Measuring comparative advantage form investment

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1.Introduction

This paper intends to find if there is an increase in comparative advantage for a country when they have an increase in their investment into capital goods. In this model , the treatment variable is going to be defined as investment, which will be in millions of United States dollars. Investment is measured by gross fixed capital formation, which is the acquisition of produced assets (including purchases of second-hand assets), including the production of such assets by producers for their own use, minus disposals. The model will determine the impact of investment on the response variable, which will be a measure for comparative advantage. In this paper, the theoretical value of comparative advantage will have to be measured by a metric. The measure being used is GDP per hour worked, which is a measure of productivity. GDP per hour work can measure productivity, as if a country gets more GDP per hour, they figured out a way to make more in less time, meaning they are more productive . For most of the countries, there is a value for productivity, in millions of US dollars, from 2010 to 2022, with some values missing for some countries. In total, we have forty-three countries from the OECD in our data set. Using these data points can show countries' change in productivity over time. The idea behind this measure of comparative advantage is that if a country increases its productivity over time, then their comparative advantage will increase. This relationship theoretically exists because they will have to spend less time and resources to make certain goods compared to other countries, and therefore will be able to trade those goods at a higher value.Theoretically, holding all other variables constant, that an increase in investment would lead to an increase of comparative

advantage. Therefore, this paper would expect that with an increase in investment, a country's comparative advantage measure of productivity will increase as well, as it would be expected that with an increase in investment, countries will be able to make more goods for less with everything else in the country being equal.

Overall, this paper can be applied to real world situations as it can possibly show whether or not it is worth it for countries to spend a lot of money investing in the process of making goods. If investment is not found statically significant to the measurements of competitive advantage, it can possibly show that the other factors of production that will be present in the model have a more important weight on comparative advantage than investment does. This idea is important because those factors of production, such as land and labor force and entrepreneurship have less of a direct relationship with spending than investment does. Therefore, given that bigger countries will have more of a budget to invest in the process of making goods, smaller countries may want to look into investing some of the money they use for investment and maintaining the other factors of production. They can also possibly only focus on one sector to gain a cooperative advantage. One way for this concept to possibly be done is by increasing the living standards and conditions in a country and increasing the investment in education. This way, a country's labor force can possibly increase as more people will come to your country with better living conditions and better education. Also, there can possibly be more entrepreneurs as thericoally, if people are more educated, they will have more tools available to them to be entrepreneurs. Therefore, this paper can possibly show how smaller countries should spend their budget in order to have a better chance of gaining a comparative advantage.

Overall, this paper would expect that investment possibly leads to a comparative advantage for countries as when a country invests in the production process of a good, they will

have less unit cost on those goods compared to countries that did not invest as much. However, this idea only holds in the countries that are around the same in the other factors of production, such as people available to work and the land available to produce goods. If investment is not statistically significant when these factors are present, the money used for the investment of a smaller country might be better used in a different area of the economy, or possibly all invested into one singular good.

2. Literature Review

There are many different past pieces of literature that the idea of this model and paper was based off of. Many of the results that were found using these papers were influencing the model being used in this paper.

When looking at possible articles to use as sources, one of the articles found was this article that looks into the relationship between comparative advantage and country size. The question presented in this article is if country size affects the patterns of inter-industry trade. The two hypotheses in this paper state that countries who have more skill in an area will be net exports and that countries with a large domestic market will be net exports in scale. This information will be helpful to the paper as imports and exports most likely will be a variable in my model. The main model this paper was based off of is the Heckshcer- Ohlin model for comparative advantage, and various other papers supporting that model. This theory predicts that access to the factors of production will have an impact on trade comparative advantage. In this paper, they had a model with three different industries, and were using pooled tests for home market effects. The demand variable in this model was constructed based on the demands ten to fifteen years prior to the estimation period. The main independent variable was to determine

output of goods within markets within two stages. The first is having a baseline production in each industry, written as SHARE in the model. The next one is the derived demand of the good, which is termed IDIODEM in the model. In the model they could not use an instrument for IDIODEM because it is a main variable, so they controlled for possible price influences in the data. Finally, they had EXPORTD, which is a dummy variable that equals one if the country in question is a net exporter. The data set consists of a sample of 82 industries and the data of trade flows have been taken from the Organisation for Economic Co-operation and Development(OECD) and the data for this study was from 1985. The OECD has 38 member countries who promote economic progress and world trade. In the model, they need data for both industries and countries in order to make the model. In the model, they have a bunch of data on countries from the ILO Yearbook, as well as a lot of industry data from various places. In the paper, there was a model having many signalar and interaction terms in order to make a model to find the results. In conclusion, this paper concludes that it does prove that countries' size affects trade systems of therefore comparative advantage. The empirical study quite clearly suggests that the higher the absolute endowment with skilled labor, the more positive is the response of net export to R&D intensity. The conclusion also mentions how it is a complement of another study in 1995 about trade patterns, but it makes up for technical differences. This study could also have trouble generalizing since it only is looking at OECD countries, but that might just be what data is available.

In conclusion, this paper was helpful to this paper as it gives me some empirical analysis of comparative advantage. Therefore, there are some variables from this model that can translate to the model being built.

Another paper that is useful to this study is a paper by Donald Davis and David Weinsitan, studying market access and economic geography when it comes to comparative advantage in trade. This paper uses the fact that traditional neoclassical models of comparative advantage suggest that, all else equal, a country with strong demand for a good will be an importer of that good. Similar to the last paper about comparative advantage and country size, this article uses the Heckshcer- Ohlin model and has a lot of other cited papers relating to this study. One of these papers was written by Lemar in 1984, that states twelve productive resources that correlate well with countries' net trade vectors. One limitation of Leamer's approach is the focus on explaining the net trade vector. This led researchers to focus on cross country patterns of production. In this paper, there is a null hypothesis that comparative advantage determines production and trade. Therefore, under this hypothesis, market size has no effect on comparative advantage. The alternative hypothesis is something called the Helpman–Krugman specification, which states that increasing returns to scale drives international trade.

The Helpman-Krugman specification from a paper by Helpman in 1981 and a paper from Krugman in 1980. This paper considers three levels of product aggregation: Varieties, Goods, and Industries. In this paper, Varieties play an important theoretical role within the model of economic geography. Goods will be defined in two ways. Under the hypothesis of increasing returns, the definition of a goods will be the collection of varieties produced under monopolistic competition. Under the null hypothesis, a good has the definition of a traditional homogeneous commodity. In both settings, an industry will be defined as a collection of goods produced using a common technology. All of the data was found from the thirteen countries in the Organisation for Economic Co-operation and Development. In the econometric model, industries and goods typically have 3- and 4-digit ISIC data respectively. Therefore, the fully econometric model has

this 3 and 4 digit code, the demand of an individual, and a dummy variable to see whether a country has a net export of a good and whether or not factors varied across sectors. In this model, IDIODEM, which is the measure of demand, is in this model with a bunch of other factors to be controlled. The prediction for the constant of IDIODEM was 0, but if the constant was between 0 and 1, comparative advantage was assumed, and if the constant was greater than one, economic geography was assumed. In conclusion, this study showed support for the economic geography hypothesis of the existence of market effects. Therefore, there was a major effect of geography and market access on comparative advantage, that was not being explained by traditional comparative advantage models. One problem with this study will be that it only focuses on OECD countries, although there was a separate study with Japanese. markets.

In conclusion, this paper is useful to my paper as it shows a statistically significant relationship between comparative advantage and a possible important variable in my study. However, it does not take into account the other factors of production, which could have an influence as well.

A final article that influenced this paper was written by David Greenaway and Johan Torstensson in 2000, there were two main questions that were being asked within the context of this article. The first question was whether economic geography or factors present within the Heckscher-Ohlin model. The second question presented within this article is whether or not concentration of production within industries has increased. If it did, countries would be able to specialize in making different products, and then trade between each other. Due to its use on the Heckscher-Ohlin model, this paper will be based on the paper about the Heckscher- Ohlin model, and various other papers written around this time supporting the Heckscher- Ohlin model, and technology differences, as the main reasons for comparative advantage. There are also many

other assumptions that are used in this paper that were taken from other papers that were written in the past. One of the first assumptions is that capital is increasing in the quality of vertically differentiated products. This assumption comes from two papers, one written by Falvey in 1981 and another byFalvey and Kierzkowski in 1987. The paper also assumes that scale economies increase with quality, by the fact that fixed costs for development of high quality products seem to be greater than low quality ones. In this paper, there are two frameworks, one where relative abundance, and then other when country size determines trade. Based off of the work on Leamer in 1984 and other, this paper defines endowment of physical capital, PCAP, by the depreciated sum of accumulated gross domestic investment, from a 1991 database. The paper also has variables mean school years, or human endowment (HCAP) and market size in all of their models. Based on these variables, the paper provides a regression analysis for each of the three years, (1969,1981,1994) individually, as well as a panel data regression together. There is also data on the robustness of the data found, as well as trade within industries as a percentage of total trade. In conclusion, this paper found that both the Heckscher-Ohlin model and economic geography affected trade. Meaning, both a large domestic market, and an endowment of human capital increases the quality of exports. This information is translated to my paper as with an increased quality of exports, a country most likely has a comparative advantage, as they are better at making goods. One thing that can potentially be a problem in using this data result is that because of the many data requirements in this study, the data is only looking at imports to Sweden by other OECD countries. Therefore, this paper does not have a complete overview of comparative advantage. Next, there are a lot of assumptions made in this paper about the economy. However, overall this paper looks like a good paper as it relates to my paper a lot.

3.Theoretical model

Theoretically, investment in technology and the production process of goods can lead to a comparative advantage for a country as theoretically, the increase reliance on technology will lead to an increase in productivity for a country, since technology should be able to make goods faster than humans, and therefore, countries will have to use less of other resources in the production process. Because of this, two different outcomes can prove to be helpful for a country. First of all, the country will be able to make more of a good in a given time period. Therefore, the unit cost of a good will be less on average than if a country did not invest in the production process. Next, a country will, in theory, be able to pay workers less as the investment will most likely either speed up the production process or make there be less workers needed to make the product. Therefore, a country will pay workers less as they need less workers, causing workers to take any lower slavery as they need a salary to live, and there is less demand for workers, but the same quantity. Also, the production process can become deskilled, meaning more workers will be able to produce the products at a satisfactory level. Then, in this case, wages go down as well as workers will take less wages with more quantity of workers available and the same demand. Therefore, a country gains comparative advantage as it will cost them less to make certain goods, and by the theorem of comparative advantage, a country with less costs to make goods in a certain time period will have a comparative advantage over another country when it comes to producing that good.

4. Econometric Model

The econometric model that is going be used for this paper is as follows:

$$Ca_{it}=B_{0it}+B_{1ti}Lni+B_{2ti}LnlaB_{3it}Lnlf+B_{4it}per\_self+B_{5it}hedu+B_{6It}lwageB_{7it}eduLw+B_{8it}lareaLf+B_{9it}lLfLw+u_{it}$$

Where the y variable, Ca, is the measure of comparative advantage that is in the model. The main explanatory variable in the model, Lni, is the log of investment in goods by countries. One would

expect this coefficient to be positive, because as mentioned above, counties with increased investment will have to spend less time and goods on making products. The model also has some other control variables as well. The first one is Lnlf, which is the log of the labor force in a country. It is expected that this coefficient is positive because a greater labor force can lead to paying each worker less, which leads to a comparative advantage. Another one is LnLa, which is the log of the land area of a country. It is expected that the coefficient is positive since with more land, a country will have more resources. Then, we have per_self, which is the percent of people self employed. This coefficient will be positive as it is a measure for entrepreneurship, which will increase comparative advantage. However, this would mean there are less people to hire, which could affect the cost of companies. Next, we have hedu, which is the amount of people with high levels of equation. It would be expected that this coefficient is positive, because if more people have a better education, they can more easily contribute to the economy. The final constant is lwage, which is the percent of people in a country with low wages. It is expected that this coefficient is positive as if more people are making low wages, the companies are paying less to workers, and therefore can make more goods. Then, the model also has a control of GDP in the model, which is expected to be a positive coefficient. The model also has three interaction terms which are high education times low wages(eduLw), land area times labor force (areaLf) and labor force times low wages(LfLw). It is expected that all of these coefficients will be positive. Finally, we have the error term, u. Some of the factors that can be in these error terms are values not included in the model like a proper measure for entrepreneurship and possible measures for trade and access to the ability to trade.

5. The Data:

The data for this model is all gathered from the The Organization for Economic Cooperation and Development (OECD) official website of statistics. The data set gathered is from the years 2010 to 2022 and consists of 43 countries. A summary of the all the variables are listed below:

Variable:	Definition:
Ca	Measure of comparative advantage, which is GDP per hours worked in millions of U.S dollars
Lni	The natural log of investment in each country per year. Original non-log values in millions of US dollars. Investment is is defined as the acquisition of produced assets (including purchases of second-hand assets), including the production of such assets by producers for their own use
Lnla	The log of the land area of each country. Original values in miles square
Lnlf	The log of the labor force in each country. Original data in thousands of people
per_self	Total percent of people who work for

	themselves- both genders with and without employees considered in figure
hedu	Total percent of people with at least upper secondary education- (roughly US high school education)- people aged 25-64
lwage	The percentage of people in each country making low wages, defined as less than two thirds of the counties median income

Summary statistics:

Variable		Number of observations	Mean	Standard deviation	Minimum value	Maximum value	N/A's
Ca		559	48.92	20.22	34.89	131.57	3
hedu		559	41.87	13.07	15.82	75.18	65
lwage		559	15.359	6.21	0.693	35.611	208
per_self		559	26.970	9.99	9.877	61.027	167
Lni		559	11.565	1.51	7.485	15.413	45
Lnla		559	11.269	1.79	6.908	15.660	0

Lnlf		559	8.832	1.52	5.185	12.009	54
edulw		559	674.02	398.87	12.54	2038.73	241
lareaLf		559	101.50	31.50	37.59	181.07	54
lLfLw		559	135.912	62.90	7.026	302.253	226

All the variables in the model have a good enough variance in the data. The standard errors are relatively constant except for variables that stay around the same between years, such as land area, GDP, labor force and investment. However, there is high standard deviation for the interaction variables. All variables have positive values as they can only be positive. In total, there are 559 observations, but some data points are missing. These are shown in the N/A column, which is how many data points are missing per each variable. Overall, the data summary shows good variance for the data, with the standard deviation being high when it makes sense for it to be high, and low when it makes sense to be low.

6.The Results

Shown below is the results table of the model. Each variable is given with its corresponding coefficient and t statistic, with the significance level shown on the t statistic.

Variable	Coefficient	T statistic
Intercept	1.385	6.004***
Lni	.1690	9.836***
Lnla	.02204	1.063
Lnlf	-.1586	-5.597***

per_self	-.006326	-9.063***
hedu	-.02840	-1.476
lwage	-.02840	-3.605***
edulw	-.003612	-1.614
lareaLf	-.003612	-1.614
lLfLw	.003329	4.911***

Overall, with the presence of all of the constants in the model, it was found that on average, a one present unit change in the amount in investment in capital by a country, they will gain 16.9 more units of comparative advantage on average. This result is in line with what was theoretically expected, as it was expected that all other variables being equal, an increase in investment will lead to an increase in productivity, which leads to an increase in comparative advantage. Also, this result from this study is aligned with other studies, including the ones previously mentioned earlier in this paper, that with all things being equal, an increase in a factor of production does lead to an increase in comparative advantage. However, many of the previous literature is looking at other factors like size of a country or market access. Because of this, past studies found a bigger correlation for comparative advantage. This model tries to show comparative advantage through a lens of what governments can control. Within the contrast there were a few interesting results as well, some that even go against what one would theoretically expect to happen. The main outcomes noticed was the low wages and labor force coefficients were both negatively correlated to comparative advantage. This is an interesting finding as one would expect that with more of a labor force and more people making lower wages, a country's comparative advantage will be greater as they have less cost per unit. Overall,

this model's main finding was that with all things being equal, an increase in investment will lead to an increase in competitive advantage for a country.

7.Conclusion

In conclusion, through this study, the data was able to find that when a country spends more on investment in capital goods, they get a comparative advantage compared to similar countries who do not invest as much. This model can be useful to society as it can potentially show that small countries do have a statistical reason to invest in capital goods as opposed to spending more on other aspects of society, like education and standard of living in society. Investment is possibly important to a society as it is one of the four main factors of production, along with land, labor and entrepreneurship. This study could be important as it can show how countries can benefit from investing and that it is not just the countries with bigger fixed factors of production, such as more land and labor, than can have a comparative advantage.

8.References

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