

RESEARCH SEMINAR IN INTERNATIONAL ECONOMICS

Gerald R. Ford School of Public Policy
The University of Michigan
Ann Arbor, Michigan 48109-3091

Discussion Paper No. 664

Comparative Advantage in Digital Trade

Alan Deardorff
University of Michigan

November 13, 2017

Recent RSIE Discussion Papers are available on the World Wide Web at:
<http://www.fordschool.umich.edu/rsie/workingpapers/wp.html>

Comparative Advantage in Digital Trade

Alan V. Deardorff

The University of Michigan

November 13, 2017

ABSTRACT

Comparative Advantage in Digital Trade

Alan V. Deardorff

The University of Michigan

Digital trade takes a variety of forms, several of which are examined here with regard to whether they can be explained by comparative advantage. The five forms of digital trade considered are 1) physical products that are advertised, ordered, and/or paid for digitally, but transported by normal trade means; 2) digital products (music, movies, books, software) that are transmitted to purchasers via the internet and are most likely to be marketed and paid for via that as well; 3) services that are provided remotely by digital means; 4) data storage and computer applications accessible in the “cloud”; and 5) web platforms that serve an international audience and are supported by advertising. I argue that the first three of these can be well explained by comparative advantage, but there are problems with the last two.

Keywords: Digital trade
Comparative advantage

JEL Subject Code: F1 Trade
F11 Neoclassical Trade Models

Correspondence:

Alan V. Deardorff
Ford School of Public Policy
University of Michigan
Ann Arbor, MI 48109-3091

Tel. 734-764-6817
Fax. 734-763-9181
E-mail: alandear@umich.edu
<http://www-personal.umich.edu/~alandear/>

Comparative Advantage in Digital Trade*

Alan V. Deardorff
The University of Michigan

I. Introduction

When Ricardo formulated what we now call his Law of Comparative Advantage, international trade took the form of goods being produced in one country and being transported by land or sea to another. His law was based on the need to locate production most efficiently in terms of the cost of production itself and the cost of moving goods to where they would be consumed. The latter might cause a good to be produced in a country without a relative cost advantage in its production, but it would never cause it to export the good. The Law of Comparative Advantage has served two important purposes during the two centuries since its publication: To explain the pattern of trade and to explain the gains from trade. For the pattern of trade, the Law predicts that if trade is not distorted by policy, countries will export goods for which they have relative cost of production lower than in their trading partners. For the gains from trade, the Law explains that trading in this fashion can reduce the overall costs of what people everywhere are able to consume.

For most of the 200 years, trade continued in much the same way as when Ricardo wrote, although transport became faster and cheaper, including eventually by air. Only in the late 20th century did a form of international trade appear that might have

* I thank Simon Evenett for asking me to write about this, and for be patient as I missed his deadline.

challenged Ricardo's conception: international trade in services. At first, trade economists tended to deny that trade in services was possible, since services typically require the presence in one location of both the producer and the consumer. Either might themselves travel to the location of the other (what today we would call modes 2 and 3 of services trade), but since that was movement of people (as is mode 4), we didn't initially call it international trade. Only when a producer could provide a service from across a border without either party themselves crossing it (what we now call mode 1) did it seem to warrant being called trade. Only in the 20th century did that begin to be possible, through means of communication such as telegraph, telephone, telex, etc., and the services that could be provided by these means were very limited.

This state of affairs might have continued longer were it not for the efforts of some major international service providers to get their products reclassified as trade in order to come under the auspices to the GATT, the General Agreement on Tariffs and Trade. The late Harry Freeman, a graduate and friend of the economics department at the University of Michigan and an officer of American Express, led a push to include trade in services within the Uruguay Round of international trade negotiations, which then included its GATS – General Agreement on Trade in Services – as one of the three pillars of the World Trade Organization.¹

As trade in services was becoming “a thing,” my colleague Bob Stern organized one of his many conferences to deal with the topic, and he asked me to contribute something about comparative advantage as it applies to, or does not apply to, trade in

¹ In an addendum to his obituary of Freeman, Shapiro (2011) says “Mr. Freeman was a crucial figure in the movement to persuade members of Congress and the executive branch to include services — “travel, education, business services, financial and banking services,” as he once defined them — in trade negotiations.”

services. I contributed the paper Deardorff (1985). In it I examined the three different kinds of trade in services that I could think of at the time: “trade services,” such as transportation, that are demanded as a part of international trade in goods; services provided by entities that travel to the location of their consumer; and services that are provided across the border by some remote means. Focusing only on the extent to which the concept of comparative advantage could be used to explain the pattern of trade, not the gains, I argued that the first two of these could fit well into the Ricardian framework. However, for the third – cross-border service trade or mode 1 – I found a case in which the normal application of comparative advantage would incorrectly predict trade.

The example could be easily understood within the context of an otherwise Heckscher-Ohlin 2x2 model of trade, but in which one of the two factors is able to contribute to the production of the service from across the border. Suppose, for example, that the factors are labor and management, with labor needed at the location of the consumer but management operating from a distance to produce the service (but not the good). If the service is relatively labor intensive, then the management-abundant country will have a relatively high relative price for the service in autarky, yet will export the service if there is free trade. Thus the relative autarky price suggests a comparative disadvantage in services, even though the country’s abundance of management makes it the most efficient provider of services abroad, where it can employ from a distance the cheaper labor that is available there.

My conclusion, then, was that comparative advantage as we have understood it since Ricardo will not always work for explaining trade in services. I have been asked, now, to look at form of trade that is even newer than trade in services – digital trade –

and examine whether comparative advantage works for explaining that. As should be clear already, the answer must surely be that it does not always work, since some digital trade is just an example of the mode 1 services trade that I examined before.

I will not therefore conduct any formal analysis here. Instead, I will just talk through the several types of digital trade that I have been able to think of and discuss how they may or may not fit into our conceptions of comparative advantage. Note that, as in my earlier paper, I am concerned only with whether comparative advantage is a useful tool for understanding the pattern of trade (who exports what to whom), not whether there are gains from trade. I presume that the usual benefits of free-market transactions apply as well to digital trade as to other forms of trade, as long as those markets are not distorted. Whether digital markets are more or less likely to include such distortions is a topic for another day.

II. Digital Trade

There is no standard definition of digital trade. USITC (2013) defines it in a Glossary (p. xii) as “the delivery of products and services over either fixed-line or wireless digital networks,” but also says (p. xv) “There is no standard or generally accepted definition for ‘digital trade.’” In the sequel to that report, USITC (2014, p. 29) “defines digital trade as U.S. domestic commerce and international trade in which the Internet and Internet-based technologies play a particularly significant role in ordering, producing, or delivering products and services.”

Since I am interested here in the comparative advantage of countries, I will ignore domestic commerce and define international digital trade as follows:

- Commerce involving more than one country for which the product itself is digital and/or any of the following are accomplished at least in part by using the internet or a similar digital technology: advertising, ordering, delivering, payment, or servicing.

The least interesting form of digital trade, by this definition, would be a physical (digital) music CD or movie DVD that is marketed internationally entirely by conventional mail.

It is least interesting here because, aside from one aspect of its production, it is a physical product that is traded by means that were conventional before digital trade in other forms existed.

Potentially more interesting are the following types of digital trade:

- Physical products that are advertised, ordered, and/or paid for digitally, but transported by normal trade means.
- Digital products (music, movies, books, software) that are transmitted to purchasers via the internet and are most likely to be marketed and paid for via that as well.
- Services that are provided remotely by digital means.
- Data storage and computer applications accessible in the “cloud.”
- Web platforms that serve an international audience and are supported by advertising, such as Facebook, YouTube, IMDB, Twitter, etc.

In what follows, I will discuss each of these in terms of the extent to which comparative advantage seems applicable to explaining them. There are also several other items that I suspect might be included as aspects of digital trade, but which I know even less about and will therefore not consider:

- The “dark web,” which apparently may do much of the above, but invisibly and illegally.
- Cryptocurrencies, such as bitcoin.
- The physical infrastructure of the internet, such as the trans-oceanic fiber optic cables that transmit the signals and are owned by companies that charge internet service providers for their use.

Physical Products

Physical products become part of digital trade when they are advertised, ordered, and/or paid for digitally, even though they must be shipped from producers to buyers by non-digital means. The location of their production is subject to the same economic considerations as any physical good, including the costs and availability of factors of production, technology, and intermediate inputs. Therefore the role of comparative advantage in determining that location should be the same as it is for other trade. The role of the digital economy in this form of commerce is that it provides some or all of the services that the commerce requires to complete the trade, aside from transportation.

As such, it is like the “trade services” that I considered in Deardorff (1985). I argued there that trade services, even though they may be provided from a different country than either the ultimate buyer or the seller, will reflect comparative advantage. For example, the retailer Amazon may be the intermediary between a producer in China and a buyer in Canada, providing its services from the United States where the available internet technology and skilled labor are most abundant.

Digital Products Delivered Electronically

Increasing amounts of trade consist of products that never take a physical form, but are instead the streams of zeroes and ones that encode music, text, video, and computer programs. While these can be recorded on physical disks, today they more often reside in computer memories and are transmitted from seller to buyer over the internet. It is perhaps tempting to think of them, therefore, as intrinsically different from physical goods, and in one sense that is true: they can be duplicated at essentially zero

cost. That, however, does not make them immune from the forces of comparative advantage, as even though the marginal cost of an additional copy is zero, the cost of the original is not. And this cost depends on the usual determinants: prices of factors of production and technology. Thus, economic forces should cause such digital products to be produced where their costs are relatively low, exactly like physical products.

The zero marginal cost of duplicating them, however, makes them not fit well into the simple Ricardian model, where marginal costs are positive and constant, while fixed costs are zero. The presence of increasing returns to scale also interferes with the Ricardian assumption of perfect competition. However, the absence of perfect competition need not invalidate the Law of Comparative Advantage. For example, although he did not comment on this aspect of his model, Krugman (1981) provided a simple model of two countries trading with monopolistic competition, and the pattern of net trade in that model conformed nicely to comparative advantage. That is, each country had a lower relative autarky price for the industry that used its relatively abundant factor, and with free trade, although it both exported and imported in that industry, its net exports were positive.²

Services Provided Remotely

As increasing numbers of services are provided digitally using computers, it has become common for these to be provided in remote locations by workers whose advantage might be their low wage or their greater expertise. With the rise of the

² That model is not, however, able to accommodate the assumption of zero marginal cost, since its CES utility specification implies (with large numbers of firms) that prices are a multiple of marginal cost, and hence would be zero. I feel confident that an alternative model of monopolistic competition could also yield comparative-advantage trade based only on fixed costs, but have not yet found or been able to construct that model.

internet, it is no longer necessary for these workers to communicate by mail, but instead they can be given their assignments and return the results of their work by e-mail or other purely digital means. The fact that internet communication is also nearly instantaneous means that some remotely provided services can happen in real time, as when a computer technician takes control of a customer's computer remotely and is then able to diagnose and repair it from a distance. Both forms of remote services may be traded at arm's length (a perhaps inappropriate metaphor given the distances involved) between a service company and a separate customer, or they may be provided in-house. A hybrid of these two would include the manufacturers of capital equipment that have built in digital capabilities so that the manufacturer is able to monitor performance, diagnose malfunctions, and perhaps repair them all via signals transmitted digitally.

The fact that such services are able to be provided across great distances at close to zero cost means that their costs consist almost solely of the costs of labor and capital in the location where the service originates. Thus a country will be an exporter of such a service only if it possesses the skilled labor and appropriate capital, just as if the service were to be provided at home. Comparative advantage should therefore be expected to explain such trade just as well as for trade in physical goods in Ricardo's day.

The Cloud

When my colleagues and I built our computer model of world trade, we used software and stored our data on a remote computer – a “mainframe” that I never saw. We were connected to it by phone lines and dial-up modems from computer terminals. Since then computing power and storage have both expanded and shrunk to the point that my

phone today may have more of both than that huge machine. And yet the trend today is again for computer users to access software, data, and storage on remote computers, said to exist in “the cloud.” That merely means that they are once again in large complexes of computers and digital storage, but they are accessed now by the internet, not by phone. Businesses and individuals all over the world can purchase space in the cloud and use the software that is stored there for their needs, and large companies such as Amazon sell this service both domestically and internationally. It is therefore yet another form of digital trade.

The business of selling such cloud services requires hefty doses of both human and physical capital, which need not be located in the same place or same country. Indeed, the fact that the physical capital, in the form of giant “server farms,” also requires massive amounts of energy both to run and to keep them cool, may argue in favor of locating them in places with an abundance of energy, such as Iceland, while the human capital operating the system and interacting with customers locates elsewhere, such as in the United States. If this is the case, then digital cloud services may conform exactly to the case of cross-border service trade that I mentioned above, where comparative advantage may fail to explain the pattern of trade. That is, if one country has an abundance of the human capital needed to manage the cloud but a scarcity of energy, while another has cheap energy but little human capital, then neither may have a low autarky relative price for cloud services, even though in combination they do.

International Web Platforms Supported by Advertising

The last case I will consider is web platforms that provide free content and are supported by advertising. To the extent that they serve an international audience – and the large ones surely do – then they seem to require the label of digital trade. But what are they trading? With respect to the users of their sites, they are exchanging some sort of content not for money but for the attention of their users, which in turn allows them to sell advertisements to those who want to reach those users. Had broadcast television worked across borders, then we might have included it as a form of international trade in the pre-digital era. But we would have been hard pressed to measure it.

What these platforms are really trading is the attention of their users, which they “produce” with their content, in exchange for the payment they require for advertising to those users. Since the platforms are typically based in one country but serving many, their transactions with advertisers in other countries are international trade.

To what extent can comparative advantage explain this trade? The companies that run these platforms certainly make extensive use of human and physical capital, and they may therefore tend to locate in countries with an abundance of both. That would conform with comparative advantage. However, a distinctive feature of most of these platforms is the network effects that make them successful. And these depend less on such factors of production, or even on technology, than on the timing of a firm’s entry and on the size of the market that they are able initially to serve. I suspect that it is no coincidence that the largest platforms on the internet today are located in the two largest countries, the United States and China, where network effects could provide the greatest

benefit. And that might well have been true even if some other country – Finland, say, or South Korea – had superior factors and technology.

III. Conclusion

I am an ardent defender of the importance of comparative advantage, which I would seek to apply in areas well beyond international trade.³ But as I have now looked at the topic of digital trade, I am forced to admit that not all such trade seems to be well explained by comparative advantage. Just as I found when I looked at trade in services back in the 1980s and found that one form of service trade – cross-border services – did not fit well into the Ricardian framework, I find something similar here for one form of digital trade, cloud services. In both cases, I can imagine a country having a high relative autarky price for such trade and nonetheless being able to export it successfully. In these two cases, the key is that the trade draws upon factors from two different countries, harnessing the abundance in both to a form of trade that neither might be able to do efficiently alone.

I also find myself questioning the relevance of comparative advantage for explaining the form of digital trade that builds on platforms whose success depends on network effects. Here too, I see countries successfully exporting for reasons that have more to do with country size than inherent comparative advantage.

I conclude, therefore, that comparative advantage remains a very useful tool, but its application is not universally valid.

³ I would like, for example, for successful scholarship to reflect comparative advantage in either theoretical or empirical research, rather than requiring that all scholars excel at both.

References

- Deardorff, Alan V. 1985. "Comparative Advantage and International Trade and Investment in Services," in Stern (1985, pp. 39-71); reprinted in Bernard Hoekman, ed., *The WTO and Trade in Services*, Northampton, MA: Edward Elgar, 2012; also in Stern (2011, pp. 105-128); available as Post-Print 5 at <http://fordschool.umich.edu/rsie/workingpapers/ppp.html>.
- Krugman, Paul R. 1981. "Intraindustry Specialization and the Gains from Trade," *Journal of Political Economy* 89(5), October, pp. 959-973.
- Shapiro, T. Rees. 2011. "Harry L. Freeman, American Express executive embroiled in investigation, dies at 79," *Washington Post*, June 17, including the added "Clarification" at the end of the online version.
- Stern, Robert M. 1985. *Trade and Investment in Services: Canada/US Perspectives*, Toronto: Ontario Economic Council.
- _____. 2011. *Comparative Advantage, Growth, and the Gains from Trade and Globalization*, New York: World Scientific.
- U.S. International Trade Commission. 2013. *Digital Trade in the U.S. and Global Economies, Part 1*, Publication No: 4415, Investigation No. 332-531, July.
- _____. 2014. *Digital Trade in the U.S. and Global Economies, Part 2*," Publication No: 4485, Investigation No: 332-540, p.29, August.