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The Evolution Dynamics and Trends of the Content of Chinese Exports from 1995-2011

Megan Kerbs
Union College - Schenectady, NY

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by

Megan K. Kerbs

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ABSTRACT

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There is no question that China's role in the international economy has grown over time, as it seems to be claiming more and more of center stage in the global arena. Back in the early 1990's, the phenomenon of globalization enabled China to expand its reach, inserting itself into intricate production hierarchies that began to define the global marketplace. China experienced a massive export boom in 2000, and since, has evolved to become a highly sophisticated, high-tech country that now plays an integral role within not only the East Asian region, but also the rest of the world. This thesis will examine China's extraordinary growth through the analysis of the evolution, dynamics and trends of the content of Chinese exports from 1995-2011. It will focus specifically on China's electronics industry—since level of technology is often indicative of level of development—in order to make speculative conclusions about China's future growth and sustainability. Ultimately, through a regional cross-comparison and the examination of extensive trade data, this paper seeks to investigate the significance of China's location within the larger East Asian region and whether this aspect of regionalization either enhances or limits China's technological development and potential growth. The results obtained provide evidence that due to East Asia's distinct character, indeed, much of the significance behind China's success lies in the regionalism that defines East Asia. Furthermore, despite China's export growth and the increase in DVA seen within its electronics sector, a "leveling off phenomenon" set in in 2004 and has continued to prevail.

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CHAPTER ONE

INTRODUCTION

A. Background Information

Since its economic reforms began in 1978, China has experienced a rapid growth in exports, which has contributed to the country's impressive economic growth. Coinciding with this export boom has been an increase in exports of electronics, leading some scholars to assert that China is swiftly rising through the international division of labor due to the existence of its own specific effective industrial policy and providential timing (Rodrik 2006).

Others argue that China's advantages derive from its fortuitous location within the developing East Asian region. In other words, regional factors—not country factors—are critical to China's catch-up. In this version, China is the most recent member of the 'Flying Geese' theory of East Asian development, first proposed by a Japanese scholar (Akamatsu 1962), but later developed by other scholars (Cumings 1984, Bernard and Ravenhill 1995). The East Asian region is a widespread nexus of countries with diverse economic levels of development. It encompasses China, along with the countries of South Korea, Taiwan, Hong Kong, and Singapore. South East Asia—Malaysia, Thailand, Indonesia, and the Philippines—lies nearby, resulting in an extensive collection of heterogeneous countries, each of which adds its own distinct piece to the larger puzzle: Japan and its innovative, next-generation technology; Korea and Taiwan contributing advanced manufacturing, medium technology, and high- or medium-skilled labor; and China and Southeast Asia with their lower skilled workforces and labor intensive activities. Because of this regionalized nature, many scholars—including those who support the Flying Geese paradigm—assert that the complexities of East Asia's industrial production process *cannot* actually be replicated country after country. Instead, industrial

diffusion's shifting hierarchical networks of production leads to only partial dispersion into other countries' diverse frameworks (Ravenhill and Bernard 1995).

Understanding the role of regional factors in China's economic rise is important for policy and theory alike. For instance, if regional factors are critical, then this indicates that China's policies, or distinctive state-market hybrid economy, are not as important as some suggest (Naughton and Tsai 2015). It also would suggest that the prospects for development among countries that are not part of a similarly dynamic economic region would potentially be more difficult. There is something to be said for the idea that the East Asian states have a certain strength—unlike those that lie on the periphery—reflected in the nature of the region-specific networks of production and industrial diffusion, transnational capital and multinational corporations, all of which a country on the outside of this diverse East Asian region would not benefit from.

Aligned with the concept of each country adding its own special piece to the larger trade puzzle is the new trade reality that has been created by the phenomenon of global vertical specialization. Also referred to as fragmentation of production, this specialization deepens the interdependency of trade relations, as it shapes the degree of specialization of the different economies involved in the international production chain (Hummels et. al 2001). Global production now consists of a network of individual suppliers who specialize in distinct services or stages of production. Currently, production is sliced and diced into separate fragments that are then spread out across the globe. This produces the phenomenon of "trade in value added (TiVA)," a concept in which any given export, or good for that matter, can be broken down into value-added contributions from various domestic industries and various foreign industries (WTO, IDE-JETRO 2011). Now that production has been increasingly fragmented across

countries, and roughly two-thirds of international trade is trade in intermediate inputs, the effect is that countries such as China—and other major nations that are late developers—have become much more engaged in globalization (Johnson and Noguera 2012).

This has drawn significant attention to the growing awareness that conventional trade statistics may actually provide a misleading perspective of the importance of trade to economic growth (Maurer and Degain 2010). Conventional measures of gross trade flows can be deceptive in that the value of products that cross borders several times for further processing—think vertical specialization—is counted multiple times. This results in two distinct issues: first, bilateral trade imbalances, again measured conventionally; second, confusion among researchers, who attempt to accurately measure and differentiate between domestic value added (DVA), foreign value added (FVA), and gross versus net terms.

As an illustration, consider Apple's 30GB iPod video (Dedrick, Linden and Kraemer, 2011). In 2006, the Chinese export value for a unit of this model equaled $150 USD. When broken down into its component parts such as display screen, microchip and processors, how much of this $150 value is attributable to producers in China? Surprisingly, only $4 (Kee and Tang 2012). The production of Apple's iPod video has been broken down, offshored, and outsourced—as it is designed and marketed by an American company, assembled by Taiwanese manufacturers in China, and includes key parts from Japanese, Korean and U.S. suppliers—forcing us to ask the question, who captures the value generated by this enormously successful innovation? Due to the phenomenon of vertical specialization and complex measures such as trade in value added, the creation today of a successful final product in the global electronics industry—such as the iPod—spreads the wealth far beyond just the lead firm, to other beneficiaries such as partners in the firm's supply chain, or firms that offer complementary

products or services (Dedrick, Linden and Kraemer, 2011).

B. Research Question and Time Period

In order to further assess this question of value added, but at a larger scale for the whole of China, this thesis asks the following question: What are the dynamics, trends, and evolution of the content of Chinese exports? This paper will focus on the time period from 1995-2011, specifically drawing on the following four years: 1995, 2000, 2005 and 2011. The selected time period is owed to data availability within the utilized database: TiVA OECD.STAT. This Organization for Economic Cooperation and Development (OECD) database includes 61 economies, 34 unique industrial sectors, including 16 manufacturing and 14 services sectors. A focus on the chosen four years will provide an effective framework to examine changes—every five years or so—within the industry. It will largely concentrate on the electronics industry, which is referred to as *C30T33: Electrical and optical equipment* at a larger scale and category, and *C30T33X: Computer, Electronic and optical equipmen*t at a more granular scale and subcategory. My working hypothesis is that the domestic value added (DVA) category of China's electronics industry has increased since 1995, while its foreign value added (FVA) category has actually decreased.

C. Motivation and Significance of Research

So that we can thoroughly understand the economic significance of this thesis question and hypothesis, let us first examine the following hypothetical question: What is the economic significance of Good 1 having 90% of its value added done in China, while Good 2 only has 10% of its value added completed there? Similarly, what can be gathered from a good that consists of 10% DVA in 1995, but then increases to 90% DVA by 2011? These questions enable us to consider a more tangible situation regarding the significance of this paper. Now, based on

my hypothesis that DVA in China's electronics industry has increased, one could argue that this increase of DVA bodes well for China's future. Innovation, technology and "know how" are often touted as key drivers of economic growth (Mansfield 1995). It is no secret that a high-level of electronic sophistication correlates with technological innovation, which enables countries to foster economic development, improve levels of training and education, and create the opportunity for small business development and entrepreneurship. It is also important to note that as of December 2015, electronic exports make up around 24.4% of China's gross export pie. Clearly, a share that occupies one quarter of China's gross exports is significant enough to focus on and dissect. This is especially true since electronics induce innovation and dynamism, whereas the automotive industry, along with many other sectors, does not to the same extent. This results in the ability to presume the electronics industry holds relevant significance pertaining to China's future, as well as allow us to assess China's continuing economic growth and stature in the global arena.

Ultimately, the overarching significance of my empirical work and "regional" perspective is that it offers a truer picture of: one, the existence and extent of hierarchy in the international economy and in particular East Asian regionalism; and two, it contextualizes the "rise of China," which many have touted as fast and inevitable. By zeroing in on the electronics industry, I am examining whether or not there are impediments to China's future rise.

D. Structure of the Thesis

This thesis is divided into five chapters. Chapter I and V are the introduction and conclusion, respectively. The following chapters—chapters II, III, and IV—provide the basis for empirical analysis and then present the findings of that analysis. In chapter II, I review the current literature related to the content and growth of China's exports. The themes that are most

relevant and significant to this topic are the following: the Flying Geese Paradigm, East Asian Regional Nexus, Vertical Specialization, Trade in Value Added, Domestic Value Added and China's Gross Export Basket. It is by these themes that I will divide up the literature review section. In chapter III, I elaborate on the analytical framework of this paper. This section will open with an introduction to the phenomenon of China's enormous growth. Its history of reforms, changes, and major macroeconomic indicators will be discussed. China's overall export performance, as well as the performance of its electronics industry in particular, will be elaborated upon in this section, with sections on domestic value added, foreign value added, and a brief conclusion to follow. Chapter IV examines and analyzes the data and results that are found, while Chapter V reviews the conclusions from the empirical analysis. It will discuss various implications of the conclusions drawn and potentially some suggestions for the future as well.

CHAPTER TWO

LITERATURE REVIEW

This thesis studies the evolution, dynamics and trends of the content of China's exports through the examination of the Flying Geese Paradigm, East Asian regional nexus, vertical specialization, trade in value added, domestic value added and China's gross export basket. Each of the texts this paper will review contributes a new and significant aspect to the chosen theme in which it falls under. However, to my knowledge, none of these works directly ask the question that I hope to answer in this thesis: What are the dynamics, trends, and evolution of the content of Chinese exports from 1995-2011? By specifically focusing on the breakdown of gross electronics exports into domestic value added (DVA) and foreign value added (FVA), this paper's empirical scope will use largely the electronics industry to thoroughly analyze and uncover the true meaning of what an increase or decrease in DVA and FVA may mean in terms of China's future economic growth, stature, and ultimately, its sustainability.

A. Flying Geese Paradigm

The literature on the Flying Geese Paradigm (FGP) originally dates back to 1962, when Kaname Akamatsu created this concept to use as a tool when describing the regional production patterns in East Asia. His text discusses the impossibility of studying the economic growth of developing countries in modern times without reflecting on the mutual interactions between these emerging countries and those of the advanced counties (Akamatsu 1962). Akamatsu set out to explain the development trajectories of less developed countries and created the FGP as a means to do so. The lead goose in this V-shaped formation is Japan itself, while the second-tier of the model consists of newly industrializing economies such as South Korea, Taiwan, Singapore and Hong Kong. Following close behind are the ASEAN (Association of Southeast

Asian Nations) countries—Indonesia, Malaysia and Thailand—with the least developed nations in the region bringing up the rear guard in the formation: China, Vietnam, Philippines, etc. Cumings then applied this analogy to the situation in East Asia: countries are said to follow one another in a developmental trajectory where the latecomers *exactly replicate* the developmental experience of the countries ahead of them in the configuration (Cumings 1984). In other words, Japan's whole electronics industry, for example, would shift or be replicated to other countries nearby. Cumings provides a beneficial reminder that East Asia's regionalization of production has its foundations in the Japanese colonial period (Cumings 1984). Since Japanese production in countries like Korea and Taiwan was a fundamental part of the pre-1945 Japanese empire, it comes as no surprise that Japanese firms directly invested in Taiwanese industry, such as its electronics and machinery manufacturing (Cumings 1984). As a result, Japan has held a competitive advantage in these industries for quite some time, which has created the expectation that its developmental trajectory and industry production patterns are to be exactly replicated by countries around it. Cumings' perspective supports the argument that a regional perspective is vital in understanding the contemporary East Asian pattern of industrialization.

However, this Flying Geese Paradigm also consists of an opposing argument. Some scholars, such as Ravenhill and Bernard (1995), assert that because of East Asia's regionalized nature, the complexities of its industrial production process *cannot* be replicated country after country; instead, industrial diffusion has been defined by shifting hierarchical networks of production that has led to only partial dispersion into other developing countries' diverse frameworks. Because only *parts* of industries and their production processes are replicated from country to country, Japan, for example, continues to remain at the head of the V-formation that corresponds to Akamatsu's Flying Geese Paradigm. Japan is generally considered to be East

Asia's most advanced nation. Its high R&D spending, great capacity to innovate, large pool of available talent to draw from, and top-notch research institutions enable it to comfortably enjoy a competitive edge in both business and technology sophistication. As a result, Japan sustains its spot as the leading East Asian country in the FGP model of international division of labor based on comparative advantage.

Ravenhill and Bernard's argument directly exhibits the concept of fragmentation of production. As countries' production processes become more and more specialized, with each nation becoming especially talented in one or two distinct pieces of the manufacturing puzzle, the notion of fragmentation of production arises. So, because Japan continues to excel at what it is best at—innovation, for example—only parts of its industries and their production processes are replicated by and within the countries following behind it. In fact, as time goes on, certain industries may be entirely passed on to less developed countries that exist at the back of the V-formation. For example, today's textile industry has largely left not only Japan, but also South Korea and Taiwan—second tier countries in the FGP—and now resides primarily in the third tier East Asian countries such as Indonesia, Thailand and Malaysia. To sum up Ravenhill and Bernard's argument, East Asian production should *not* be viewed as a "tightly coupled process in which the rise of national economies parallels successive product cycles" (Ravenhill and Bernard 1995).

B. East Asian Regional Nexus

The role of regional factors in China's economic rise is essential to understand in terms of both policy and theory. The scholars that support the "regionalism" explanation for East Asian development assert that it is the existence of regional networks throughout East Asia—which have given rise to regionalized networks of production and industrial diffusion—that have made

the developmental paths of East Asian new industrialized countries (NICs) uniquely successful (Ravenhill and Bernard 1995). If we assume that it is indeed these regional factors that are the critical component to China's economic rise, then this indicates that China's policies or distinctive state-market hybrid economy are not as important as some suggest (Naughton and Tsai 2015). Naughton and Tsai's text argues that it is China's distinct form of state capitalism that has enabled the Chinese economic growth miracle that followed 1978. To further examine this argument, the text asks the following questions: Is China following in the footsteps of its developmental state neighbors in East Asia? Among the global spectrum of political and economic models, which are most relevant to China's future? These inquiries both relate to China's individual form of state capitalism that has various implications for industrial competitiveness, government-business relations, corporate governance and domestic welfare (Naughton and Tsai 2015). "State capitalism" emphasizes state-owned enterprises and state business, as it captures China's combination of a predominately market economy, its emerging capital markets and its large and prominent government-owned corporations. These features of the Chinese system have enabled its impressive economic and export growth, which support the argument backed by Naughton and Tsai that it is China's extraordinary growth is due to its distinct state system.

However, if we assert that the previously discussed regional factors outweigh the importance of China's policies and distinctive state-market hybrid economy, then it would suggest that the prospects for development among countries that are *not* a part of a similarly dynamic economic region—such as East Asia—would be potentially more difficult. There is something to be said for the idea that the East Asian states—unlike those that lie on the periphery—have a certain strength reflected in the nature of the region-specific networks of

production and industrial diffusion, all of which a country on the outside of this diverse East Asian region would not benefit from.

C. Vertical Specialization

The phenomenon of vertical specialization is considered by some scholars to have changed the nature of world trade, as it creates an additional component of intricacy to the dynamics of production. Dramatic changes are occurring, as production processes increasingly consist of a sequential, vertical trading chain that transcends boundaries, with each country specializing in particular stages of the production sequence of a good. In order for vertical specialization to take place, the following components must exist: 1) a good is produced in two or more sequential stages; 2) two or more countries provide value-added during the production of the good; and 3) at least one country must use imported inputs in its stage of the production process, and some of the resulting output must be exported" (Hummels, Ishii and Yi 2001). Given the proliferation of models that have been developed by trade economists to study the impact of vertical specialization on production and trade patterns, one might presume that extensive empirical documentation of the increase of vertical specialization exists. In fact, this is not the case. Hummels, Ishii and Yi (2001) originally spearheaded the analysis of vertical specialization, which led to the creation of more complex databases such as OECD that incorporated complicated measures such as value-added. Their text provides a narrower model of vertical specialization by involving the imported goods that are then used as inputs in a country's export goods. Hummels, Ishii and Yi (2001) argue that great changes are occurring in the nature of international trade pertaining to vertical specialization. By using input-output tables from 10 OECD and four emerging market countries—two of which are Korea and Taiwan—industry-level data on imported inputs, gross output, and exports enables us to conclude the following:

Vertical specialization accounts for 30% growth in these countries exports (Hummels, Ishii and Yi 2001). Clearly, this phenomenon now plays a significant role in the world of production, as it positively affects growth in a country's export levels by involving other countries and their goods—primarily inputs from developed nations that are transformed and then exported to other developed nations—into its trading chains.

To further discuss the phenomenon of vertical specialization, Amador and Cabral (2009) examine the dynamics and international distribution of vertical specialization. Using information combined from input-output matrices and international trade data, as well as a measure that identifies a country's trade flow pertaining to its VS activities, the results point to a significant increase of vertical specialization in high-technology products—in particular, radio, TV and communications equipment—over the last two decades. In addition, there is also empirical evidence that there is a sharp increase of vertical specialization activities in East Asia, specifically in the first level of new industrialized economies like Hong Kong and South Korea (Amador and Cabral 2009). Both of these findings are telling, for an increase in vertical specialization among high-technology products, especially in East Asia, will correlate with the increases and decreases in DVA and FVA, respectively, that I hypothesize have occurred within China's electronics industry. Moreover, the discussion of East Asia's geographical relevance in terms of increasing vertical specialization will greatly add to my added contributions, which are examined later on in this thesis.

D. Trade in Value Added

Due to the now very prevalent dynamic of vertical specialization that exists within and throughout the world of production and trade, the concept of "trade in value added" (TiVA) has become all the more necessary to understand. Trade in value added takes into account the

fragmentation of the value chains and provides a breakdown of gross exports by domestic and foreign origin, creating the concepts of "domestic value added" and "foreign value added" (WTO, IDE-JETRO 2011).

Trade analysts, through the value added approach, can explore new perspectives on world trade. Let us examine the following example that tangibly illustrates the significance of what "value added" entails: The redistribution of trade between Asian trading partners of the United States is commonplace due to the rapid increase in international and regional supply chains, with part of the production initially located in Japan or in other economies transferring to China. Typically, the assembly of the final products, which relocates to China, is the last stage of the supply chain, as the production of the core components remains within the original country. Thus, while customs statistics show China to be the principal country of origin for US imports—think of the "Made in China" tag we see on every Apple product, for example—most of the content of the products, as well as their economic value, is actually still originating in the Asian partner or even within the United States itself (WTO, IDE-JETRO 2011).

To further discuss the concept of trade in value added, Johnson and Noguera (2012) examine the question of how to account for the value added content of bilateral trade. They utilize the VAX ratio (ratio of value added to gross exports) as a measure of the intensity of production sharing, which can be interpreted as a metric of domestic content of exports. Through a global input-output framework used to estimate the value added content of trade, and bilateral trade statistics and input-output tables compiled from the World Bank and IMF macroeconomic and Balance of Payments and United Nations Commodity Trade Statistics (Comtrade) Database, Johnson and Noguera find that the U.S.—China value added imbalance is 30-40% smaller than the gross imbalance, which shows that bilateral value added trade imbalances differ from gross

trade imbalances. A significant component of this imbalance has to do with the measurement of trade in value added on a net basis at each step of the vertical trading chain, while gross exports are measured in gross terms (WTO, IDE-JETRO 2011).

As Johnson and Noguera's findings show, the problem of trade imbalance due to difference in measurement method is substantial. As a result, significant attention has been drawn to the growing awareness that conventional trade statistics may actually provide a misleading perspective of the importance of trade to economic growth (Maurer and Degain 2010). Again, conventional measures of gross trade flows can be deceptive in that the value of products that cross borders several times for further processing—think vertical specialization—are counted multiple times. Therefore, a general confusion has been said to have risen among academics, political economists and trade analysts, all of whom attempt to accurately measure and differentiate between domestic value added (DVA), foreign value added (FVA), and gross versus net terms. The evolution of global supply chains and the related expansion of vertical trade call for the development of new measures of international trade (IDE-JETRO). The quantification of cross-boarder production connections is absolutely critical in order to answer a wide range of important empirical questions in both international trade and macroeconomics.

While it is necessary to examine various academics' findings on the concept of trade in value added, we cannot forget to ask one of the simplest yett most vital questions—Why is this important? As previously mentioned, with global production sharing expanding, gross trade flows are providing an increasingly misleading picture of the economic importance of trade and production. Measuring trade on a value-added basis allows us to better grasp key features of international trade (Logan 2013). For example, exports calculated on a value-added basis—instead of on a gross basis—are a smaller portion of global activity since imported intermediates

are accounted for but *not* included in gross exports (Logan 2013). Additionally, by tracking products through their respective production processes and across countries to their final export destination, value-added more accurately portrays which countries account for the final demand of exports (Logan 2013).

Pertaining to trade in value added for China, much confusion exists regarding COEs (Chinese owned enterprises) that are located and operating in China versus FIEs (foreign invested enterprises) that have opened subsidiaries within China. Establishing an FIE is a common method of launching an operation in Asian countries, especially in China. While both types of firms may be situated in China and thus technically generate DVA for Chinese exports, there is one especially stark difference between COEs and FIEs: while China almost always benefits from the profits produced by COEs, it almost *never* benefits from the profits that FIEs create. In order to better understand this statement, let us visualize a pie chart, with the whole being equivalent to a firm's total revenue. The full pie chart is a firm's total revenue. After taking out material inputs, you are left with a rough approximation of "value-added." The most important parts of value-added can be roughly divided into taxes for government, wages for labor and profits for owners of capital. Of these, taxes and wages generally stay in country, but as previously mentioned, profits likely differ between COEs and FIEs in terms of how they are used. FIEs are more likely to "repatriate" their profits back to their "home country" (let's say their headquarters is in Japan or the U.S., for example) or shift them to other parts of their business (let's say to build up their India operations, for example). By contrast, COEs are more likely to keep profits at home. Keep in mind this is not an absolute. FIEs might want to "re-invest" and grow in China and COEs might want to expand. However the owners of capital want to see their profits eventually, and presumably the owners of most COEs live in China and most FIEs live

abroad. So while China is home to much production and innovation, it is not actually retaining all of the earnings generated on its soil. Still, despite the fact that FIE firms in China often take their profits out of the country, they actually account for a far greater amount of "Chinese" DVA in its exports than COEs do. We will examine this fact in more detail later on.

E. Domestic Value Added

The domestic content of a country's exports is often referred to as the "domestic value added" content of exports. In such cases, the value added of an exported good encompasses the good's total value minus both direct and indirect imported inputs, and also includes all the domestic intermediate goods and services used for the production of the good (IDE-JETRO 2015). The domestic content of any export will include the direct value added from the exporting industrial sector plus the value added from other domestic sectors that are indirectly embedded into the production process (IDE-JETRO 2015).

China's rather remarkable record of sustained growth has caused its developmental trajectory and contributing growth components to be scrutinized by both academics and policymakers alike. Hong Ma, Zhi Wang, and Kunfu Zhu (2013) examine China's domestic value added by focusing on the difference between Chinese exports by foreign invested enterprises (FIEs) compared to Chinese exports by Chinese owned enterprise (COEs), in order to gain a better and more accurate sense of a measurement of DVA generated from China's exports. Utilizing an accounting framework with a precise estimation method that takes into account both the production and trade activities for FIEs and COEs, the scholars' preliminary results indicate that in 2007, FIEs functioning in China created almost half of Chinese DVA in Chinese exports while COEs only contributed less than 5%. Even more significant is the fact that foreign factory owners in Hong Kong and Taiwan, specifically, captured a little over half of the value of these

exports. The results of this text speak directly to the content of China's exports, the topic of this thesis, which allows me make proper conclusions about various dynamics and trends pertaining to the changes in value added of its exports over time. In addition, its focus on the separation between FIEs and COEs creates an added layer of sophistication to my analysis of the content of China's exports.

Also related to the concept of domestic value added is Hiau Looi Kee and Heiwai Tang's (2012) work that focuses on the DVA in China's exports but at the granular firm and industry levels. The motivation behind this research stems from China's export success, as the paper uses customs transaction and firm-level production data to ultimately conclude the following: There has been an increase in the domestic value added ratio (DAVR) in Chinese processing exports—exports which utilize a disproportionally high percent of imported intermediates—which has thus led to an increase in the DAVR in overall exports. Kee and Tang (2012) assert that this increase is due to within-firm substitution of imported materials with domestic materials, which is largely driven by increasing foreign direct investment (FDI) that gives rise to domestic production of materials. This text effectively proves that DVA in China's exports has indeed increased over time, which I have hypothesized. In addition, it elaborates on a potential reason as to why this increase has taken place, a topic that I will touch upon later on in this paper. Most importantly, Kee and Tang (2012) closely examine processing trade, which directly speaks to the trade imbalance that results from trade in value added measurement difficulties. Because processing trade presumably has low domestic content, any policy analysis based on aggregate statistics of gross trade flows could be highly misleading.

F. China's Gross Export Basket

It is no secret that over the past decade China's exports have boomed. In fact, over the

past fifteen years they have jumped more than tenfold and as a result, China overtook Japan as the world's third largest exporter in 2004. Pertaining to China's exports, there are two generally acknowledged arguments in the scholarly world. The first is of a more technical nature, in that it is derived directly from the breakdown of trade. By focusing on the electronics market, trade analysts are able to uncover the true meaning behind thousands of imports and exports of both intermediate and final goods in and across China, East Asia, and the world. Because electronics products are assemblages of intermediate inputs imported into China from mostly other East Asian countries, conclusions of China's technological capabilities should not, and cannot, be judged on its exports. The sophistication of these imports that come from other advanced countries must also be considered.

This idea goes against the arguments of various scholars, such as Dani Rodrik (2006), for example. Rodrik examines the significant question of "What's So Special about China's Exports?" Using an indicator that measures the productivity level accompanying a country's export basket, along with data that includes over 5,000 products up to the 6-digit commodity level, Rodrik's findings are numerous. First, Rodrik asserts that government policies have assisted in nurturing domestic capabilities in consumer electronics and other advanced areas that would most likely not have developed in their absence. Second, China has accomplished growth, improved education, health and more, using its *own brand* of experimental gradualism: increasing dependency on markets and price signals, yet doing so within the boundaries of highly unorthodox institutions (Rodrik 2006). Rodrik considers this term to be the unconventional way in which China has achieved global integration. Most importantly, he touches upon the significance of the success of China's export industries—such as the consumer electronics industry—stating that it is actually unexpected for a country at China's level of income to have

as sophisticated an "export basket" as it does. Rodrik asserts, based on the portfolio of China's electronics exports, the country's technological sophistication has grown very fast. He then builds upon this statement by ultimately asking: "Will China continue to latch onto higher-income products over time?" This question will be considered in a later part of my thesis that addresses China's future sustainability based on conclusions drawn from the evolution and visible, traceable trends within its electronics industry. However, it is important to note—Rodrik does not consider the existence of fragmented production, an implication that I deem essential to take into account when contemplating China's technological proficiencies. That being said, to the degree that I am able to show that China's DVA has increased over time, Rodrik's argument and findings nicely dovetail with mine.

G. Conclusion

Turn over your iPhone, iPad, iPod or MacBook—along with many other types of electronics—and you will see the "Made in China" tag stamped across the back. As a result, there is a common misconception among the general population that everything coming out of China is actually produced there. In reality, China is actually the last stage of the East Asian production process. In order to further examine these East Asian trade and manufacturing networks, this thesis studies the evolution, dynamics and trends of the content of Chinese exports from 1995-2011, while specifically focusing on its electronics industry. Existing literature on the concepts of the Flying Geese Paradigm (FGP), East Asian regional nexus, vertical specialization, trade in value added, domestic value added and China's gross export basket provide telling information and insight into the domestic value added (DVA) of China's electronics industry, as well as the potential significance that this industry, and an increase in its DVA, holds for China's future.

While a large portion of this thesis speaks to the importance of thinking about and measuring the world of trade in terms of Trade in Value Added (TiVA), it is also imperative to highlight that there are implications that exist as a result of thinking about the world in these terms. First, there is the question of how to measure not only the DVA or FVA in China's gross exports, but also the *sophistication* level, a concept that we have previously examined in Rodrik's work. He asserts that based on the portfolio of China's electronics exports, the country's technological sophistication has grown very fast. Thus, we ask: Is China rising through the international division of labor? Is it accelerating into the industries where our competitiveness lies? For example, once China starts really penetrating into technological frontiers, it becomes more of a direct threat to the leading East Asian countries, i.e. Japan. As mentioned previously, China's electronics industry now makes up 24.4% of its gross export pie, which represents a definitive increase over time. This positive shift clearly shows that electronics exports have been a legitimate contentious point and may accurately be interpreted as an indication of China's sophistication and potential manufacturing threat to advanced countries. In fact, a recent buzz has arisen amongst both academics and the public alike about China's manufacturing capabilities. In May of 2015, the Economist published an article titled "Made in China," which speaks to the rise of China's electronics manufacturing sector: "In many industries China is still learning from the world, say the engineers, but its electronics manufacturing is so advanced that 'the world is learning from China'" (The Economist 2015). Clearly, there is no question that China's manufacturers have risen to become export powerhouses. Now, it is only a matter of time until its electronics industry truly becomes cutting edge within East Asia.

An additional implication that exists as a result of thinking about the world in terms of

TiVA is the widespread problem of trade imbalances that are a direct result of measuring the world of trade using two very different methods. To explain more clearly, let's use the example of the U.S-China bilateral trade deficit that exists. In gross terms, an export *from* Japan that is only *used* in China and then exported from China to the United States, gets counted as a Chinese export instead of a Japanese export. In other words, whatever is imported *into* China goes into its gross imports and whatever is exported *from* China goes into its gross exports. As a result, the bilateral deficit that we have with China is *overestimated* since part of it is the result of Japanese goods *inside* Chinese exports. So, our deficit with Japan should actually be higher—based on this example—than it is with China. Clearly, bilateral value-added trade imbalances differ from gross trade imbalances, so not carefully differentiating between the two creates inaccurate bilateral trade deficit numbers, which thus generates a false image to the entire world of the trade relationship between the U.S, China and Japan.

I will continue to expand upon the evolution, dynamics and trends of the content of Chinese exports, from 1995-2011, in the following section by examining the analytical framework of this paper.

CHAPTER THREE

ANALYTICAL FRAMEWORK

As this thesis aims to study the evolution, dynamics and trends of the content of Chinese exports from 1995-2011, while specifically focusing on its electronics industry, it is essential to first understand the context of this phenomenon of extraordinary growth that we are examining within China. Section A will focus on China as a whole, by initially providing a general context for this recent growth, and afterwards looking specifically at various reforms and macroeconomic indicators that have taken place. Section B will draw upon China's export performance, first at a macro level and then zeroing in on its electronics industry specifically in section C. Section D will address domestic value added (DVA) and section E foreign value added (FVA), both explaining what these concepts entail and what can be derived by looking at China's DVA and FVA numbers within its electronics industry. The conclusion will further explain what I am going to do with this analytical framework; what sort of data I am going to use in chapter IV; and from where this data has been extracted.

A. Introduction: China and its Enormous Growth

The "Made in China" label imprinted on the back of our Apple iPhone, let's say, speaks to the generally believed notion that this sophisticated device is coming entirely from China. However, when taken apart, the iPhone—a marvel of design, functionality, and engineering—consists of bits and pieces made in a variety of countries. Clearly, China is not doing all of the manufacturing. Take the high-tech, highly valued smartphone processor, or likewise, the tiny camera piece that sits on front of an iPhone, for example. This camera is being produced in a place like Japan, for the companies there have the greatest strengths in the relevant technologies concerning that camera. Then, when all of the iPhone's relevant intermediate goods are imported

back to China, assembled and ultimately exported as a final product from China, it appears that this sophisticated device is coming entirely from China. Someone, somewhere, might ask: So what?

We are examining this phenomenon in the context of a country that, subsequent to its economic reforms over two decades ago, has undergone enormous changes. One of the most spectacular is its recent experience of high growth rates. This massive success stems from the initiation of market reforms in 1978, which shifted China from a centrally planned to a market based economy—in other words, from a socialist to a more capitalist type of economic system. As a result, the country has experienced rapid social and economic development. Now, with a population of around 1.35 billion people, China has recently become the second largest economy in the world and its role in the global arena has become more important and influential. GDP growth averages about 10 percent a year, which has lifted more than 500 million people out of poverty (The World Bank 2015).

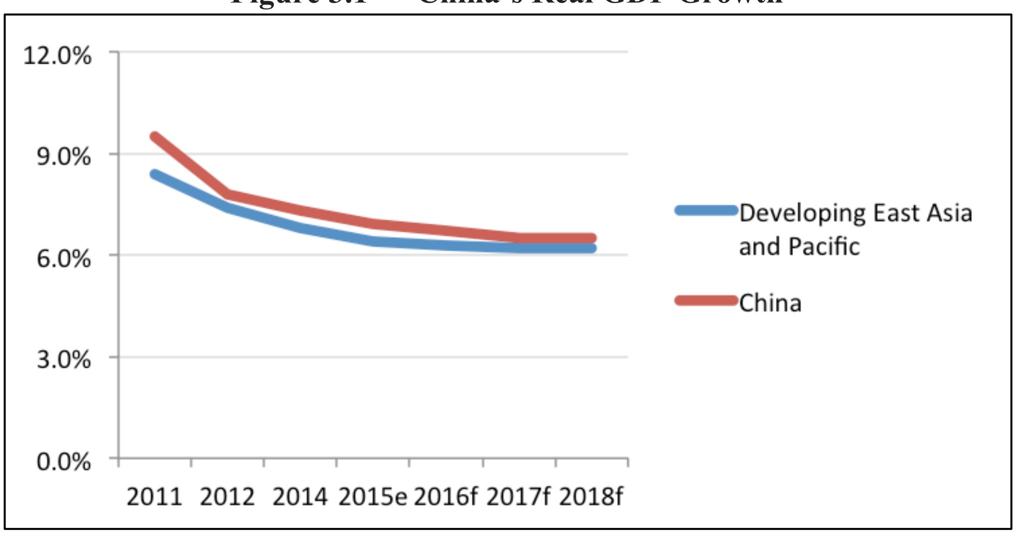
Nonetheless, China still remains a developing country, as its per capita income is still significantly less than those of advanced countries. Its market reforms are incomplete and official data show that approximately 98.99 million people in China lived below the national poverty line at the end of 2012 (The World Bank 2015). Clearly, poverty reduction remains a fundamental challenge as China contains the second largest number of poor people in the world after India. In addition, challenges such as high inequality, rapid urbanization, external imbalances and problems regarding environmental sustainability have been brought about due to the rapid economic ascendance that has recently taken place (The World Bank 2015). Furthermore, its aging population and internal migration of labor have created demographic pressures.

In order for China's growth to be sustainable and its challenges properly handled,

significant policy adjustments are required. Its 12th Five-Year Plan (2011-2015) effectively and forcefully addresses these issues. It focuses on the "development of services and measures to address environmental and social imbalances, setting targets to reduce pollution, to increase energy efficiency, to improve access to education and healthcare, and to expand social protection" (The World Bank 2015). Instead of focusing on pace of growth, China has the intention to focus on quality of life, as its annual growth target of 7 percent indicates (The World Bank 2015).

Additionally, let us further flesh out the context of China's extraordinary growth by analyzing the country in terms of some World Development Indicators provided by the World Bank database. Starting with Gross Domestic Product (GDP), the broadest measure of a country's economy, we see that China's GDP growth has actually decreased and begun to level

Figure 3.1 — China's Real GDP Growth



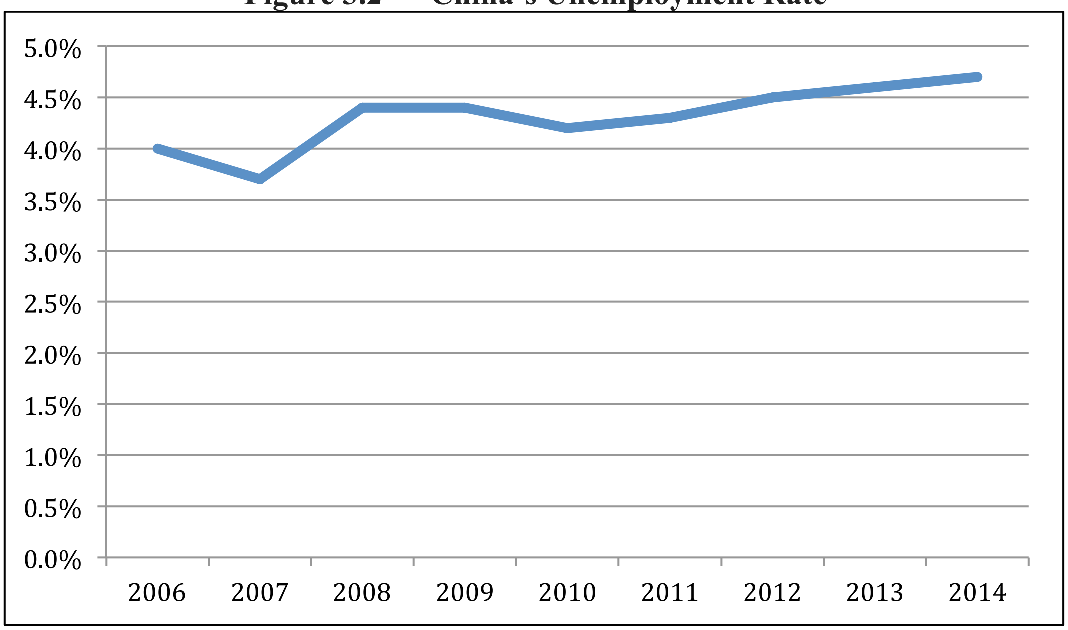
Source: Data compiled from http://databank.worldbank.org

off in recent years. In 2011, it had a real GDP growth rate of 9.5%. However, it then decreased in 2012, 2013, and 2014, falling to 7.8%, 7.7%, and 7.3% respectively (WDI 2015). The World Bank estimated that China's GDP will continue to fall in 2015, 2016, 2017 and 2018, down to

6.9%, 6.7%, 6.5% and 6.5% respectively (WDI 2015). The decrease in China's real GDP growth is shown in figure 3.1 above, which includes its estimated forecasts for the future as well as the Developing East Asia and Pacific region's real GDP projections.

Regarding unemployment rate, a measure of the number of people actively looking for a job as a percentage of the labor force, China's remained unchanged at 4.05% in the fourth quarter of 2015 from 4.05% in the third quarter of 2015. Between 2002 and 2015, China's unemployment rate averaged 4.13% (WDI 2015). Figure 3.2 below displays this information. In 2007, there is a sharp drop in unemployment rate to 3.75%, though it quickly rebounds in

Figure 3.2 — China's Unemployment Rate



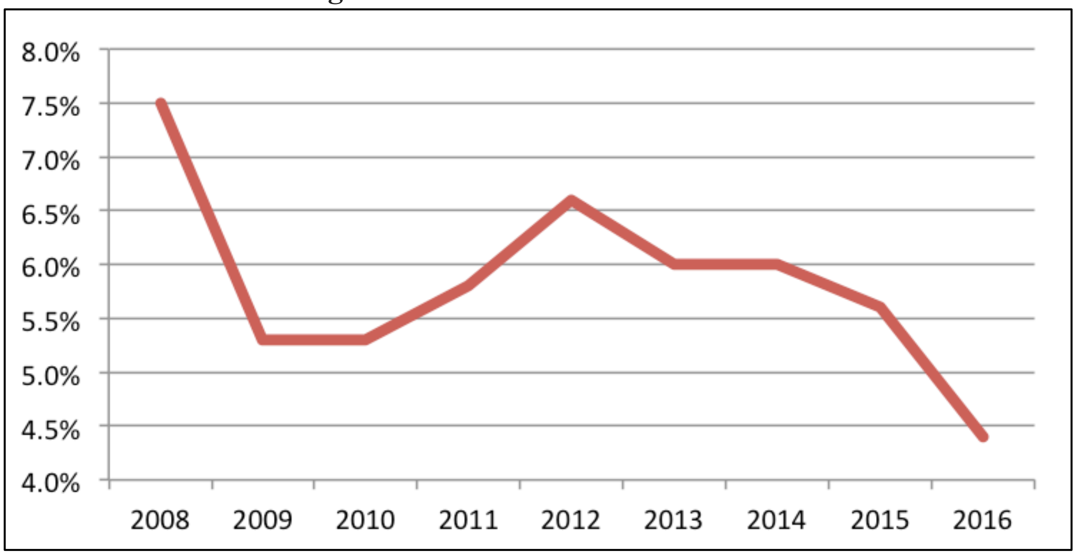
Source: Data compiled from http://databank.worldbank.org

2008 before falling again. Unemployment rate in China is reported by the Ministry of Human Resources and Social Security of the People's Republic of China.

Lastly, China's interest rate has been steadily declining in recent years as the People's Bank of China (PBOC) has continued to cut rates in order to combat a slowing economy and deflationary pressures. Figure 3.3 below displays the very tumultuous numbers that China's

interest rate has undergone, as it reached a height of 7.5% in 2008, only to decline to around 5.25% by 2010 (WDI 2015). We also see that it often plateaus for a select period of time before increasing or decreasing. This pattern often illustrates the state of a steady economy, until it is decided that times are either good or bad, which then results in the increase or decrease of

Figure 3.3 — China's Interest Rate



Source: Data compiled from http://databank.worldbank.org

interest rates. With the decline of interest rates around 2015, and a historic period of lows very recently, China's central bank has taken action. It injected CNY 100 billion (USD 15.2 billion) into the financial system on February 2nd 2016 and increased the frequency of open market operations between January 29th and February 19th in order to help maintain liquidity and stimulate its sluggish economy (WDI 2015).

We have now fleshed out more of the context behind China's recent extreme growth. Subsequent to its economic reforms over two decades ago, the country has clearly undergone enormous changes, including the experiencing of extraordinarily high growth rates. By examining various macroeconomic indicators, such as real GDP growth, unemployment rate and interest rate, we gain a more well rounded understanding of China, the health of its economy and

its overall state, in hopes that this knowledge will enable clearer insight into its export boom, and hence, incredible growth.

However, it is important to note that there are limits to growth within the type of production system that China is integrated into. How are the recent patterns of these indicators suggestive of not only the production system that China is integrated into, but also what others are saying about China's declining growth rates? Because this thesis is focused on the evolution, dynamics, and trends of the content of China's exports—especially within its electronics industry—I want to reiterate a point mentioned previously in the abstract: the DVA of exports in China's electronics industry appears to have somewhat leveled off since 2008. In the 1990's and early 2000's, China's DVA was steadily increasing within its trade industries. Yet now, it seems to have leveled off *at the same time* that its growth has begun to decline. This suggested correlation will be further examined and analyzed in subsequent chapters.

In the next section, China's overall export performance will first be put into perspective, followed by its performance in the electronics industry specifically. This will appropriately lead into a discussion of DVA and FVA, which will bring us full circle back to the example of Apple's iPod and its relevance to both China and this thesis.

B. China's Export Performance

Within the past decade, China has experienced an export boom. Its exports have rapidly increased, inducing extraordinary growth rates, which as a result, have shifted all eyes to China as spectators within the global arena wonder what is next for this powerhouse. Since the end of the 1970s, the Chinese economy has been expanding dramatically, as the increase of China's participation in international trade has certainly been one of the most outstanding features of this economic development. In fact, Chinese exports have increased far more rapidly than the

country's GDP growth. Its exports rose, on average, 5.7% in the 1980s, 12.4% in the 1990s, and a whopping 20.3% between 2000 and 2003 (Silva-Ruete 2006). By 2003, its export growth rate was seven times larger than the export growth rate recorded by the world as a whole (Silva-Ruete 2006).

The trade boom that China has experienced in the last two decades speaks to its increased participation in the world's main export markets. Chinese exports have grown from US$25 billion in 1984 to US$383 billion in 2003, which represents a jump from 1.5% to 5.8% in its share in world exports (Silva-Ruete 2006). This export growth is due to highly dynamic and diversified export activity. In 1987, approximately a quarter of China's exports were classified as products that were in high demand globally, yet by 2002, this number had risen to 60%, which is the same proportion as that logged by the United States' exports (Silva-Ruete 2006). Furthermore, export concentration indicators suggest that not only is China's export supply highly diverse compared to that of other countries, but its technological component is also increasing. These findings associate with the conclusions made by Rodrik that were discussed previously. To reiterate, he states that is it is actually unexpected for a country at China's level of income to have as sophisticated of an "export basket" as it does. Thus, based on the diverse and sophisticated portfolio of China's electronics exports, the country's technological sophistication has grown very fast (Rodrik 2006). The gradual shifting of its exports from fairly simple manufactured goods towards more sophisticated products is shown in the following numbers: in 1985, close to 90% of Chinese exports consisted of either primary products or manufactured items that were based on low technology or natural items; by 2002, this figure had fallen to 50%, as the percentage of high-tech exports rose from less than 5% to above 30% in the same period (Silva-Ruete 2006). It comes as no surprise that, despite beginning in low-value, labor-intensive

sectors such as apparel and footwear, China's export portfolio has now moved, with the help of outsourcing, specialization, and trade in value added, into greater value, higher productivity channels such as computers and electronics.

C. China's Performance in Electronics

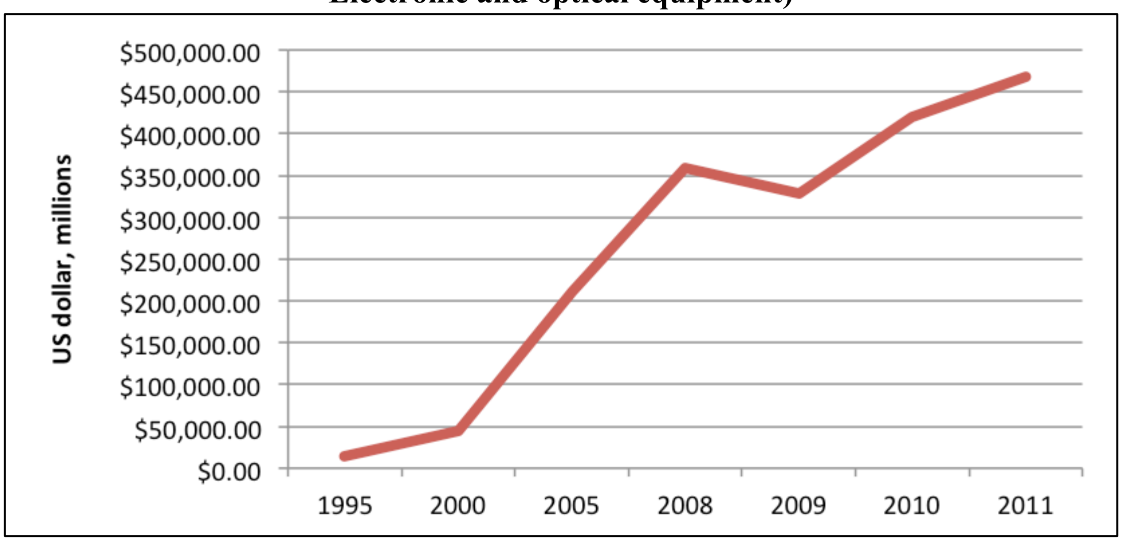
Now that China's general export performance has been put into perspective, let us turn to China's performance in the electronics sector, which is the focus of this paper. As mentioned above, the export configuration of China's real export growth has changed drastically since 1995. Growing export shares in electronics and machinery— products of sophistication and specialization—countered the decline in agriculture and apparel. In 2004, China overtook the United States to become the world's leading exporter of information and communications technology (ICT) goods such as mobile phones, laptop computers and digital cameras (OECD 2005). One year earlier, in 2003, the U.S. led with exports of ICT goods worth USD 137 billion, followed by China with USD 123 billion. However, in 2004, China's number increased to USD 180 billion worth of exported ICT goods, compared with U.S. exports in the same category valued at USD 149 billion (OECD 2005). The data show a shift towards greater trade between China and other Asian countries, with a corresponding decline in ICT imports from the European Union and United States. Previously China relied on electronic components, such as computer chips, that were imported from the U.S. and EU to manufacture advanced mobile phones and laptops. Now these components are being increasingly sourced from other Asian countries such as Japan, Hong Kong, Korea and Malaysia. These facts speak to the significance of regionalization and China's location within the dynamic, diverse East Asian regional nexus. Furthermore, China is manufacturing and exporting more electronic components than ever before, as they now form China's second largest export item after computers and related

equipment (OECD 2005).

More specifically, this paper's empirical focus is on the electronics sector characterized by OECD as: "C30T33X: Computer, Electronic and optical equipment." This industry is a sub-sector of "C30T33: Electrical and optical equipment." The Organization for Economic Cooperation and Development (OECD) and World Trade Organization (WTO) created a joint initiative to address the issue regarding Trade in Value Added (TiVA)—the fact that flows of goods and services within global production chains are not always reflected in conventional measures of international trade—by considering the value added by each country in the production of goods and services that are consumed worldwide (OECD 2016). This C30T33X industry—Computer, Electronic and optical equipment—is just one of many industries included in the 2015 edition of the TiVA database, which covers over 34 unique industrial sectors, including 16 manufacturing and 14 services sectors.

Using trade data specifically from industry C30T33X, figure 3.4 below shows that China's gross exports within this sector have skyrocketed since 1995. While they equated to

Figure 3.4 — China's Gross Exports: Electronics Industry (C30T33X: Computer, Electronic and optical equipment)



Source: Data compiled from http://stats.oecd.org/

around USD 143 million in 1995, the worth of these exports increased to USD 468 million by 2011. To additionally show the growing significance of the electronics industry within China's gross export basket, let us examine the table below, which shows three different commodity groups, along with the sum of trade value in USD and the percentage of gross exports from

Table 3.5 — Chinese Export Data

Product Description	Sum of Trade Value in USD (1996-2013)	% of gross exports from China
Electrical mchy equip parts thereof…	$3.68 billion	23.12%
Nuclear reactors, boilers, mchy…	$2.90 billion	18.23%
Art of apparel & clothing access…	$.7 billion	4.49%

Source: Data compiled from http://wits.wordldbank.org

China for each group. Table 3.5 uses Chinese export data pulled from the WITS trade database, and shows the product group of electrical equipment parts—a subset of the entire electronics market—to be China's largest source of gross exports. Ranked in order from first to third, we see that the commodity group of electrical equipment parts (23.12%) makes up China's greatest gross exported product group. Since 2000, exports of electrical parts have increased from trade values of $46.067 billion in 2000 to $562.308 billion in 2013 (WITS 2015).

By examining both OECD and WITS trade data, it is very clear that the electronics industry has become a significant part of China's trade portfolio. Its export basket, while once largely consisting of low-value, labor-intensive sectors such as apparel and footwear, has now moved into sectors of greater value and higher productivity such as computers and electronics. The next section will address the concept of DVA, an essential component to this paper as well as in the larger picture of China's export growth.

D. Domestic Value Added (DVA)

As previously discussed, the phenomenon of vertical specialization, and stemming from that, trade in value added—which accounts for value-added contributions in exports from various domestic industries and various foreign industries—is especially significant to China's electronics industry. Domestic value added (DVA) in gross exports is an estimation of value added, by an economy, in producing services for export. This measure is a percentage share of value (OECD 2016).

WTO and IDE-JETRO (2011) state that the addressing of DVA incorporated in exported goods can—inter alia—help economies in the following multiple ways: identify the sources of international competitiveness and comparative advantages and to better reflect the actual contribution of the various industrial sectors in the production process of its exported goods; to evaluate the actual impact of foreign trade on economic growth and employment; and to provide another angle for the examination of bilateral trade balances or regional transactions.

The OECD-WTO joint initiative on TiVA does an exceptional job at providing all the necessary information, sources and materials so that the TiVA database is easily accessible and navigable to the average person. For example, a TiVA indicator codebook provides definitions for each indicator in the database, along with interpretation directions, equations, notes and more. Since the empirical focus of this paper is on domestic value added within China's electronics industry, the codebook can be utilized to gain a better understanding of what exactly one of our primary indicators—"EXGR_DVA: Domestic value added content of gross exports"—means. OECD defines this indicator as follows: "Domestic value added content of gross exports includes the value added generated by the exporting industry during its production processes as well as any value added coming from upstream domestic suppliers that is embodied

in the exports (OECD 2015).” Furthermore, domestic value added content of gross exports is calculated using the equation below:

$$\mathbf{EXGR\_DVA_{c,p,i} = V_c B_{c,c} EXGR_{c,p,i}}$$

In this case, $EXGR_{c,p,i}$ is a Kx1 vector with all entries equal to zero except the one corresponding to industry i. Little “c,p,i” stands for country, partner country, and industry, respectively. All gross trade measures are in USD millions at current prices with a basic price valuation.

The DVA trade data — extracted from the OECD database — will be further analyzed for China’s electronics industry in Chapter IV. This will give us better insight into exact numbers, patterns and what this all may mean relative to China, the content of its electronics exports, and its future sustainability in the global arena. Let us now address the concept of FVA.

E. Foreign Value Added (FVA)

Similar to DVA, foreign value added (FVA) is an integral component of value added trade statistics. At the country level, foreign value added in exports indicates what part of the country’s gross exports consist of inputs that have been produced by other countries, or the extent to which a country’s exports are dependent on imported content (UNCTAD 2013). At the industry level, the average foreign value added is actually a proxy for the extent to which industry value chains are segmented into distinct tasks and activities that generate trade, compounding the double counting effect (UNCTAD 2013).

We have previously discussed the complications surrounding the quantification of the world of trade, i.e. the difference of measurement in gross versus net terms. To reiterate: Raw material extracted from one country may be exported first to a second country to be processed and then exported again to a manufacturing plant in a third country, until it is finally exported to

a fourth country for final processing and consumption. While the value of the raw material counts only once as a GDP contribution in the original country, it is counted several times in world exports, thus the notion of "double counting." So, in terms of China's foreign value added—although China was the world's biggest exporter of electronic goods in 2009, almost 40% of its $467 billion-worth of exports were first imported (The Economist 2013). In other words, the exports require a lot of imports, which resulted in the production of electronic products with large shares of FVA. Furthermore, because the electronics industry consists largely of goods that can be broken down into discrete components and then separately produced, easily transported, and assembled in low-cost locations, it has consequently been ranked one of the highest industries in share of foreign value added in trade (UNCTAD 2013).

The rise of "global manufacturing" and increased vertical integration have undoubtedly led to significant changes in trade patterns throughout the world. At the global level, the average foreign value added in exports is approximately 28% (UNCTAD 2013). This means that, roughly, around $5 trillion of the $19 trillion in 2010 world exports of goods and services has been contributed by foreign countries for further exports and is thus "double counted" in global trade figures. The remaining $14 trillion is the actual value added contribution of trade to the global economy (UNCTAD 2013).

The OECD-WTO joint initiative on TiVA includes "foreign value added content of gross exports" as one of its indicators. I will be examining this, along with "domestic value added content of gross exports," in this thesis. The TiVA indicator codebook states that "foreign value added content of gross exports captures the value of imported intermediate goods and services that are embodied in a domestic industry's exports. The value added can come from any foreign industry upstream in the production chain" (OECD 2015). Foreign value added content of gross

exports can be calculated using the equation below:

$$\mathbf{XGR\_FVA_c = V\ B_{(c),c}EXGR_{c,i}}$$

Here, $B_{(c),c}$ is the column block of B corresponding to country c, with the row block corresponding to c being zero. Similar to DVA, FVA is measured in USD millions.

Chapter IV will examine the extracted OECD data that will display DVA, FVA, and gross export numbers and patterns for China's electronics industry over the time period of 1995-2011. From that, we will be able to better analyze increases and decreases across the industry in terms of DVA and FVA, and what these results may mean for China's future growth and sustainability.

F. Conclusion

An analytical framework for the context of this phenomenon of extraordinary growth that we are examining within China has now been developed. This framework is necessary to further understand the evolution, dynamics and trends of the content of Chinese exports from 1995-2011, especially within its electronics industry. To properly establish this framework, we commence by providing a general context for this recent growth. Using the example of Apple's iPod to set the stage, we examine—subsequent to its economic reforms over two decades ago—China's rapid social and economic development. To further flesh out China's extraordinary growth, we then analyze the country in terms of various macroeconomic indicators such as GDP, unemployment rate and interest rate. A pattern of decline or stagnation across each of these indicators is seen, which brings us to an important point—there are limits to growth within the type of production system that China is integrated into.

This analytical framework is further built upon as China's export performance is

evaluated. At a macro level, it is very clear that China has experienced an export boom. China's increased participation in international trade has certainly been one of the most outstanding features of its economic development, as its exports have increased far more rapidly than the country's GDP growth. In addition, China's increased participation in the world's main export markets has enabled its export portfolio to move, with the help of outsourcing, specialization, and trade in value added, into greater value, higher productivity channels such as computers and electronics. Regarding the performance of China's electronics industry, it is very clear that this sector has become increasingly significant within its absolute export basket. Electronics exports have skyrocketed since 1995 and as a result, China has since overtaken the U.S. to become the world's leading exporter of information and communications technology (ICT) goods such as mobile phones, laptop computers and digital cameras (OECD 2005). One of the central questions of this thesis is what can be interpreted from the massive success of China's electronics industry specifically, since much can be said in terms of sophisticated technology, innovation, and know-how in regards to future sustainability. Finally, after briefly addressing DVA and FVA—how these concepts are defined, calculated, and the significance of each in the world of trade—our analytical framework has been completed.

In chapter IV, we will analyze extensive data that has been extracted from both the OECD and WDI databases. This data will include China's FVA content of gross exports; DVA content of gross exports and DVA share of gross exports within not only China's electronics industry but across other industries as well; GDP per capita for many countries throughout the world; and more. In using a wealth of data from multiple databases, across numerous industries, and throughout multiple regions, this thesis will aim to produce extensive breadth and depth to the examination of the evolution, dynamics and trends of the content of Chinese Exports from

1995-2011.

CHAPTER FOUR

DATA AND RESULTS

Chapter IV will present the data and empirical results for this study. Section A introduces the data utilized in this thesis and justifies the decision to conduct a cross region comparison in order to better understand both China and its position within the East Asian region. Section B defines and further explains the three measures—average, standard deviation and coefficient of variation—that are each used to characterize the trade data. Next, section C will conduct a regional comparison of East Asia and Europe, with the intention of ultimately showing how East Asia is distinct from Europe. In section D, the previously examined data on East Asia will be used to better locate China's role within the larger East Asian region. Our focus here will be on China specifically. Then, we will turn to Section E, which takes a look at the World Development Indicator (WDI) data—GDP per capita—in order to assess levels of development within the East Asian and European regions. Stemming from this, theories of international trade will be applied to better tell the story of why we might see the patterns and results that we do. Finally, chapter IV will come full circle in section F, as we return to the larger question of the "leveling off phenomenon" that China's electronics industry has seemed to hit in terms of DVA in its exports. Here the possibilities as to why this plateauing has occurred and what it may mean for China's future sustainability are examined. Section G will conclude the chapter.

A. Introduction to Data

Although China is the focal point of this thesis, the examination of this country alone is not sufficient. In order to thoroughly understand the bigger picture, a regional cross-examination between East Asia—the larger regional system in which China is a part of—and Europe—the other highly regionalized center in the world—is necessary. From this, we can better assess what

makes East Asia distinct from Europe, in order to ultimately categorize China's role within the East Asian region. We will then have the grounds to assess if China alone is as strong as it appears to be in manufacturing and exports, or if its rise is heavily dependent on the success of the surrounding East Asian region, such that China's regional integration has driven its growth. If so, then many explanations of China's success may be undercut, such as strong state guidance, judicious government policy, and more. This is a question of China's individual strength, or instead of East Asia's regionalized nature.

In terms of this thesis, the countries that constitute East Asia (defined as EA within the data frame) are Japan, Korea, Hong Kong, Indonesia, Malaysia, Philippines, Singapore, Chinese Taipei, Thailand, Vietnam, and, of course, China. These are largely the same economies that have contributed to the East Asian growth phenomenon. The data frame categorizes the European region (defined as EU) to include the following 25 countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, Romania, Russia, Greece and Bulgaria. Just to clarify—Israel has been included as a part of the European region because of proximity and the fact that it has an important high-tech sector. EU and EA only incorporate the largest, most significant countries of the region; the smaller countries that do not add much—such as Cambodia in East Asia, for example—have been left out for the purpose of simplicity and effectiveness in painting an accurate image of each region.

By comparing the regions of East Asia and Europe, I aim to determine whether or not there really is something unique about the East Asian region. More specifically, this conclusion will enable us to examine if China's extraordinary growth is due to its inclusion within East

Asia, or if it is simply from China's own internal capabilities and strengths, such as its large domestic markets, rich resources, authoritarian government or judicious policy choices — all common alternative explanations of Chinese growth.

B. Providing Clarity: Average, Standard Deviation, Coefficient of Variation

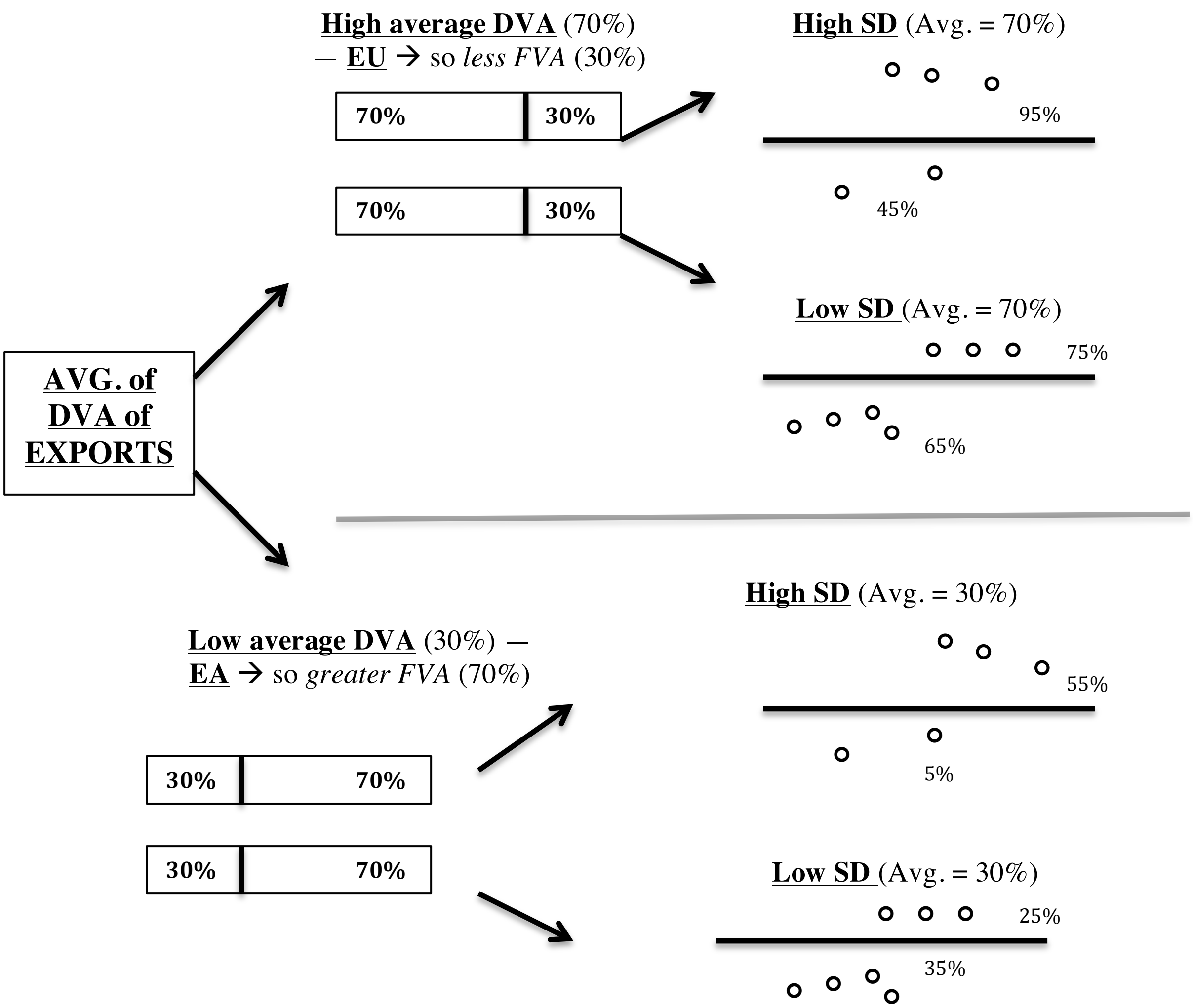
In order to properly compare East Asia and Europe, I developed new measures that will enable effective regional cross comparison and ultimately allow China to be placed within the larger East Asian system. This thesis will use the domestic value added (DVA) content of gross exports indicator—from OECD's TiVA database—to calculate both average (AVG) and standard deviation (SD) of the DVA of exports for each region in numerous industries.

For this thesis, the AVG that will be shown in tables and graphs is the average of DVA of exports in the select industry. So, in terms of our regional cross comparison—the "average" number shown per year for each region is the calculated total mean of DVA in the selected industry's exports across *all the countries* within the chosen region. As for standard deviation, if a region is said to have a "high SD," then this means that some countries' exports are very high in DVA, while other countries in the region export goods with very little DVA. It also signifies that the countries within that region have very heterogeneous economies and unequal production systems relative to each other. Quite simply, there is a lot of variation in the manufacturing that each country is performing. On the other hand, if a region has a "low SD" this means that the countries share a more common level of DVA in their exports. This would signify that countries within that region are more homogenous — their economies are on a similar level, they are trading and interacting with each other, and, as a whole, their production systems are largely equivalent.

Let us now take these two measures and our understanding of them, and tell a narrative of

how they can be applied to the data used in this thesis. This story will put meaning behind the data so that the statistics represent more than just numbers. Figure 4.1 below will illustrate the description being told. This model begins with "average of DVA of exports" as our top node and

Figure 4.1 — Diagram of Average and Standard Deviation Breakdown



further breaks this category down into numerous branches and sublevels of "average" and "standard deviation" measures. Each branch is created based on a level of "high" or "low." In order to best illustrate this image, stark examples of select regions, countries, and (imaginary) numbers will be used. However, the exact data tables and numbers will be displayed and

examined in a later section within this thesis. Figure 4.1 above shows the diagram that we will now explain in greater detail.

Let us begin with the average of DVA of exports as our first node. Again, this is a measure of the average DVA of exports of *all the countries* within the select region—either East Asia or Europe, in this case. This node is then split into two sub levels or categories—one is defined by a "high" average DVA of exports and the other by "low" average of DVA of exports. Based on our data below, Europe (EU) defines the "high average DVA" subcategory in that it has a higher average of DVA than does East Asia (EA) in four of the six industries that this thesis examines. Therefore, let us pretend EU has an average of, say, 70% DVA in a particular industry —this is considered to be "high." A greater DVA signifies less foreign value added (FVA). Figure 4.1 shows this DVA/FVA breakdown in terms of a rectangle bar that symbolizes the absolute value added for the region—in other words, the sum of DVA and FVA. In this diagram, we see that the larger part of the displayed bar consists of DVA share (70%) and the smaller part of FVA share (30%). Less FVA most likely signifies that the region is less tightly networked in terms of trading goods that contribute to the production of a final product. In other words, the industries of the countries within the European region are more separate than those in the East Asian region.

On the other hand, the "low" subcategory of average of DVA of exports—let's pretend 30% DVA within the industry—can be largely defined by EA. The fact that the East Asian region has lower average DVA numbers than Europe in a majority of the examined industries means that it has greater FVA. In figure 4.1 above, we see this breakdown again in the rectangle bars that display a 30% share of DVA and a 70% share of FVA, the later of which is greater than the FVA of EU in the "high average DVA" category. Greater FVA indicates that another country

(most likely in the same region) is doing a large portion of the work or adding value in the production of a good. Therefore, it can be assumed that the countries within the East Asian network are more networked than those in Europe, since each country is adding to another's FVA within the region. It can be concluded, therefore, that the industries of the eleven countries that compose EA in this paper are all incredibly interconnected, which helps to explain the strength of the East Asian region. Furthermore, this facet has certainly enabled the tremendous growth seen in China— especially in its electronics industry—as it is a part of this larger regionalized system. The role of regionalism is without a doubt crucial to Chinese development and potentially the key to its success. This point will be further elaborated upon in a later section that focuses specifically on China within the East Asian region.

Now, let us further split up figure 4.1 into "high" and low" standard deviation sub groups. The "high average DVA" category can be split into these two sub levels of standard deviation and the "low average DVA" category can be split into the same two sub levels of standard deviation. This breakdown is shown in figure 4.1. A circle represents a country within that region. The following explanation of what "high standard deviation" and "low standard deviation" entail can be applied to both the "high average DVA" and "low average DVA" categories. For this purpose, let us take the "high average DVA" category—the one defined by Europe (EU) at 70% DVA—and split it into a high and a low level of standard deviation. The "high SD" level signifies more variance in the data, such that the countries within the region have unequal economies and production systems. As a result, there are countries with high levels of DVA (say 95%) that exist far apart from other countries with low levels of DVA (say 45%). Very rich, advanced countries exist, while poor, less developed ones do as well. For example, take Japan and Malaysia in East Asia. Malaysia may be relatively abundant in certain resources,

while Japan certainly excels at more specialized, advanced tasks. Furthermore, the economies of these two countries are certainly not equal.

On the other hand, a region with a "low SD" consists of countries with largely equal economies that are much more similar to one another. They are likely located closer together and share similar levels of DVA. For example, in figure 4.1 we see that one country in a "low SD" region may have an average DVA of 75% while another may have one of 65%. In both cases, the average DVA centers around 70%, but there the former has high variance and the later has low variance. Most importantly, a more equivalent production system exists—so, countries of equal importance are trading with one another and contributing around the same amounts. For example, France and Germany within the European region are not identical but certainly very similar in terms of equal economies and production systems. France may specialize in one pharmaceutical product, for instance, and Germany in another kind. These same explanations for "high SD" and "low SD" can be applied to our "low average DVA" (and thus large FVA) category shown in figure 4.1. Here, if a region has a "high SD," then some countries have high average DVA (say 55%) and some have low average DVA (say 5%). In this case, the latter is likely doing simple production processes that generate little DVA before the product is exported again. If the region has a "low SD," the countries are likely similar to each other in terms of their economies and production systems, and are highly networked.

Finally, let us turn to a statistic called "coefficient of variation" (CV). CV—also known as relative standard deviation (RSD)—is a standardized measure of dispersion of a distribution. In terms of this thesis, it helps us get a sense of the *scale* of standard deviation within a specific industry of a select region. This thesis examines coefficient of variation so that both the calculated average and standard deviation numbers within the industry data can be incorporated

into one measure. This single measure then enables us to better make sense of what story the data is telling about the European (EU) and East Asian (EA) regions.

In order to calculate CV, divide the SD in the numerator by the average in the denominator, and multiply by 100. Figure 4.2 below shows this CV equation. One can see from

Figure 4.2 — Coefficient of Variation Equation

$$\mathbf{CV} = \frac{\text{Standard Deviation (SD)}}{\text{Average}} \mathbf{x100}$$

this equation that CV scales the average. Thus, a greater average denotes a smaller SD; a smaller average denotes a larger SD. This correlation is shown in the table below. From our OECD/WDI data, we have extracted—for both the European and East Asian regions—standard

Table 4.3 — Calculated CV in both EU and EA's electronics' industry (1995)

1995	**Average (DVA)**	**SD**	**CV**
Europe (EU)	65.63	11.99	**18.27%**
East Asia (EA)	55.75	17.19	**30.80%**

Source: Data compiled from http://stats.oecd.org/

deviation and average numbers from both regions' electronics industry. The CV has been calculated using the equation above. As seen in table 4.3, EU has an average (of DVA of its electronics industry exports in 1995) of 65.63. It has a SD of 11.99. Visibly, this is a relatively large average number for a rather small SD. On the other hand, EA has an average (of DVA in its electronics industry in 1995) of 55.75% and a SD of 17.19. This is a relatively small average number for quite a large SD. So, what can be concluded from these calculated CV measures? Because the coefficient of variation represents the ratio of the standard deviation to the mean, it

is useful in comparing the degree of variation, or measure of dispersion, between East Asia and Europe. We see that the CV for EU is 18.27% and the CV for EA is 30.80%. The gap between these two coefficients shows us that the scale of SD within EA is much greater than in EU. For East Asia, having a relatively small DVA but a large SD in its electronics industry speaks to the great amount of heterogeneity we see within the region. On the other hand, for Europe, having a relatively large DVA but a small SD in its electronics industry speaks to the more homogenous nature of the region. So, the coefficient of variation, even relative to the difference in regional averages, reinforces the gap between SD that we see between EA and EU.

In the next section, we will conduct a regional cross comparison of East Asia and Europe based on the measures of average, standard deviation and coefficient of variation that were discussed in this section. Section C will aim to tell the story of how the East Asian and European regions differ from one another, while specifically showing in what ways East Asia is distinctive. This feature is especially important, for it will provide a telling backdrop for us to fit China into in section D.

C. Regional Cross Comparison: East Asia and Europe

Before a cross comparison of the European and East Asian regions based on the numbers from the measures discussed in section B is conducted, it is essential to first define which specific industries—in addition to electronics—this thesis examines. Below, table 4.4 lists each

Table 4.4 — Selected Industries

1	C30T33X	Computer, Electronic and optical equipment
2	C17T19	Textiles, textile products, leather and footwear
3	C21T22	Pulp, paper, paper products, printing and publishing
4	C34	Motor vehicles, trailers and semi-trailers
5	C15T16	Food products, beverages and tobacco
6	C25	Rubber and plastics products

Source: Data compiled from http://stats.oecd.org/

industry, as well as its C-code which is used to categorize the industrial sector within the OECD database. It is important to note that industries were selected because each is considered to be "manufacturing" (instead of "agriculture" or "services," for example). Manufacturing processes are more easily broken up into sub-assemblies that can be traded. Furthermore, these industries cross a variety of technology levels: The food products and textiles industries are at the low end, while motor vehicles and electronics are at the high end. For each industrial sector, the following information was selected from the TiVA database: 'Indicator'—Domestic value added share of gross exports; 'Partner'—World; and 'Time'—1995, 2000, 2005, 2008, 2009, 2010, 2011. As a result, the database generated six Excel spreadsheets—one per industry—that each contain the percentage share of DVA of gross exports, for the 61 countries that OECD classifies as 'World', across all of the seven years. It is from this data that the average and standard deviation measures are calculated.

Now let us look at the averages and standard deviations of EU and EA within each industry and see how this information compares across regions. Figure 4.5 shows which region— EU or EA—has the larger AVG DVA and larger SD in the industry. The two stars seen next to some of the numbers denote which region has the larger measure. Immediately, some

Table 4.5 — Region with the Greater AVG and SD in Each Industry

Industry	**AVG**		**SD**	
	EU	**EA**	**EU**	**EA**
C30T33X Electronics	63.08**	54.53	14.24	17.86**
C17T19 Textiles	70.20**	66.84	13.04**	9.62
C21T22 Pulp, Paper	74.95**	69.19	7.69	12.86**
C34 Motor Vehicles	57.71	61.37**	11.80	14.36**
C15T16 Food Products	74.66	75.98**	7.11	12.48**
C25 Rubber, Plastic Products	66.76**	66.01	8.01	12.01**

** Denotes the larger value
Source: Data gathered from http://stats.oecd.org/

telling patterns stand out. For example, in four of the six industries, EU has a larger AVG of DVA of exports than does EA. For that reason, four out of the six values listed under EU have two stars next to them. In the two industries—motor vehicles and food products—where EA has a higher AVG of DVA than EU, the difference between regions is minor. Conversely, in five out of the six industries, EA has a greater SD than EU. What exactly do these trends mean?

Clearly, there are stark differences between the European and East Asian regions. Based on this industry-level trade data, it can be concluded that there is far less variance in Europe than there is in East Asia; yet there is far greater average DVA in exports in Europe than there is in East Asia. In terms of SD, the East Asian regional network consists of countries whose economies are ordered in a hierarchical way — for example, Japan has an 82% DVA in its electronics industry, while Malaysia only has 33% DVA. This heterogeneity correlates with a greater variance in that these countries have economies, production systems, and levels of development that are all on very different scales from one another. On the contrary, the European region consists of countries that lie in a tighter band — for example, Germany has 75% DVA in its electronics industry, while Romania, an Eastern European country, has 83% DVA. Despite the large gap between their levels of development, the share of DVA in these two countries is certainly on a more similar level than Japan and Malaysia in East Asia. Europe's homogeneity correlates with a lower SD in its variance, and thus more similarity amongst countries in terms of their economies, production systems, and levels of development.

Regarding the average measure, EU has a greater overall average of DVA than EA. The amount of DVA within a region is associated with level of interconnection. As previously mentioned, some regions are certainly more networked than others. This characteristic carries over to industries as well—different industries have different levels of being networked. For

example, of the six industries that this thesis inspects, both Europe and East Asia have its greatest average of DVA of exports in the food product industry. This makes sense—these countries are very capable of growing and processing their own food, which results in less sharing among countries in terms of needing one another to produce food products for export. Because there is less importing, exporting and interaction over all, there is a higher level of average DVA within the industry.

On the contrary, compared to the other sectors, the electronics and motor vehicle industries have much lower averages of DVA in both regions. A lower average DVA means that a greater share of FVA must exist. As a result, we can conclude that these two industries are *more* networked than the food products industry, which makes sense. The motor vehicle and electronics industries are more capable of being networked and fragmented because of the way in which they are assembled. For example, clothing within the textiles industry is manufactured as a continuous process—the yarn turns into the cloth, which turns into a t-shirt. On the other hand, electronics and cars go through an assembly process—parts are imported from all over the place and assembled into the final product, which is comprised of these many different intermediate components. For instance, an iPhone requires a tiny camera piece and smart phone processor; a car requires wheel, seat, motor assembly, and more. The phenomenon of globalization has enabled the inherent nature of industries such as motor vehicles and electronics to be magnified and strengthened in that it has produced a division of labor with new methods of specialization, a manifestation that leads directly to the fragmentation of production. From here on out, the world becomes entirely connected, as manufacturing processes are dispersed among different firms, through different hierarchies, and across many countries. For complex industries like electronics, the general export-processing model in terms of outsourcing has intensified, in that production

responsibilities are split up across many different locations in the extended network (Steinfeld, 2010).

However, it is important to note that only some sectors are able to take advantage of this export-processing model. Export processing is common in many developing countries, as it is often used where there is a need to break the production process apart in order to obtain cheap labor. For example, integrated circuits, a component used within electronics products, are highly advanced pieces. Part of their production process is the packaging, which is labor intensive. In other words, cheap labor is needed in order to package and test these circuits. As as long as we are dealing with an industry in which its production processes can be fragmented—such as electronics—then export-processing zones are useful. The fact that the electronics industries in both EU and EA have a lower average DVA in its exports speaks to the outsourcing and division of production tasks that take place particularly within this industry. In short, because EU has a larger average DVA than EA in four out of the six industries, it can be concluded that as a whole, the European region is *less* networked than the East Asian region.

Since China is the focus of this thesis, it is essential to specifically determine what distinguishes East Asia from Europe so that we can ultimately assess China's place within this unique East Asian region. These distinctions have been mentioned throughout the regional cross comparison above, though not emphasized as defining characteristics of East Asia specifically. Based on our data, the East Asian region is distinct from Europe in the following ways: it is a very networked, interconnected, highly regionalized system; there is much variance within the region; and lastly, as a result of the first two characteristics, a unique East Asian "growth model" has come to form that facilitates efficient trade, a natural spreading of network production systems, and thus, the exceptional growth that China has seen since 2000.

These distinctions are especially evident within the electronics industry data, which demonstrates yet again why this industrial sector is particularly significant to East Asia. In regard to EA, out of all six of the examined industries, the electronics industry has, by far, the smallest measure of AVG of DVA in each year and the largest measure of SD in each year. Controlling for industry, the former explains why the electronics industry is incredibly networked and interconnected; the later indicates the degree of variance that exists. Controlling for region, these same patterns appear across EA when compared to EU. Therefore, we are able to establish this set of distinct characteristics for the East Asian region, all of which explain its dynamic and progressive nature that one could argue is not inherent—at least remotely to this extent—in the European region. Because East Asia is more networked and certain industries like electronics are capable of being broken apart and dispersed, China has greatly benefited in that it is able to export and outsource intermediate components to be manufactured. Ultimately these components are sent back to China for assembly into the final product. This ability for China to profit from the unique characteristics of the East Asian region further reiterates the "regional explanation" behind Chinese growth.

D. China within the East Asian Region

Now that we have conducted a regional cross-comparison of East Asia and Europe, as well as concluded why East Asia is so unique, let us address the question of how we categorize China in the midst of the East Asian model. In other words, is China alone as strong as it appears to be with exports and production? Or, does its success simply stem from the fact that it is a part of a regionalized system?

In order to better assess these questions, let us first examine DVA exclusively for China's electronics industry (instead of the entire East Asian region). To reiterate: this thesis focuses

largely on the electronics sector because innovation, technology and "know how"—all components of this industry—are often touted as key drivers of economic growth (Mansfield 1995). It is no secret that a high-level of electronic sophistication correlates with technological innovation, which enables countries to foster economic development and growth. So, the trade data show that China's electronics industry has a low share of DVA in its electronics exports, meaning that much of the value-added (VA) is FVA from other East Asian countries. Again, a larger share of FVA implies that China—as well as its electronics industry—is highly integrated into EA production networks. Table 4.6 below displays the shares of DVA and FVA within China's electronics sector from 1995-2011. There is a large increase in DVA between 2000-2008, which is right around the time of China's electronics export boom. This upsurge in

Table 4.6 — DVA and FVA shares in China's Electronics Industry (C30T33X)

	1995	2000	2005	2008	2009	2010	2011
DVA (%)	26.4	22.6	31.3	43.2	44.4	43.8	45.0
FVA (%)	73.6	77.4	68.7	56.8	55.6	56.2	55.0

Source: Data gathered from http://stats.oecd.org/

DVA corresponds with China's becoming a more important player within East Asia's electronics network. Yet despite this increase, these DVA shares are still much lower than is normally expected for such a massive country. In fact, the OECD data show us that for China, the "domestic value added content of gross exports" is huge. If China's aggregate export amount is massive—as it was in 2011, at $210 billion USD—one would expect the share of DVA to be great as well, since larger countries should be able to do more in terms of production. On the other hand, smaller countries, like Romania for example, are exporting lesser amounts. In 2011, its aggregate export amount was only $1.8 billion USD. That being said, the share of DVA within its electronics industry is almost twice as great as China's, at around 85% in 2011

compared to China's 45%. So, Romania is small with a small amount of aggregate exports *but* a very high share of DVA, whereas China is gigantic with a massive amount of aggregate exports *but* a low share of DVA. This makes China even more distinctive.

To better understand the significance of what we are seeing, let us extract electronics industry data from Poland—a larger, peripheral and post-socialist country that is part of the EU—and compare it to China. It is important to note — China is around 31 times larger than Poland. Nevertheless, table 4.7 below shows that Poland's electronics industry DVA in each of the seven years is greater than China's. In fact, in 1995 it is *much* greater — by around 42% — and gradually decreases so that by 2011, it is down to 46.31%. Poland's declining DVA

Table 4.7 — DVA and FVA shares in Poland's Electronics Industry (C30T33X)

	1995	2000	2005	2008	2009	2010	2011
DVA (%)	78.29	66.18	58.20	51.45	59.31	44.81	46.31
FVA (%)	21.71	33.82	41.80	48.55	40.69	55.19	53.69

Source: Data gathered from http://stats.oecd.org/

indicates that it began integrating with the rest of Europe as it emerged from the end of the Cold War. While its joining the EU in 2004 may have had some impact on this, the decline of DVA was already occurring prior to its EU membership. Therefore, it is clear that a country does not need the formal institutions of the EU to become part of a more networked region.

Despite this large decrease, Poland's DVA in 2011 is *still* larger than China's. As a result of China's size, one would expect it to have a higher overall share of DVA. In addition, controlling for the same six industries that have been previously examined, the data show the Poland's average DVA across all seven years within five of the six industries—motor vehicles being the exception—is greater than China's. This fact highlights the rarity that is China, in terms of being a huge country but not having a higher average DVA than a country of much

smaller size like Poland. This fact is quite convincing and remarkable, as it drives home my point about the significant role that East Asia and its regional nexus plays within Chinese development.

Now, let us compare China to Japan, a high-tech, highly sophisticated, powerhouse country within the same East Asian region. This will also give us a better sense of the hierarchy that exists within East Asia. In the electronics industry, the data show that Japan has an average DVA of 86.50% across all seven years. This share of DVA is *far greater* than what is seen in China's electronics industry (36.7%). The patterns that have been previously discussed related to region, in terms of AVG of DVA and SD, are also applicable to the country level.

So, because Japan has such a large DVA in its electronics sector, we can conclude that it is far less interconnected in terms of *exporting* to other countries than China's electronics industry is, with its lower DVA. In other words, Japan does a lot of its producing at home, whereas China is interconnected as well but with regard to *importing* a large amount from other countries. While Japan does export some of its final electronics products, these goods do not require the many inputs from other countries that China's final electronics goods do. Instead, Japan is doing things from scratch—it does not need much help. China, on the other hand, outsources a huge part of its electronics industry before assembling the final product for export, which speaks to the large dependency that it has on exports from other countries. Both are considered to be "interconnected," though it is important to make the distinction that Japan's interconnectedness stems from its exporting while China's stems from its importing. However, Japan is not *just* exporting in general—this would not qualify as "interconnected" or "networked" production on its own. Instead, its exporting consists of a lot of the high-tech intermediate goods that other countries depend on for their own electronics industry and exports.

By contrast, China's electronics industry depends on the intermediate goods from places like Japan, Korea or Taiwan, etc. Despite these different forms of interconnectedness, China, Japan, and every other East Asian country are ultimately all connected to each other within the East Asian regional nexus.

Our data and findings on China, Poland and Japan ultimately enable us to conclude that, indeed, the significance behind China's success lies in the regionalism that is East Asia. If China was not integrated into a regionalized system and did not have various East Asian countries to outsource its intermediate goods to and assist in the manufacturing of its products, there is no guaranteeing that the sharp increase in DVA that its electronics industry has experienced since 2000 would have taken place. Furthermore, there is no guarantee that the export boom and subsequent growth China has undergone would have occurred.

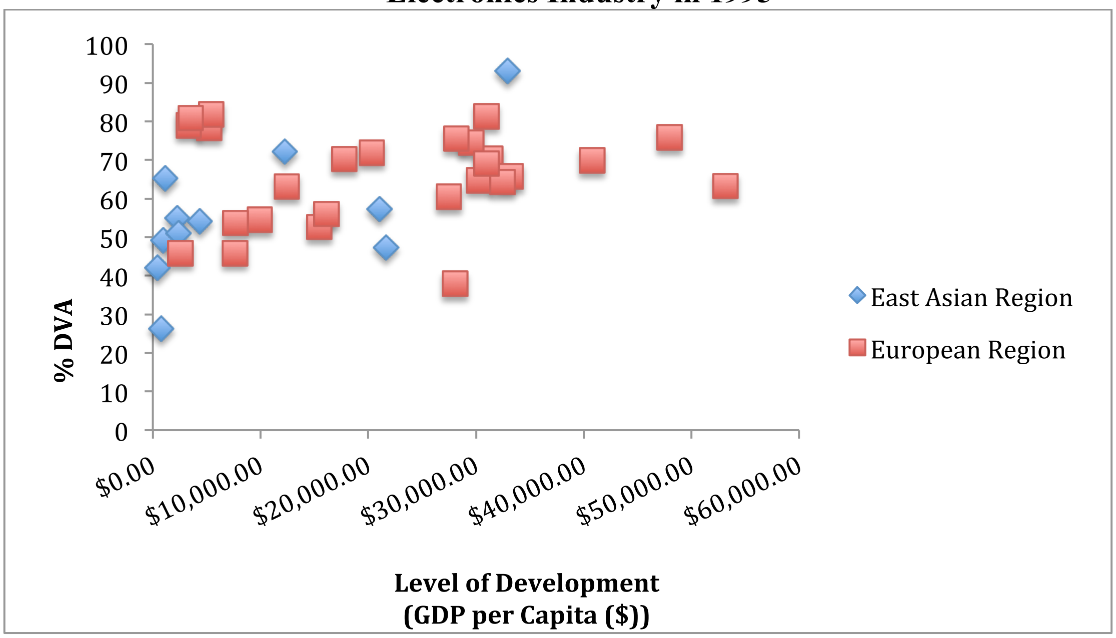
E. Levels of Development

Despite having thoroughly explored and analyzed OECD's TiVA data from seven different industries, while measuring for average of DVA, standard deviation and coefficient of variation, there is still an additional level to this thesis that needs to be probed. Using the World Bank's "World Development Indicator (WDI)" data, we will examine GDP per capita of each country in both the East Asian and European regions. GDP per capita is most widely used to determine level of development. Therefore, this section will address whether or not there is a relationship between level of development and DVA. Our ultimate goal is to take the results and use them to locate China on a map—where does it fit in amongst the countries of these other regions? What does the data say about China specifically?

A visual image is necessary in order to effectively show the relationship between GDP per capita and share of DVA. Therefore, figures 4.8, 4.9, and 4.10 below display scatterplots that

have been created to provide snapshots—in 1995 and then again in 2011—of the relation between GDP per capita and share of DVA within East Asia and Europe. Level of development, or GDP per capita, which is most widely used to determine level of development, is on the x-axis; share of DVA (%) is on the y-axis. Figure 4.8 below graphs this relationship, plotting EA against EU in relation to their electronics industry in 1995. While we do not see a perfect correlation in either region, there is certainly a positive correlation in both—as GDP per capita

Figure 4.8 - Relation between GDP per capita and DVA in East Asia and Europe's Electronics Industry in 1995



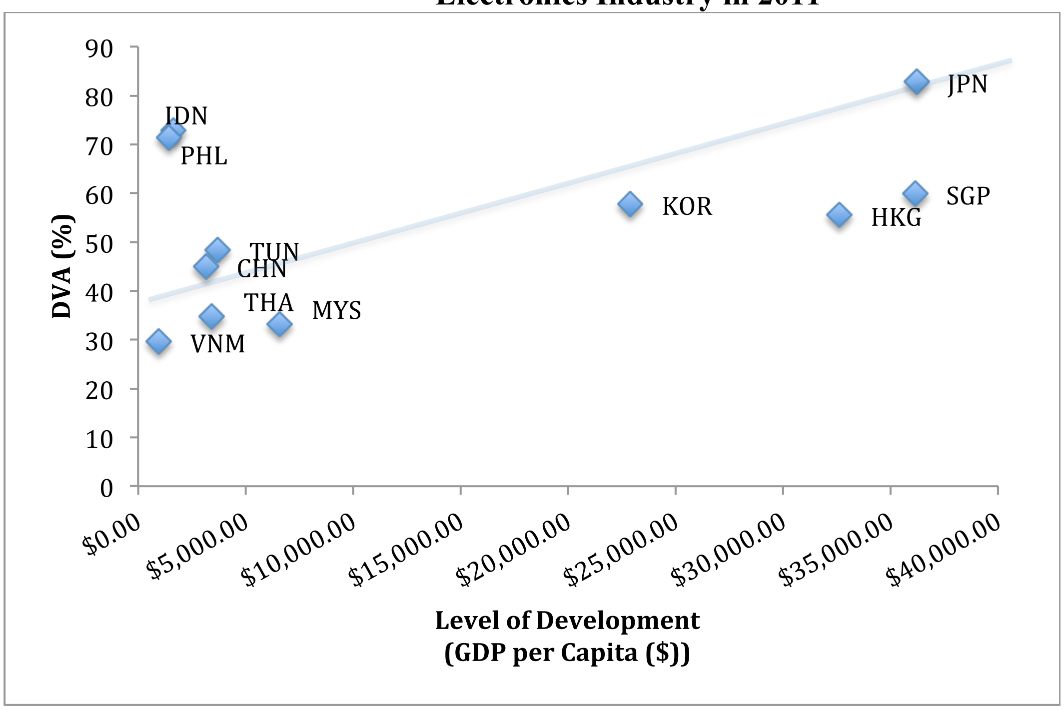
Source: Data gathered from http://stats.oecd.org/

goes up, DVA (%) tends to go up as well. However, while the East Asian region shows a definite positive correlation between these two measures, the European region's correlation is less strong. The points—in this case, the European countries—are a lot more dispersed among levels of development than the East Asian countries, which form a pretty distinct upward sloping line. Just to note—the one blue point that is a clear outlier above the other East Asian countries is Japan, while the blue point that represents China lies in the clump of countries around 45% DVA. We

will examine both of these countries more closely in the next section. The patterns of each region will be further analyzed in the paragraphs that follow as well, as we plot EA and EU separately in order to better assess each country within the region and the visible relationship between level of development and DVA.

As discussed previously, East Asia has an overall higher SD than Europe, as its SD is greater in five out of the six industries that we examined. This larger variance correlates with greater inequality amongst the economies of countries in East Asia. So, some countries are producing quite a bit of DVA while others are producing far less. Figure 4.9 below displays a scatterplot of the electronics industry of East Asia in 2011. In terms of this relationship between GDP per capita and DVA, the large SD of EA does correlate with large gaps in levels of

Figure 4.9 - Relation between GDP per capita and DVA in East Asia's Electronics Industry in 2011



Key
1). TUN = Tunisia
2). JPN = Japan
3). KOR = Korea
4). CHN = China
5). HKG = Hong Kong
6). IDN = Indonesia
7). MYS = Malaysia
8). PHL = Philippines
9). SGP = Singapore
10). TWN = Taiwan
11). THA = Thailand
12). VNM = Vietnam

Source: Data gathered from http://stats.oecd.org/

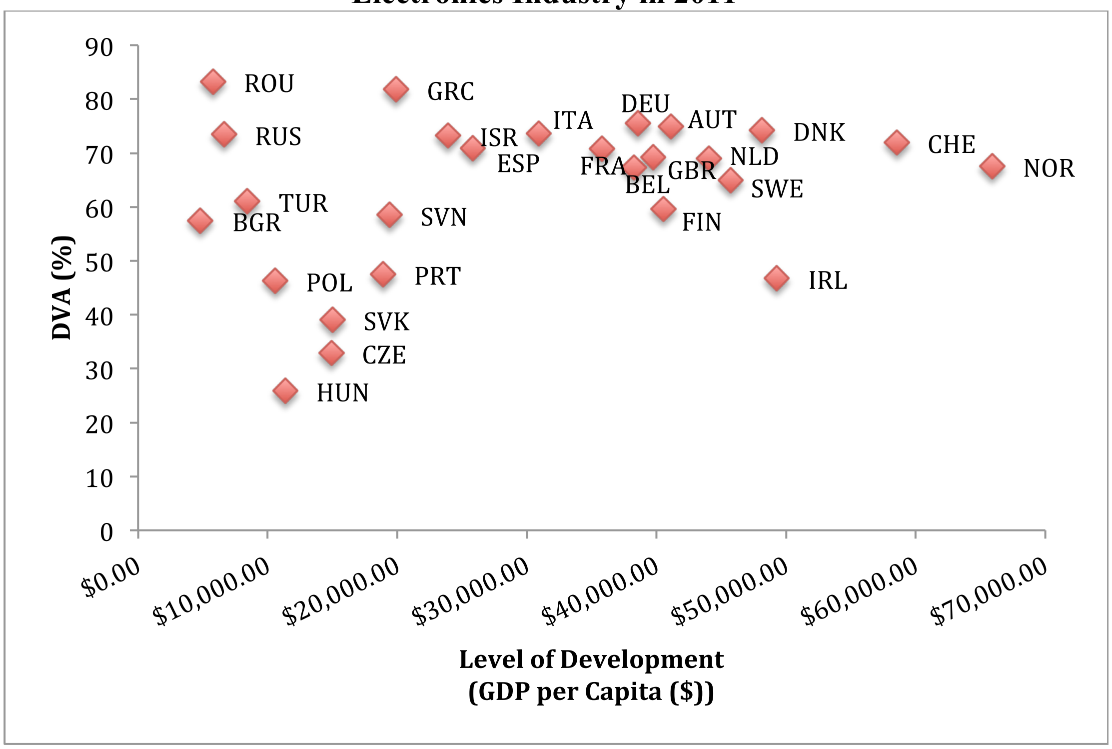
development that we see amongst EA countries on the scatterplot. For example, there is a large gap in development between Japan and Vietnam, where Japan has a much larger DVA in its

electronics industry and thus GDP per capita (level of development) than Vietnam, whose DVA, and thus level of development, is much lower. In terms of China, we see that it lies in the clump of East Asian countries that are located towards the bottom left corner of the scatterplot. China's DVA in electronics is low—as we have discussed—at 45.01% in 2011; its GDP per capita is $3,150.17. For a country of China's size, both of these measures are quite small which explains its lower level of development. Lastly, the spread, or gaps, between EA countries—both horizontally and vertically—is substantial, which results in a few clear outliers. For instance, both Indonesia and the Philippines have low levels of development but high shares of DVA. Clearly they are not a part of the East Asian networks and thus have not entered into the regional production system. Consequently, companies have not chosen these two places to do their export production. Also, while Indonesia looks more like Japan in terms of level of DVA, it is clearly *not* exporting the high-end electronics products that enable Japan to have such a great level of development. Because of this, Japan will have a much greater aggregate dollar of exports compared to Indonesia, which will have a much smaller dollar value and be exporting cheap, poor-quality goods. Thus, no one is dependent on Indonesia, while many countries—such as China—are dependent on Japan for exports. These features speak to the heterogeneity of East Asia. The significance of East Asia as a heterogeneous region will be elaborated upon later in the context of theories of international trade.

Now let us turn to the electronics industry for the region of Europe in 2011. This scatterplot displays the same data as figure 4.9 does, although for EU and not EA. It is presented in figure 4.10 below. Unlike the large SD seen in East Asia, the SD in Europe is much smaller. This indicates that there is less variance among countries. As a result, the economies of EU countries are much more similar than they are in EA; their production systems are largely alike;

and overall, the difference in DVA between countries is not as great as it is in EA. Figure 4.10 displays these characteristics well. We see that a pretty large clump of EU countries all rest around the same level of DVA (70%) in their individual electronics sectors. Unlike Korea and Vietnam in East Asia, for example, France and Germany do not differentiate much in levels of DVA and thus rest around similar amounts of GDP per capita, or levels of development. As was

Figure 4.10 - Relation between GDP per capita and DVA in Europe's Electronics Industry in 2011



Key

1). AUT = Austria
2). BEL = Belgium
3). CZE = Czech Republic
4). DNK = Denmark
5). FIN = Finland
6). FRA = France
7). DEU = Germany
8). HUN = Hungary
9). IRL = Ireland
10). ISR = Israel
11). ITA = Italy
12). NLD = Netherlands
13). NOR = Norway
14). POL = Poland
15). PRT = Portugal
16). SVK = Slovak Republic
17). SVN = Slovenia
18). ESP = Spain
19). SWE = Sweden
20). CHE = Switzerland
21). TUR = Turkey
22). GBR = United Kingdom
23). ROU = Romania
24). RUS = Russia
25). GRC = Greece
26). BGR = Bulgaria

Source: Data gathered from http://stats.oecd.org/

explained earlier, France may specialize in one pharmaceutical product, for instance, while Germany specializes in another. Yet in general, there will not be much variation in the manufacturing process of these pharmaceutical products. Furthermore, the majority of the countries in Europe rest at far greater level of development, or GDP per capita, than the countries in East Asia. While it is relatively easy to draw a line of correlation through the East Asian countries in figure 4.9, it is far more difficult to do the same for Europe in figure 4.10. Thus, one can conclude that a lot of these EU countries are likely not a part of the electronics network of

production. Because the EU networks ignore many of the countries within Europe, we are unable to draw an obvious line of correlation like that which exists for East Asia. Furthermore, Europe has a bunch of outliers, all of which are not a core part of the electronics network. Figure 4.10 shows a large clump of European countries between $30,000 and $50,000 GDP per capita. In East Asia, Japan has the highest GDP per capita at $36,203. This difference can be explained by the overall greater average of DVA had by Europe compared to East Asia. Because of this, EU is expected to have this greater level of development. Lastly, the fact that many of these EU countries lay around the same level of DVA speaks to the homogeneity seen in the European region. Similar to East Asia and its heterogeneity, we will elaborate upon the significance of the EU's homogeneity in what follows.

In closing, it is important to reiterate that GDP per capita is most widely used to determine level of development. In turn, level of development is largely indicative of level of technology. This is why the success of a country or region's electronics sector is often predictive of the success of its future growth and sustainability. For example, figure 4.8 shows that Japan has the highest GDP per capita and largest share of DVA in its electronics industry out of any East Asian country. So, more value is being added in Japan as less is being added in other countries around it. As a result, Japan has the largest level of development, and thus the most sophisticated level of technology in East Asia. Many would also consider Japan to be the most powerful country in the region in terms of growth and economic success. For China, its lower DVA correlates with a lower GDP per capita and thus level of development, which explains why its level of technology has not yet caught up to Japan's. As a result, China is not at the level that Japan is within East Asia. Finally, it is important to note—the shape of the spreads of GDP per capita and DVA for EA and EU in figure 4.8 from 1995 are largely similar to those displayed by

each region in figures 4.9 and 4.10 from 2011. This speaks to the largely unchanging, or plateauing, of DVA that has occurred in both the EU and EA regions. This point will be elaborated upon in the last section of this chapter.

F. International Theories of Trade to Further Explain the Data

While we have now thoroughly presented, examined, discussed and analyzed the measures of average DVA, SD, coefficient of variation, and the relationship between GDP per capita, which is indicative of level of development, and share of DVA, there is still a story that can be told in order to even better explain the patterns we have seen in each region. By utilizing theories of international trade, we will now more thoroughly discuss the trends seen within the East Asian and European regions.

Let's start with East Asia. As mentioned above, the East Asian region displays a large standard deviation in its variance. At the start of this thesis, the 'Flying Geese' theory of development was examined, which essentially explains the various developmental trajectories of East Asian countries. These select countries underwent different paths of development, some earlier than others. As a result, a great degree of heterogeneity developed within the region. This heterogeneous East Asian region can be explained by focusing on older theories of international trade. The driving force between conventional theories of international trade is comparative advantage. By using these conventional theories of international trade, we can explain the interconnectedness and networking inherent within the East Asian regional nexus. It is this concept of comparative advantage that enables a country like China, despite its rather low share of DVA and level of development, to still have the ability to export and trade in such high numbers. In addition to the concept of comparative advantage, the gravity model kicks in for the East Asian region. This model says that, all else equal, more trade takes place between countries

that are located geographically closer together. The patterns of average DVA and SD that are seen in EA can be explained by a combination of comparative advantage and the gravity model. The combination of these two is what largely defines the regionalized system that is East Asia.

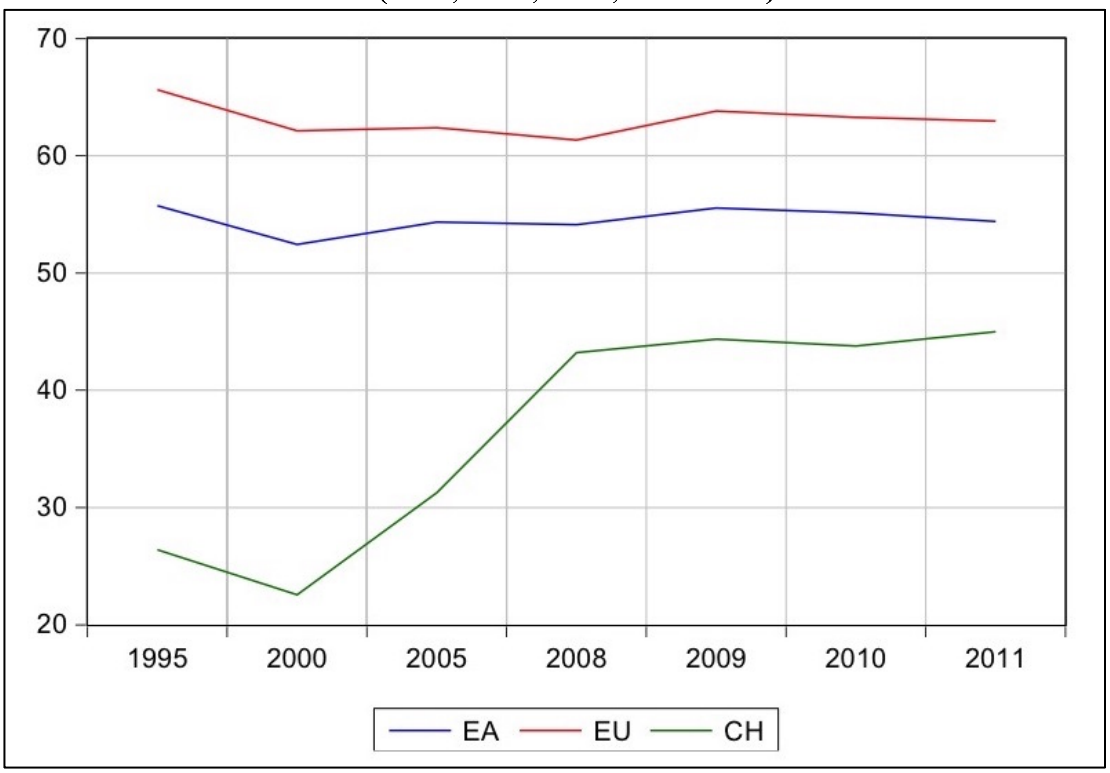
On the other hand, more modern theories of international trade can be used to explain what is seen in terms of patterns across Europe. The countries of Europe are more mature economies. They went through the industrial revolution much earlier and thus are overall more sophisticated in terms of technological development. This explains why they are able to produce such a great amount of DVA. The combination of these factors results in less variation across countries—hence its lower SD than East Asia—and therefore, a largely homogenous region. The more modern theories of international trade emphasize this homogeneity, with a focus on intra-trade instead of comparative advantage. Intra-trade refers to the exchange of similar products belonging to the same industrial classification. The term is usually applied to international trade, where the same types of goods or services are both imported and exported. Intra-trade allows for more refined degrees of sophistication. For example, a computer chip may be designed in Germany for a very specific kind of task, while a slightly different computer chip may be designed in France for a similar task. The two are not identical, but they are very similar. These products are called “differentiated products,” and speak to the similar levels of development that largely exist across Europe.

G. China’s “Leveling Off Phenomenon”

We still have not addressed one of the most curious patterns visible across the electronics industries of East Asia, Europe, and specifically, China. Figure 4.11 below addresses what I call the “leveling off phenomenon.” From 1995-2011, we can see that the average DVA in the electronics industries of East Asia and Europe has essentially rested at a plateau. There have

been minor increases and decreases, but largely, the DVA appears to have leveled off within both regions' electronics industry. China, on the other hand, experiences something a bit different. As previously mentioned, an export boom occurred around 2000, correlating with the sharp increase visible in the DVA of its electronics industry in figure 4.11 below. As a result of this increase, the share of electronics industry exports amongst China's gross export pie rose to

Figure 4.11 - Average % of DVA of the Electronics Industry in East Asia, Europe and China (1995, 2000, 2008, 2009-2011)



Source: Data gathered from http://stats.oecd.org/

almost 25%, or one quarter of all that China exports. This significant increase is indicative of China's continuing economic growth and future sustainability, for the electronics sector induces innovation and dynamism, which correlates with level of technology, a status that is representative of level of development. Therefore, one can assume that after seeing this sharp increase in DVA within China's electronics industry, the country's level of technology, sophistication and development will continue to increase as well and leave China at an even

higher standing within both the East Asian region and global arena. However, around 2008, this increasing of DVA began to plateau and has continued to level off since then.

So, there are two phenomena that are present here: one is the "leveling off phenomenon" that is existent in all three regions. The other is the fact that the plateauing is happening at *different levels*—each at around a 10% difference. China has plateaued at a share of around 45% DVA; East Asia at around 55% DVA; and Europe at around 65% DVA. The difference in these levels can be explained by the patterns in DVA that were examined beforehand. Europe has a much larger average of DVA than East Asia; within East Asia, China's average share of DVA is certainly not the lowest out of all the countries, but it is not the highest either. Figure 4.9 shows this. These differences in DVA create the distinct levels of plateauing amongst the two regions and China seen in the graph above.

In order to best explain the "leveling off phenomenon," let us use the concrete example of a country-to-country comparison. For example, India and China each contain more than a sixth of the world's population and have seen dramatic economic growth in recent decades. When we look at India's trade data, we see that the DVA share of its gross exports within its electronics industry is high—as high as 85% in 1995 and down to 69% in 2011, still quite a large share especially since its GDP per capita is so low—in fact, much lower than China's. Yet for China, the DVA share of its gross exports within its electronics industry is still much smaller than India's. In 1995, it was as low as 26%. After the export boom, it increased to 45% in 2011, though this is still far less than the share of DVA seen in India's electronics sector. So, what is the explanation behind these enormous differences? The answer is regionalization, or in India's case, the lack thereof.

India's DVA of exports is so high compared to China because there is no Japan, Korea,

or Taiwan, for example, right next to India. It is not nearly as integrated into a regional system of production as China is with East Asia. As a result, India has to rely on its own resources in its exports, which explains the large shares of DVA that exist. This lack of regionalization puts restrictions on India in terms of what it can and cannot do—unlike China, it does not have a Japan to turn to in order to assist in producing the intermediate components of its final electronics products, for instance.

That being the case, how can this information be used to explain the leveling off that is apparent in China's electronics industry? Empirically, the four years in which we see this phenomenon—from 2008 to 2011—is certainly a limitation in that it is a relatively short period of time in historical terms. It is important to acknowledge this fact as we further analyze the plateauing of DVA. Nevertheless, let us think about this "leveling off phenomenon" as essentially a manifestation of a *limit* to China's technological development. Again, the electronics industry is indicative of leading-edge technology in China. So, because this sector's DVA has been plateauing, instead of continuing to increase, one could speculate that there is indeed a limit to China's technological development *due to* the regionalization of the diverse East Asian nexus. The fact that China is a part of a region that has a Japan and Korea right there means that these two countries, with larger shares of DVA, greater levels of development, and probably more comparative advantages than China, are doing the more important tasks. As a result, a barrier, as one could call it, is essentially created for China in that it is much harder for China to compete with these surrounding, more superior countries. For India, it is the opposite effect—because India has everything to itself, it is possible that, say, twenty years from now, it could actually develop massive corporations that could be potentially competitive to Japan. In other words, India does not experience this barrier to growth that China arguably does.

The point is that for China, being so incredibly integrated into the East Asian network certainly has its advantages, such as the period of rapid growth experienced in its electronics industry or its aggregate size, which facilitates more exports and jobs because China has the ability to export a massive amount. These advantages counter India's situation, where it is not part of a network and thus is *not* exporting nearly as much or generating as many jobs. So, which is better? China's current condition with this abstract "barrier" but tons of exports and extensive job creation; or, India without a "barrier" but fewer exports and less job generation? This may be a matter of opinion, but for now, we see the "disadvantages" of East Asia's regionalized system playing out in China, with the leveling off of DVA in its electronics industry.

G. Conclusion

We have now thoroughly examined the data and results of this thesis. To best understand the data, the chosen measures of average, standard deviation and coefficient of variation are first defined and then explained. Then, by conducting a regional cross-comparison between East Asia and Europe, we are able to better assess what makes the East Asian region distinct from the European region. As a result, China's role within the East Asian region can be categorized. This helps us better understand if China alone is as strong as it appears to be with manufacturers and exports, or if its rise is heavily dependent on the success of the surrounding East Asian region, such that China's regional integration has driven its growth? The conclusions made after examining the relationship between DVA and GDP per capita — which is indicative of level of development — speak to the homogeneity that defines Europe versus the heterogeneity that defines East Asia. We close by shedding light upon the "leveling off phenomenon" that is seen in the electronics industries' of East Asia, Europe and China. Ultimately, we conclude with the speculation that while China's regionalization within East Asia is certainly advantageous in

many ways, it also has its downsides—having powerhouse countries such as Japan and Korea next door creates a type of barrier, or limit, for China in terms of continuous growth. This acts as a plausible explanation for the leveling off of DVA seen within its electronics industry. The chapter that follows will speak to the conclusions of this thesis.

CHAPTER FIVE

CONCLUSION

A. Summary of Findings

In this thesis, I have examined China's extraordinary growth through the analysis of the evolution, dynamics and trends of the content of Chinese exports from 1995-2011. I focus specifically on China's electronics industry—since the level of technology is often indicative of the level of development—in order to make predictions about China's future growth and sustainability. From a wider perspective, my thesis also sheds light upon the significance of China's location within the larger East Asian region and whether or not this aspect of regionalization either enhances or limits China's technological development and growth in the future.

After a thorough analysis of the data, the conclusions reached are as follows: Overall, the East Asian region has a larger degree of variance, or inequality, amongst its countries and is also far more interconnected, or networked, than the European region. Thus, some East Asian countries are much more dominant—such as Japan—than others—like Vietnam. As a result, there are also large gaps in GDP per capita, or level of development, throughout the region. At the country level, East Asia's high degree of variance signifies very large shares of DVA in some countries whereas other countries have very low shares of DVA and thus are doing little to no production. As a result, countries like Japan, with a high DVA, are dominant and the driver behind the East Asian production system, while Malaysia, for example, is doing far less and holds a much more minimal role within the regional production networks. In addition, the inequality that exists amongst East Asian countries speaks to the great degree of heterogeneity seen within the region, whereas Europe's lower level of variance, or inequality, explains its

largely homogeneous nature in terms of a majority of its economies being around the same level of development as one another.

On the other hand, East Asia's low level of DVA indicates that the region is more interconnected and networked than Europe. Thus, the majority of the industries within East Asia are intertwined, as each country is adding to another's FVA. For example, both Japan and China are "interconnected" though in different ways. Unlike China, Japan has a large share of DVA in its electronics sector—hence East Asia's high SD—which implies that Japan is far less interconnected in terms of *exporting* to other countries than China's electronics industry is, with its lower DVA. In other words, Japan does a lot of its producing at home, whereas China is interconnected as well but with regard to *importing* a large amount from other countries. So, Japan's exporting consists of a lot of the high-tech intermediate goods that other countries depend on for their own electronics industry and exports. By contrast, China's electronics industry depends on the intermediate goods from places like Japan, Korea, Taiwan, etc. As for Europe, it is far less networked as its overall high level of DVA enables European industries to function separately and without nearly as much reliance one another.

In terms of China, data show that its share of DVA is lower than to be expected for such a massive country. With over $200 billion in exports, China's economy is clearly enormous. Due to economies of scale and the diversification of its economy, China has the talent and knowledge to be good at all branches of production within its electronics industry. As a result, one would expect its DVA to be high when compared to a smaller country that does not have economies of scale or as diverse of an economy. When compared to Poland, a peripheral and post-socialist country that is around thirty-one times *smaller* than China, China's share of DVA is *still* less even with Poland's decreasing DVA levels. Furthermore, within the East Asian region, Japan

rests far above China in terms of level of DVA and GDP per capita, or level of development. As a result, its technological sophistication is also greater, which explains why China, despite its incredible growth, is still dependent on Japan for intermediate goods and other imports. Because China's aggregate export amount is massive, one would expect its *share* of DVA to be great as well since larger countries should be able to do more in terms of production. These facts are all quite convincing and remarkable, as they ultimately point to the conclusion that indeed, the significance behind China's success stems from its position within the larger East Asian regional nexus.

Finally, after much discussion about DVA and its significance pertaining to both East Asia and China, the data show a rather curious trend that I call the "leveling off phenomenon." Despite what is, in historical terms, considered to be a relatively short period of time, one can see that from 2008-2011, the DVA in China's electronics industry leveled off despite its previous exponential growth between 2000-2008. Speculative conclusions can certainly be made based on the data in terms of why this plateauing of DVA has set in. I argue that this "leveling off phenomenon" is essentially a manifestation of a *limit* to China's technological development. Again, the electronics industry is indicative of level of technology in China. So, because this sector's DVA has plateaued instead of continuing to increase, one could speculate that there is indeed a limit to China's technological development *due to* the regionalization of the diverse East Asian nexus. Since China has a neighbor like Japan—a powerhouse country with a large amount of DVA, a high level of development and great technological sophistication—a type of barrier, or limit, is arguably placed on China in terms of its continuous growth. Japan fills the role of a "senior member" within the East Asian region, as it experienced its development earlier than China and essentially took off after WWII. As a result, China came in as a latecomer to the

game of export-driven industrialization. So, having Japan as a mature economy at the head of the East Asian region arguably means that it does *not make sense* for China to be like Japan; instead, China can simply continue to utilize Japan's sophisticated, cutting-edge skills—especially in terms of electronics—rather than trying to compete with them and duplicate their processes.

Furthermore, the way in which multinational corporations (MNCs) operate in China is different than how they operate in other East Asian countries like Japan or Korea, for example. General Electric (GE), Toyota, and Honda—all very powerful MNCs—operate in a far *less* integrated way within the Chinese economy than they do within Japan's economy. This lack of integration has to do with the nature of China's supply chain networks. The supply chains within Japan are far more integrated in its economy than the supply chains in China are. Hence, the greater level of DVA in Japan and the lower level in China. This difference in the nature of operation of MNCs could be yet another explanation for the leveling off of DVA seen in China's electronics industry.

B. Suggestions for Future Research

This thesis examines China's extraordinary growth through the analysis of the evolution, dynamics and trends of the content of Chinese exports from 1995-2011. Its focus on China's electronics industry specifically enables informed guesses to be made about its future growth and sustainability, since level of technology is often indicative of a country's level of development. However, empirically there is a limit in that the OECD data only provides trade in value added information from 1995-2011. The leveling off of DVA in China's electronics industry is seen over a period of four years, which is, in historical terms, a relatively short period of time. If future data comes out that shows China's electronics industry DVA continuing to level off, then we know it truly has hit a barrier in terms of technological advancement, which may indeed

indicate that there are downsides to China's integration within East Asia. Yet if I am wrong, then a situation may exist a few years from now where Chinese DVA in its electronics industry continues to rise towards 55% or even 65% as its GDP per capita increases. Only the future will tell.

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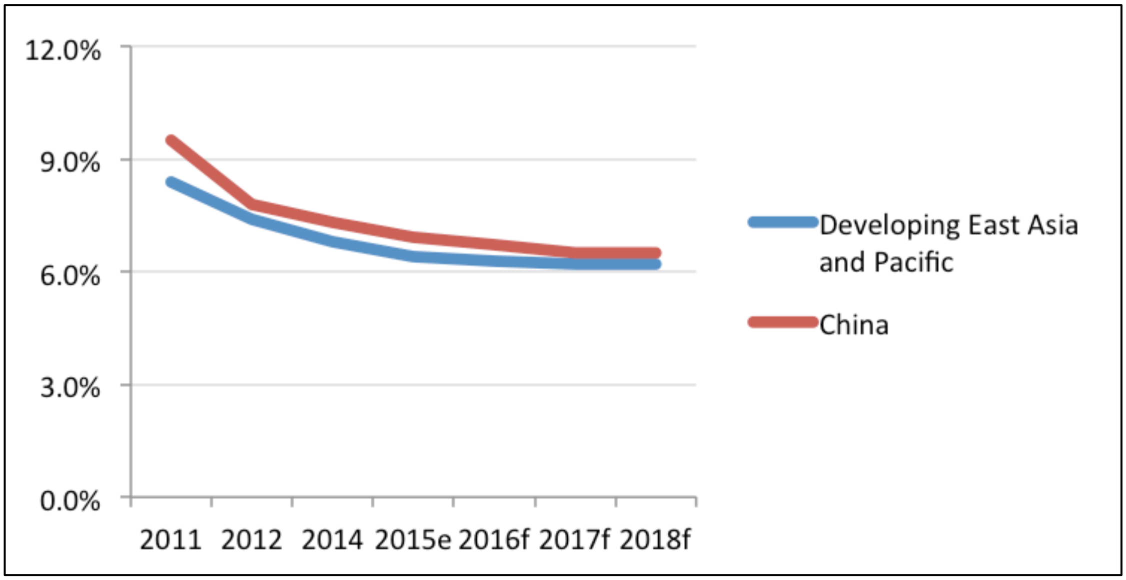
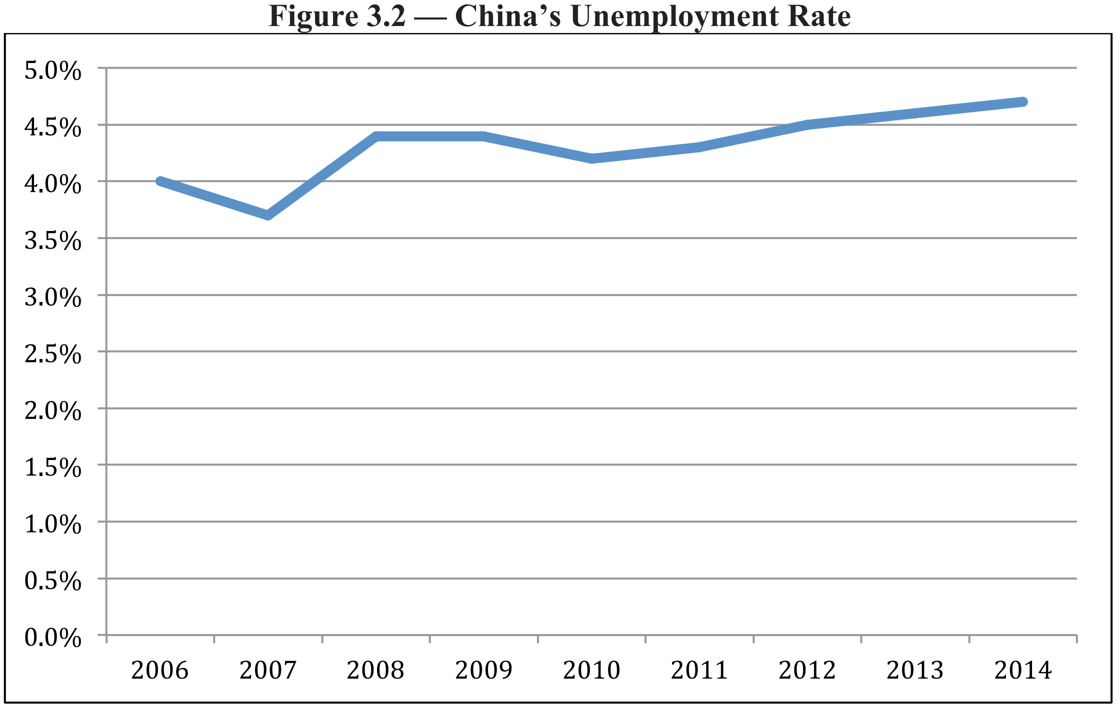
Appendix

Figure 3.1 — China's Real GDP Growth



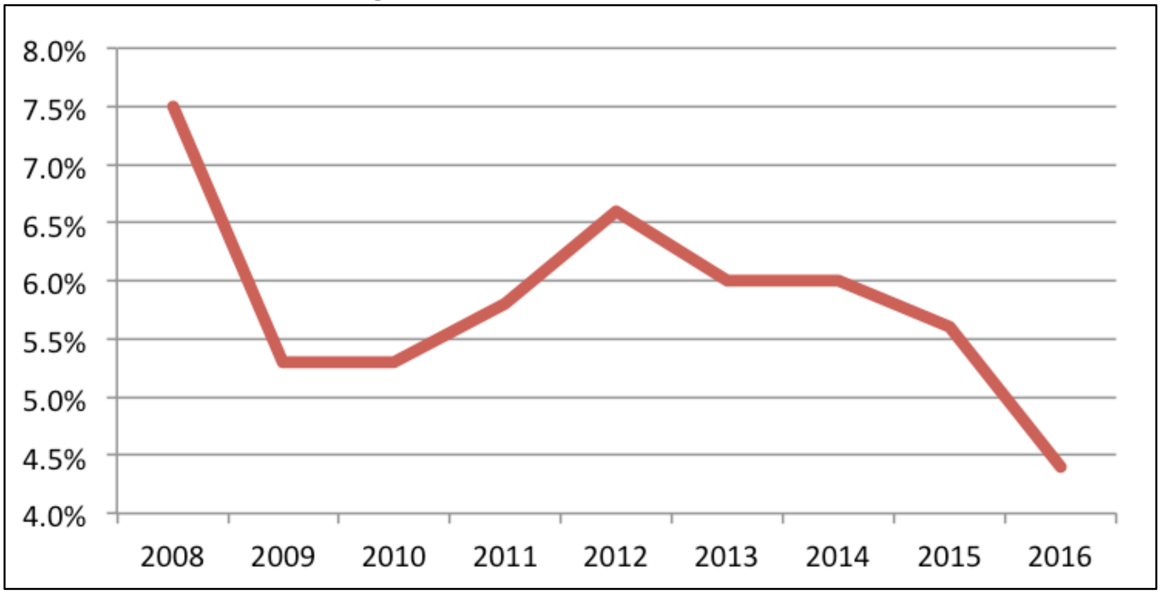
Source: Data compiled from http://databank.worldbank.org

Figure 3.2 — China's Unemployment Rate



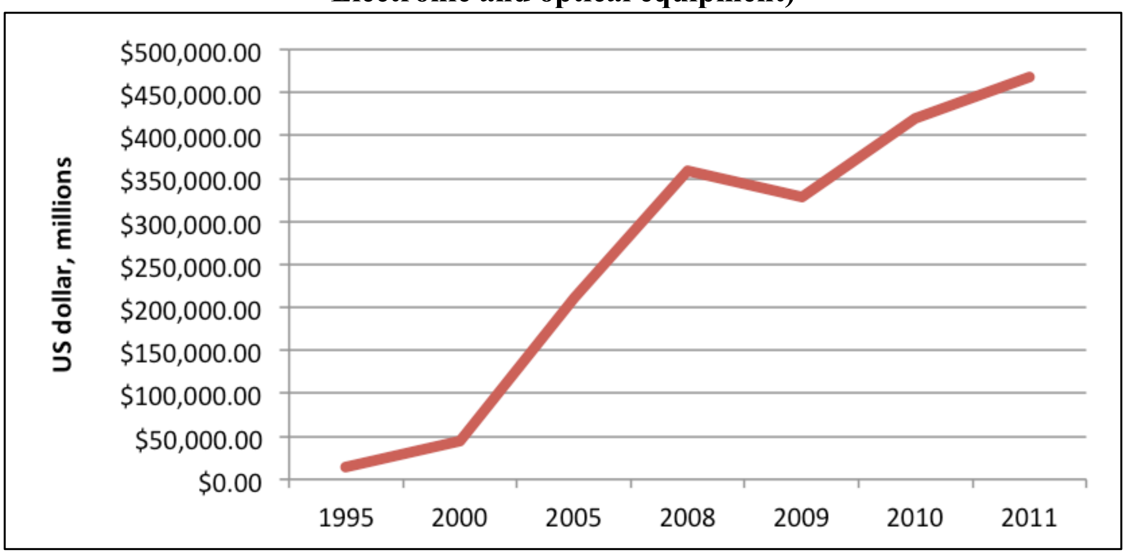
Source: Data compiled from http://databank.worldbank.org

Figure 3.3 — China's Interest Rate



Source: Data compiled from http://databank.worldbank.org

Figure 3.4 — China's Gross Exports: Electronics Industry (C30T33X: Computer, Electronic and optical equipment)



Source: Data compiled from http://stats.oecd.org/

Figure 4.1 — Diagram of Average and Standard Deviation Breakdown

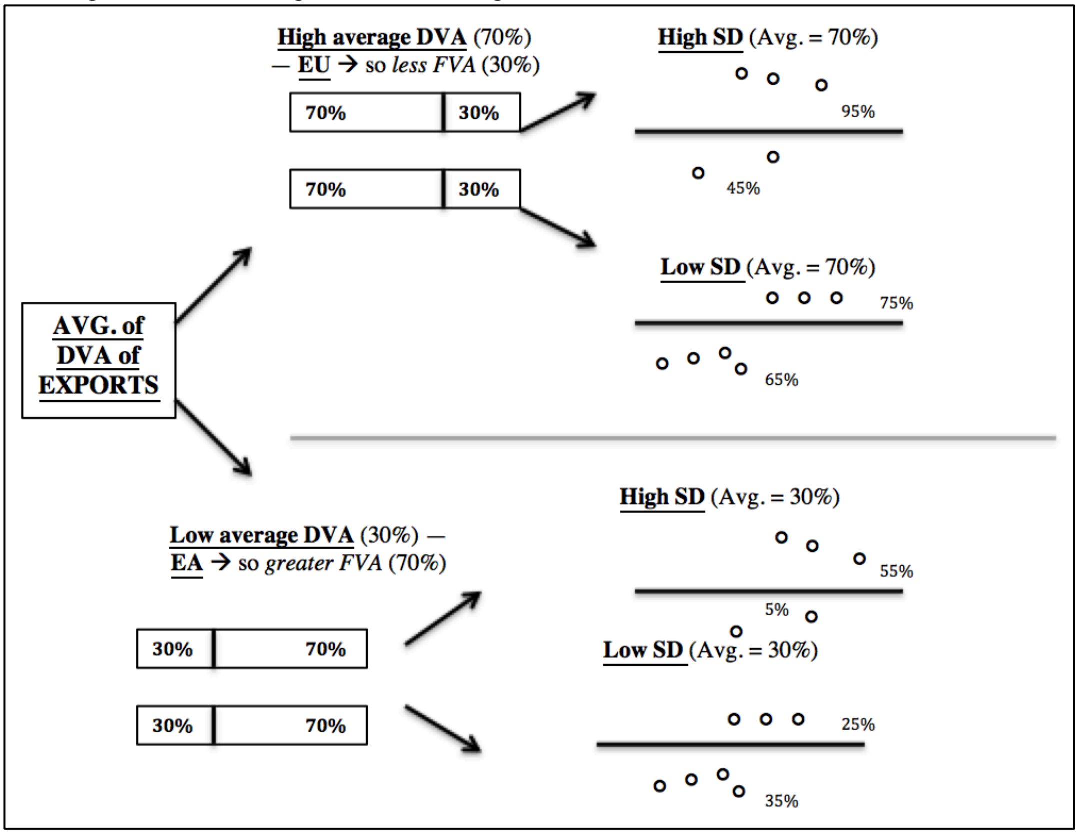
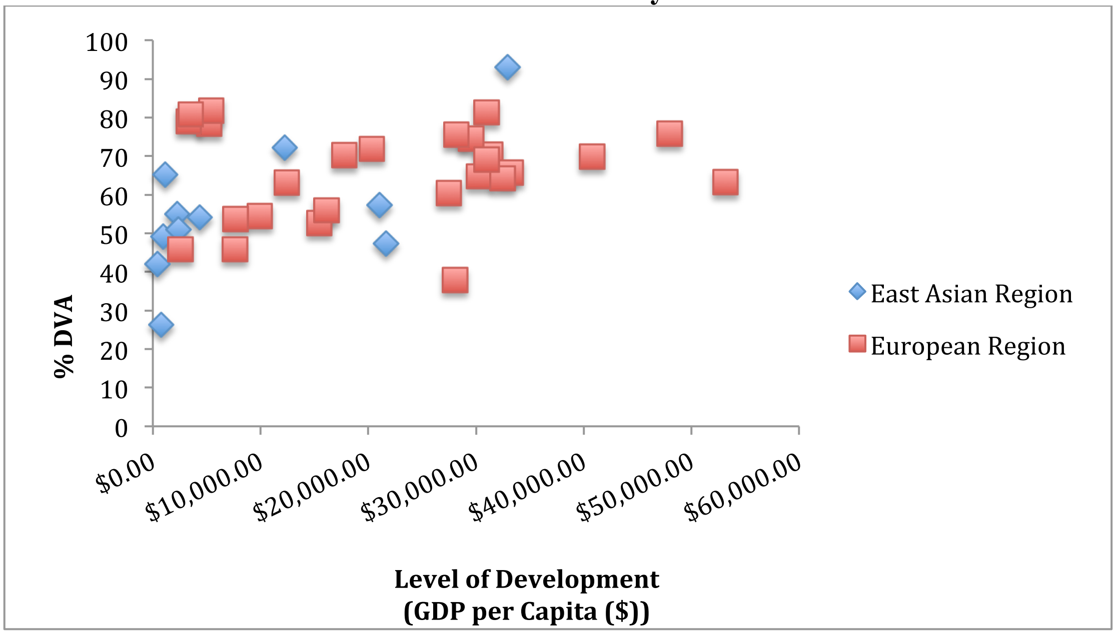


Figure 4.2 — Coefficient of Variation Equation

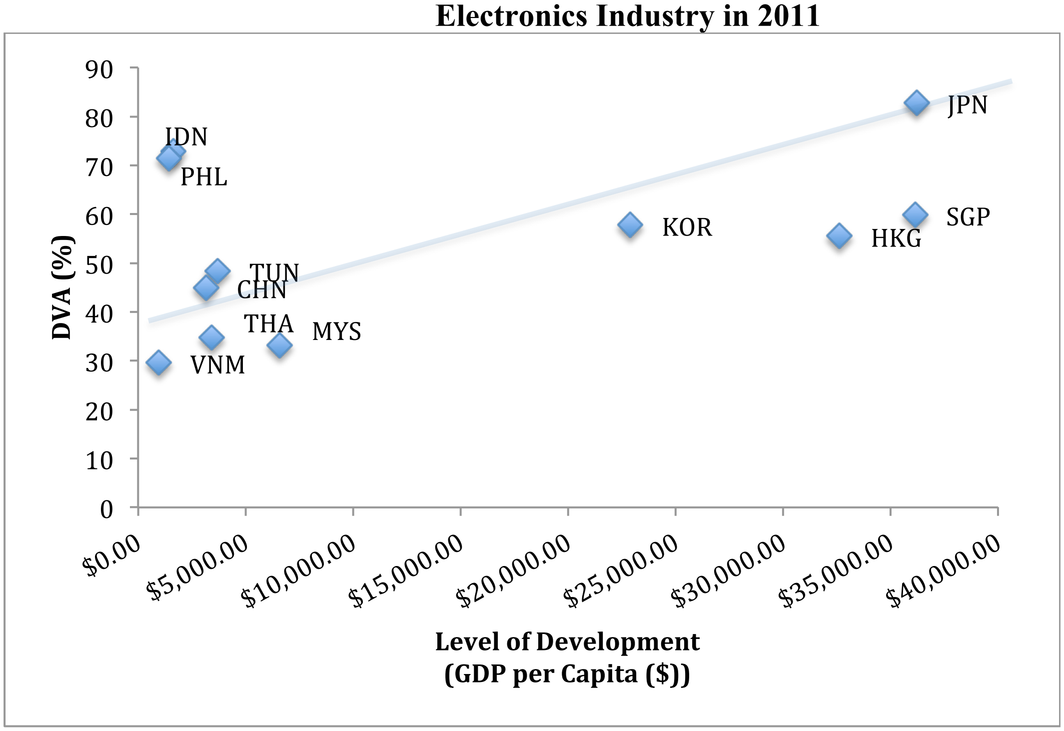
$$\mathbf{CV} = \frac{\text{Standard Deviation (SD)}}{\text{Average}}\ \mathbf{x100}$$

Figure 4.8 - Relation between GDP per capita and DVA in East Asia and Europe's Electronics Industry in 1995



Source: Data gathered from http://stats.oecd.org/

Figure 4.9 - Relation between GDP per capita and DVA in East Asia's Electronics Industry in 2011



Key

1). TUN = Tunisia

2). JPN = Japan

3). KOR = Korea

4). CHN = China

5). HKG = Hong Kong

6). IDN = Indonesia

7). MYS = Malaysia

8). PHL = Philippines

9). SGP = Singapore

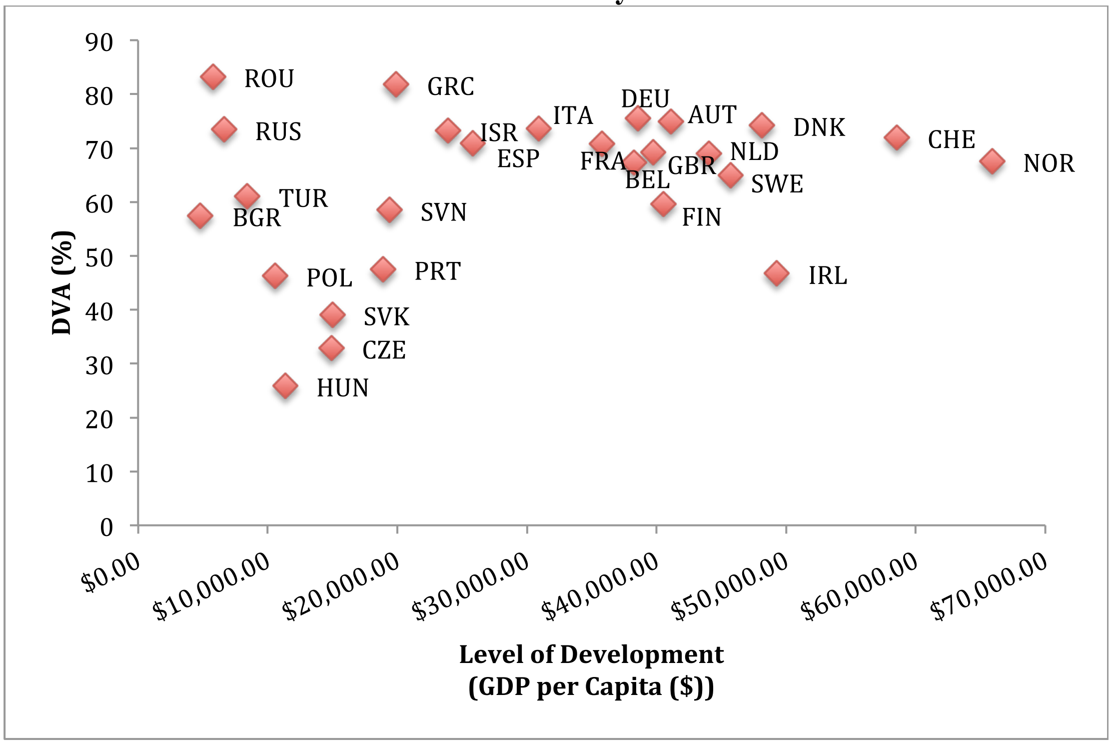
10). TWN = Taiwan

11). THA = Thailand

12). VNM = Vietnam

Source: Data gathered from http://stats.oecd.org/

Figure 4.10 - Relation between GDP per capita and DVA in Europe's Electronics Industry in 2011

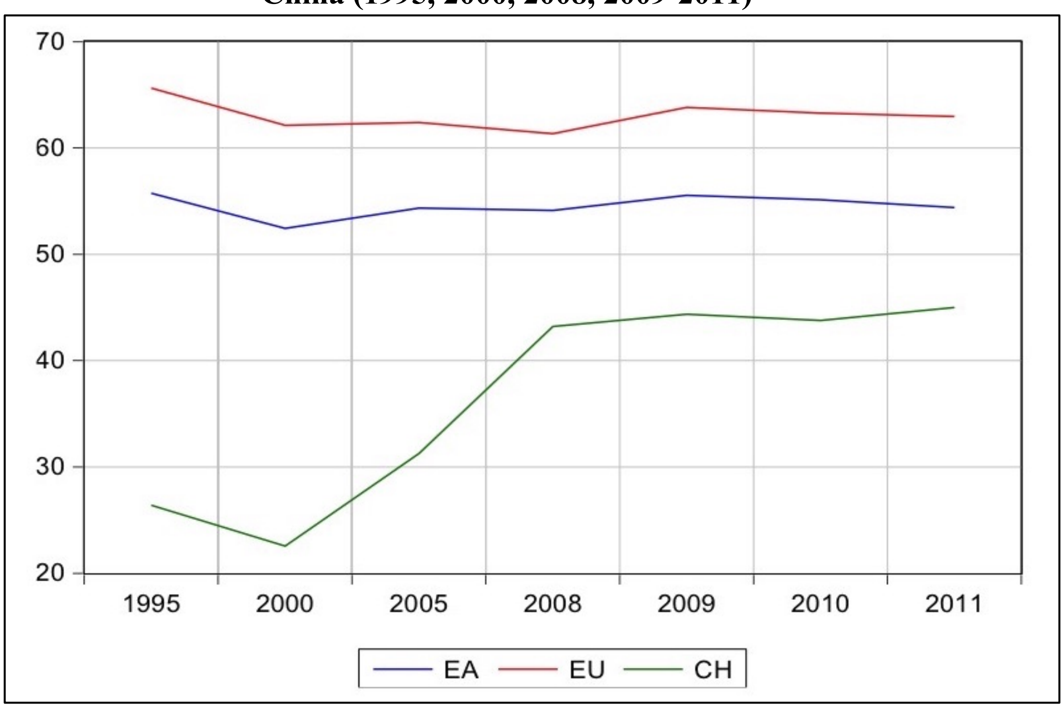


Key

1). AUT = Austria
2). BEL = Belgium
3). CZE = Czech Republic
4). DNK = Denmark
5). FIN = Finland
6). FRA = France
7). DEU = Germany
8). HUN = Hungary
9). IRL = Ireland
10). ISR = Israel
11). ITA = Italy
12). NLD = Netherlands
13). NOR = Norway
14). POL = Poland
15). PRT = Portugal
16). SVK = Slovak Republic
17). SVN = Slovenia
18). ESP = Spain
19). SWE = Sweden
20). CHE = Switzerland
21). TUR = Turkey
22). GBR = United Kingdom
23). ROU = Romania
24). RUS = Russia
25). GRC = Greece
26). BGR = Bulgaria

Source: Data gathered from http://stats.oecd.org/

Figure 4.11 - Average % of DVA of the Electronics Industry in East Asia, Europe and China (1995, 2000, 2008, 2009-2011)



Source: Data gathered from http://stats.oecd.org/

Tables

Table 3.5 — Chinese Export Data

Product Description	Sum of Trade Value in USD (1996-2013)	% of gross exports from China
Electrical mchy equip parts thereof…	$3.68 billion	23.12%
Nuclear reactors, boilers, mchy…	$2.90 billion	18.23%
Art of apparel & clothing access…	$.7 billion	4.49%

Source: Data compiled from http://wits.wordldbank.org

Table 4.3 — Calculated CV in both EU and EA's electronics' industry (1995)

1995	Average (DVA)	SD	CV
Europe (EU)	65.63	11.99	**18.27%**
East Asia (EA)	55.75	17.19	**30.80%**

Source: Data compiled from http://stats.oecd.org/

Table 4.4 — Selected Industries

1	C30T33X	Computer, Electronic and optical equipment
2	C17T19	Textiles, textile products, leather and footwear
3	C21T22	Pulp, paper, paper products, printing and publishing
4	C34	Motor vehicles, trailers and semi-trailers
5	C15T16	Food products, beverages and tobacco
6	C25	Rubber and plastics products

Source: Data compiled from http://stats.oecd.org/

Table 4.5 — Region with the Greater AVG and SD in Each Industry

Industry	AVG		SD	
	EU	EA	EU	EA
C30T33X Electronics	63.08**	54.53	14.24	17.86**
C17T19 Textiles	70.20**	66.84	13.04**	9.62
C21T22 Pulp, Paper	74.95**	69.19	7.69	12.86**
C34 Motor Vehicles	57.71	61.37**	11.80	14.36**
C15T16 Food Products	74.66	75.98**	7.11	12.48**
C25 Rubber, Plastic Products	66.76**	66.01	8.01	12.01**

** Denotes the larger value

Source: Data gathered from http://stats.oecd.org/

Table 4.6 — DVA and FVA shares in China's Electronics Industry (C30T33X)

	1995	2000	2005	2008	2009	2010	2011
DVA (%)	26.4	22.6	31.3	43.2	44.4	43.8	45.0
FVA (%)	73.6	77.4	68.7	56.8	55.6	56.2	55.0

Source: Data gathered from http://stats.oecd.org/

Table 4.7 — DVA and FVA shares in Poland's Electronics Industry (C30T33X)

	1995	2000	2005	2008	2009	2010	2011
DVA (%)	78.29	66.18	58.20	51.45	59.31	44.81	46.31
FVA (%)	21.71	33.82	41.80	48.55	40.69	55.19	53.69

Source: Data gathered from http://stats.oecd.org/