Rehabilitating Heckscher-Ohlin

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A Trade in Value Added (TiVA) Approach

By

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Cambridge Scholars Publishing

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PREFACE

Our understanding of international trade is, to put it mildly, disturbingly incomplete. Despite centuries of work, we have yet to come up with a model of trade that is empirically consistent – that is, explains most if not all of trade patterns in the world. This is all the more surprising as the past half century has witnessed the emergence of free or freer trade as one of a handful responses to lower productivity and GDP growth. In this volume, an attempt is made to rehabilitate what generations of scholars and laypersons have felt to be the only intuitive and logical explanation of trade, namely differing factor endowments across regions/countries. It maintains that various oversights in the original Heckscher-Ohlin formulation are what eventually led to its demise. Correcting for these results in a more appealing version of the factor proportions hypothesis, one consistent with trade not only today, but throughout history.

INTRODUCTION

Despite having been found to be wanting empirically, the Heckscher-Ohlin factor-proportions approach to international trade continues to hold sway in the field – as evidenced by its continued presence in undergraduate and graduate textbooks. This can be attributed to among other factors its intuitive nature – that is, its commonsensical approach to trade. The more of a factor a country or region has, and the less of another, the more likely is it to engage in trade exporting goods that use the former intensively, and importing goods that use the latter intensively.

This volume sets out to rehabilitate the Heckscher-Ohlin approach to trade by casting it in a more general framework, one in which technology is both endogenous and factor-proportions-based, and endowments of natural resources play a key role, all in the context of a model of vertical trade in value added – that is, trade within value/supply chains.

This provides a long-overdue reformulation of trade as vertical in nature – that is, between links in value chains. The study of international trade has from the get-go (early 19th century) been fundamentally flawed as it has focused on finished goods and services when in actual fact, countries, then and now, traded and trade in value added. This was the case of 19th century Great Britain, as well as 21st century China. Today, China does not export goods, but rather exports value added. Specifically, they import processed raw materials and intermediate inputs, add value and export the final product. What follows is a brief summary of the chapters.

1-Trade Theory: A Critical Review

This chapter critically reviews trade theory from Adam Smith to Marc Melitz, focusing on the political economy of international trade. For example, it is argued that early interest in international trade had little to do with the conventional gains from horizontal trade and everything to do with the gains from vertical trade and the need to acquire raw materials and extend the U.K. market for finished goods.

It is argued that the bulk of current international trade is vertical in nature with China as a telling example of a resource-poor country importing raw materials and exporting finished goods. Other examples include 19th-century Great Britain and late 20th century Japan. In all three, horizontal

trade (i.e. finished goods for finished goods) would be impossible given the resource constraint.

Trade policy in these countries has stressed the need to secure access to raw materials and foreign product markets in a life-or-death way. Threats to either are taken serious for good reason. If either is threatened, the consequences are dire.

2-Rehabilitating the Factor-Proportions Theory of International Trade

(published in Modern Economy, 2015, 6(4):436-457.)

This chapter sets the tone for the volume as a whole. It develops a generalized factor-proportions theory of trade in which comparative advantage at all levels or links of the visions-augmented value chain are the result of factor proportions. Accordingly, product and process development (i.e. the vision stage) is determined by a country's endowment of skilled managers and scientists.

3-Vertical Comparative Advantage

(published in the International Trade Journal, 2011, 25(3): 305-348.)

As its title suggests, this chapter defines as well as analyzes vertical comparative advantage. This contrasts with horizontal or whole good/service comparative advantage by focusing on the advantages and disadvantages countries and regions within countries face/enjoy at the value chine-link level. Put differently, the focus is on understanding comparative advantage at the value-added level as opposed to the good/service level.

The starting point is the visions-augmented value chain which consists of the typical vertical value chain augmented by the conception of the product or process link. Unlike the conventional Heckscher-Ohlin approach, it allows for mobile labor and capital. Anchoring comparative advantage are differences in a country or region's ability to generate visions (i.e. new products and processes) as well as the endowment of natural resources. The result is a convincing rationalization of world trade today, one in which technological asymmetries are endogenized. Furthermore, it provides a rich framework in which to analyze the various instruments of trade policy.

4-Entrepreneurial Ability, International Trade and Multinational Firms

(published in the International Economic Journal, 1989, 3(3):1-23)

Perhaps the greatest shortcoming in all of trade theory, from David Ricardo to Marc Melitz, is the parametric treatment of technology as a source of comparative advantage (horizontal and vertical). This article, published in 1989, attempts to endogenize technology by invoking the factor proportions approach to technology-yielding human capital. Specifically, it focuses on the entrepreneurial dynamics of innovation. Following Harvey Liebenstein's work on entrepreneurship, it assumes that there are two types of managers, innovative and routine. Countries with a high ratio of the former to the latter are more likely to develop product and process technology-based comparative advantage.

The article also focuses on the cultural determinants of managerial endowments, arguing that countries that are more liberal, more permissive, more democratic are more likely to have more innovative managers, and thus are more likely to introduce new products and processes.

5-Competitive and Comparative Advantage: Towards a Unified Theory of International Trade

(published in International Economic Journal, , 30(1), 2016, 1-18)

The failure of conventional trade theory to not only explain world trade, but to provide governments with a set of policy tools led to the development by Harvard University business professor Michael Porter of the concept of competitive advantage, focusing on the nuts and bolts, at the managerial level, of developing a competitive advantage (i.e. relative to competitors) – in short, of endogenizing comparative advantage. As the managerial input is absent from most analyses of trade, a rapprochement between the two concepts has until now been impossible.

This article, drawing from Chapters 2 and 3 where the managerial input is integrated in the form of the Visions stage of the value chain, proposes such a rapprochement. Specifically, competitive advantage is shown to be the equivalent of a vertical comparative advantage at the visions link of the augmented value chain. Countries with such a vertical comparative advantage are more likely to dominate

6-What do the TiVA Data Tell Us About Comparative Advantage in General

(published in International Trade Journal, 2013, 211-17.)

The future of trade theory invariably lies in explaining comparative advantage at the value-added level. In other words, in our increasingly globalized world, value chains are increasingly spread across multiple regions and countries, raising the question of why. This chapter provides a glimpse of what the future holds in store by analyzing comparative advantage using the Trade in Value Added (TiVA) published by the WTO-OECD.

Summary and Conclusions

In many ways, this collection of essays is intended to right a historical wrong, namely by examining trade for trade's sake, and not for growth or distributional purposes. Unfortunately, despite nearly two centuries of work, the discipline was unable to break with its origins, namely with focusing on horizontal comparative advantage and trade.

This volume is a sample of what the future holds in store for trade theory as it focuses on understanding trade in value added, including the all-important visions link which endogenizes technology-based comparative advantage. While this approach is currently embryonic, it will only gain in importance as more and better TiVA data become available.

1

INTERNATIONAL TRADE THEORY: A CRITICAL REVIEW

Despite a history that spans over two centuries, international trade remains a phenomenon in search of a credible theory by which it should be understood, a theory that is grounded in the fundamentals of wealth creation, distribution and exchange and one that is corroborated by the data. Of course, this implies that hundreds of years of writings have failed to provide a thorough understanding of a phenomenon that is as old as time, namely the exchange of goods and services across geographical and political boundaries.

This chapter provides a critical review of the writings of what are considered to be the stalwarts of the literature, from 19th century British financier David Ricardo to 20th century Nobel laureate Paul Krugman, to Marc Melitz. It will be organized as follows. To begin with, a brief history of international trade will be provided, spanning millennia. This will provide the background in which to set the various theoretical developments and thus provide context for the many developments.

This will be followed by a presentation of the various theories of international trade as well as an in-depth inquiry into the contributor's motives. As it turns out, this is key to understanding not only the resulting theory, but also its success or failure. For example, it is often assumed that David Ricardo's interest in international trade stemmed from what are known as the gains from trade – that is, the welfare gains resulting from specialization. However, if one reads between the lines, it is clear that his main motives, like that of Adam Smith, were growth related. In short, freer trade would be growth inducing by providing both the necessary raw materials as well as markets for British goods.

A Brief History of Trade

Table 1.1 presents a timeline of the history of international trade, beginning with the pre-historic era, followed by trade in early civilizations, the industrial 19th century and the 20th and 21st centuries.

Table 1.1 Timeline of History of International Trade

	Pre-Historic Paleolithic and Mesolithic Eras	Early Civilizations Neolithic Era	Industrial 19th Century	Industrial 20th and 21st Centuries
Scale	Local	Regional	Global	Global
Vertical/Horizontal	Vertical	Vertical	Vertical	Vertical
Institutions	Tribal	Empires	Free-Trade	Multinational Firms
Examples	North-American Trade Networks among First Nations	Mesopotamia, India, Egypt, Persia, Rome, Ottoman, French, British, Portuguese, Spanish	Great Britain	U.S., Europe, Japan, China

It is often said that trade whether it be at an individual or societal level is an extension of the very nature of Homo-sapiens, namely as being fundamentally social. After all, socialization is a form of exchange in which information is shared/traded. The archeological record (i.e. pre-Neolithic) is replete with examples of trading activity, typically involving various raw materials such as cryptocrystalline and amorphous stones, including chert, flint, obsidian, and chalcedony used primarily for stone making. With the advent of civilization and large-scale specialization and exchange, trade was extended beyond the various city-states, resulting in the earliest empires that were, in actual fact, large value chains with the various colonies providing raw materials in return for value added, government and culture. The most telling example is, of course, the Roman empire, built around a trading network that spanned the entire Mediterranean basin and beyond.

Throughout this period, trade was organized hierarchically – that is, around government. Prior to the 19th century, there is little evidence of market – free market – trade. Until the 19th century, merchants in the great trading empires required royal assent – or charter. Free large-scale trade between consenting parties was illegal and punishable by law.

This all changed in the mid-19th century when Great Britain, facing shortages (foodstuffs and feedstocks) innovated by repealing the Corn Laws and in the process, opening the country to free – as non-government based – trade. In essence, it decoupled trade from governance. Markets would now govern the direction of trade. In actual fact, free trade was not a disavowal of the empire, but rather, an appendage in so far as the institutions of trade were concerned. In short, trade could occur both within and outside the Commonwealth.

The 20th century witnessed yet another paradigm shift in the conduct of trade, particularly with regard to the institutions of trade. In short, it marked the birth of a new form of organization, namely the trans-national or multinational company, a sort of private empire. Instead of exporting goods, these companies exported themselves in the form of foreign branch plants serving the local market(s). In addition to these horizontal multinational companies were their vertical equivalents, investing in upstream – mostly raw materials – foreign entities. Like early empires, this was in large measure a response to feedstock shortages. A good example is the U.S. steel industry's massive mid-20th century investment in the rich iron-ore deposits of Northern Quebec.

Today, these giant companies control roughly three-quarters of world trade, leaving little room for the market. Decisions that impact the four corners of the world trading system are made in boardrooms across the developed world. Companies like General Electric, General Motors, Toyota and Volkswagen literally control whole sectors of the world economy.

With the benefit of hindsight, it is abundantly clear that any attempt at understanding trade today must take these facts into consideration. Anachronistic models and approaches that date back to the early 19th century, while informative, must be seen for what they were – namely attempts by moral philosophers to understand an increasingly complex interplay of factors. One such factor is the development of new processes and products – in short, technological change. As pointed out, the inflection points in the history of international trade were the result of new products and processes, the steam engine and the electric motor being two cases in point.

Trade Theory

As pointed out, international trade is an activity that is as old as time. Prehistoric peoples engaged in trading activities that went beyond regional/national boundaries.. Yet, the study of trade is a relatively recent development. Empires characterized most of the history of civilization, a

period of many millennia. Why is it then that the study of trade only emerged in the early 19th century?

While we do not pretend to know why, a number of possibilities arise. First, interest in trade coincided with the beginnings of the industrial revolution. Hence, it could be argued that it somehow had to do with the changes being thrust upon Great Britain – to the Boulton-Watt reciprocating, dual-acting steam engine which accelerated material processes, thus increasing productivity and output growth. It could also reasonably be attributed to the enlightenment which witnessed the emergence of a number of fields of inquiry.

What stands out in this period is the focus or emphasis on free trade. It bears reminding that in the mid-17th century, trade occurred within well-defined empires. Extra-empire trade was rare and typically conducted by governments (e.g. trade between the kings and queens of England and France). One can only surmise that this situation was viewed as an impediment to Britain. But why? Why the push for free trade? Was it due to the standard gains from trade argument? Or was it something else? After all, just why British political economists (moral philosophers) would be suddenly interested in the welfare of the Portuguese is somewhat of a mystery.

Or was it something else? We know that Adam Smith's espousal of free trade was based in large measure on his view that "specialization is determined by the extent of the market" by which it should be understood that the adoption of the Watt steam engine was conditional on the extent of the market, and free trade provided a solution. Put differently, by extending markets, free trade was growth inducing. Yet, nowhere in the literature is this noted.

Another growth-related impediment was rising wages, owing to the rising price of corn. Higher wages cut into profits, savings and investment. As industrial towns increased in size, the demand for foodstuffs increased. The Corn Laws, put in place by the Lords, were as such *de facto* growth reducing. Free trade in corn, it therefore follows, provided a way out. Cheaper imported corn would lower the pressure on wages, increase profits and investment and ultimately be growth inducing.

Yet another growth-related impediment was the paucity of industrial feedstocks, particularly cotton. The U.S. war of independence had dire consequences for Great Britain as it no longer had access to U.S. cotton, a staple in the burgeoning textile industry. Free trade with its former colonies (and new slave states in the what was the newly opened territories of the Louisiana Purchase would also be growth inducing.

Horizontal Trade Theory in an Increasingly Vertical Trade World

Ironically, the first forays into the formal study of trade approached the subject matter from the horizontal trade point of view, namely that trade involved the exchange between countries of finished goods. In Ricardo's case, it consisted of wine and cloth. Yet, at the time, Great Britain's trade was increasingly vertical with industrial feedstocks and foodstuffs being at the top of the list. The mechanization of the textile industry increased the demand for cotton, silk, wool and linen, well beyond what it could produce locally. Yet, nowhere in the literature is there any mention of this, raising the question of why? Why was vertical trade not so much as mentioned?

The reason, we submit had to do with the political economy of trade at the time. It was clear to most European countries that Great Britain was well on the way to dominating manufacturing. The steam engine and the resulting high-throughput mass production techniques lowered substantially its costs, providing it with an absolute advantage in virtually all industries and moreover had dire implications for its trading partners. Clearly, if nothing was done, it would dominate manufacturing, becoming the highly touted workshop of the world.

One could argue that the choice of couching the analysis of trade in terms of finished goods was, in part if not in whole, an attempt to allay these fears. Ricardian trade theory, by invoking comparative as opposed to absolute advantage, was an attempt at showing, analytically, that across-the-board absolute advantage (attributed to Portugal) would not spell the end of cloth manufacturing in what Ricardo described as the less-productive U.K. One cannot but be struck by what was a form of pandering to its trade partners and the rest of the world, all in the name of promoting Great Britain's industrial dominance.

Evidence that Ricardian trade theory had more to do with the political economy of trade and less to do with the science of trade comes in the form of subsequent developments, namely the absence of. It did not set off a flurry of activity whether theoretical or empirical. Despite its increasingly important role in industrialization (as a source of feedstocks), little became of Ricardo's initial insights.

In fact, the only follow-up came in what can be viewed as an out and out rejection of free trade by German political economist Friedrich List who is known as the father of protectionism. After spending time in the newly-formed United States of America where tariffs had been put in place by the Federalist Alexander Hamilton and subsequent Administrations, List developed the theory of protection, known as the infant industry argument

whereby tariffs can be justified on the grounds that they allow a country to establish an industry. As would be the case throughout the 19th century, countries in Europe and North America set their sights on imitating the industrial miracle that was taking place before their eyes in Great Britain. They too would partake in the revolution that was sweeping the world.

A Century-Old Hiatus

By the end of the century, the writing was on the wall. The world knew next-to-nothing about the causes of trade. Rather, its knowledge consisted of a hypothetical result, namely the notion of comparative advantage, a result that was never validated empirically. While countries had industrialized and trade volumes had soared, our knowledge was virtually non-existent, begging the question why? Was it that the gains from horizontal trade described by Ricardo were no longer an issue, or was it that the various impediments to growth described above had been overcome?

All of this would change in the 20th century, the result of world wars and the arrival of a new world power that would challenge Great Britain's stranglehold on world trade and finance, namely the United States. Largely the result of a new power drive technology (electric unit drive) and the introduction of a whole host of new, electricity and fossil fuel-powered goods, it would come to dominate not only trade, but investment (direct and indirect) and finance. Trade would never be the same. Not only would the U.S. export its goods and services, it would export its companies known today as U.S. multinational firms.

But the first salvo in so far as our understanding of trade was concerned came in the wake of World War I, in Sweden to be precise.

Eli Heckscher and Post-WWI Tariffs

Post-WWI Europe was a chaotic scene. Countries' industrial capacity had been dealt a severe blow. The gold standard had been decimated. Exchange rates were free to vary. And many governments took advantage of this newfound freedom to devalue their currency in the hope of stimulating their economy. Many countries including the U.S. responded by raising tariffs, fearing an onslaught of foreign products. So too did Sweden. As it turned out, this raised an interesting question, namely which of labor or capital benefits the most from tariffs.

Unfortunately, there was no way to know. Ricardian trade theory excluded capital, focusing on labor. This led economic historian and Stockholm School of Economics' director Eli Heckscher to develop a more

inclusive framework, one more suited to addressing this question. In short, he integrated neoclassical production and consumption analysis into a 2x2x2 model, two country, two goods, and two factors, capital and labor. To make the model tractable, he would assume that factors are mobile within sectors, but immobile across countries. Also, technology would be free – in other words, countries would have access to the same production techniques.

To render the model tractable, he assumed that the two countries in question had access to the same. It is important to bear in mind that it was not his intention to develop a general theory of international trade, but rather a framework in which to answer the distributional questions related to tariffs.

The result was an updated Ricardian model in which neoclassical production and consumer theory replaced Ricardo's classical production theory. Clearly, it represented a significant improvement as it could now be used to address a panoply of questions.

Pax Americana and the Heckscher-Ohlin-Samuelson Model

By the end of World War II, the world order had radically changed. Sitting atop the global economy was the U.S. whose economy had been spared the devastating destruction of the war. From a former colony of Great Britain, it now stood tall, exporting its goods and firms to all four corners of the world. Pax americana is how history remembers this period.

From a nation that had single-handedly invented protectionism and honed the fine art of erecting trade barriers, it had become the dominant exporting nation on the planet. The Republican Party, the party of tariffs, had a trade epiphany, embracing free and open world trade.

The epiphany percolated down to the scholarly level. U.S. scholars would now turn their attention to understanding trade, if only to justify or rationalize U.S. dominance. But the problem was how? Clearly, Ricardian trade theory wouldn't do for the reasons mentioned above. This would ultimately lead to a renewed interest in trade theory based on the little-known writings of Eli Heckscher and his student Bertil Ohlin.

In what was the heyday of formal neoclassical analysis, MIT economics professor Paul Samuelson would generalize the ideas of Eli Heckscher and Bertil Ohlin into a full-fledged theory of international trade based on factor endowments. By categorizing goods as either labor or capital intensive, they could show, analytically the direction of trade given a country's endowment of the two factors. U.S, foreign trade would reflect the country's abundant

capital (relative), while its trading partners' would reflect their abundant labor (relative). What was previously believed to be arbitrage via international factor markets would now occur on product markets. Capital abundant countries would export capital via capital-intensive goods, while labor abundant countries would export labor via labor intensive goods. In short, factor proportions would dictate the direction of trade. At long last, the profession had a model of trade that was not only plausible, but consistent with neoclassical analysis of production and consumption.

Leontief and His Paradox

Unfortunately, the honeymoon was short lived. The Heckscher-Ohlin-Samuelson model of trade faced its first test in the mid-1950s when a German-Russian economist Wassily Leontief whose specialty was input-output analysis decided to put the theory to the test. With data on factor intensities and trade by industry, he constructed indices of labor and capital intensities for U.S. exports and imports, the idea being that the U.S. with its abundant capital would be a net exporter of capital and its trading partners would be net exporters of labor. In other words, the index of relative capital-labor intensity of U.S. exports would be greater than the same index of imports. It bears reminding that this was a momentous event as it represented the first time a trade theory would be tested scientifically – that is, by turning to the data.

The results were vexing, to say the least. The U.S.'s exports were found to be less capital intensive than its imports. In other words, far from exporting capital, it was importing it. And its labor abundant trading partners were importing labor and exporting capital. The data had turned the model on its head.

Bowen, Leamer and Sveikauskas: The Final Nail in the Coffin

After the dust had settled, most agreed that the Heckscher-Ohlin-Samuelson 2x2x2 model was oversimplification of trade in general and U.S. foreign trade in particular. Among its shortcomings were (i) its rather simplistic production technology (ii) its restricted nature -two countries (iii) its failure to model world trade as opposed to the trade of one nation. In short, international trade was a more complex phenomenon that previously believed. Put differently, the post-WWII world of trade was a far cry from David Ricardo and Eli Heckscher's hypothetical world.

This led to the generalization of the model by Jaroslav Vanek in 1962 to the case of *m* goods, *n* countries and *p* factor inputs. The result was the Heckscher-Ohlin-Vanek model of world trade. In roughly the same time, a group of like-minded trade economists undertook what was to be a colossal undertaking by building a world trade data base with which to test the model. The challenge was immense: finding comparable data on exports, imports, and factor inputs for multiple countries. By 1988, the results were in. In a paper published in the American Economic Review, they reported their findings. In short, the results invalidated the theory. Relative factor endowments could do no better than a coin toss to predict the direction of trade. Moreover, capital abundant countries were found to export labor and import capital via the factor content of their exports and imports.

The demise of the factor-proportions approach to trade was, understandably, a major blow to the profession. After all, it had held the promise of a rigorous, theoretically-consistent approach to trade, one grounded in the neoclassical tradition. However, with the benefit of hindsight, specifically its somewhat checkered history, one could argue that this was not altogether surprising. After all, *ab ovo* it was never intended to be a general theory of international trade. Eli Heckscher had originally developed a model/analytical framework to address a specific question, namely how tariffs affected factor payments (wages and profits). Its assumptions were as simplifying as they were unrealistic – at least, in so far as its general applicability was concerned. To argue that countries have identical process and product technologies as well as tastes was unrealistic to begin with, especially in the early 20th century when technology was in a state of constant flux. To argue that the U.S.'s post-WWII trading partners had identical technologies was a stretch in anyone's book. And secondly, to argue that labor and capital were immobile was also a stretch. Again, the early 20th century witnessed the emergence of transnational corporations, moving resources seamlessly across borders. All in all, it was flawed from the start, despite being theoretically attractive – and an apparent improvement its Ricardian forebearer.

Intra-Industry Trade

Not only did the data not support the Heckscher-Ohlin-Vanek theory of international trade, they also brought to light another statistical anomaly, namely that most of the world's trade occurred between what were similar countries, again contradicting one of the cardinal principles of endowment-based trade models, namely that trade is increasing in asymmetries. As it turned out, most of world trade occurred between industrialized G7

countries, commonly referred to as the North. North-North trade accounted for roughly 70 percent of world trade, while North-South, the remaining 30 percent. South-South trade was negligible.

This ultimately led to what are referred to as Krugman-style models based in large measure on Dixit-Stiglitz preferences, differentiated products and economies of scale. According to these models, welfare is increasing in product variety. As trade increases the latter, welfare increases as consumers have access to more and more varieties.

Horizontal Trade Hysteresis

David Ricardo's decision to focus on horizontal instead of vertical trade has loomed large in our centuries-old attempt to understand international trade. Most if not all of the models and theories taught in undergraduate and graduate courses focus on horizontal trade within what is essentially a Walrasian market setting, Marc Meltiz's work being a case in point.

However, there is hope on the horizon, hope that the profession will see trade for what it is, namely largely vertical, consisting not of finished goods against finished goods, but of value added against value added. In short, of describing trade in the 19th British century, the 20th American century and now the 21st century Chinese century. This is reflected in the WTO-OECD's 2011 project to shift the focus of trade data from total traded value to value added traded – that is, trade in value added. It is hoped that if successful, it will provide a more accurate, unbiased portrait of trade relations among and within countries. Another example of this shift is the recent focus of trade in tasks. In short, goods are broken down into a series of tasks or links in supply chains.

The Productivity Slowdown: Implications for International Trade

Just when things couldn't possibly get worse for the study of trade, an epoch-defining shock hit the World, namely the productivity slowdown, marked by a dramatic decrease in productivity and output growth, bringing to an end, three decades of record-shattering growth. In effect, growth rates plummeted from an average of five percent in the post-WWII period to a meager 1-1.5 percent in the late 1970s and early 1980s.

It's causes unknown, governments and pundits pointed to a panoply of possible causes, including growing protectionism in countries wanting to industrialize, as well as from important commodity-producing nations such

as OPEC. The antidote, many argued, consisted of reversing course and reducing barriers to trade worldwide.

This was a particularly vexing period for trade economists for a simple reason, namely that such allegations and remedies had no basis in their work – specifically, in the trade literature. The latter had virtually nothing to say about growth, focusing for the most part on welfare. While some turned to CGE (calculable general equilibrium) models to estimate the welfare effects, nothing substantial became of it. In actual fact, many of the predicted effects did not materialize.

If nothing else, the productivity slowdown served to reopen the debate over the gains from trade. As pointed out earlier, there is every reason to believe that Adam Smith and David Ricardo's forays in the field of international trade had little to do with the conventional welfare-based gains from trade and everything to do with growth – Smith invoking free trade-induced "extended markets" and Ricardo, lower food costs, and improved feedstocks. Throughout the 1980s, 1990s and 2000s countries around the world negotiated and signed bilateral and multilateral trade agreements, all in the name of growth. Without exception, these were prefaced with references to trade being growth-inducing, the most salient example being the Free Trade Agreement signed between Canada and the United States. According to Prime Minister Brian Mulroney, the agreement would result in a nine percent increase in Canadian GDP growth in addition to tens of thousands of high-paying jobs. An informal survey of the hundreds of regional trade agreements (RTAs) revealed almost without exception the stated goal of increasing growth and development.

Unfortunately, trade theorists had little-to-nothing to say about whether trade/openness was growth increasing. As if caught off guard, a number of them set out to test this proposition – that is, that openness was growth increasing, or conversely, that growth was increasing in openness. The results, as shown by Rodriguez and Rodrik (2002), were inconclusive. In short, they showed that the results that did find a positive relationship were flawed (notably with regard to the very definition of openness) and that when corrected, they showed no such result.

The Productivity Slowdown and Endogenous Growth Theory: A Lesson for International Trade

In addition to the policy fallout (i.e. globalization), the productivity slowdown had a profound effect on the very study of growth. Until then, technology had been viewed as parametric – that is, as being exogenous. While there had been work in the 1950s and 1960s on the sources of

productivity and hence output growth, the literature (i.e. the Harrod-Domar and Solow-Swan models) assumed it to be exogenous. All of this changed in the 1980s and 1990s when the profession literally mobilized with the hope of (i) better understanding the underlying causes and (ii) design policy measures to restore what had been three decades of record growth rates.

Despite the lack of success on both of these fronts, the writing on the wall was clear. Growth theorists could no longer wave their hands – the time was nigh, the science would need to understand the forces driving productivity growth. In many regards, there is a lesson in this for the international trade literature. If we are to undertand the forces that shape trade, we have to go beyond parameterizations, beyond randomness, beyond the obvious. In short, we need to understand the forces that underlie the process and product innovations that have coincided with the inflection points in international trade. This volume, endogenizing innovation and technological change, is an attempt at doing just that.

Summary and Conclusions

As we have attempted to show, the history of trade theory has been checkered to say the least. From Adam Smith's plea in favor of free trade to modern-day models, our understanding of the forces which determine trade (and growth) is scant at best. Which is somewhat surprising given the time and effort the profession has devoted to the field – a period of over two centuries.

However, the best indictment of present-day trade theory comes from the field itself, notably from the popularity of what is a non-mainstream approach to understanding trade known as competitive advantage, the brain child of Harvard Business School economist Michael Porter. It is often said that the proof of the pudding is in the eating. In this case, competitive advantage-based analysis has been a resounding success as measured by the sheer number of books and articles written on the subject and the millions in sales. Governments and managers alike have invested massively in his work.

This success can be explained in large measure by failure, specifically the failure of the economics profession to generate empirically-consistent, policy-amenable models and theories of international trade and investment. More to the point, since its inception, trade theory has been painstakingly abstract, empirically suspect, and policy implication poor. So, when governments turned for guidance in the growth-obsessed 1980s and 1990s, they turned to what has to be viewed as second-best, or even third-best work on trade.

This, however, summarizes what was and what is. The relevant question, in so far as this chapter and the book as a whole is concerned, is what does all of this say about where trade theory can go from here? In other words, what are the lessons and clues of the past that can guide future work, including this book?

Guiding Principles for Future Work

If history should be our guide, the trade literature should:

1- Focus on trade in value added (TiVA), and not on goods. Supply chains are global; trade theory should reflect this.
2- Trade models from David Ricardo to Marc Melitz have assumed a given technology or set of technologies (product/process). Put differently, technology broadly-defined has been treated as exogenous. Taking a cue from new growth literature, future trade models will need to go beyond this assumption and endogenize technology – or, at best, attempt at endogenizing it. For example, technology-based cost advantages do not fall like manna from heaven but are the result of managerial and technical talent. In other words, future models have to go beyond the obvious, beyond the
3- Factor endowments need to include all possible inputs, not only the traditional ones (see Bowen, Leamer and Sveikauskas (1987)). This includes countries' endowments of innovators, of artists, of scientists, of engineers. Further, given the multitude of inputs, there is a pressing need for an ordering or hierarchy of inputs. In other words, not all inputs are created equal.
4- The bulk of work in the field has for the most part implicitly assumed that trade occurs in what are Walrasian-style markets, yet the evidence shows that most trade occurs within large vertically and horizontally integrated multinational firms. This very fact must be recognized in future work.
5- Future work will need to focus on the institutions of international trade from the market to large vertically- and horizontally-integrated multinational firms, the top 500 of which account for a large part of international trade.

2

REHABILITATING THE FACTOR-PROPORTIONS THEORY OF INTERNATIONAL TRADE

Abstract

The Heckscher-Ohlin theory of international trade is an enigma of sorts. Despite being falsified on numerous counts (Bowen, Leamer and Sveikauskas 1987, Trefler, 1995), it persists as the core theory of international trade, found both in undergraduate and graduate textbooks, not to mention in much research and policy. Clearly, while it has failed to be confirmed by the data, the notion that factor proportions motivate trade, whether at the regional or national level, continues to hold sway. This chapter is an attempt at rehabilitating the factor proportions hypothesis (FPH) as a theory of interregional and international trade. Its main premise is simple and straightforward, namely that the Heckscher-Ohlin Hypothesis (HOH), formalized in large measure by Paul Samuelson, is one—but not the only possible—formalization of the FPH. An alternative formalization, based on a more realistic set of assumptions (endogenous technology, mobile capital and labor) is presented, tested and confirmed by the data. It concludes by examining the policy implications.

Introduction

Despite being rejected empirically, the Heckscher-Ohlin (H-O) theory of international trade remains at the core of trade theory and, to a certain extent, trade policy, owing in large measure to its intuitive appeal. This chapter is an attempt to rehabilitate the Factor Proportions Hypothesis (FPH) of international trade. However, unlike recent attempts (Trefler 1995, Trefler and Zhu 2000), it seeks to recast the theory from first principles. The gist of our argument is simple, namely that the failure of H-O trade theory owes in large measure to a theoretical misspecification. More to the point, the 20th century witnessed paradigm shifts in economic fundamentals. Fueling the latter were two developments, namely modernity (Bresnahan and Trajtenberg 1995, Helpman and Trajtenberg 1996) with the accompanying vertical and horizontal production differentiation, and secondly the

development of the transnational vertically-and horizontally-integrated corporation (Hymer 1976, Dunning 1981). Both we argue had far-reaching implications for the factor-proportions theory of trade. For example, the ability to innovate and the resulting process and product technologies varied across regions and countries and like other endowments became a key determinant of trade patterns. Unfortunately, these were ignored by both Eli Heckscher and Bertil Ohlin, and later by Paul Samuelson and others who formalized the relative endowments theory of international trade.

It will be shown that when the factor-proportions theory of international trade is set in the appropriate theoretical construct (e.g. one that includes a region/country's ability/endowment to innovate and vertical specialization), then most if not all of its predictions are borne out by the data. In other words, had Eli Heckscher, Bertil Ohlin, Paul Samuelson and others cast the relative endowments theory of international trade in the appropriate model, then the FPH would have been confirmed by the data. Moreover, by doing so, it is no longer necessary to resort to a set of unrealistic assumptions (e.g. immobility of capital and labor) to generate predictions. As such, our task is analogous to that of Marty McFly in the movie "Back to the Future," specifically, we seek to correct what was essentially an error in Eli Heckscher and Bertil Ohlin's formalization of the age-old factor proportions hypothesis (FPH).

Other than incorporating the idea of endogenous technological change (product and process) and the transnational firm into the corpus of H-O theory, this chapter innovates in other important areas, notably in terms of the value chain. Traditionally, value chains are exogenously given. That is, for a given product, a value chain complete with multiple vertical links is defined. We endogenize them by adding what we refer to as the visions-link which as its name indicates, consists of that stage at which the value chain for a given product is conceived of. As it precedes the value chain chronologically, it is assumed to be at the beginning (apex) of the vertical value chain. We shall refer to this as the visions-based value chain (VBVC).

Another important innovation is the concept of vertical comparative advantage (Beaudreau 2011). Since time immemorial, the notion of horizontal comparative advantage has dominated the debate over trade. Implicitly, it has been assumed that goods are produced entirely in a given legal jurisdiction (state, country, etc.). The emergence and growth of the transnational firm has invalidated and continues to invalidate this assumption (WTO 2010).[1] As such, regions and countries do not have a

[1] In fact, it could be argued that trade in general since the Renaissance and even before violates this assumption. As Beaudreau (2004) argues, trade has since time

comparative advantage in the production of goods, but rather, a comparative advantage in a particular sub-process (link) or stage of production of goods. For example, resource rich regions-countries will have a vertical comparative advantage in the upstream resource links.

As our model allows for perfectly mobile capital and labor (traditional factors), the question of long-run vertical comparative advantage arises. For example, if capital and labor are free to migrate, then factor-price equalization will remove any and all forms of comparative advantage, and ultimately bringing an end to trade *per se* (Mundell 1957) or so it was believed. To address these concerns, two forms of comparative advantage are examined, namely structural comparative advantage and arbitrage comparative advantage. The former include the ability to conceptualize value chains (goods and services) and natural resources, while the latter include a capital-, labor-, or energy-based comparative advantage.

The chapter is organized as follows. It is our view that the factor-proportions hypothesis (FPH) has a history that extends well beyond Eli Heckscher's 1919 paper and Bertil Ohlin's 1935 Thesis Dissertation. Section I presents a brief history of the FPH, focusing on its evolution over time, especially in the 20th century. This is followed by our model (Section II), which we refer to as the generalized factor proportions hypothesis (GFPH). Its general nature owes to the fact that technology is endogenous and, more importantly, is determined by a country's endowment of visionaries and scientists. The predictions of the model are then presented and tested in Section III using U.S. state data and international trade data. More specifically, the GFPH predicts that regions and countries that are relatively well endowed with visionaries and scientists will export what Elhanan Helpman referred to as *Headquartering Activity* (Helpman 1984). Also, regions and countries that are relatively well-endowed in natural resources will export upstream value added, while states and countries that are well endowed with labor will export mid-stream value added (manufacturing activity). Section IV examines the policy implications, specifically regarding vertical comparative advantage—that is, link in value chain comparative advantage, not whole-value-chain comparative advantage (WTO 2010).

FPH: Literature Review

The idea behind the FPH and HOH is relatively simple, not to mention intuitive, namely that if someone has more of something relative to another

immemorial been vertical in nature. Early empires can be seen as country-wide value chains.

thing than someone else, then should trade occur, his/her something will be traded against the other thing. It matters little what the something actually is. It could be material as it could be immaterial. Examples include: charm for sustenance, organization for security, affection for wealth. In this section, we examine the FPH and HOH from a historical perspective, focusing our attention on three periods, namely the classical period (prior to HOH), the 20th Century and the 21st Century. Within each period, we will be interested in ascertaining both the breadth of the endowment (i.e. the basis of trade) and its relationship to trade in general. For example, is it restricted to material factor inputs (capital and labor) or does it extend beyond?

Trade is inherently based on the presence of asymmetries. This is true of all forms of trade, whether they be material in nature or not. For example, it holds in human relationships, where differences across individuals are a source of attraction and a basis for trade. Which leads us to our first observation, namely that because of its intuitive nature, the FPH is probably as old as human thought in general, and intellectual endeavors (writing) in particular. Put differently, any treatise, written or other, of trade would have invariably considered factor proportions as a—if not the—basis for trade.

This being said, let us turn to the question of paternity, proper. When and where did the modern FPH arise? And in what circumstances? As in all cases involving intellectual paternity, the evidence is sparse and inconclusive. Bertil Ohlin himself attributed the HOH to "Frenchworks," specifically to the writings of Jean-Charles Léonard Simonde de Sismondi who in "De la Richesse Commerciale argued "that the comparative abundance of capital and labour in different countries determines their territorial specialization as between industries requiring relatively much labour and those requiring relatively much capital." Simon Power however takes issue with this view, arguing that "De la richesse commerciale" is a work lacking in originality, being a popularization of the ideas of Adam Smith.

He speculates that perhaps Ohlin was referring to earlier French writers, pointing specifically to Turgot to whom the following quote is attributed:

> Effectively, all one need do is to reflect upon the immense quantity of charcoal used in the reduction of metal and the equally immense quantity used in the production of iron, to convince oneself that however abundant the mineral, it cannot be brought into production unless it happens to be located near a large quantity of wood and that the wood has little value. . The production and sale of iron is assigned by nature to new nations, nations which possess vast untouched forests, far from all outlets, where one finds it advantageous to burn an immense quantity of wood for the sole value of the salts that one gains from washing the remaining cinders. This commerce,

> weak in England, still flourishing in France, much more in Germany and in the North, should, following the natural course of events, be taken up in Russia, in Siberia, and in the American colonies, until such time as they themselves become highly populated, and all nations find themselves in equilibrium, and until the increase in the price of iron is strong enough to renew interest in its production in those countries where it had been abandoned, the result of not being able to compete with the poorer nations. (Power 1987, 293)

He then goes on to dispel this view, pointing out that Turgot himself was strongly influenced by the English economist Josiah Tucker. He concludes by noting that the HOH has a "far longer history that Ohlin was aware of, and it would seem most unlikely that it was first touched upon….in French works." We agree and hasten to add that the equivocal nature of its historical antecedents speaks in large measure to the intuitive nature of the FPH. We would go further and add that the FPH is as old as trade itself, extending back millennia to the early empires and beyond.

It is interesting to note that Eli Heckscher was first and foremost an economic historian and author of a highly regarded "history" of mercantilism. It could be argued that anyone studying the history of early empires could not but hold the FPH as the guiding principle underlying world trade.

This brings us to Eli Heckscher's seminal 1919 paper in which he presents what will become the HOH for the first time. Specifically, he examined trade through the prism of factor proportions, focusing on three inputs, namely land, labor and capital. Technology was assumed to be symmetric, making for the situation in endowments and factor intensities determined trade flows.

Clearly, this assumption was critical. Unlike the Ricardian model where comparative advantage was based in large measure on technological asymmetries, Heckscher had leveled the playing field, so to speak. With the benefit of hindsight, this assumption seems both misguided and misplaced. After all, Heckscher was an economic historian, having written the history of British industrialization. But more importantly, Heckscher wrote at a time of massive technological change in the form of the second industrial revolution. Ironically, he was unable—or unwilling—to acknowledge a nation's endowment in science as a possible source of comparative advantage.

The second industrial revolution witnessed paradigm process and product innovations, not to mention the shift of economic, military and political power to the United States. U.S.-based multinational firms with their new process and product technologies conquered the planet, including Sweden. Great Britain was in decline, as was most of Europe. In short, if