Gains from Trade in Transition Economies:

The Cases of Mongolia and Vietnam

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Abstract

Within the international trade framework, three independent studies were carried out.

First, we argue that the extreme dependence on the natural resource sector has affected a part of the Mongolian economy negatively, thus causing the manufacturing sector decline. This phenomenon, or the so-called Dutch Disease hypothesis were tested and the results are supportive of the argument. We found a long-run negative relationship between the growing resource sector and manufacturing: a one-percent increase in the resource sector brings a two-percent decrease in manufacturing.

Second, contributing to the vast literature of gains from variety (Broda and Weinstein, 2006), I estimated the welfare impact of the enormous imported varieties growth in Mongolia and found it to be considerably larger than that found in other country studies. Thus, my results show that from 1988 to 2015, the gains from variety were equal to 22 percent of Mongolia's GDP, or 0.8 percent annually. While estimating the gains from variety, I estimated 1390 elasticities of substitution exclusive to Mongolia using the most disaggregated data available for Mongolia.

Third, we compared the industry level welfare gains to find out which one of the two significant liberalization phenomena (BTA with the U.S. or WTO accession) benefitted Vietnam the most. In doing so, we used the relatively new measure by Arkolakis et al (2012) to calculate the industrial gains. In this context, we computed the dynamic gains from trade to make the comparison. We found out that perhaps having more countries as trade partners is better than having one "big" partner, meaning that after the accession to the WTO, Vietnam enjoyed relatively greater gains.

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Introduction

I have dedicated two thirds of my dissertation to study the Mongolian economy and its weaknesses in hope for offering solutions. The rest of my dissertation is dedicated to study and compare Vietnam's gains from two significant milestones of international trade, the bilateral trade agreement (BTA) and the World Trade Organization (WTO) accession.

The ***first chapter*** was conducted seeking evidence of the "Dutch Disease" in Mongolia. The Mongolian economy is a small open economy highly dependent on exports of natural mineral resources, which accounted for 90 percent of the total exports since 2010. Thus. there are potential adverse effects of this booming resource sector on other sectors in the economy, in particular, the manufacturing sector.

I conducted empirical analysis using a Vector Error Correction Modeling (VECM) approach. This approach allows me to quantify the systematic effects of a booming resource sector on manufacturing output, considering the short-term effects separately from the long-term consequences. Strong evidence was found and it suggests that a one-percentage increase in resource production is followed by more than two-percentage shrinkage in manufacturing.

In addition to the statistical analysis, I systematically reviewed the natural resource economics literature to find out how natural resource windfalls effect the economy, and I discussed about both the negative and positive experiences of the natural resource abundant countries. Furthermore, as a possible policy response to the Dutch Disease, I reviewed about the optimal exploitation of the resources and three popular policy implications.

As a contribution to the literature, this research thus, offers support for the Dutch Disease hypothesis, and supplements the literature by providing the Mongolian case study evidence.

Furthermore, I believe this chapter might be useful for Mongolian policymakers to better understand the mechanisms and possible solutions of the Dutch Disease phenomenon.

The results of the study were presented at the Embassy of Mongolia in Tokyo, in April 2015, as well as the 6th Spring Meeting of The Japan Society of International Economics (JSIE).

The ***second chapter*** was carried out to estimate the comprehensive gains from variety for Mongolian economy during 1988-2015, following the seminal works by Feenstra (1994) and Broda and Weinstein (2006).

Mongolia had undertaken serious economic reforms in 1990 after the collapse of the Soviet Union and suffered a long and dramatic process of transformation into the free-market economy, easing price controls, liberalizing domestic and foreign trade. The centrally planned economy, state-owned industries and banking systems were transferred into the private sectors. However, the economy is still in transition.

The gains from variety for Mongolian economy were estimated, using six-digit harmonized system (HS) products data which is the most disaggregated data available for Mongolia. I estimated 1390 elasticities and with the elasticities, I constructed an exact price index to measure the welfare gains from variety growth. This method is consistent with the theory of monopolistic competition and is robust in empirical applications (Feenstra, 1994).

The results show that the welfare gain owing to newly imported varieties from 1988 to 2015 amounts to 22 percent of GDP, or 0.8 percent annually. This is a significant result considering the moderate annual gains from 0.1 percent (Broda and Weinstein, 2006) to 0.4 percent (Chen and Ma, 2012) the most studies show.

I contribute to the growing literature by providing a measure of Mongolia's welfare gain due to import variety from 1988 to 2015. This is the first such study to apply the methodology of Broda and Weinstein (2006) to calculate Mongolian gains from variety, thus I had two *motivations* in mind. First, by measuring Mongolia's gains from import varieties after the liberalization in 1990s, I provided supporting evidence favoring trade liberalization for developing countries. Second, I estimated elasticities exclusive to Mongolia using a highly disaggregated import data and these elasticities may be useful for other studies.

In the ***third chapter***, we examine the industry-level welfare impacts of the two significant liberalization measures of Vietnam, the BTA with the United States (U.S.) and the WTO accession. It is rare to find such important liberalization measures in the same economy, making one wonder if the size of a partner or the number of partners matter the most in international trade. Consequently, the aim of this chapter is to compare the industrial welfare impacts of the BTA and the WTO accession in Vietnamese economy, using the methodology proposed by Arkolakis et al. (2012).

Arkolakis et al. (2012) demonstrate that for quantitative trade models, whatever the welfare contribution of particular margins may be, the total size of the gains from trade can always be computed using the same aggregate statistics, *domestic expenditure share* and *trade elasticity*.

Here are the main findings of the third chapter. Compared to hypothetical state of autarky, we found that both the BTA and the WTO contributed significantly to Vietnam's gains from trade. However, the tariff reduction effects of the BTA were rather short-lived from 2002 to 2004, while the welfare gain after the accession to the WTO continued consistently from 2007 to 2011, despite the Global Financial Crisis. Furthermore, comparing the industrial gains of three most gaining industries, the welfare gained after the WTO accession found to be larger in magnitude.

Considering all the findings, we conclude that the welfare gained after the WTO accession is larger than the gains earned after the BTA with the U.S. In addition, we found that textile industry contributed substantially to the overall gains from trade.

We believe that our findings provide supporting evidence favoring the trade liberalization for developing countries, particularly for the economies that are still in transition. It may also provide informative implications to Vietnam's policymakers. In addition, we estimated sectoral trade elasticities using Vietnamese trade data, which may be useful for other studies.

Chapter 1

Dutch Disease in Mongolia: Empirical evidence

1.1 Introduction

The natural resource sector plays considerable role in Mongolian economy. The establishment of Erdenet Mining Corporation, one of the biggest ore mining and processing factories in Asia, in 1978 not only represented large increases in the national wealth but also accelerated rapid growth in the natural resource sector in Mongolia. The further developments together with the most recent Oyutolgoi mine exploitation from 2010, made Mongolia a resource exporter.

Although the Mongolian economy enjoys high resource incomes, there are potential adverse effects of the booming resource sector on other sectors in the economy, in particular, manufacturing. In other words, there is a potential threat of de-industrialization in the economy.

The negative effect, such as this, of the resource windfall to the economy is explained by the phenomenon so-called the Dutch Disease. The mechanism behind the Dutch Disease is clear. A part of the resource revenues is spent on non-traded goods (services) which leads to a real appreciation (i.e., a rise in the relative price of non-traded goods in terms of traded goods). This in turn draws resources out of the non-resource traded sector (manufacturing) into the non-traded goods producing sector (Corden and Neary (1982).

Under the Dutch Disease hypothesis Hutchison (1994) has done a comparative statistical analysis which examines whether the development of the oil and gas sectors had adverse effects on the manufacturing sectors in the United Kingdom, the Netherlands, and Norway. I follow his empirical model and conduct statistical analysis looking for evidence of Dutch disease in Mongolia. The vector error correction modeling (VECM) approach is used. Strong evidence was found and it suggests that a one percentage increase in resource production is followed by a more than two percentage shrinkage in manufacturing. Variance decomposition results tell us that the share as large as 40% of manufacturing variance is attributable to the booming resource sector in a year. I also conducted robustness checks to see if the sample period from 2003 to 2007 and different resource price calculations make any difference. The robustness check results are in line with the main results.

Although the Mongolian economy is characterized by symptoms of the Dutch disease, no formal statistical work has been applied to this problem. The research fills this gap using monthly data from the National Statistical Office of Mongolia. In addition, to contribute to the explanatory implications for the Mongolian decision makers, I reviewed more general literature of how natural resource windfalls effect the economy, and discussed about both the negative and positive experiences of the natural resource abundant countries. Furthermore, as a possible policy response to the Dutch Disease, I discussed about the optimal exploitation of the resources and three popular policy implications.

The rest of the chapter is organized as follows. Section 1.2 reviews the theoretical and empirical literature of natural resource curse phenomenon and presents possible responsive policy implications to dampen the negative effect of the resource windfall. Using the descriptive statistics, Section 1.3 considers the Mongolian experience with natural resource discoveries and developments. Section 1.4 presents the VECM methodology and data, and reports the empirical results. Section 1.5 summarizes the major findings of the analysis and concludes.

1.2 Theoretical and Empirical Literature

Many recognize the opportunities natural resources provide for economic growth and development and thus the challenge of ensuring that natural resource wealth leads to sustained economic growth and development. Still, many countries are cursed by natural resource wealth. The key question is why resource rich economies such as Botswana or Norway are more successful while others perform badly despite their immense natural wealth. Is it because resource booms induce appreciation of the real exchange rate and makes non- resource sectors less competitive, i.e. is it because of the Dutch disease? More generally, are natural resources a “curse” or a “blessing”?

Frederik van der Ploeg (2011) argues that empirically either outcome is possible. He surveyed a variety of hypotheses and supporting evidence for why some countries benefit and others lose from the presence of natural resources. These include that a resource windfall induces appreciation of the real exchange rate, deindustrialization (Dutch disease) and bad growth prospects, and that these adverse effects are more severe in volatile countries with bad institutions and lack of rule of law, corruption, and underdeveloped financial systems. Another hypothesis is that a resource boom reinforces rent seeking and civil conflict especially if institutions are bad, induces corruption, and keeps in place bad policies.

1.2.1 The Experiences of Resource Rich Countries

The experiences of resource rich countries have been diverse. In here, benefitting from Frederik van der Ploeg’s (2011) seminal work, I discuss some examples of countries whose dependence on natural resources have gone together with bad macroeconomic performance and growing inequality among their citizens and contrast these with others which have benefited from their natural resource wealth.

The most dramatic example is perhaps Nigeria. Oil revenues per capita in Nigeria increased from 33 U.S. dollars in 1965 to 325 U.S. dollars in 2000, but income per capita has stagnated at around 1100 U.S. dollars in PPP terms since its independence in 1960 putting Nigeria among the 15 poorest countries in the world. Between 1970 and 2000 the part of the population that has to survive on less than 1 U.S. dollar per day shot up from 26 to almost 70 percent. Clearly, huge oil exports have not benefited the average Nigerian. Although Nigeria has experienced rapid growth of physical capital at 6.7 percent per year since independence, it has suffered a declining productivity of 1.2 percent per year. Capacity utilization in manufacturing remains around a third. Two thirds of capacity, often owned by the government, thus goes to waste. Consecutive military dictatorships have plundered oil wealth and Nigeria is known for its anecdotes about transfers of large amounts of undisclosed wealth. Oil wealth has fundamentally altered politics and governance in Nigeria. It is hard to argue that standard Dutch disease story of worsening competitiveness of the non-oil export sector fully explains its miserable economic performance.

Other oil exporters, Iran, Venezuela, Libya, Iraq, Kuwait and Qatar experienced negative growth during the last few decades. Organization of the Petroleum Exporting Countries (OPEC) as a whole saw a decline in Gross National Income (GNP) per capita while other countries with similar GNP per capita enjoyed growth. The deindustrialization and disappointing growth experience of South Africa following the boom in gold prices can be explained by the appreciation of the real exchange rate in the 1970's followed by gradual depreciations together with increased barriers to technological adoption. The disruption of the 'air bridge' from 1994 onwards shifted the production of coca paste[1] from Peru and Bolivia to Columbia and led to a huge boom in the demand

[1] Coca paste is an intermediary product in the chemical extraction of cocaine from coca leaves.

for Columbian coca leaf. This has led to more self-employment and work for teenage boys in rural areas, but not to widespread economic spill-over effects, and the financial opportunities that coca provided have fueled violence and civilian conflict especially outside the major cities (Angrist and Kugler, 2008). Greenland benefits from a large annual grant from Denmark to ensure a similar GDP per capita to the Danish one. As a result, it has suffered from an appreciated real exchange rate as well as rent seeking from a comprehensive system of state firms and price regulations (Paldam, 1997).

Others experiences are more positive. 40 percent of Botswana's GDP stems from diamonds, but Botswana has managed to beat the resource curse. It has the second highest public expenditure on education as a fraction of GNP, enjoys the world's highest growth rate since 1965 and its GDP per capita is at least ten times that of Nigeria. The Botswana experience is notable, since it started its post-colonial experience with minimal investment and substantial inequality.

Of 65 resource rich, developing countries only four managed to achieve long-term investment exceeding 25 percent of GDP and an average GDP growth exceeding four percent, namely Botswana, Indonesia, Malaysia and Thailand (Gylfason, 2001). Aside from Botswana, three resource rich Asian countries have achieved this by economic diversification and industrialization. Still, they are not doing well compared to their neighbors with little raw material wealth, including Hong Kong, Singapore and South Korea.

Norway has shown remarkable growth in manufacturing and the rest of the economy, compared with its neighbors despite phenomenal growth in oil exports since 1971 (Larsen, 2006). Norway is the world's third largest petroleum exporter after Saudi-Arabia and Russia, but is one of the least corrupt countries in the world and enjoys well developed institutions, far sighted management and market friendly policies.

United Arab Emirates account for close to 10 percent of the world's crude oil and four percent of the world's natural gas reserves, but has turned its resource curse into a blessing (Fasano, 2002). Its government debt is very small, inflation is low and hydrocarbon wealth has been used to modernize infrastructure, create jobs and establish a generous welfare system. Major strides in life expectancy and literacy have been made through universal and free access to education and health care. In anticipation of exhaustion of its natural resources, oil- rich Abu Dhabi has emphasized petrochemical and fertilizers, Dubai has diversified into light manufacturing, telecommunications, finance and tourism, and the other emirates have focused on small-scale manufacturing, agriculture, quarrying, cement and shipping services.

Many Latin American countries have abandoned misguided state policies, encouraged foreign investment in mining and increased the security of mining investment. In terms of spending on exploitation, since the 1990's Latin America appears to be the fastest growing mining region, well ahead of Australia, Canada, Africa and the U.S. Chile has recently achieved remarkable annual growth rates of 8.5 percent while the mining industry accounted for almost half of total exports. Peru ranks second in the world in the production of silver and tin, fourth in zinc and lead and eighth in gold and its mineral sectors enjoy prospects for further growth. Another leader in this region is Brazil. Argentina seems to be moving ahead as well.

Natural Resource and Growth

Here I discuss about some cross-country stylized facts on the effects of resources on economic and social outcomes. There is a negative correlation between growth performance and the share of natural resources in merchandise exports, however this does not tell us anything about causation (van der Ploeg, 2011).

Natural resource dependence may harm the economy through other variables than lower growth (Gylfason et al., 1999; Gylfason, 2001, 2004). For example, partial cross-country correlations for oil exporters in the Arab world and elsewhere suggest that resource dependence is associated with less non-resource exports and foreign direct investment. Evidence of a sample of 87 countries suggest that resource wealth is associated with less openness to foreign trade and less openness to gross foreign direct investment, which in turn may harm growth prospects. Also, in a sample of 85 countries the share of natural resource wealth in national capital is negatively correlated with both gross domestic investment as percentage of GDP and the average ratio of broad money (M2) to GDP[2].

Furthermore, although there are exceptions such as Botswana, there is an inverse correlation between resource dependence and school enrolment at all levels, expected years of schooling and public spending on education. This may matter as there is a positive correlation between education and growth.

Finally, empirically there is a positive correlation between natural resource dependence and macroeconomic volatility and a negative correlation between macroeconomic volatility and growth (van der Ploeg and Poelhekke, 2009). Thus, we can conclude that these partial correlations are not inconsistent with the suggestion that resource dependence crowds out foreign, social, human, real and financial capital, each effect tending to dampen growth.

Natural Resource and Wealth of Nations

I discuss here about the statistics by the World Bank (2006) to see to what extent natural resource wealth is converted into physical, human and other wealth.

[2] A ratio of M2 to GDP is a measure of financial development.

Various components of national wealth for the year 2000 have been calculated for nearly 120 countries in the world (World Bank, 2006). Produced capital is estimated from historical investment data with the perpetual inventory method. Natural capital consists of subsoil assets, timber resources, non-timber forest resources, protected areas, cropland and pastureland. However, due to data problems, fisheries, subsoil water and diamonds are excluded. The explicit value of ecosystems is not evaluated either.

The value of natural capital is estimated from world prices and local costs. Intangible capital reflects the contribution of raw labor, human capital, research and development (R&D), social capital and other factors such as institutions and rule of law. It is calculated residually as the excess of total national wealth over the sum of produced and natural capital and is well explained by school years per capita, a rule of law index and remittances per capita. For example, an extra year of schooling yields extra intangible capital varying from 840 U.S. dollars for low-income to 16,430 U.S. dollars for high-income countries.

Although global wealth per capita is 96,000 U.S. dollars, this masks huge variety across countries. The share of produced assets in total wealth is more or less the same irrespective of how poor or rich a country is. However, the share of natural capital in total wealth is much higher in poorer countries while the share of intangible capital in total wealth is substantially higher in richer economies. Interestingly, richer countries have a substantially higher value of natural capital per capita despite having lower shares of natural capital in total wealth. The results confirm what we know from the literature on economic growth that intangible capital is the main engine of growth and wealth. Richer countries focus relatively more on dynamic sectors such as manufacturing and services, whereas poorer countries specialize in the more static primary sectors.

It also indicates that the poorer countries rely relatively heavily on land resources (more than two thirds of natural wealth in low-income countries). In the ten wealthiest countries only Norway has a natural capital share of more than 3 percent (namely 12 percent). On the other hand, the bottom ten countries all have shares of natural capital in total wealth exceeding 30 percent.

The statistics also indicate that highly resource rich economies, such as the oil exporters Nigeria, Venezuela and Algeria, sometimes even have negative shares of intangible capital in total wealth. This suggests that these countries have extremely low levels of GNI as their returns on productive and intangible capital are very low and possibly even negative. Consequently, they have very low total wealth and can sustain only very low levels of consumption per capita. This is another symptom of the resource curse.

1.2.2 Theoretical Explanations of Natural Resource Curse

Here we discuss the theoretical support and evidence available for a wide range of hypotheses about the effects of natural resources on the economy and society, including effects on institutions, rent seeking, conflict and policy.

Dutch Disease: Natural Resource Windfalls Cause De-Industrialization

The hypothesis predicts that a resource windfall induces appreciation of the real exchange rate, contraction of the traded sector and expansion of the non-traded sectors.

Early policy contributions highlight the appreciation of the real exchange rate and the resulting process of de-industrialization induced by the increase in oil exports in Britain (Forsyth and Kay, 1980). There has also been a relative decline of Dutch manufacturing as a result of worsening of competitiveness associated with the export of natural gas found in Slochteren (Ellman, 1981). The idea behind this Dutch disease is that the extra wealth generated by the sale of natural resources induces appreciation of the real exchange rate and a subsequent contraction of the traded sector (Corden and Neary, 1982; Corden, 1984).

Higher natural resource revenue boosts national income and demand. The short-run consequences of higher resource revenues are thus appreciation of the real exchange rate (a higher relative price of non-traded goods), decline of the traded sector and expansion of the non-traded sector. Labor shifts from the traded sector to the non-traded sector. This increases both consumption and output of non-traded goods. The rise in consumption of traded goods and the contraction in the production of traded goods is made possible by additional imports financed by the increase in resource revenues. National income rises by more than natural resource revenues. The natural resource *bonanza* thus increases welfare.

For the longer run effects one must allow capital and labor to be mobile across sectors and move beyond the specific factors framework. In an open economy Heckscher-Ohlin framework with competitive labor, capital and product markets, no resource use in production and constant returns to scale in the production of traded and non-traded goods, a natural resource windfall induces a higher (lower) wage-rental ratio if the non-traded sector is more (less) labor-intensive than the traded sector. In any case, there is a rise in the relative price of non-traded goods leading to an expansion of the non-traded sector and a contraction of the traded sector. Labor and capital shift from the traded to the non-traded sectors.

More interesting may be to study the effects of a resource boom in a dynamic dependent economy with adjustment costs for investment and allow for costly sectoral reallocation of capital between non-traded and traded sectors (Morshed and Turnovsky, 2004). One could also use a model of endogenous growth in the dependent economy (Turnovsky, 1996) to explore the implications of a resource boom on economic growth.

What happens if the exploitation sector uses labor and capital as factor inputs? Apart from the previously discussed *spending effects* of a resource boom, there are also *resource movement effects* (Corden and Neary, 1982). De-industrialization occurs on account of the usual appreciation of the real exchange rate (the *spending effect*), but also due to the labor drawn out of both the non-traded and traded sectors towards the resource sector (the *resource movement effect*). Looking at the longer run where both factors of production (labor and capital) are mobile between the traded and non-traded sectors and the resource sector only uses labor, it helps to consider a mini-Heckscher-Ohlin economy for the traded and non-traded sectors. The Rybczinski theorem states that the movement of labor out of the non-resource towards the resource sectors causes output of the capital-intensive non-resource sector to expand. This may lead to the paradoxical result of pro-industrialization if capital-intensive manufacturing constitutes the traded sector, despite some offsetting effects arising from the de-industrialization effects arising from an appreciation of the real exchange rate (Corden and Neary, 1982). If the non-traded sector is more capital intensive, the real exchange rate depreciates if labor is needed to secure the resource windfall; the Rybczinski theorem then says that the non-traded sector expands and the traded sector contracts. This increase in relative supply of non-traded goods fuels depreciation of the real exchange rate. Real exchange depreciation may also result from a boost to natural resource exports if the traded sector is relatively capital intensive and capital is needed for the exploitation of natural resources. Since less capital is available for the traded sector, less labor is needed and thus more labor is available for the non-traded sector. This may lead to a depreciation of the real exchange rate. This also occurs if the income distribution is shifted to consumers with a low propensity to consume non-traded goods (Corden, 1984).

Empirical Evidence for Dutch Disease

Although early evidence for a shrinking manufacturing sector in response to terms of trade shocks and real appreciation has been mixed, more recent evidence for 135 countries for the period 1975-2007 indicates that the response to a resource windfall is to save about 30 percent, decrease non-resource exports by 35-70 percent, and increase non-resource imports by 0-35 percent (Harding and Venables, 2010). These findings hold in pure cross-sections of countries (averages across one, two, three or four decades), in pooled panels of countries, and in panel estimations including dynamics and country fixed effects.

Another study uses detailed, disaggregated sectoral data for manufacturing and obtains similar results: a 10 percent oil windfall is on average associated with a 3.6 percent fall in value added across manufacturing, but less so in countries that have restrictions on capital flows and for sectors that are more capital intensive (Ismail, 2010). Using as a counterfactual the Chenery-Syrquin (1975) norm for the size of tradables (manufacturing and agriculture), countries in which the resource sector accounts for more than 30 percent of the GDP have a tradables sector 15 percentage points lower than the norm (Brahmbhatt, et al., 2010). The macroeconomic and sectoral evidence thus seems to offer support for Dutch disease effects.

Interestingly, macro cross-country and micro U.S. county level evidence suggests that resource rich countries experience de-specialization as the least skilled employees move from manufacturing to the non-traded sectors thus leading their traded sectors to be much more productive than resource poor countries (Kuralbayeva and Stefanski, 2010).

Within-country, quasi-experimental evidence on the Dutch disease for Brazil is also notable (Caselli and Michaels, 2009). The study exploits a dataset on oil dependence for Brazilian municipalities, which is useful as oil fields are highly concentrated geographically and local resource dependence is more likely to be exogenous as it is decided by the national oil company, Petrobras. It turns out that oil discoveries and exploitation do not affect non-oil GDP very much, although that in line with the Dutch disease hypothesis services expand and industry shrinks somewhat. But they do boost local public revenue, 20-25 percent (rather than 10 percent) going to housing and urban development, 15 percent to education, 10 percent to health and 5 percent on welfare. Interestingly, household income only rises by 10 percent, mostly through higher government wages. The lack of migration to oil-rich communities also suggests that oil does not really benefit local communities much. The evidence for Brazil thus offers support for the Dutch disease hypothesis.

Effects on Society. There are also a wide range of hypotheses about the effects of natural resources on the economy and society. These include economic growth, institutions, corruption, rent seeking, conflict and policy. Frederik van der Ploeg (2011) provides systematic explanations in this context. The hypothesis regarding the effect of natural resources on economic growth say that if the traded sector is the engine of growth, a resource bonanza will lead to a temporary fall in growth. Early cross-country evidence indeed indicates a negative link between resources and growth. There is the hypothesis that the resource curse can be turned into a blessing for countries with good institutions. Van der Ploeg (2011) provides some evidence in support thereof. In addition, the hypothesis that presidential democracies are more likely to suffer a negative effect of resources on growth; econometric and quasi-experimental evidence for the hypothesis that resource windfalls increase corruption, especially in countries with non-democratic regimes are discussed in his seminal paper. Econometric supports for the hypothesis that the negative effect on growth is less in countries with well-developed financial systems and the hypothesis that resources induces voracious rent seeking and armed conflict are also explained. There is also a discussion of the hypothesis that resource windfalls encourage unsustainable and unwise policies.

Why are many resource-rich developing countries unable to fully transform their large stocks of natural wealth into other forms of wealth? van der Ploeg (2011) explains this with two hypotheses. First, the "anticipation of better times" hypothesis suggests that resource rich countries may borrow in anticipation of higher world prices for resources and improvements in extraction technology in the future. Second, the "rapacious extraction" hypothesis explains how, in the absence of effective government intervention, conflict among rival factions induces excessive resource extraction and investment, and negative genuine saving when there is wasteful rent seeking, and short-sighted politicians. However, there are no studies yet which attempt to incorporate these political economy insights into a formal model addressing the optimal depletion of natural resources.

1.2.3 Exploitation and Management of the Resource Windfalls

In here, I focus on the optimal ways of harnessing a *given* windfall. Such windfalls are typically anticipated (for example, in 5-7 years there will be a mine) and temporary (say, the mine has a deposit of 20 years). The benchmark for harnessing such a windfall is based on the permanent income hypothesis, which says that countries should borrow ahead of the windfall, pay back incurred debt and build up sovereign wealth during the windfall and finance the permanent increase in consumption out of the interest on the accumulated sovereign wealth after the windfall has ceased. Indeed, the IMF has often recommended resource rich countries to put their windfalls in a sovereign wealth fund.

However, one must consider the special features of resource rich developing countries. Many of them are converging on a development path, suffer capital scarcity and high interest rates resulting from premium on high levels of foreign debt, and households do not have access to perfect capital markets. In that case, the permanent income hypothesis is inappropriate.

In contrast to transferring much of the increment to future generations (as with the permanent-income rule), the optimal time path for incremental consumption should be skewed towards present generations and saving should be directed towards accumulating of domestic private and public capital and cutting debt rather than accumulating foreign assets (van der Ploeg and Venables, 2010). Effectively, the windfall brings forward the development path of the economy. Although the hypothesis of learning- by-doing in the traded sector may be relevant for advanced industrialized economies, developing economies are more likely to suffer from absorption constraints in the non-traded sector especially as it is unlikely that capital in the traded sector can easily be transferred to the non-traded sector. This cuts the other way, since it is then optimal to temporarily park some of the windfall in a sovereign wealth fund until the non-traded sector has produced enough home-grown capital (infrastructure, teachers, nurses, etc.) to alleviate absorption bottlenecks and allow a gradual rise in consumption. The economy experiences temporary appreciation of the real exchange rate and other Dutch disease symptoms. However, these are reversed as home-grown capital is accumulated.

1.2.4 Summary of Possible Policy Responses

Brahmbhatt et al (2010) suggest that the actual impacts of natural resources on an economy will depend to a large extent on policies. In here, I discuss three policy responses to dampen the negative effect or so-called the de-industrialization effect of the Dutch Disease problem.

First, a fiscal policy.

An adequate fiscal policy would be balanced between the need to implement development objectives and the need to constrain the spending effect. A fiscal rule called the "*permanent income approach*" provides an important benchmark for fiscal policy (van Wijnbergen 2008). Applied only to exhaustible resources, this approach recommends first calculating the expected net present value of all expected net future revenues from these resources; and then calculating the constant real amount (or annuity) that, received forever, would yield the same net present value. The permanent income approach then recommends restricting government spending from these exhaustible natural resource revenues to only this constant annuity amount, while saving the rest abroad. Later, when exhaustible natural resources have run out, the government would be able to draw on its accumulated financial assets to continue spending the same constant annuity amount.

Whereas saving most of the revenues in order to smooth consumption may be part of the development strategy in some countries, the development needs may be too great in other (especially, low-income) countries. Collier et al. (2009) argue that directing all resource revenues to current consumption is wasteful and inequitable; however, postponing the consumption into the far-distant future is wasteful and inequitable as well. They suggest an *"optimal"* fiscal rule for a developing country. This rule would make it possible to save some of the revenues (less at the beginning and more at the end of the high-resource-revenues period) and allow for more investment and consumption from the resource revenues than in the permanent income strategy. Perfect implementation of this approach would require strict fiscal discipline and clear spending rules.

Second, a structural policy.

Spending policies also can help curb Dutch disease. Directing spending toward tradables (including imports) rather than non-tradables would help slow the impacts through the spending effect. Improving the quality of spending to ensure that productivity in non-tradable sectors increases alongside the structural changes also would be important. If the spending effect works also through private spending, general policies toward improving productivity of the private firms would help reduce the impacts.

The country also may undertake other reforms that do not necessarily involve large expenditures, but that enhance economy wide productivity: improvements in business regulations, reductions in red tape, reduction of monopolistic barriers that discourage innovation, and other improvements in the overall business climate. Such policies will reduce the regulatory burden on the non-resource economy. Other policies, such as ones that promote foreign direct investment, could create conditions for learning by doing through spillover effects.

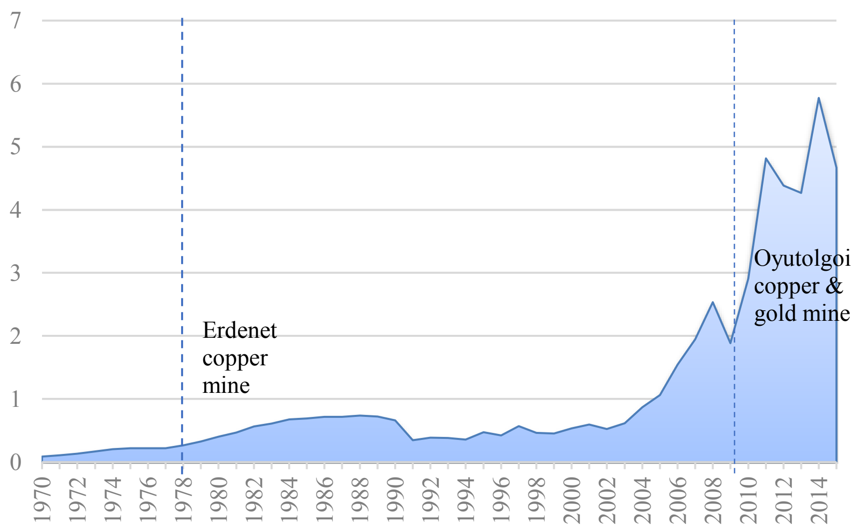
Third, a monetary policy.

The choice of an appropriate anchor for monetary policy is especially important for macroeconomic management in commodity-exporting countries. Inflation targeting has been an extremely successful instrument, although it may result in a monetary policy that is so tight it puts appreciation pressure on the exchange rate when commodity prices increase. Recently, there has been discussion of developing more appropriate forms of price targeting in commodity-exporting countries. Whereas Consumer Price Index inflation targeting has worked in many countries, it has been less successful in stabilizing relative tradables/non-tradables prices in commodity exporters. Frankel (2009) shows that targeting of a more specific price index that has a higher share of export commodity prices and/or production prices (such as the Producer Price Index or the Export Price Index) would have been more appropriate, although more difficult to administer or make transparent to the general population.

1.3 Mongolian Experience with Dutch Disease: Stylized Facts

Mongolia is abundant in natural resource minerals, such as coal, copper, gold, crude oil, iron, molybdenum, and zinc etc. Natural resource sector plays large role in the economy, reaching 24 percent of the GDP and almost 90 percent of the exports. Clearly the economy is heavily dependent on natural resources. In contrast to this, however, the manufacturing sector is underdeveloped and stagnant.

Figure 1.1 *Total Exports of Mongolia (Billion USD)*



Source: National Statistical Office of Mongolia (NSO)

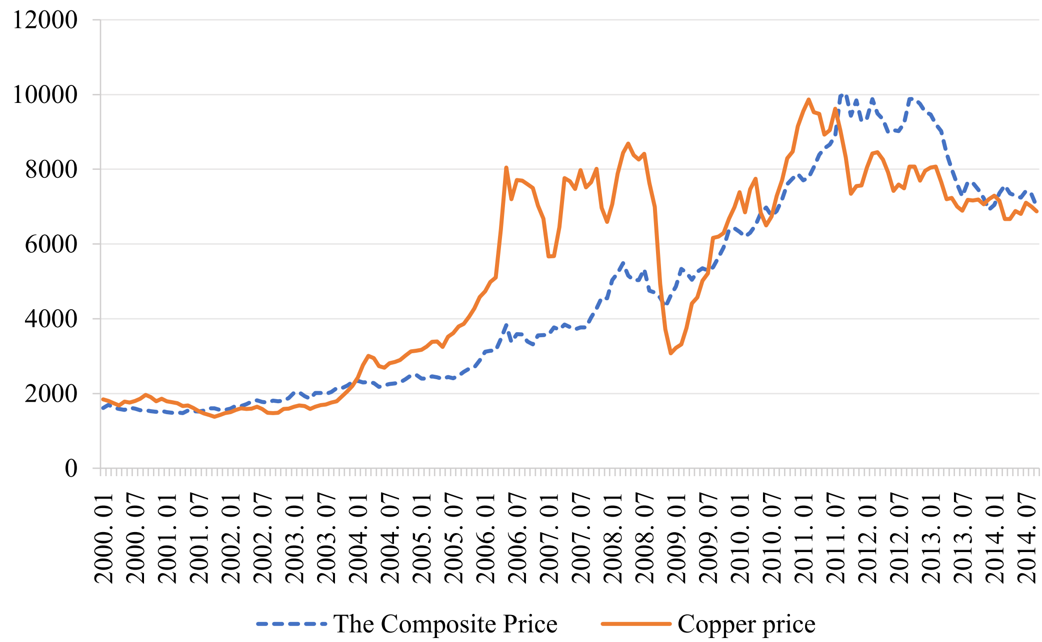
The very first step towards becoming a resource exporter was taken in 1978 by building and utilizing the Erdenet copper mine. The Erdenet mine is one of the largest factories in Asia with annual production of 530 thousand tons of copper concentrate and around 4.5 thousand tons of molybdenum concentrates.[3] Figure 1.1 illustrates the total exports of Mongolia based on the National Statistical Office of Mongolia (NSO) data. Figure 1.1 implies that the mine has had a

[3] Details can be found in the official webpage of the Erdenet mine at www.erdenetmc.mn

major significance to Mongolian exports from its start and is therefore considered as the first resource boom in the analysis.

In 2009, the Oyutolgoi mine entered the industry with estimated deposits of 30 million tons of copper and 1.7 million ounces of gold, meaning that it is operable for more than 50 years.[4] This makes Oyutolgoi the one of the biggest mines in the world. Mine construction began in 2010 and the first exports were in mid-2013. The annual production and export of copper concentrate reached 819.8 thousand tons in 2015. Figure 1.1 also shows the magnitude of the significance of the Oyutolgoi mine to Mongolian exports and it is the second resource boom in the analysis.

Figure 1.2 *Copper Price and The Composite Price (USD per Ton)*



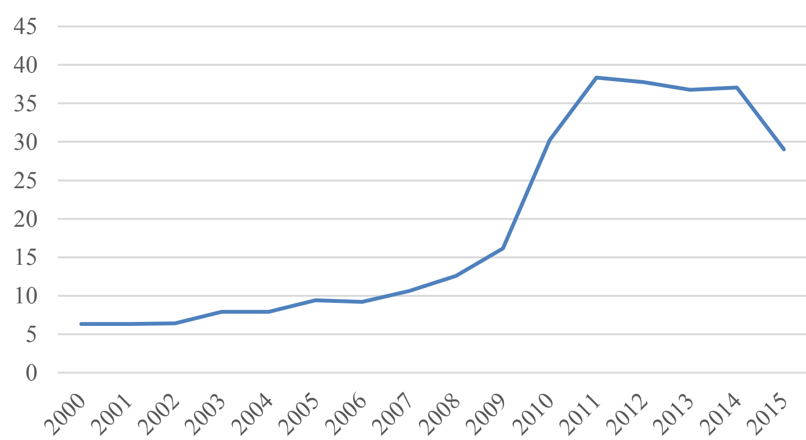
Source: London Metal Exchange

Thus, Figure 1.1 implies that because of the heavy resource dependence, the Mongolian economy

[4] See details in www.ot.mn

is vulnerable to the world market resource price volatilities. Figure 1.2 shows the monthly rates of the copper price and the composite price, which is a weighted average of copper, coal and gold prices.[5] Until the mid-2003, the copper price was quite stable around 1700 U.S. dollars and from July 2003, the price constantly increased until it reached 8045 U.S. dollars in May 2006, almost five times higher than the initial level. Except for small small fluctuations, the copper price stayed high for almost three years. During these three years, the Mongolian economy has enjoyed fast growth of 9 percent and dramatic export increase from 0.5 billion U.S. dollars in 2003 to 2.3 billion in 2008.

Figure 1.3 *Real Mineral Resource Production (Million tons)*



Note: Data for the year 2015 is the aggregation of the first 11 months.
Source: NSO

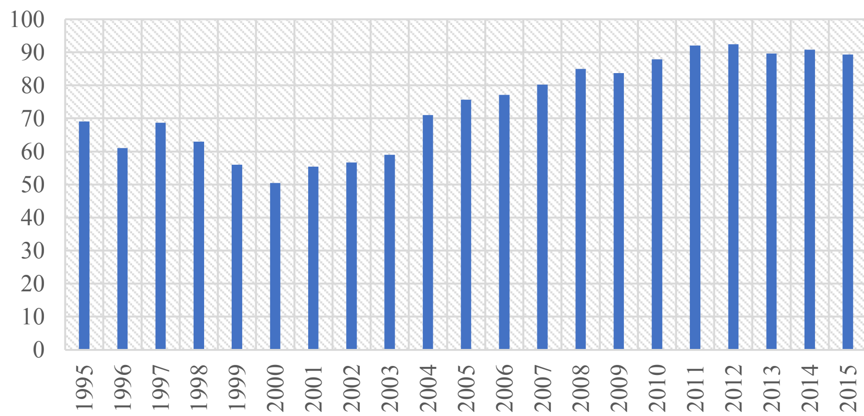
The facts associated with the Dutch Disease argument are in many ways consistent with the Mongolian experience. Figure 1.3 shows that the real mineral resources production grew rapidly over the years following the mineral resource booms. Mineral production was close to 7 million tons in 1989 following the resource boom of the Erdenet mine in 1980s and the number was more

[5] See appendix B for the detailed calculations of the composite price

than 35 million tons in 2014 resulting from the Oyutolgoi mine resource boom, which is more than a five-fold increase.

Productivity increases in the mining sector worked to raise labor incomes in the sector. For example, from 2009 the Oyutolgoi mine resource boom with its investments was followed by an average 55% increase in the wages of mining sector for five years. During the period, productivity in mining sector jumped almost five-fold compared to the national level.[6] These observations in fact are consistent with the resource movement effect in the Corden and Neary (1982) framework.

Figure 1.4 *Mineral Resource Share of Exports (Percentage)*



Note: Author's calculation based on NSO data.

According to Figure 1.4 the mineral resource share of exports also rose persistently during the period, except in 2000 which may have been a result of the Asian financial crisis. Similarly, the slight drop in the share in 2009 can be explained by the Global financial crisis in 2008. The share of resource in exports grew dramatically for the last five years reaching 90% on average. This clearly shows that the economy is heavily dependent on the resource sector.

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[6] Source: National Statistical Office of Mongolia

The dependence of the government sector on mineral resource is a top concern in Mongolia. In 2006, a windfall tax was introduced in the mining sector, and as a result the mineral resource revenues represented almost 45% of the total government budget. In 2010, the windfall tax was replaced by a royalty tax and the share decreased to 28%. However, starting from 2011, 3-year average revenue from the mining sector accounted for one third of the total budget revenue. This rise of the government revenue allowed the government sector expansion and was a major reason to aggregate demand and wage increases. Thus, this implies that the spending effect of the Corden and Neary (1982) framework is in action.

The developments made by the government policies following the budget increase from the resource exports, are explicitly shifting the economy towards a generous welfare state. As a response to their electoral campaign promises, the government started to distribute money in 2008. The government spending increased dramatically as well as the private consumption.[7]

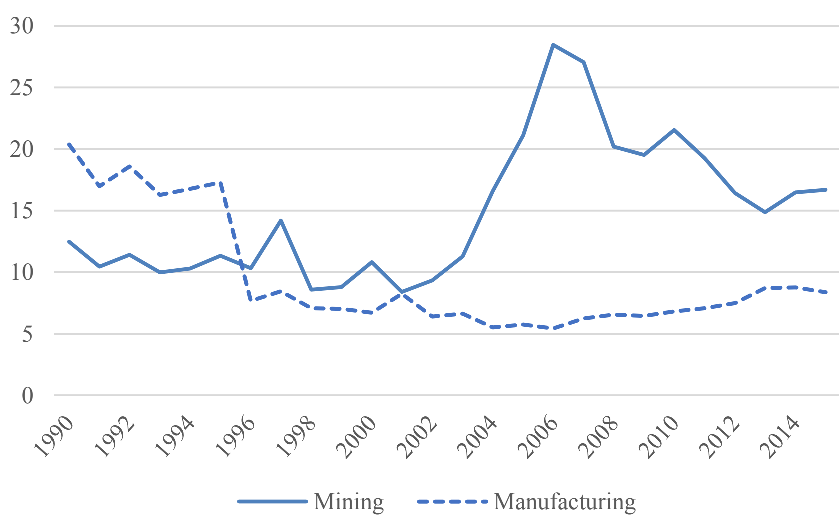
The theory by Corden and Neary (1982) predicts that a resource windfall induces appreciation of the real exchange rate and thus, deindustrialization. The mechanism behind this is clear. Part of the resource revenues is spent on non-traded goods which leads to a real appreciation (i.e., a rise in the relative price of non-traded goods in terms of traded goods). This in turn draws resources out of the non-resource traded sector into the non-traded goods producing sector (Corden and Neary, 1982). This means simply that for example, if the extra income from the resource sector, is spent by government spending or private consumption, and not saved, our export price relative to foreign prices will increase, making our exports not competitive on foreign market. If this continues in the longer run, with the resource movement effect, our already small non-resource export sector or the manufacturing sector will vanish.

[7] Source: NSO

Consequently, the main concern of the natural resource dependent economies is the de-industrialization issue, or declining of the manufacturing sector.

It is important to recognize, however, the fact that the economy is negatively affected by the natural resource windfall. Once it is recognized, learning from the abundant experiences of the other countries, we would be able to contribute in providing policy implications to avoid further worsening of the de-industrialization process. Thus, we would offer optimal harnessing rule, once we empirically find evidence regarding the existence of the Dutch Disease.

Figure 1.5 *Mining and manufacturing output (% GDP)*



Source: NSO

Therefore, to see if the resource windfall has a negative effect to the economy, i.e. to see if there is a Dutch Disease in the Mongolian economy, we should examine the manufacturing sector, since it is the "victim" of the "disease". Let us see how the manufacturing sector changed from 1990 to 2015. Figure 1.5 shows the GDP share of the manufacturing and mining. We can see and contrast the sectors. As expected, we see that the Mongolian manufacturing has been declining, or growing slower than the GDP. In contrast to this, the Mongolian mining industry grew rapidly from 2001, or grew faster than the GDP. In 2010, mining to GDP ratio was close to 20 percent, while the manufacturing to the GDP ratio was not more than seven percent.

Using descriptive analysis, we thus, have seen the symptoms of the Dutch Disease in Mongolia. We now empirically test for an evidence.

1.4 Empirical analysis

Before explaining my methodology, it is important to note that most of the studies in the literature use cross-section analysis with many countries (for example, Harding and Venables, 2010) or many industries (for example, Ismail, 2010) in certain point of times. Therefore, as a consequence, it is quite rare to find one country case with time series analysis.

1.4.1 Methodology and data

It is quite complicated to examine the dynamics of manufacturing sector adjustment due to the natural resource discovery and exploitation. Thus, the underlying structural parameters, the adjustment speeds of the goods and asset markets, as well as the expectations and anticipations will differ from country to country and are difficult to obtain empirically in a structural econometric model. Therefore, I use the vector error correction modeling (VECM) strategy to decompose the variance of manufacturing output fluctuations into different time horizons with corresponding natural resource booms and world resource prices.

This methodology is particularly appropriate in cases such as this with potentially complicated dynamic relationships. The VECM gives me the possibility to create a short-run model with a given long run relationship. The model has a special explanatory variable – the error-correction term – which represents the equilibrium equation. By means of this term, the restricted dynamic short run model converges to the imposed long run model.

Methodology. Following Hutchison's (1994) model, I examine a multivariate system (Y_t) that includes real manufacturing output (y_t^m), natural resource production (y_t^r), the money supply (m_t) and real copper price (p_t^{cu}). This is referred to as the basic model. In an extension, the real effective exchange rate (e_t) is also included in Y_t. The only nominal variable here is money supply and the inclusion of the variable to the model makes possible the consideration of the expansionary government policy effects mentioned earlier to capture the essence of spending effect. In addition, as a robustness check, I analyzed the model with a composite price index (p_t^{com}) of major raw minerals instead of the real copper price.[8]

Y_t is assumed to have vector autoregressive (VAR) representation with errors, u_t:

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_\rho Y_{t-\rho} + u_t \tag{1}$$

where Y_t is a ρ x 1 (ρ represents the number of variables, it is four in basic model and five in the extended model) vector of time series, $A_1, \dots, A_\rho$ are ρ x ρ coefficient matrices and u_t is a ρ x 1 unobservable zero mean white noise process.

In general, economic time series are non-stationary processes and it is useful to take the first difference by subtracting Y_{t-1} from both sides of (1). It can be written as:

$$\Delta Y_t = A_0 + \Gamma_1 \Delta Y_{t-1} + \cdots + \Gamma_{\rho-1} \Delta Y_{t-\rho+1} + \Pi Y_{t-\rho} + u_t \tag{2}$$

[8] Detailed calculations of the composite price index are provided in the appendix B.

where $\Gamma_i = -(\mathrm{I} - A_1 - \cdots - A_i)$, $i = 1, 2, \ldots, \rho - 1$, and $\Pi = -\left(\mathrm{I} - A_1 - \cdots - A_\rho\right)$. Except for the long-run equilibrium term or error correction term $\Pi Y_{t-\rho}$, equation (2) is nothing else but the traditional first difference VAR model.

The coefficient matrix Π contains information about the long-run equilibrium.[9] The rank (r) of Π matrix, is the cointegration rank, i.e. it shows how many long-run relationships exist between the variables of Y_t. Π can be expressed as $\Pi = \alpha\beta'$ where α and β are ρ x r matrices containing the loading coefficients and the cointegration vectors respectively (Johansen 1991). The $\beta' Y_t$ is stationary even though Y_t itself is non-stationary. Therefore (2) can be interpreted as a vector error correction model (VECM).

Both trace and maximum eigenvalue tests are employed to determine the number of cointegrating vectors. The approach is to test the null hypothesis that there is no cointegration among the elements of vector Y_t; rejection of the null is then taken as evidence of cointegration. The long-run constraints expressed by the estimated cointegrating vectors ($\hat{\beta}' Y_t$) are then imposed to the differenced VAR model via error correction terms.

After estimating the VECM, impulse response functions and variance decompositions are calculated with the variables ordered as: manufacturing output, mineral production, money supply and real copper price. This ordering allows the three potential explanatory variables to exert the largest possible influence on manufacturing output movements.

Data. Seasonally adjusted monthly data is used covering the period of 2003M1-2015M11. The variables are measured in natural logarithms. The data consists of real manufacturing output, actual physical production of mineral resources, nominal M2 as money supply, the real dollar price of

[9] For more detailed explanation see Johansen (1991).

copper and the real effective exchange rate (REER). The main source of data is NSO and the Bank of Mongolia. Complete definitions, units and sources of the data are provided in the appendix.

1.4.2 Unit Root Tests

The t-statistics for the Augmented Dickey-Fuller (ADF), Dickey-Fuller Generalized Least Squares (DF-GLS) and Phillips and Perron (PP) unit root tests are reported in Table 1.1. The tests were conducted both in log levels (x) and log first-differences (dx) and each time series includes a constant and both constant and time trend. The null hypothesis states that there exists a unit root in the time series, and failure to reject the null indicates that the variable may be non-stationary. The ADF statistics were estimated using Akaike Information Criterion (AIC) with maximum lag of 13 since it is recommended to use AIC instead of the Schwarz Information Criterion to determine lag length of the autoregressive process for the ADF statistic.[10] The PP test is less restrictive since the error term can follow a more general process.

The ADF, DF-GLS and PP tests are consistent in failing to reject the null in log levels (x), meaning the series are likely non-stationary in levels, except for manufacturing and mineral production PP tests and DF-GLS test for REER. Three tests are consistent in rejecting the unit root hypothesis for most of the variables in log first-difference form (dx). However, ADF tests and DF-GLS with trend for manufacturing fail to reject the null. PP tests with and without trend consistently rejecting the null for all the variables in dx.

[10] See Stock and Watson (2011, Chapter 14) for lag length selection in time series regression with multiple predictors.

Table 1.1 *Augmented Dickey-Fuller, Dickey-Fuller GLS and Phillips-Perron Unit Root Tests*

	Real manufacturing output	*Mineral production*	*Money supply*	*Real Copper price*	*Real effective exchange rate*
ADF intercept (x)	0.317	-0.985	0.639	-1.989	-1.514
ADF intercept & trend (x)	-0.967	-1.173	-1.807	-2.028	-3.221
DF-GLS intercept (x)	0.486	0.007	1.150	-1.224	-0.242
DF-GLS intercept & trend (x)	-1.266	-1.297	-1.064	-1.373	-3.238*
PP intercept (x)	-2.633	-2.136	1.120	-1.991	-1.126
PP intercept & trend (x)	-4.019**	-5.389**	-1732	-1.935	-2.806
ADF intercept (dx)	-2.782	-5.026**	-3.186*	-9.399**	-8.912**
ADF intercept & trend (dx)	-3.012	-5.023**	-3.440*	-9.526**	-8.882**
DF-GLS intercept (dx)	-2.793**	-1.473**	-2.677**	-9.400**	-8.882**
DF-GLS intercept & trend (dx)	-2.734	-0.360**	-3.470**	-9.455**	-8.885**
PP intercept (dx)	-27.329**	-42.943**	-13.626**	-9.454**	-8.800**
PP intercept & trend (dx)	-51.207**	-45.192**	-13.671**	-9.526**	-8.768**

Note: x and dx refer to the variable listed in log level and log first-difference form respectively. * and ** denote the individual test statistic statistically significant at the 5% and 1% level respectively.

Source: Monthly data from 2003M1 to 2015M11 were used from the NSO.

Consequently, we perhaps can say that all five variables appear to be integrated of order one or I(1), i.e. non-stationary in levels and stationary in first-differences. In addition, the change in sample period and adoption of composite price index instead of real copper price variable do not alter the findings.[11]

[11] The results are robust for the sample period 2003-2007 and for the adoption of the composite price index instead of real copper price. See appendix for the composite price index.

Table 1.2 *Johansen Cointegration Tests*

Null Hypothesis	*Test statistics*		*Critical Value at 0.05*	
	Trace	*Max-Eigen*	*Trace*	*Max-Eigen*
	Basic model			
None*	93.027*	69.898*	47.856	27.584
At most 1	23.129	15.709	29.797	21.131
At most 2	7.419	7.137	15.494	14.264
At most 3	0.282	0.282	3.841	3.841
	Extended model			
None*	112.564*	72.467*	69.819	33.877
At most 1	40.096	20.298	47.856	27.584
At most 2	19.798	12.706	29.797	21.131
At most 3	7.091	6.753	15.494	14.264
At most 4	0.338	0.338	3.841	3.841

Note: * denotes the rejection of the null hypothesis at the 5% significance level. The critical values of the Trace and Maximum eigenvalue tests were taken from the EViews Software edition 8.

1.4.3 Cointegration tests

A linear combination of two or more non-stationary series may be stationary as shown by Engle and Granger (1987). This stationary linear combination is called the cointegrating equation and can be interpreted as a long-run equilibrium relationship among the variables.

Table 1.2 shows the Johansen cointegration tests consisting of trace and maximum eigenvalue test statistics as well as the critical values at 5% significance level for the number of cointegrating vectors. I assumed a linear trend in data and allowed the cointegrating equation to have both intercept term and trend. However, assuming no trend in VAR. These specifications of the VAR are found in EViews software edition 9, as fourth choice under the deterministic trends specification option. The null hypothesis for each test is also included in Table 1.2.

Johansen tests for the model indicate cointegrating relationships between real manufacturing output, mineral production and other variables. One cointegrating vector is suggested in both the four-variable and five-variable models by maximum eigenvalue and trace statistics at the 5% significance level.

The estimate of cointegrating vector β' is reported in Table 1.3. This is the estimated long-run constraint imposed on the VECM model from which the variance decompositions and impulse response functions are derived. The restriction for β' matrix is imposed as a negative unity on the variable of primary interest, real manufacturing output (y_t^m). A negative coefficient on mineral production (y_t^r) would indicate a long-run tradeoff, or crowding out, between outputs in the manufacturing and natural resource sectors. Therefore, in the long-run one percent growth in mineral resource production is estimated to bring a two percent contraction in the manufacturing output.

The cointegrating vector suggested by the Johansen test indicates a long-run negative relationship between the resource output and manufacturing in Mongolia. Thus, the estimate of cointegrating vector supports the Dutch Disease hypothesis as an important long-run phenomenon. Changing real copper price variable (p_t^{cu}) with the composite price index (p_t^{com}) does not negate the result.[12] Moreover, narrowing the sample period does not alter the result.[13] In summary, there is a strong evidence for the existence of Dutch Disease in Mongolia.

[12] The results are also negative and robust for the composite price index.
[13] Narrowing the sample period down to 2003-2007, also shows the same result.

Table 1.3 *Cointegration Coefficients in Johansen Estimation*

	Basic model	*Extended model*
Real manufacturing output	-1.00	-1.00
Minerals output	-2.060029	-2.081264
	(0.22272)	(0.26649)
	[9.24935]	[7.81005]
Real copper price	-0.17472	-0.200841
	(0.08142)	(0.08618)
	[2.19203]	[2.33057]
Money supply	0.987296	0.990133
	(0.07318)	(0.07182)
	[-13.4906]	[-13.7862]
REER		0.439602
		(10.7575)
		[-0.04086]

Note: The coefficients are normalized with a negative unity on the manufacturing output. A negative coefficient indicates a long-run offset. Standard errors are in parentheses and t-statistics are in square brackets.

1.4.4 VECM variance decompositions and impulse responses

Table 1.4 reports the manufacturing output variance decompositions derived from the estimates of the VECM for basic and extended models. The VECM was estimated using the estimated cointegrating vector shown in Table 1.3. The estimation results suggest that natural resource sector innovations cause a major role in generating manufacturing output fluctuations. The estimated percentage impact of natural resource sector on manufacturing output error variance after a year is as high as 40%.

The real copper price shocks seem to play very small role. However, when the composite price index is included in the model instead of the copper price, percentage impact explaining the

Table 1.4 *Manufacturing variance decompositions (2-year time span)*

Four-variable Basic Model

Months	*Manufacturing*	*Mineral sector*	*Real copper price*	*Money supply*
1	100	0	0	0
3	82	9	0	9
6	63	27	1	9
12	52	40	1	7
18	44	48	2	6
24	40	53	2	5

Five-variable Extended Model

Months	*Manufacturing*	*Mineral sector*	*Real copper price*	*Money supply*	*REER*
1	100	0	0	0	0
3	82	9	0	9	0
6	64	24	1	9	2
12	52	35	3	7	3
18	45	42	4	6	3
24	41	47	4	5	3

Note: Variance decompositions report the percentage impact of the n months ahead manufacturing forecast error variance from corresponding variable listed in the column. VECM is ordered as real manufacturing output, mineral production, money supply and real copper price.

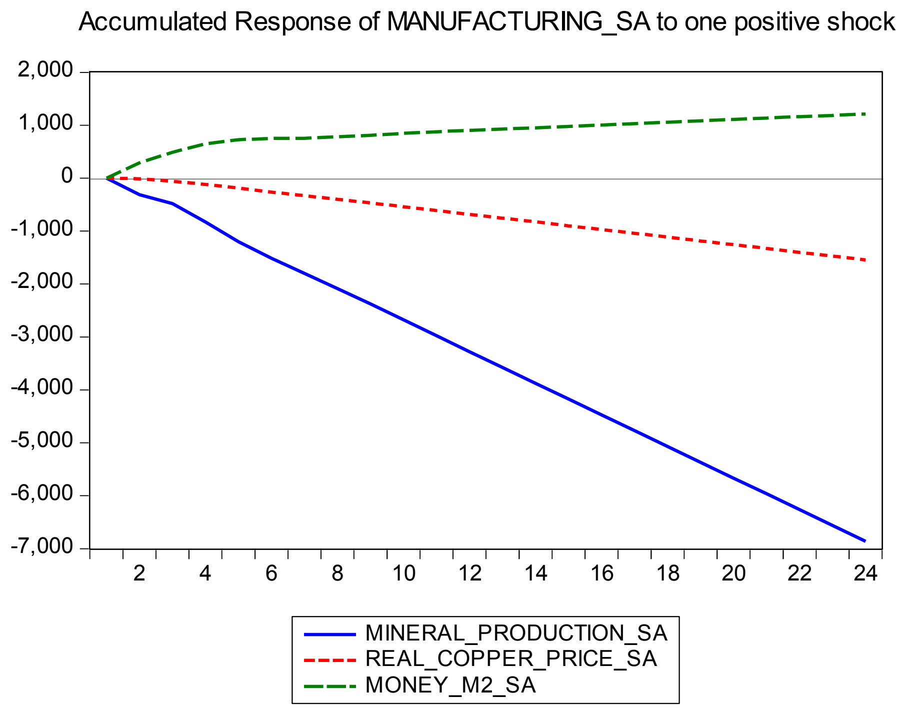
manufacturing variance is higher.[14] Monetary factors play relatively small, however, not negligible role in this context.

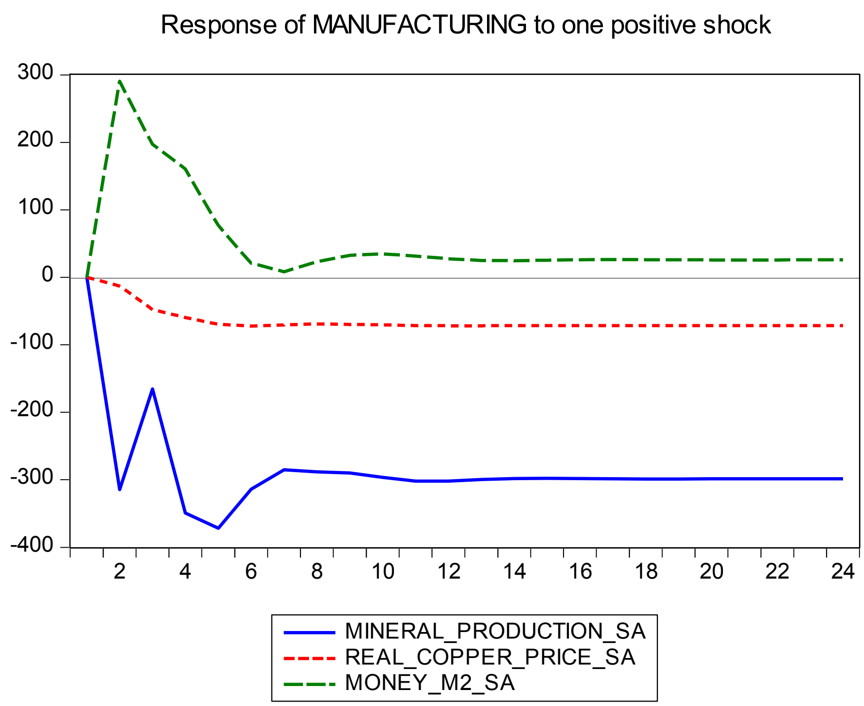
The Figure 1.6 shows the accumulated impulse response functions of manufacturing output to a one unit positive shock in mineral sector, real copper price and REER, respectively for two-year span. All three factor shocks have significant and sustainable negative effects on manufacturing output, moreover the natural resource production shock has a greater effect in magnitude. Thus, the results are supportive of the Dutch Disease hypothesis in Mongolia.[15]

[14] A robustness check was conducted for the Manufacturing variance decompositions with composite price index instead of real copper price.

[15] Robustness check has been done with different time span and price variable, respectively. The change in sample period and the adoption of composite price index instead of the real copper price do not make major difference to the results

Figure 1.6 *Impulse responses of manufacturing sector (derived from extended model)*





Note: Figures shows the impulse response functions of manufacturing output to a one unit positive shock in mineral sector, real copper price and REER, respectively for two-year span.

1.5 Conclusion

This chapter reviews the theoretical and empirical explanations of the effects of natural resource windfalls on the economy. Within this context, I examined the experience of Mongolia with natural resource booms. The core question is how the natural resource windfall has influenced Mongolian manufacturing. Thus, the main hypothesis examined is that of the "Dutch Disease", the argument that natural resource booms cause de-industrialization (Corden and Neary, 1982). I also discussed about the possible policy responses.

The descriptive statistics show that the Mongolian economy is already natural resource dependent with natural resource share of exports reaching 90 percent in 2015. In contrast, the manufacturing sector stayed stagnant. Thus, using the formal cointegration and related VECM analysis, I found a long-run tradeoff: a one-percentage increase in resource production is followed by a two-percentage contraction in the manufacturing. The variance decompositions derived from the VECM suggest that within a year as large as 40 percentage of manufacturing output variance is attributable to developments in the domestic resource production in Mongolia. Moreover, the impulse response functions show a significant long-term adverse effect on manufacturing arising from resource boom and resource price rise. Overall, the chapter presented the empirical evidence of the Dutch Disease in Mongolia. Comparing the results to the other studies suggest that the Dutch Disease effect found to be quite high.

I believe that the policy implications to dampen the de-industrialization effect of the Dutch Disease in Mongolia are as follows. First, constraining the spending effect. I would recommend "*optimal*" fiscal rule for Mongolia. Second, making structural changes to diversify manufacturing. Third, directing the spendings toward tradables (including imports) rather than nontradables. I believe that my findings might provide informative implications for Mongolian policy makers.

Chapter 2

Comprehensive Study on Gains from Trade in Mongolia

2.1 Introduction

In the core of the monopolistic competition model with differentiated goods by Dixit and Stiglitz (1977), Krugman (1979 and 1980) and Helpman and Krugman (1985), consumers and producers benefit from having more varieties of final goods and intermediate inputs, respectively. However, most studies focus on the conventional sources of gains, such as productivity improvement as a result of increasing returns of scale, trade-induced innovation, technology spillover, and improved market efficiency because of import competition (Chen and Ma, 2012). These studies often assume a constant set of products over time and this leads to systematically understated welfare gain calculations.

The quantitative analysis of gains from variety starts with the seminal work of Feenstra (1994). Feenstra (1994) showed how to estimate the elasticity of substitution of individual products, and using these elasticities he offered the formula for an exact price index that can account for entry and exit of varieties. By doing so, Feenstra (1994) demonstrated that new product varieties lead to an increase in consumer utility. However, a comprehensive measure of the gains from import variety puts tremendous demands on data availability, and was not realized until Broda and Weinstein (2006).

Applying Feenstra's estimation technique, Broda and Weinstein (2006) estimated the welfare gain that the US enjoyed through trade liberalization over the past 30 years by computing the elasticities of substitutions of more than 30,000 products. Using the elasticities, they created the import price index adjusted for new and disappearing varieties and measured the value that consumers attached to these new product varieties. They found that the total gain from the introduction of new varieties in the U.S. was 2.6 percent of GDP between 1972 and 2001. This meant that in order to obtain the new set of varieties imported each year, consumers would be ready to pay on average 0.1 percent of their income.

Following Broda and Weinstein (2006), a body of country studies emerged, using the same methodology.[16] Chen and Ma (2012) found that the welfare gain in the Chinese economy as a result of new import variety amounts to 4.9 percent of GDP, or 0.4 percent annually between 1997 and 2008. Minondo and Requena (2010) investigated the welfare gains due to Spanish imports of new varieties over the period 1988-2006. They found that the total welfare gain is equal to 1.2 percent of GDP in 2006. In a comparative study of Switzerland and the U.S., Mohler (2009) estimated a lower and an upper bound of the gains from variety. He found that during the period from 1990 to 2006, the gains from variety in Switzerland were between 0.3 and 4.98 percent of GDP and that in the U.S. the gains from variety were between 0.5 and 4.7 percent of GDP. Mohler and Seitz (2010) applied the methodology to the 27 countries of the European Union for the period of 1999 to 2008. Their results show that within the European Union, especially "newer" and smaller member states exhibit high gains from newly imported varieties. For instance, Estonia gained 2.80 percent of GDP (GDP of Estonia), Slovakia 2.37 percent, Latvia 1.65 percent, Bulgaria 1.59 percent, and etc. They also found that interestingly, two of the largest economies in the group,

[16] As a reference, only a few papers are mentioned here. In addition to its welfare gain estimation, Broda and Weinstein (2006) paper is often cited for the import demand elasticity estimation. Already estimated data of 73 countries excluding Mongolia is available at the following Columbia university webpage: http://www.columbia.edu/~dew35/TradeElasticities/TradeElasticities.html

France and Germany, both had negative gains from variety. They argue that the reason for this is that these larger economies were already heavily integrated in the European economy and did therefore not experience the increase in product varieties as did the "new", smaller economies.

I contribute to the growing literature by providing a measure of Mongolia's welfare gain due to import variety from 1988 to 2015. This is the first study that pursues this measure for Mongolia, thus I have two *motivations* in mind. First, as a small open economy, Mongolia underwent a drastic liberalization after the dissolution of the Soviet Union. The economy is now in transition. Thus, measuring Mongolia's gains from import varieties will provide supporting evidence favoring trade liberalization for developing countries. It may also provide informative implications to Mongolia's policymakers. Second, I obtain estimates for hundreds of elasticities of substitution using a highly disaggregated import data of Mongolia, which may be useful for other studies. For example, different elasticities may imply different responsiveness of imported products to demand shocks or exchange rate movements suggested by Chen and Ma (2012).

In this chapter, the gains from variety for Mongolian economy were estimated, using six-digit harmonized system (HS) products data which is the most disaggregated data available for Mongolia. I estimated 1390 elasticities and with the elasticities, I constructed an exact price index to measure the welfare gains from variety growth. This method is consistent with the theory of monopolistic competition and is robust in empirical applications (Feenstra, 1994). The results show that the welfare gain owing to newly imported varieties from 1988 to 2015 amounts to 22 percent of GDP, or 0.8 percent annually.

The definition of variety used in this chapter is same as the variety defined in Broda and Weinstein (2006), which is an Armington (1969) definition of a product variety. By this definition a variety is a particular good produced in a particular country. To be more specific, a product in this chapter is defined as a six-digit HS good. To give an example, sparkling wine (with HS-6 product code 220410) was imported from only one country, Germany, in 1989, in contrast to this, in 2015 the same wine was imported from 13 different countries such as France, Spain, Italy, Chile etc. This represents an increase of single variety to 13. Therefore, by the Armington (1969) assumption, an HS-6 product supplied by one country is regarded as different from the same product supplied by any other country.

Gains from increased import varieties are not limited to consumers. Access to more imported varieties may enhance productivity growth, leading domestic firms to gain substantially. In fact, with the widely used constant elasticity of substitution (CES) structure, new varieties could be modeled either as consumption goods or as intermediate inputs (Romer, 1994). I follow Broda and Weinstein (2006) and treat all imported goods as intended for final consumption.

The rest of the chapter is organized as follows. Section 2.2 describes the data and reviews Mongolia's drastic import growth from 1988 to 2015. Section 2.3 reviews the model of Broda and Weinstein (2006). Section 2.4 explains the estimation strategy and gives a brief overview of the importance of elasticities of substitutions. Section 2.5 reports the results of the analysis and presents the welfare gain. Section 2.6 concludes.

2.2 The Development of Imports, 1988-2015

2.2.1 Data

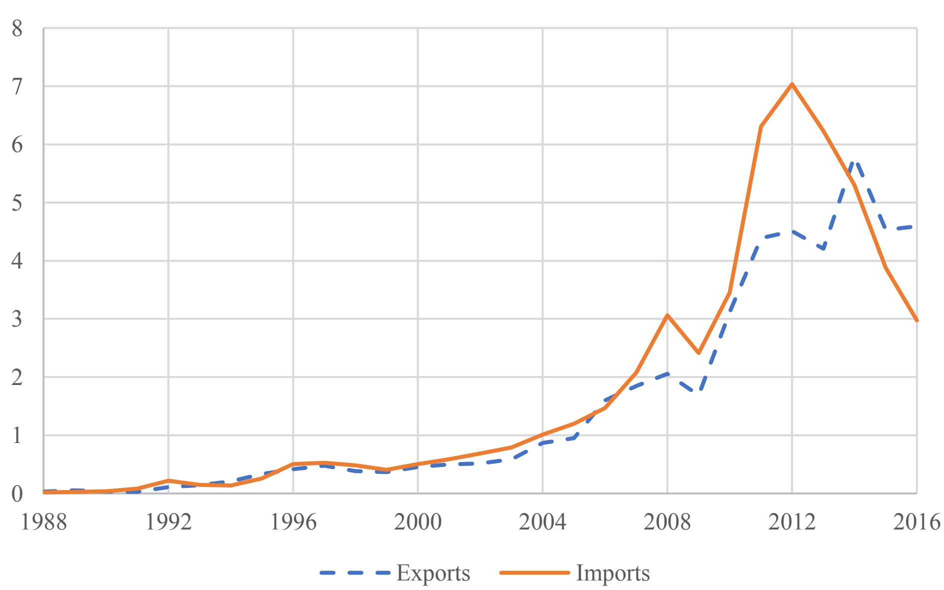
I used the United Nations Comtrade - International Trade Statistics database in this chapter. The import data of Mongolia was not sufficient, lacking the years 2002, 2008-2012, 2015- 2016.

Therefore, due to this data availability problem, I used the export data of rest of the world to Mongolia from 1988 to 2015, covering 28 continuous years. The data contains information on the total value, quantities and trading partner of registered product imports to Mongolia. Unspecified country data, no quantity data are dropped. Furthermore, due to the insufficient numbers of varieties, HS-6 products with less than 37 observations are dropped. This is due to the problem that many products were not imported to Mongolia constantly throughout the period. This left me with 158 thousand observations of 1628 products. Gross domestic product (GDP) data were taken from the World Bank Database.

2.2.2 Descriptive Analysis

To study the welfare implication of the drastic increase in imports of Mongolia, we should consider the increase in value of each product (i.e. the intensive margin) and the increase in the number of products and varieties for each product (i.e. the extensive margin).

Figure 2.1 *Exports and Imports (Billion Dollars)*

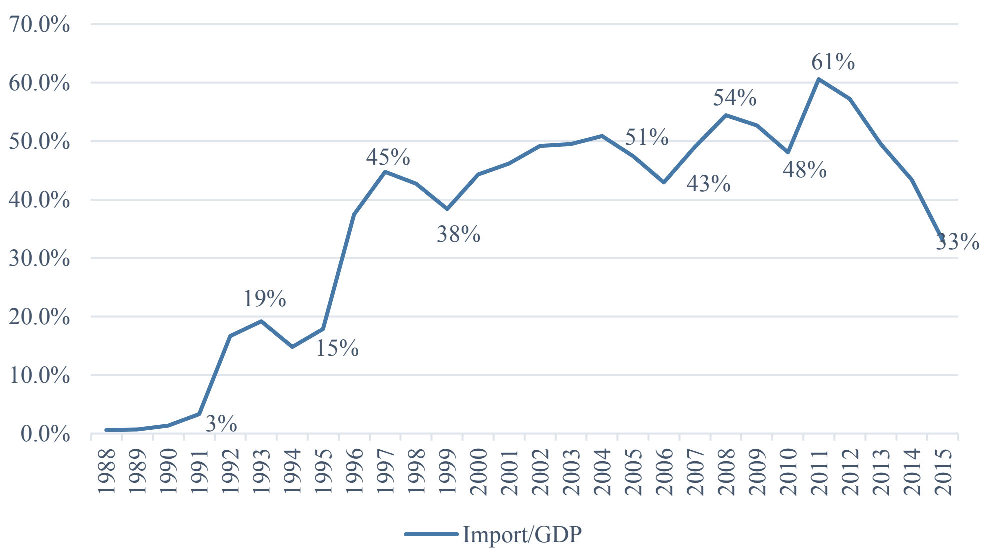


Source: Author created the figure based on UN Comtrade data.

Mongolia undertook serious economic reforms in 1990 after the collapse of the Soviet Union and suffered a long and dramatic process of transformation into the free-market economy, liberalizing domestic and foreign trade. Figure 2.1 shows Mongolian foreign trade between 1988 and 2016. We can see that there is a dramatic growth in the import value. According to our data, the import value was near zero in 1988 and gradually increased until 2012, reaching 7 billion dollars.

Figure 2.2 shows the Mongolian imports share of GDP between 1988 and 2016. The imports share of GDP was almost zero in 1988. It gradually rose after the liberalization in 1990, and reached 45 percent when Mongolia became the World Trade Organization (WTO) member in 1997. By 2012, the share was 61 percent of GDP.[17] We can see an obvious rising demand for imports from Figures 2.1 and 2.2, and it demonstrates the importance of imports to Mongolian economy.

Figure 2.2 *Imports Share of GDP (%)*



[17] However, as a result of the downturn in the economy, the share of imports of GDP in Figure 2.2, as well as its absolute volume in Figure 2.1, has dropped after 2012.

Source: Author's calculation based on import data from UN Comtrade and GDP data from Worldbank.

Table 2.1 summarizes the count measure of imported varieties of Mongolia between 1988 and 2015 and reveals that behind the rapid growth in import value, the growth in import varieties is similarly dramatic. Column (2) reports the number of HS-6 products for the related years. We can see that the number of these products increased by a factor of 7 during the period, from only 226 in 1988 to 1610 in 2015. Moreover, column (5) shows the total number of imported product varieties, which can be calculated as the number of HS-6 products multiplied by the average variety in column (4).

Table 2.1 *Variety in Mongolian Imports (1988-2015)*

	Year (1)	*Number of HS-6 products (2)*	*Median number of exporting countries (3)*	*Average number of exporting countries (4)*	*Total number of varieties (5)*
All 1988 goods	1988	226	1	1.1	255
All 2001 goods	2001	1512	3	3.5	5304
All 2015 goods	2015	1610	5	6.2	10052
Common, 1988-2015	1988	219	1	1.1	247
Common, 1988-2015	2015	219	3	8.0	1746
1988 not in 2015	1988	7	1	1.1	8
2015 not in 1988	2015	1391	3	6.0	8306

Source: Author's calculation based on the UN Comtrade data.

It can be seen from column (5) that the total number of varieties increased 40 times, from 255 to 10052. This is a remarkable increase that no other country study has ever shown. Columns (3) and (4) show the median and average number of source countries exporting to Mongolia, i.e. the number of varieties. We can observe that the number of exporting countries increased over time.

In 1988 only one variety or source country was available per good, but in 2015 on average six varieties were available. The middle part of the Table 2.1 reports statistics of the common goods which were available in both the beginning and the end of the period. It is notable that, on average, these common products were imported from only one source country in 1988, however in 2015 the number of source countries rose to eight. The last two rows of the table show that there are 1391 new goods which were not available in 1988, imported from six different countries on average. These dramatic changes in goods and varieties suggest that conventional measures using a fixed basket of goods or varieties could be largely biased. Consequently, these facts demonstrate that the gains from variety are not negligible.

2.3 Methodology: the Broda and Weinstein Method

Following Feenstra (1994) and Broda and Weinstein (2006), I start by deriving an exact price index for a constant elasticity of substitution (CES) utility function of a single good with a constant number of varieties. This index is then extended by allowing for new and disappearing varieties. Finally, I show how to construct an aggregate import price index and gains from variety formula. Let us start with a simple CES utility function with the following functional form for a single imported good. Assume that varieties of a good g are treated as differentiated across countries of supply, c:

$$M_{gt} = \left(\sum_{c \in C} d_{gct} m_{gct}^{1-\sigma_g} \right)^{\frac{1}{(1-\sigma_g)}} \quad ; \sigma_g > 1 \tag{1}$$

where C denotes the set of all countries and hence of all potentially available varieties. In the equation, m_{gct} is the subutility derived from the consumption of imported variety c of good g in period t; d_{gct} is the corresponding taste or quality parameter. The elasticity of substitution among varieties of good g is given by σ_g and is assumed to be larger than one.

Let $I_{gt} \subset C$ be the subset of all varieties of good g imported in period t. Using standard cost minimization for the subutility function (1) gives us the minimum unit-cost function:

$$\phi_{gt}(I_{gt}, \vec{d}_{gt}) = \left(\sum_{c \in I_{gt}} d_{gct} (p_{gct})^{1-\sigma_g} \right)^{\frac{1}{1-\sigma_g}} \quad (2)$$

where p_{gct} is the price of variety c of good g in period t and $\vec{d}_{gt}$ is the vector of taste or quality parameters for each country.

Suppose the set of varieties I_g in period t and $t-1$ are identical, the taste parameters $\vec{d}_g$ are also constant over time and $\vec{x}_{gt}$ and $\vec{x}_{gt-1}$ are the cost-minimizing consumption bundle vectors for the varieties of good g for given the price vectors. In this case Diewert (1976) defines an exact price index as a ratio of the minimum cost functions:

$$P_g(\vec{p}_{gt}, \vec{p}_{gt-1}, \vec{x}_{gt}, \vec{x}_{gt-1}, I_g) = \frac{\phi_{gt}(I_g, \vec{d}_g)}{\phi_{gt-1}(I_g, \vec{d}_g)} \quad (3)$$

where the price index does not depend on the unknown taste or quality parameters d_{gc}. Sato (1976) and Vartia (1976) have derived the exact price index for the case of the CES unit-cost function. It can be written as the geometric mean of the individual variety price changes:

$$P_g(\vec{p}_{gt}, \vec{p}_{gt-1}, \vec{x}_{gt}, \vec{x}_{gt-1}, I_g) = \prod_{c \in I_g} \left(\frac{p_{gct}}{p_{gct-1}} \right)^{w_{gct}} \quad (4)$$

where the weights are calculated using the expenditure shares s_{gct}:

$$w_{gct} = \frac{\left(\frac{s_{gct} - s_{gct-1}}{\ln\ s_{gct} - \ln\ s_{gct-1}}\right)}{\sum_{c \in I_g}\left(\frac{s_{gct} - s_{gct-1}}{\ln\ s_{gct} - \ln\ s_{gct-1}}\right)} \tag{4.1}$$

$$s_{gct} = \frac{p_{gct}x_{gct}}{\sum_{c \in I_g} p_{gct}x_{gct}} \tag{4.2}$$

So far, it was assumed that all varieties of good g were available in both periods to calculate the exact price index. To include new and disappearing varieties into account, Feenstra (1994) showed how to modify this exact price index for the case of different, but overlapping, sets of varieties in the two periods. This contribution of Feensta is given by the following proposition.

Proposition: For every good g, if $d_{gct} = d_{gct-1}$ for $c \in I_g = (I_{gt} \cap I_{g-1}), I_g \neq \emptyset$, then the exact price index for good g with change in varieties is given by

$$\pi_g(\vec{p}_{gt}, \vec{p}_{gt-1}, \vec{x}_{gt}, \vec{x}_{gt-1}, I_g) \quad = \frac{\phi_{gt}(I_{gt}, \vec{d}_g)}{\phi_{gt-1}(I_{gt-1}, \vec{d}_g)} \tag{5}$$

$$= P_g(\vec{p}_{gt}, \vec{p}_{gt-1}, \vec{x}_{gt}, \vec{x}_{gt-1}, I_g)\left(\frac{\lambda_{gt}}{\lambda_{gt-1}}\right)^{\frac{1}{\sigma_g - 1}} \tag{6}$$

where

$$\lambda_{gt} = \frac{\sum_{c \in I_g} p_{gct}x_{gct}}{\sum_{c \in I_{gt}} p_{gct}x_{gct}} \quad \text{and} \quad \lambda_{gt-1} = \frac{\sum_{c \in I_g} p_{gct-1}x_{gct-1}}{\sum_{c \in I_{gt-1}} p_{gct-1}x_{gct-1}} \tag{7}$$

Feenstra's theoretical contribution is correcting the conventional price index $P_g(I_g)$ by multiplying it with an additional term which captures the influence of new and disappearing varieties. This additional term is called the lambda ratio. The numerator of this term, λ_{gt}, captures the impact of newly available varieties. λ_{gt} is the ratio of expenditures on varieties available in both periods (i.e., $c \in I_g = (I_{gt} \cap I_{g-1})$) relative to the entire set of varieties available in period *t* (i.e., $c \in I_{gt}$). Hence, λ_{gt} decreases when expenditure share of new varieties increases and therefore, the exact price index decreases relative to the conventional price index. On the other hand, the denominator of the lambda ratio, λ_{gt-1}, captures the impact of disappearing varieties. λ_{gt-1} increases when there are only few disappearing varieties, and therefore the exact price index is relatively low when compared to the conventional price index.

The exact price index also depends on the elasticity of substitution between varieties, σ_g. If σ_g is high, $\frac{1}{\sigma_g - 1}$ is close to zero and the additional term $\left(\frac{\lambda_{gt}}{\lambda_{gt-1}}\right)^{\frac{1}{\sigma_g - 1}}$ is close to unity. Hence the variety change has small influence on the price index. This is intuitive, when σ_g is high since new and disappearing products are close substitutes to existing varieties, they will only have a minor influence on the price index.

The exact price index with variety change for good g was derived in equation (6). Aggregating it for all imported goods *G* gives us the aggregate exact import price index:

$$\Pi(\vec{p}_t, \vec{p}_{t-1}, \vec{x}_t, \vec{x}_{t-1}, I) = \frac{\phi_t(I_t, \vec{d})}{\phi_{t-1}(I_{t-1}, \vec{d})} \tag{8}$$

$$= CIPI(I) \prod_{g \in G} \left(\frac{\lambda_{gt}}{\lambda_{gt-1}}\right)^{\frac{w_{gt}}{\sigma_g - 1}} \tag{9}$$

where $CIPI(I) = \prod_{g \in G} P_g(I_g)^{w_{gt}}$ and the weights w_{gt} are defined in equation (4.1). Equation (9) shows that the aggregate exact import price index is the product of the aggregate conventional import price index, CIPI(I), and the aggregated lambda ratios which is referred as an "aggregate bias" of the import price in Broda and Weinstein (2006).

The aggregate import bias, or simply the bias measure, is thus an indicator of an upward bias of the aggregate conventional import price index compared to the aggregate exact import price index. The ratio between aggregate exact price index including variety and the aggregate conventional price is as follows.

$$Bias = \frac{\Pi(I)}{CIPI(I)} = \prod_{g \in G} \left(\frac{\lambda_{gt}}{\lambda_{gt-1}} \right)^{\frac{w_{gt}}{\sigma_g - 1}} \quad (10)$$

Using a simple Krugman (1980) structure of the economy, the inverse of the bias can be weighted by the import expenditure share to get the gains from variety:

$$GFV = \left(\frac{1}{Bias} \right)^{w_t{}^M} - 1 = \left[\prod_{g \in G} \left(\frac{\lambda_{gt}}{\lambda_{gt-1}} \right)^{-\frac{w_{gt}}{\sigma_g - 1}} \right]^{w_t{}^M} - 1 \quad (11)$$

where $w_t{}^M$ is the import expenditure share in *t*. [18]

2.4 Estimation Strategy

Equation (9) implies that in order to compute the exact import price index we have to estimate the

[18] The import expenditure share $w_t{}^M$ is calculated as the share of imports in GDP in *t*. This is the separation point of my work from Broda and Weinstein (2006). To estimate the *overall* welfare gain, they used the ideal import share for their whole sample period, however they do not provide an estimation annually. In contrast to that, I am estimating the welfare gain for *each year* in my sample period and as an overall gain, I simply take the summation. Refer to section 2.5.3 for details.

elasticity of substitution between varieties of each good. Therefore, in this section, I briefly review the estimator developed by Feenstra (1994) and improved by Broda and Weinstein (2006). After the review, using examples I explain the importance of the elasticities of substitution.

The estimation procedure allows for random changes in the taste parameters for imported varieties and is robust to measurement errors produced by using unit values. Given the utility function (1), the import demand equation for a specific variety using expenditure shares is as follows:

$$\Delta \ln s_{gct} = \varphi_{gt} - (\sigma_g - 1)\Delta \ln p_{gct} + \varepsilon_{gct} \quad (12)$$

where $\varphi_{gt} = (\sigma_g - 1)\ln\left[\frac{\phi_{gt}(d_t)}{\phi_{gt-1}(d_{t-1})}\right]$ is a random effect since d_t is random and $\varepsilon_{gct} = \Delta \ln d_{gct}$.

The export supply equation is specified by:

$$\Delta \ln p_{gct} = \psi_{gt} + \frac{\omega_g}{1+\omega_g}\Delta \ln s_{gct} + \delta_{gct} \quad (13)$$

Where $\psi_{gt} = -\omega_g \frac{\Delta \ln E_{gt}}{(1+\omega_g)}$, $E_{gt} = \sum_{c \in C_{gt}} p_{gct} x_{gct}$ and $\omega_g \geq 0$ is the good specific inverse supply elasticity[19] (assumed to be constant across countries) and $\delta_{gct} = \frac{\Delta \ln v_{gct}}{(1+\omega_g)}$ is an error term that captures any random changes in a technology factor v_{gct}.

To identify the elasticity of substitution I can assume that the error terms between the demand and supply curve ($\varepsilon_{gct}, \delta_{gct}$) are uncorrelated after controlling for good and time specific effects. This means, demand and supply errors at the variety level are assumed to be uncorrelated, once good-

[19] $\omega_g = 0$ is a special case of the export supply equation (13), where it is horizontal and there is no simultaneity bias, which is used for most of the empirical studies with gravity model to estimate the elasticity of substitution. However, stating $\omega_g \geq 0$, this study allows the export supply equation of variety *c* to vary with the amount of exports.

time specific effects are controlled for. To take advantage of this assumption, I first eliminate the random terms φ_{gt} and ψ_{gt} from equations (12) and (13) by taking differences relative to a reference country k:

$$\Delta^k \ln s_{gct} = -(\sigma_g - 1)\Delta^k \ln p_{gct} + \varepsilon_{gct}^k \tag{14}$$

$$\Delta^k \ln p_{gct} = \frac{\omega_g}{1+\omega_g}\Delta^k \ln s_{gct} + \delta_{gct}^k \tag{15}$$

where $\Delta^k x_{gct} = \Delta x_{gct} - \Delta x_{gkt}$, $\varepsilon_{gct}^k = \varepsilon_{gct} - \varepsilon_{gkt}$ and $\delta_{gct}^k = \delta_{gct} - \delta_{gkt}$. Next, I multiply (14) and (15) and use the assumption of the independent error terms, i.e. $E\left(\varepsilon_{gct}^k \delta_{gct}^k\right) = 0$. As a result, we obtain the following:

$$\left(\Delta^k \ln p_{gct}\right)^2 = \theta_1\left(\Delta^k \ln s_{gct}\right)^2 + \theta_2\left(\Delta^k \ln p_{gct}\, \Delta^k \ln s_{gct}\right) + u_{gct} \tag{16}$$

where $\theta_1 = \frac{\omega_g}{(1+\omega_g)(\sigma_g-1)}$, $\theta_2 = \frac{1-\omega_g(\sigma_g-2)}{(1+\omega_g)(\sigma_g-1)}$ and $u_{gct} = \varepsilon_{gct}^k \delta_{gct}^k$. However, there is a correlation between u_{gct} and the explanatory variables. To make the error term u_{gct} independent of the explanatory variables, the average of all variables over *t* are taken and denoted by upper bar:

$$\left(\overline{\Delta^k \ln p_{gct}}\right)^2 = \theta_1\left(\overline{\Delta^k \ln s_{gct}}\right)^2 + \theta_2\left(\overline{\Delta^k \ln p_{gct}}\, \overline{\Delta^k \ln s_{gct}}\right) + \overline{u_{gct}} \tag{17}$$

Using weighted least squares estimation, the estimates of θ_1 and θ_2 can be now consistent.

For each good g, the following objective function is used to obtain Hansen's (1982) estimator:

$$\hat{\beta}_g = \arg\min_{\beta \in B} G^*\left(\beta_g\right)' W G^*\left(\beta_g\right) \tag{18}$$

where $G^*\left(\beta_g\right)$ is the sample analog of $G\left(\beta_g\right)$, B is the set of economically feasible β such that

$\sigma_g > 1$ and $\omega_g > 1$, and W is a positive definite weighting matrix. The optimal weights depend on the time span and import quantities (Broda and Weinstein, 2006). I estimate θ_1 and θ_2 and subsequently solve for σ_g. If the estimated σ_g is not economically reasonable, I use a grid search over the space defined by B. In particular, I follow Broda and Weinstein (2006) to compute the minimized GMM objective function over $\sigma_g \in [1.05, 131.5]$ at intervals which are 5 percent apart.[20]

Why Elasticities are Important?

An elasticity of substitution is a responsiveness (of the buyers) of a good to the price changes in its substitutes. Basically, it shows what happens to the relative demand when relative price changes between two goods. It is measured as the ratio of proportionate change in the relative demand for two goods to the proportionate change in their relative prices. In theory, in order to obtain estimates, we make number of restrictive, simplifying assumptions. Similarly, in order to value varieties, let us assume that we have only one or at most two elasticities of substitution, an assumption often made when using a utility function. This will implicitly assume the following (Broda and Weinstein, 2006). First, elasticities of substitution among varieties of different goods are the same. However, same amount of increase in price of a variety of two different goods may be valued differently by consumers. For example, presumably consumers care more about varieties of computers than crude oil. So, all increases in imports do not give the same gains in reality. Second, elasticities of substitution across goods equals that across varieties of a given good. However, presumably we care more about the different varieties of vegetables than about varieties of potatoes. Third, maybe the largest problem arises from assuming that all varieties enter into the utility

[20] For more detailed explanation refer to the working paper version of Broda and Weinstein (2006), which is Broda and Weinstein (2004).

function with a common elasticity. For example, let's say Saudi Arabian oil prices went up. Then what will happen to our imports of Mexican oil? What will happen to our imports of automobiles? One should rise and the other should fall. The reason is that Mexican oil is almost the perfect substitute of the Saudi Arabian oil and cars are the complements. However, if we assume that the elasticities are equal, then it is very hard to interpret the meaning of the elasticity and there will be no intuition to its magnitude.

2.5 Results

In this section I discuss the results of my estimation of Mongolian welfare gains from an increased import product variety from 1988 to 2015. The estimation has four steps. First, following the estimation strategy in section 2.4, elasticities of substitution σ_g for each product are estimated. Second, I use equation (7) to calculate the lambda ratios λ_g for each imported product category. Third, with σ_g and λ_g, I obtain an estimate of the exact price index for each product after import variety change. Finally, using equation (9), I apply the log-change ideal weights to the price movements of each good in order to estimate the impact of variety growth on the aggregate import price index. Then with the knowledge of each year's aggregate import price index, using equation (11), I quantify the variety gains from trade with respect to GDP.

2.5.1 Elasticities of Substitution

I estimated equation (17) for each HS-6 product and obtained 1390 elasticities of substitution (sigmas henceforth). Although it is impossible to report all sigmas, Table 2.2 presents the descriptive statistics of sigmas and Table 2.3 reports sigmas for the 20 products with the largest import share. By examining these tables, we can obtain a sense of the degree of substitutability among varieties. If sigma is high, say above 10 or 20, then this suggests that the potential for gains from variety, are small. This is intuitive. When σ_g is high, since new and disappearing products are close substitutes to existing varieties, they will only have a minor influence on the price index and hence the gains from variety.[21] On the other hand, if sigma is low, then this suggests that goods are highly differentiated by country, meaning the potential for gains from variety is high.

Table 2.2 *Estimated Elasticities of Substitution*

Statistic	*HS-6 level*
Percentile 90	12.1
Percentile 50 (Median)	3.6
Percentile 10	1.8
Mean	8.4
No of HS products	1390
Median variety per product	14

Note: Author's calculation. See text for explanation.

Table 2.2 shows that the average elasticity of substitution is 8.4. and median is 3.6.[22] Table 2.3 shows that the most products with the largest import share, with only one exception, have lower elasticities of substitution, which implies larger gains from variety.

[21] If we look at equation (6) and (9), it is clear that if σ_g is high, $\frac{1}{\sigma_g - 1}$ is close to zero and the additional term $\left(\frac{\lambda_{gt}}{\lambda_{gt-1}}\right)^{\frac{1}{\sigma_g - 1}}$ is closer to unity. Hence the variety change has small influence on the price index, when σ_g is high.

[22] As a reference results of Broda and Weinstein (2006) are as follows, mean is 17.3 in HS9, 7.5 in SITC-5 and median is 3.7 in HS9, 2.8 in SITC-5 in period 1972-1988 in US.

Table 2.3 *Sigmas for the 20 Products with the Largest Import Share*

HS-6 products	*Sigma*	*Import share (%)*	*Descriptions*
271000	2.39	22.95	Petroleum Oils, Oils Obtained from Bituminous Minerals, Preparations Thereof
870323	1.44	2.33	Other Vehicles, Spark-ignition Engine Of a cylinder capacity exceeding 1,500 cc but not exceeding 3,000 cc
842952	1.20	1.33	Machinery With a 360degrees Revolving Superstructure
870410	24.63	1.33	Motor vehicles for the transport of goods Dumpers designed for off-highway use
870322	7.33	1.11	Other Vehicles, Spark-ignition Engine Of a cylinder capacity exceeding 1,000 cc but not exceeding 1,500 cc
870423	2.43	1.06	Motor vehicles for the transport of goods GVW exceeding 20 metric tons
110100	2.21	1.05	Wheat Flour, Meslin Flour
730890	8.69	1.02	Other Structures and Parts of Structures, of Iron or Steel
252329	5.04	1.01	Other Portland Cement
240220	2.90	0.94	Cigarettes (Containing Tobacco)
843149	3.39	0.81	Parts of Derricks, Cranes, Graders, Levelers, Scrapers or Pile-drivers
180690	5.06	0.78	Cocoa Preparations (In Containers, Packings, in Liquid, Powder, Granular Form)
847490	2.26	0.75	Parts of Machinery for Sorting, Crushing, Mixing, Molding or Shaping
300490	2.07	0.73	Other Medicaments (Put up in Packings for Retail Sale)
721420	17.22	0.72	Concrete reinforcing bars and rods, Hot-rolled, Hot-drawn, Hot-extruded
610462	5.78	0.70	Women's or Girls' Trousers, Breeches, of Cotton, Knitted or Crocheted
630221	3.71	0.66	Bed Linen, Printed, of Cotton
732611	4.11	0.59	Grinding Balls and Similar Forged or Stamped Articles for Mills
271320	3.26	0.58	Petroleum Bitumen
170490	3.12	0.55	Other Sugar Confectionery, Not Containing Cocoa

Source: Author's calculation.

2.5.2 Change in Varieties

The second step is to calculate the changes in variety over time (i.e. the lambda ratio). The calculation of lambdas requires the existence of common varieties in the beginning and at the end of the period.[23] This is one of the major obstacles we face when implementing the technique. As a result, there are fewer lambda ratios than product groups or sigmas. Some lambda ratios cannot be defined at the HS-6 level since there is no common variety. I then follow Broda and Weinstein (2006) and define the lambda ratio at the HS-4 level.

Table 2.4 shows the summary statistics for the lambda ratios. The median lambda ratio is 0.96, expressing that the typical imported product category in Mongolia experienced a positive variety growth of about 4 percent[24]. Using the lambda ratios as a measure of variety growth is more sophisticated than just counting new and disappearing varieties. Due to the large number of new varieties with small market shares, just counting the new varieties can be misleading. Thus, this underscores the importance of carefully measuring variety growth when making price and welfare calculations. The measure also accounts for the importance of different varieties to the consumer budget decision by using expenditure shares as weights. Lower the lambdas mean more the varieties, more we spend on new varieties.

Table 2.4 *Descriptive Statistics of Lambda Ratios*

Statistic	*HS-6 level*
Percentile 5	0.14
Percentile 50 (Median)	0.96
Percentile 95	4.78

Note: In here, due to the existence of outliers reaching high absolute values, median is more preferable than mean.

[23] The reason why we need common varieties is that we cannot value the creation and destruction of a variety without knowing something about how this affects the consumption of other varieties (Broda and Weinstein, 2006).
[24] Calculated as 1/0.96=4.2%.

2.5.3 Welfare Gain

Using the estimated elasticities of substitution and the lambda ratios, now I am ready to calculate the variety change effects on price. Following equation (9) by aggregating the lambda ratios gives the estimates of the impact of variety growth on the aggregate exact import price index. Table 2.5 reports the results of this exercise.

In column (4) of Table 2.5, the ratio of the aggregate exact price index including variety and the aggregate conventional price index is reported as the *bias* measure as in equation (10). It is worth explaining the intuition behind this bias. If this fraction is lower than one, it means that the changing set of imported varieties has *lowered* the import price index. In that case, the consumers benefit from lower unit costs of imports. Thus, these lower costs are the source of the welfare gains. On the other hand, if the bias is larger than one, this means that the import price index is *increased* by the changing variety set. Thus, the disappearing varieties are more valuable to the consumers than the new varieties and it results in welfare loss. Column (4) shows that in most years, the bias is lower than one, meaning the variety change resulted in lower import price index. On average, the bias measure is 0.978 which means that ignoring new and disappearing product varieties in the conventional price index had led to an upward bias of 2.25 percent.[25] This is the same thing as saying that import price inflation is overstated by 2.25 percent per year.

It is now time to calculate the welfare effect of the fall in the Mongolian exact import price. It should be noted that the welfare gain from this price fall is based on the functional forms assuming the Dixit-Stiglitz structure and cannot be general. Although my estimate of the impact of imported varieties on import prices is correct for any domestic production structure (Broda and Weinstein,

[25] Calculated as $(\frac{1}{bias} - 1) \times 100$.

2006), it is not possible to translate this into a welfare gain without making explicit assumptions about the structure of domestic production. Following Broda and Weinstein (2006), my choice is to assume the same structure of the Mongolian economy as in Krugman (1980). There are two reasons for this. First, since Krugman's model is the dominant model of varieties, to understand the potential welfare gains, it provides a useful benchmark. Second reason is the lack of the necessary data and model of the economy's input-output linkages to estimate variants of the monopolistic competition model with more complex interactions between imported and domestic varieties.

Column (5) of Table 2.5 presents the gains from variety for every year between 1988 and 2015. The results show that in yearly basis, the welfare gain due to the increase in imported product varieties in Mongolia, accounted for average 0.8 percent of GDP. This means that a representative Mongolian consumer would be willing to give up 0.8 percent of her income to access the new import varieties every year. The welfare gains for the whole sample period from 1988 to 2015 is approximately 22 percent of the GDP and it is a remarkable result considering the moderate gains the most studies show.

Considering the relatively high results of the welfare gain, I consider the following two reasons among many, to be important. First, as presented in section 2.2, the Mongolian import share of GDP is extremely high. In Table 2.5, Column (3) shows the import shares from 1988 to 2015. The import share rose significantly after 1996 and the average was 36 percent during the period. This is rather high compared to other studies. For instance, Broda and Weinstein (2006) found the ideal import share of the U.S.to be 6.7 percent for 1972-1988 and 10.3 percent for 1990-2001, respectively and Chen and Ma (2012) found the log-change ideal weight of China's import in GDP to be 11.5 percent during 1997-2008. Since I used the share of imports in GDP as a weight ${w_t}^M$ in equation (11), and the Mongolian import share of GDP is relatively high, the variety gain is consequently high. Second and the main reason is that not only the growth in number of varieties was drastic, but also the growth in number of products was significant. Column (1) and (2) of Table 2.5 present the average number of varieties and number of HS-6 products, respectively. We can see that during the period, the number of varieties rose 6 times, from one to six, and on the other hand, the number of products rose 7 times, from 226 to 1610. This means that the numerator of the lambda ratios, λ_{gt}, which captures the impact of newly available varieties is low. Since λ_{gt} is the ratio of expenditures on varieties available in both periods (i.e., $c \in I_g = \left(I_{gt} \cap I_{g-1}\right)$) relative to the entire set of varieties available in period t (i.e., $c \in I_{gt}$), evolving of the new variety decreases λ_{gt}. Hence, the exact price index is relatively low and the welfare gain is relatively high.

Table 2.5 *Import Price Bias and the Gains from Variety*

Year	*Average number of varieties* (1)	*Number of HS-6 products* (2)	*Import share* (3)	*Bias* (4)	*Gains from Variety (%)* (5)
1988	1.1	226	0.01	1.000	0.00%
1989	1.2	275	0.01	0.992	0.01%
1990	1.3	342	0.01	0.993	0.01%
1991	1.2	485	0.03	1.017	-0.06%
1992	1.4	783	0.17	0.911	1.56%
1993	1.6	791	0.19	0.888	2.32%
1994	2.1	1114	0.15	1.041	-0.60%
1995	2.5	1216	0.18	0.903	1.84%
1996	2.9	1408	0.37	0.811	8.14%
1997	2.9	1382	0.45	0.998	0.07%
1998	3.0	1398	0.43	1.011	-0.46%
1999	2.8	1410	0.38	0.973	1.06%
2000	3.3	1521	0.44	0.978	1.01%
2001	3.5	1512	0.46	0.942	2.79%
2002	3.5	1542	0.49	0.959	2.10%
2003	4.1	1579	0.50	0.966	1.75%
2004	4.3	1592	0.51	0.991	0.45%
2005	4.4	1573	0.47	1.009	-0.40%
2006	4.6	1601	0.43	1.036	-1.53%
2007	4.9	1587	0.49	0.957	2.17%
2008	5.1	1599	0.54	0.983	0.95%
2009	4.9	1601	0.53	0.993	0.36%
2010	5.7	1608	0.48	0.993	0.32%
2011	6.6	1611	0.61	0.981	1.18%
2012	7.1	1613	0.57	1.049	-2.68%
2013	7.7	1614	0.50	0.937	3.27%
2014	7.4	1616	0.43	1.027	-1.15%
2015	6.2	1610	0.33	1.058	-1.84%
Total (1988-2015)					22.63%
Average per-annum	*3.8*	*1293*	*0.36*	***0.978***	***0.81%***

Note: Author's calculation based on six-digit disaggregated data from UN Comtrade. See text for detailed explanation.

2.6. Conclusion

There is a considerable amount of literature attempting to quantify the welfare gain of growing import variety. Thus, the importance of importing new varieties has been long-established. Moreover, the literature confirms that gains from trade varieties are in general much higher in developing countries than in developed countries. Mongolia is a small country that opened up in 1990s and has been in transition since. Compared to its size, the economy imports a great deal, spending on average 36 percent of the total expenditure in a year from 1988 to 2015. The economy has been gaining greatly from international trade. However, no comprehensive study exists on how much Mongolia gained from import variety growth.

I used highly disaggregated import data from 1988 to 2015 to estimate the elasticities of substitution for 1390 imported goods. These elasticities allowed me to construct a comprehensive measure of the welfare gain using the seminal works by Feenstra (1994) and Broda and Weinstein (2006). The welfare gain as a result of growth in import variety during the period amounts to 22.6% of GDP (or 0.8% annually). Indeed, the welfare impact of import variety growth is remarkable.

The evidence from this chapter suggests that especially for small and transitioning economies the creation and extension of trade linkages can be an important source of welfare, a fact often neglected in the discussion about the positive effects of globalization and economic integration.

Chapter 3

Which Gain was Larger? Bilateral Trade Agreement with the U.S. or WTO Accession: The Case of Vietnam

3.1 Introduction

Welfare gains through international trade is at the center of international economics literature. However, it is only recently that the data and the methodologies become available to empirically assess such welfare gains. Building on the recently developed methodologies of estimating the elasticity of substitution and computing welfare gains from trade, we estimate the manufacturing sector's welfare gains of Vietnam from its trade liberalization.

Since the beginning of international trade theory by Ricardo and Heckscher-Ohlin in the nineteenth and twentieth centuries, gains from trade have been a main topic in the literature. More recent trade theories have studied various channels and mechanisms of the welfare impact of trade, including the important contributions such as Krugman (1980), Eaton and Kortum (2002), Melitz (2003) and others. However, until recently the empirical measurement of the welfare impact through trade has been practically not possible. Thanks to computers and the huge datasets which are now available, and moreover the empirical methodologies developed by trade economists, the estimation of the welfare impact of trade has come to the forefront in the literature. We will use these methods to measure the gains from Vietnam's liberalization.

In an effort to integrate with the world trade system, Vietnam has signed 12 Free Trade Agreements (FTAs) and further has launched five ongoing negotiations. The Bilateral Trade Agreement (BTA) with the United States (U.S.) came into effect in December 2001 and as a result, exports increased dramatically, making the U.S. the single largest export destination for Vietnam. It was expected that access to the U.S. market would allow Vietnam to hasten its transformation into a manufacturing-based, export-oriented economy.

In January 2007, Vietnam officially became a member of the World Trade Organization (WTO). The country's accession to the WTO was intended to provide an important boost to the economy, as it ensured that the liberalizing reforms continue and created options for trade expansion. However, the WTO accession also brought serious challenges, requiring the economy to open up to increasing foreign competition. More details on the Vietnamese trade liberalization, particularly the BTA and the WTO are given in section 3.2.

In this chapter, we examine the industry-level welfare impacts of the two significant liberalization measures of Vietnam, the BTA with the U.S. and WTO accession. It is rare to find such important liberalization measures in the same economy, making one wonder if the size of a partner or the number of partners matter the most in international trade. As a matter of fact, the "concentration-diversification trade-off"[26] i.e. a comparative welfare impact analysis, particularly in one economy with two liberalization episodes, is a neglected area in the international trade literature, to the best of our knowledge. Consequently, the aim of this chapter is to compare the welfare impacts of the BTA and WTO accession in Vietnamese economy, using the methodology proposed by Arkolakis et al. (2012).

In the international trade literature, there is a large number of empirical papers focusing on the measurement of the gains from trade, such as Feenstra (1994), Klenow and Rodríguez-Clare

[26] The term used here is similar to the portfolio management strategy term used in Financial Economics. However, the concentration implied here is the size of a partner country's economy and the diversification refers to the number of partner countries one has.

(1997), Broda and Weinstein (2006) and Feenstra and Weinstein (2009). The purpose of such exercises is to quantify the contribution of a particular margin— for instance, new goods or new varieties—to changes in real income. However, Arkolakis et al. (2012) demonstrate that for quantitative trade models, whatever the welfare contribution of particular margins may be, the total size of the gains from trade can always be computed using the same aggregate statistics, domestic expenditure share and trade elasticity.

The theoretical relationship between trade and welfare is well set by Arkolakis et al. (2012). They focus first on the simplest trade model possible: the Armington model. It is based on the simplifying assumption that goods are "differentiated by country of origin", meaning two countries cannot produce the exact same good. Each good enters preferences in a Dixit-Stiglitz fashion. In this environment, the logic behind the welfare formula is straightforward. On the one hand, changes in real income depend on terms-of-trade changes. On the other hand, terms-of-trade changes vis-à-vis each trade partner can be inferred from changes in relative imports using the trade elasticity, which is just equal to one minus the elasticity of substitution across goods. Aggregating changes in relative imports across all exporters, they obtain the equation for the welfare change. The details of the theory are given in section 3.3.

Our empirical strategy is adopted from Lai et al. (2016). Using the methodology of Arkolakis et al. (2012), Lai et al. (2016) examine the industry-level welfare gain from Chinese WTO accession in 2002. They find surprisingly that the gains to the import sector are larger than the gains to the export sector. We follow their steps to compare the industry-level gains from the Vietnam's BTA with the U.S. in 2001 with the gains from the Vietnamese accession to the WTO in 2007 using the input-output data. The empirical strategy is explained more in detail in section 3.4.

Here are the main findings of this chapter. Compared to autarky, we found that both the BTA and the WTO contributed significantly to Vietnam's gains from trade. However, the tariff reduction effects of the BTA were rather short-lived from 2002 to 2004, while the welfare gain after the accession to the WTO continued consistently from 2007 to 2011, despite the Global Financial Crisis. Furthermore, comparing the industrial gains of three most gaining industries, the welfare gained after the WTO accession found to be larger in magnitude. Considering all the findings, we conclude that the welfare gained after the WTO accession is larger than the gains earned after the BTA with the U.S. In addition, we found that textile industry contributed substantially to the overall gains from trade. Our quantitative results are explained systematically in section 3.5.

We intentionally and carefully refrained from directly comparing the welfare impact of the two phenomena in Vietnam. Instead, we calculated the dynamic gains that show the gains in specific margin (four margins) after the phenomenon. In other words, we compare the differences in gains from trade. In addition, to eliminate the effects of the change in consumer tastes, we used the same elasticities for the calculation of the gains for the both phenomena.

The remainder of the chapter is organized as follows. Section 3.2 describes the data and reviews Vietnam's liberalization phenomena with descriptive statistics. Section 3.3 gives a brief overview of the gains from trade theory. Section 3.4 describes the empirical strategy by carefully explaining the intuitions behind the Arkolakis et al. (2012) formula. Section 3.5 reports and interprets the results systematically and section 3.6 concludes.

3.2 Descriptive Statistics

3.2.1 Data

Since we conducted industrial level analysis, input-output data were used. The data covering the period from 1995 to 2011 were used from the OECD Input-Output 2015 database.[27]. Using the data, we focus primarily on the manufacturing industries. Table 3.1 shows industrial classification codes of 16 manufacturing industries, also agriculture and mining as a whole. Tariff data of two-digit International Standard Industrial Classification, Rev.3 (ISIC-Rev. 3) data were taken from the World Integrated Trade Solution (WITS) and Trade Analysis Information System (TRAINS) database. To estimate the trade elasticities, we benefited from the United Nations International Trade Statistics Database (UN Comtrade). These data covered the period from 1995 to 2016. In addition, to create figures, export, import data as well as the GDP data from 1995 to 2015 were used from the World Development Indicators database from World Bank.

3.2.2 Trade liberalization in Vietnam

Trade liberalization measures contributed to a rapid expansion of international trade in Vietnam since 1995. The exports increased 15 times in 2011 and 25 times in 2015 relative to the level in 1995.[28] The expansion of exports was accompanied by the growth of labor-intensive exports in addition to the natural resource based exports of crude oil and agricultural products. Exports of garment and textile rose dramatically. Imports also grew fast and consisted of mostly machinery and equipment, and intermediate inputs. This high growth of imports was largely stimulated by the inflows of foreign investment and the increasing domestic demand for intermediate inputs. The

[27] As a robustness check, alternative data of YNU-GIO from Shrestha and Sato (2015) were used. These data cover from 1997 to 2012.
[28] Author's calculation based on exports of goods and services (current USD) data from the WDI. See Figure 3.4.

Table 3.1 *Industrial Classification Codes*

Industry name	*Industry code*	*ISIC code*	*OECD code*
Agriculture and mining industries			
Agriculture, forestry, and fishing	1	01-05	C01T05
Mining and quarrying	2	10-14	C10T14
Manufacturing industries			
Food products, beverages and tobacco	3	15-16	C15T16
Textiles, wearing apparel, leather and footwear	4	17-19	C17T19
Wood and products of wood and cork	5	20	C20
Paper, paper products, printing and publishing	6	21-22	C21T22
Coke, refined petroleum products and nuclear fuel	7	23	C23
Chemicals and chemical products	8	24	C24
Rubber and plastics products	9	25	C25
Other non-metallic mineral products	10	26	C26
Basic metals	11	27	C27
Fabricated metal products, except machinery and equipment	12	28	C28
Machinery and equipment n.e.c.	13	29	C29
Office, computing, communication and medical	14	30 and 32-33	C30T33X
Electrical machinery and apparatus	15	31	C31
Motor vehicles, trailers and semi-trailers	16	34	C34
Other transport equipment	17	35	C35
Furniture, other manufacturing, recycling	18	36	C36T37

Note: ISIC-Rev.3 codes were matched to the corresponding OECD IO codes by author. Industry 14 includes C30 Office, accounting and computing machinery, C32 radio, television and communication equipment and apparatus and C33 medical, precision and optical instruments.

rapid increase in trade has contributed to the growth and modernization of the economy and turned Vietnam into one of the most open economies in the Southeast Asian region with the trade share to GDP reaching 1.6 in 2011 and 1.8 in 2015.[29]

[29] Using WDI data, the trade share to GDP is calculated as the sum of exports and imports divided by GDP.

The effort to integrate with the regional economy began in 1995 when Vietnam became a member of the Association of Southeast Asian Nations (ASEAN) and committed itself to tariff reductions under the ASEAN free trade area (AFTA). It was then followed by the Asia-Pacific Economic Cooperation (APEC) membership in 1998. Vietnam then signed the bilateral trade agreement with the U.S. in 2000. As a member of ASEAN, Vietnam participated in the FTAs between ASEAN and other countries, specifically China, Korea, Japan, India, Australia and New Zealand (see Table 3.2). Vietnam signed the Trans-Pacific Partnership (TPP) negotiations and agreement, however it is not yet in effect. In addition, Vietnam is under negotiation for FTA agreements with the European Free Trade Association (EFTA), European Union (EU) and Russian Federation, Belarus, and Kazakhstan.

Vietnam's trade with regional countries reflects its general composition of trade and comparative advantage. Most of Vietnam's exports to regional markets are natural-resource based and agricultural products. Vietnam is a large supplier of crude oil to China, and to a lesser extent, it exports crude oil to Japan, Singapore and some other East Asian countries. Fishery and other agricultural products are the major exports to regional countries, particularly to Japan, China, Korea and Singapore. Textile, garment and footwear are exported to high-income regional economies, largely to Japan and Korea. Exports of electronics began from the late of 1990s, but the volume of exports remains limited. Electronic parts and products are produced by foreign firms in Vietnam and are exported to their affiliates in the region.

Machinery, equipment and production inputs constitute a large proportion in Vietnam's imports as the country heavily depends on the imports of these products for investment and domestic production. Most of Vietnam's imports from the region are production inputs, ranging from petroleum, iron and steel, fertilizers, plastics and chemical to electronic parts and materials for textile and garments.

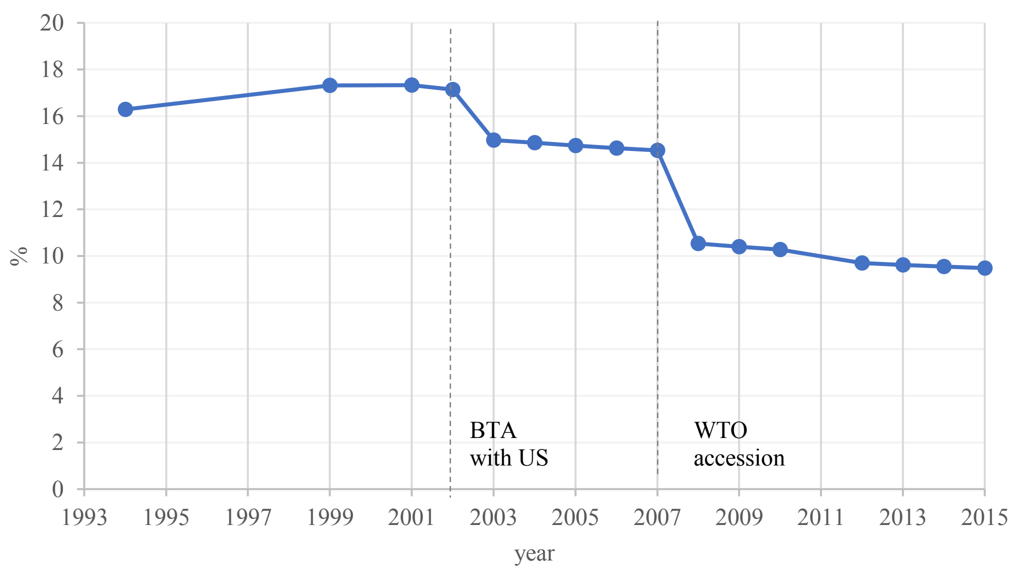
Table 3.2 *Free Trade Agreements since 1995*

Country/ Region	*Date of Signature*	*Date of entry into force*	*End of implementation period*
ASEAN	Jul-95	Jul-95	
APEC	Nov-98	Nov-98	
U.S.-Vietnam	Jul-00	Dec-01	
ASEAN-China	Nov-04	Jan-05	2020
	Jan-07	Jul-07	
ASEAN-Korea	Aug-06	Jan-10	2024
	Nov-08	Oct-10	
WTO	Jan-07	Jan-07	
ASEAN-Japan	Mar-08	Dec-08	2026
Japan-Vietnam	Dec-08	Oct-09	2026
ASEAN-Australia-New Zealand	Feb-09	Jan-10	2025
ASEAN-India	Aug-09	Jan-10	2024
Chile-Vietnam	Nov-11	Jan-14	2029
Korea-Vietnam	May-15	Dec-15	
Eurasian Economic Union	May-15	Oct-16	

Note: The coverage of ASEAN-Japan and Chile-Vietnam is goods only, the rest of the FTAs cover goods and services as the area of negotiation.
Source: World Trade Organization webpage

Now, let us look at the tariff rates. Figure 3.1 shows the ad valorem equivalent tariff rates for Vietnam from 1994 to 2015. The tariff rates fell from 17% to 15% in 2003, and again to 11% in 2008, reflecting the significance of the two liberalization phenomena. Figure 3.2 shows the industry-level tariff rates in 2002, 2008 and 2015, respectively. Tariff levels vary significantly across industries. For example, following the WTO accession in 2008, the rate was as high as 67% in tobacco and as low as 2% in petroleum, basic metals and medical instruments. We can also see that tariff rates fell over time in all industries except tobacco and petroleum.

Figure 3.1 *The Average Vietnamese Tariffs of Agriculture, Mining, and Manufacturing Industries*

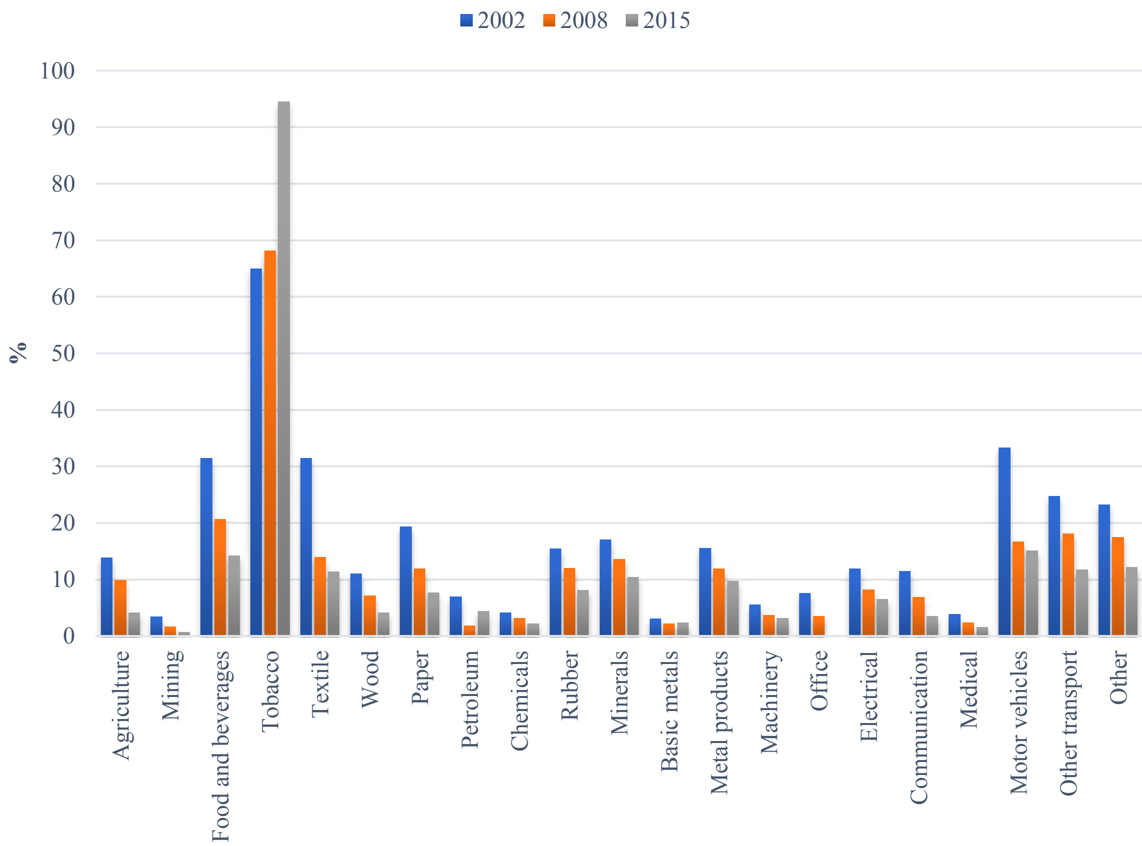


Note: Simple average of the effectively applied rates across all products of the 2-digit ISIC-Rev.3 industry data from the WITS TRAINS database.

The BTA with the U.S.

The signing of the BTA with the U.S. was in 2000. The BTA then came into force on 10 December 2001. The principal obligation of the U.S. under the BTA was to grant Vietnam "normal trade

Figure 3.2 *Tariff Rates by Industries in 2002, 2008 and 2015*

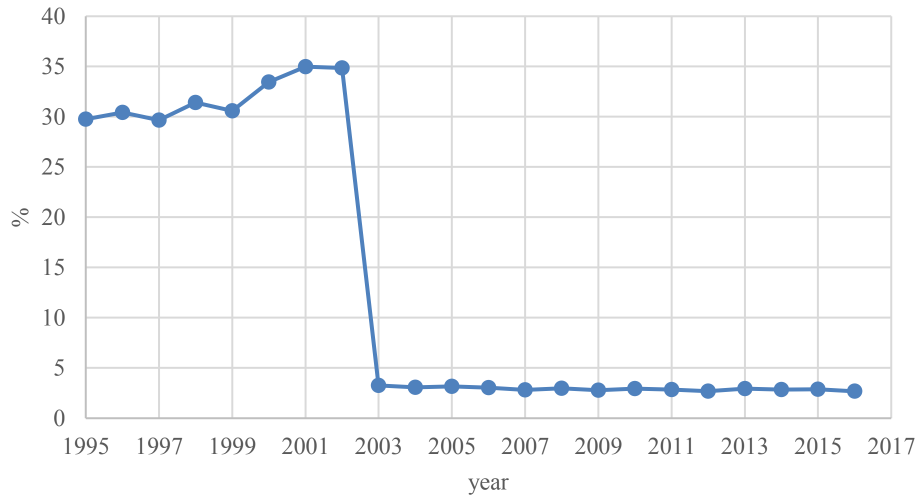


Note: The effectively applied rates at the 2-digit ISIC-Rev.3 industry classification, are used from the WITS TRAINS database.

relations" (NTR) or "most favored nation" (MFN) status.

The consequence of this action was to lower the U.S. import tariffs on Vietnam exports. Average tariffs were lowered from 35 percent to 4 percent (see Figure 3.3), essentially opening the vast U.S. market to Vietnamese exporters literally overnight (Vietnam's Ministry of Planning and Investment's CIEM, FIA and STAR, 2007). Particularly significant were tariff cuts on labor-intensive manufactured products, in which Vietnam has a strong comparative advantage. Vietnam's exports to the U.S. responded dramatically to the improved access to the U.S. market. Indeed, since the BTA went into effect, the U.S. has gone from one of Vietnam's smallest export

Figure 3.3 The *Average U.S. Tariffs on Vietnamese Agriculture, Mining, and Manufacturing Industries*



Note: Simple average of the effectively applied rates across all products of the 2-digit ISIC-Rev.3 industry data from the WITS TRAINS database.

destinations to become its single largest export market.

Vietnam, for its part, was not required to make significant cuts in tariffs on imports from the U.S., cutting rates for only 261 tariff lines (Vietnam's Ministry of Planning and Investment's CIEM, FIA and STAR, 2007). There was, therefore, no reason to expect that the growth of U.S. exports to Vietnam would accelerate anywhere nearly as dramatically as did Vietnam's exports to the U.S. However, while Vietnam was not required under the BTA to make significant tariff cuts, it was required to thoroughly reform its commercial laws and regulations.

Full bilateral economic normalization was completed in December 2006 when President Bush extended permanent normal trade relations (PNTR) to Vietnam. The U.S. revoked the U.S.-Vietnam Textile Agreement, which had imposed quotas on Vietnamese apparel exports since July 2003, upon Vietnamese formal accession to the WTO. In June 2007, just months after Vietnam's WTO accession, the two countries signed a bilateral Trade and Investment Framework Agreement

(TIFA).

Exports. The agreement created great opportunities for Vietnam's exports in the first two years. Vietnam's exports to the U.S. surged by 128 percent in 2002 and by another 90 percent in 2003 (Vietnam's Ministry of Planning and Investment's CIEM, FIA and STAR, 2007). Just two years after the agreement, the U.S. went from being a relatively small market for Vietnamese exports to become Vietnam's single largest export market, and has remained so since then. The export surge ended in 2003, however, with the implementation of the U.S.- Vietnam Textile Agreement and its limitations on apparel export growth. After 2003, Vietnamese exports to the U.S. grew in line with overall exports, with the share of the U.S. in total exports at about 20 percent.

Imports. According to the Assessment of the Five- Year Impact of the U.S.-Vietnam BTA on Vietnam's Trade, Investment and Economic Structure report (2007), although, Vietnamese imports from the U.S. have also grown solidly after the BTA, the (U.S.) remains a relatively minor source of imports into Vietnam, representing between 2 to 4 percent of total imports over the first five years of BTA. This is partly a result of the low base of imports from the (U.S.) to Vietnam before the BTA as suggested by the Vietnam's Ministry of Planning and Investment (2007), and the relatively limited increase in access to the Vietnamese market by the BTA. Most fundamentally, however, this reflects structural factors. At Vietnam's stage of development, most of its imports consisted of raw materials and machinery, used for labor-intensive production and infrastructure projects, and imports of lower-quality—and often relatively inexpensive—consumer goods. These types of imports are much more likely to be supplied by Vietnam's Asian neighbors, including China, ASEAN, Korea, Japan, and Taiwan as lead suppliers of imports to Vietnam.

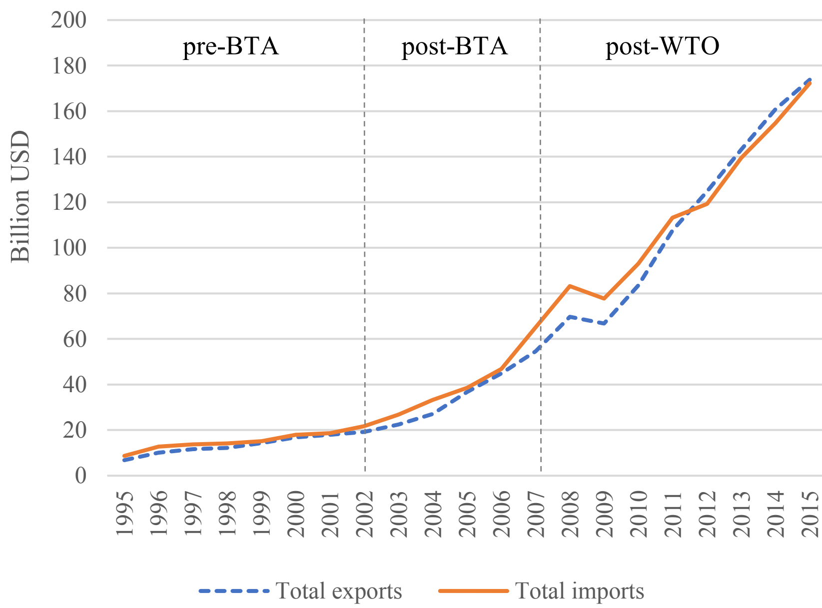
WTO Accession

On January 11, 2007, Vietnam officially became the 150th member of the WTO. The country's accession to the WTO was intended to provide an important boost to the economy, as it ensured that the liberalizing reforms continue. However, the WTO accession also brought serious challenges, requiring the economy to open up to increasing foreign competition.

Indeed, with the acquisition of the WTO membership, further progresses were made toward the liberalization of trade. Under the WTO deal, Vietnam agreed to lower the tariff- and non-tariff barriers and bring the trade policies in conformity with the WTO rules and regulations. The tariffs on industrial products were to be cut by 13% on average, and the tariffs on agricultural products were to be reduced by 21% over the period of 3 to 5 years (Nguyen, 2016). Indeed, most of the tariffs for the agriculture, mining and manufacturing products were dropped significantly in the first two years as can be seen in Figure 3.1. Furthermore, quantitative restrictions and state-trading rights were to be abolished for all products with the exception of *petroleum* and *sugar* industries. Export subsidies of all kinds were no longer allowed, while other subsidies needed to be brought in conformity with WTO rules and regulations.

Despite the progressive trade reforms, Nguyen (2016) argues that Vietnam's trade regimes have remained rather restrictive. While intermediate inputs and capital goods are largely subject to zero or low tariff rates, high tariff and non-tariff barriers were employed to protect many consumer goods and certain production inputs that are being domestically produced such as cement, fertilizers, or steal. The protection through tariffs is also provided to some so-called infant industries, such as *automobile* or *petroleum* products. The automobile sector continues to enjoy the high level of protection after the accession to the WTO as the tariff reduction for this sector is scheduled until 2019. Given this structure of protection, Nguyen (2016) concludes that the effective protection provided to domestic products, and consumer goods in particular, is much higher than that offered by the nominal tariff rates. Refer to Figure 3.1 for the average Vietnamese

Figure 3.4 *Vietnamese Exports and Imports*



Source: Exports and imports of goods and services (current USD) data from WDI.

tariff rates of agriculture, mining, and manufacturing industries and Figure 3.2 for tariff rates by industries in 2002, 2008 and 2015.

As a result of this dramatic fall in nominal tariff rates, the trade flourished as in Figure 3.4. Figure 3.4 shows the total trade of goods and services from 1995 to 2015. We can see both the export and import lines are steeper in the post-BTA period compared to the pre-BTA period. Furthermore, the lines are the steepest after the WTO accession in 2007. The exports of goods and services rose 3 times reaching 174 billion dollars in 2015 compared to the 2007 level and rose 9 times compared to the level in 2002. We see, in Figure 3.4, a slight decline in both exports and imports from 2008 to 2009 due to the Global Financial Crisis.

Furthermore, upon the accession to the WTO, export quotas for garment and textile were removed and this led to further boost in exports. Before 2007, export quotas on the garment and textiles were imposed by the importing countries, EU, the U.S., and Norway. These quotas were initially removed for the WTO members in 2005, as mandated by the Agreement on Textile and Clothing (ATC). Thus, after the accession to the WTO in 2007, Vietnam's exports were no longer subject to these quotas.

Textile and Clothing Industry

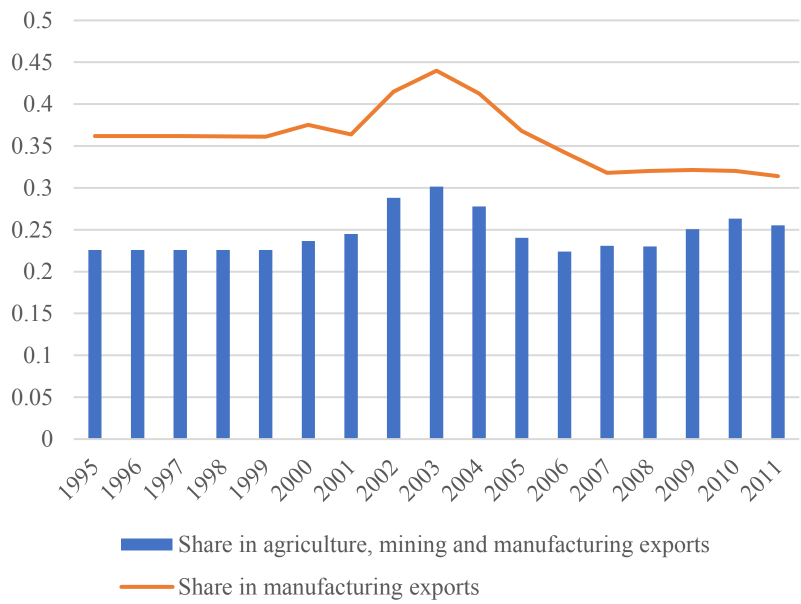
Related Agreements. From 1974 until the end of the Uruguay Round in 1994, the trade of the industry was governed by the Multifibre Arrangement (MFA). This was a framework for bilateral agreements or unilateral actions that established quotas limiting imports into countries whose domestic industries were facing serious damage from rapidly increasing imports.

The quotas were the most visible feature. They conflicted with GATT's general preference for customs tariffs instead of measures that restrict quantities. They were also exceptions to the GATT principle of treating all trading partners equally because they specified how much the importing country was going to accept from individual exporting countries.

Since 1995, the WTO's Agreement on Textiles and Clothing took over from the Multifibre Arrangement. By 1 January 2005, the sector was fully integrated into normal GATT rules. In particular, the quotas came to an end, and importing countries are no longer be able to discriminate between exporters. The Agreement on Textiles and Clothing no longer exists because it had self-destruction built in.

Vietnam's Textile Industry. For the first 18 months under the BTA, Vietnam's exports of clothing to the U.S. faced MFN tariff rates and no export quotas in the U.S. market. During that time, most of Vietnam's competitors were constrained by export quotas applied through the WTO's Agreement on Textiles and Clothing. According to Vietnam's Ministry of Planning and

Figure 3.5 *Export Share of Textile*



Note: Vertical bars show the share of textile exports in total exports of agriculture, mining and 16 manufacturing industries. Line shows the ratio of textile imports to total manufacturing exports.
Source: OECD IO-2015

Investment's CIEM, FIA and STAR (2007), during this period clothing exports to the U.S. expanded dramatically, rising almost 1800 percent in 2002 and 650 percent the first six months of 2003 compared to the same period the previous year.

The surge in clothing exports came to a halt in mid-2003 with the signing of the U.S.-Vietnam Textile Agreement, which effectively limited the growth of Vietnam's textile and clothing exports to the U.S. to 7–8 percent thereafter.

With Vietnam's accession to the WTO in January 2007 and the passage of Permanent Normal Trade Relations in December 2006, the U.S. eliminated quotas on Vietnam's textile and clothing exports in January 2007.

Figure 3.5 shows the export share of textile industry in total exports of 18 industries, which are agriculture, mining and 16 manufacturing industries mentioned in Table 3.1, as well as the export share in 16 manufacturing industries. We see that under the BTA, there is a dramatic rise in the export share reaching almost one-third of the total 18 industries exports. Compared to the average share of 24.5 percent during the period from 1995 to 2011, it is a significant increase. We can see that the exports shares are increasing again after the Vietnam's accession to the WTO.

3.3 Gains from Trade Theory

This section offers a brief overview of the theoretical relationship between trade and welfare by Arkolakis, Costinot and Rodríguez-Clare (2012). The beauty of the Arkolakis model is that its results simply state that whatever the welfare contribution of particular margins—for example, new goods or new varieties—may be, the total size of the gains from trade can always be computed using two aggregate statistics, the domestic expenditure share and the trade elasticity.

In order to illustrate the logic, we focus on the simplest trade model possible: the Armington (1969) model (the Armington model, henceforth). On the supply side, the Armington model is similar in structure to an endowment model. There are $i = 1, \dots, n$ countries, each producing a differentiated good from labor. The supply of labor is inelastic and given by L_i. On the demand side, there is a representative agent in each country maximizing the following Dixit-Stiglitz utility function,

$$U_i = \left(\sum_{i=1}^{n} q_{ij}^{\frac{(\sigma-1)}{\sigma}} \right)^{\frac{\sigma}{(\sigma-1)}}, \sigma > 1 \qquad (1)$$

where q_{ij} is the quantity of country *j*'s good consumed by country i and σ is the elasticity of substitution between goods. The associated price index in country *j* is given by

$$P_j = \left[\sum_{i=1}^{n} \left(w_i \tau_{ij} \right)^{1-\sigma} \right]^{\frac{1}{(1-\sigma)}}, w_i > 0, \tau_{ij} \geq 1 \qquad (2)$$

where w_i is the wage in country i and τ_{ij} are the variable iceberg trade costs between country i and country j. Accordingly, the value X_{ij} of country j 's total imports from country i is equal to

$$X_{ij} = \left(\frac{w_i \tau_{ij}}{P_j}\right)^{1-\sigma} Y_j \,, 1 - \sigma < 0 \tag{3}$$

where $Y_j \equiv \sum_{i=1}^{n} X_{ij}$ is total expenditure in country j and $1 - \sigma$ is the partial elasticity of relative imports with respect to variable trade costs, $\left[\partial \ln\left(X_{ij}/X_{jj}\right)\right]/\partial \ln \tau_{ij}$, which was referred to as the *trade elasticity* in the introduction. Finally, trade balance implies $Y_j = w_j L_j$.

Now consider a foreign shock in country j that affects labor endowments, $\mathbf{L} \equiv \{L_i\}$, and trade costs, $\boldsymbol{\tau} \equiv \{\tau_{ij}\}$, around the world, but leaves country j 's labor endowment L_j, as well as its ability to serve its own market τ_{jj} unchanged. Let's then consider the change in real income, $W_j \equiv Y_j/P_j$, caused by such a shock. In the context of the Armington model, it is straightforward. Using labor in country j as the numeraire, and noting that trade balance implies $d \ln Y_j = d \ln w_j$, we have $d \ln Y_j = 0$. By equations (2) and (3), changes in real income are therefore given by

$$d \ln W_j = -\sum_{i=1}^{n} \lambda_{ij}\left(d \ln w_i + d \ln \tau_{ij}\right) \tag{4}$$

where $\lambda_{ij} \equiv X_{ij}/Y_j$ is the share of country j's total expenditure that is devoted to goods from country i. By equation (3), changes in relative imports are such that

$$d \ln \lambda_{ij} - d \ln \lambda_{jj} = (1 - \sigma)\left(d \ln w_i + d \ln \tau_{ij}\right). \tag{5}$$

Combining equations (4) and (5), we obtain

$$d \ln W_j = \frac{\sum_{i=1}^{n} \lambda_{ij}\left(d \ln \lambda_{jj} - d \ln \lambda_{ij}\right)}{1 - \sigma} = \frac{d \ln \lambda_{jj}}{1 - \sigma} \tag{6}$$

where the second equality derives from the fact that $\sum_{i=1}^{n} \lambda_{ij} = 1$. Integrating the previous expression between the initial equilibrium (before the shock) and the new equilibrium (after the shock), we finally get

$$\widehat{W}_j = \hat{\lambda}_{jj}^{\frac{1}{1-\sigma}} \tag{7}$$

where $\hat{v} \equiv v'/v$ denotes the change in any variable v between the initial and the new equilibrium. Equation (7) will be adopted as the core of our analysis. It shows that welfare changes in country *j*—whatever the origin of the foreign shock may be—can be inferred from changes in the share of domestic expenditure λ_{jj}, using the trade elasticity, here $1 - \sigma$.

The basic idea behind equation (7) is clear as suggested by Arkolakis et al. (2012). On the one hand, welfare changes in country j only depend on terms-of-trade changes (equation 4). On the other hand, terms-of-trade changes can be inferred from changes in the relative demand for goods from different countries (equation 5).

We impose the macro-level restrictions as in Arkolakis et al. (2012): (i) trade in goods is balanced, (ii) the aggregate profit to revenue ratio is constant, and (iii) changes in bilateral trade costs yield a symmetric effect on relative import demand from different export countries.

Ex Ante Welfare Evaluation

We now briefly review Arkolakis et al.'s welfare evaluation with a very particular type of shock: *moving to autarky*. Formally, we assume that variable trade costs in the new equilibrium are such that $\tau_{ij} = +\infty$ for any pair of countries $i \neq j$. All other technological parameters and endowments are the same as in the initial equilibrium. For this particular counterfactual exercise, predicted change in the share of domestic expenditure under autarky is as follows:

$$\hat{\lambda}_{jj} = \frac{1}{\lambda_{jj}} \quad \text{since} \quad \lambda'_{jj} = 1.$$

Combining this observation with equation (1), under the three macro-level restrictions, *the change in real income associated with moving to autarky in country j can be computed as*

$$\widehat{W}_j^{\,A} = \lambda_{jj}^{-\frac{1}{1-\sigma}}. \tag{8}$$

Unlike equation (7), equation (8) is an ex ante result in the sense that it does not require any information on trade flows in the new equilibrium. Arkolakis et al. (2012) showed that conditional on initial values of λ_{jj} and $1-\sigma$, the gains from trade predicted by models[30] satisfying the three macro-level restrictions must be the same. Within that class of models, new margins of adjustment may affect the structural interpretation of the trade elasticity, and in turn, the composition of the gains from trade. Nevertheless, new margins cannot change the total size of the gains from trade. The absolute value of the percentage change in real income associated with moving from the initial equilibrium to autarky is given by the following, as stated in the introduction,

$$\widehat{W} = 1 - \lambda^{-\frac{1}{1-\sigma}}. \tag{8}$$

3.4 Empirical Strategy

Since we are conducting an industrial analysis, we must estimate equation (8) for each industry. Furthermore, we allow the trade elasticities to change across industries. Therefore, henceforth the subscript i represents the 18 industries of our concern, i.e. $i = 1, \ldots, 18$,

$$\widehat{W_\iota} = 1 - \lambda_i^{-\frac{1}{1-\sigma_i}}. \tag{9}$$

[30] Arkolakis et al. (2012) show the formula can be applied to several widely used trade models such as Armington, Krugman (1980), Eaton and Kortum (2002) and Melitz (2003) and extensions.

In order to estimate equation (9), we need the two aggregate statistics, the domestic expenditure share, λ_i and the trade elasticity, $1 - \sigma_i$.

We follow Lai, Riezman and Wang's (2016) empirical strategy to estimate the welfare gain for the manufacturing industries of Vietnam. As a first step, in pursuit of calculating the domestic expenditure share λ_i, we calculate the import penetration ratios for the 18 industries. Next, the trade elasticities, $1 - \sigma_i$, for the respective industries are estimated. Finally, the gains from trade, i.e. the change in real income, in each respective industry are calculated as in equation (9). After the calculation, the two liberalization phenomena with respect to their welfare impacts are compared.

Import Penetration Ratios

Lai et al. (2016) use import penetration ratios π_i, to calculate the domestic expenditure shares, taking advantage of the simple relationship between the variables, $\lambda_i = 1 - \pi_i$. Import penetration ratio in each industry is calculated using the formula,

$$\pi_i = \frac{M_i}{(Y_i + M_i - X_i)} \tag{10}$$

where Y_i is a gross output and M_i, X_i are gross imports and exports of sector i. We can show that $\partial \pi_i / \partial M_i > 0$ and $\partial \pi_i / \partial X_i > 0$. That is, an increase in trade, either imports or exports, increases the import penetration ratio. As a consequence, given equation (9) and the fact that $(1 - \sigma_i) < 0$, we would expect increases in both imports and exports to have positive effects on the welfare gains from trade. Moreover, the extent to which imports and exports affect the gains from trade depends negatively on the absolute value of trade elasticities.

Trade Elasticities

We estimated the elasticities of substitution (σ_i) following the Broda and Weinstein (2006) estimation strategy, which was explained in chapter 2, section 2.4, using two-digit HS products data of Vietnam, since we need the industrial level elasticities. Trade elasticities play a significant role in determining the gains from trade, given equation (9). Intuitively, when an industry is more open with greater imports and exports, the gains from trade are larger. More importantly, if an industry has a lower trade elasticity in absolute terms, domestic demand is less sensitive to changes in trade costs, thus yielding higher welfare gains from trade liberalization. Indeed, the lower the absolute value of the trade elasticities $1 - \sigma_i$, the higher the welfare gain $\widehat{W_i}$, as in equation (9).

Industrial Welfare Gain

Finally, the welfare gain is calculated for each industry using the import penetration ratios and the trade elasticities. Equation (9) implies that the higher the import penetration ratio in a sector is, the greater the welfare gains will be (recall that $(1 - \sigma_i) < 0$).[31] Intuitively, using comparative advantage, increased import concentration suggests greater demand for cheaper imports from abroad. As a result of this trading outcome, prices fall and real income rises, leading to higher welfare gains. Moreover, equation (9) also indicates that, in industries with inelastic import demand, gains from trade liberalization by opening up the economy are greater.

[31] The higher the π_i is, since $\lambda_i = 1 - \pi_i$, the lower the λ_i will be. Given the trade elasticity, equation (9) suggests high gains from trade, when λ_i is low.

We can divide the gains from trade channels into the direct and indirect channels from the prospective of consumers and producers. Consider a uniform reduction in tariffs on all imports. The direct channel is the one in which imports are used for final consumption. In this case, the household spends less on a given amount of imports resulting in welfare gains. The indirect channels are for those industries that use these imports as intermediate goods. For these industries, production costs are lower, thus generating larger profits and higher welfare gains. This can occur for both exporting and import substituting industries. Thus, trade liberalization produces gains directly to consumers and indirectly through their effects on firms that use the imports as intermediate inputs.

Additionally, as argued by Lai et al. (2016), trade liberalization produces mixed effects on changes in levels of competition. Those import-competing firms originally protected by tariffs would face tougher competition from foreign firms. In the short run, this could lead to unfavorable effects both for the intensive (production might decrease) and the extensive (firms might choose to exit the market) margins. In the longer run, however, this could result in more productive incumbents and new entries of more productive firms. We suspect that the negative consequences will diminish in the longer run and more competitive firms can even result in long-run gains.

3.5 Results

Our objective is to compare the gains from trade after the BTA with the U.S. and the WTO accession. We take the benchmark years as 2002 and 2007, respectively for the BTA and WTO accession. First, we calculated the import penetration ratios. Second, we estimated the trade elasticities. Finally, using these measures, we estimated the welfare gains for each industry.

We found that both developments contributed significantly to Vietnam's gains from trade relative to autarky. However, the real income change in respective industries vary significantly when compared to autarky, from the largest in textiles and clothing to the least in other transport equipment. The results show that the tariff reduction effects of the BTA were rather short-lived from 2002 to 2004 at most, while the welfare gain after the accession to the WTO continued consistently during the period from 2007 to 2011. Furthermore, comparing the industrial gains of three most gaining industries, the welfare gained after the WTO accession found to be larger in magnitude. Considering all the findings, we conclude that the welfare gained after the WTO accession is larger than the gains earned after the BTA with the U.S.

3.5.1 Import Penetration Ratios

Following the equation (10), we used the OECD input-output tables to calculate the import penetration ratio in each industry. Table 3.3 reports these ratios for the selected years. Most of the industries see the import penetration ratios rise throughout the period which implies that those industries were becoming more exposed to foreign trade. However, it could indicate that either more domestic demand was satisfied with the imports or there was an increase in exports, or both. Focusing on the benchmark years 2002 and 2007, for manufacturing industries, the import penetration ratios range from 0.07 to 1.06. While industries such as textile, petroleum, machinery, basic metals and office feature relatively high import penetration ratios (greater than 0.60), those including food and tobacco, paper, minerals, metal products and others have low ratios (below 0.27). From 1995 to 2011, import penetration ratios rose sharply by at least 100% in the textile and office industries. Over the same period, import penetration ratios in furniture and other transport fell significantly (at least 50%).

Table 3.3 *Import Penetration Ratios*

	Industry name	*Industry Code*	*1995*	*1998*	*2002*	*2007*	*2011*
Agriculture		1	0.01	0.01	0.03	0.09	0.06
Mining		2	0.08	0.06	0.10	0.06	0.21
Manufacturing	Food and tobacco	3	0.19	0.17	0.11	0.13	0.17
	Textile	4	0.37	0.48	0.86	0.68	1.51
	Wood	5	0.15	0.31	0.25	0.31	0.37
	Paper	6	0.20	0.21	0.26	0.27	0.27
	Petroleum	7	1.03	1.09	1.02	1.06	0.72
	Chemicals	8	0.53	0.56	0.59	0.54	0.66
	Rubber	9	0.29	0.32	0.26	0.28	0.33
	Minerals	10	0.13	0.09	0.07	0.08	0.09
	Basic metals	11	0.40	0.46	0.60	0.69	0.76
	Metal products	12	0.43	0.40	0.21	0.27	0.29
	Machinery	13	0.82	0.82	0.86	0.87	1.07
	Office & medical	14	0.39	0.48	0.61	0.71	0.80
	Electrical	15	0.49	0.61	0.39	0.45	0.70
	Motor vehicles	16	0.66	0.55	0.35	0.64	0.42
	Other transport	17	0.49	0.38	0.28	0.23	0.20
	Other (Furniture)	18	0.50	0.59	0.23	0.20	0.19

Note: In our input-output table data from OECD, the sectoral divisions available to the manufacturing industries are limited to 16. Because of this limitation, there is a lack of sectoral divisions in food and tobacco, office and medical.

Let us see the dynamic pattern of trade for each industry. Using the data obtained from OECD database, the export and import schedule of 18 industries are depicted in Figure 3.6. The pattern suggests that despite the short-lived declines in some industries, in the long run both exports and imports increased in all industries. We expect increases in both imports and exports to have positive effects on the welfare gains from trade as noted in the previous section. Furthermore, it is apparent from Figure 3.6 that trade schedules are steeper after 2005, suggesting that perhaps the gains from trade after the WTO accession in 2007 are higher due to the faster growth in sectoral trade.

Figure 3.6 *Exports and Imports by Sectors*

Note: Figures show value of **exports (dotted line)** and **imports (solid line)** by industries from 1995 to 2011. Values are measured in billion USD.
Source: Author's calculation based on the OECD data.

Lai et al. (2016) divides the manufacturing industries into exporting and importing industries depending on their intensities (export or import value divided by the gross income). They then compared the gains for these industries. They argue that most of China's importing industries incurred large gains from trade compared with autarky, whereas most of its exporting industries had modest gains. Following their steps, however without exploiting the intensities, we divided the Vietnamese manufacturing industries depending on their value of imports and exports in Table 3.4. It suggests that the industries in the first column has contributed to the trade gain more with their exports, and the industries in the second column contributed more with their imports.

Table 3.4 *Manufacturing Industries Division*

Industry Code	*More exports*	*Industry Code*	*More imports*
1	Agriculture	6	Paper
2	Mining	7	Petroleum
3	Food and Tobacco	8	Chemicals
4	Textile	9	Rubber
5	Wood	11	Basic metals
10	Minerals	12	Metal products
14	Office since 2012	13	Machinery
18	Other (Furniture)	14	Office and medical
		15	Electrical
		16	Motor vehicles
		17	Other transport

Note: Following the application of Lai et al. (2016), we divide the manufacturing industries into two subgroups. The subgroup industries in the first column export more than they import, thus suggesting that they contribute to the welfare gain more with their exports. Vice versa for the second column subgroup industries.

3.5.2 Elasticities

Lai et al (2016) borrowed the elasticities from Caliendo and Parro (2015), who estimated the Ricardian-type gravity model for the elasticities. Caliendo and Parro (2015) aimed to measure the

Table 3.5 *Trade Elasticities*

	Industry name	Industry Code	Trade elasticity	
			Full sample (1995-2016)	*Subsample (1995-2001)*
Agriculture		1	-3.26	-1.69
Mining		2	-2.68	-3.75
Manufacturing	Food and tobacco	3	-3.42	-2.90
	Textile	4	-2.35	-3.96
	Wood	5	-2.18	-0.68
	Paper	6	-4.34	-3.22
	Petroleum	7	-5.08	-2.11
	Chemicals	8	-1.16	-0.93
	Rubber	9	-2.45	-2.02
	Minerals	10	-3.23	-2.80
	Basic metals	11	-1.36	-1.81
	Metal products	12	-2.51	-2.37
	Machinery	13	-1.27	-2.09
	Office	14	-2.27	-4.70
	Electrical	15	-2.44	-2.50
	Motor vehicles	16	-12.28	-3.55
	Other transport	17	-54.52	-7.51
	Other (Furniture)	18	-16.33	-5.49
	Mean		-6.37	-3.09

Note: Author's calculation based on two-digit HS products data from UN Comtrade database. See text for detailed explanation.

trade welfare of North American Free Trade Agreement (NAFTA). Thus, their data for the estimation was limited, however, to only 1993, the year before NAFTA came into effect.

Considering the incompatibility of using the elasticities estimated for the U.S. economy, we estimated the elasticities for the Vietnamese economy. The trade elasticities are equal to one minus the elasticities of substitution. We estimated the elasticities of substitution following the Broda and Weinstein (2006) estimation strategy[32], which is based on an Armington-type model. We used

[32] The estimation strategy of the Broda and Weinstein (2006) is explained in chapter 2, section 2.4.

two-digit HS products data of Vietnam, since we need the industrial level elasticities. The data for the elasticity estimation covers 22 years, 1995 to 2016. However, to reflect the demand characteristics before the liberalization phenomena, we also estimated the elasticities from the subsample of 1995 to 2001. To eliminate the effects of the change in consumer tastes, we used the same elasticities for the calculation of the gains for the both phenomena.

Table 3.5 reports the elasticities. Elasticities estimated from the subsample are smaller in absolute terms, than the elasticities estimated from the full sample. As noted in the previous section, the lower the absolute value of the trade elasticities $1 - \sigma_i$, the higher the welfare gain $\widehat{W_i}$. Thus, using the elasticities of the subsample saved the analysis from an underestimation problem.

3.5.3 Welfare Gain

Finally, the welfare gain (measured by percentage changes in real income) is calculated for each industry using the import penetration ratios and the subsample trade elasticities. The results are reported in Table 3.6 and Table 3.7.

I calculated the percentage changes in industrial real income for each year from 1995 to 2011. However, due to convenience, Table 3.6 shows the gains from trade in 1995, 2002, 2007 and 2011 compared with the hypothetical state of autarky. The benchmark years for the BTA with the U.S. and WTO accession, respectively are 2002 and 2007. Comparing the benchmark years with autarky, we can see that gains from trade vary greatly across manufacturing industries, from a modest gain of less than 3% in minerals, to a sizeable gain of more than 100% in petroleum.

Table 3.6 *Gains from Trade Relative to the Autarky Level*

		Change in real income (%)			
Industry Code	*Industry*	*1995*	*2002*	*2007*	*2011*
1	Agriculture	0.400	1.547	5.618	3.734
2	Mining	2.150	2.663	1.705	6.083
3	Food and tobacco	7.196	3.829	4.553	6.072
4	Textile	10.848	39.685	25.002	184.499
5	Wood	21.377	34.147	42.606	49.436
6	Paper	6.832	9.039	9.232	9.354
7	Petroleum	119.203	116.981	126.196	45.446
8	Chemicals	55.900	61.961	56.551	68.398
9	Rubber	15.478	13.710	15.056	17.831
10	Minerals	4.992	2.422	2.999	3.447
11	Basic metals	24.506	39.538	47.792	54.507
12	Metal products	21.158	9.351	12.192	13.358
13	Machinery	55.594	61.570	62.433	128.870
14	Office and medical	10.048	18.232	23.339	29.022
15	Electrical	23.559	18.095	21.275	38.197
16	Motor vehicles	26.254	11.252	25.316	14.327
17	Other transport	8.693	4.327	3.469	2.927
18	Other (Furniture)	11.977	4.732	4.085	3.733

Note: Author's calculation based on OECD input-output data. The benchmark years for the BTA with the U.S. and WTO accession, respectively are 2002 and 2007.

Among manufacturing industries in 2002, petroleum, chemicals and machinery enjoyed the largest gains from trade exceeding 60% real income increase compared with the corresponding autarky levels. In contrast, food and tobacco, minerals, other transport and others had the smallest gains up to 5%. On the other hand, in 2007, the same petroleum, chemicals and machinery industries incurred the largest gains from trade exceeding 55%, while the same food and tobacco, minerals, other transport and others had modest gains which are below 4.6%. This means that, industries that enjoyed the largest (the smallest) gains after the BTA with the U.S., also gained the most (minimum) after the WTO accession. Thus, we can conclude:

RESULT 1: (Gains from Trade Compared to Autarky)— Same industries incurred the largest gains from trade after both liberalization episodes compared with autarky. This is also true for the industries with the smallest gains.

The results are clearly straightforward from equation (9). On the one hand, those industries gaining the most have sizable import penetration ratios, with the petroleum industry facing the highest rate of import penetration. On the other hand, all but the textile industry have relatively inelastic demands. These altogether explain why those industries incurred large gains from trade compared with autarky.

Furthermore, carefully examining Table 3.6, we see that most of the manufacturing industries have higher gains from trade in 2002 and 2007 compared to the initial gains in 1995. For example, textile gained the most with 39.7 % in 2002 and 25.0 % in 2007 compared to the 10.8 % initial gain in 1995. However, five industries, namely food and tobacco, minerals, metal products, other transport and other faced modest gains from trade in 2002 and 2007, losing more than 50 % of their gains compared to 1995. One possible explanation is perhaps these industries are strategically protected from the competition. It is clear in Figure 3.2 that tariff rates were relatively high in all five industries (food and tobacco, minerals, metal products, other transport and other) ranging from 77 % in tobacco to 13 % in metal products in 2008. We thus can state the following:

RESULT 2: (Gains from Trade Compared to Initial Gains in 1995)—Most of Vietnam's manufacturing industries incurred large trade gains in 2002 and 2007 compared to the initial gains in 1995, whereas several relatively "protected" industries (food and tobacco, minerals, metal products, other transport and other) suffered losses.

Next, let us consider how Vietnam's BTA with the U.S. and accession to the WTO, respectively affected Vietnam's gains from trade. Table 3.7 reports the dynamic patterns of sectoral gains. For instance, the "gains in one-year margin" part of the table shows the gains from trade a year after the benchmark years. Columns (1) and (2) report the percentage change in gains after the BTA and the WTO accession, respectively. Thus, the very first number 0.21, in Table 3.7, represents the gains incurred from 2002 to 2003 in the agriculture industry. Column (3), reports the difference between gains earned after the BTA and WTO accession, calculated as column (1) minus column (2). Hence, for example in agriculture, welfare gained a year after the BTA, from 2002 to 2003, is 3.43% higher than the gains earned a year after the WTO accession, from 2007 to 2008. The rest of Table 3.7 is structured in a same fashion, showing the two-, three- and four-year margins of dynamic gains from trade.

To see the dynamic gains incurred after the BTA, let us examine columns (1), (4), (7) and (10) in Table 3.7. We see, for example, that the office industry gained 0.83% from 2002 to 2003 and 3.05% from 2002 to 2006. This tells us that the office industry has gained modest in the early period of liberalization, however these gains continued through the fourth-year margin. Examination of Table 3.7 shows that this pattern is relatively rare. Most industries achieved most of their gains from trade in the early (2002–2004) period and these gains slowed down or were even reversed in some cases. If we look at electrical, for example, we see that in the early period they gained 5.05% and their total gains (2002–2006) were negative, -3.35%. This tells us that in the later period, gains from trade were much smaller and perhaps even negative after the BTA. That is, the expected sizable gains after the BTA in Vietnam seem relatively short-lived.

This is not surprising because tariffs had been reduced sharply at the early years before 2003, as illustrated in Figures 3.1 and 3.3. If we look at the average trade gains after the BTA, it was 0.71% in the first year and 0.58% in the first two years and turned negative from the three-year margin.

However, the medians are 0.18% (in 2002-2003), 0.30% (in 2002-2004) and negative afterwards. This suggests that, most of the industries gained in the first two years after 2002. Over a longer term from 2002 to 2006, the average gains from trade dropped to -0.32%. Thus, we conclude:

RESULT 3: (Dynamic Gains from Trade after the BTA)—Most of Vietnam's gains from trade following the BTA were incurred at the early stage from 2002 to 2004 when mutual tariffs were reduced significantly.

Let us next consider the dynamic gains of the WTO accession case. Columns (2), (5), (8) and (11) in Table 3.7 report the cumulative gains from trade after the liberalization. Unlike the BTA case, gains from trade in most manufacturing industries faced consistent growth. Machinery, for example, is the second most gained industry after textile, and enjoyed 48.01% gain right after the liberalization from 2007 to 2008 and 66.44% in total (2007-2011).

Furthermore, we examine the average gains in post-WTO regime. It is evident from the Table 3.7 that for the first two years, the average gains were relatively low compared to the latter margins. The average gains were 3.17% from 2007 to 2008 and 1.29% from 2007 to 2009, meaning the average gains dropped sharply from 2008 to 2009 by 1.88%. The median measures also show the same result. Clearly, we see that the impact of the Global Financial Crisis was unescapable.

Table 3.7 *Dynamic Gains (Percentage Change)*

Industry name	***Gains in one-year margin***			***Gains in 2-year margin***			***Gains in 3-year margin***			***Gains in 4-year margin***		
	BTA	*WTO*	*BTA-WTO*	*BTA*	*WTO*	*BTA-WTO*	*BTA*	*WTO*	*BTA-WTO*	*BTA*	*WTO*	*BTA-WTO*
	Δ(02 to 03)	*Δ(07 to 08)*		*Δ(02 to 04)*	*Δ(07 to 09)*		*Δ(02 to 05)*	*Δ(07 to 10)*		*Δ(02 to 06)*	*Δ(07 to 11)*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
Agriculture	0.21	-3.22	3.43	0.39	-1.31	1.70	0.50	-2.14	2.64	0.86	-1.88	2.74
Mining	-0.96	8.50	-9.46	1.34	1.91	-0.57	23.99	-0.19	24.18	18.88	4.38	14.50
Food and tobacco	0.15	0.72	-0.57	0.22	0.24	-0.02	-0.38	1.37	-1.75	-0.21	1.52	-1.73
Textile	2.82	7.17	-4.35	2.02	30.67	-28.65	-18.72	145.48	-164.20	-23.49	159.50	-182.98
Wood	-0.42	-1.74	1.32	3.21	-0.27	3.49	-0.01	4.22	-4.24	6.48	6.83	-0.35
Paper	0.35	-0.19	0.54	0.17	1.44	-1.26	-1.00	0.99	-1.98	-0.56	0.12	-0.68
Petroleum	1.99	-2.67	4.65	1.89	-55.05	56.94	3.07	-87.59	90.66	5.99	-80.75	86.75
Chemicals	0.62	1.94	-1.32	-1.04	-11.10	10.06	-7.21	9.33	-16.54	-8.21	11.85	-20.06
Rubber	-0.36	-0.20	-0.16	-0.77	-3.18	2.41	-1.64	2.03	-3.67	-1.26	2.77	-4.04
Minerals	0.12	0.13	0.00	0.43	-0.03	0.46	0.41	0.50	-0.09	0.09	0.45	-0.36
Basic metals	-0.07	11.01	-11.08	3.53	2.19	1.34	2.51	4.34	-1.83	6.90	6.72	0.19
Metal products	1.40	-2.39	3.80	-0.60	-1.50	0.89	-1.73	-0.27	-1.46	-1.23	1.17	-2.39
Machinery	-1.73	48.01	-49.74	-5.93	59.71	-65.64	-9.08	64.48	-73.56	-1.46	66.44	-67.89
Office	0.83	-1.76	2.60	3.38	2.99	0.39	-1.95	-4.33	2.38	3.05	5.68	-2.63
Electrical	7.62	4.51	3.11	5.05	9.40	-4.35	-2.85	17.46	-20.31	-3.35	16.92	-20.27
Motor vehicles	-0.41	-11.49	11.08	-1.19	-11.26	10.07	-2.55	-10.35	7.80	-2.84	-10.99	8.15
Other transport	1.58	0.02	1.56	0.05	-1.15	1.20	-2.59	-0.26	-2.33	-3.01	-0.54	-2.47
Other (Furniture)	-0.99	-1.31	0.32	-1.73	-0.41	-1.32	-2.25	0.47	-2.72	-2.42	-0.35	-2.06
Average	0.71	3.17	-2.46	0.58	1.29	-0.71	-1.19	8.09	-9.28	-0.32	10.55	-10.87
Median	0.18	-0.09	0.43	0.30	-0.15	0.68	-1.69	0.74	-1.91	-0.89	2.15	-1.90

Note: Dynamic gains are the change in the trade gains from the benchmark year (2002 for the BTA, 2007 for the WTO). For instance, Columns (1) and (4) show the dynamic gains incurred from 2002, the benchmark year of the BTA, to 2003 and 2004, respectively.

After the accession to the WTO, with only three exceptions, including petroleum (due to high price increase), other transport and other (due to their high tariffs), we see that the manufacturing industries gained steadily throughout the period (2007-2011). However, in the early period (2007-2009), the gains from trade were much smaller and perhaps even negative due to the Global Financial Crisis. It is, however, surprising to find that despite the Crisis in 2008, as many as eight out of our 16 manufacturing industries had small, however positive gains from 2007 to 2008 and nine industries from 2007 to 2009. We thus can conclude:

RESULT 4: (Dynamic Gains from Trade following the WTO accession)—Despite the Global Financial Crisis in 2008, many industries had positive gains in the early period from 2007 to 2009, contrary to our expectations. Moreover, the gains rose substantially after 2009 for most industries except three (petroleum, other transport and other). Thus, the WTO accession had consistent and long-lasting impact on the gains from trade in Vietnam.

Let us now turn to the comparison of the two liberalization phenomena, using what we have learned from Results 1, 3 and 4. Once again, the benchmark years of the BTA and WTO accession, respectively are 2002 and 2007. We examine both experiences based on several key indicators.

First, examining columns (3), (6), (9) and (12) of Table 3.7, we compare the average and median dynamic industrial gains. As we can see, the average gains are consistently rising after the accession to the WTO. The percentage changes in real income are higher in the WTO accession case in all margins, indicating that on average, Vietnamese manufacturing industries enjoyed higher welfare gains from trade after the WTO accession compared to the BTA case. However, if we look at the medians, the gains after the BTA are larger in the first two margins. This implies that after the WTO accession, few industries such as textile and machinery gained dramatically and it raised the averages. Thus, actually there are more industries with higher gains after the BTA in the first two margins (exactly 10 and 11 industries, respectively). Intuitively, this is expected because the Global Financial Crisis affected the gains from trade negatively for the WTO case.

Second, we consider comparing the magnitude of the welfare gains after the two liberalization measures. We learned from Result 1 that compared to the hypothetical autarky, the most gained and the least gained industries were the same for the both cases (see Table 3.6). Exploiting this finding, let us compare the magnitude of the gains for the three most gained industries, namely petroleum, chemicals and machinery. By examining Table 3.7, we see that in four-year time, petroleum gained more after the BTA by 86.75%, while chemicals and machinery gained more after the WTO accession by 20.06% and 67.89%, respectively. This suggests that the total change in the real income of three significant industries, is higher in the WTO accession case.

Third, it is expected that the trade liberalization with the WTO member countries, rather than only with the U.S., would bring more gains. However, we can argue that the order of the two developments, the BTA and then the WTO accession, is important. Perhaps Vietnam gained more than we measured here, after the BTA. Perhaps the BTA was a "big push" for the Vietnamese economy to join the WTO by, for example, revisiting the relative laws and regulations, redirecting the institutions and most importantly, setting freer mind for a change etc. Thus, we argue that the signing of the BTA was a vital development that advanced the Vietnamese economy for the WTO accession. Therefore, we can conclude:

RESULT 5: (Comparison of the Dynamic Gains from Trade)—Both the BTA and the WTO accession phenomena affected Vietnam positively, bringing significant welfare gains. (1) The gains from trade after the accession to the WTO were consistently growing throughout the period (2007-2011) for the most industries, while the gains after the BTA were rather *short-lived (2002-2004). (2) The magnitude of the welfare gain was higher after the WTO accession when three most gained industries (petroleum, chemicals and machinery) compared. (3) In addition to the welfare gains we measured here, Vietnam benefited much more from the BTA, in a way that we cannot even measure, such as preparing the economy for the WTO accession.*

Lastly, let us examine the textile industry. We saw from Figure 3.5 that textile plays an important role in Vietnamese exports, counting a big share of 24.5% in total exports of the agriculture, mining and 16 manufacturing industries. Indeed, as shown in Table 3.6, textile is the most gained industry with 184.5% gain in 2011 relative to the autarky level.

Table 3.8 reports the percentage change in textile industry's real income. Third column of the table shows that textile's annual gain saw a consistent rise throughout the period. However, during three consecutive years from 2004 to 2006, the industry faced losses. This is perhaps the pleasant opportunity for the Vietnamese textile exporters with the BTA was interrupted shortly with an import quota by the U.S. with the U.S.-Vietnam Textile Agreement. The U.S. was the biggest and the cheapest market for the Vietnamese textile exporters, because until 2005, most of the countries were imposing quotas applied through the WTO's Agreement on Textiles and Clothing.

Fortunately for Vietnamese textile exporters, in January 2007, Vietnam became the WTO member and eliminated the quota walls once and for all. After that, we can see that the welfare gain increased dramatically reaching 114.8% in 2010. We now can sum this as:

RESULT 6: (Dynamic Gains from Trade in Textile)—Textile is one of a few most-gaining industries in Vietnam. The trade restrictions from the international markets continued until 2007 with only a short positive break from 2002 to mid-2003 by the BTA. After the Vietnam's *accession to the WTO in 2007, the gains from trade in the textile industry flourished.*

Table 3.8 *Gains from Trade in Textile (Percentage Change)*

Year	*Gains Relative to Autarky (Cumulative gain)*	*Annual gain*	*Gains of Margins*
1995	10.85		
1996	15.07	4.22	
1997	15.59	0.52	
1998	15.34	-0.25	
1999	17.65	2.31	
2000	24.16	6.51	
2001	25.73	1.57	
2002 - BTA	39.69	13.96	
2003	42.51	2.82	2.82
2004	41.71	-0.80	2.02
2005	20.97	-20.74	-18.72
2006	16.20	-4.77	-23.49
2007 - WTO	25.00	8.80	
2008	32.17	7.17	7.17
2009	55.67	23.50	30.67
2010	170.48	114.81	145.48
2011	184.50	14.02	159.50

Note: Textile consists of textiles, textile products, leather and footwear. Gains relative to autarky are calculated using equation (9). Annual gains are derived from the cumulative gains. Gains of margins are same with Table 3.7.
Source: Author's calculation based on the OECD input-output data.

3.6. Concluding remarks

In this chapter, we examined the welfare gains from two considerable trade liberalization developments in Vietnam. They are the BTA with the U.S. which went into force in 2002 and the Vietnamese accession to the WTO in 2007. We estimated trade elasticities exclusive to

Vietnamese agriculture, mining and 16 manufacturing sectors, and using the elasticities we quantified the gains from trade from 1995 to 2011.

We found that both developments contributed significantly to Vietnam's gains from trade relative to autarky. However, the real income change in respective industries vary significantly when compared to autarky, from the largest in textiles and clothing to the least in other transport equipment. The results show that the tariff reduction effects of the BTA were worn off rather fast from 2002 to 2004, while the welfare gain after the accession to the WTO continued consistently from 2007 to 2011. Furthermore, comparing the industrial gains of three most gaining industries, the welfare gained after the WTO accession found to be larger in magnitude. Considering all the findings, we conclude that the welfare gained after the WTO accession is larger than the gains earned after the BTA with the U.S. In addition, we found that textile industry contributed substantially to the overall gains from trade.

Consequently, regarding the "concentration-diversification trade-off" argument that was stated in the Introduction, our results perhaps are in favor of the diversification, meaning perhaps that having many trade partners is better off than having a partner with large markets, in the context of the gains from trade. However, we admit that this finding might not be generalized.

We believe that our findings provide supporting evidence favoring the trade liberalization for developing countries, particularly for the economies that are still in transition. It may also provide informative implications to Vietnam's policymakers. In addition, we estimated sectoral trade elasticities using Vietnamese trade data, which may be useful for other studies.

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Appendix

A. Data

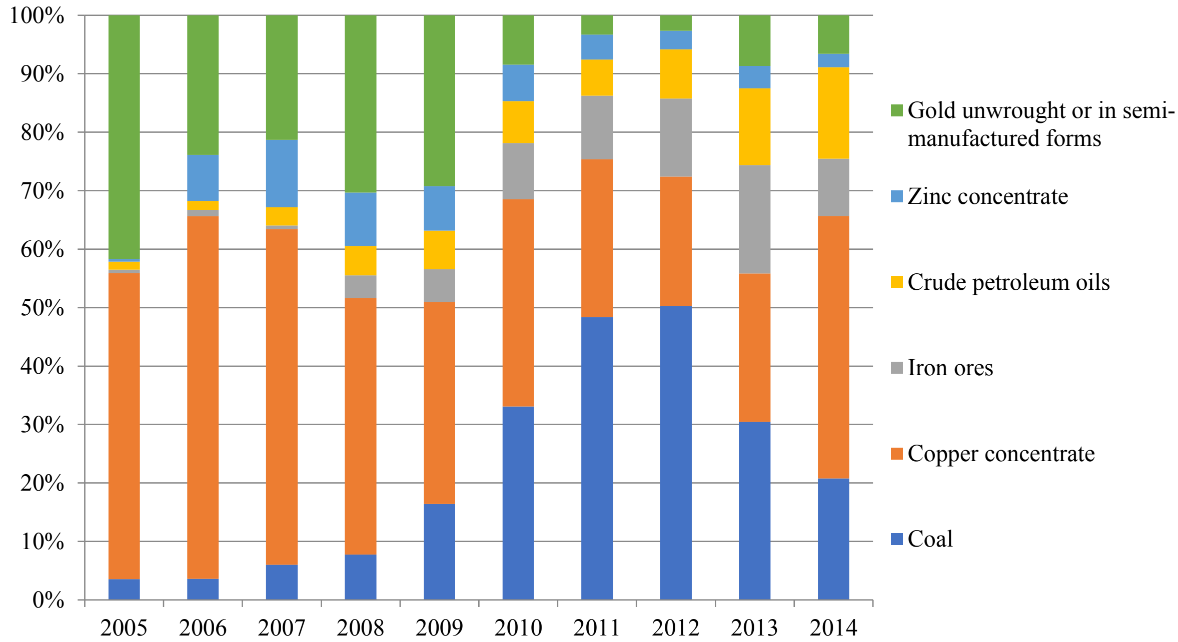
Variables	Measurements	Source
Manufacturing output	Log of real manufacturing output (million tugrugs[33])	National Statistical Office of Mongolia (NSO)
Mineral production	Log of physical mineral production (thousand tons)	NSO
Money supply	Log of M2 money supply (billion tugrugs)	NSO
Real copper price	Log of real copper price (US dollar per tonne)	London Metal Exchange
REER	Log of REER	Bank of Mongolia

Manufacturing output and real copper price are deflated by national consumer price index with base year 2005. Minerals considered are coal, crude oil, copper concentrate with 35%, molybdenum concentrate with 47%, gold, flour spar, flour spar concentrate, iron ore, zinc concentrate, copper 99%, metal steel and metal foundries.

B. Detailed Calculations on the Composite Price Index

To calculate the composite price index, P_t^{com}, I chose three minerals which accounted for the most of the mineral export revenue on average for the last 10 years. By looking at the following figure and calculating the compositions of minerals on average year, the major minerals are – copper for 40.5 percent, coal for 22.0 percent and gold for 17.6 percent which are altogether 80.1%.

[33] Mongolian national currency



Each mineral price is multiplied by its corresponding weight and all are added up. For example, the composite price index in 2010M01 is calculated as:

$$P_{2010m1}^{com} = 0.51 \times P_{2010m1}^{cu} + 0.27 \times P_{2010m1}^{coal} + 0.22 \times P_{2010m1}^{au}$$

where P^{cu}, P^{coal} and P^{au} are prices of copper, coal and gold, respectively.