference between potential and actual trade flows is interpreted as trade inefficiency. It is exactly equivalent to an unexhausted trade, which is the trade potential. When the potential trade is far greater than actual trade, the country-pair is said to have a low trade efficiency (Stack, Pentecost, & Ravishankar, 2018).

To this date, there have been a great deal of studies on trade potential, potential trade, and trade efficiency. Despite the difference in approach, four research strands have emerged.

The first strand consists of those studies, which use indices to calculate potential trade levels (De, 2020; Kodithuwakku, Weerahewa, & Boughanmi, 2016; Oramah & Abou-Lehaf, 1998;
Paswan, 2003). According to this approach, potential trade is estimated by matching the total export supply for a given commodity of a country with the total import demand for that commodity of a trading partner (Bano, Takahashi, & Scrimgeour, 2013). A variant of this approach is the indicative trade potential index (Kodithuwakku et al., 2016). This index allows for the identification of the products for which there is the highest trade complementarity between the exports of the exporting country and the imports of the importing country. In short, the index of trade potential is easy to apply because the calculation is straightforward. The disadvantage of this approach, however, is that it does not take into account trade barriers or resistances in the estimation process.

The second strand includes those studies that employ the traditional gravity models to estimate potential trade levels (Abbas & Waheed, 2019; Evelyn S. Devadason, Govindaraju, & Mubarak, 2018; Johnston, Morgan, & Wang, 2015). According to this approach, the estimated model is used to estimate potential trade, which is the predicted trade from the model (Agrawal & Sangita, 2017). Then trade efficiency is the ratio of actual trade to potential trade (Tochkov, 2018). Untapped trade potential is the absolute difference between the potential trade and the actual level of trade (Batra, 2006; Irshad, Xin, Hui, Arshad, & Watson, 2018). Accordingly, a positive value implies the possibility of trade expansion in the future while a negative value shows that the actual trade has exceeded its trade potential. In contrast, several studies defined the trade potential as the ratio of potential to actual trade (Agrawal & Sangita, 2017; Roy & Chatterjee, 2013). If the trade potential index is unity, then the actual trade is exactly equal to the potential trade. When the trade potential index is less than unity, then the actual trade is greater than the potential trade, implying that the two countries have very close trade relations. When trade potential index is greater than unity, then actual trade is lower than the potential trade. In this case, there is a potential to increase bilateral trade (Ravishankar & Stack, 2014). In short, the advantage of this approach is that it takes into account observed resistances to trade. However, two potential problems arise from this approach. First, conventional gravity models estimate the central value of a dataset (the mean effects of the determinants of bilateral trade), whereas potential trade is, by definition, involved at the upper limit. Second, unobserved resistances to trade such as asymmetric information and internal and external constraints are difficult to quantify and thus are lumped into the error term. For this reason, the expected value of the error term is no longer zero and normally distributed. Therefore, the normality assumption is violated, leading to inconsistent estimates (K. Kalirajan & Findlay, 2005).

The third strand consists of those studies, which applied the stochastic frontier analysis (SFA) to the traditional gravity model to overcome the disadvantages of the traditional gravity model

---

1 Breuss and Egger (1999) is an exception, who used the OLS estimator to calculate confidence intervals to evaluate the sampling variation of trade potential of a country’s exports to its trading partner.
Instead of assessing whether a country underperforms or outperforms the mean sample, SFA measures how much trade resistances exist in the bilateral trade relationship (Armstrong, 2007). This approach is based on the assumption that trade relationships are subject to two economic disturbances. So the error term is decomposed into conventional random error term and non-negative term, which captures trade inefficiency due to unobserved trade resistances (Armstrong, 2007; Peter Drysdale & Garnaut, 1982; Salim, Kabir, & Mawali, 2011). Therefore, the actual level of trade is always lower than the potential level of trade because trade resistances hinder the actual trade from reaching the maximum level (Nguyen & Doan, 2017). The advantage of this approach is that it estimates the frontier level of trade in the hypothetical case of no restriction. However, a potential limitation of this approach is that the endogeneity problem in SFA might lead to biased estimates.

The fourth strand includes those studies, which go beyond the estimating trade efficiency scores by running a second regression equation, which analyzes the determinants of trade efficiency scores estimated from SFA (Doan & Xing, 2018; Peter Drysdale, Hijang, et al., 2012; Nguyen & Doan, 2017; Noviyani, Na, & Irawan, 2019). Accordingly, there are two groups of factors that affect trade performance and efficiency, including behind-the-border (internal) constraints and beyond-the-border (external) constraints (Kaliappa Kalirajan & Singh, 2008). These constraints include the cultural, political, and institutional characteristics of the exporting and importing countries (McPherson & Trumbull, 2008). In short, the advantage of this approach is that it analyzes a wide range of factors that affect trade efficiency. However, there remain two potential problems. First, to explain the variation in trade efficiency, previous studies only focus on the quality of either internal constraints or external constraints or both. They have not tackled the differences between internal constraints of the exporting country and external constraints of the importing country. International transactions involve at least two countries with different jurisdictions and systems. Therefore, differences in institutional structures, regulatory framework, and cultural values between exporting and importing countries should be important factors, which hinder trade from reaching the maximum level and thus lower trade efficiency. Second, the endogeneity problem from the regression equation, which explains the variation in trade efficiency, potentially leads to biased estimates.

Through the review of related literature, we identify two knowledge gaps. First, the SFA model used to estimate trade efficiency as well as the models used to quantify the determinants of trade efficiency have not solved the endogenous problem. Second, previous studies have not analyzed the impact of institutional and cultural distances on trade efficiency. In addressing such a knowledge gap in the existing literature, this paper aims to analyze the bilateral influence
of cultural and institutional distance on ASEAN’s trade efficiency. To accomplish the research objective, this paper is guided by the following research questions:

- Is ASEAN’s trade with the rest of the world efficient?
- What are the determinants of trade efficiency between ASEAN and the rest of the world?
- What policy implications can we derive from the estimated results?

The unique features of this study are as follows: First, this is the first study on the impact of the differences between internal constraints and external constraints on trade efficiency, specifically, the impact of institutional and cultural distances on ASEAN’s trade efficiency. Second, in order to obtain accurate efficiency scores, we use an improved version of the standard stochastic frontier model proposed by Karakaplan (2018). The advantage of this method over previous ones is that it is able to control for the problem of endogeneity. Third, in quantifying the determinants of trade efficiency, we apply a sys-GMM estimator in order to overcome the problem of resulting from endogeneity, measurement errors, and omitted variables.
Comment 2: A paragraph with a literature review needed. This could add value to the article, especially if the authors emphasize the significant part of their work in terms of the econometric approach and the relevance of doing that.

Revision: we added a paragraph with a literature review as follows:

2. Literature review

According to Armstrong (2007), quantifying the determinants of trade efficiency requires two steps of estimation. The first step involves the estimation of trade efficiency scores based on the stochastic frontier gravity model and the second step involves in a regression equation to analyze the determinants of trade efficiency scores.

Estimation of trade efficiency

Much research conducted to estimate trade efficiency is based on the gravity model using SFA (Demir, Bilik, & Utkulu, 2017; Kumar & Prabhakar, 2017b). The traditional gravity model was pioneered by Tinbergen (1962), Pöyhön (1963), and Linnemann (1966). Undergone a number of modifications, it has become very popular and been widely used to assess the determinants of bilateral trade. Accordingly, bilateral trade between any two countries is affected by export supply, import demand, and trade resistances.

![Figure 1. The general gravity model in international trade](image)

In Figure 1, the export supply includes factors that represent the exporting country’s ability to produce goods for export, while import demand consists of factors that reflect the importing country’s ability to import. Trade resistances can be broken down into natural resistances and man-made resistances, as presented in Figure 1 (Armstrong, 2007). Natural resistances are objective and observable barriers. They can be controlled for. In contrast, man-made resistances are subjective and unobserved barriers. They are difficult to quantify and thus lumped into the disturbance term (Baier & Bergstrand, 2009). In reality, man-made resistances always exist. Because of this, the volume of actual bilateral trade is always beneath the highest possibility levels, indicating the presence of trade inefficiency. In this case, the traditional...
gravity model is not appropriate because the assumption of normally distributed error term is violated due to the unobserved man-made resistances. This econometric problem leads to the application of SAF (Assefa, 2017; Demir, Bilik, & Utkulu, 2019; K. Kalirajan, 2010).

Instead of estimating the mean effect of the determinants of bilateral trade, SFA estimates how much man-made resistances exist in a bilateral trade relationship. Among studies on estimating trade efficiency scores, Ravishankar and Stack (2014) employed a gravity equation using the SFA to estimate Eastern European countries’ trade potential. Their panel sample consisted of bilateral export flows from 17 Western European countries to 10 new EU member countries for the period 1994–2007. The estimated efficiency scores imply a high degree of East-West trade integration. In addition, early trade liberalization and the removal of barriers under bilateral free trade agreements (FTAs) have boosted trade efficiency. Other studies that followed a similar stochastic frontier approach to estimate trade efficiency scores include Hassan (2017), Kumar and Prabhakar (2017a), Viorica (2015), and Stack et al. (2018), among others.

Barma (2017) used a stochastic gravity model of trade to analyze the determinants of Indian agricultural export flows to 112 partner countries for the period 2000-2013. An improvement of this study is that it employed various time-invariant (model bc88 and model pl81) and time-varying (model bc92, model bc95, and model TRE) specifications in a stochastic gravity model. The empirical results support high yet decreasing home country inefficiency.

**Determinants of trade efficiency**

Although studies on estimating trade efficiency are numerous, those on quantifying the determinants of trade efficiency are scant. As explained above, man-made resistances hinder actual trade from reaching the potential level. These resistances are influenced by the behind-the-border (internal) constraints of the home country and the beyond-the-border (external) constraints of the trading partners. They include socio-economic, cultural, institutional, and political rigidities (Salim et al., 2011; Sayavong, 2015).

One of the early studies on the determinants of trade efficiency was conducted by Peter Drysdale, Huang, and Kalirajan (2012). Their sample included China’s trade with 57 countries in the rest of the world (ROW) for the period 1991-1995. They found that trade tariffs in both the exporting and importing countries were not significant, the economic freedom indexes in the two groups of countries turned out to be important determinants of China’s trade efficiency.
Using a similar approach, Doan and Xing (2018) applied a stochastic gravity model to estimate efficiency levels of Vietnam’s exports to its major trading partners during the period 1995-2013. In the second stage, the study investigated the impact of FTAs and rules of origin on export efficiency. The empirical results showed that membership in ASEAN contributed positively to the country’s trade efficiency while rules of origin and non-membership in EU and NAFTA had a negative impact.

Nguyen and Doan (2017) employed a stochastic gravity model to estimate the efficiency performance of Vietnam’s trade with its main trading partners from 1995-2015. They found that Vietnam’s membership in ASEAN Free Trade Agreement has improved the trade efficiency, whereas tariffs and domestic devaluation have reduced it. To analyze factors affecting trade efficiency and trade potential of countries along the Belt and Road, Kexin (2018) used trade data from 35 countries for the period 1995–2014. Using cointegration estimation methods, he found that trade diversification, trade concentration, and trade complementarity index are important determinants of trade efficiency. Noviyani et al. (2019) analyze the efficiency of Indonesia's merchandise exports and the factors affecting the Indonesia’s export efficiency. Their sample include Indonesia’s exports to its 62 trading partners for the period 2011-2016. They found that export inefficiency increased by business freedom, investment freedom, and landlocked dummy, and then export inefficiency decreased by labor freedom, financial freedom, contiguous dummy and FTA dummy.

Based on the review of the literature, it is clear that previous studies only analyzed the impact of the quality of internal and external constraints on trade efficiency. No study has assessed the impact of the differences between the internal and external constraints on trade efficiency. The inclusion of such differences is justified on the ground that cross-border transactions involve in at least two countries with different socio-economic characteristics, institutional and regulatory structures, political systems, and cultural values. These differences affect trade efficiency because they potentially lower trust, increase uncertainty and risk, and lead to misunderstanding and unfamiliarity.

**Institutional distance and trade efficiency**

Based on Kostova (1996)’s definition, institutional distance refers to dissimilarity in a wide range of structures such as contract enforcement, property rights, and the rule of law that influence international trade (Anderson & Marcouiller, 2002; Méon & Sekkat, 2008). For international trade to take place, enterprises from different jurisdictions must agree on and
comply with the signed contract (Nunn, 2007). However, institutions differ greatly from
country to country (Acemoglu & Dell, 2010). In order to survive, firms must conform to the
prevailing rules and belief systems (Scott, 1995). The rules here may be formal (such as formal
contracts) or informal (such as relational contracts). Therefore, in many cases, enterprises are
left with imperfect realizations of contracts. Like cultural distance, differences in institutional
quality and structures between any two countries restrict actual trade from reaching the
potential level in several ways. First, as the institutional quality and structures of the two
countries are similar, enterprises in these two countries are more familiar with each other’s
business systems and procedures. In this case, trust and commitment between them develops
more easily. They necessarily reduce trade costs resulting from search, networking, and
adjustment costs (de Groot, Linders, Rietveld, & Subramanian, 2004; Mendonça, Lirio, Braga,
& Silva, 2014). Second, similar institutional framework contributes to contract enforcement
and transaction mechanisms (Ranjan & Lee, 2007). Reducing the risk of opportunistic behavior
and enhancing law enforcement can lower control and monitoring costs of contracts. Third,
homogeneous institutions decrease information asymmetries by channeling information about
market conditions (Borrmann, Busse, & Neuhaus, 2006). The good flowing from each of these
similarities indicates that the more distant the institutional quality of the two countries is, the
higher the transaction costs are (de Groot et al., 2004). Therefore, institutional distance is
expected to have a negative impact on trade efficiency.

*Cultural distance and trade efficiency*

Cultural distance can be defined as the degree to which shared norms and values differ between
countries (G. Hofstede, 2001). Such distance is found to impede bilateral trade (Boisso &
Ferrantino, 1997; Tadesse & White, 2008a, 2008c). In other words, it prevents actual trade
from reaching the maximum level. The mechanism through which cultural distance affects
trade efficiency is related to trade costs (Williamson, 1979). First, cultural distance potentially
leads to lack of trust and commitment, which is needed to overcome moral hazards in business
transactions and can reduce the transaction costs (Xing & Zhou, 2018). Since the delivery and
payment may take place at different times, confidence is of paramount importance to
international transaction (White & Tadesse, 2008). As pointed out by Tadesse and White
(2008b), parties involved are potentially vulnerable to fraud or risk because contracts between
them are often incomplete. International trade laws alone are enough to ensure the
commitments of the parties involved. Therefore, certain level of trust and commitment is need
ed to needed to initiate trade deals, make sure that trading partners comply with the contracts, and
complete transactions (Coyne & Williamson, 2012; Guiso, Sapienza, & Zingales, 2009; Tabellini, 2010). Second, cultural differences between countries increase uncertainty about the business partners, which results in a higher exposure to risk (Geert Hofstede, 1989). People from different cultures may have different understandings and interpretations of the same situation. According to Brouthers and Brouthers (2000), such difference can result in noise and complicate interactions between parties. Third, cultural distance may raise the search and networking costs associated with finding appropriate trading partners. It is because cultural differences hinder information exchange and communication between countries involved. Understanding each other’s cultures make it easier to acquire information about profitable international trade opportunity. Another possibility is that people are biased against cultures that are highly different from their own culture, or biased in favor of cultures that are more like their own. As confirmed by Glaeser, Laibson, Scheinkman, and Soutter (2000) cultural distance reduces the effectiveness of decision making because it increases perceived costs. Therefore, cultural distance is expected to have a negative impact on trade efficiency.
**Comment 3:** Figures related to the trade of the Asian countries are missing. A plot of trade of each member of the ASEAN area could be useful for understanding the role of these countries in the main international arena after developments in new free trade agreements.

**Revision:** We added a graph plotting trade of each member of the ASEAN area and the interpretation of the graph as follows:

![Graph showing ASEAN countries' trade with the rest of the world](image)

**Figure 1:** The ASEAN countries’ trade with the rest of the world

ASEAN countries’ total trade had substantially grown over the years 2006-2016. Specially, during this period, ASEAN’s total trade increased by 1.5 times, reaching 2,167.7 billion USD in 2016. The fluctuations in the ASEAN’s trade mostly come from Singapore, Malaysia, Thailand and Indonesia. Vietnam and the Philippines are the countries with the least amount of trade in the bloc, but their trade has been on the rise in recent years.

As the data revealed, ASEAN countries’ total trade accelerated the fastest in the period 2009-2012 when Common Effective Preferential Tariff (CFTA) was replaced by ASEAN Trade in Goods Agreement (ATIGA) in 2010, China-ASEAN free trade agreement (CAFTA) officially came into effect in 2010, and the ASEAN Comprehensive Investment Agreement (ACIA) came into effect in 2012. The replacement of ATIGA and the formation of CFTA pushed the total trade of ASEAN countries to increase rapidly thanks to tax cuts, elimination of unrelated barriers, rules of origin, customs, standards and compliance, and sanitary and phytosanitary measures in ATIGA. However, from 2014 to now, the total trade of ASEAN countries has been on a downward trend. This decline could be due to the large economies of ASEAN being affected by US-China trade tensions (Curran, 2019).
Comment 4: There are several issues related to the materials and methods paragraph. I would advise to better explain your strategy and providing a clear structure of the methodological and descriptive section. I think this is a key part of the paper and it should be well structured. The materials and methods paragraph should contain a structure of the different steps or pathways that authors make to estimate potential trade and trade efficiency, as a figure showing inputs and output using in the estimation framework of the stochastic gravity model.

My main concern is related to cultural and institutional distance data and the trade freedom indicator. The authors indicate in the equations ID_{ijt}, CD_{ijt}, TF_{ijt}, as the overall score. There is a need to better justify why these variables were chosen. Why are authors using the overall indicators? The overall score captures the effects of all the individual components of the score itself. But it could be that some of them, such as the level of corruption or the level of non-tariff measures or tariffs, have a greater weight in determining the efficiency of trade. I would suggest also checking for the individual components, the estimates could indeed change. It would be interesting to check to what extent each of the individual components participates in determining the efficiency of the trade. Some interaction terms or effect could also be possible.

Revision: The materials and methods paragraph is re-organized as follows

3. Materials and methods

This study requires two steps of estimation as proposed by Armstrong (2007). The first step involves the estimation of the stochastic frontier gravity model (Equation 1) and then the calculation of the efficiency scores (Equation 3). In the second step, we analyze the factors affecting trade efficiency scores (factors explaining the variation in the one-sided error term) using the system GMM approach (Equation 4).

3.1. Estimating trade efficiency

The gravity model has been a workhorse in quantifying the determinants of bilateral trade. According to this model, bilateral trade between any two countries is affected the export supply (e.g., GDP of the exporting country), import demand (e.g. GDP of the importing country), and trade resistances. Trade resistances can be broken down into natural resistances (e.g. geographical distance, language, landlocked status, etc.) and man-made resistances (e.g. institutional and cultural distances). Since natural resistances are observable, they appear in the right-hand side of the gravity equation. However, man-made resistances are unobservable, so they are lumped together into the disturbance term (Baier & Bergstrand, 2009). Drawing on Xing and Zhou (2018) and Atif, Haiyun, and Mahmood (2017), our gravity model is as follows:
\[
\ln \text{Trade}_{ij,t} = \alpha + \beta_1 \ln \text{GDP}_{i,t} + \beta_2 \ln \text{GDP}_{j,t} + \beta_3 \ln \text{DIST}_{ij} + \beta_4 \ln \text{Area}_i + \beta_5 \ln \text{Area}_j
\]
\[
+ \beta_6 \text{Colony}_{ij} + \beta_7 \text{Landlocked}_{ij} + \beta_8 \text{Language}_{ij} + b_9 \text{FTA}_{ij,t}
\]
\[
+ \varepsilon_{ij,t}
\]

(1)

Where:

- \(\ln\) is natural logarithm.
- \(\text{Trade}_{ij,t}\) is the trade volume (export plus import) between country \(i\) and country \(j\) at the time \(t\), measured in thousand USD.
- \(\text{GDP}_{i,t}\) is Gross Domestic Product of country \(i\) at the time \(t\), measured in billion USD.
- \(\text{GDP}_{j,t}\) is Gross Domestic Product of country \(j\) at the time \(t\), measured in billion USD.
- \(\text{DIST}_{ij}\) is the weighted distance between country \(i\) and the country \(j\), measured in km.
- \(\text{Area}_i\) and \(\text{Area}_j\) are the land areas of country \(i\) and country \(j\) respectively, measured in \(\text{km}^2\).
- \(\text{Colony}_{ij}\) is a dummy variable taking a value of 1 if country \(i\) and country \(j\) have a colonial relation, and 0 otherwise.
- \(\text{Landlock}_{ij}\) is a dummy variable which equals 1 if at least one of the two trade partners (either country \(i\) or country \(j\)) is landlocked and zero otherwise.
- \(\text{Language}_{ij}\) is a dummy variable which equals 1 if both country \(i\) and country \(j\) speak a common language and zero otherwise.
- \(\text{FTA}_{ij,t}\) is a dummy variable which equals 1 if both country \(i\) and country \(j\) have FTA agreement in year \(t\) and zero otherwise.

The error term consists of two components \((\varepsilon_{ij,t} = \nu_{ij,t} - u_{ij,t})\). The first component \((\nu_{ij,t})\) is the conventional symmetric error term, which is purely random and follows the normal distribution, \(\nu_{ij,t} \sim iid N(0, \sigma_u^2)\). The second component \((u_{ij,t})\) captures trade inefficiency due to the man-made resistances, which prevent actual trade from reaching the potential level (Kalirajan, 2007). It is a single-sided error term and follows a half-normal distribution, \(u_{ij,t} \sim iid N^+(0, \sigma_u^2)\), which represent deviations from maximum trade that are specific to each bilateral relation. They are distributed independently from each other and from the independent variables. Therefore, our gravity model with decomposed error term is as follows:
\[ \ln Trade_{ij,t} = \alpha + \beta_1 \ln GDP_{i,t} + \beta_2 \ln GDP_{j,t} + \beta_3 \ln DIST_{ij} + \beta_4 \ln Area_i + \beta_5 \ln Area_j \\
+ \beta_6 \text{Colony}_{ij} + \beta_7 \text{Landlocked}_{ij} + \beta_8 \text{Language}_{ij} + \beta_9 \text{FTA}_{ij,t} \\
+ (v_{ij,t} - u_{ij,t}) \quad (2) \]

The values of \( u_{ij,t} \) range between zero and one. When \( u_{ij,t} \) is zero, Equation 2 becomes the conventional gravity equation. In this case, actual trade and potential trade are identical, meaning that there is no trade inefficiency or the effect of man-made resistances is not important. When \( u_{ij,t} \) is greater zero and smaller or equal to one, there are trade inefficiencies (the effect of man-made resistances is important). In this case, OLS estimation would violate the assumption of a normally distributed random disturbance because the disturbance in this case includes unobserved man-made resistances (Kalirajan and Findlay, 2005).

To overcome such problem, Armstrong (2007) proposed the gravity stochastic frontier analysis (SFA), introduced by Aigner, Lovell, and Schmidt (1977) and Meeusen and van Den Broeck (1977). Instead of finding the mean effect of the determinants of bilateral trade, SFA estimates unobservable resistances to trade. The application of SFA in the gravity model allows the model to quantify the trade efficiency at bilateral level. Therefore, our first step is to estimate Equation 2 using the SFA. After Equation 2 is estimated, we calculate ASEAN’s trade efficiency scores, which are equivalent to the ratio of country-pair actual trade in any given year \( t \) to the corresponding country-pair trade if \( u_{ij,t} \) is zero (Battese & Coelli, 1988). The country-pair specific trade efficiency scores can be computed as follows:

\[
\text{Trade efficiency}_{ij,t} = \frac{Actual Trade_{ij,t}}{Potential Trade_{ij,t}} = \frac{\exp(x_{ij,t}\beta + v_{ij,t} - u_{ij,t})}{\exp(x_{ij,t}\beta + v_{ij,t})} \\
= \exp(-u_{ij,t}) \quad (3)
\]

The value of the trade efficiency score ranges from 0 to unity. A higher score implies higher trade efficiency, which means that trade volume is closer to the trade frontier. A value of zero indicates a need to raise actual trade nearer to maximal level, whereas a value of unity implies that actual trade coincides with a potential trade\(^2\).

3.2. Analyzing the determinants of trade efficiency

As explained above, the second step is to analyze the factors affecting ASEAN’s trade efficiency. In this study, we focus on the impact of institutional and cultural distances on

\(^2\) Based on the estimated efficiency scores, trade potential can be calculated as follows:

\[
Potential trade_{ij,t} = \frac{Actual trade_{ij,t}}{Trade efficiency_{ij,t}}
\]
ASEAN’s trade efficiency with the rest of the world. In doing so, we employ the dynamic panel data model as follows:

\[
TE_{ij,t} = a + b_1TE_{ij,t-1} + b_2ID_{ij,t} + b_3CD_{ij} + b_4\ln TF_{ij,t} + \epsilon_{ijt}
\]  (4)

\(TE_{ij,t}\) is trade efficiency between country \(i\) and country \(j\) in year \(t\) is the efficiency score in year \(t\) derived from the gravity stochastic frontier model.

\(TE_{ij,t-1}\) is the trade efficiency between country \(i\) and country \(j\) in year \(t-1\) is the efficiency score in year \(t-1\) derived from the gravity stochastic frontier model.

\(ID_{ij,t}\) is the institutional distance between country \(i\) and country \(j\). It is calculated using the following equation:

\[
ID_{ij,t} = \frac{1}{7} \sum_{k=1}^{7} \left( I_{ki,t} - I_{kj,t} \right)^2 / V_{k,t}
\]  (5)

Where: \(I_{ki,t}\) and \(I_{kj,t}\) denote \(k\)th institutional dimension of country \(i\) and country \(j\) in year \(t\), respectively. \(V_{k,t}\) is the variance of \(k\)th institutional dimension across countries in year \(t\). There are seven institutional dimensions with the score for each dimension ranging from 1 (worst) to 7 (best). First, \textit{property rights} reflect the extent to which a country's law protects property rights (including tangible and intangible assets) of individuals and collectives. Second, \textit{ethics and corruption} assess the level of bribery and corruption occurring in a country and they based on three variables related to diversion of public funds, people's trust in the government, and irregular payments and bribes. Third, \textit{undue influence} evaluates the fairness of the justice system and government decisions for companies and individuals within a country. Fourthly, \textit{government efficiency} refers to the transparency and performance of government in a country. Fifthly, \textit{security} indicates the influence of criminal organizations on the operation of the business and reliability of police services. Sixth, \textit{corporate ethics} evaluates the corporate ethics of companies (ethical behavior in interactions with public officials, politicians, and other firms). Seventh, \textit{accountability} refers to the impact of audit standards, reporting and the level of law protection on the board of directors, shareholders and investors of enterprises.

\(CD_{ij}\) is the cultural distance between country \(i\) and country \(j\). It is calculated using the following equation:

\[
CD_{ij} = \frac{1}{4} \sum_{k=1}^{4} \left( C_{kj} - C_{ki} \right)^2 / V_k
\]  (6)

\(^3\) The seven dimensions of institutional quality are developed by WEF (World Economic Forum). Detailed information about seven institutional dimensions is presented in the Appendix 1.
Where: \( C_{ki} \) and \( C_{kj} \) represent \( k \)'th cultural dimension of country \( i \) and country \( j \), respectively. \( V_k \) is the variance of \( k \)'th dimension across countries. There are four dimensions of the national culture score. First, power distance (PDI) is defined as the degree to which people of an organization or institution accept the unequally distributed power. Second, individualism versus collectivism reflects the degree to which a society prefers a loosely-knit social framework in which the role of individual is emphasized (individualism) or a tightly-knit framework in which the role of group is emphasized (collectivism). It also reflects the creative capability of a country. Third, masculinity versus femininity refers to the degree to which a society emphasizes achievement, heroism, assertiveness and material rewards for success (masculine culture) or cooperation, modesty, caring for the weak and quality of life (feminist culture). Fourth, uncertainty avoidance (UAI) describes the degree to which members of a society accept uncertainty, ambiguity, and risks. In a society with High UAI, people cohere to regulations, policies and guiding documents. In contrast, in a society with low UAI. People maintain a more relaxed attitude in which practice is more important than principles.

\( TF_{ij,t} \) is the product of country \( i \)'s trade freedom and country \( j \)'s trade freedom in year \( t \). It is calculated as follows:

\[
\ln TF_{ij,t} = \ln(TF_{i,t} \times TF_{j,t})
\]

Where: TF_{i,t} and TF_{j,t} are the indices of trade freedom of country \( i \) and country \( j \) in year \( t \), respectively. Trade freedom is the controlled variable. According to the Heritage Foundation, trade freedom is a composite measure of the absence of tariff and non-tariff barriers that affect the import and export of goods and services. It reflects a country's level of trade freedom in the import of goods and services from other nations, and a measure of free interaction between sellers and buyers in the international marketplace. The score of the trade freedom index ranges from 0 (repressed) to 100 (free trade).

3.3. Endogeneity problem

Endogeneity problem with Equation 2 (the stochastic frontier gravity model)

The trade literature has shown that Equation 1 can potentially suffer from the problem of endogeneity resulting from simultaneity on the theoretical ground that GDP can affect bilateral trade (Natale, Borrello, & Motova, 2015; Zheng, Shao, & Wang, 2017), and bilateral trade can affect GDP (Lewer & Berg, 2003; Li & Jiang, 2018; Sakyi, Villaverde, Maza, & Bonuedi, 2017). In this study, the instrument for the GDP variable is estimated using the augmented Solow growth model, whose independent variables are capital, labor, and technology.
In order to confirm whether there is a problem of endogeneity in the stochastic frontier gravity equation, we conduct the test for endogeneity specified in Karakaşlan and Kutlu (2017), according to which the joint significance of the components of the $\eta$ term is checked. If the components of the $\eta$ term are jointly significant, then the model suffers from the problem of endogeneity. In this case, a correction would be necessary. Conversely, if the components are not jointly significant, then the model does not suffer from the endogeneity. In this case, the correction term is not necessary, and efficiency can be estimated by traditional frontier models.

*Endogeneity with Equation 5 (the determinants of ASEAN’s trade efficiency)*

Because Equation 2 is dynamic, its lagged dependent variable leads to a correlation between the lagged dependent variable and the error term, which makes the OLS estimator biased and inconsistent. In addition, the panel dataset has a short time-dimension and a large country-pair dimension. Therefore, we employ a system GMM estimator, which allows us to overcome the problems of serial correlation, heteroskedasticity, endogeneity, and omitted variables. The estimator is a system consisting of both first-differenced and levels equations. To estimate the equation, we apply the Blundell and Bond (1998) methodology to small-sample correction. The system GMM is consistent if the instruments are valid and there is no second-order serial correlation in the residuals. Therefore, we conduct the Sargan test of over-identifying restriction to check for the validity of the instruments and implement an AR(2) test to check for second-order serial correlation in the residuals.

**3.4. Data**

This study uses a panel dataset of 65 countries around the world. The dataset includes bilateral trade between six ASEAN countries (Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam) and 59 non-ASEAN countries for the period 2006–20164 (the list of countries included in our sample is presented in <Appendix-1>). Our selection of the above six ASEAN countries is based on the fact that they are the major trading countries in ASEAN.

Yearly total bilateral trade between countries is collected from the World Integrated Trade Solution (WITS, 2018), which is adapted from the United Nations Statistics Division. Data on GDP are extracted from the World Economic Outlook (WEO) database of the International Monetary Fund (IMF). Information regarding weighted distance, colonial relationship, landlocked status, and common language is obtained from CEPII (Centre d'Études Prospectives

---

4 Data for variables such as institutional quality and trade freedom are only available since 2006.
et d'Informations Internationales, the leading French center for research and expertise on the world economy).\textsuperscript{5} Land areas of both importers and exporters are obtained from UNdata.\textsuperscript{6} Data on FTAs are extracted from the World Trade Organization (WTO) and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). Data on gross capital formation and labor force are taken from the World Bank. Data on institution are obtained from the World Economic Forum. Data on culture are gained from Hofstede Insights.\textsuperscript{7} Data on trade freedom are taken from The Heritage Foundation.\textsuperscript{8}

\textsuperscript{5} http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp
\textsuperscript{7} https://www.hofstede-insights.com/models/national-culture/
\textsuperscript{8} https://www.heritage.org/index/visualize
Comment 5: Results: The authors should pay attention to the description of the results. It is a relevant piece, as well as the methodological one, of the article and should be argued more thoroughly. Detailed and in-depth comments with policy implications are needed. What are the implications or the conclusions of Tables 3 and 4? What do authors mean that trade efficiency of trade in ASEAN is moderate? And what is the possible explanation for which Singapore is the country that has the highest efficiency score? What is it means? What are the differences with the other ASEAN countries? All this information is important and at the same time missing. Yet, Is the highest score meaning a more integrated market? The same kind of comment also applies to table 5. What do authors mean with the following sentence “Our finding complements several previous studies”? Which? A comparison with the literature is needed in showing the originality or novelty of their research. Additionally, results should also be compared coherently with the existing literature.

Revision: We added the implication/conclusion of Table 3 (the underlined sentences)

Table 3: Estimate of ASEAN’s Average Trade efficiency

<table>
<thead>
<tr>
<th>Year</th>
<th>ASEAN</th>
<th>Indonesia</th>
<th>Malaysia</th>
<th>Philippines</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Vietnam</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>0.601</td>
<td>0.595</td>
<td>0.646</td>
<td>0.565</td>
<td>0.623</td>
<td>0.597</td>
<td>0.500</td>
</tr>
<tr>
<td>2007</td>
<td>0.580</td>
<td>0.585</td>
<td>0.627</td>
<td>0.545</td>
<td>0.593</td>
<td>0.575</td>
<td>0.487</td>
</tr>
<tr>
<td>2008</td>
<td>0.554</td>
<td>0.560</td>
<td>0.623</td>
<td>0.457</td>
<td>0.580</td>
<td>0.538</td>
<td>0.500</td>
</tr>
<tr>
<td>2009</td>
<td>0.534</td>
<td>0.502</td>
<td>0.623</td>
<td>0.444</td>
<td>0.599</td>
<td>0.519</td>
<td>0.445</td>
</tr>
<tr>
<td>2010</td>
<td>0.517</td>
<td>0.484</td>
<td>0.579</td>
<td>0.395</td>
<td>0.574</td>
<td>0.518</td>
<td>0.455</td>
</tr>
<tr>
<td>2011</td>
<td>0.517</td>
<td>0.491</td>
<td>0.559</td>
<td>0.373</td>
<td>0.570</td>
<td>0.516</td>
<td>0.495</td>
</tr>
<tr>
<td>2012</td>
<td>0.501</td>
<td>0.471</td>
<td>0.533</td>
<td>0.384</td>
<td>0.556</td>
<td>0.490</td>
<td>0.510</td>
</tr>
<tr>
<td>2013</td>
<td>0.495</td>
<td>0.468</td>
<td>0.529</td>
<td>0.373</td>
<td>0.550</td>
<td>0.474</td>
<td>0.529</td>
</tr>
<tr>
<td>2014</td>
<td>0.491</td>
<td>0.453</td>
<td>0.528</td>
<td>0.368</td>
<td>0.557</td>
<td>0.465</td>
<td>0.536</td>
</tr>
<tr>
<td>2015</td>
<td>0.487</td>
<td>0.435</td>
<td>0.512</td>
<td>0.363</td>
<td>0.560</td>
<td>0.459</td>
<td>0.548</td>
</tr>
<tr>
<td>2016</td>
<td>0.478</td>
<td>0.420</td>
<td>0.495</td>
<td>0.347</td>
<td>0.557</td>
<td>0.447</td>
<td>0.560</td>
</tr>
</tbody>
</table>

Source: The authors’ computation

Table 3 presents the estimate of trade efficiency scores. High efficiency scores imply that a country’s actual trade is close to maximum levels, whereas low efficiency scores reflect a country’s actual trade deviates from frontier estimates, implying scope for improved trade performance. As the results reveal, the mean trade efficiency of ASEAN is somewhat higher than the average, but on a download trend. There are two possible reasons for the decrease in ASEAN’s trade efficiency. First, the instability in the politics and business environment of
some ASEAN countries has raised trading partners and investors’ concern. According to the statistics of the WEF, the institutional quality of ASEAN countries is showing signs of decline. The decline was most evident in the Philippines from 3.86 in 2014 to 3.51 in 2017 due to corruption and bribery issues that have not been strictly controlled (Mourdoukoutas, 2018). In addition, the scandal related to embezzlement in the Malaysian State Investment Fund makes the country’s physical quality index to drop dramatically, which negatively affects the trading partners’ decisions (Noh, 2016). Second, the US-China trade war indirectly affects the trade of ASEAN countries through domestic and international supply chains. The imposition of US tariffs on Chinese goods has led to a sharp drop in the US’s domestic demand for Chinese products. This situation has negatively affected ASEAN’s companies supplying raw materials to China because Chinese exporting companies have to cut production due to US’s high tariff. This negative effect is most evident in Singapore because Singapore has a high degree of trade integration and participates in many large supply chains related to China.

Among ASEAN countries, Singapore is the country that has the highest efficiency scores, reflecting that it has reached high degree of trade integration. First, Singapore’s trade policy is the most liberalized. Compared with other ASEAN countries, Singapore has lowest tariff and non-tariff barriers. Second, it has succeeded in developing a knowledge economy with high quality of human resources and institutional framework. Third, this country has priority policies for multinational companies (MNCs) establishing their R&D centers in Singapore, which promote technology transfer and bring national cultures closer. Finally, Singapore people can speak English and Chinese fluently, making the country’s bilateral trade with English speaking countries and China more easily. All these factors contribute to Singapore’s trade efficiency.

All countries except Vietnam show a downward trend in efficiency score. There are two possible explanations for the increase in Vietnam’s trade efficiency. First, Vietnam has made strong efforts to liberalize its trade policies and integrate into the world economy. As the result, compared with other ASEAN countries, Vietnam has the fastest increase in the trade freedom index, from 57.6 scores in 2006 to 83 scores in 2016. These efforts have helped Vietnam attract a large amount of FDI⁹, thereby increasing its ability to produce goods, transfer technology and reduce cultural gaps. Second, Vietnam’s political situation is very stable, creating trust and confidence of the trading partners. Third, in recent years, Vietnam has tried its best to reform its administrative system, enhance institutional quality, and increase the quality of human resources. All these factors have helped Vietnam to strengthen its trade efficiency.

---

⁹ According to report of PwC (https://www.pwc.com/) Vietnam, ASEAN was ranked 4th in the top 10 markets by FDI inflows, of which, Vietnam was ranked in the top 2 FDI destinations in ASEAN, after Singapore.
**Revision:** We added the implication/conclusion of Table 4 (the underlined sentences)

**Table 4: ASEAN - ROW Potential Trade**

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Bilateral Trade (Billion USD)</th>
<th>Trade Efficiency (Score)</th>
<th>Potential Trade (Billion USD)</th>
<th>Unexhausted Trade (Billion USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>926.592</td>
<td>0.601</td>
<td>1541.077</td>
<td>614.485</td>
</tr>
<tr>
<td>2007</td>
<td>1049.610</td>
<td>0.580</td>
<td>1810.699</td>
<td>761.089</td>
</tr>
<tr>
<td>2008</td>
<td>1237.258</td>
<td>0.554</td>
<td>2232.716</td>
<td>995.458</td>
</tr>
<tr>
<td>2009</td>
<td>1002.990</td>
<td>0.534</td>
<td>1879.835</td>
<td>876.845</td>
</tr>
<tr>
<td>2010</td>
<td>1297.419</td>
<td>0.517</td>
<td>2508.225</td>
<td>1210.806</td>
</tr>
<tr>
<td>2011</td>
<td>1546.282</td>
<td>0.517</td>
<td>2992.355</td>
<td>1446.073</td>
</tr>
<tr>
<td>2012</td>
<td>1589.515</td>
<td>0.501</td>
<td>3170.165</td>
<td>1580.650</td>
</tr>
<tr>
<td>2013</td>
<td>1615.774</td>
<td>0.495</td>
<td>3262.721</td>
<td>1646.947</td>
</tr>
<tr>
<td>2014</td>
<td>1615.371</td>
<td>0.491</td>
<td>3293.260</td>
<td>1677.889</td>
</tr>
<tr>
<td>2015</td>
<td>1474.255</td>
<td>0.487</td>
<td>3029.928</td>
<td>1555.673</td>
</tr>
<tr>
<td>2016</td>
<td>1476.738</td>
<td>0.478</td>
<td>3091.498</td>
<td>1614.760</td>
</tr>
</tbody>
</table>

*Source:* The authors’ computation

*Note:* Potential trade = Actual bilateral trade/Trade efficiency

Unexhausted trade = Potential trade - Actual trade

Table 4 presents the estimated unexhausted trade between ASEAN and ROW. The second and the third columns present the actual trade and the trade efficiency scores respectively. The forth column displays the potential trade, which is the maximum amount of trade that ASEAN can achieve in the hypothetical case of no restriction in economic systems. The fifth column provides the estimate of unexhausted trade, which is the maximum amount of trade that ASEAN can exploit. According to Table 4, the actual-to-potential trade between ASEAN and ROW ranges from 47.8 to 60.1 percent. This result implies that the technical efficiency of bilateral trade between ASEAN and ROW is relatively stable. However, it is clear that there is a slight downward trend in ASEAN’s trade efficiency. By definition, the trade efficiency is the ratio of actual to potential trade. It implies that, keeping actual trade constant, decrease in efficiency scores means increase in trade potential. Therefore, the unexhausted trade between ASEAN and ROW has been increasing. For example, between 2013 and 2016, ASEAN’s trade efficiency scores decreased from 0.601 to 0.478. At the same time, ASEAN’s potential trade
volume increased from 1541.1 to 3,091.5 billion USD. So the unexploited trade of ASEAN would increase from 614.5 to 1614.8 billion USD. This result implies that the scope for improving ASEAN’s trade performance has been increasing. In other words, if ASEAN countries and their trading partners can eliminate the man-made resistances, ASEAN can increase its bilateral trade by a maximum amount of 1,614.8 billion USD.

**Revision:** We added explanations for Table 5 (the underlined sentences)

The coefficient of $TE_{ij,t-1}$ is positive and statistically significant. This means that ASEAN’s trade efficiency in the previous year is associated with its level of trade efficiency in the current year. Our finding complements a number of previous studies (Antimiani & Costantini, 2013; Ozcan, 2017; Zhang, van Gorp, & Ebbers, 2019). Normally, countries having trade activities with each other in the previous year have the tendency to maintain their trading relations in current year. The reason is that the exporters made considerable investment in setting up the network in their trading partners. Similarly, trade efficiency between any two countries in the previous year is often closely associated with that in the previous year. The reason is that, when two countries set up trading relationship, they must find the way to reduce man-made resistances to facilitate their bilateral trade. However, this process takes place step by step. It is very rare that trade efficiency between a country-pair is very high in current year if it was very low in the previous year.
**Comment 6:** The results shown in Table 5 could have a different impact if the authors consider the single market? I think that estimation by countries could be useful in understanding whether differences in ASEAN countries exist?

**Revision:** We added the results and interpretations (single market and single components of the overall scores are taken into consideration) as follows:
<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>ASEAN</th>
<th>Singapore</th>
<th>Malaysia</th>
<th>Thailand</th>
<th>Vietnam</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural distance_{ij,t}</td>
<td>-0.004**</td>
<td>-0.003*</td>
<td>-0.062**</td>
<td>-0.017*</td>
<td>-0.015*</td>
<td>-0.003**</td>
<td>-0.015**</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.012)</td>
<td>(0.011)</td>
<td>(0.008)</td>
<td>(0.007)</td>
<td>(0.001)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Power Distance_{ij,t}</td>
<td>-0.003*</td>
<td>-0.047**</td>
<td>-0.058**</td>
<td>-0.076*</td>
<td>-0.055*</td>
<td>-0.002**</td>
<td>-0.001**</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.015)</td>
<td>(0.022)</td>
<td>(0.039)</td>
<td>(0.027)</td>
<td>(0.001)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Individualism_{ij,t}</td>
<td>-0.003*</td>
<td>-0.027**</td>
<td>-0.033**</td>
<td>-0.031*</td>
<td>-0.015*</td>
<td>-0.000</td>
<td>-0.011*</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.009)</td>
<td>(0.008)</td>
<td>(0.013)</td>
<td>(0.007)</td>
<td>(0.001)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Masculinity_{ij,t}</td>
<td>-0.005</td>
<td>-0.009</td>
<td>-0.047</td>
<td>-0.044</td>
<td>-0.023</td>
<td>-0.000</td>
<td>-0.003</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.047)</td>
<td>(0.041)</td>
<td>(0.020)</td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Uncertainty Avoidance_{ij,t}</td>
<td>-0.006</td>
<td>-0.000</td>
<td>-0.051</td>
<td>-0.115</td>
<td>-0.067</td>
<td>-0.001</td>
<td>-0.007</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.001)</td>
<td>(0.055)</td>
<td>(0.063)</td>
<td>(0.047)</td>
<td>(0.001)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>3540</td>
<td>590</td>
<td>590</td>
<td>590</td>
<td>590</td>
<td>590</td>
<td>590</td>
</tr>
</tbody>
</table>

Source: Empirical results
Notes: Standard errors are in parentheses.
Significance at the 0.01 (**) and 0.05 (*) levels.
Table 7: Impact of institutional distance on ASEAN’s trade efficiency

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>ASEAN</th>
<th>Singapore</th>
<th>Malaysia</th>
<th>Thailand</th>
<th>Vietnam</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional distance(i_{j,t})</td>
<td>-0.004**</td>
<td>-0.011**</td>
<td>-0.013**</td>
<td>-0.017*</td>
<td>-0.015*</td>
<td>-0.003**</td>
<td>-0.015**</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.008)</td>
<td>(0.007)</td>
<td>(0.001)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Property rights(i_{j,t})</td>
<td>-0.001*</td>
<td>-0.001</td>
<td>-0.014**</td>
<td>-0.026*</td>
<td>-0.014*</td>
<td>-0.006*</td>
<td>-0.013**</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.004)</td>
<td>(0.011)</td>
<td>(0.006)</td>
<td>(0.002)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Ethics and corruption(i_{j,t})</td>
<td>-0.005*</td>
<td>-0.013*</td>
<td>-0.055*</td>
<td>-0.013</td>
<td>-0.009*</td>
<td>-0.003*</td>
<td>-0.056**</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.004)</td>
<td>(0.022)</td>
<td>(0.007)</td>
<td>(0.004)</td>
<td>(0.001)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>Undue influence(i_{j,t})</td>
<td>-0.001</td>
<td>-0.005</td>
<td>-0.082*</td>
<td>-0.012*</td>
<td>-0.001**</td>
<td>-0.011**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.003)</td>
<td>(0.034)</td>
<td>(0.010)</td>
<td>(0.005)</td>
<td>(0.000)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Government efficiency(i_{j,t})</td>
<td>-0.001*</td>
<td>-0.007</td>
<td>-0.044**</td>
<td>-0.047*</td>
<td>-0.033*</td>
<td>-0.015*</td>
<td>-0.012**</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.006)</td>
<td>(0.008)</td>
<td>(0.023)</td>
<td>(0.017)</td>
<td>(0.007)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Security(i_{j,t})</td>
<td>-0.002*</td>
<td>-0.001</td>
<td>-0.013*</td>
<td>-0.037*</td>
<td>-0.007*</td>
<td>-0.001*</td>
<td>-0.003**</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.006)</td>
<td>(0.018)</td>
<td>(0.003)</td>
<td>(0.000)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Corporate ethics(i_{j,t})</td>
<td>-0.001*</td>
<td>-0.005</td>
<td>-0.046**</td>
<td>-0.011*</td>
<td>-0.015*</td>
<td>-0.002**</td>
<td>-0.014**</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.005)</td>
<td>(0.012)</td>
<td>(0.005)</td>
<td>(0.006)</td>
<td>(0.001)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Accountability(i_{j,t})</td>
<td>-0.002*</td>
<td>-0.009</td>
<td>-0.044*</td>
<td>-0.019**</td>
<td>-0.013*</td>
<td>-0.003*</td>
<td>-0.011**</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.006)</td>
<td>(0.019)</td>
<td>(0.007)</td>
<td>(0.006)</td>
<td>(0.001)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>No of Obs</td>
<td>3540</td>
<td>590</td>
<td>590</td>
<td>590</td>
<td>590</td>
<td>590</td>
<td>590</td>
</tr>
</tbody>
</table>

Source: Empirical results
Notes: Standard errors are in parentheses.
Significance at the 0.01 (**) and 0.05 (*) levels.
As the results in Table 6 reveal, cultural and institutional differences are the main causes that reduce the trade efficiency of ASEAN countries, especially for Malaysia, Vietnam, and Thailand. The difference in power distance, individualism, uncertainty avoidance and masculinity all have negative impacts on the trade efficiency of ASEAN countries. Among them, differences in power distance and individualism are the most important resistances that reduce ASEAN’s trade efficiency. This result may be due to the fact that ASEAN countries attach great importance to collectivism and social hierarchy. This feature is most evident in Malaysia, where the greatest division of power exists as a result of the Malay feudal system and British influence (Ooi Jin Bee, 2019). Accordingly, the heads of an organization will be the most powerful in all business decisions of the organization or company. Therefore, in many cases, the company's operations lack flexibility and efficiency due to waiting for decisions from the head. In contrast, North American and European countries are characterized by low power distance and respect individualism. In these cultures, everyone can speak out and decide at the same time. This makes a difference in the flexible and adaptive management style in a fiercely competitive business environment.

In addition, differences in consumer needs in countries due to cultural differences are also one of the reasons lead to inefficiencies in trade. According to Dash, Bruning, and Acharya (2009), consumers in countries with low power distance and high individualism such as North American and Europe will focus on products with high reliability and quality. In contrast, consumers in ASEAN countries with high power distance and low individualism often expect insights from suppliers rather than product reliability and certainty. Because of this difference, it takes time for countries to get used to each other’s market, business practices and consumer’s preference trends, resulting in low trade efficiency between ASEAN and major trading partners in the North American and European countries.

According to Table 7, the coefficient of institutional distance is negative and statistically significant in all cases. The magnitude of the coefficient is highest for Thailand, Vietnam, and the Philippines. It means that inefficiencies in trade due to institutional distance are most evident in these tree countries. Among seven dimensions of institution, difference in ethics and corruption between ASEAN and its trading partners is the most important constraint that hinders ASEAN’s trade efficiency. This result is reasonable since the corruption in some ASEAN countries is problematic (Checchi, 2017). Accountability and security are among the second most important.

---

10 North American and Europe are the regions that account for a large proportion of ASEAN’s trade, but their trade efficiency is not high. According to WITS data, the total trade between ASEAN and North America countries ranked 2nd, accounting for about 14.65% (~221.48 billion USD), but the trade efficiency was only 0.55, ranking 9th. Similarly, the total trade between ASEAN and EU countries ranked third, accounting for about 10.82% (~163.70 billion USD), but trade efficiency was only 0.59, ranked 6th.
resistance to trade efficiency. Institutional differences between ASEAN and potential partners can be attributed to management weaknesses and policy gaps in ASEAN countries that have not been improved. Differences in property rights, ethics and corruption, and corporate ethics are the main causes that reduce the trade efficiency of ASEAN countries. According to the statistics of the WEF, excepted for Malaysia and Singapore, the remaining ASEAN countries have lower levels of intellectual property protection than the average level of the world. Moreover, Vietnam, Indonesia and Thailand are the countries monitored by the United States Trade Representative (USTR) due to issues such as unauthorized disclosure, licensing and enforcement systems complaints in countries. Another issue in the institutions of ASEAN countries that leads to the institutional gap with the rest of the world is the ethics and corruption and corporate ethics. For some ASEAN countries, bribery and corruption are considered problematic. This problem is an informal non-tariff barrier to partner countries such as the US, Canada and the EU countries\textsuperscript{11}, which has raised concerns in developing trade transactions with ASEAN countries.

\textsuperscript{11} Developed countries like the US, UK, Canada and some other EU countries have very high levels of intellectual property protection. The business customs and cooperation of these countries are oriented towards long-term, more sustainable relationships than those based on intimacy and materiality.
**General comment**: Finally, the part related to the policy implication is scarce. Indeed, a major development in understating the rigidities or the processes that affect trade flows (similarity or dissimilarity cultural) could help policy maker’s an engaging objective and action to achieve goals.

**Revision**: We added a paragraph of policy implication (the underlined sentences)

*First*, as institutional distance hinders ASEAN’s trade efficiency, both ASEAN countries and their trading partners should take steps to reduce their institutional distance. In fact, most ASEAN members are developing countries with a moderate level of institutional quality, while the main trading partners of ASEAN are developed nations with relatively high institutional quality. Therefore, to narrow this institutional-quality gap, ASEAN countries need to implement solutions to improve their institutional quality. As indicated by the empirical results, differences in ethnics and corruption, accountability, and security are among the main resistances to ASEAN’s trade efficiency. Hence, ASEAN countries should build solutions in three main directions: (i) increasing the responsibility and transparency of state agencies related to taxes, budgets and spending. Accordingly, reviewing the management system, enhancing the level of education (Alonso & Garcimartín, 2013), reducing levels of inequality (Kotschy & Sunde, 2017), and strengthen human capital (Kanyama, 2014) are important factors to enhance accountability and transparency in government agencies; (ii) developing a specific set of rules appropriate to each member countries and general regulations for the whole region to strengthen network security and social security in some ASEAN countries. These measures have a positive impact on trading partners’ decisions and trade liberalization negotiations (e.g. EU-ASEAN case); (iii) Increasing financial transparency and reducing information asymmetry between domestic and international companies. Such efforts would help ASEAN countries enhance their understanding of trading partners’ business systems and vice versa. They will also facilitate contract enforcement and enhance transaction mechanisms as well as decrease information asymmetries.

*Second*, since cultural distance has a negative impact on ASEAN’s trade efficiency, ASEAN countries should take appropriate measures to reduce the cultural distance between their trading partners and themselves. Among four cultural dimensions, differences in power distance and individualism versus collectivism are the most important hindrances to ASEAN’s trade efficiency. Therefore, lowering the differences in these two dimensions should significantly contribute to the decrease in cultural distance between ASEAN and its trading partners. Reducing cultural
differences will increase mutual trust, promote understanding of each other’s business practices, and facilitate information exchange between ASEAN countries and their trading partners. In the context of intensified international integration, ASEAN countries and their trading partners need to improve transportation connections and enhance their communication and interaction (Webber, 1969) to nurture affinity in diversity. In addition, cultural distance can reflect differences in language. Therefore, efforts must also be made to promote the learning of foreign languages.

Goods of ASEAN countries will easily penetrate into the EU and US markets if produced by ASEAN-based EU and US multinational enterprises (MNEs) because these enterprises understand diversified needs of the consumers in the importing countries better than do ASEAN’s local companies. As a result, ASEAN’s manufacturing companies should cooperate with MNEs to build global supply chains to minimize the risk of cultural differences. In doing so, ASEAN policymakers should develop strategies and policies to attract foreign direct investment and create favorable conditions for foreign companies to expand production facilities in ASEAN countries. Such strategies and policies would help to establish the relationships between ASEAN countries and MNEs, through which, cultural differences between ASEAN countries and their trading partners will be reduced.

Third, once applied, trade barriers raise the cost and hinder the flow of traded goods. Over the long-term, consistently imposing trade barriers between ASEAN countries and their trading partners will distort patterns of comparative advantage and lead to a reduction of trade efficiency. Therefore, in order to increase ASEAN’s trade efficiency, it is of paramount importance to promote free trade between ASEAN members and their trading partners. Doing so will require ASEAN countries to take the initiative to negotiate with their trading partners the possibility of reducing or removing trade barriers. In addition, most ASEAN members are developing nations, hence their commodities, especially agricultural products, often face high trade barriers when exported to developed countries such as the U.S. and the EU. To overcome this problem, ASEAN nations should improve the quality of their exported products and meet the SPS and TBT requirements of importing countries.
MINOR REMARKS:

**Comment 7:** The authors should pay attention to the number of the equation. Please, the equation should be well enumerated;

**Revision:** we revised the number of the equation in a way that is well enumerated.

**Comment 8:** The correlation matrix is missing, and I think that some variables could also correlated. The authors should provide this important table.

**Revision:** We provided correlation matrix table in the appendix. The table of the correlation matrix is as follows:

Table 4 presents the correlation matrix for explanatory variables in stochastic frontier gravity equation and the trade efficiency equation. All of the correlation coefficients for the explanatory variables do not exceed either -0.5 or +0.5. Hence, there should not be a serious multicollinearity problem in our data.

**Table 3: Correlation matrix**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stochastic frontier gravity’ equation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lnGDP_{jt}</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lnGDP_{lt}</td>
<td>0.040</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lnWDIST_{ij}</td>
<td>0.052</td>
<td>-0.029</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landlock_{j}</td>
<td>-0.000</td>
<td>-0.114</td>
<td>0.048</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colony_{ij}</td>
<td>-0.033</td>
<td>0.182</td>
<td>0.051</td>
<td>-0.040</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Languages_{ij}</td>
<td>-0.073</td>
<td>0.119</td>
<td>-0.006</td>
<td>-0.105</td>
<td>0.102</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTA_{ij,t}</td>
<td>0.016</td>
<td>0.194</td>
<td>-0.410</td>
<td>-0.073</td>
<td>-0.039</td>
<td>0.100</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lnArea_{i}</td>
<td>0.286</td>
<td>0.000</td>
<td>-0.005</td>
<td>0.000</td>
<td>-0.004</td>
<td>-0.182</td>
<td>-0.153</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>lnArea_{j}</td>
<td>-0.000</td>
<td>0.484</td>
<td>0.144</td>
<td>-0.121</td>
<td>0.032</td>
<td>0.088</td>
<td>0.155</td>
<td>0.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The determinants of trade efficiency’ equation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID_{ij,t}</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD_{ij}</td>
<td>0.176</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>lnTF_{ij,t}</td>
<td>0.206</td>
<td>0.191</td>
<td>1.000</td>
</tr>
</tbody>
</table>
### Appendix D: The information of seven dimensions of institutional quality

<table>
<thead>
<tr>
<th>1. Property rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property rights</td>
</tr>
<tr>
<td><em>In your country, how strong is the protection of property rights, including financial assets? [1 = extremely weak; 7 = extremely strong]</em></td>
</tr>
<tr>
<td>Intellectual property protection</td>
</tr>
<tr>
<td><em>In your country, how strong is the protection of intellectual property, including anti-counterfeiting measures? [1 = extremely weak; 7 = extremely strong]</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Ethics and corruption (quỹ công, giao dịch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversion of public funds</td>
</tr>
<tr>
<td><em>In your country, how common is diversion of public funds to companies, individuals, or groups due to corruption? [1 = very commonly occurs; 7 = never occurs]</em></td>
</tr>
<tr>
<td>Public trust in politicians</td>
</tr>
<tr>
<td><em>In your country, how would you rate the ethical standards of politicians? [1 = extremely low; 7 = extremely high]</em></td>
</tr>
<tr>
<td>Irregular payments and bribes</td>
</tr>
<tr>
<td><em>Average score across the five components of the following Executive Opinion Survey question: In your country, how common is it for firms to make undocumented extra payments or bribes connected with (a) imports and exports; (b) public utilities; (c) annual tax payments; (d) awarding of public contracts and licenses; (e) obtaining favorable judicial decisions? In each case, the answer ranges from 1 [very common] to 7 [never occurs].</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Undue influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judicial independence</td>
</tr>
<tr>
<td><em>In your country, to what extent is the judiciary independent from influences of members of government, citizens, or firms? [1 = heavily influenced; 7 = entirely independent]</em></td>
</tr>
<tr>
<td>Favoritism in decisions of government officials</td>
</tr>
</tbody>
</table>
In your country, to what extent do government officials show favoritism to well-connected firms and individuals when deciding upon policies and contracts? [1 = always show favoritism; 7 = never show favoritism]

4. Public-sector performance

Wastefulness of government spending

In your country, how efficiently does the government spend public revenue? [1 = extremely inefficient; 7 = extremely efficient in providing goods and services]

Burden of government regulation

In your country, how burdensome is it for businesses to comply with governmental administrative requirements (e.g., permits, regulations, reporting)? [1 = extremely burdensome; 7 = not burdensome at all]

Efficiency of legal framework in settling disputes

In your country, how efficient is the legal framework for private businesses in settling disputes? [1 = extremely inefficient; 7 = extremely efficient]

Efficiency of legal framework in challenging regs.

In your country, how easy is it for private businesses to challenge government actions and/or regulations through the legal system? [1 = extremely difficult; 7 = extremely easy]

Transparency of government policymaking

In your country, how easy is it for businesses to obtain information about changes in government policies and regulations affecting their activities? [1 = extremely difficult; 7 = extremely easy]

5. Security (đảm bảo an ninh)

Business costs of terrorism

In your country, to what extent does the threat of terrorism impose costs on businesses? [1 = to a great extent; 7 = not at all]

Business costs of crime and violence

In your country, to what extent does the incidence of crime and violence impose costs on businesses? [1 = to a great extent; 7 = not at all]

Organized crime
In your country, to what extent does organized crime (mafia-oriented racketeering, extortion) impose costs on businesses? [1 = to a great extent; 7 = not at all]

Reliability of police services

In your country, to what extent can police services be relied upon to enforce law and order? [1 = cannot be relied upon at all; 7 = can be completely relied upon]

6. Corporate ethics

Corporate ethics

In your country, how would you rate the corporate ethics of companies (ethical behavior in interactions with public officials, politicians, and other firms)? [1 = extremely poor—among the worst in the world; 7 = excellent—among the best in the world]

7. Accountability (minh bạch trong tài chính, bảo vệ nhà đầu tư)

Strength of auditing and reporting standards

In your country, how strong are financial auditing and reporting standards? [1 = extremely weak; 7 = extremely strong]

Efficacy of corporate boards

In your country, how would you characterize corporate governance by investors and boards of directors? [1 = management has little accountability to investors and boards; 7 = management is highly accountable to investors and boards]

Protection of minority shareholders’ interests

In your country, to what extent are the interests of minority shareholders protected by the legal system? [1 = not protected at all; 7 = fully protected]

Strength of investor protection

Strength of Investor Protection Index on a 0–10 (best) scale
References


Ozcan, B. (2017). Information and communications technology (ICT) and international trade: evidence from Turkey. *Eurasian Economic Review, 8*(1), 93-113. doi:10.1007/s40822-017-0077-x


United Nations Escap Retrieved from [https://www.unescap.org/](https://www.unescap.org/)


