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# Impacts of Exogenous Shocks Using GTAP

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## **Impacts of Exogenous Shocks in Selected Region using GTAP**

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GTAP is a well - documented software using mainly for generating economic impacts from exogenous shock. GTAP database is well organized with double account balance containing mainly bilateral and multilateral trade data among various countries around the world. GTAP Data Base also provides a consistent snapshot of the global economy. Moreover, it is possible to extract Social Account Matrices (SAM) and Input - Output Table from GTAP. To the extent, it is able to use data in applying to many kinds of analysis, for example, poverty reduction from policy or environmental impacts.

For data source in GTAP, it is collected from two main sources. First, regional input - output table, typically from nationally published input - output tables. Second, data is from international organizations including merchandise trade data from UN, services trade data from UN Trade website and EUROSTAT, macroeconomic data from World Bank Development Indicators, tariff data from MAcMap, income and factor taxes data from IMF, and energy data from the International Energy Agency.

This paper presents the result in economy in selected countries including JKC (Japan, South Korea, and China), ASEAN7 (Malaysia, Laos, Vietnam, Cambodia, Singapore, Philippines, Indonesia), Thailand, NAFTA countries (Mexico, Canada, and the U.S.), European Union 25, and Rest of the world (ROW) from three exogenous shocks. In using GTAP, it is required to aggregate sectors and factors. In this study, I aggregate the data of various commodities to 6 sectors including food, extraction (mining and extraction), light manufacturing, heavy manufacturing, construction and communication, and other services. For factor, I aggregate the data of factors to four kinds of factor including land, unskilled labor, skilled labor, and capital.

In this study, I investigate the effects from three shocks. Firstly, the scenario of growth in industrial production in Thailand. For very long time, Thailand try to be more industrialized countries. According to four Year Plan of Industry, there are many policies, for example, sustainable basis of industry sector, Improvement of competitive environment (legitimacy and infrastructure), Industrial Cluster, and productivity. Additionally, Thai Economy is mostly dependent on export sector and there are many export supporting policies through FTA or direct trade. When there are a growth in industrial sector in Thailand, it automatically increase the tendency to export domestically produced outputs to trading partner around the world. According to CIA world factbook, Thailand has 7.2 percent growth in industrial production in 2012. Then, my first shock is 7.2 percent in industrial output. Secondly, world population is growing every year from two potential force including low death rate and high fertility rate due to an improvement in medical science. Now, world population has already passed 7 billion thousand people. According to U.N. projection, by 2050, population in each region will be shown by table below,

<i>Major area and region</i>	<i>1950-2000</i>	<i>2000-2050</i>	<i>2050-2100</i>	<i>2100-2150</i>	<i>2150-2200</i>	<i>2200-2250</i>	<i>2250-2300</i>
Africa.....	2.56	1.64	0.45	-0.16	-0.07	0.05	0.05
Southern Africa .....	2.34	-0.16	-0.06	-0.02	0.09	0.08	0.05
Eastern Africa.....	2.70	1.78	0.55	-0.14	-0.08	0.05	0.05
Middle Africa.....	2.52	2.10	0.57	-0.20	-0.10	0.05	0.06
Western Africa.....	2.64	1.85	0.51	-0.15	-0.09	0.05	0.05
Northern Africa .....	2.36	1.13	0.03	-0.19	-0.01	0.06	0.05
Asia.....	1.93	0.70	-0.08	-0.15	0.01	0.06	0.05
Western Asia .....	2.66	1.47	0.33	-0.15	-0.05	0.04	0.04
India.....	2.09	0.82	-0.10	-0.22	-0.01	0.06	0.04
Other South-central Asia .....	2.40	1.37	0.16	-0.22	-0.05	0.05	0.04
South-eastern Asia.....	2.14	0.78	-0.09	-0.13	0.03	0.06	0.05
China .....	1.66	0.18	-0.33	-0.06	0.09	0.08	0.06
Other Eastern Asia.....	1.14	-0.11	-0.37	0.01	0.08	0.06	0.05
Latin America and the Caribbean.....	2.27	0.78	-0.09	-0.16	0.02	0.07	0.05
Brazil.....	2.32	0.61	-0.19	-0.10	0.06	0.07	0.06
Other South America.....	2.18	0.91	-0.02	-0.20	-0.01	0.07	0.06
Caribbean.....	1.59	0.39	-0.17	-0.19	0.00	0.07	0.06
Central America.....	2.59	0.90	-0.07	-0.18	0.00	0.06	0.05
Oceania.....	1.77	0.78	0.01	-0.06	0.03	0.06	0.06
Polynesia .....	1.86	0.80	0.09	-0.12	0.00	0.06	0.05
Micronesia.....	2.35	1.10	0.13	-0.06	0.03	0.07	0.06
Melanesia.....	2.23	1.38	0.19	-0.21	-0.07	0.05	0.05
Australia/New Zealand.....	1.64	0.54	-0.08	0.03	0.08	0.07	0.06
Northern America.....	1.22	0.70	0.11	0.07	0.07	0.06	0.04
Europe .....	0.57	-0.28	-0.32	0.04	0.08	0.07	0.06
Eastern Europe.....	0.65	-0.63	-0.49	0.05	0.08	0.06	0.05
Southern Europe.....	0.58	-0.30	-0.49	0.00	0.08	0.07	0.06
Western Europe.....	0.53	0.01	-0.16	0.06	0.09	0.08	0.07
Northern Europe.....	0.39	0.12	-0.09	0.05	0.08	0.07	0.06

According to the table above, by 2050, almost all region will face medium or high population growth led by Africa and Oceania. However, South - eastern Asia and Northern America will also contribute to total population. It is too big to ignored. Current population in North America is (Mexico, Canada, and the U.S.) altogether over 500 million people. With positive growth rate, it will affect economy as a whole. In case of big and flourish country, more population may benefit all because labor force will be increased and dependency rate automatically declines. When economy has more factor of production, it is normally expected for firm to be able to produce more output. Output will expand and return to factor may get higher. However, in case of small and poor country, an increase in population may lead to an inadequate supply of food and government services to serve them. Government may have to spend a huge amount of its budget to take care of them. It is undesirable situation which currently occur in third world. So, for big three countries in North America, the impact of population growth may generate a great impact to economy. Then, the second shock is 0.7 percent increased in population in NAFTA countries.

Thirdly, when there are more populations in big and flourish countries like the U.S., Mexico, and Canada, it is expected to produce more output and have more income. Mexico, Canada, and the U.S. largely together contribute to world output and so do consumption. According to IMF, three countries's GDP together is almost \$20,000 Billion (23% of world GDP at PPP). So, it is a big countries in economic size. Even a small change there, it will yields a great result in world economy. For GDP, it is the value of output produced domestically in nation no matter what the nation of creator. I will imply an increase in GDP of big three countries to be a change in national income. For the data of GDP, it will be shown by table below,

	<b>2011</b>	<b>2012</b>	<b>Growth(%)</b>
<b>CAN</b>	1.38	1.44	4.35
<b>MEX</b>	1.66	1.75	5.42
<b>US</b>	15.23	15.88	4.27
<b>Average</b>			4.68

According to table, an average of growth rate in GDP from three big countries is 4.68 and I use this growth rate to be the third shock which an increase in citizen's income can create many effects to economy.

In procedure of interpretation of the result, it is guided by Mary E. Burfisher (2011) and Thomas W. Hertel (1997). I will explain separately by the result from each of shock and in the end, I will compare the welfare from three shocks.

1. For the result from first shock, the effect of industrial production growth in Thailand increases by 7.2% is shown by table below,

<b>Countries</b>	<b>GDP Price Index</b>	<b>GDP Quantity Index</b>	<b>Change in Value of GDP</b>	<b>Private H.H. Demand</b>	<b>TOT</b>
<b>JKC</b>	0.0172	0.0023	0.0194	0.0642	0.0248
<b>Thailand</b>	-1.8008	7.0942	5.2933	33.0877	-1.1173
<b>ASEAN7</b>	0.0457	0.0056	0.0514	0.2572	0.0572
<b>NAFTA</b>	0.0051	0.0003	0.0054	0.0224	0.0089
<b>EU(25)</b>	0.0059	0.0004	0.0062	0.0236	0.0059
<b>ROW</b>	0.0082	0.0010	0.0092	0.0393	0.0135

According to table above, there is a decrease in GDP price index or an indicator of inflation by comparing current GDP to GDP in reference year in Thailand by 1.8 percent which means that when there is output added to economy, price is likely to go down. for GDP quantity index, there is a huge increase in GDP Quantity Index by 7.09 percent which confirm an expansion of industrial growth. For change in value of GDP, it is obvious that Thailand has economy growth by 5.2 US million and so do other countries. For private household demand, 33.09 percent increased in Thailand. It shows that output in industry in Thailand serves domestic demand mainly. For Term of Trade (price exported i over price imported i) is declined in Thailand and increased in other countries. It is implied that Thailand loses competitiveness in export sector from industrial growth.

<b>Countries</b>	<b>Output of Capital Good</b>	<b>Region H.H. Income</b>	<b>Government Consumption Expenditure</b>	<b>Private Consumption</b>
<b>JKC</b>	0.0280	0.0082	0.0083	0.0205
<b>Thailand</b>	5.5630	6.2772	6.5113	4.9678
<b>ASEAN7</b>	0.0891	0.0427	0.0440	0.0548
<b>NAFTA</b>	0.0178	0.0018	0.0018	0.0057
<b>EU(25)</b>	0.0223	0.0024	0.0024	0.0065

According to table above, output of capital goods in Thailand is increased by 5.56 US million. It is implied that most of the output from industrial sector in Thailand is capital product. Also, this shocks contribute to regional household income by 6.27 US million. However, government consumption expenditure and private consumption also increase. It tell us that output produced in industrial sector is consumed mostly in Thailand.

<b>Private Consumption Price</b>	<b>JKC</b>	<b>Thailand</b>	<b>ASEAN7</b>	<b>NAFTA</b>	<b>EU(25)</b>	<b>ROW</b>
<b>Food</b>	-0.0016	-1.8336	-0.0379	-0.0056	-0.0059	-0.0069
<b>Extraction</b>	0.0086	-1.2377	0.0176	0.0019	0.0031	0.0051
<b>L Manuf.</b>	0.0041	-0.9275	-0.0177	0.0006	0.0016	-0.0022
<b>H Manuf.</b>	0.0001	-0.6753	-0.0135	-0.0006	0.0021	0.0006
<b>Construct.</b>	0.0127	-1.2282	0.0244	0.0038	0.0030	0.0056
<b>Other</b>	0.0162	-0.8372	0.0406	0.0048	0.0053	0.0085

For private consumption price, in all region, there is a decline in food sector. For Thailand, there is a decrease in consumption price in all sector. In other region, a small increase in price occurs.

<b>Domestic Sales</b>	<b>JKC</b>	<b>Thailand</b>	<b>ASEAN7</b>	<b>NAFTA</b>	<b>EU(25)</b>	<b>ROW</b>
<b>Food</b>	-0.017	6.395	-0.040	-0.011	-0.015	-0.010
<b>Extraction</b>	-0.010	8.387	-0.054	-0.009	-0.003	-0.008
<b>L Manuf.</b>	-0.013	7.270	-0.074	-0.004	-0.008	-0.018
<b>H Manuf.</b>	-0.022	8.270	-0.051	-0.008	-0.007	-0.014
<b>Construct.</b>	0.009	6.853	0.036	0.003	0.005	0.005
<b>Other</b>	0.004	7.503	0.018	0.001	0.001	0.002

According to table, there is of course an increase in sales in Thailand from production growth. However, in other region, domestic sales is declined. It may be like this scenario because Thailand export cheap commodity to other region (consider TOT).

<b>Commodity</b>	<b>Volume of Global Import</b>	<b>Volume of Global Export</b>	<b>Value of World Supply</b>	<b>Value of World Import</b>	<b>Value of World Export</b>
<b>Food</b>	0.08	0.07	0.02	0.05	6.96
<b>Extraction</b>	0.08	0.08	0.05	0.08	11.07
<b>L Manuf.</b>	0.05	0.05	0.04	0.04	5.63
<b>H Manuf.</b>	0.09	0.09	0.05	0.09	5.44
<b>Construct.</b>	0.08	0.09	0.04	0.07	4.09
<b>Other</b>	0.06	0.06	0.02	0.06	4.83

For volume of global import, export, and world supply, heavy manufacturing is affected mostly. For value of world export, extraction is going up the most by \$11.07 million.

	<b>Volume of Global Import</b>	<b>Volume of Global Export</b>	<b>Value of Import</b>	<b>Value of Export</b>
<b>JKC</b>	0.060	0.009	0.044	0.017
<b>Thailand</b>	5.258	6.829	5.264	5.718
<b>ASEAN7</b>	0.130	0.049	0.087	0.063
<b>NAFTA</b>	0.020	-0.011	0.014	-0.008
<b>EU(25)</b>	0.009	-0.010	0.007	-0.006
<b>ROW</b>	0.029	0.001	0.021	0.006

For impact in each region, Thailand is of course faced an increase in import and also export because the major proportion of Thai economy is from trade sector.

<b>Volume of World Trade</b>	0.078
<b>Value of World Trade</b>	0.071

According to table above, volume of world trade is increased by 0.078 percent and value of world trade is increased by 0.71 percent. It shows that Thailand is a very small country contributed to world output.

<b>Industry Output</b>	<b>JKC</b>	<b>Thailand</b>	<b>ASEAN7</b>	<b>NAFTA</b>	<b>EU(25)</b>	<b>ROW</b>
<b>Land</b>	0.000	7.200	0.000	0.000	0.000	0.000
<b>Unskilled L</b>	0.000	7.200	0.000	0.000	0.000	0.000
<b>Skilled L</b>	0.000	7.200	0.000	0.000	0.000	0.000
<b>Capital</b>	0.000	7.200	0.000	0.000	0.000	0.000
<b>Food</b>	-0.019	6.949	-0.039	-0.023	-0.027	-0.018
<b>Extraction</b>	-0.009	9.715	-0.087	-0.015	-0.007	0.003
<b>L. Manuf.</b>	-0.020	7.070	-0.036	-0.007	-0.015	-0.020
<b>H. Manuf.</b>	-0.009	7.126	0.060	-0.010	-0.015	-0.012
<b>Construct.</b>	0.011	6.670	0.030	0.004	0.007	0.006
<b>Other.</b>	0.005	7.389	0.006	0.002	0.004	0.003
<b>Capital Goods</b>	0.028	5.563	0.089	0.018	0.022	0.023

For industry output, Thailand is only one country which enjoy an expansion in all sector. However, in construction, other service and capital good, all region enjoys output growth.

<b>WELFARE</b>	<b>Allocation</b>	<b>Endowm.</b>	<b>TECH</b>	<b>POP</b>	<b>TOT</b>	<b>IS</b>	<b>Total</b>
<b>JKC</b>	200.91	0.00	0.00	0.00	585.50	-141.40	645.01
<b>Thailand</b>	2205.57	12954.92	0.00	0.00	-1994.89	279.78	13445.36
<b>ASEAN7</b>	57.31	0.00	0.00	0.00	356.71	-21.72	392.30
<b>NAFTA</b>	49.22	0.00	0.00	0.00	173.23	46.62	269.06
<b>EU(25)</b>	62.44	0.00	0.00	0.00	338.21	-49.92	350.72
<b>ROW</b>	126.65	0.00	0.00	0.00	541.26	-113.36	554.55
<b>Total</b>	2702.09	12954.92	0.00	0.00	0.00	0.00	15657.00

For the last result shown for the first shock, total welfare is decomposed by many factors including allocation efficiency, endowment efficiency, technology, population, term of trade, and IS. Then, total contribution from all effect is \$13,445.36 US million in Thailand and followed by JKC and ROW. Total world effect is almost \$16 US billion.

2. For the result of second shock, population growth in North America by 0.7 percent.

<b>Countries</b>	<b>GDP Price Index</b>	<b>GDP Quantity Index</b>	<b>Change in Value of GDP</b>	<b>Private H.H. Demand</b>	<b>TOT</b>
<b>JKC</b>	-0.0001	-0.0001	-0.0003	-0.0029	-0.0005
<b>Thailand</b>	0.0005	0.0000	0.0004	-0.0010	0.0001
<b>ASEAN7</b>	0.0005	0.0000	0.0004	-0.0016	0.0000
<b>NAFTA</b>	-0.0010	0.0003	-0.0007	0.2643	0.0000
<b>EU(25)</b>	0.0001	0.0000	0.0001	-0.0012	-0.0001
<b>ROW</b>	0.0009	-0.0001	0.0008	-0.0004	0.0004

From the effect of population growth in NAFTA region, GDP price index is decreased in that region. However, GDP Quantity Index is increased the most due to more labor force for producing output which lead to 0.004 US Million increased in GDP. Additionally, NAFTA region is only one region which have more private household demand. However, Term of Trade left unchanged in almost all countries.

<b>Countries</b>	<b>Output of Capital Good</b>	<b>Region H.H. Income</b>	<b>Government Consumption Expenditure</b>	<b>Private Consumption</b>
<b>JKC</b>	-0.0009	-0.0003	-0.0003	-0.0003
<b>Thailand</b>	-0.0013	0.0001	0.0001	0.0001
<b>ASEAN7</b>	-0.0009	0.0000	0.0000	0.0000
<b>NAFTA</b>	0.0010	0.0003	-0.0032	0.0014
<b>EU(25)</b>	-0.0005	0.0000	0.0000	0.0000
<b>ROW</b>	-0.0003	0.0001	0.0001	0.0001

According to table above, output of capital goods declines in almost all countries except three countries in NAFTA. JKC is only one countries which regional household income decreased. For government consumption, it decreases in JKC and NAFTA. However, 0.0014 US million increased in NAFTA countries.



<b>Private Consumption Price</b>	<b>JKC</b>	<b>Thailand</b>	<b>ASEAN7</b>	<b>NAFTA</b>	<b>EU(25)</b>	<b>ROW</b>
<b>Food</b>	0.0029	0.0064	0.0059	0.0256	0.0018	0.0038
<b>Extraction</b>	0.0007	0.0010	0.0008	0.0019	0.0004	0.0009
<b>L Manuf.</b>	0.0000	0.0001	0.0001	-0.0008	0.0001	0.0004
<b>H Manuf.</b>	0.0000	0.0002	0.0001	-0.0006	0.0001	0.0004
<b>Construct.</b>	-0.0001	0.0001	0.0001	-0.0012	0.0001	0.0006
<b>Other</b>	-0.0003	-0.0001	-0.0001	-0.0017	0.0001	0.0005

For private consumption price, the most increased in price is food sector and so do in Thailand, ASEAN7, NAFTA, EU, and ROW.

<b>Domestic Sales</b>	<b>JKC</b>	<b>Thailand</b>	<b>ASEAN7</b>	<b>NAFTA</b>	<b>EU(25)</b>	<b>ROW</b>
<b>Food</b>	0.0026	0.0020	0.0011	0.1018	0.0024	0.0017
<b>Extraction</b>	0.0000	-0.0001	-0.0002	0.0415	0.0005	-0.0006
<b>L Manuf.</b>	-0.0005	-0.0005	-0.0007	0.0029	-0.0002	-0.0012
<b>H Manuf.</b>	-0.0002	-0.0004	-0.0007	0.0028	-0.0002	-0.0013
<b>Construct.</b>	-0.0004	-0.0004	-0.0005	-0.0012	-0.0002	-0.0003
<b>Other</b>	-0.0002	0.0001	-0.0001	-0.0054	-0.0001	-0.0001

For domestic sales, food sector enjoy an expansion in all region, especially NAFTA. NAFTA also enjoy an increase sales in extraction, light and heavy manufacturing. However, construction and communication sector are decreased in all regions.

<b>Commodity</b>	<b>Volume of Global Import</b>	<b>Volume of Global Export</b>	<b>Value of World Supply</b>	<b>Value of World Import</b>	<b>Value of World Export</b>
<b>Food</b>	0.01035	0.00964	0.02324	0.01767	0.01767
<b>Extraction</b>	0.00286	0.00294	0.00787	0.00368	0.00381
<b>L Manuf.</b>	0.00004	0.00005	0.00016	0.00002	0.00002
<b>H Manuf.</b>	-0.00002	-0.00002	0.00019	0.00005	0.00005
<b>Construct.</b>	-0.00070	0.00004	-0.00068	-0.00060	0.00014
<b>Other</b>	-0.00048	-0.00048	-0.00250	-0.00068	-0.00068

For effect in trade, food sector is still the most affected sector by both importing and exporting.

	<b>Volume of Global Import</b>	<b>Volume of Global Export</b>	<b>Value of Import</b>	<b>Value of Export</b>
<b>JKC</b>	-0.0010	0.0002	-0.0120	0.0003
<b>Thailand</b>	-0.0005	0.0000	0.0025	0.0004
<b>ASEAN7</b>	-0.0006	-0.0001	0.0008	0.0002
<b>NAFTA</b>	0.0044	0.0037	0.1565	0.0040
<b>EU(25)</b>	-0.0002	0.0002	0.0003	0.0003
<b>ROW</b>	0.0000	-0.0001	-0.0001	0.0007

According to table above, NAFTA is only region which has positive import. Additionally, NAFTA also enjoy an increase in export. However, net export is still negative.

<b>Volume of World Trade</b>	0.00058
<b>Value of World Trade</b>	0.000913

For effect in world, volume and value of world trade increase.

<b>Industry Output</b>	<b>JKC</b>	<b>Thailand</b>	<b>ASEAN7</b>	<b>NAFTA</b>	<b>EU(25)</b>	<b>ROW</b>
<b>Land</b>	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Unskilled L</b>	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Skilled L</b>	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Capital</b>	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Food</b>	0.0033	0.0046	0.0029	0.0806	0.0049	0.0046
<b>Extraction</b>	0.0002	0.0010	0.0005	0.0368	0.0014	0.0007
<b>L. Manuf.</b>	-0.0005	-0.0007	-0.0010	0.0036	-0.0003	-0.0018
<b>H. Manuf.</b>	-0.0001	-0.0007	-0.0008	0.0036	-0.0003	-0.0020
<b>Construct.</b>	-0.0003	-0.0004	-0.0004	-0.0011	-0.0001	-0.0004
<b>Other.</b>	-0.0002	0.0000	-0.0001	-0.0051	-0.0002	-0.0003
<b>Capital Goods</b>	-0.0009	-0.0013	-0.0009	0.0010	-0.0005	-0.0003

From table above, it presents industry output. I found that there is increase in output in food, extraction, light and heavy manufacturing sector and decrease in construction and other services sector. This scenario is also faced by all other region. For capital goods, there is an increase in NAFTA while a decrease in all other regions.

<b>WELFARE</b>	<b>Allocation</b>	<b>Endowm.</b>	<b>TECH</b>	<b>POP</b>	<b>TOT</b>	<b>IS</b>	<b>Total</b>
<b>JKC</b>	-13.29	0.00	0.00	0.00	-11.60	4.46	-20.44
<b>Thailand</b>	-0.06	0.00	0.00	0.00	0.15	0.14	0.23
<b>ASEAN7</b>	-0.28	0.00	0.00	0.00	-0.31	0.58	-0.01
<b>NAFTA</b>	-34828.14	-70061.10	0.00	104940.04	0.52	-9.67	41.65
<b>EU(25)</b>	-5.14	0.00	0.00	0.00	-4.26	2.15	-7.25
<b>ROW</b>	-8.03	0.00	0.00	0.00	15.51	2.34	9.82
<b>Total</b>	-34854.93	-70061.10	0.00	104940.04	0.00	0.00	24.00

For contribution of all factors, NAFTA enjoy an increase in welfare by 41.65 US million mostly by population growth and followed by ROW. However, JKC has a decrease in welfare from Term of Trade and Allocation inefficiency.

3. For the result in third shock, household income increased by 4. 4.68 percent.

<b>Countries</b>	<b>GDP Price Index</b>	<b>GDP Quantity Index</b>	<b>Change in Value of GDP</b>	<b>Private H.H. Demand</b>	<b>TOT</b>
<b>JKC</b>	-1.800	-0.063	-1.863	-1.753	-0.662
<b>Thailand</b>	-1.288	-0.046	-1.334	-0.941	-0.115
<b>ASEAN7</b>	-1.265	-0.014	-1.279	-0.824	-0.188
<b>NAFTA</b>	4.090	0.154	4.244	33.897	3.384
<b>EU(25)</b>	-2.045	-0.003	-2.048	-1.589	-0.499
<b>ROW</b>	-1.563	-0.062	-1.624	-1.368	-0.424

According to table above, NAFTA is only one region enjoying an increase in GDP quantity index, positive change in the value of GDP, private household demand, and improvement of Terms of Trade. However, positive GDP price index means inflation. Then, we can expect a higher level of commodity in Mexico, Canada, and the U.S.

<b>Countries</b>	<b>Output of Capital Good</b>	<b>Region H.H. Income</b>	<b>Government Consumption Expenditure</b>	<b>Private Consumption</b>
<b>JKC</b>	-5.273	-1.898	-0.388	-1.889
<b>Thailand</b>	-6.527	-1.348	-0.287	-1.339
<b>ASEAN7</b>	-5.409	-1.293	-0.289	-1.286
<b>NAFTA</b>	-3.923	9.046	5.485	9.034
<b>EU(25)</b>	-7.009	-2.076	-0.259	-2.073
<b>ROW</b>	-5.284	-1.649	-0.315	-1.640

According to table, NAFTA is also only one region which enjoy output of capital goods, regional household income. Additionally, there is an increase in government consumption and private consumption.

<b>Private Consumption Price</b>	<b>JKC</b>	<b>Thailand</b>	<b>ASEAN7</b>	<b>NAFTA</b>	<b>EU(25)</b>	<b>ROW</b>
<b>Food</b>	-1.21	-0.74	-0.86	2.37	-1.61	-1.17
<b>Extraction</b>	-1.56	-1.25	-1.22	3.08	-1.82	-1.44
<b>L Manuf.</b>	-1.42	-1.24	-1.13	1.99	-1.69	-1.33
<b>H Manuf.</b>	-1.44	-1.24	-1.12	2.05	-1.64	-1.29
<b>Construct.</b>	-1.68	-1.29	-1.20	3.57	-1.88	-1.49
<b>Other</b>	-1.75	-1.02	-1.20	3.97	-1.95	-1.53

According to table above, all region has a decrease in consumption price in all sectors except NAFTA.

<b>Domestic Sales</b>	<b>JKC</b>	<b>Thailand</b>	<b>ASEAN7</b>	<b>NAFTA</b>	<b>EU(25)</b>	<b>ROW</b>
<b>Food</b>	0.54	0.20	0.06	-1.13	0.68	0.31
<b>Extraction</b>	0.47	0.10	0.15	-3.11	0.52	0.30
<b>L Manuf.</b>	0.64	-1.35	0.01	-3.84	0.21	-0.38
<b>H Manuf.</b>	0.62	0.37	0.38	-6.15	0.17	-0.13
<b>Construct.</b>	-1.62	-1.45	-1.41	0.04	-1.91	-1.42
<b>Other</b>	-0.22	0.01	-0.09	3.47	-0.29	-0.14

For domestic sales, domestic producer in most region enjoy increased sales. However, in NAFTA, only construction, communication, and other services have an expansion in domestic sales. It may be because when people has more income, they enjoy more imported goods.

<b>Commodity</b>	<b>Volume of Global Import</b>	<b>Volume of Global Export</b>	<b>Value of World Supply</b>	<b>Value of World Import</b>	<b>Value of World Export</b>
<b>Food</b>	-0.56	-0.54	-0.58	-1.16	-1.07
<b>Extraction</b>	0.13	0.20	-0.88	-1.01	-0.92
<b>L Manuf.</b>	0.57	0.54	-1.01	-0.38	-0.38
<b>H Manuf.</b>	-0.32	-0.32	-1.58	-1.32	-1.30
<b>Construct.</b>	-0.16	-0.17	-1.38	-1.31	-1.38
<b>Other</b>	-0.39	-0.39	1.27	-1.08	-1.08

For trading sector, increase in personal income in NAFTA causes an increase in volume of global export in extraction, light and heavy manufacturing sector but decrease in food, construction, and other services. But for value of import and export, all sector declines.

	<b>Volume of Global Import</b>	<b>Volume of Global Export</b>	<b>Value of Import</b>	<b>Value of Export</b>
<b>JKC</b>	-1.28	4.99	-2.21	3.40
<b>Thailand</b>	-0.42	1.98	-1.56	0.73
<b>ASEAN7</b>	-0.60	1.45	-1.59	0.27
<b>NAFTA</b>	5.32	-22.09	5.19	-18.83
<b>EU(25)</b>	-1.25	3.52	-2.62	1.65
<b>ROW</b>	-1.57	2.69	-2.61	1.23

For regional analysis, NAFTA import much by 5 US million but export declines by 18 million US. It causes trade deficit in NAFTA while other regions's export increase. It is implied that other regions export their commodity to NAFTA and enjoy their trade surplus.

<b>Volume of World Trade</b>	-0.06
<b>Value of World Trade</b>	-1.04

For the world trade, value of world trade declines by \$1.04 US million.

<b>Industry Output</b>	<b>JKC</b>	<b>Thailand</b>	<b>ASEAN7</b>	<b>NAFTA</b>	<b>EU(25)</b>	<b>ROW</b>
<b>Land</b>	0.00	0.00	0.00	0.00	0.00	0.00
<b>Unskilled L</b>	0.00	0.00	0.00	0.00	0.00	0.00
<b>Skilled L</b>	0.00	0.00	0.00	0.00	0.00	0.00
<b>Capital</b>	0.00	0.00	0.00	0.00	0.00	0.00
<b>Food</b>	0.60	0.40	0.22	-2.81	1.06	0.58
<b>Extraction</b>	0.59	0.76	0.17	-7.08	1.49	1.50
<b>L. Manuf.</b>	2.09	0.05	1.34	-6.76	1.33	0.52
<b>H. Manuf.</b>	1.60	1.38	1.10	-10.28	1.83	0.71
<b>Construct.</b>	-1.50	-1.16	-1.24	-0.28	-1.57	-1.23
<b>Other.</b>	-0.14	0.19	0.09	2.99	-0.03	0.08
<b>Capital Goods</b>	-5.27	-6.53	-5.41	-3.92	-7.01	-5.28

According to table above, it presents industry output. NAFTA does not enjoy growth in industry output which is opposite to all other region. This scenario may be the answer of previous table that why NAFTA is only one country which has trade deficit.

<b>WELFARE</b>	<b>Allocation</b>	<b>Endow</b>	<b>TECH</b>	<b>POP</b>	<b>TOT</b>	<b>IS</b>	<b>Total</b>
<b>JKC</b>	-5659.67	0.00	0.00	0.00	-16337.83	-7965.22	-29962.72
<b>Thailand</b>	-113.63	0.00	0.00	0.00	-253.77	-225.37	-592.78
<b>ASEAN7</b>	-146.08	0.00	0.00	0.00	-1329.46	-1097.05	-2572.58
<b>NAFTA</b>	25425.35	0.00	0.00	0.00	63991.25	27211.82	116628.42
<b>EU(25)</b>	-483.07	0.00	0.00	0.00	-28764.62	-8903.15	-38150.84
<b>ROW</b>	-7631.68	0.00	0.00	0.00	-17305.55	-9021.14	-33958.37
<b>Total</b>	11391.23	0.00	0.00	0.00	0.02	-0.11	11391.14

For welfare which measure by contribution from many factor, NAFTA is only one region enjoying a positive welfare improvement by \$116,628.42 US Million.

Lastly, I compare the total world welfare effect from three shock. The result is shown by table below,

	<b>Sim1</b>	<b>Sim2</b>	<b>Sim3</b>
<b>JKC</b>	-20.44	645.01	-29962.72
<b>Thailand</b>	0.23	13445.36	-592.78
<b>ASEAN7</b>	-0.01	392.30	-2572.58
<b>NAFTA</b>	41.65	269.06	116628.42
<b>EU(25)</b>	-7.25	350.72	-38150.84
<b>ROW</b>	9.82	554.55	-33958.37
<b>Total</b>	24.00	15657.00	11391.14

According to table, world welfare is improved much from second shock or an increase in population in NAFTA due to its large economic size.

So, this paper try to present the effect from exogenous shock to economy around selected region using GTAP. World economy is interdependence. Any small change in one region is able to create a lot of positive or negative impact to welfare of world population.

## Reference:

Karen M. Huff and Thomas W. Hertel. (2000). **Decomposing Welfare Changes in the GTAP Model**. Center of Global Trade Analysis, Purdue University.

Mary E. Burfisher. (2011). **Introduction to Computable General Equilibrium**. New York: Cambridge University Press

Philip Harslett. (2013). **The GTAP Data Base Construction Procedure**. Center of Global Trade Analysis, Purdue University.

Thomas W. Hertel. (1997). **Global Trade Analysis Modeling and Applications**. New York: Cambridge University Press.

## Website

Industrial Growth retrieved from <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2089rank.html>

Thailand Industry Plan retrieved from <http://www1.industry.go.th/industry/index.php/modules-menu/2013-09-14-00-44-38/-2553-2556/331--2553-2556/file>

GDP of North America Region retrieved from <http://www.imf.org>

Population Growth retrieved from <http://www.un.org/esa/population/publications/longrange2/WorldPop2300final.pdf>