

# **A Custom Made CGE Model for an Isolated, Politically Non-recognized Small Island Economy: Exogenous Income Shock to the North Cyprus Economy**

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## **Abstract**

The objective of this study is to construct a single-country general equilibrium model for North Cyprus economy and explore the impact of external income shock on the economy as a whole. The model it is the first comprehensive model describing the economic activities in North Cyprus and it is constructed using a 3-level nested CES function in production, utility maximization structure in consumption and investment demand. Government sector spends the fixed proportion of its revenues on commodities, and a trade closure is determined by Armington and CET functions for import demand and export supply of goods and services.

North Cyprus economy is a small island economy. Significant trade barriers exist primarily due to unrecognized status of the Turkish Republic of North Cyprus as a sovereign state. Therefore the unstable political environment makes the North Cyprus economy highly vulnerable to external shocks. Imposing external income shock by 40 percent accelerated the expenditures but resulted in greater trade deficit in North Cyprus. Despite the adverse effect on the trade balance, results show that output of construction, wholesale & trade and hotels & restaurants increased and household's utility increased due to higher income.

In the first section, the study gives the brief description and recent economic developments in North Cyprus Next section is the literature review, followed by the methodology used in this paper. Finally the paper presents the implications of the external income shock on main macro-economic variables.

**Keywords:** General Equilibrium Model, Foreign Savings, Migrant Remittances, North Cyprus

**JEL Classification:** C68

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## 1. Introduction

Economic isolation from the world economy due to the current political situation has led to limited production capability in North Cyprus. Due to the market inefficiency in goods and factors market, North Cyprus economy fails to utilize its resources and thus, it has been extremely difficult to achieve its economic goals. The economy is highly dependent on the Turkish economy; besides, being a small island with specific features, North Cyprus economy suffers from high taxation, duties and transportation costs. Turkish Cypriot economy has been negatively affected by the international economic and financial crises in the recent years. Despite the various attempts to resolve the current situation in Cyprus, isolation and political unrecognition on the north part of the island still continues. In April 2003, crossing the Green Line became possible and the movement across the Green Line by the both Turkish and Greek Cypriots seems benefited the economies of both communities according to the Economic Interdependence Report (2011). The report shows that, consumer expenditures accelerated since 2003 and social insurance payments and health services, wholesale & retail sectors, hotels & restaurants have all benefited the Turkish Cypriot economy by an estimated 185 million Euros in 2008. It is also estimated in expenditure terms that, in 2009 funds moving from south to north Cyprus were 192 million Euros (342 million TL) of which, 118 million Euros comes from the Tourists, and 74 million Euros is due to labor income, pensions and trade.

Since 2003 the characteristic of the labor market in the North has changed. Large numbers of Turkish Cypriot workers without any restriction are moving towards the Green Line and those who work in the South, transfer their earnings in the form of remittances to the North part of the island. Overall, 35 percent of the Turkish Cypriots who registered as employed in the south part of the island mainly work in the construction sectors. This is due to the non-recognition of their qualifications and communication problems in Greek language. The effect of the labor mobility not only increased the wage earnings of host country employees but also attracted the foreign workers from Turkey. Under these circumstances Turkish Cypriot workers who leave the workforce, are replaced by the immigrant workers coming from Turkey. Our concern in this study is to study the macroeconomic consequences of migrant remittances due to labor mobility on the Island. The surge in migration and remittances has received increasing attention for decades. *Bayangos and Jansen (2011)* analyzed the effect of the migration

remittances on competitiveness and according to the authors remittances constitute an inflow of finance which may lead to an appreciation of the real exchange rate undermining the competitiveness of the traded-goods sector and, in particular, of exports; the so-called Dutch disease effect. However, an increase in remittances may affect competitiveness also through other channels. An increase in remittances inflows is associated with an out-migration of workers decreases domestic labor force, moreover, households receiving remittances may use the higher income to reduce work effort and increase leisure or education, which will further reduce the labor supply. The reduction of the labor supply may also lead to an increase in the wage level, which will increase production cost and reduce competitiveness.

In this paper, we develop a CGE model which reveals the characteristics of the North Cyprus economy as well as the labor market features. In the model, industries are broken down into 13 sub-industries. However, there are four factors of production in the 3-level nested CES production function and for the benchmark year, outcome reveals the value added of the economy. Then value added together with the intermediate production gives the total output in 1998. The first and the last input-output matrix is prepared in 1998 and we are assuming that the structure in North Cyprus has not changed since 1998. There are many studies in the literature analyzing the migration impact on productivity and it is empirically proved that immigration benefits the host countries if the skills are complement with the other production factors in economies in the long-run, even though immigration lowers the wage earnings of the nationals. However, migration may negatively affect the host country's productivity when they are substitute to the production factors. According to *Borjas (1994)*, there can be harmful effects despite the benefits of immigration when migration occurs. For example, if immigrants lack the skills that employers demand and find it difficult to adapt, immigration may significantly increase the costs associated with income maintenance programs as well as exacerbate the ethnic wage differentials already exists in the host country. Conversely, if immigrants are complements then additional labor force should result in an increase in the earnings and also employment opportunities of natives in the long run.

In this study, workers are categorized into two groups in order to analyze their contribution in production separately. To distinguish labor, we used 1996 Census of North Cyprus, where labor force in each industry is classified by their education level. In the production function land and natural resources is also included. According to *PRIO (2006)*, land prices in the North rose by

417 percent between the first half of 2003 and the first half of 2006. Despite the higher land prices, property prices are still more expensive in the South relative to the prices in the North. Easing the borders between the North and the South parts of Cyprus had certainly increased the expectations on the solution of the Cyprus problem.

The rest of the economy is included in the CGE model as follows. Households, who own the production factors, try to maximize their utility their preferences are shown with the Cobb-Douglas utility function. They demand traded goods and services. Businesses' investment decision is constrained with the total savings in North Cyprus and their behavior is shown in the Cobb-Douglas function. Government collects direct and indirect taxes through the circular flow and their expenditures on goods and services and on transfers are the fixed proportion of their total revenues. Export supply and import demand functions are represented by the CET and CES functions with Armington assumptions respectively.

## **2. Background Notes of the North Cyprus Economy**

In North Cyprus, there is large flow of savings coming from elsewhere, mainly from Turkey and the UK, and the investment expenditures are financed jointly by domestic savings and foreign savings. On the other hand, branches of Turkish Banks collect savings in North Cyprus and these savings are used to finance investment elsewhere. Considering all mentioned above, there is potential of capital flow into the country as well as saving inflow as economic circumstances change. Therefore as capital inflows, prospective increase of rate of return would have direct and upward effect on land and natural resource prices. Table 1 presents the saving-investment shares, public expenditures and trade balance in real GDP.

**Table 1: Saving, Investment and Trade Balance Shares in Real GDP**

	<b>2000</b>	<b>2004</b>	<b>2007</b>
Total Investment	17.31	26.33	39.59
Fixed Investment	15.82	24.10	38.68
Public Investment	6.38	7.57	9.53
Private Investment	6.81	7.63	9.29
Foreign Savings	3.16	1.04	11.81
Domestic Savings	14.14	25.29	27.77
Total Savings	17.31	26.33	39.59
Public Revenues	37.38	52.84	63.22
Total Expenditure	51.12	66.01	77.23
Current			
Expenditure	19.87	22.82	33.89
Foreign Trade			
Balance	-2.61	-12.53	-20.95

*Source: State planning Organization of TRNC*

As it is indicated in Table 1, periods are chosen to implement the circumstance of the economy before the recession started in North Cyprus. Easing the borders in 2003 had a positive impact on the country's growth performance. Turkish Cypriot economy experienced a rapid rate of growth trend between 2003 and 2007, due to positive effect of expectations on solution on Cyprus problem and EU perspective framework. In this period the real growth rate of GDP and GNP progressed between 10.6 and 14.2 percent and 11.4 and 15.4 percent respectively according to State planning Organization of TRNC (Turkish Republic of North Cyprus). However, high growth rate of private investments has affected trade volume, imports increased. Greater production and employment provided high growth rate on public disposal income. Higher government income provided expansion on public current expenditures and public investments decreasing the public saving deficit. As private sector investment expenditures have increased more than consumption expenditures, improvement has been achieved in private sector savings designated for investments.

Table 2 presents the sector shares in real GDP between 2000 and 2010. As it is shown, the lowest share has been experienced in agricultural sector due to the negative climatic conditions in Cyprus.

**Table 2: Distribution of Gross Domestic Product by Sector (%)**

	2000	2004	2008	2010
Agriculture	6.9	9.1	5.1	5.9
Industry	10.5	9.4	10.7	9.8
Quarrying	0.6	0.5	0.8	0.6
Manufacturing	5.7	4.8	4.0	2.3
Electricity - Water	4.3	4.0	5.9	6.9
Construction	4.5	4.3	7.1	5.6
Trade-Tourism	16.1	15.9	14.2	16.0
Wholesale and Retail Trade	10.0	10.8	9.7	10.7
Hotels and Restaurants	6.1	5.2	4.5	5.4
Transport-Communication	13.0	10.5	12.1	9.4
Financial Institutions	6.4	7.6	7.0	7.2
Ownership Of Dwellings	2.4	2.5	3.5	3.9
Business and Personal Services	8.0	9.2	10.3	11.6
Public Services	24.0	20.8	21.7	21.0
Import Duties	8.2	10.7	8.2	9.6

*Source: State planning Organization of TRNC*

Largest sector share in GDP belongs to the public services, followed by trade and tourism sector and transport and communications. Positive developments and growth in physical production during the 2003 and 2007 period has also been due to increase in foreign demand. The construction sector has increased its share in the economy as a result of speeding up of the infrastructural investments. Apart from larger amount of new investments in tourism sector, renovation, local and foreign demand for dwellings and higher public infrastructural investments have all caused the rapid growth in construction and sectors.

### 3. Literature Survey

There are various studies in the literature using the CGE model approach; to simulate the welfare effects of trade liberalization, exchange rate regime, environmental effect, migration on so on. General equilibrium models are widely used when it comes to show the distributional effects of the exogenous shocks both on the main macro variables as well as at the intermediate level depending on how the model is structured.

*Stifel and Thorbecke (2003)* built a CGE model for the African economy to stimulate the welfare effects of trade liberalization specifically on poverty. Their study provides the basis for analyzing the distribution of modern and informal sector activities in both rural and urban areas. The evidenced that changes in population shares of the socio-economic groups that follow population shifts have important implications for the magnitude of changes in national poverty.

*Okkers (2005)*, taking labor heterogeneity and all the channels into account built a CGE model to stimulate the effect of immigration in Belgium. His results show that although immigration is macro-economically beneficial, there is significant adverse effect of immigration at the distributional stage.

Study by *Brown and Leeves (2007)* addresses the interrelationships between migration, remittances and household income in two Pacific Island countries, Fiji and Tonga. The analysis aims to identify the effects on household income sources of the combined impacts of the migrant's absence and the inflow of remittances, taking into account how migration and remittances can have both positive and negative effects. The empirical analysis is based on household survey data collected by the authors and they used the methodology developed by *Taylor et al. (2003)* to conduct their findings. Their results indicate that migration can have significant effects on subsistence income, although neither migration nor remittances appear to any significant effects on market agricultural activities.

*Iyjaz and Aftab (2011)* analyzed the welfare impact of labor emigration and workers' remittances and their findings suggest that remittances are an important financial inflow since remittances is a big source of foreign exchange earnings. Negative outflow of labor force is being cancelled out by a positive inflow of workers' remittances to Pakistan. However,

emigrants do contribute positively towards the GDP in Pakistan despite the contribution of emigrants the contribution of local labor force is more than that of the emigrants.

In another analysis, *Ottaviano and Peri (2007)* using the supply driven component of immigration tried to analyze the consequences of migration on wages, consumption and housing prices of natives in simple general equilibrium framework. They founded that, there are positive and significant wage and housing price effects which are caused by immigration. In an economy with workers of different skills, natives respond to inflow of immigrants by moving around and upgrading their jobs, as there are complementarities between the skills and services produced by natives and immigrants. Although immigrants have a small and negative effect on wages of unskilled natives, this negative effect due to increase in the supply of unskilled workers are partly compensated by the complementarities within the skill groups.

*Barajas, Chami, Hakura and Montiel (2011)* analyzed the effect of worker remittances on the equilibrium real exchange rate in recipient countries. Their findings show that, large inflows of worker remittances have been perceived as posing macroeconomic challenges for the recipient countries. The authors think that worker remittances challenge the equilibrium mechanism as large inflows of worker remittances could lead to the emergence of “Dutch disease,” that is, remittance inflows could result in an appreciation of the equilibrium real exchange rate that would tend to undermine the international competitiveness of domestic production, particularly that of nontraditional exports.

However, *Williams (2003)* contributes on the debate using three-region, three factor, and six-good multi-national computable general equilibrium model. The model was constructed as follows; for the one type of producer, capital is explicitly included in the nested CES type production function together with unskilled labor. Then for the second type of producer, again CES type production function is used where skilled labor and composite of unskilled labor and capital are used as inputs to the production function. Each producer minimizes their cost functions subject to their production functions. As a result factor demand functions are derived to be used in the CGE model. The author included capital income in household income assuming two types of households exists in the model namely rich and poor. Each household is assumed to have a different type of nested CES utility function. They try to maximize their utility subject to

their income constraints. One type of households' derived demand functions consist of composite traded and non-traded goods on the other hand, the other household demands only traded goods. Government sector also is included to impose taxes and redistribute income among the households. It is assumed that government budget to balance in this analysis. Then the model is calibrated using (assuming) the elasticity of substitution between composite traded and non-traded goods for the households and the values used for the elasticity of substitution among the production factors also are based on some assumptions. The author concludes his analysis mentioning some important limitations. First of all, CGE models are static models and they cannot forecast the timing of adjustments from benchmark to counterfactual equilibrium. Those static models cannot capture any additions to human capital that occur over time. Because of the data limitations, the author aggregated the entire "rest of the world" into one region and this was unrealistic. Simulation impacts of various shocks fluctuate widely from one study to another. CGE model is widely used to quantify the effects of those shocks on economies which takes all the channels into account such as, the links between capital and labor and the interactions between the factor markets, good and service markets, therefore it seems to be an appropriate tool to stimulate the non-factor external income shock on the North Cyprus economy.

#### **4. Methodology and Algebraic Modeling**

The single-country general equilibrium model with references to the case- specific features of North Cyprus is constructed as follows. There are 2-goods "tradable and non-tradable", 4-factors, 13-industries. In the production process we use a 3-level nested CES function. Household's utility maximization is constrained by their income which are factor' income and the transfers they receive. A constrained optimization function for investment demand is represented by Cobb-Douglas function and government sector is included where fix proportion of their revenue is spent on goods and services. Finally, trade closure is determined by Armington and CET functions for import demand and export supply of goods and services.

##### *Households:*

There is only one type of household who demand goods and services. Households have the following type of utility function.

$$U = \sum_{i=1}^n C_i^{\alpha C_i} \quad i = 1, \dots, 13 \quad \text{where} \quad \sum \alpha C_i = 1 \quad (1)$$

Household's income comes from the factors of production and from the government transfers shown by the following equation.

$$MY = lw.LS + hw.HS + kw.KS + rw.RS + Trans \quad (2)$$

Their income is subject to taxation, then household save some proportion of their income. Finally disposable income in other words, households budget constraint is derived as follows.

$$M = (1 - tm).MY - SH \quad (3)$$

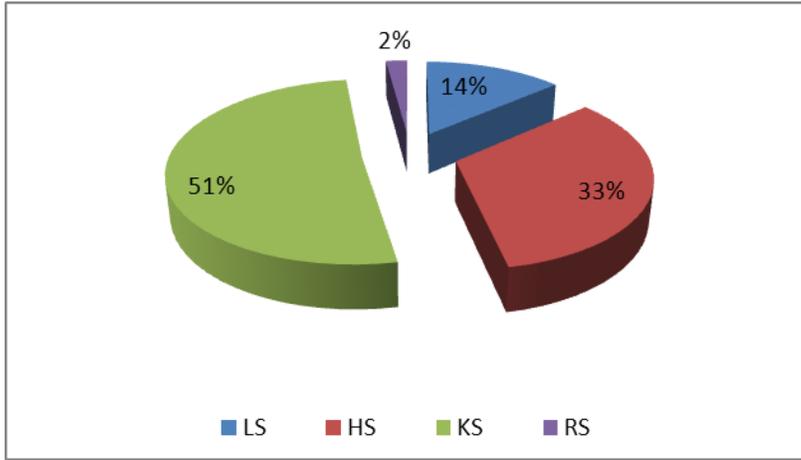
Households then maximize their utility function subject to their budget constraint and the derived demand for the commodities is shown as;

$$C_i = \frac{1}{PC_i} \cdot \alpha C_i \cdot M \quad (4)$$

#### *Production:*

There are four factors of production unskilled labor, skilled labor, capital and land and they are represented by the 3-level nested CES production function. Production at the intermediate level is represented by the Leontief function and that is based on the 1998 input-output table. Output for the whole economy is produced by adding the sum of intermediate inputs to the value added  $VA_i$ . Chart 1 presents the factor shares in value added where LS is the unskilled labor supply, HS is the skilled labor supply, KS is the capital stock and finally RS represents the land and natural resources in North Cyprus. Then the production process is shown by the following CES function (Equation 5).

Figure 1: Factor shares in Output



Source: Input-Ourput Tables, 1998

$$XD_i = A_i \left\{ \delta_i \left[ \underbrace{\beta_i \left[ \underbrace{(\gamma_i K_i^{\mu_i} + (1-\gamma_i)L_i^{\mu_i})^{1/\mu_i}}_{J_i} \right]^{\rho_i}}_{G_i} + (1-\beta_i) H_i^{\rho_i} \right]^{\theta_i} + (1-\delta_i) R_i^{\theta_i} \right\}^{1/\theta_i} \quad i = 1, \dots, 13$$

Where  $A_i = \frac{XD_i}{VA_i}$

Producers minimize the average cost of production subject to the nested CES production function and factors demand derived from the optimization are as follows.

$$K_i^* = \frac{\gamma_i^{e_i} \cdot k_i^{-e_i}}{\left( \gamma_i^{e_i} \cdot k_i^{1-e_i} + (1-\gamma_i)^{e_i} \cdot l_i^{1-e_i} \right)^{-(e_i/1-e_i)}} \cdot J_i \quad (6)$$

$$L_i^* = \frac{(1-\gamma_i)^{e_i} \cdot l_i^{-e_i}}{\left( \gamma_i^{e_i} \cdot k_i^{1-e_i} + (1-\lambda_i)^{e_i} \cdot l_i^{1-e_i} \right)^{-(e_i/1-e_i)}} \cdot J_i \quad (7)$$

$$H_i^* = \frac{(1 - \beta_i)^{se_i} \cdot h_i^{-se_i}}{\left(\beta_i^{se_i} \cdot j_i^{1-se_i} + (1 - \beta_i)^{se_i} \cdot h_i^{1-se_i}\right)^{-(se_i/1-se_i)}} \cdot G_i \quad (8)$$

$$R_i^* = \frac{(1 - \delta_i)^{ge_i} \cdot r_i^{-ge_i}}{\left(\delta_i^{ge_i} \cdot g_i^{1-ge_i} + (1 - \delta_i)^{ge_i} \cdot r_i^{1-ge_i}\right)^{-(ge_i/1-ge_i)}} \cdot XD_i \quad (9)$$

Then composite price  $\hat{J}_i$  for composite input  $J_i$  is calibrated, substituting optimum labor  $L_i$  and capital  $K_i$  combinations into the cost function and composite price  $\hat{g}_i$  for composite input  $G_i$  is calibrated using optimum combinations of  $J_i$  and  $H_i$ .

After all, zero profit condition holds in production where total revenue from producing the output equals the total cost of production. Results are shown in table 1 are consistent with the benchmark equilibrium.

**Table 3: Domestic output and composite inputs produced within the Nested Production Stage (Values are in Current prices, TL)**

	$XD_i$	%	$J_i$	%	$G_i$	%
1. Crop Production	18,163,540	4.82	7,503,738	7.87	7,263,867	7.13
2. Livestock Production	18,683,020	4.95	9,835,623	10.31	9,759,920	9.59
3. Forestry	114,625	0.03	78,425	0.08	76,121	0.07
4. Fishing	339,163	0.09	208,231	0.22	193,880	0.19
5. Quarrying	2,100,864	0.56	796,860	0.84	706,207	0.69
6. Manufacturing	40,450,770	10.73	7,032,455	7.37	5,943,650	5.84
7. Electricity - Water	12,787,540	3.39	1,636,563	1.72	2,294,150	2.25
8. Construction	31,712,940	8.41	9,202,945	9.65	8,465,943	8.31
9. Wholesale and Retail Trade	47,780,290	12.67	9,665,005	10.13	8,351,027	8.20
10. Hotels and Restaurants	35,901,280	9.52	9,050,373	9.49	7,612,247	7.48
11. Transport and Communication	46,163,640	12.24	10,777,430	11.30	8,999,222	8.84
12. Financial Institutions	32,935,490	8.73	14,644,510	15.35	11,691,910	11.48
13. Dwellings Business and Personal & Public Services	89,982,350	23.86	14,946,160	15.67	30,466,330	29.92
Total	377,115,512		95,378,318		101,824,474	

Source: GAMS output for the North Cyprus Economy's CGE model

*Investment:*

Investment purchases such as physical capital, machinery and equipment by the private and public corporations are financed by the total savings in the economy. Total savings consist of private savings, public savings and foreign savings. Private savings are endogenously determined in the model and public and foreign savings are exogenously fixed variables. In other words, public savings and foreign savings closure the government budget and trade balance respectively. Private and public sectors then demand those capitals which is determined through Cobb-Douglas function shown below.

$$I_i^* = S_i (\alpha I_i) P_i^{-1} \quad (10)$$

Where,  $\sum_{i=1}^n \alpha I_i = 1$

*Government:*

Government collects direct and indirect taxes and spends the fixed proportion of its revenue on community services and consumption goods. However, government also makes transfer payments and the inclusion of the transfer payment is shown in equation (2). In our model, government expenditures are exogenous, tax instruments are endogenous to reflect (increase) the revenues and government balance is fixed. Following equations represents the government's behavior in the model.

$$EG = \sum_{i=1}^n CG_i + Transf \quad \text{and} \quad TAXR = EG + SG \quad (11)$$

*Rest of the World:*

Demand for imported commodities is represented by CES function with Armington (1969) assumption to identify traded goods and services in-use, separately. The assumption is widely used in the CGE models to define demands for domestically produced commodities, as well as demand for imported goods when the products are nationally differentiated following *Lloyd and Zhang 2006*. With the Armington structure, two-stage budgetary allocation procedure is assumed. Firstly, budget is allocated among the domestically demanded commodities and then

expenditure on each commodity is allocated between domestic and imported commodities. In order to derive the demand for domestic and imported commodities, firms minimize their cost, subject to their CES type production function and solving the problem yields the following import demand functions.

$$XDD_i = (1 - \varphi T_i)^{\zeta T_i} \cdot PDD_i^{(-\zeta T_i)} \cdot \left[ (1 - \varphi T_i)^{\zeta T_i} \cdot PDD_i^{(1-\zeta T_i)} + (\varphi T_i)^{\zeta T_i} \cdot PIM_i^{(1-\zeta T_i)} \right]^{\frac{\zeta T_i}{(1-\zeta T_i)}} \cdot \frac{SX_i}{AR_i} \quad (12)$$

$$IM_i = (\varphi T_i)^{\zeta T_i} \cdot PIM_i^{(-\zeta T_i)} \cdot \left[ (1 - \varphi T_i)^{\zeta T_i} \cdot PDD_i^{(1-\zeta T_i)} + (\varphi T_i)^{\zeta T_i} \cdot PIM_i^{(1-\zeta T_i)} \right]^{\frac{\zeta T_i}{(1-\zeta T_i)}} \cdot \frac{SX_i}{AR_i} \quad (13)$$

For the supply of exported commodities, each industry produces a composite commodity  $XD_i$  which can be exported and/or sold domestically in the market. In this structure, exports and domestically sold products are assumed to be differentiated by market (with respect to their prices), with the relationship between them represented by a constant elasticity of transformation (CET) function. CET function describes the market transformation process and each firm allocates its output between the domestic and export markets. Domestic supply function for goods is derived from the first order conditions and following supply functions are obtained.

$$XDD_i = (1 - \gamma T_i)^{\frac{1}{1+\rho T_i}} \cdot (PDD_i)^{\frac{1}{1+\rho T_i}} \cdot \left[ (\gamma T_i)^{\frac{1}{1+\rho T_i}} \cdot (PE_i)^{\frac{\rho T_i}{1+\rho T_i}} + (1 - \gamma T_i)^{\frac{1}{1+\rho T_i}} \cdot (PDD_i)^{\frac{\rho T_i}{1+\rho T_i}} \right]^{\frac{1}{\rho T_i}} \cdot \frac{XD_i}{\alpha T_i} \quad (14)$$

$$E_i = (\gamma T_i)^{\frac{1}{1+\rho T_i}} \cdot (PE_i)^{\frac{1}{1+\rho T_i}} \cdot \left[ (\gamma T_i)^{\frac{1}{1+\rho T_i}} \cdot (PE_i)^{\frac{\rho T_i}{1+\rho T_i}} + (1 - \gamma T_i)^{\frac{1}{1+\rho T_i}} \cdot (PDD_i)^{\frac{\rho T_i}{1+\rho T_i}} \right]^{\frac{1}{\rho T_i}} \cdot \frac{XD_i}{\alpha T_i} \quad (15)$$

Finally trade balance is shown in equation (16) where foreign saving is exogenously

$$\text{fixed. } \sum_{i=1}^n PMW_i \cdot IM_i = \sum_{i=1}^n PEW_i \cdot E_i + SF \quad (16)$$

## **5. Data and Calibration**

When we started modeling the first CGE model of the North Cyprus economy, several issues have arisen. At the very beginning of construction of the CGE model, we needed to calibrate some of the variables in order to complete the model. In practice, data representing benchmark equilibrium that are used in calibration are constructed from national accounts and other government data sources. Calibration involves one year's data and consistent data is shown in the SAM in Appendix. Required values for the relevant elasticities identify other parameters such as distribution parameters; are based on other sources. Thus, elasticity of substitution parameters is taken exogenously from the various resources. Elasticity of substitution parameter values are very important as they specify the curvature of the isoquants and indifference surfaces, with their position given by the benchmark equilibrium data. After completing all the variables and the parameters needed for the model, the system is validated and the model is run for the benchmark year. Equilibrium conditions which characterize the model are whether demand equals supply in goods market and factors market. However, in the labor market, we assume there is no unemployment and thus, labor supply equals the labor demand. System constraints are satisfied through the optimization processes at each sub section. Finally, Walrasian constraints are imposed and homogeneity tests are applied to verify the reliability of the model.

## **6. Preliminary Simulation Results and Conclusion**

At the first stage, the model was solved for the base year without imposing any changes in the parameters or exogenous variables so that the optimal solution replicates the original values for the benchmark year. Then, benchmark year results are saved for comparison with the results of the simulations implemented at the second stage. The study focuses on the impacts of the remittances (non-factor income) on main macro-economic variables. We assumed that, Turkish Cypriots (unskilled workers) who work in the South Cyprus are replaced by the Turkish workers. Although labor is mobile across the borders, there is no change in labor supply. We also assumed that, land and skilled labor endowments are exogenously fixed and wages, rent and return on capital adjust after the shocks are being implemented. In order to show the impact of non-factor income on macro-economic variables, we increased foreign savings by 40 percent and allowed

capital movement in our model. Simulation results on main macro-economic variables are shown in the following tables.

**Table 4: Counterfactual Equilibrium Compared to Benchmark Equilibrium**

	Benchmark	Simulation	% Change
Investment	49,779,827	67,731,637	36.06
Stocks	3,075,951	3,075,951	0.00
Consumption	188,419,094	191,534,070	1.65
Public Expenditures	62,884,655	67,385,475	7.16
Imports	163,766,671	188,633,429	15.18
Import duties	23,527,821	23,527,821	0.00
Exports	111,904,224	116,026,037	3.68
GDP	228,769,259	233,591,920	2.11

*Source: GAMS output for the North Cyprus Economy's CGE model*

40 percent increase in foreign savings increased consumption expenditures by 1.65 percent, government expenditures by 7.16 percent and investment expenditures by 36.6 percent. Investment expenditures increased dramatically and the main source of the growth in investment expenditures is the savings. This suggests two things; first, the shock is imposed on the foreign savings and that directly finance country's domestic investments secondly, 15.8 percent rise in imports and reduction in exports in real terms deteriorates the foreign trade balance. Although GDP increased by 2.11 percent in nominal terms, it is observed that, trade deficit as percentage in nominal GDP increased by 37 percent.

The price effects, income effect and the changes in consumers' utility are also shown in Table 5. It is clearly seen that households are better off. With additional transfers into their budget, their utility increased by 1.51 percent. Tax revenues are increased by 8.96 percent and income increased by 4.87 percent.

**Table 5: Counterfactual Equilibrium Compared to Benchmark Equilibrium**

	Simulation ( % Change)
HHs Saving	4.87
Foreign Saving	40.00
Public Saving	0.00
Tax Revenue	8.96
Income	4.87
Expenditure	4.87
Household's Utility	1.51
Unskilled labor wage	4.45
Skilled labor wage	5.25
Capital return	3.42
Rent	5.54
CPI	3.21

*Source: GAMS output for the North Cyprus Economy's CGE model*

In our analysis, we had assumed that wages, rent and return on capital adjusts to keep the factors market in equilibrium and foreign exchange rate is fixed as the North Cyprus economy is too small to affect the world prices. It is observed in Table 5 that wages of unskilled and skilled labor increased by 4.45 percent and 5.25 percent respectively. Return on capital increased by 3.42 percent and this is reflected by the 1.6 percent capital inflow. Finally land prices increased by 5.54 percent together with 3.21 percent increase in consumer price index.

The micro-simulations in Table 6 presents the sectorial changes in output, domestic output supplied on the domestic market and the domestic sales of composite commodities demanded by intermediate users and final demanders. It is observed that output increased in construction sector by 33.22 percent, wholesale & trade sector by 4.26 percent and hotels and restaurants sector by 6.40 percent. Reduction in manufacturing sector's output by 22.8 percent implies that production in manufacturing goods heavily depends on the imported materials. As its show in column (3), domestic sales of manufacturing goods increased by 6.71 percent after the shock. It was pointed out by the various studies that since 2003 construction and related sectors busted. The simulations also reveal that domestic output supplied on domestic market in quarrying and

construction sectors increased by 19.79 percent and 33.22 percent respectively. Wholesale & retail trade and financial institutions are also benefited by 3.69 percent and 2.11 percent respectively. In column (3), domestic sales of composite commodities demanded are presented and all the sectors except crop, livestock and electricity& water production benefited with additional income.

**Table 6: Changes in Output, Domestic Supply and Demand by Sector**

	Output (XD) (1)	Domestic Output Supplied on Domestic Market (2)	Domestic Sales of Composite Commodities (3)
1. Crop Production	-11.86	-14.30	-1.95
2. Livestock Production	-8.91	-8.92	-8.64
3. Forestry	-5.05	-5.05	2.15
4. Fishing	-1.25	-1.25	6.08
5. Quarrying	-11.86	19.79	24.00
6. Manufacturing	-22.80	-36.68	6.71
7. Electricity - Water	-1.72	-1.72	-1.69
8. Construction	33.22	33.22	33.22
9. Wholesale and Retail Trade	4.26	3.69	3.69
10. Hotels and Restaurants	6.40	-45.11	-5.64
11. Transport and Communication	-2.65	-4.81	0.67
12. Financial Institutions	2.81	2.11	2.31
13. Dwellings Business and Personal & Public Services	0.59	-4.28	5.18
<b>Overall Impact</b>	<b>-18.83</b>	<b>-63.33</b>	<b>66.08</b>

Source: GAMS output for the North Cyprus Economy's CGE model

(1) Domestic output

(2) Exports are excluded from domestic output

(3) Imports are included

The aim was to construct the first CGE model for the North Cyprus economy and analyze the impact of the external income shock on the main macro-economic variables and output. The simulations showed that external income certainly stimulates the demand side of the economy as investments, consumption and government expenditures increase but at the same time higher import demand deteriorates the trade balance. Nominal GDP increased around 2 percent, and considering the higher price index Real GDP decreased. However, output which consists of value added and intermediate inputs, decreased by 18 percent prior to the shock. Main sectors facing a decline in production are manufacturing, quarrying, agriculture and electricity & water. However, wages rent and capital prices increased as expected and there is a 1.6 percent capital inflow. This study focused only on the external income effect keeping the other model determinants constant. It is observed that our findings are consistent with the official findings of North Cyprus State Planning Organization that the economy experienced a growth after 2003. The CGE model results not only show the impact of the simulations at the aggregate level but also it enables us to view the distributional effects in production and demand side in the economy. Imposing an external income shock was the first scenario we planned to implement. It will be very interesting to show the combine effects of different scenarios on the economy as there are many other influences, such as labor mobility across the borders, immigration issues and frequent changes in the prices. Our economy is experiencing a deep recession and there are economic and political instabilities which makes the economy vulnerable to changes. New reforms are implemented, and many of other reforms are planned to take place in the new future. We suggest that the structure of the economy must be analyzed critically before imposing any changes in the structure.

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# Appendix

Chart 1: CGE Model - The Market Supply

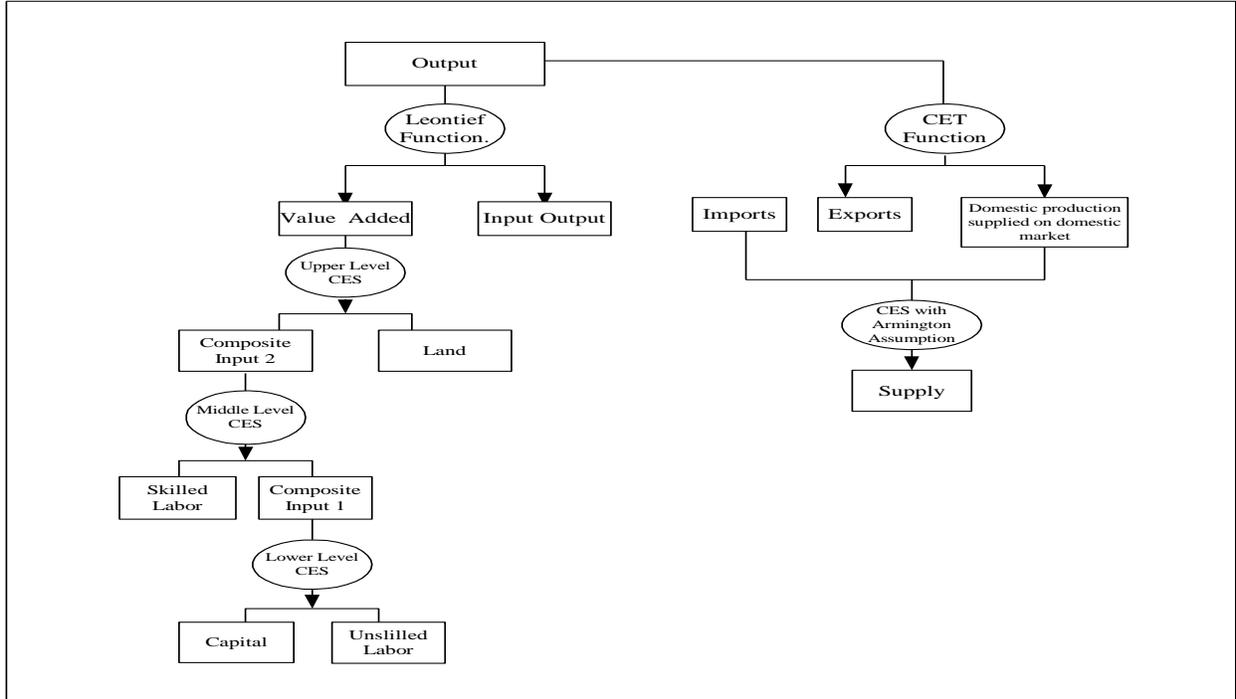
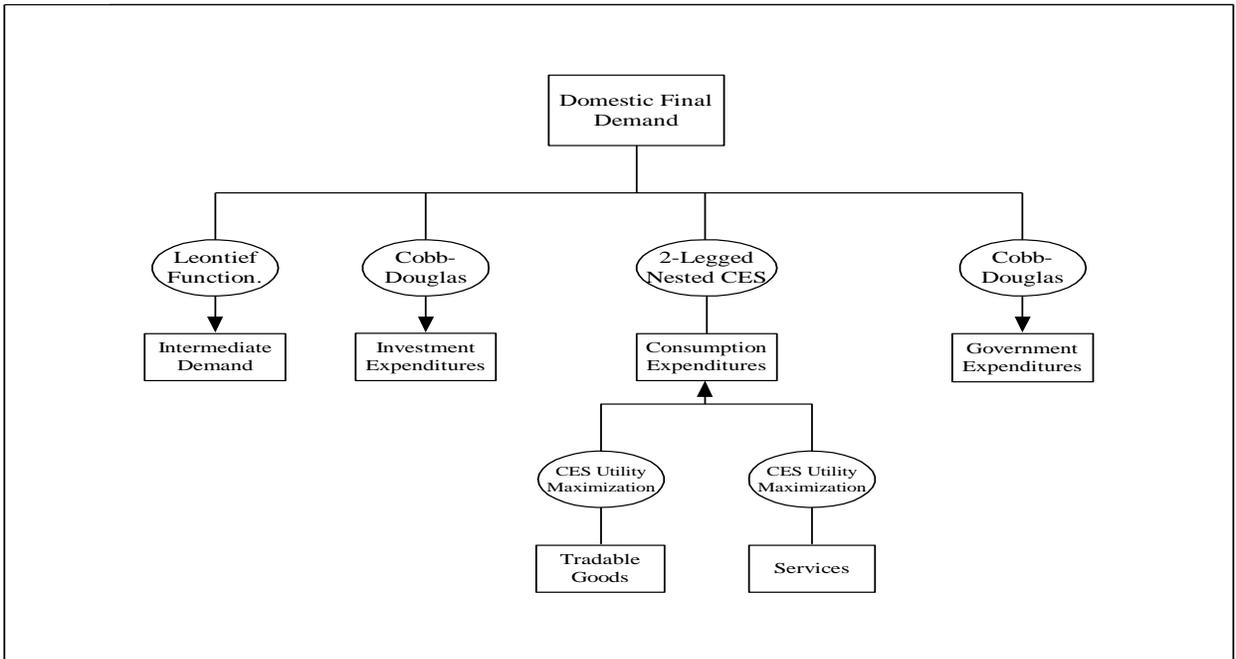


Chart 2: CGE Model – Domestic Final Demand



**Table 8: Aggregated Social Accounting Matrix of North Cyprus**

Factors of Production					Agents							
	Labor L	Labor H	Land R	Capital K	Factors (1+2+3+4)	Industries (1-13)	Households	S-I	Government	Rest of World	Taxes	Total
	1	2	3	4	5	6	7	8	9	10	11	12
1	29,740,138											
2		72,178,787										
3			4,575,385									
4				110,897,340								
5						228,769,256						228,769,256
6						148,346,249	188,419,094	52,855,776	62,884,655	111,904,224		564,409,999
7					217,391,650				10,999,555			228,391,205
8							24,650,610		-23,657,300	51,862,450		52,855,760
9											50,226,925	50,226,925
10						187,294,492						187,294,492
11					11,377,602		15,321,502			23,527,821		50,226,925
12					228,769,252	564,409,997	228,391,206	52,855,776	50,226,910	187,294,495	50,226,925	

Source: Author's creation

**Table 7: The Model Notation**

Variables:	Parameters
$C_i$ Consumption demand of commodities	$A_i$ Efficiency parameter for CES production function
$I_i$ Final demand of investment expenditures	$AR_i$ Efficiency parameter for CES import demand function
$CG_i$ Public consumption expenditures	$\alpha T_i$ Efficiency parameter for CET export supply function
EG Total government expenditures	$e_i$ Elasticity of substitution parameter at the first nest of the production process
$IM_i$ Imports	$se_i$ Elasticity of substitution parameters at the middle nest of the production process
$E_i$ Exports	$ge_i$ Elasticity of substitution parameters at the upper nest of the production process
$K_i$ Demand for capital	$\zeta T_i$ Elasticity of substitution parameter for the CES import demand function
$L_i$ Demand for unskilled labor	$\sigma T_i$ Elasticity of transformation parameter for the CET export supply function
$H_i$ Demand for skilled labor	$alpha C_i$ Distribution parameter for consumption
$R_i$ Demand for productive land resource	$\alpha I_i$ Distribution parameter for Investment
$J_i$ Composite value of capital-and-unskilled labor	$\alpha G_i$ Distribution parameter for Government
$G_i$ Composite value of capital-and-unskilled labor complements and skilled labor	$\delta_i$ Distribution parameter
$\Pi_i$ Profit	$\beta_i$ Distribution parameter
$XD_i$ Domestic Output	$\gamma_i$ Distribution parameter
VA <sub><i>i</i></sub> Value Added	$\mu_i$ Substitution parameter
$SX_i$ Domestic sales of composite traded commodities and services	$\rho_i$ Substitution parameter
$XDD_i$ Domestic output supplied on the domestic market	$\theta_i$ Substitution parameter
$U$ Household's utility	$\psi_i$ Substitution parameter
$PDD_i$ Prices of domestic commodities	$\rho m_i$ Substitution parameter
$PIM_i$ Prices of imported commodities	$\rho T_i$ Substitution parameter
$j_i, g_i$ Composite prices of composite inputs $J_i$ and $G_i$	$io_{ij}$ Input-output coefficient
$PC_i$ Market price for commodities	$mps$ Marginal propensity to save
$P_i$ Commodity prices	
$P_i$ Market price for investment commodities	
$k_i, l_i, h_i, r_i$ Rate of return to capital, wage of unskilled labor, wage of skilled labor and rent	
$PE_i$ Prices for exported commodities	
$PX_i$ Prices of composite commodities	
$PMW_i$ World price of imports	
$PEW_i$ World price of exports	
TAXR Sum of direct and indirect taxes	
Transf Government transfer payments	
M Household's budget	
MY Factor's income	
S Total savings	
SH Household's savings	
SG Public savings	
SF Foreign savings	