I. Introduction

The Democratic Republic of Congo (DRC) is located in Central Africa and is the largest French-speaking country in the continent (See Figure 1). The country is known for its size, being the second largest country in the continent after Algeria. DRC shares its borders with Angola, Burundi, Central African Republic, Republic of Congo, Rwanda, South Sudan, Tanzania, Uganda, and Zambia (see Figure 1). It is also known for its abundance in natural resources. The outbreak of conflicts and wars in the 1990s, however, led to the widespread looting of resources. As a post-conflict country, DRC is still undergoing recovery and reconstruction efforts. Only recently has the country’s vast deposits of natural resources been contributing in economic development and peace building within the Central African region.

DRC majorly exports refined copper, diamonds, crude petroleum, and cobalt ore, whereas it imports...
packaged medicaments, glass bottled, refined petroleum, human or animal blood, and iron structures. In 2018, China and South Africa were DRC’s top two exporting and importing partner countries (See Table 1). Interestingly, the top five exporting and importing countries were identical, including China, South Africa, Zambia, United Arab Emirates, and India. In both of the lists, China and South Africa were the top 2 countries. Generally, DRC trades more with Asian and Western countries than with its neighboring countries.

Recently, international organizations have been recognizing tourism as a potential factor in driving inclusive growth and economic development in the African region. Tourism in Africa accounts for about 8.5% of the GDP, 7% of international trade, 30% of trade in services, and 7% of total exports of goods and services to developing countries (UN 2017). According to UNTWO (2017), the travel and tourism industry had a growth rate of approximately 4% for eight years and 393 million people travelled abroad between 2008 and 2017. With such development, the international community has recognized tourism as a solution to reduce poverty in developing countries by using it to structurally transform economies through creating new jobs and increasing exports (UNWTO 2017, World Bank 2017). Thus, tourism is a topic that is of utmost importance in a developing country like the DRC.

With the interest of international organizations in DRC is involved as member in several international and regional organizations related to trade and tourism. Some includes the World Trade Organization (WTO), World Tourism Organization (UNWTO), Southern African Development Community (SADC) and Common Market for Eastern, and Southern Africa (COMESA). During the implementation of the 2063 Agenda of the African Union, the DRC also signed the African Free Trade Continental Agreement with 43 other African countries. This agreement aims to create a continental market for more than 1.2 billion people with a GDP estimated at $3 trillion and to

Table 1. Ranking of Countries with Respect to Average Export and Import (2018)

| Rank | Export       | Import       |
|------|--------------|--------------|
| 1    | China        | China        |
| 2    | South Africa | South Africa |
| 3    | Zambia       | Zambia       |
| 4    | United Arab Emirates | United Arab Emirates |
| 5    | India        | India        |
| 6    | Tanzania     | Tanzania     |
| 7    | Belgium      | Belgium      |
| 8    | Hong Kong    | Hong Kong    |
| 9    | France       | France       |
| 10   | Mauritius    | Mauritius    |
| 11   | Mozambique   | United States|
| 12   | Kenya        | Mozambique   |
| 13   | Togo         | Kenya        |
| 14   | Netherlands  | Togo         |
| 15   | Malaysia     | Netherlands  |
| 16   | Singapore    | Malaysia     |
| 17   | Namibia      | Singapore    |
| 18   | Russian Federation | Namibia     |
| 19   | Uganda       | Russian Federation |
| 20   | United Kingdom | Uganda      |
| 21   | Germany      | United Kingdom|
| 22   | Nigeria      | Germany      |
| 23   | South Korea  | Nigeria      |
| 24   | Switzerland  | South Korea  |
| 25   | Canada       | Switzerland  |

Source: Author's organization based on data from DOTS Database (IMF).
eliminate tariff and non-tariff barriers so that African products can circulate freely within the zone without customs taxes. It is expected to increase domestic production and job creation, and reduce poverty (African Union 2018). However, trade and tourism in DRC still face many challenges. The decades of instability and violence in the country led to poor economic management and infrastructure, arbitrary taxation, marginal enforcement of property rights, and the weak rule of law (Heritage 2018). Such are critical obstacles in developing a conductive business environment for trade. In terms of tourism, armed conflicts, inadequate infrastructure and management, and poor communication and financial services hinder tourists from traveling to the country (Drake-Brockman 2012). In order to better understand DRC’s trade flows and tourism pattern, this study investigates a panel dataset, covering 165 countries over two years (2014-2015). This study makes the first attempt to empirically examine determinants of DRC’s trade and tourism patterns, with consumer price index (CPI), region-specific analyses, socio-economic and political factors as additional variables influencing the country’s trade and tourist flows, which should be recognized as a contribution to the existing literature.

The rest of the paper is organized as follows. Section 2 presents the literature review. Section 3 describes the methodology and data used in this study. Section 4 analyzes the empirical results. Section 5 concludes with policy implications.

II. Literature and Model

The gravity model was first introduced by Tinbergen (1962) to explain cross-border trade. The model is based on Newton’s universal law of gravitation, which states that bilateral flows between two countries are directly proportional to the countries’ economic masses and inversely proportional to the distance between them. Gravity model has been used extensively to explain the international trade of goods (Tinbergen, 1962; McCallum, 1995; Linnemann, 1966; Rose, 2000; Anderson and Van Wincoop, 2003), migration (Gil-Pareja et al., 2007; Mak and Moncur, 2003; Karemera et al., 2000), and foreign direct investment (Béassy-Quére et al., 2007; Bergstrand and Egger, 2007; Head and Ries, 2008). Tinbergen (1962) estimates the determinants of trade flows and provides initial specifications by applying the gross domestic product (GDP) to measure a country’s economic size. Gil-Pareja et al. (2007) compare and contrast the studies that analyze the impact of the currency euro on trade by examining origin and destination countries. Lee and Oh (2020) applied the model to analyze multilateral trade settings in Southeast Asia to examine the benefit of regional integration with extended cooperation with neighboring countries, known as ASEAN+3 or ASEAN+6. The gravity model is also useful examining determinants of tourism patterns (See Oh and Zong (2016) for China, Bermeo and Oh (2013) for Peru, and Kosnan and Ismail (2012) for Malaysia’s international tourism flows).

This study adopts two sets of regressions. The first equation is the typical model used by many studies to calculate trade patterns. The second equation, an adoption of Oh and Zhong (2016)’s model, measures tourism patterns. The equations are:

\[
\ln TR_{ct} = \alpha + \beta_1 \ln(GDP_{ct} \times GDP_{jt}) + \beta_2 \ln(PGDP_{ct} \times PGDP_{jt}) + \beta_3 \ln(Dist_{cj}) + \beta_4 \ln(Region_j) + \varepsilon_{ct}
\]

\[
\ln TA_{ct} = \alpha + \beta_1 \ln(GDP_{ct} \times GDP_{jt}) + \beta_2 \ln(PGDP_{ct} \times PGDP_{jt}) + \beta_3 \ln(CPI_{ct} / CPI_{jt}) + \beta_4 \ln(Dist_{cj}) + \beta_5 \ln(Region_j) + \varepsilon_{ct}
\]

In both of these equations, c represents DRC and j represents the countries where tourists are coming from. TA_{ct} is the number of tourists’ arrivals from countries j to country c (DRC) in year t and TR is the trade volume, which is the sum of imports and exports. GDP_{ct} \times GDP_{jt} is the product of GDP of country c and the tourist's country j in year t; PGDP_{ct} \times PGDP_{jt} is the product of per capita GDP of country c and the tourist's country j in year t; CPI_{ct} / CPI_{jt} is the relative price of tourism given...
by ratio of the CPI of country c over the CPI of the tourist's country j in year t; Dist\(_{cjt}\) is the distance between country c and the tourist's country j; Region=1 if the tourist's country j is located in Africa, and 0 otherwise; \(\varepsilon_{cjt}\) indicates residuals.

Hypotheses for the basic variables are such that both GDP and per capita GDP affect positively while distance is a negative factor. CPI measures price level, which estimates that trade flows and tourist flows are less with the higher price level. Region dummy is expected to show a positive sign, supporting a higher level of intra-regional movement.

The data for GDP, per capita GDP, population, imports, exports, and CPI are all collected from the World Bank's World Development Indicators. For distance, the data is from www.distancefromto.net and for the numbers of tourists’ arrivals, it is from the National Tourism Office of DRC’s Ministry of Tourism.

III. Analyses and Discussions

The empirical results are consistent with the general prediction of the gravity model. In the basic model, shown in Table 2, the coefficients for GDP and distance are consistently positive and negative, respectively. This implies that DRC’s export and import volume, as well as international tourist arrivals follow the prediction of the gravity model. For example, when GDP of a partner country rises by 1%, DRC’s export to, import from, and tourist arrivals from the country rises by 0.842-0.844%, 0.783-0.785%, and 0.457-0.464%, respectively, while distance shows consistently negative coefficients in all models. In the extended models (see Table 3), however, ‘distance’ lacks statistical significance, although it is still negative. Instead, the region dummy (where African countries are denoted as 1, and other countries, as 0) is mostly positive, ranging from 2.03 to 2.06, implying that this dummy absorbs the most of the explanatory power of the distance coefficient. In addition, the coefficients for CPI are all negative, showing that tourists are taking the DRC’s relatively lower price level into consideration when they decide to visit the country.

Following Montenegro and Soto (1996), Sohn (2005), and Oh and Tumurbaatar (2011), the following section presents the predicted trade volumes of the country’s exports and imports with its trading partners, as well as the predicted tourist arrivals.

Predicted volumes are derived from the estimation

|                        | Log of Export       | Log of Import         | Log of Tourist Arrivals |
|------------------------|---------------------|-----------------------|-------------------------|
|                         | (1)                 | (2)                   | (3)                     | (1)                     | (2)                   | (3)                     |
| Log of GDP             | 0.842***            | 0.844***              | 0.842***                | 0.783***                | 0.785***              | 0.783***                | 0.464***                | 0.458***                | 0.457***                |
|                        | (0.026)             | (0.026)               | (0.026)                 | (0.020)                 | (0.020)               | (0.020)                 | (0.078)                 | (0.078)                 | (0.078)                 |
| Log of per capita GDP  | 0.636***            | 1.481***              | 0.636***                | 0.413***                | 1.199***              | 0.414***                | -0.361***               | 0.104                   | -0.355***               |
|                        | (0.036)             | (0.034)               | (0.036)                 | (0.036)                 | (0.030)               | (0.030)                 | (0.135)                 | (0.115)                 | (0.135)                 |
| Log of Distance        | -0.141**            | -0.156**              | -0.141**                | -0.052                  | -0.066                | -0.052                  | -0.665***               | -0.671***               | -0.664***               |
|                        | (0.065)             | (0.066)               | (0.065)                 | (0.048)                 | (0.050)               | (0.048)                 | (0.215)                 | (0.216)                 | (0.215)                 |
| Constant               | -2.298***           | -2.228***             | -2.299***               | 0.693                   | 0.762                 | 0.696                   | 2.562                   | 2.704                   | 2.671                   |
|                        | (0.538)             | (0.544)               | (0.539)                 | (0.504)                 | (0.509)               | (0.505)                 | (2.174)                 | (2.174)                 | (2.176)                 |
| Number of Observations | 277                 | 277                   | 277                     | 277                     | 277                   | 277                     | 312                     | 312                     | 312                     |
| R Square               | 0.930               | 0.928                 | 0.930                   | 0.926                   | 0.923                 | 0.923                   | 0.131                   | 0.128                   | 0.131                   |
| Estimation Methods     | OLS                 | OLS                   | OLS                     | OLS                     | OLS                   | OLS                     | IV                      | IV                      | IV                      |

Note: ***, **, * at 1%, 5%, 10% significance, respectively. White robust corrected standard errors in parenthesis to tackle heterogeneity; (1) Basic model with GDP, per capita GDP, and distance (all log transformed) as explanatory variables; (2) Log-transformed population is used instead of GDP; (3) Log-transformed population is used as an instrumental variable for GDP.
based on regression results. By comparing the predicted volumes with the actual ones, it can be identified whether there is any sort of trade barrier or distortion that blocks normal flows of trading goods and flows of tourist arrivals. The results in Tables 4 and 5 are derived from the results in the above-mentioned tables, as their average values.

As shown in Table 4, neighboring African countries show higher ratio in both export and import, implying that the regional economic bloc is not very active. Regarding exports, seven countries in the table are in Africa and the numbers increase up to 13 if nearby Middle East countries are included. Under the assumption that the missing values are zero, four more countries are added - Ethiopia, Seychelles, Tunisia, and Zambia. For imports, there are five African countries and 12 African Middle East countries. Despite the existence of the Southern African Development Community (SADC), DRC is not working closely with the other member state countries. As shown in Table 1, there are more countries from Asia, Europe, and America on DRC’s top exporting and importing countries than countries from Southern Africa. Some of the reasons why this is so are the economic underdevelopment in Africa and insufficient transport infrastructure. Some of the most inefficient ports are in Africa, notably Ethiopia, Nigeria, and Malawi (Clark et al., 2004). According to Limão and Venab (2001), Africa’s poor infrastructure is the major reason for Africa’s poor performance in trade and transport costs. Although such pattern is not clearly shown among tourist arrivals (both in Table 4 and Table 5), but, as shown in Table 6, no African countries are on the list regarding the number of tourist arrivals. DRC is exhibiting better performance in tourism than in trade but it is only marginal, and the country should further try to attract more tourists from geographically proximate countries.

Table 3. Extended Models with CPI and Region Dummy

|                      | Log of Export          | Log of Import          | Log of Tourist Arrivals |
|----------------------|------------------------|------------------------|-------------------------|
|                      | (1)                    | (2)                    | (3)                     |
| Log of GDP           | 0.845***               | 0.849***               | 0.846***                |
|                      | (0.027)                | (0.027)                | (0.027)                 |
| Log of per capita GDP| 0.670*** 1.529*** 0.670*** | 0.413*** 1.208*** 0.413*** | -0.058 0.443*** -0.056  |
|                      | (0.041)                | (0.045)                | (0.041)                 |
| Log of Distance      | -0.091                | -0.093                | -0.091                  |
|                      | (0.062)                | (0.062)                | (0.062)                 |
| CPI                  |                        |                        | -0.004*                 |
|                      | (0.002)                | (0.002)                | (0.002)                 |
| Region               | 0.201*                | 0.254**               | 0.202*                  |
|                      | (0.103)                | (0.110)                | (0.103)                 |
| Constant             | -3.197*** -3.374*** -3.269*** | 0.705 0.557 0.710      | -5.908** -5.947** -5.853***        |
|                      | (0.749)                | (0.770)                | (0.755)                 |
| Number of Observations| 277                   | 277                   | 277                     |
| R Square             | 0.931                  | 0.929                  | 0.931                   |
| Estimation Methods   | OLS                    | OLS                    | OLS                     |

Note: ***, **, * at 1%, 5%, 10% significance, respectively. White robust corrected standard errors in parenthesis to tackle heterogeneity; (1) Basic model with GDP, per capita GDP, and distance (all log transformed) as explanatory variables; (2) Log-transformed population is used instead of GDP (3) Log-transformed population is used as an instrumental variable for GDP.

1) SADC is a Regional Economic Community established in 1992 to promote regional integration and poverty eradication within the Southern African region through economic development and pursuing peace and security. It has 16 members, including Angola, Botswana, Comoros, Democratic Republic of Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, and Zimbabwe.
Table 5. Actual vs. Estimated for Export, Import and Tourist Arrivals - Top 20 Countries Where "Estimated" Exceeds "Actual"

| Country | EX_A | EX_E | EX_R | Country | IM_A | IM_E | IM_R | Country | TOUR_A | TOUR_E | TOUR_R |
|---------|------|------|------|---------|------|------|------|---------|--------|--------|--------|
| Kosovo | 20.96511 | 22.02676 | 1.050639 | Sudan | 22.53297 | 23.97327 | 1.06392 | Bahrain | 0.846674 | 4.283626 | 5.059362 |
| Afghanistan | 21.04144 | 22.07883 | 1.049303 | Iran | 24.37501 | 26.12234 | 1.062963 | Kyrgyzstan | 0.9905135 | 4.251113 | 4.291822 |
| Burundi | 19.13227 | 20.02296 | 1.047047 | Timor.este | 20.60275 | 21.74616 | 1.055498 | Bahamas | 0.846674 | 3.541587 | 4.182942 |
| Egypt | 24.47273 | 25.61127 | 1.046523 | Nigeria | 24.42921 | 25.53349 | 1.045203 | Lao PDR | 1.193247 | 4.399547 | 3.687038 |
| Pakistan | 23.84101 | 24.9399 | 1.046092 | Pakistan | 25.26604 | 1.042173 | Guatemala | 1.616896 | 4.833528 | 2.998387 |
| Nepal | 21.45148 | 22.26983 | 1.031849 | Qatar | 24.74979 | 25.77484 | 1.041417 | Azerbaijan | 2.253379 | 5.061115 | 2.246012 |
| Iran | 25.29345 | 26.13819 | 1.033397 | Eq. Guinea | 22.64693 | 23.51887 | 1.038501 | Lithuania | 2.045621 | 4.561253 | 2.229757 |
| Qatar | 25.3768 | 26.18989 | 1.032041 | Azerbaijan | 23.57787 | 24.47325 | 1.037979 | Kuwait | 2.318893 | 5.036477 | 2.171932 |
| Yemen | 21.97777 | 22.67673 | 1.031803 | Kuwait | 25.56497 | 25.48214 | 1.037147 | Latvia | 1.997966 | 4.306942 | 1.556563 |
| Albania | 22.02794 | 22.71444 | 1.031165 | Gabon | 22.48932 | 23.25129 | 1.033881 | Cambodia | 2.384561 | 5.09683 | 2.137429 |
| Argentina | 25.94433 | 23.58549 | 1.030986 | Guinabissau | 19.55624 | 20.71686 | 1.031732 | Uzbekistan | 2.522797 | 5.26315 | 2.061719 |
| Sudan | 22.99228 | 23.70288 | 1.030906 | Yemen | 22.52654 | 23.21692 | 1.030647 | Morocco | 3.470186 | 6.498482 | 1.870068 |
| Libya | 23.39366 | 24.60471 | 1.028868 | Armenia | 22.1019 | 22.65563 | 1.029713 | Belarus | 2.669834 | 4.950002 | 1.854049 |
| Algeria | 24.73018 | 25.39794 | 1.027002 | Argentina | 25.01168 | 25.77387 | 1.029646 | Ethiopia | 3.678154 | 6.812356 | 1.852116 |
| Saudi Arabia | 26.40759 | 27.05516 | 1.024522 | Egypt | 24.97959 | 25.63822 | 1.026519 | Costa Rica | 2.552797 | 4.481225 | 1.755418 |
| Dominican Rep. | 23.52142 | 24.07289 | 1.023445 | Uzbekistan | 23.4718 | 24.05996 | 1.025058 | Saudi Arabia | 3.611388 | 6.606262 | 1.679759 |
| Rwanda | 20.91932 | 21.39667 | 1.022819 | Uruguay | 23.28847 | 23.84871 | 1.024013 | Romania | 3.227761 | 5.407559 | 1.657329 |
| Armenia | 21.76568 | 22.41413 | 1.02181 | Saudi Arabia | 26.11799 | 26.7384 | 1.023754 | Uganda | 3.993075 | 6.630413 | 1.660478 |
| Uruguay | 23.20837 | 23.70705 | 1.012167 | Albania | 22.49212 | 23.01887 | 1.023461 | Yemen | 3.144233 | 5.198395 | 1.653311 |
| Mauritius | 22.48492 | 22.95149 | 1.02075 | Oman | 23.400027 | 23.86359 | 1.021363 | Paraguay | 2.738768 | 4.514645 | 1.848222 |

Note: Actual vs. Estimated for Export, Import and Tourist Arrivals - Top 20 Countries Where "Actual" Exceeds "Estimated"
IV. Conclusion

This study investigates DRC’s trade and tourism patterns by analyzing a panel dataset of 165 countries from 2014 to 2015. The results confirm the prediction of the gravity model with positive coefficients for economic size and negative coefficients for distance. The findings of this research can be applied in both academic studies and practice. First, the study complements the existing literature on DRC’s development by incorporating tourism in the analysis, which has been rarely addressed. For instance, Wilkie and Carpenter (1999) is one of few studies that analyzed the role of tourism in DRC. The study also made academic contributions by utilizing the gravity model to examine the relationship between DRC’s trade and tourism patterns and other countries’ socioeconomic factors.

The results provide several policy implications. DRC needs to diversify its trading partners and cooperate more with its neighbors. It also needs to attract more tourists by investing generously in public infrastructure. Public infrastructure like roads will link DRC to major ports of other African countries. Also, there is a need to promote diversity. In order to add diversity to the country, DRC should promote its country and launch tourism initiatives, such as allowing tourists from other African countries to easily travel across the continent using air pass visa, form a currency union like the euro and broaden internet access for tourists.

It is recommended that policy makers consider strengthening the SADC trade agreements and agreements with its fellow COMESA member countries. Such endeavors will greatly reduce the number of non-tariff trade barriers, allowing DRC to engage in bilateral trade under more favorable conditions and broaden its trading network. There is also a need to implement policies to minimize real exchange volatility and strengthen misalignment to improve trade flows.

The main limitation of this study is that it limited its geographic concentration to Africa, treating only Africa as the dummy variable. However, Table 1 indicates that DRC’s trade is not only with countries in Africa but also with those in Asia and the Middle East. An economic bloc that encompasses not only African countries but also neighboring Middle East countries is expected to bring economic benefit to the region. Thus, future studies could analyze in detail how DRC’s trade and tourism patterns alter when regions other than Africa are considered.

| Rank | Country       | Number of Arrivals |
|------|---------------|--------------------|
| 1    | France        | 84,452,000         |
| 2    | United States | 77,465,000         |
| 3    | Spain         | 68,175,000         |
| 4    | China         | 56,886,000         |
| 5    | Italy         | 50,732,000         |
| 6    | Turkey        | 39,478,000         |
| 7    | Germany       | 34,970,000         |
| 8    | United Kingdom| 34,436,000         |
| 9    | Russia        | 33,729,000         |
| 10   | Mexico        | 32,093,000         |
| 11   | Thailand      | 29,923,000         |
| 12   | Austria       | 26,728,000         |
| 13   | Hong Kong     | 26,686,000         |
| 14   | Malaysia      | 25,721,000         |
| 15   | Greece        | 23,599,000         |
| 16   | Japan         | 19,737,000         |
| 17   | Saudi Arabia  | 17,994,000         |
| 18   | Canada        | 17,971,000         |
| 19   | Poland        | 16,728,000         |
| 20   | Netherlands   | 15,007,000         |
| 21   | Macao         | 14,308,000         |
| 22   | India         | 13,284,000         |
| 23   | South Korea   | 13,232,000         |
| 24   | Croatia       | 12,683,000         |
| 25   | Ukraine       | 12,428,000         |

Source: World Bank World Development Indicators
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