Models of Conditional Cash Transfer Programs: A Computable General Equilibrium Model

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Abstract

Conditional Cash Transfers (CCT) can be implemented in developing countries to both provide incomes to poor families and to encourage school attendance. The investment in human capital can increase long term labor productivity and increase economic growth. This paper employs a computable general equilibrium model to quantify the effects of increased productivity in Barazil and Mexico after introduction of CCT programs. A CGE model is a multi-sector, multi-regional system of simultaneous equations, covering market equilbrium in product, factor, and financial markets. The results of the model show a significant increaese in economic growth for both Mexico and Brazil.

Keywords: Mexico, Brazil, Conditional Cash Transfer, CCT, computable general equilibrium, CGE, development, Global Trade Analysis Project, GTAP.

JEL Classification Codes: H50, O10, C3

1. Introduction

Conditional Cash Transfers (CCT) can be implemented in developing countries to both provide incomes to poor families and to encourage school attendance. The investment in human capital can increase long term labor productivity and increase economic growth. This paper employs a computable general equilibrium model to quantify the effects of increased productivity in Barazil and Mexico after introduction of CCT programs. A CGE model is a multi-sector, multi-regional system of simultaneous equations, covering market equilbrium in product, factor, and financial markets. The results of the model show a significant increaese in economic growth for both Mexico and Brazil.

2. Background

In Mexico, In 1997, the federal government introduced the Programa de Educación, Salud y Alimentación (the Education, Health, and Nutrition Program), known by its Spanish acronym, PROGRESA, as part of its renewed effort to break the intergenerational transmission of poverty. The program has a multiplicity of objectives, aimed primarily at improving the educational, health, and nutritional status of poor families, particularly of children and their mothers. PROGRESA provides cash transfers linked to children's enrollment and regular school attendance and to clinic attendance. The program also includes in-kind health benefits and nutritional supplements for children up to age five and for pregnant and lactating women.

Studies suggest that PROGRESA's combination of education, health, and nutrition initiatives has had a significant effect on the welfare and human capital of poor rural families. In particular, evidence suggests that the PROGRESA program has significantly increased the enrollment of boys and girls, particularly of girls, and above all at the secondary school level (Schultz). In addition, most of the increase in school attendance is attributable to children, especially boys, working less.

The results imply that children will have, on average, about 0.7 years of extra schooling because of PROGRESA, although this effect may increase if children are more likely to go on to senior high school as a result of PROGRESA. Taking into account that higher schooling is associated with higher levels of income, the estimations imply that children have lifetime earnings that are 8 percent higher due to the education benefits they have received through PROGRESA.

In Brazil, President Lula formally launched the Bolsa Família Program on October 20, 2003, as a merger of earlier cash tansfer programs. On the social side, the centerpiece was a sweeping reform of Brazil's social safety net, the Bolsa Familia Program (BFP), which integrated four cash transfer programs into a single program under the umbrella of a new Ministry of Social Development. The transfers are made preferentially to women in each family. The program supports the formation of human capital at the family level by conditioning transfers on behaviors such as school attendance and use of other social services.

Since its launch, the Bolsa Familia Program has grown exponentially, and by January 2005 had expanded to cover about 26.4 million people. By the end of 2006, about 44 million people are expected to be covered, at least two-thirds of whom are extremely poor. In terms of numbers of beneficiaries, the Bolsa Familia Program is by far the largest conditional cash transfer in the developing world. Its systems for beneficiary selection, monitoring and evaluation, quality control, and scaling uphave implications that extend well beyond Brazil.

2. CGE Model for Conditional Cash Transfers

What is the macroeconomic effect of conditional cash tansfer programs in Mexico and Brazil? One effect is increased school enrollment, which serves to boost labor productivity. The model in this paper uses a "shock" to unskilled labor productivity in Brazil and Mexico to measure the effects on GDP, sector output, trade, economic welfare, and other indicators. The section is broken into several parts, including, (a) a background of CGE models; (b) the Global Trade Analysis Project (GTAP); (c) the structure of this paper's model, (d) model results; (e) model limitations and future research.

2.1. Background of General Equilibrium Models

General equilibrium, a concept which dates back to Leon Walras (1834-1910), is a pillar of modern economic thought. General equilibrium recognizes that there are many markets in an economy, and that these markets all interact in complex ways with each other. In rough terms, everything depends on everything else. Demand for any one good depends on the prices of all other goods and on income. Income, in turn, depends on wages, profits, and rents, which depend on technology, factor supplies and production, the last of which, in its turn, depends on sales (i.e., demand). (Hertel, et al., 2007).

Computable General Equilibrium (CGE) modeling specifies all economic relationships in mathematical terms and puts them together in a form that allows the model to predict the change in variables such as prices, output and economic welfare resulting from a change in economic policies. To do this, the model requires information about technology (the inputs required to produce a unit of output), policies and consumer preferences. The key of the model is "market clearing," the condition that says supply should equal demand in every market. The solution, or "equilibrium," is that set of prices where supply equals demand in every market— goods, factors, foreign exchange, and everything else (Hertel, et al., 2007).

A CGE model is a closed system. This means that no production or financial flow escapes the system and none are created outside of the system. In basic closure terms, we assume output will equal income. Households, businesses, the government, and the financial sector, and the foreign sector are all connected by real flows and financial flows. Intuitively, the idea of a "general" equilibrium is captured; any given market is connected to all of the other markets for the system.

Over the last 25 years, CGE models have become an important tool for analyzing economic issues, including trade policy, taxation policy, technological growth, energy policy, environmental issues, and even warfare. This development is explained by the ability of CGE models to provide an elaborate and realistic representation of the economy including the linkages between all agents, sectors and other economies. While this complete coverage permits a unique insight into the effects of changes in the economic environment throughout the whole economy, single country, and especially global CGE models very often include an enormous number of variables, parameters and equations (Brockmier, 2001).

CGE modeling is a very powerful tool, allowing economists to explore numerically a huge range of issues on which econometric estimation would be impossible; in particular to forecast the effects of future policy changes. The models have their limitations, however. First, CGE simulations are not unconditional predictions but rather 'thought experiments' about what the world would be like if the policy change had been operative in the assumed circumstances and year. The real world will doubtless have changed by the time we get there. Second, while CGE models are quantitative, they are not empirical in the sense of econometric modeling: they are basically theoretical, with limited possibilities for rigorous testing against experience. Third, conclusions about trade and other policies are very sensitive to data assumption. One can readily do sensitivity analysis on the parameter values assumed for economic behavior, although less so on the data, because altering one element of the base data requires compensating changes elsewhere in order to keep the national accounts and social accounting matrix in balance. Of course, many of these criticisms apply to other types of economic modeling, and therefore, while imperfect, CGE models remain the preferred tool for analysis of many global issues.

2.2. The Global Trade Analysis Project

One of the most widely-used CGE models is the GTAP Model. The Global Trade Analysis Project (GTAP), with headquarters at Purdue University, has organized a consortium of national and international agencies which provide guidance and base-level support for the Project (GTAP, 2008).

GTAP is a multi-regional CGE model which captures world economic activity in 57 different industries of 66 regions. The underlying equation system of GTAP includes two different kinds of equations. One part covers the accounting relationships which ensure that receipts and expenditures of every agent in the economy are balanced. The other part of the equation system consists of behavioral equations which based upon microeconomic theory. These equations specify the behavior of optimizing agents in the economy, such as demand functions (Brockmier, 2001). Input-out tables summarize the linkages between all industries and agents.

The mathematical relationships assumed in the GTAP model are simplified, though they adhere to the principle of "many markets." The simplification is that thousands of markets are "aggregated" into groups. For example, 'transport and communications services' appear as a single industry. In principle all the relationships in a model could be estimated from detailed data on the economy over many years. In practice, however, their number and parameterization generally outweigh the data available. In the GTAP model, only the most important relationships have been econometrically estimated. These include the international trade elasticities and the agricultural factor supply and demand elasticities. The remaining economic relationships are based on literature reviews.

2.3. Structure of this Paper's Model

The model employed in this paper is that of the GTAP project. While the core database has 57 sectors and 66 regions, we have aggregated the matrices to simplify the world into just nine sectors (plus capital investment goods), nine regions, and five factors of production. This aggregation is described in Table 1. The data is first, "calibrated," meaning the model is solved for its original equilibrium prices and volumes in all markets.

This baseline is meant to represent the economy as is, before any shock takes place. Thousands of equations are created, each representing supply and demand conditions in markets inside each region, including markets for goods, services, factors of production, savings, government expenditure, and more. Equations are also generated for trade of all goods between each of the regions, separately created for each industry. The calibrated result is a large set of simultaneous equations, of which the solution matches the existing prices and quantity levels of the economy.

Table 1		
Aggregation of the Model		
Regions	Sectors	Factors
Mexico	GrainsCrops	Land
Brazil	MeatLstk	UnSkLab
United States	Extraction	SkLab
East Asia	ProcFood	Capital
Southeast Asia	TextWapp	NatRes
South Asia	LightMnfc	
Rest of Latin America	HeavyMnfc	
EU	U_C_Tr_Com	
Rest of World	OthServices	
Source: Generated by author		

A "shock" is then introduced to system. Mathematically, a "shock" is the alteration of a single parameter or variable in the giant system. That change acts like a stone thrown in a pond, with waves created throughout every one of the thousands of equations in the system. The model is re-solved with the one autonomous change, and the effects on the system are then measured.

Table 2	
Exogenous Shock to Factor Productivity (Brazil and Mexico)	
	(Percent Change)
Land	0
UnSkLab	10
SkLab	0
Capital	0
NatRes	0
Source: Generated by author	

The "shock" in this model is a 10 percent increase in labor productivity for unskilled workers in Mexico and Brazil (Table 2). The change in relative prices of factors and all goods and services will change production and consumption patterns, and ripple through the economy. Possible economic effects will be seen in GDP, prices, employment, consumption, imports, exports, and overall economic welfare. The role of a CGE model is to quantify the direction and magnitude of these changes.[1]

3. Model Results

A computable general equilibrium model can generate an enormous array of matrix results. In this model, results are grouped into the following sections: 1) prices; 2) output and income 3) factor markets; 4) international trade; and 5) welfare effects.

3.1. Factor Markets

The increased productivity of unskilled labor in Mexico and Brazil leads to higher wages in those countries, as well as changes to the other factors of production. As shown in Table 3, in Mexico, the price of unskilled labor increases by 3.17 percent.

[1] For more on economic efficiency and taxation, see McConnell, Campbell R. and Brue, Stanley L., Economics: Principles, Problems, and Policies, 16th Ed., McGraw Hill Publishing, 2006.

Other prices also increase, including those for land (8.82 percent), skilled labor (2.24 percent), capital (2.11 eprcent), and natural resources (1.74 percent). In Brazil, wages for unskilled labor increase by 5.02 percent, while other factor prices also increase, including those for land (3.29 percent), skilled labor (3.33 percent), capital (2.84 percent), and natural resources (1.40 percent).

Table 3

Market Price of Factors of Production (percent change)

pm	MEX	BRAZ	USA	EastAsia	SEAsia	SouthAsia	LatinAmer	EU_25	RestofWorld
Land	8.82	3.29	0.27	0.01	0.04	-0.05	0.21	0.24	0.12
UnSkLab	3.17	5.02	-0.08	-0.1	-0.09	-0.12	-0.05	-0.09	-0.09
SkLab	2.24	3.33	-0.07	-0.11	-0.09	-0.12	-0.06	-0.1	-0.09
Capital	2.11	2.84	-0.07	-0.1	-0.09	-0.12	-0.05	-0.1	-0.08
NatRes	1.74	1.4	0.45	0.44	0.38	0.44	0.46	0.57	0.39

Source: Generated by author

Sectors in both Mexico and Brazil significantly alter their combinations of inputs. In Mexico, demand for unskilled labor decreases in four sectors (grains and crops, meat and livestock, extraction, and processed food), while it increases in six sectors (textiles and apparel, light manufacturing, heavy manufacturing, utilities/construction/transport/communications, other services, and in capital goods). A similar shift occurs in Brazil, where demand for unskilled labor decreases in seven sectors, shifting to increases in three sectors (utilities/construction/transport/communications, other services, and in capital goods).

It appears that the more productive labor force means that many agricultural and primary sectors can achieve their output with fewer workers now, while the workers themselves move in significant numbers to manufacturing and service ectors. Demand for all factors of production in Mexico and Brazil is presented in Table 4 and Table 5.

Table 4

Mexican Demand for Factors of Production, byt sector (percent change)

qfe[**MEX]	GrainsCrops	MeatLstk	Extraction	ProcFood	TextWapp	LightMnfc	HeavyMnfc	U_C_Tr_Com	OthServices	CGDS
Land	0.25	-0.62	-1.11	-3.93	-3.86	-3.58	-3.61	-3.68	-3.35	-1.74
UnSkLab	-5.23	-3.04	-7.6	-1.38	0.3	0.95	0.89	4.04	1.5	1.84
SkLab	1.94	2.19	-0.1	-1.51	-1.04	-0.4	-0.46	0.1	0.14	2.76
Capital	1.98	2.25	-0.07	-1.37	-0.88	-0.24	-0.3	0.3	0.3	2.89
NatRes	0.01	0	0	0	0	0	0	0	0	0

Source: Generated by author

Table 5

Brazilian Demand for Factors of Production, byt sector (percent change)

qfe[**BRAZ]	GrainsCrops	MeatLstk	Extraction	ProcFood	TextWapp	LightMnfc	HeavyMnfc	U_C_Tr_Com	OthServices	CGDS
Land	0.13	-0.4	-0.31	-0.82	-1.01	-0.9	-0.56	-0.45	0.17	1.76
UnSkLab	-7.07	-6.05	-7.99	-2.42	-1.89	-1.65	-0.87	1.54	0.77	1.86
SkLab	0.15	-0.62	-0.38	-1.76	-2.31	-2.07	-1.29	-1.2	0.34	3.53
Capital	0.28	-0.38	-0.28	-1.23	-1.73	-1.48	-0.7	-0.46	0.94	4.02
NatRes	0	0	0	0	0	0	0	0	0	0.01

Source: Generated by author

3.2 Output

The model suggests that the increased productivity results in a 2.49 percent increase in real GDP for Mexico, and a 3.52 increase in Brazil. Changes in GDP to other regions in the model are negligible. Real GDP is presented in Table 6.

Table 6	
Real GDP	
qgdp	Percent change
MEX	2.49
BRAZ	3.52
USA	0
EastAsia	0
SEAsia	0
SouthAsia	0
LatinAmer	0
EU_25	-0.01
RestofWorld	0
Source: Generated by author	

In Mexico, all sectors experience a significant increase in output (Tables 7-9). Sectors with the largest absolute increases in output include other services ($8.7 billion), capital goods ($8.4 billion), heavy manufacturing ($5.5 billion), light manufacturing ($4.1 billion), and processed foods ($3.9 billion). Similarly, all Brazilian sectors experience an increase in output, with the largest increases in other services ($12.8 billion), utilities/construction/transport/communication ($11.2 billion), heavy manufacturing ($4.9 billion), and light manufacturing ($3.9 billion).

Table 9									
Industry Output by Region (percent change)									
qo	MEX	BRAZ	USA	EastAsia	SEAsia	SouthAsia	LatinAmer	EU_25	RestofWorld
GrainsCrops	2.49	0.69	0.1	0.03	0.02	0.01	0.07	0.09	0.06
MeatLstk	3.5	0.58	0.04	0.01	0.01	0	0.03	0.06	0.05
Extraction	0.25	0.12	0.07	0.08	0.07	0.08	0.07	0.1	0.06
ProcFood	4	1.9	0	-0.01	-0.01	0.01	-0.01	0	0
TextWapp	1.96	3.39	0.04	0.02	-0.01	0.05	-0.08	0	-0.03
LightMnfc	2.31	3.53	0	0.01	-0.04	-0.02	-0.05	-0.01	-0.04
HeavyMnfc	1.83	2.54	0.06	0.05	0	-0.02	0.01	0.04	-0.06
U_C_Tr_Com	2.15	4.6	-0.02	-0.03	-0.03	-0.03	-0.03	-0.01	-0.03
OthServices	3	3.75	0	0	0.01	0.01	0	0	0.01
CGDS	6	6.67	-0.12	-0.13	-0.16	-0.12	-0.12	-0.15	-0.12
Source: Generated by author									

3.3 Market Prices

According to the model, both Mexico and Brazil would experience moderate changes to market prices in various sectors. In Mexico, the largest percent decrease in prices would be in processed food (-0.96 percent) and meat and livestock (-0.27 percent). The largest percent increases would be in utilities, construction, transport, and communications (0.44 percent), and extraction (0.19 percent). In Brazil, the largest price increases are found in grains and other crops (0.81 percent), meat and livestock (0.59 percent), and other services (0.51 percent). Brazil's largest price decreases include those in textiles and apparel (-0.48 percent) and light manufacturing (-0.38 percent). Price changes are presented in Table 10.

Table 10									
Market Price of Output (percent change)									
pm	MEX	BRAZ	USA	EastAsia	SEAsia	SouthAsia	LatinAmer	EU_25	RestofWorld
GrainsCrops	0.11	0.81	-0.01	-0.08	-0.04	-0.09	0	-0.07	-0.06
MeatLstk	-0.27	0.59	-0.05	-0.08	-0.06	-0.09	-0.02	-0.08	-0.06
Extraction	0.19	0.45	0.04	0	0.02	-0.01	0.06	0.01	0.03
ProcFood	-0.96	0.3	-0.07	-0.08	-0.07	-0.1	-0.03	-0.08	-0.07
TextWapp	-0.08	-0.48	-0.07	-0.09	-0.08	-0.1	-0.06	-0.09	-0.08
LightMnfc	0.05	-0.38	-0.07	-0.09	-0.08	-0.09	-0.05	-0.09	-0.07
HeavyMnfc	0.11	0.14	-0.06	-0.08	-0.07	-0.07	-0.02	-0.08	-0.05
U_C_Tr_Com	0.44	-0.2	-0.07	-0.09	-0.08	-0.1	-0.05	-0.09	-0.08
OthServices	-0.02	0.51	-0.07	-0.1	-0.09	-0.11	-0.05	-0.09	-0.08
CGDS	-0.14	-0.13	-0.07	-0.09	-0.08	-0.09	-0.05	-0.09	-0.07
Source: Generated by author									

3.4 International Trade

According to the model, Mexico's trade balance would decrease by $6.39 billion, while that for Brazil would decrease by $4.38 billion (Table 11). In comparison, trade balances for several other regions would significantly increase, including the EU ($3.69 billion), the United States ($2.91 billion), and East Asia ($2.16 billion).

Table 11
Change in Trade Balance

DTBAL	Millions of dollars
MEX	-6,392.6
BRAZ	-4,375.5
USA	2,912.4
EastAsia	2,156.8
SEAsia	217.2
SouthAsia	252.9
LatinAmer	216.3
EU_25	3,694.4
RestofWorld	1,318.1

Source: Generated by author

Trade balances by region and by sector are shown in Table 12. Exports and Imports are presented in Table 13 and Table 14. Model results suggest that in Mexico, the lower trade balance is mostly due to large trade balance decreases in heavy manufacturing (-$3.66 billion) and light manufacturing (-$1.33 billion). Imports of light manufactures increased 2.54 percent, while imports of heavy manufactures increased 2.60 percent. A similar situation occurs in Brazil, where the trade balance in heavy manufactures decreases $2.17 billion as imports in the sector increase 4.5 percent.

Table 12
Change in Trade balance by Sector (millions of dollars)

DTBALi	MEX	BRAZ	USA	EastAsia	SEAsia	SouthAsia	LatinAmer	EU_25	RestofWorld
GrainsCrops	-169.2	-354.5	115.1	92.6	14.9	23.7	53.8	166.9	118.4
MeatLstk	-63.5	-244.5	73.7	45.4	4.6	4.2	11.7	101.2	74.0
Extraction	-397.7	-699.1	-64.9	47.5	69.0	48.4	85.3	58.2	885.7
ProcFood	54.1	-181.8	28.3	41.4	-15.7	9.8	-13.3	91.7	3.7
TextWapp	-178.5	11.1	128.4	-9.6	-11.5	10.6	-17.1	87.2	-11.2
LightMnfc	-1,334.4	126.8	666.3	88.3	-7.8	20.1	23.5	316.8	114.6
HeavyMnfc	-3,654.5	-2,169.2	1,823.7	1,590.3	109.4	83.2	93.8	2,123.4	0.5
U_C_Tr_Com	-310.9	-271.5	51.0	113.9	13.6	16.4	-10.5	244.8	10.0
OthServices	-338.0	-592.9	90.9	147.0	40.7	36.7	-11.0	504.2	122.3

Source: Generated by author

Table 13
Exports by Sector (percent change)

qxw	MEX	BRAZ	USA	EastAsia	SEAsia	SouthAsia	LatinAmer	EU_25	RestofWorld
GrainsCrops	-0.47	-3.31	0.3	0.3	0.13	0.32	0.25	0.23	0.23
MeatLstk	1.57	-4.05	0.78	0.27	0.11	0.53	0.18	0.26	0.23
Extraction	-1.53	-3.98	0.48	0.48	0.18	0.53	0.12	0.23	0.13
ProcFood	3.63	-1.45	0.2	0.02	-0.03	0.1	-0.03	0.04	-0.02
TextWapp	0.03	2.87	0.55	0.04	0	0.11	-0.1	0.02	-0.04
LightMnfc	-0.81	2.07	0.22	0.06	-0.05	0.05	0.17	0.01	-0.04
HeavyMnfc	-1.16	-1.29	0.32	0.15	0.01	0.09	0.1	0.1	-0.07
U_C_Tr_Com	-1.8	0.37	0.04	0.08	0.04	0.1	0	0.06	0.03
OthServices	-0.2	-2.22	0.07	0.12	0.09	0.19	-0.05	0.09	0.06

Source: Generated by author

Table 14									
Imports by Sector (percent change)									
qim	MEX	BRAZ	USA	EastAsia	SEAsia	SouthAsia	LatinAmer	EU_25	RestofWorld
GrainsCrops	2.97	3.66	-0.1	-0.18	-0.05	-0.1	-0.01	-0.11	-0.07
MeatLstk	2.78	4.02	0	-0.12	-0.12	-0.13	-0.29	-0.12	-0.28
Extraction	2.64	4.23	0.03	-0.02	-0.01	-0.07	-0.08	0	-0.02
ProcFood	1.49	3.38	0.15	-0.04	0	-0.16	0.05	-0.03	-0.01
TextWapp	2.26	1.98	0.05	0	0.01	-0.01	0.07	-0.01	0.01
LightMnfc	2.54	3.24	0	-0.03	-0.03	-0.08	0.1	-0.03	-0.02
HeavyMnfc	2.6	4.5	-0.03	-0.02	-0.02	-0.04	0	-0.03	-0.02
U_C_Tr_Com	3.47	4.1	-0.02	-0.04	-0.02	-0.06	0.05	-0.02	0
OthServices	3.08	4.88	0.02	-0.04	-0.01	-0.06	0.05	-0.02	-0.01
Source: Generated by author									

4.4. Welfare Decomposition

Table 15 presents the overall welfare decomposition from the CGE simulation. The welfare decomposition is essentially a consumer surplus concept, broken down by gains or losses to consumers from efficiency gains, factor endowments, technological improvements, terms of trade effects, and the savings-investment mechanism. According the CGE model results, the cash transfer program would result in a $17.3 billion increase in economic welfare in Mexico, and a $21.9 billion in Brazil.

In Mexico, the largest gains come almost equally from two sources: technological change from higher productivity ($8.9 billion) and greater efficiency in the allocation of productive resources ($8.0 billion). In Brazil, the majority of the welfare gain is caused by the technological change. Factors are not re-allocated as much as in Mexico, but productivity increases output in Brazil.

Table 15						
Welfare Decomposition by Region (millions of dolalrs)						
WELFARE	Allocative Efficiency	Factor Endowment	Technological Change	Terms of Trade	Savings and Investment	Total
1 MEX	8,001.6	0.0	8,986.0	266.0	-2.0	17,251.6
2 BRAZ	3,087.9	0.0	18,601.8	234.9	19.4	21,943.9
3 USA	-38.5	0.0	0.0	-110.3	-19.9	-168.8
4 EastAsia	-21.6	0.0	0.0	-480.4	48.4	-453.6
5 SEAsia	-9.0	0.0	0.0	11.0	7.2	9.3
6 SouthAsia	-28.3	0.0	0.0	-59.6	-11.8	-99.8
7 LatinAmer	0.3	0.0	0.0	99.4	-6.7	93.0
8 EU_25	-825.2	0.0	0.0	-492.3	-32.7	-1,350.2
9 RestofWorld	-92.1	0.0	0.0	530.8	-2.0	436.8
Total	10,075.0	0.0	27,587.8	-0.5	0.0	37,662.2
Source: Generated by author						

5. Model Limitations and Future Research

This experiment raises several methodological questions. The largest issue would be the static nature of this CGE model. It is a counterfactual simultaneous equations model which introduces a one-time shock to an economic equilibrium, and then measures a new equilibrium. A more dynamic model would better capture effects over time, such as the accumulation of capital stock, investment flows, and economic growth over a longer period of time. The long term effects of trade liberalization on capital mobility, investment spending, infrastructure, productive capacity, and other long term economic phenomena are not competely captured in a static CGE model.

Another area for research would be the magnitude of the productivity shock itself. Higjher education is assumed to increase the productivity of unskilled workers, but the exact magnitude for the conditional cash transfer programs in Brazil and Mexico are not clearly specified. This current model is a simulation, assuming a 10 percent shock, but the actual productivity gains would likely be much higher, and varied over sectors.

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