The Effect of Economic Sanctions on Domestic Production, Trade and Transportation of Sanctioned Goods

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Abstract

It is well established that countries generate greater economic benefits from engaging in free trade than from pursuing autarky. Various forms of government intervention in trade, such as tariffs, quotas, and taxes, discourage economic interaction between states, and reduce the gains from free trade. Economic sanctions are a form of government action by senders of sanctions that are designed to block specified categories of trade or investment in the target. The effect of sanctions on trade and investment between senders and targets have been extensively researched (Askari 2003; Hufbauer et. al. 1997, Caruso 2003). Less is known about the effect of sanctions on the domestic economy of targeted countries. In this paper we apply a unique methodological refinement of the computable general equilibrium (CGE) approach to understand the effect of various types and levels of international sanctions on the severity and dissipation of economic losses in targets of sanctions.

To further our understanding of how domestic economies in targeted countries and their trading partners are affected by sanctions, we estimate the direct and indirect effects of differing types and levels of sanctions. A unique aspect of the model is that it considers the export of restricted goods in targeted economies and the use of international transport using the modified

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version of the dynamic Global Trade Analysis Project (GTAP) model of global trade. We introduce substitution between different modes of transport into the dynamic version of the GTAP model using the approach developed by Avetisyan et al. (2017)[1]. Substitution elasticities range from of 0.6 to 2.2, and generate significant response to changes in the relative price of different modes of goods transport.

Countries that use sanctions attempt to design them in a way that the costs of will mainly be borne by the targeted country[2] with relatively smaller costs to the sender economy. A consequence of sanctions is that the more successful sanctions are at restricting the supply of goods to the target, the higher the price of those goods becomes in the targeted country. As the price of goods in the target rise above world prices, the incentive for third party countries to step in and replace the supply of the goods also rises. This spurs the import of such goods into the targeted country from its other trading partners (Hufbauer et al. 2007)[3].

As trade routes change, from initial preferred routes under free trade, to alternative routes necessitated by government intervention in the form of economic sanctions, the choice of international transport mode will also change. In the country imposing sanctions, the goods that are restricted will become cheaper as supply increases due to a reduction in available markets due to sanctions. This will result in an increased use of domestic transportation in the sender as goods previously destined for international markets are now consumed at home.

Initially these changing patterns of trade are expected to advantage sender countries. The long run negative impacts, however, may dissipate over time and undermine their intended

[1] Avetisyan, M., Hertel, T., 2017. Impacts of Trade Facilitation on Modal Choice in International Trade. Working Paper, Texas Tech University.
[2] One estimate is that as of the year 2001, sanctions cost targeted countries approximately $27 billion annually (Hufbauer, Gary, Jeffrey J. Schott, Kimberly Ann Elliott, and Barbara Oegg. 2007. Economic Sanctions Reconsidered. 3rd ed. Washington: Peterson Institute).
[3] Hufbauer, Gary, Jeffrey J. Schott, Kimberly Ann Elliott, and Barbara Oegg. 2007. Economic Sanctions Reconsidered. 3rd ed. Washington: Peterson Institute

effects. Adjustment to sanctions is expected to take place through the increased domestic production of targeted goods and trade substitution with other trading partners. The longer that sanctions are in place, the more fully the targeted states economy will change. Eventually, as new patterns of trade are routinized, and domestic capacity for production is established, the sanctioned economy is expected to transform so that pre-sanction patterns of trade are no longer preferred to those that develop under sanctions.

JEL codes: F51, R41

1. Introduction

In this paper, we use data from the dynamic Global Trade Analysis Project (GTAP) model to simulate the effect of sanction restrictions on particular goods in a targeted state's economy. GTAP modelling is a novel approach in the sanctions literature and allows us to explore questions that other forms of statistical modelling have been unable to address. An important issue addressed in this paper is the effect of sanctions on the domestic production of sanctioned goods in the targeted state. We use data from two important sanction case studies, United Nations sanctions against North Korea over the testing of nuclear weapons and Russian sanctions against Georgia over the South Ossetia and Abkhazia dispute, that allow us to simulate short and long run effects of sanctions. Specifically, we are interested in whether sanctioned states will shift to alternate supplies of sanctioned goods from other countries or make adjustments to their domestic economy to produce goods restricted by sanctions.

Some key findings of the empirical analysis are that global water transportation is the most affected mode of transport under sanctions, the economies of sender nations tend to be affected less by sanctions than targets, and that sanctions tend to have the greatest bite on

targeted economies in their first year. In the second year of sanctions we see little effect of sanctions on targets, as targeted states are able to make adjustments to compensate for restrictions to their trade.

2. Literature Review

It is well established that countries generate greater economic benefits from engaging in free trade than from pursuing autarky. Various forms of government intervention in trade, such as tariffs, quotas, and taxes, discourage economic interaction between states, and reduce the gains from free trade. Economic sanctions "are essentially government imposed disruptions of economic exchange between the sanctioning, or "sending" nation(s), and the sanctioned or "target" nation(s)" (Spindler 1995, 206). Sanctions have similar pecuniary effects as other forms of government intervention in international commerce and "involve similar reductions in the general economic welfare of the sender, target and global economies" (Spindler 1995, 206).

The primary difference between economic sanctions and other forms of government intervention is in the motive for imposing the restriction. States frequently choose economic sanctions as a foreign policy tool. By blocking the targeted country's access to the benefits of foreign trade, sender states seek to coerce the targeted state into changing some type of policy in order to have the sanctions removed. In addition to imposing restrictions on specific goods that the targeted country would prefer to acquire through trade, sanctions may also seek to constrain its access to capital (Biersteker et al., 2016).[4]

Restrictions on trade and finance that are associated with sanctions are generally designed to impose an economic cost on the targeted state's economy, with a comparably smaller cost to

[4] Sanctions may also signal political resolve, although this is of less importance to this paper.

the sending state. Sanctions have been imposed by international organizations, such as the United Nations, which receives its sanctions authority from article 41, Chapter VII, of the U.N. Charter. Sanctions have also been imposed by regional groups such as the European Union, and Organization of American States, and by individual states. The clearest justification for sanctions derives from the UN Charter, but international law also provides for the use of unilateral sanctions under certain conditions. Alexander (2009) notes that "The UN chapter VII framework does not provide the exclusive legal basis for states to impose economic sanctions, as states are relatively free under the rules of state responsibility in customary international law to adopt unilateral sanctions against states, entities and individuals"

Countries subjected to sanctions that restrict their access to international trade and finance, will attempt to find other sources for restricted goods in an effort to counter the effects of sanctions. Specific countermeasures include developing alternative suppliers of sanctioned goods and capital, and increasing levels of domestic production of the sanctioned goods. Both of these measures will entail short term costs as the target adjusts its economy to accommodate for sanctions. Long term effects of sanctions, may be less significant if the target is able to make the necessary changes required to survive without the sanctioned goods. A third alternative is that he target may not be able to find alternative sources for sanctioned goods and be forced to do without. In this case, the effect of sanctions is likely to persist for a longer period of time. The sanctioned government's recourse in this scenario is usually try to scapegoat the sender nations for any economic hardship brought about by the sanctions.

Researchers have studied the effect of sanctions on trade and financial interactions between the sender and targeted country, as well as between the targeted country and its other trading partners (Early, 2009; Biglaiser and Lektzian, 2012; Lektzian and Biglaiser, 2013;

Caruso, 2003; McLean and Whang, 2012). Less is known about the effect of sanctions on the domestic economy of targeted countries and this is one important area where this paper seeks to make a contribution.

3. Theoretical Assumptions

We develop expectations regarding how different types of countries (large or small exporter/importer; democratic/autocratic) will adjust to different types of sanctions (import, export, finance; UN/Unilateral).

Export sanctions will affect trade volumes, while an export tax or quota will increase the export price of the sanctioned product resulting in lower exports. Export restrictions will generally reduce the domestic price of the sanctioned product due to increased supply in the local market. Also, the market prices will be distorted resulting in welfare losses in domestic and foreign markets. The intermediate and final consumption of the sanctioned product is expected to rise locally and thereby reduce the prices of other domestically produced commodities. In addition to the direct impact, the reduction in export volumes is expected to generate spillover effects in various sectors of the targeted state's economy in the short run. However, in the long run these negative impacts may dissipate and undermine the intended sanction effects in the targeted foreign economy due to adjustment to sanctions.

4. Macroeconomic Analysis: Implications for the North Korean and Georgian economies

The fall of the Soviet Union in 1991 eliminated most of North Korea's trading partners and contributed to the country's isolation in the world. In 1991, a number of factories were closed driven by fuel shortages further worsening the North Korean economy.

In 1992, North Korea's last major ally and trading partner, China, established diplomatic and trade relations with South Korea. Due to the worsening economy North Korea started looking for financial aid, trade relations, and foreign investment from Western countries by developing and approving new legislation to promote foreign investment in the country. This was a major step toward increasing openness with the world.

However, in October 2006, North Korea announced its intention to test its first nuclear weapon. In response the United Nations took action by passing Resolution 1718, prohibiting exports of luxury goods, arms and related material to North Korea. More international economic sanctions followed the 2006 UN Resolution due to continuous efforts of developing nuclear weapons and ballistic missiles. This explains why until now North Korea is trading mostly with its largest trading partner, China, via rail transport, and only 10% of its trade is carried with other trading partners using other modes of transportation.

The fall of the former Soviet Union also affected its republics including Georgia, which was later subject to Russian economic sanctions. In 2006, Russia imposed an import ban on Georgia's key agricultural exports (wine, water, and fruits) in response to the dispute over South Ossetia and Abkhazia, with the large Russian population seeking secession from Georgia. Even though Georgia has been an active member of the World Trade Organization (WTO) and attained permanent normal trade relations with other member countries in 2000, the Russian economic sanctions had a negative impact on its trade and economic development. The free trade agreement with the rest of the Commonwealth of Independent States (CIS FTA) and the Association Agreement (AA DCFTA) with the European Union eliminating various trade duties and restrictions, helped mitigating these negative consequences by redirecting exports of sanctioned goods to other countries using air, water, land and pipeline modes of transportation.

In this section we estimate the impacts of international sanctions on the economies of North Korea and Georgia as well as sender countries using a dynamic computable general equilibrium (CGE) model. This is a multi-market model of behavioral responses of producers and consumers to price changes within the limits of labor, capital, and natural resource endowments (Dixon and Rimmer, 2002). CGE is a state-of-the-art approach to economic consequence analysis, which overcomes the major limitations of the Input-Output analysis (Rose, 1995). CGE models incorporate input substitution, behavioral changes, provide information on prices and markets, and can differentiate between goods used for intermediate and final consumption.

CGE models have been extensively used in trade and transport-related analysis. Lloyd and MacLaren (2010) use a "semi-general equilibrium" approach, including non-tariff measures, to capture general-equilibrium impacts ignored in partial-equilibrium forms of the Trade Restrictiveness Index and the Mercantilist Trade Restrictiveness Index. Sandoval et al. (2009) analyze the economic feasibility of hydrogen trade and transportation with different carbon stabilization and tax policy scenarios using a CGE model of the global economy. In a recent study, Winchester et al. (2013) apply a recursive dynamic CGE model to analyze the impacts of a representative carbon policy on U.S. aviation operation and emissions. In this paper we apply a unique methodological refinement of the CGE approach to understand the effect of various types and levels of international sanctions on the severity and dissipation of economic losses over time.

Trade sanctions translate into changes in trade and transportation costs, which, in turn, translate into changes in relative competitiveness of target country imports and exports. Although the costs of international sanctions will mainly be borne by the target country, reducing or eliminating the exports of certain goods from sender countries entering the target market

makes them relatively expensive, and spurs target country imports of such goods from its other trading partners. Also, the targeted goods will become cheaper in sending countries due to increased supply in domestic economics. This has the effect of initially advantaging sender countries. However, in the long run the negative impacts of international sanctions may dissipate and undermine the intended effects in the target country economy due to adjustment to sanctions through increased domestic production of targeted goods and trade substitution with other trading partners. The extent to which the negative effect of increased international sanctions is offset by the effect of increased domestic production and import substitution requires a sophisticated general equilibrium economic modeling approach.

4.1 The Model and Methodology

We estimate the direct and indirect effects of differing types and levels of sanctions on the export of restricted goods in targeted economies using the modified version of the dynamic GTAP model called GDyn.[5] This version of the model incorporates GDP and factor endowment growth rate projections within 2004-2020 for each country or region in the GTAP database (Walmsley, 2006). The GDyn model takes both real GDP and factor input growth as exogenous, and it allows a Hicks neutral technological change variable to balance these changes with other values in the model. We introduce the substitution between different modes of transport into the dynamic version of the GTAP model using the elasticities and approach developed by Avetisyan et al. (2017). The latter is a modified version of the GTAP computable general equilibrium model described in Hertel (1997).

[5] https://www.gtap.agecon.purdue.edu/models/Dynamic/model.asp

In the GTAP model the goods are produced by combining labor, capital, land, and intermediate inputs (including the energy substitution nest) using the Leontief functional form. First, the electricity and non-electricity goods are joined to form the energy nest governed by a constant elasticity of substitution (CES). The model then combines the energy sub-product with capital to form the capital-energy sub-product, which is later joined with other factors in a CES production function to generate the value added nest. At the final level of the production structure, the value added is combined with intermediate inputs to produce the final output. The household forms its preferences over savings, consumption, and government spending based on Cobb-Douglas assumption, while its consumption is administered by a constant-difference of elasticities (CDE) functional form.

International trade and transport in the GTAP model are represented by merchandise goods and "margin" services (shipping services, or transport costs). These data are included in a "trade matrix," which describes bilateral flows of merchandise commodities, while the transport margins maintain the balance between global exports and imports. Figure 1 summarizes the structure of the standard GTAP model.

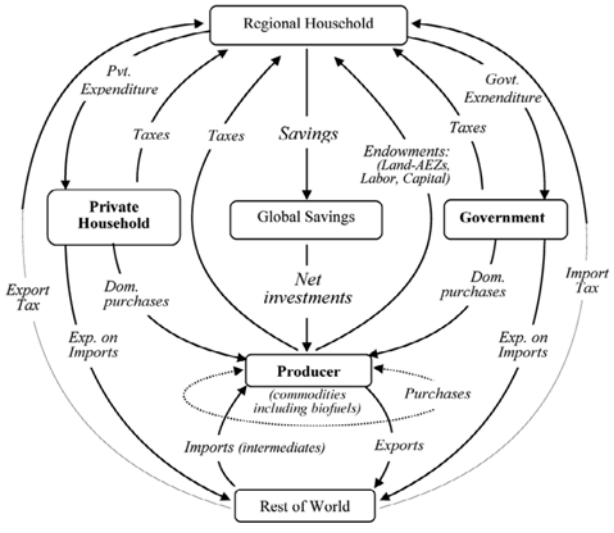

Figure 1. Structure of the standard GTAP model (source: Hertel et al., 2010)

We modify the dynamic version of the GTAP model by incorporating transport mode substitution, similar to that used for assessing the direct and indirect impacts of improved logistics and transport mode substitution in the global economy by Avetisyan et al. (2017). The latter estimates the modal substitution elasticities for land-air and water-air transport pairs, which are then modified using transport cost weighted aggregation to generate modal substitution elasticities by commodity, source, and destination. The estimated CES elasticities of substitution between 0.6 and 2.2 govern modal choice decisions in response to changes in the relative cost of various modes of transport. Also, in most sectors the water-air substitution elasticities dominate the land-air modal substitution elasticities.

In the modified version of the dynamic GTAP model, the modal use is governed by a CES elasticity of substitution in the following equation:

$$TRANS_{m,i,r,s} = X_{i,r,s} * \tau_{m,i,r,s}^{(\sigma_{i,r,s}-1)} * \left(\frac{PTRANS_{i,r,s}}{PT_m}\right)^{\sigma_{i,r,s}} \quad (1)$$

where:

$TRANS_{m,i,r,s}$ is the international usage of transport mode m to ship good i from region r to s;
$\tau_{m,i,r,s}$ is the transportation technology of mode m to ship good i from region r to s;
$X_{i,r,s}$ is the export sales of commodity i from region r to s;
$\sigma_{i,r,s}$ is the elasticity of modal substitution to ship good i from region r to s;
PT_m is the price of composite transportation services;
$PTRANS_{i,r,s}$ is the cost index for international transport shipping good i from region r to s.

Using the modified version of the dynamic GTAP model we look at how the gross domestic product and trade patterns are expected to change in response to different types of sanctions. Evidence from international sanctions imposed against North Korea over the testing of nuclear weapons and Russian sanctions against Georgia over the South Ossetia and Abkhazia dispute provide additional case study insights of how trade patterns with target countries and its production of different types of goods was altered as a result of the sanctions. In this paper we

look at how alternative types of sanctions would have affected the gross domestic product, trade and transport patterns in target countries as well as in sender countries, and how these negative effects are likely to dissipate due to adjustment to sanctions over time. Additionally, we are able to provide a more generalized look at the effect of sanctions on different types of countries.

4.2 Experimental Design

Our goal in this study is to evaluate the impact of international economic sanctions on the North Korean and Georgian economies and then develop general implications. In so doing, we must assess the competing effects of shifting patterns of production on the one hand, and redirected international trade and transport services on the other. A key question in our experimental design is: How to induce the prescribed dynamic shift in production and trade associated with an 'economic sanctions experiment'?

For both sanctions we look at the 2006 – 2008 period and observe the changes in the main macroeconomic variables and international trade and transport services for 2006 – 2007 (a) and 2007 – 2008 (b) time intervals. We then develop two scenarios for each economic sanction. The first scenario examines only the direct and indirect impacts of economic sanctions for each target country within 2006 – 2008 (all other things held constant), while the second scenario replicates the first one and additionally assumes economic growth in all countries and regions of the world. This enables better understanding of the negative impacts of international sanctions and how those effects dissipate over time.

Given the information about each of these sanctions, we begin there, and develop the analysis in great detail, before moving on to a summary of the results. For consistency, we use the GTAP version 8 data base for our economic sanctions experiments in North Korea and

Georgia. With these sectoral and regional emphases, we begin by implementing two CGE experiments: NKSANCTIONS (a) and (b), in which we ban the export of luxury goods, arms and related material to North Korea, and GEOSANCTIONS in which we apply an import ban on Georgia's key agricultural exports (wine, water, and fruits). Following the detailed examination of total economic and transportation services impacts of these two international sanctions, we move on to a short summary and general conclusions.

5. Results

We first analyze the changes in GDP, domestic production, trade and transport services under scenarios NKSANCTIONS (a) and (b). As shown in Table 1, under scenario NKSANCTIONS (a) the United Nations sanctions prohibiting exports of luxury goods, arms and related material to North Korea result in GDP and export sales reduction across all countries with the largest reduction in North Korea, -1.113% and 36%, respectively. This result shows that the impact of international sanctions is negative on both sending and target country economies. Within the 2006-2007 period, we can see changes in imports and transport services use in all regions, with North Korea experiencing the largest reduction. Due to these sanctions, global air, water, and other transportation services decline by -0.033%, -0.024%, and -0.058%, respectively. Since North Korea is trading primarily through rail transport the reduced exports to the country mainly affect its use of other/rail transportation. Following the first year of international sanctions, during the 2007 – 2008 period both North Korea and the rest of the countries see improvements in main macroeconomic variables driven mainly by export and import substitution, changes in domestic production patterns, and transport mode substitution. This result supports the assumption that the negative impacts of economic sanctions dissipate over time. We also observe

improvement in global exports. At the global level, the use of air and other transport services increases, while the sea transport services experience reduction during the two year period of international sanctions.

Table 1. Scenario NKSANCTIONS (a) – GDP, trade and transportation impacts (no economic growth within 2006-2008), percent change

Region	Year 2006 - 2007						Year 2007 - 2008					
	GDP	Exports	Imports	Other Transport	Water Transport	Air Transport	GDP	Exports	Imports	Other Transport	Water Transport	Air Transport
Australia	-0.008	-0.082	-0.015	0.033	0.024	0.094	-0.003	-0.010	-0.004	0.004	0.004	0.010
New Zealand	-0.005	-0.033	-0.007	0.037	0.003	0.075	-0.002	-0.003	-0.002	0.006	0.002	0.008
China	-0.064	-0.219	-0.063	0.024	0.015	0.090	-0.006	-0.014	-0.003	0.002	0.002	0.008
Hong Kong	-0.166	-0.251	-0.076	0.083	0.045	0.166	-0.052	-0.048	-0.017	0.008	0.005	0.016
Japan	-0.008	-0.082	-0.001	0.008	-0.001	0.064	-0.003	-0.007	-0.003	0.001	0.003	0.008
South Korea	-0.008	-0.033	-0.005	0.009	-0.010	0.036	-0.003	-0.003	-0.001	0.003	0.001	0.006
North Korea	-1.113	-35.974	-83.108	-17.827	-26.260	-27.179	-2.561	-6.176	-21.850	-2.662	-5.110	-3.759
Indonesia	-0.002	-0.022	0.004	0.033	0.009	0.059	-0.001	-0.002	-0.001	0.004	0.002	0.006
Malaysia	-0.023	-0.026	-0.002	0.088	0.018	0.126	-0.007	-0.005	-0.001	0.011	0.004	0.014
Bangladesh	-0.002	-0.030	0.012	0.005	0.004	0.032	0.000	-0.001	0.000	0.000	0.000	0.003
India	-0.010	-0.098	-0.034	0.014	0.020	0.076	-0.003	-0.012	-0.005	0.001	0.005	0.008
Pakistan	-0.001	-0.037	0.003	0.009	0.053	0.085	-0.001	-0.003	-0.001	0.001	0.009	0.009
Sri Lanka	-0.003	-0.023	0.008	0.022	0.084	0.027	-0.001	-0.001	0.000	0.002	0.014	0.002
Canada	-0.006	-0.038	-0.008	0.035	0.038	0.093	-0.002	-0.004	-0.002	0.005	0.008	0.010
United States of America	-0.004	-0.080	-0.004	0.024	0.010	0.041	-0.001	-0.007	-0.003	0.003	0.002	0.005
Mexico	-0.002	-0.022	0.008	0.017	0.002	-0.017	0.000	0.000	0.000	0.002	0.002	-0.003
Argentina	-0.004	-0.039	-0.010	0.029	0.085	0.121	0.000	-0.001	-0.002	0.004	0.014	0.013
Bolivia	-0.002	-0.020	-0.005	0.028	0.022	0.067	-0.001	-0.002	-0.002	0.004	0.003	0.007
Brazil	-0.004	-0.070	-0.008	0.011	0.029	0.023	-0.001	-0.005	-0.004	0.001	0.006	0.003
Colombia	-0.001	-0.027	0.015	0.011	0.003	0.047	-0.001	-0.002	0.000	0.002	0.003	0.005
Venezuela	-0.012	-0.018	-0.049	0.006	0.006	0.025	-0.001	-0.001	-0.007	0.001	0.003	0.003
Austria	-0.012	-0.053	-0.010	0.040	0.006	0.107	-0.001	-0.002	-0.001	0.005	0.003	0.011
Switzerland	-0.025	-0.058	-0.009	0.066	0.009	0.116	-0.008	-0.007	-0.003	0.008	0.002	0.012
Norway	-0.017	-0.064	-0.020	0.033	-0.004	0.074	-0.006	-0.009	-0.004	0.004	0.001	0.007
Bulgaria	-0.013	-0.033	-0.006	0.068	0.015	0.181	-0.004	-0.003	-0.002	0.010	0.005	0.019
Belarus	-0.005	-0.016	-0.003	-0.001	0.002	0.079	-0.001	-0.001	0.000	0.002	0.001	0.008
Romania	-0.005	-0.064	0.013	0.015	-0.009	0.088	-0.002	-0.001	-0.003	0.002	0.003	0.009
Russian Federation	-0.004	-0.028	-0.009	0.019	0.033	0.065	-0.001	-0.004	-0.002	0.003	0.005	0.007
Ukraine	-0.005	-0.024	-0.004	0.036	0.088	0.139	-0.002	-0.003	-0.001	0.006	0.014	0.015
Kazakhstan	-0.002	-0.017	0.006	0.004	0.008	0.040	0.000	-0.001	0.000	0.001	0.001	0.004
Kyrgyzstan	-0.010	-0.021	0.002	0.151	0.100	0.105	-0.003	-0.002	-0.001	0.020	0.016	0.013
Georgia	-0.002	-0.019	0.009	0.024	0.077	0.125	0.000	0.000	0.001	0.005	0.012	0.013
Israel	-0.017	-0.051	-0.010	0.043	-0.010	0.101	-0.002	-0.002	-0.001	0.005	0.001	0.010
Iran	-0.000	-0.011	0.016	0.035	0.042	0.101	0.000	-0.001	0.001	0.005	0.008	0.011
Turkey	-0.001	-0.030	0.016	0.028	0.000	0.116	0.000	-0.001	0.000	0.003	0.001	0.013
Ethiopia	-0.003	-0.027	0.002	0.014	0.014	0.144	-0.001	-0.002	-0.002	0.002	0.004	0.017
Malawi	-0.001	-0.015	0.006	0.025	0.047	0.093	0.000	-0.001	0.000	0.004	0.009	0.011
Uganda	-0.002	-0.024	0.001	0.079	0.096	0.020	-0.001	-0.002	-0.001	0.010	0.017	0.002
Botswana	-0.005	-0.019	0.001	0.094	0.143	0.139	-0.002	-0.002	-0.001	0.013	0.023	0.015
Rest of the World	-0.016	-0.045	-0.008	0.063	0.019	0.109	-0.005	-0.006	-0.002	0.008	0.004	0.011
Total	-	-0.114	-	-0.058	-0.024	-0.033	-	-0.011	-	0.0005	-0.001	0.001

Under scenario NKSANCTIONS (b), shown in Table 2, we consider economic growth along with the United Nations sanctions banning exports of luxury goods, arms and related material to North Korea. North Korean exports and imports still decline but at a lower rate.

Table 2. Scenario NKSANCTIONS (b) – GDP, trade and transportation impacts (assuming economic growth within 2006-2008), percent change

Region	Year 2006 - 2007						Year 2007 - 2008					
	GDP	Exports	Imports	Other Transport	Water Transport	Air Transport	GDP	Exports	Imports	Other Transport	Water Transport	Air Transport
Australia	3.682	2.684	4.308	3.665	3.630	3.697	3.622	2.857	4.148	3.580	3.574	3.571
New Zealand	3.450	3.291	3.191	3.477	3.600	3.679	3.444	3.256	3.225	3.424	3.591	3.571
China	6.991	8.570	5.014	7.247	6.388	6.816	6.839	8.594	4.916	7.003	6.232	6.582
Hong Kong	4.342	4.048	4.684	4.459	4.259	4.340	4.495	4.288	4.750	4.411	4.239	4.250
Japan	1.798	2.326	2.474	1.869	3.355	2.403	1.758	2.213	2.472	1.814	3.330	2.310
South Korea	4.919	3.732	4.933	4.639	4.193	4.121	4.861	3.913	4.815	4.585	4.188	4.109
North Korea	3.150	-34.638	-82.440	-15.239	-23.531	-25.422	3.122	-5.198	-16.753	0.765	-1.165	-1.984
Indonesia	5.472	5.481	4.737	5.547	5.495	5.566	5.373	5.473	4.614	5.411	5.386	5.383
Malaysia	5.983	5.401	5.790	5.909	5.275	5.041	5.885	5.360	5.615	5.700	5.165	4.826
Bangladesh	5.352	4.511	5.234	6.256	6.206	6.254	5.295	4.681	5.107	6.140	6.097	6.194
India	5.962	7.951	4.480	6.106	5.438	5.938	5.828	7.949	4.395	5.927	5.392	5.772
Pakistan	5.823	4.488	5.744	6.362	5.555	5.647	5.626	4.712	5.444	6.097	5.453	5.472
Sri Lanka	6.425	4.700	6.772	6.863	4.974	6.846	6.392	5.052	6.571	6.737	4.996	6.712
Canada	2.433	2.720	2.184	2.645	3.484	2.996	2.517	2.678	2.331	2.666	3.400	2.912
United States of America	3.134	1.608	3.950	3.113	3.177	3.074	3.179	1.632	3.998	3.119	3.204	3.063
Mexico	3.593	3.265	3.088	3.668	3.655	3.586	3.691	3.228	3.250	3.739	3.714	3.664
Argentina	3.628	3.588	2.966	3.497	3.674	3.708	3.543	3.554	2.930	3.381	3.560	3.531
Bolivia	3.494	3.167	3.118	3.608	3.540	3.566	3.479	3.150	3.159	3.553	3.501	3.478
Brazil	3.830	0.294	5.284	3.704	2.925	3.605	3.757	0.512	5.111	3.620	2.922	3.525
Colombia	3.470	5.062	1.916	3.489	4.083	3.909	3.572	4.984	2.114	3.556	4.070	3.906
Venezuela	2.525	2.889	1.700	2.521	3.372	3.038	2.418	2.754	1.812	2.393	3.244	2.870
Austria	2.520	2.562	2.556	2.831	3.852	3.189	2.453	2.510	2.509	2.704	3.784	2.990
Switzerland	2.200	1.822	2.442	2.388	2.879	2.522	2.136	1.831	2.362	2.257	2.819	2.366
Norway	2.363	2.653	2.247	2.739	3.663	2.577	2.272	2.564	2.231	2.601	3.598	2.407
Bulgaria	4.194	2.112	4.606	3.626	3.696	2.479	4.066	2.246	4.381	3.510	3.690	2.429
Belarus	2.097	3.259	2.571	2.703	3.147	2.512	2.094	3.151	2.447	2.702	3.169	2.497
Romania	4.634	-17.424	16.37	4.694	-0.621	1.088	4.297	-14.027	13.393	4.527	0.090	1.561
Russian Federation	4.411	5.518	2.658	4.555	4.760	4.761	3.852	4.881	2.419	3.977	4.251	4.185
Ukraine	4.279	4.458	3.876	4.242	4.314	4.298	3.630	3.982	3.313	3.727	3.909	3.791
Kazakhstan	5.736	5.340	5.509	5.606	5.682	5.573	4.861	4.834	4.521	4.756	4.824	4.805
Kyrgyzstan	4.460	3.599	4.885	4.721	4.624	4.357	4.319	3.610	4.634	4.406	4.379	4.113
Georgia	7.751	3.335	8.191	6.244	4.456	5.613	6.193	3.607	6.266	5.311	4.152	4.844
Israel	3.571	2.608	3.809	3.543	4.061	3.764	3.686	2.776	3.856	3.590	4.044	3.667
Iran	5.056	5.843	3.673	4.989	4.764	5.202	5.039	5.764	3.749	4.873	4.608	4.942
Turkey	4.910	2.990	5.232	5.006	4.559	3.991	4.722	3.146	4.923	4.774	4.432	3.930
Ethiopia	5.115	5.517	4.590	5.665	5.517	5.117	5.361	5.758	4.789	5.915	5.720	5.106
Malawi	3.054	3.433	3.065	3.754	4.283	4.072	2.869	3.288	2.890	3.532	4.146	3.839
Uganda	5.466	5.662	4.745	6.102	5.392	5.816	5.427	5.646	4.715	5.968	5.324	5.754
Botswana	4.816	5.201	3.668	4.978	5.069	5.047	4.696	5.081	3.586	4.754	4.842	4.810
Rest of the World	4.151	3.897	4.126	4.239	4.143	4.093	4.078	3.864	4.055	4.087	4.072	3.930
Total	-	3.361	-	3.531	4.193	3.755	-	3.413	-	3.525	4.180	3.784

In all other regions economic growth effects dominate the negative direct and indirect impacts of international sanctions imposed on their trade with North Korea, except Romania, which experiences a significant reduction in exports during the 2006 – 2008 period. This is due to increased prices of its domestic production and exports driven by more expensive land and natural resource endowments.

As illustrated in Table 2, the negative impacts of international sanctions on the North Korean economy are declining at the end of the 2006 – 2008 period, supporting the assumption that the negative effects of international sanctions dissipate over time. Since the rail transportation is the main mode of transport for the trade between North Korea and its major trading partner China, increased use of rail transportation (0.765%) contributes to the economic growth in North Korea. Global exports and use of all transport services are also increasing due to assumed global economic growth within the 2006 – 2008 interval.

According to Table 3, the UN sanctions significantly affect the domestic production of sanctioned goods in North Korea, increasing it by 15.7% and 1.7% during the first and second years of sanctions and by 21.1% and 8.3% during the first and second years of sanctions under scenarios NKSANCTIONS (a) and NKSANCTIONS (b), respectively. Under the scenario NKSANCTIONS (a) the majority of other countries reduce their production of sanctioned goods due to decline in exports to North Korea and other regions. However, with scenario NKSANCTIONS (b) North Korean imports of these goods are again eliminated, but other countries increase both their exports and imports of sanctioned goods to and from the rest of the world regions.

Table 3. Scenario NKSANCTIONS (a and b) – Domestic production and trade of sanctioned goods, percent change

Region	No economic growth within 2006-2008 (a)						With economic growth within 2006-2008 (b)					
	Year 2006 - 2007			Year 2007 - 2008			Year 2006 - 2007			Year 2007 - 2008		
	Production	Exports	Imports	Production	Exports	Imports	Production	Exports	Imports	Production	Exports	Imports
Australia	-0.0034	-0.416	-0.011	0.0003	-0.057	-0.004	3.604	1.412	4.442	3.534	1.984	4.246
New Zealand	0.0013	-0.107	-0.013	0.0004	-0.013	-0.004	3.331	3.462	2.975	3.330	3.420	3.051
China	-0.0120	-0.317	-0.066	0.0007	-0.019	-0.002	7.081	8.809	4.494	6.882	8.907	4.411
Hong Kong	-0.0229	-0.426	-0.107	0.0021	-0.076	-0.021	4.464	3.901	4.800	4.524	4.295	4.893
Japan	-0.0012	-0.117	0.006	0.0008	-0.011	-0.004	1.575	1.920	2.618	1.541	1.816	2.664
South Korea	0.0001	-0.047	-0.003	0.0006	-0.006	-0.001	4.735	3.507	5.230	4.696	3.768	5.037
North Korea	15.7270	-59.524	-100.000	1.6905	-14.537	-100.000	21.058	-59.088	-100.000	8.272	-14.952	-100.000
Indonesia	0.0001	-0.052	0.012	0.0001	-0.006	0.000	5.413	5.558	4.656	5.310	5.579	4.517
Malaysia	-0.0065	-0.049	0.000	-0.0004	-0.009	-0.001	6.065	5.347	6.001	5.944	5.323	5.790
Bangladesh	-0.0013	-0.037	0.021	0.0000	-0.001	0.001	5.136	4.518	5.503	5.102	4.710	5.360
India	-0.0011	-0.135	-0.021	0.0007	-0.019	-0.004	6.037	8.863	3.558	5.907	8.877	3.466
Pakistan	-0.0028	-0.065	0.008	0.0002	-0.006	-0.002	5.808	4.725	5.325	5.638	4.993	4.975
Sri Lanka	-0.0034	-0.054	0.016	-0.0002	-0.006	0.000	6.677	4.134	7.256	6.664	4.620	6.938
Canada	-0.0002	-0.069	-0.003	0.0004	-0.008	-0.001	2.277	2.748	2.035	2.364	2.675	2.221
United States of America	-0.0007	-0.147	-0.004	0.0003	-0.015	-0.004	2.987	1.148	4.152	3.035	1.216	4.220
Mexico	0.0003	-0.030	0.013	0.0000	-0.001	0.000	3.565	3.214	2.991	3.665	3.146	3.199
Argentina	-0.0014	-0.145	-0.004	0.0002	-0.005	-0.001	3.672	3.969	2.706	3.581	4.013	2.683
Bolivia	-0.0035	-0.159	0.000	-0.0002	-0.021	-0.001	3.522	3.255	2.805	3.515	3.261	2.903
Brazil	0.0004	-0.164	-0.003	0.0003	-0.018	-0.004	3.866	-1.361	5.907	3.786	-1.001	5.681
Colombia	0.0029	-0.031	0.026	0.0003	-0.005	0.001	3.464	6.321	1.217	3.576	6.031	1.482
Venezuela	0.0141	-0.338	-0.073	0.0012	-0.018	-0.010	2.378	4.162	1.491	2.246	3.971	1.654
Austria	-0.0025	-0.104	-0.011	0.0002	-0.005	-0.001	2.364	2.391	2.479	2.296	2.371	2.455
Switzerland	-0.0090	-0.142	-0.013	0.0012	-0.020	-0.004	2.036	1.484	2.552	1.968	1.555	2.469
Norway	-0.0111	-0.369	-0.024	0.0007	-0.054	-0.005	2.244	2.605	1.943	2.138	2.616	1.971
Bulgaria	-0.0090	-0.103	-0.003	-0.0003	-0.013	-0.003	4.018	1.288	5.435	3.902	1.580	5.073
Belarus	0.0005	-0.045	-0.005	-0.0002	-0.003	-0.001	1.352	2.250	1.981	1.422	2.341	1.893
Romania	0.0026	-0.094	0.022	0.0006	-0.004	-0.003	5.310	-21.952	21.673	4.631	-18.422	16.782
Russian Federation	-0.0032	-0.243	-0.002	-0.0001	-0.035	-0.002	4.268	7.067	2.389	3.702	6.309	2.170
Ukraine	-0.0042	-0.092	0.001	0.0000	-0.013	-0.001	4.128	3.975	3.300	3.442	3.516	2.738
Kazakhstan	-0.0004	-0.303	0.012	-0.0001	-0.014	0.000	5.895	4.704	5.483	4.866	4.972	4.424
Kyrgyzstan	-0.0108	-0.138	-0.003	0.0006	-0.019	-0.002	4.714	3.680	5.150	4.526	3.650	4.871
Georgia	-0.0056	-0.176	0.018	-0.0008	-0.012	0.002	7.771	1.727	9.031	6.097	2.645	6.503
Israel	-0.0053	-0.098	-0.012	0.0005	-0.004	-0.001	3.343	2.228	4.014	3.466	2.484	4.056
Iran	-0.0004	-0.098	0.022	-0.0001	-0.012	0.001	4.810	7.457	3.125	4.776	7.050	3.278
Turkey	-0.0033	-0.073	0.032	-0.0004	-0.007	0.001	4.961	2.860	5.527	4.774	3.093	5.120
Ethiopia	0.0026	-0.308	0.000	0.0011	-0.039	-0.003	5.223	6.368	3.856	5.493	6.834	4.047
Malawi	0.0052	-0.044	0.005	0.0006	-0.003	-0.001	3.243	5.857	3.060	3.026	5.595	2.887
Uganda	-0.0023	-0.238	0.005	0.0001	-0.031	-0.001	5.662	6.479	4.498	5.619	6.556	4.470
Botswana	-0.0031	-0.151	0.002	0.0000	-0.021	-0.001	4.779	6.838	3.172	4.667	6.730	3.119
Rest of the World	-0.0106	-0.168	-0.010	0.0003	-0.025	-0.002	4.210	3.818	4.162	4.120	3.848	4.100

We then analyze the changes in GDP, domestic production, trade and transport services under scenarios GEOSANCTIONS (a) and (b). As shown in Table 4, under scenario GEOSANCTIONS (a) the Russian sanctions banning Georgian imports of wine, water, and fruits in response to the dispute over South Ossetia and Abkhazia result in GDP, export, and import

reduction in some countries with the largest reduction happening in Georgia, -24.7%, -95.8%, and -67.8%, respectively.

Table 4. Scenario GEOSANCTIONS (a) – GDP, trade and transportation impacts (no economic growth within 2006-2008), 10^{-3} percent change

Region	Year 2006 - 2007						Year 2007 - 2008					
	GDP	Exports	Imports	Other Transport	Water Transport	Air Transport	GDP	Exports	Imports	Other Transport	Water Transport	Air Transport
Australia	0.000	-0.019	0.011	-0.017	-0.005	-0.008	0.000	-0.002	0.001	-0.001	-0.001	-0.001
New Zealand	0.000	-0.022	0.001	-0.125	0.020	0.011	0.000	-0.002	0.001	-0.001	0.000	0.000
China	-0.011	-0.017	-0.004	-0.025	0.028	0.079	0.000	-0.001	0.000	-0.001	0.001	0.003
Hong Kong	0.000	-0.004	-0.006	-0.131	0.043	0.053	0.000	0.000	0.001	-0.001	0.001	0.001
Japan	0.000	-0.047	0.006	0.001	0.074	0.050	0.000	-0.004	0.001	0.000	0.003	0.001
South Korea	0.001	-0.011	0.000	-0.274	0.101	0.211	0.000	-0.001	0.001	0.000	0.004	0.008
North Korea	0.000	-0.006	-0.008	-0.053	0.011	-0.023	0.000	-0.001	0.000	-0.003	-0.001	-0.002
Indonesia	0.000	-0.007	0.004	-0.014	-0.007	-0.009	0.000	-0.001	0.001	-0.001	-0.001	-0.001
Malaysia	-0.002	0.000	0.005	-0.023	0.026	0.050	0.000	0.000	0.000	-0.001	0.000	0.001
Bangladesh	-0.001	0.013	-0.001	-0.002	-0.002	-0.016	0.000	0.000	0.000	0.000	0.000	-0.001
India	-0.003	-0.022	0.010	-0.012	0.034	-0.032	0.000	-0.002	0.001	-0.001	0.001	-0.002
Pakistan	0.000	-0.023	0.018	0.003	-0.043	-0.010	0.000	-0.002	0.001	0.000	-0.003	-0.001
Sri Lanka	0.005	0.006	0.152	0.009	-0.159	0.012	0.000	-0.001	0.006	0.000	-0.008	0.001
Canada	0.000	-0.007	0.028	-0.090	0.007	-0.007	0.000	-0.001	0.002	-0.001	-0.002	-0.001
United States of America	0.000	-0.038	0.020	-0.016	0.014	0.030	0.000	-0.003	0.001	0.000	0.000	0.001
Mexico	0.000	-0.013	0.016	-0.012	0.016	0.013	0.000	-0.001	0.001	0.000	0.000	0.000
Argentina	0.000	-0.051	0.049	-0.082	-0.154	-0.090	0.000	-0.003	0.003	-0.003	-0.009	-0.005
Bolivia	-0.001	-0.013	0.018	-0.028	-0.020	-0.039	0.000	-0.001	0.001	-0.001	-0.001	-0.002
Brazil	-0.001	-0.053	0.078	-0.011	-0.051	-0.002	0.000	-0.004	0.004	0.000	-0.003	0.000
Colombia	0.001	0.011	0.041	-0.018	-0.009	-0.013	0.000	0.000	0.002	-0.001	-0.002	-0.001
Venezuela	-0.001	-0.008	-0.038	-0.002	0.026	-0.022	0.000	-0.001	0.000	0.000	0.000	-0.002
Austria	-0.002	-0.016	0.007	-0.093	0.065	0.025	0.000	-0.001	0.001	-0.001	0.002	0.000
Switzerland	-0.001	-0.017	-0.025	-0.037	0.024	0.012	0.000	-0.001	-0.001	-0.001	0.001	0.000
Norway	0.000	0.006	0.007	-0.114	0.071	0.005	0.000	0.000	0.001	0.000	0.002	0.000
Bulgaria	0.009	-0.056	0.061	-0.238	0.064	-0.060	0.000	-0.006	0.006	-0.003	0.000	-0.008
Belarus	-0.004	0.107	0.032	-0.338	0.092	0.077	0.000	0.002	0.001	0.000	0.003	0.001
Romania	-0.001	-0.057	-0.013	-0.175	0.026	0.035	0.000	-0.007	0.002	0.000	-0.001	0.000
Russian Federation	0.009	-0.257	-1.306	-0.159	-0.061	-0.057	0.000	-0.010	-0.047	-0.005	-0.002	-0.001
Ukraine	-0.023	-0.025	-0.024	-0.239	0.189	0.232	-0.001	-0.003	-0.005	0.003	0.013	0.015
Kazakhstan	-0.001	0.174	0.166	-0.098	-0.029	-0.052	0.000	0.006	0.008	-0.001	-0.001	-0.002
Kyrgyzstan	-0.073	-0.472	0.373	-0.963	-0.366	-0.415	-0.003	-0.019	0.014	-0.038	-0.015	-0.015
Georgia	-24.696	-95.825	-67.834	40.895	75.898	72.275	-4.445	-2.107	-5.630	1.443	5.053	4.167
Israel	0.002	-0.021	0.032	-0.027	0.117	0.031	0.000	-0.001	0.001	-0.001	0.005	0.001
Iran	0.000	0.044	0.046	-0.070	0.068	0.043	0.000	0.001	0.002	-0.001	0.002	0.001
Turkey	-0.007	0.036	0.179	-0.040	-0.051	-0.086	0.000	0.000	0.005	0.000	-0.001	0.000
Ethiopia	0.007	-0.067	0.070	-0.043	-0.067	-0.106	0.000	-0.004	0.003	-0.002	-0.004	-0.006
Malawi	0.002	-0.023	0.082	-0.186	-0.021	-0.078	0.000	-0.002	0.004	-0.004	-0.002	-0.005
Uganda	0.000	0.007	0.027	-0.054	-0.040	-0.031	0.000	0.000	0.002	-0.003	-0.003	-0.002
Botswana	0.000	-0.011	-0.021	-0.130	0.021	-0.016	0.000	0.000	0.000	-0.001	0.000	-0.001
Rest of the World	-0.002	0.012	0.018	-0.119	0.030	0.037	0.000	0.000	0.001	-0.002	0.001	0.001
Total	-	-0.036	-	-1.083	0.122	0.522	-	-0.002	-	0.008	0.005	0.023

Although the export and import sales as well as the use of all transportation services in Russia decline due the import sanctions, its GDP increases by 0.009%. This result shows that the

impact of international sanctions is not always negative on sending country economies. Due to these sanctions we observe substitution between other and air/water transportation at the global level. Specifically, within the 2006 – 2007 period the decline of other transportation services by -1.083% is compensated by increased use of sea and air transport services by 0.122%, and 0.522%, respectively.

During the 2007 – 2008 period both Georgia and the rest of countries see improvements in main macroeconomic variables driven mainly by export and import substitution as well as changes in domestic production patterns. This result again supports the assumption about negative impacts of economic sanctions dissipating over time. At the end of the two year period of Russian sanctions global exports and the use of all transport services are growing and reducing the global negative impacts of sanctions.

Under scenario GEOSANCTIONS (b), shown in Table 5, we consider global economic growth along with the Russian sanctions prohibiting Georgian imports of wine, water, and fruits in response to the dispute over South Ossetia and Abkhazia. In all regions economic growth effects dominate the negative direct and indirect impacts of Russian sanctions imposed on Georgian imports. One exception is Romania, which experiences significant reduction in exports during the 2006 – 2008 period. This is again due to increased prices of its domestic production and exports driven by more expensive land and natural resource endowments.

Table 5. Scenario GEOSANCTIONS (b) – GDP, trade and transportation impacts (assuming economic growth within 2006-2008)

Region	Year 2006 - 2007						Year 2007 - 2008					
	GDP	Exports	Imports	Other Transport	Water Transport	Air Transport	GDP	Exports	Imports	Other Transport	Water Transport	Air Transport
Australia	3.682	2.756	4.309	3.621	3.596	3.584	3.622	2.862	4.149	3.571	3.566	3.552
New Zealand	3.450	3.314	3.194	3.430	3.585	3.591	3.444	3.255	3.226	3.412	3.586	3.556
China	6.991	8.731	5.033	7.151	6.316	6.656	6.839	8.595	4.914	6.992	6.223	6.561
Hong Kong	4.342	4.188	4.611	4.229	4.142	4.054	4.495	4.297	4.724	4.356	4.213	4.194
Japan	1.798	2.404	2.460	1.851	3.340	2.324	1.758	2.216	2.472	1.809	3.322	2.293
South Korea	4.919	3.753	4.925	4.619	4.184	4.070	4.861	3.912	4.814	4.577	4.181	4.097
North Korea	3.150	3.741	3.252	3.360	3.657	3.357	3.122	3.681	3.253	3.339	3.640	3.374
Indonesia	5.472	5.496	4.729	5.508	5.483	5.497	5.373	5.473	4.615	5.403	5.383	5.372
Malaysia	5.983	5.407	5.768	5.789	5.233	4.887	5.885	5.358	5.610	5.676	5.155	4.799
Bangladesh	5.352	4.529	5.218	6.248	6.199	6.214	5.295	4.677	5.108	6.140	6.096	6.186
India	5.962	8.031	4.507	6.080	5.396	5.842	5.828	7.950	4.397	5.922	5.380	5.755
Pakistan	5.823	4.512	5.741	6.350	5.488	5.548	5.626	4.710	5.446	6.095	5.438	5.455
Sri Lanka	6.425	4.713	6.761	6.836	4.869	6.814	6.392	5.049	6.572	6.732	4.973	6.707
Canada	2.433	2.750	2.188	2.600	3.427	2.888	2.517	2.679	2.332	2.656	3.385	2.893
United States of America	3.134	1.675	3.949	3.082	3.159	3.025	3.179	1.633	4.001	3.113	3.199	3.053
Mexico	3.593	3.279	3.082	3.648	3.644	3.597	3.691	3.226	3.252	3.735	3.709	3.667
Argentina	3.628	3.619	2.974	3.461	3.571	3.571	3.543	3.553	2.933	3.374	3.539	3.508
Bolivia	3.494	3.182	3.123	3.575	3.515	3.491	3.479	3.149	3.161	3.546	3.495	3.466
Brazil	3.830	0.353	5.289	3.688	2.884	3.575	3.757	0.513	5.115	3.617	2.912	3.519
Colombia	3.470	5.080	1.900	3.475	4.070	3.851	3.572	4.982	2.114	3.552	4.063	3.895
Venezuela	2.525	2.898	1.732	2.502	3.351	2.996	2.418	2.753	1.819	2.390	3.236	2.860
Austria	2.520	2.607	2.553	2.775	3.828	3.063	2.453	2.509	2.510	2.693	3.776	2.970
Switzerland	2.200	1.872	2.423	2.295	2.848	2.380	2.136	1.835	2.358	2.236	2.810	2.340
Norway	2.363	2.708	2.247	2.687	3.649	2.482	2.272	2.570	2.229	2.589	3.592	2.390
Bulgaria	4.194	2.138	4.598	3.540	3.662	2.276	4.066	2.246	4.380	3.490	3.678	2.396
Belarus	2.097	3.266	2.569	2.693	3.132	2.419	2.094	3.149	2.447	2.697	3.164	2.482
Romania	4.634	-17.363	16.34	4.673	-0.623	0.993	4.297	-14.026	13.394	4.523	0.084	1.547
Russian Federation	4.411	5.540	2.662	4.529	4.716	4.684	3.852	4.883	2.420	3.971	4.241	4.171
Ukraine	4.279	4.475	3.876	4.194	4.206	4.136	3.630	3.982	3.314	3.713	3.887	3.764
Kazakhstan	5.736	5.351	5.498	5.599	5.670	5.525	4.861	4.832	4.521	4.754	4.822	4.797
Kyrgyzstan	4.460	3.609	4.871	4.545	4.505	4.232	4.319	3.607	4.631	4.370	4.355	4.090
Georgia	7.751	3.249	8.132	6.267	4.449	5.561	6.193	3.600	6.263	5.304	4.139	4.829
Israel	3.571	2.649	3.802	3.480	4.052	3.641	3.686	2.776	3.856	3.580	4.038	3.647
Iran	5.056	5.851	3.655	4.951	4.712	5.089	5.039	5.763	3.747	4.865	4.595	4.923
Turkey	4.910	3.007	5.216	4.974	4.553	3.856	4.722	3.142	4.923	4.767	4.430	3.906
Ethiopia	5.115	5.529	4.585	5.647	5.495	4.948	5.361	5.753	4.790	5.911	5.714	5.077
Malawi	3.054	3.441	3.058	3.723	4.217	3.963	2.869	3.285	2.890	3.524	4.130	3.819
Uganda	5.466	5.680	4.741	6.009	5.277	5.791	5.427	5.646	4.715	5.949	5.298	5.748
Botswana	4.816	5.212	3.661	4.867	4.903	4.888	4.696	5.081	3.586	4.730	4.806	4.783
Rest of the World	4.151	3.929	4.116	4.155	4.104	3.960	4.078	3.865	4.052	4.069	4.062	3.907
Total	-	3.463	-	3.576	4.197	3.775	-	3.421	-	3.5213	4.176	3.779

As illustrated in Tables 4 and 5, the negative impacts of Russian sanctions on the Georgian economy are declining at the end of the 2006 – 2008 period, supporting the assumption that the negative effects of international sanction dissipate over time. Georgian exports and imports are carried via air, water, land and pipeline modes of transport, and therefore increased

use of all transportation services contributes to the economic growth in the country. Moreover, global exports and international use of all transport services are also increasing due to assumed global economic growth within the 2006 – 2008 period.

The Russian sanctions have considerable impact on the domestic production of sanctioned goods in Georgia, changing it for fruits by -0.5% and 0.001%, wine and water by 0.06% and 0.002%, and preserved fruits by -0.07% and 0.001% during the first and second years of sanctions under scenarios GEOSANCTIONS (a). The latter supports the assumption of dissipating effect of sanctions over time. We also observe that Russia reduces its production of wine, water, and preserved fruits, while substituting reduced imports of fresh fruits with increased local production and reduced imports of wine, water, and preserved fruits from Georgia with imports of these goods from other regions during the first and second years of economic sanctions. Also, due to export substitution the reduction in Georgian exports of fresh and preserved fruits is becoming less severe within the 2006 – 2008 period.

Under the scenario GEOSANCTIONS (b), the domestic production of sanctioned goods in Georgia grows throughout the first and second years of sanctions. During the same period the Russian economy increases its production and imports of sanctioned goods to substitute for reduced imports of such goods from Georgia. Also, due to export substitution Georgian exports of fresh and preserved fruits, wine, and water increase within the 2006 – 2008 period.

6. Conclusions

The severity of international sanctions and the choice of target countries and sectors have insightful implications for the economic effects of such sanctions. Although in case of international sanctions imposed against North Korea both the target and sending economies

experience negative direct and indirect impacts, we can clearly see that the Russian sanctions imposed against Georgian imports positively affect the Russian economy, while having a negative impact on Georgia during the initial period of sanctions. These results illustrate that the impact of international sanctions will negatively affect the target country economy but not necessarily the sending country.

International sanctions have significant impacts on the domestic production of sanctioned goods. Our results indicate that the UN sanctions significantly increase the domestic production of sanctioned goods in North Korea during the first and second years of sanctions. The majority of other countries reduce their production of sanctioned goods due to decline in exports to North Korea and other regions. However, the economic growth during the sanctions period induces other countries to increase their trade of sanctioned goods with the rest of the world. Our second scenario of international sanctions shows that the Russian economic sanctions have dissipating impact on the domestic production of sanctioned goods in Georgia resulting in increased local production of such goods driven by increased exports to other countries. We also observe that Russia increases its production of fresh fruits, while substituting reduced imports of wine, water, and preserved fruits from Georgia with imports of these goods from other countries during the period of economic sanctions. However, the economic growth during the sanctions period induces Georgia to increase the domestic production of sanctioned goods, while resulting in increased production and imports of these goods in Russia to substitute for reduced imports from Georgia. Due to export substitution Georgian exports of sanctioned goods increase within the economic sanctions period.

Since the sea transport is the most cost-effective mode of transportation to move goods and raw materials between countries, over 90% of the world's trade is carried by sea[6]. Therefore, any international trade sanction will have the largest negative impact on sea transportation, as shown in our analysis. Tables 1 and 4 illustrate that at the end of the two year period of international sanctions the global water transportation is the most affected mode of transport under both the UN-North Korea and Russia-Georgia sanctions.

Overall, our results indicate that both direct and indirect negative impacts of international sanctions on target economies dissipate over time due to export and import substitution, changes in domestic production patterns, and transport mode substitution. Finally, the results of this study have some limitations due to compositional variations in the sanctioned goods across regions.

[6] https://business.un.org/en/entities/13

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