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INTERNET AND ITS GLOBAL IMPACT TO TRADE-IN SERVICES



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→ INTRODUCTION

The Internet has become a part of our daily life. We use it for everything from finding information, connecting with people across the border, and doing commercial transactions. The increasingly diversified use of the internet is also parallel to its broader reach globally. According to data from International Telecommunication Union (ITU), approximately 31.38% of the worldwide population had access to the internet in 2009. This number increased significantly in 2014 when the number of individuals using the internet reached around 49% of the global population. This nearly 20% increase in the span of 6 years shows the huge potential of the internet in connecting communities all over the world.

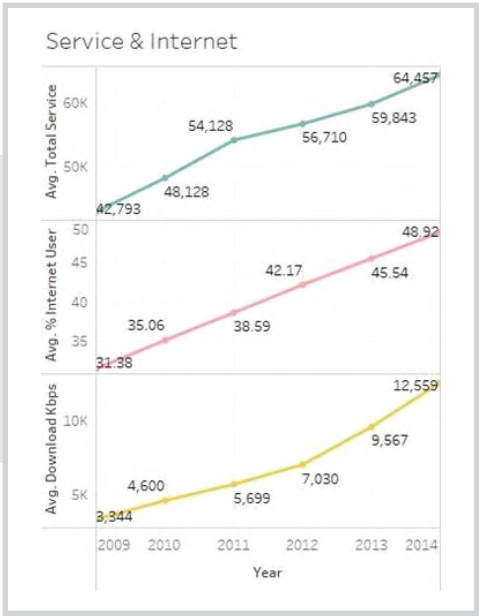
In addition to the quantity of the internet, the growth of digitalization worldwide can also be reflected from the increasing quality of internet connection. The quality of internet connection is being measured by the average download speed in a country. Using numbers from Ookla Netindex Data on Internet Speed, we can figure out that the average global download speed in 2009 was approximately 3,344 kbps. This number increased almost four times to 12,559 kbps in 2014. From this preliminary finding, we can also see how there is a notable upward trend in internet speed worldwide, in addition to the increasing level of internet penetration. The prominence of internet across countries surely brings impact to many sectors. One sector that has



been affected to some extent by the internet is international trade. While many academic articles have shown that internet, indeed, causes increase in the volume of trade-in goods by using various methods, data, and models (see Freund and Weinhold, 2004; Clark and Wallsten, 2006; Abeliensky and Hilbert, 2017; Lin, 2015; Wang and Li, 2017), its impact to trade-in services in particular is more difficult to pinpoint and less frequently discussed. Sampson and Snape argue that this is due to the different nature between trade-in goods and trade-in services. Trade in goods has a more measurable concept of restrictions in the form of customs and quotas, while restrictions for trade-in services are mostly in the form of domestic policy.

The small number of academic research on international trade-in services might also be caused by the limited volume of international service trade-in the past years. Quoting Freund and Weinhold, service transactions require direct interaction between producers and consumers, which makes selling to distant locations difficult (2002, p. 236). The internet here provides a medium for these two parties to interact with each other in real-time, without incurring significant cost, hence fueling the increase of total trade-in services.

Figure 1. Global Trend of Trade in Services, Internet User, and Download Speed (2009 – 2014)
 Sources: UNCTAD, World Bank, and Ookla



Referring to the statistics, we can see that the increasing volume of global trade-in services is, indeed, in parallel to the increase of internet use and internet speed. Data presented on Figure 1 shows that the average total of annual trade-in services worldwide keeps increasing. In 2009, the average number of trade-in services reached more than US\$ 42 billion. This number increased significantly in 2014, where it reached more than US\$ 64 billion. This trend of increase in all three variables could be an indication of correlation between internet and trade-in services.

However, when we analyze the correlation between internet and trade-in services, we also need to consider other variables. These variables might interfere with the relationship between internet and trade-in services, thus nullifying the correlation between the two. One of the variables that I am particularly concerned about is government policy. Many large-scope studies on internet and trade-in services often exclude policy or level of restriction on trade-in services due to the aforementioned difficulty of measuring it. This may become a potential problem on the validity of the existing research as policy is often correlated to economic development in a country.

With those being said, there are three research questions that I want to focus on in this article. First, does the internet possess positive impact towards the volume of trade-in services between states? By asking this question, I want to see if the increase of internet users and download speed will result in the increase of total trade-in services. Second, how important is the internet as a variable for affecting the volume of trade-in services compared to other variables? I want to compare the significance level and magnitude of internet variables with other control variables, and see if the internet has the most significance level and the biggest magnitude. Third, how does the quantity and quality of the internet compare in regards to their impact on trade-in services? In this question I want to see which one of the two has more impact on trade-in services. This can be useful to formulate a policy recommendation for the government.

Following this introduction, the next part of my paper will discuss some preceding literature on the internet and international trade. I will review their methods, results, and areas of improvement that will be addressed by my research. It will be followed by my explanation on the model and data that I use in analyzing the issue. Then I proceed with elaborating on the result of my analysis pertaining to the research questions. Lastly, I conclude my research based on previous explanations.





→ LITERATURE REVIEW

There are several academic literatures that discuss the correlation between internet and trade. However, in this section I want to focus on three literatures that specifically explore the use of regression model in their analysis. These literatures are particularly selected due to the purpose of this paper is creating a generalization on the correlation between internet and trade-in services. The three selected papers are from Freund and Weinhold (2002), Choi (2010), and Abeliansky and Hilbert (2017). Freund and Weinhold and Choi focus on trade-in services, while Abeliansky and Hilbert focus on trade-in goods.

In their research, Freund and Weinhold are specifically focusing on U.S. trade. They are using U.S. bilateral trade-in services data with 31 partner countries from 1995 – 1999. To measure internet penetration, they use data on the number of top-level domain names attributed to each country. Control variables in their research are GDP, population, currency appreciation, financial depth, distance, common language, and adjacency. From their analysis, they find out that internet has a significant impact on international trade-in services. From their regression table, we can see that a 10% increase in internet leads to a 1.7% increase in trade-in services. This result confirms their hypothesis that there is a positive correlation between internet penetration and trade-in services. However, there are several issues in the research that I have identified. The first one is the issue of causality. Freund and Weinhold admit that this result only proves the correlation between internet and trade-in services, but not causality. One of the problems is the possibility of endogeneity between these

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Choi tries to follow up and broaden the coverage of Freund and Weinhold's research by using panel data on trade-in services used for 151 countries from 1990 to 2006. When it comes to measuring the internet level, Choi uses data on the number of Internet users per 100 people. He also uses GDP, population, and financial depth as explanatory variables. He analyzes these variables by using pooled OLS regression



analysis on three dependent variables: total services trade, services import, and services export. He also conducts additional analysis by using the fixed-effect model and includes year dummies as an explanatory variable to the model. Another thing to underline is that he is using the log version of all variables in his regression analysis, except for the year dummies.

Based on his research, the internet apparently has a significant but small impact on trade-in services. A 10% increase in Internet users per hundred people turned out to increase service trade from 0.23% to 0.42%. This result still confirms Choi's hypothesis that the internet has significant correlation with trade-in services, albeit the small magnitude that it has. Choi then proceeds to test the endogeneity in his model – something that is not done by Freund and Weinhold. He uses panel GMM estimation and Hansen's J-Statistics to test the endogeneity between variables. For the result, P-values of Hansen's J-statistic shows that the model is well-specified and thus, endogeneity between internet and trade-in services is not proven.

However, I have identified several areas of improvement in his paper. First, there is no variable that covers government policy in his research. I believe it is important to control policy in the model if we want to prove that the internet has an impact on trade-in services, as policy might have a bigger impact and thus decrease the significance of the internet. Secondly, he only uses a one-dimensional variable of the internet. He does not consider the quality of the internet, which can be measured by its bandwidth speed, in his model. By including the variable of internet speed, then we can see if the proliferation of the internet matters more compared to the increasing quality of it.

Lastly, Abeliasky and Hilbert focus on the impact of the internet on trade-in goods, using CEPII bilateral trade data of 122 countries from 1995 to 2008. I decided to include this paper in this section as I believe this paper has the best model and



methodology so far. Unlike the previous research, it includes bandwidth speed to represent communication capacity in addition to ICT subscription variables. There are 10 independent variables in their model, which are 1) telecommunication subscriptions, 2) bandwidth data speed, 3) GDP, 4) population, 5) RTAs (dummy variable), 6) common currency (dummy), 7) distance, 8) colonial relationship, 9) common legal origin, and 10) common language.

For the result, they find a positive correlation between both ICT quantity and quality with trade-in goods. Their research also shows that the quality of data speed is more important than the number of ICT subscriptions. On this point, they argue that the results can be interpreted in terms of “a gap to the global technological frontier: not being able to communicate at the speed expected by the global technological frontier can inhibit the opportunity to participate in international trade” (p.46). However, this research only focuses on trade-in goods, and thus there is a need to perform similar research for trade-in services.

➔ EMPIRICAL METHODS AND DATA SOURCES

I adopt the idea of gravity equation to test whether an increase in the internet increases service trade, but with some modifications applied. Unlike the traditional gravity equation model, I eliminate the distance variable from my model as I do not identify the list of service trade partners that each country has in my analysis. The dependent variable is the yearly volume of service trade-in a country (SERVICE). The internet is included on the right-hand side of the equation, which is represented by two variables: percentage of internet users (USER) and average download speed in kbps (SPEED). GDP growth (GDP), population (POP), and GNI are included to control for level of development, country size, and income effects (Freund and Weinhold, 2002). The financial depth variable (FIN) is included as a proxy for overall comparative advantage in services in a country, where greater financial depth is expected to increase service trade (Choi, 2010). I also include government policy as an independent variable, represented by Services Trade Restrictions Index (STRI). I expect that higher score of STRI, which means a higher level of service trade restriction, will lead to lower number of trade-in services.

$$\log(\text{SERVICE})_{it} = \alpha + \beta_1 \text{USER}_{it} + \beta_2 \log(\text{SPEED})_{it} + \beta_3 \text{GDP}_{it} + \beta_4 \log(\text{POP})_{it} + \beta_5 \log(\text{GNI})_{it} + \beta_6 \log(\text{FIN})_{it} + \beta_7 \text{STR}_{it} + e$$

where $t = 2009, \dots, 2014$.

Here I use the log form of SERVICE, SPEED, POP, GNI, and FIN, as the data of these variables are heavily skewed and thus, could significantly affect the result of regression. Subscript i represents country, while subscript t represents year. I will do regression analysis on this model by using the Ordinary Least Squares (OLS) method. Preceding this regression, I will also do baseline analysis using Tableau. I will try to identify the pattern of correlation between SERVICE and each independent variable by creating scatter plots. I will also produce a simple regression line along with the scatter plot to help identify the yearly trend of correlations between these variables.

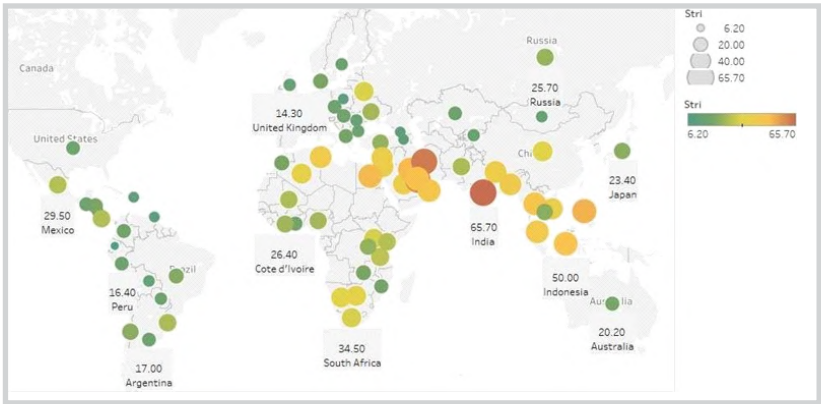
I mainly use statistical data in this research. There are seven sets of panel data that I acquire from various institutions. I mainly use data from UNCTAD for total trade-in services. However, there are several missing trade data that I have to complete by using data from the World Bank. I use data on trade-in services that correspond to the concepts and definitions of the sixth edition of the IMF Balance of Payments Manual (BPM6), which defines services as “the result of a production activity that changes the conditions of the consuming units, or facilitates the exchange of products or financial assets.” All data are expressed in millions of U.S. dollars.

I use data from the International Telecommunication Union for the number of internet users per 100 people. ITU defines internet users as individuals who have used the internet (from any location) in the last 3 months. The internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc. I use Ookla Netindex Data for internet speed. Ookla is a company that focuses on broadband testing, network diagnostic applications and data. The data is compiled by Gaurav Sood from Harvard Dataverse.

In addition to that, I acquired data on the percentage of GDP growth, total population, and GNI per capita from the World Development Indicators (WDI) dataset produced by the World Bank. I also use data on broad money from WDI World Bank to represent financial depth. World Bank defines broad money as “the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors

other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper," and is presented in percentage to GDP.

Figure 2. Mapping of Service Trade Restrictions Index

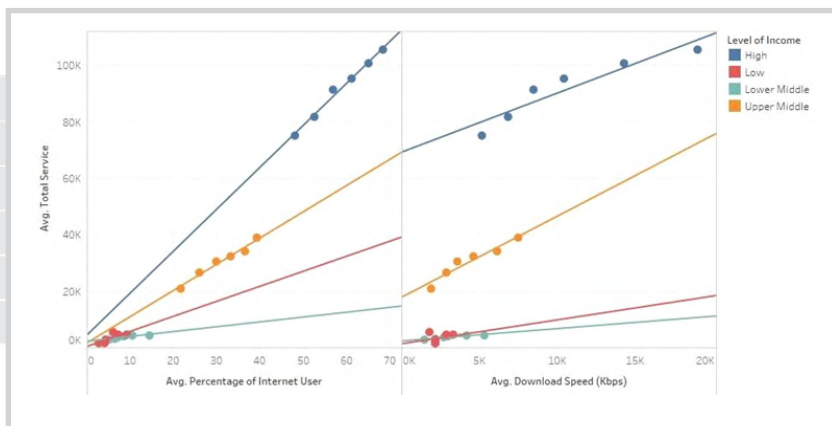


Lastly, I use Service Trade Restriction Index (STRI) data from Development Economics Research Group, World Bank to measure policy restriction. STRI provides "comparable information on services trade policy measures for 103 countries, five sectors (telecommunications, finance, transportation, retail and professional services) and key modes of delivery." It has a score of 0 to 100, with 0 indicating no policy restriction on trade-in services and 100 indicating maximum restriction on trade-in services. The data is cross-sectional and was published in 2012.

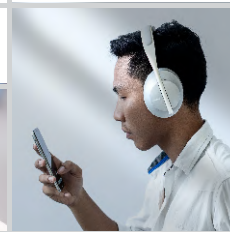
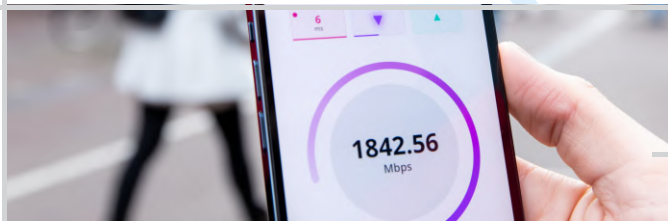


→ EMPIRICAL EVIDENCE

Figure 3. Scatter plots of internet users and download speed on total trade-in services from 2009 to 2014. Countries are grouped based on their level of income.

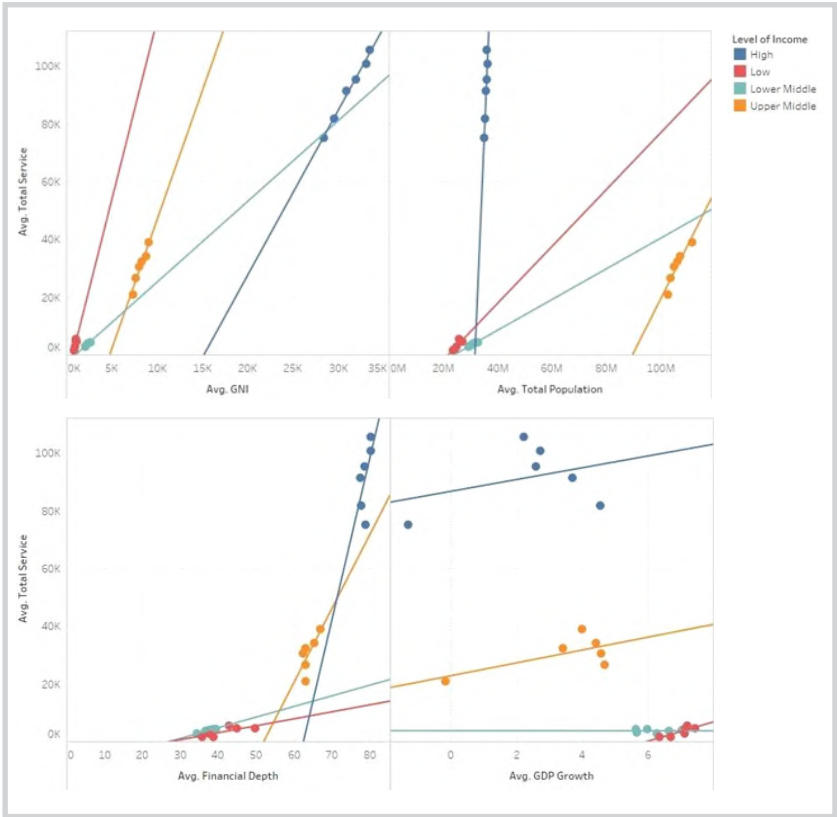


I start my analysis by creating scatter plots to identify the correlation between the percentage of internet users and average download speed with a total volume of trade-in services. In all of my scatter plot analyses (except for STRI), I divide 122 countries into 4 groups based on their income level. The reason I present the scatter plot in a group of countries is for clarity as I use panel data with 732 observations and to show the differences that may occur between different levels of income. I use classification standards from the United Nations' World Economic Situation and Prospects (WESP). This report classifies the income level into four groups: low, lower middle, upper middle, and high. Countries with less than \$1,035 GNI per capita are classified as low-income countries, between \$1,036 and \$4,085 as lower middle income countries, between \$4,086 and \$12,615 as upper middle income countries, and those with income of more than \$12,615 as high-income countries.



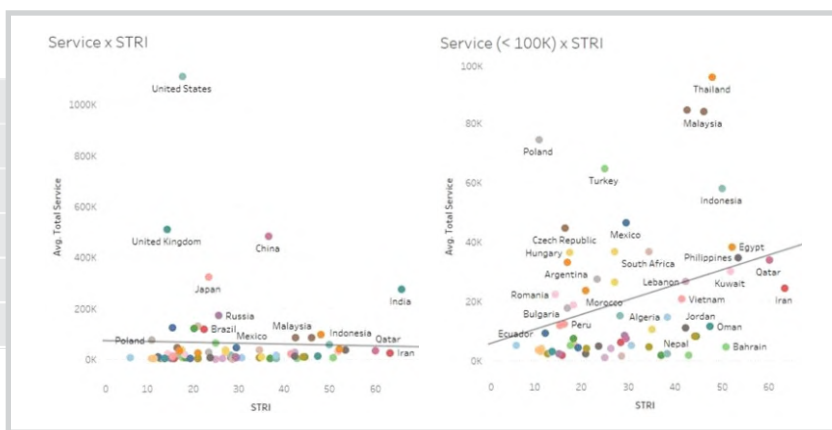
From Figure 2 we can see that these four groups of income have similar results. There is a positive correlation between the percentage of internet users and average download speed with total trade-in services in all groups of countries. However, there are different degrees of slope between each group of income. We can see that a higher income level will generally lead to a higher slope in both scatter plots. This might indicate a spurious correlation between internet and trade-in services, with income level as the Z variable. Moreover, we can also see that higher level of income will lead to higher intercept, which indicates a positive correlation between level of income and trade-in services.

Figure 4. Scatter plots of GNI, total population, financial depth, and GDP growth on trade-in services
Countries are grouped based on their level of income, using data from 2009 to 2014.



When it comes to the correlation between trade-in services and other non-internet variables, we can see from figure 3 that the results are different from one variable to another. All independent variables show a positive effect on trade-in services to some extent, although the correlations do not seem as strong as the correlation between internet variables and trade-in services. For GNI, total population, and financial depth, we can see that there is a clear pattern between the dependent and independent variables from the dots that indicates positive correlations. The regression line in these three scatter plots also confirms the positive correlation. However, the correlation becomes unclear when it comes to GDP growth and trade-in services. The regression line also shows mixed results, as countries in the high, upper middle, and low income group show positive correlation between GDP growth and trade-in services, while countries with lower middle income show negative correlation.

Figure 5. Scatter plots of STRI on trade-in services



I expected the correlation between STRI and trade-in services would be negative, meaning that the increasing level of restriction would lead to decrease in trade-in services. From the first scatter plot, we can see that there is indeed a negative correlation between STRI and total trade-in services. However, the correlation seems to have small magnitude, as shown by the slight decrease of the regression line. For this reason, I proceed to exclude the outliers of the data, which are countries that have more than US\$100,000 of annual trade-in services. By using this data, I find out that the correlation between STRI and trade-in services is positive. Therefore, based on the data, the increase in the level of restriction apparently does not decrease trade-in services but instead increases it. Given this point, I proceed to test my model using

regression analysis to further identify the details of correlations between these variables.

I conduct four regression analyses to test the correlations, with each analysis including a different set of variables. These different analyses also have different numbers of observations due to data availability. The first analysis includes all seven independent variables, with 73 countries and 73 observations. The first analysis only includes data from 2012 to adjust with cross-sectional data on STRI. The second analysis excludes financial depth and contains 91 countries and observations. Like the first analysis, the second one also only includes data from 2012 to adjust with data on STRI. The third analysis excludes STRI and covers 588 observations from 99 countries. Lastly, the fourth analysis excludes STRI and financial depth. This analysis covers 732 observations from 122 countries.

Table 1. Result of regression analysis

Dependent Variables	All Countries			
	1	2	3	4
USER	0.174*** (0.006)	0.022*** (0.006)	0.012*** (0.002)	0.019*** (0.002)
logSPEED	0.270*** (0.080)	0.240*** (0.085)	0.146*** (0.026)	0.109*** (0.029)
logGNI	0.575*** (0.131)	0.613*** (0.115)	0.764*** (0.035)	0.828*** (0.038)
GDP	0.018 (0.013)	-0.009 (0.016)	0.003 (0.006)	-0.006 (0.006)
logPOP	0.723*** (0.035)	0.744*** (0.036)	0.714*** (0.013)	0.725*** (0.013)
STRI	0.005 (0.005)	0.005 (0.005)		
logFIN	0.293** (0.121)		0.422*** (0.045)	
Constant	-12.186 (1.435)	-11.493 (1.550)	-12.793 (0.430)	-11.739 (0.420)
R ²	0.941	0.920	0.931	0.905
No. of observation	73	91	588	732

Notes:

- 1) Standard errors in parentheses.
- 2) *, **, and *** refer to confidence at the 90%, 95%, and 99% levels, respectively.

10 From the regression result, we can see that both internet user and internet speed are significantly correlated with trade-in services at 99% level across all analyses. Other variables such as GNI and total population also have a high level of statistical significance, as they are correlated with trade-in services at 99% confidence. Financial depth also has significant correlation with trade-in services, showing 95% confidence level in the first analysis and 99% confidence level in the second analysis. Surprisingly, STRI does not have statistical significance across all analyses. This is unexpected since one would think that policy restriction will significantly impact the trade-in services. According to the analysis, GDP growth also does not significantly correlate with trade-in services.

When comparing magnitude between independent variables, we can see that GNI and total population apparently have a bigger coefficient than the two internet variables. It means that GNI and total population have a bigger impact on trade-in services compared to the percentage of internet users and internet download speed. In addition, it also shows that internet speed has a bigger impact than internet users, thus showing that quality matters more than quantity. Another interesting result to highlight is the small coefficient of STRI. These findings further prove that level of trade restriction has minimal impact on trade-in services.





➔ CONCLUSION

1 PAGE 1The Internet, both its percentage of users and its download speed, have a significant impact on trade-in services. However, neither has the most significant impact on trade-in services. Based on the regression result, both national income per capita (GNI) and number of total populations have a bigger impact compared to the internet variables. Meanwhile, between internet speed and internet users, it turns out that internet speed has a bigger magnitude of impact compared to internet users. On the other hand, STRI apparently does not significantly impact the volume of trade-in services. This disproves my hypothesis on the positive correlation between STRI and trade-in services.

Given these points, we may proceed with formulating recommendations on trade-in services for the government. To increase the number of trades in services, the government also needs to improve the quality of the internet. High-speed internet is needed for economic activities; thus, the government must boost internet speed to increase the number of trades-in services. However, it does not mean that the government can put their policy of broadening the reach of the internet to rural areas to the back seat. In my opinion, internet quality and quantity improvement should be done hand in hand to create maximum impact on trade-in services.

At last, there are several improvements that can be made to improve this research. The first one is to use bilateral data on trade-in services. This research would be more accurate if I could have complete, multi-year bilateral data on trade-in services for each country. By using this bilateral data instead of total trade, I can identify trade partners for each country and incorporate more variables such as distance and common language. This would make the model more accurate. In addition, it would also be interesting to explore more data options on policy, as I feel that STRI is insufficient to portray the potential impact of policy on service trade.

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→ ABOUT CfDS

Center for Digital Society (CfDS) is the research center established by the Faculty of Social and Political Sciences, Universitas Gadjah Mada. The institution is created under the concern over the contemporary dynamics of socio-political condition of the world that is accentuated by the impeccable influence of information technology. The phenomenon triggers the new patterns and complexities in the society, and thus requires new approaches in managing such complexities.

CfDS pledged to delve more on the study of contemporary digital society, including related issues surrounding the topic; such as the issues of smart city and urban development. The emphasis is then put on the utilization of technology to shape the society in becoming digitalized, as well as to bring solvency to social issues.

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