

Economy-Wide Effects of Remittances

A Computable General Equilibrium Assessment from Vietnam

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Abstract

Recently, the flow of money sent back from Vietnamese who are working or living abroad to their homeland has been increasing rapidly. Such financial inflow has become a stable and significant one comparable with other important traditional funding sources such as foreign direct investment (FDI) and official development assistance (ODA). By using computable general equilibrium (CGE) modeling techniques, this paper is the first attempt to investigate the effects of the overseas remittances on the Vietnamese economy *as a whole*. The paper includes four major sections. The first examines the real situation of remittances in Vietnam and recent literature dealing with this issue. The second briefly reviews the current state of the economics of remittances. The third section presents a standard CGE model for the Vietnamese economy with a focus in the appearance of the overseas remittances. The fourth section provides different scenarios to simulate the effects of changes in the remittances on various aspects of the economy. The results show that agriculture and small-scale sectors would expand by the increase of the remittances. It is also found that while interest rate may slightly fall due to the remittance inflow, the average level of rent for land and wage for labor in both rural and urban areas tend to rise.

Keywords: Vietnamese economy, overseas remittances, computable general equilibrium model

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1. OVERSEAS REMITTANCES TO VIETNAM: AN OVERVIEW

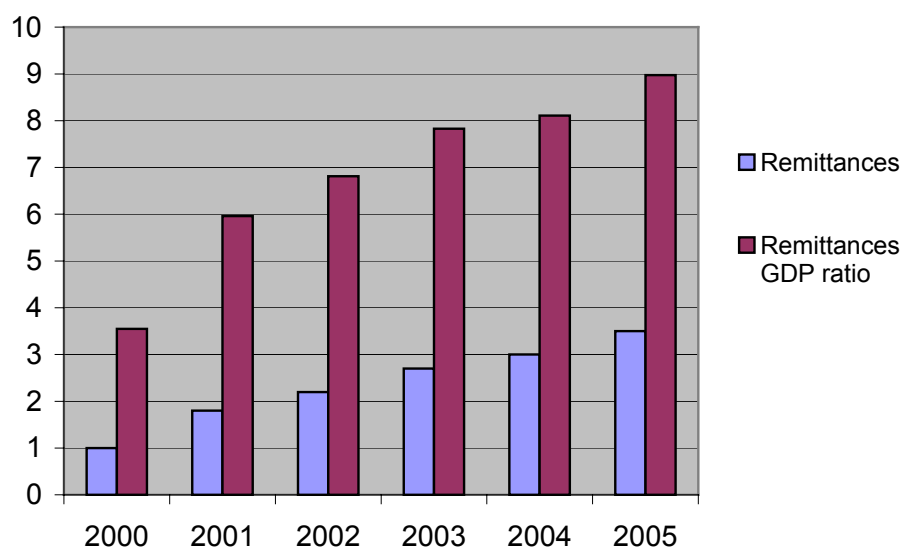


Figure 1: Overseas Remittances to Vietnam, 2000-05

Source: Author's estimate

Table 1: Sources of overseas remittances (%)

Country	1992/93	1997/98
Laos	0.0	0.0
Cambodia	0.2	0.0
Thailand	0.3	0.4
China	0.2	0.2
Hongkong	0.0	1.1
Taiwan	n/a	0.8
Australia	7.3	8.6
France	2.8	4.0
Western Europe	9.9	7.7
Former Soviet Union	3.4	3.2
Eastern Europe	9.3	3.9
United States	41.1	57.7
Canada	6.2	6.1
Others	19.2	6.5
By region		
North America	47.3	63.8
Europe	20.0	15.6
Australia	7.3	8.6
Asia	4.2	5.6
Others	19.2	6.5

Source: Pfau and Giang (2006)

Table 2: Flows of Overseas Remittances to Vietnam (%)

	1992/93			1997/98			2002			2004		
Region	share of total pop	share of total remittances	ratio of remittances received to pop	share of total pop	share of total remittances	ratio of remittances received to pop	share of total pop	share of total remittances	ratio of remittances received to pop	share of total pop	share of total remittances	ratio of remittances received to pop
Red River delta	20.9	30.9	1.5	19.6	15.8	0.8	21.9	9.5	0.4	22.1	19.5	0.9
North East	14.2	3.0	0.2	15.1	2.8	0.2	11.9	5.7	0.5	11.6	3.9	0.3
North West	2.6	0.2	0.1	2.9	0.0	0.0	2.7	1.0	0.4	3.0	0.7	0.2
North Central Coast	12.8	1.2	0.1	13.8	6.9	0.5	13.4	9.5	0.7	13.1	10.9	0.8
South Central Coast	9.5	8.0	0.8	8.5	9.9	1.2	8.5	9.8	1.2	8.7	9.9	1.1
Central Highlands	2.3	0.7	0.3	2.8	0.3	0.1	5.8	2.8	0.5	5.0	1.8	0.3
South East	15.9	42.6	2.7	15.9	49.1	3.1	14.6	29.2	2.0	16.2	31.6	2.0
Mekong River Delta	22.5	13.3	0.6	21.5	15.3	0.7	21.3	32.5	1.5	20.4	21.8	1.1
Urban/Rural												
Rural	80.0	20.9	0.3	77.6	25.2	0.3	76.8	49.0	0.6	74.1	49.9	0.7
Urban	20.0	79.1	4.0	22.4	74.8	3.3	23.2	51.0	2.2	25.9	50.1	1.9

Source: Pfau and Giang (2006)

Table 3: Use of remittances (%)

	Consumption	Household construction	Non-farm investment	Others ^(a)
Share of funds received	73	14.4	6	6.6

(a): including education, farm investment.

Source: Pfau and Giang (2006)

2. HOW THE OVERSEAS REMITTANCES AFFECT THE ECONOMY

A brief literature review:

Adams (2003), Adams & Page (2003) in general.

Taylor (1999) on the role of , Bouhga-Hagbe (2004) studies the case of Morocco.

Bracking (2003) on negative effect(s), Chami et al. (2003) questioning the effects.

Kapur (2003) positive effect, Ratha (2003) & World Bank (2004) consider it as a effective source for development.

Drinkwater et al. (2003) effects on labor market. Sayan (2006) on the relation to the cyclical movements of GDP at home.

3. OVERVIEW OF THE MODEL

3.1. AN OVERVIEW OF CGE MODELING

Theoretical foundation: Kirman (1998). Data foundation: Cohen (2002) for the development of the SAM.

Lofgren et al. (2002) provides a standard presentation of the structure of a typical CGE. Besides, there are many alternative references: Brief & practical: Böhringer et al. (2002), Wing (2004), Fossati (1996).

Basic texts: Cornwall (1984), Derviset al. (1982), Francois et al. (1997), Ginsburgh & Keyzer (1997), Hertel (1997), Hosoe (2003), Shoven & Whalley (1992). More advanced texts: Gunning & Keyzer (1995), Taylor (1990)

Examples of application: Melo & Tarr (1992) for the US, Mujeri & Khondker (2002) for Bangladesh, Sapkota & Sharma (1998) for Nepal, Thurlow & van Seventer (2002) for South Africa, Townsend & Ratnayake (2000) for New Zealand.

3.2. A CGE MODEL FOR VIETNAM

For basic assumptions and an outline of the structure, see more in Lofgren et al. (2002).

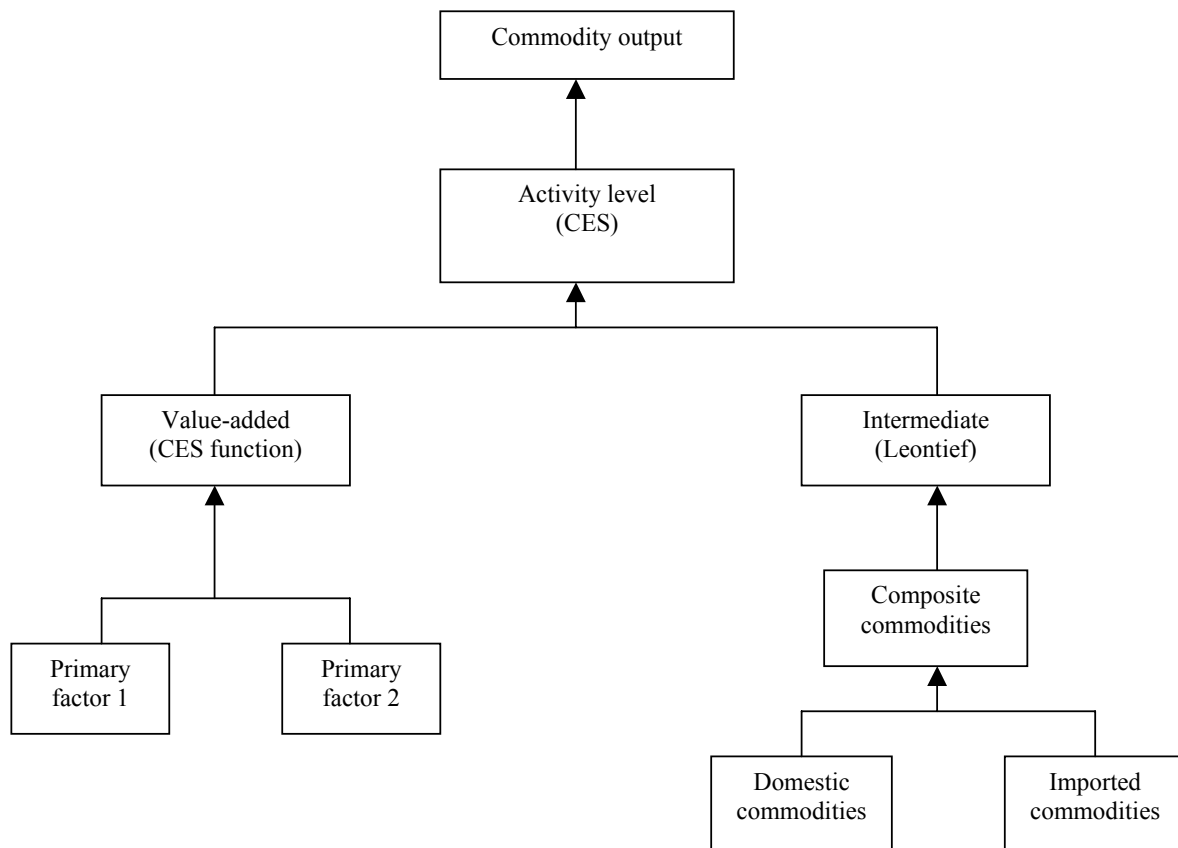


Figure 2: Production technology

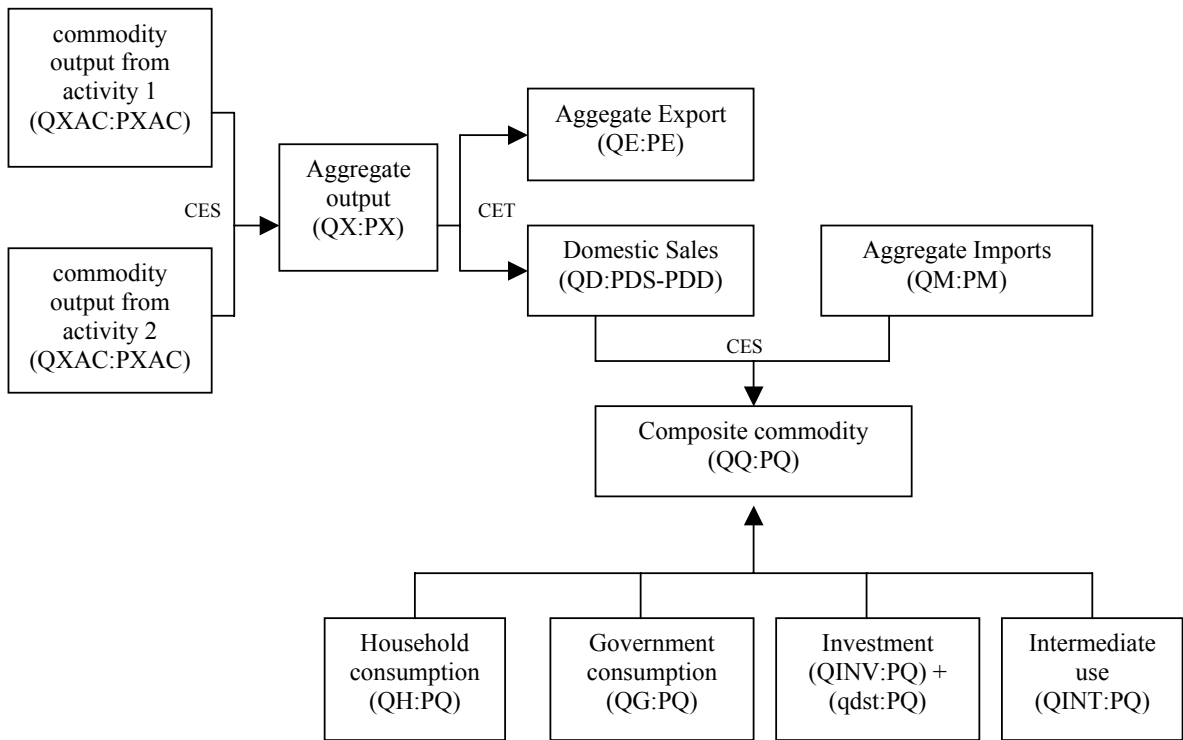


Figure 3: Flows of marketed commodities

3.2. OPENING THE BLACK-BOX OF CGE MODELING:

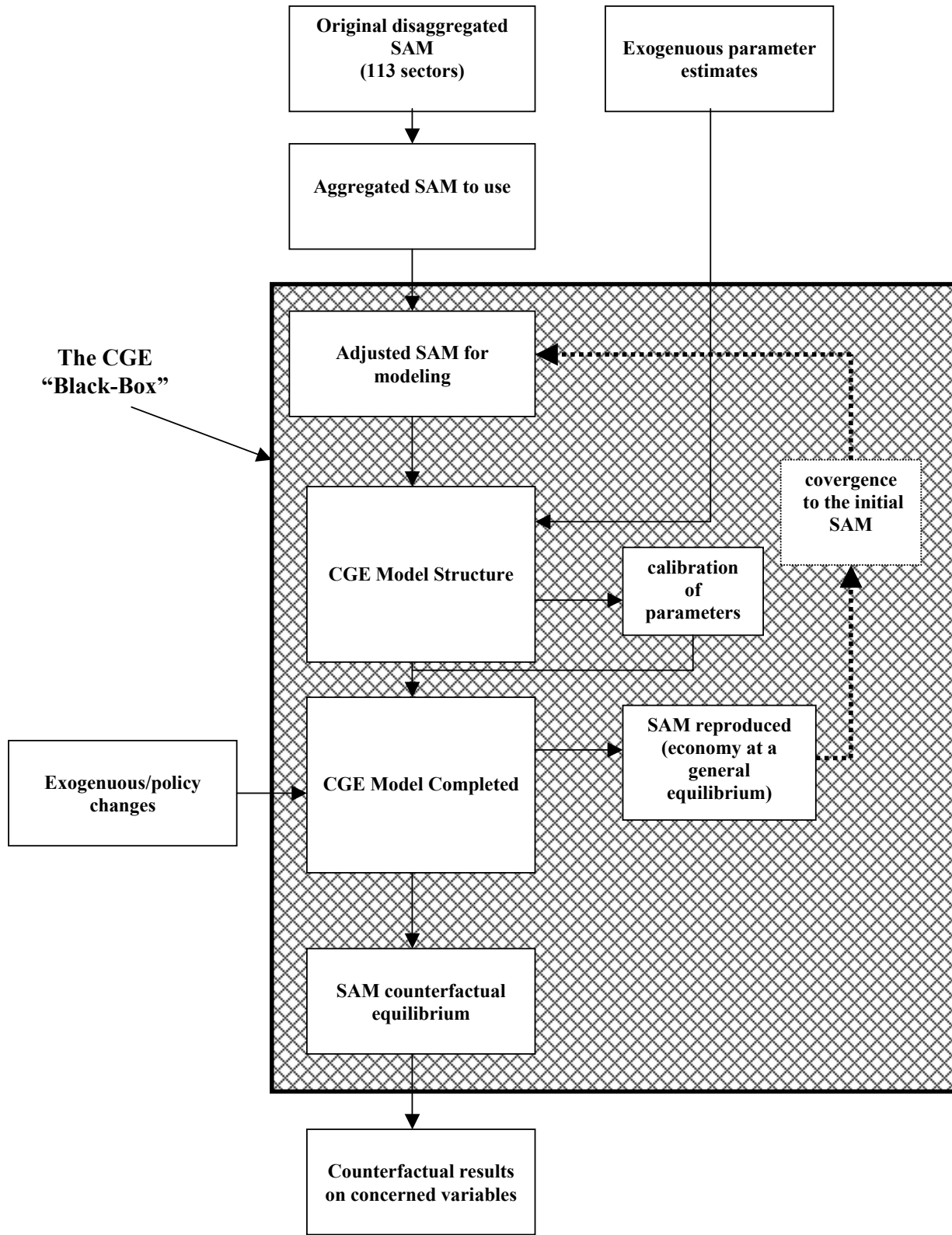


Figure 4: The working of a CGE model

3.3. THE AGGREGATED SAM, VIETNAM 2000 (Table 4)

(see Tapp et al. (2002) for the documetation of this SAM)

	A01-AGR	A02-IND	A03-SER	C01-AGR	C02-IND	C03-SER	MM	LAB-RUR	LAB-URB	CAPITAL
A01-AGR				149924.7						
A02-IND					497321.7					
A03-SER						255216				
C01-AGR	18886.71	78750.98	2117.232							
C02-IND	32594.5	271862.9	66373.66							
C03-SER	1882.218	15243.32	36288.17				88435.14			
MM				17345.61	71089.53					
LAB-RUR	52855.09	37329.4	35023.35							
LAB-URB	2026.781	34036.24	54502.22							
CAPITAL	18393.19	74859.09	51483.06							
LAND	31585.39									
HH-RUR								125207.8		15705.25
HH-URB									90565.24	22115.33
ENT										97851.8
DTAX										9062.958
ITAX	5606.667	16042.32	10433.02	786.9837	2229.714	859.5582				
IMPTAR				127.3112	13467.43					
GOV										
S-I										
ROW				3886.792	224704.8	25067.05				
TOTAL	163830.5	528124.2	256220.7	172071.4	808813.2	281142.6	88435.14	125207.8	90565.24	144735.3

	LAND	HH-RUR	HH-URB	ENT	DTAX	ITAX	IMPTAR	GOV	S-I	ROW	TOTAL
A01-AGR		12960.71	945.0894								163830.5
A02-IND		28276.74	2525.746								528124.2
A03-SER		797.4548	207.2317								256220.7
C01-AGR		23829.18	18420.68						3288.859	26777.79	172071.4
C02-IND		72311.52	56161.3						128190.6	181318.7	808813.2
C03-SER		30362.68	29565.93					45566.91		33798.26	281142.6
MM											88435.14
LAB-RUR											125207.8
LAB-URB											90565.24
CAPITAL											144735.3
LAND											31585.39
HH-RUR	28517.17			4790.011				13002.31		5524.466	192747
HH-URB	906.1792			9733.287				9755.687		13361.49	146437.2
ENT								3742.09		2607.39	104201.3
DTAX	2162.042	765.8816	1065.118	26112							39168
ITAX											35958.26
IMPTAR											13594.74
GOV					39168	35958.26	13594.74			2028	90749
S-I		23442.88	37546.12	51808.45				18682			131479.5
ROW				11757.53							265416.1
TOTAL	31585.39	192747	146437.2	104201.3	39168	35958.26	13594.74	90749	131479.5	265416.1	

3.4 MATHEMATIC STRUCTURE

SETS

$a \in A$	activities
$a \in ACES \in A$	activities with a CES function at the top of the technology nest
$ALEO \in A$	activities with a Leontief function at the top of the technology nest
$c \in C$	commodities
$c \in CD \subset C$	commodities with domestic sales of domestic output
$c \in CDN \subset C$	commodities not in CD
$c \in CE \subset C$	exported commodities
$c \in CEN \subset C$	commodities not in CE
$c \in CM \subset C$	imported commodities
$c \in CMN \subset C$	commodities not in CM
$c \in CT \subset C$	transaction service commodities
$c \in CX \subset C$	commodities with domestic production
$f \in F$	factors
$i \in INS$	institutions (domestic and rest of the world)
$i \in INSD \subset INS$	domestic institutions
$i \in INSDNG \subset INSD$	domestic nongovernment institutions
$h \in H \subset INSDNG$	households

PARAMETERS

Latin Letters

$cwts_c$	weight of commodity c in the CPI
$dwtsc$	weight of commodity c in the DPI
ica_{ca}	quantity of c as intermediate input per unit of activity a
$icd_{cc'}$	quantity of commodity c as trade input per unit of c' produced and sold domestically
$ice_{cc'}$	quantity of commodity a as trade input per exported unit of c'
$icm_{cc'}$	quantity of commodity c as trade input per imported unit of c'
$inta_{cc'}$	quantity of aggregate intermediate input per activity unit
iva_a	quantity of value-added per activity unit
\overline{mps}_i	base savings rate for domestic institution i
$mps01_c$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates
pwe_c	export price (foreign currency)
pwm_c	import price (foreign currency)
$qdst_c$	quantity of stock change
\overline{qg}_c	base-year quantity of government demand
\overline{qinv}_c	base-year quantity of private investment demand
$shif_{if}$	share for domestic institution i in income of factor f
$shii_{ii'}$	share of net income of i' to i
ta_a	tax rate for activity a

	te_c	export tax rate
	tf_f	direct tax rate for factor f
	\overline{tins}_i	exogenous direct tax rate for domestic institution i
	$tins01_i$	0-1 parameter with 1 for institution with potentially flexed direct tax rates
	tm_c	import tariff rate
	tq_c	rate of sales tax
	$transfr_{if}$	transfer from factor f to institution i
	tva_a	rate of value-added tax for activity a
Greek Letters	α_a^a	efficiency parameter in the CES activity function
	α_a^{va}	efficiency parameter in the CES value-added function
	α_a^{ac}	shift parameter for domestic commodity aggregation function
	α_c^q	Armington function shift parameter
	α_a^t	CET function shift parameter
	β_{ach}^h	marginal share of consumption spending on home commodity c for household h
	β_{ch}^m	marginal share of consumption spending on marketed commodity c for household h
	δ_a^a	CES activity function share parameter
	δ_{ac}^{ac}	share parameter for domestic commodity aggregation function
	δ_c^q	Armington function share parameter
	δ_c^t	CET function share parameter
	δ_{fa}^{va}	CES value-added function share parameter for factor f in activity a
	γ_{ch}^m	subsistence consumption of marketed commodity c for household h
	γ_{ach}^h	subsistence consumption of home commodity c from activity a for household h
	θ_{ac}	yield of output c per unit of activity a
	ρ_a^a	CES production function exponent
	ρ_a^{va}	CES value-added function exponent
	ρ_c^{ac}	domestic commodity aggregation function exponent
	ρ_c^q	Armington function exponent
	ρ_c^t	CET function exponent
EXOGENOUS VARIABLES	\overline{CPI}	consumer price index
	\overline{DMPS}	change in domestic institution savings rates (=0 for base)
	\overline{DTINS}	change in domestic institution tax share (=0 for base)
	\overline{FSAV}	foreign savings (FCU)

\overline{GADJ}	government consumption adjustment factor
\overline{IADJ}	investment adjustment factor
\overline{MPSADJ}	savings rate scaling factor (=0 for base)
\overline{QFS}_f	quantity supplied for factor
$\overline{TINSADJ}$	direct tax scaling factor (=0 for base)
$\overline{TRNSFR}_{i-row}$	transfer to domestic institutions from ROW
\overline{WFDIST}_{fa}	wage distortion factor for factor f in activity a
MPS_i	marginal propensity to save for domestic non-government institution

**ENDOGENOUS
VARIABLES**

DPI	producer price index for domestically marketed output	1
EG	government expenditures	1
EH_h	consumption spending for household h	h
EXR	exchange rate (LCU per unit of FCU)	1
$GSAV$	government savings	1
PA_a	activity price (unit gross revenue)	a
PDD_c	demand price for commodity produced and sold domestically	c
PDS_c	supply price for commodity produced and sold domestically	c
PE_c	export price (domestic currency)	c
$PINTA_a$	aggregate intermediate input price for activity a	a
PM_c	import price (domestic currency)	c
PQ_c	composite commodity price	c
PVA_a	value-added price (factor income per unit of activity)	a
PX_c	aggregate producer price for commodity	c
$PXAC_{ac}$	producer price of commodity c for activity a	ac
QA_a	quantity (level) of activity	a
QD_c	quantity sold domestically of domestic output	c
QE_c	quantity of exports	c
QF_{fa}	quantity demanded of factor f from activity a	fa
QG_c	government consumption demand for commodity	c
QH_{ch}	quantity consumed of commodity c by household h	ch
QHA_{ach}	quantity of household home consumption of commodity c from activity a for household h	ach
$QINTA_a$	quantity of aggregate intermediate input	a
$QINT_{ca}$	quantity of commodity c as intermediate input to activity a	ca
$QINV_c$	quantity of investment demand for commodity	c
QM_c	quantity of imports of commodity	c

QQ_c	quantity of goods supplied to domestic market (composite supply)	c
QT_c	quantity of commodity demanded as trade input	c
QVA_a	quantity of (aggregate) value-added	a
QX_c	aggregated marketed quantity of domestic output of commodity	ct
$QXAC_{ac}$	quantity of marketed output of commodity c from activity a	ac
$TINS_i$	direct tax rate for domestic nongovernment institution	i-2
$TRII_{i'}$	transfers from domestic nongovernment institution i' to i	(i-2)(i-3)/2
WF_f	average price of factor f	f
YF_f	income of factor f	f
YG	government revenue	1
YI_i	income of domestic nongovernment institution	i-2
YIF_{if}	income to domestic institution i from factor f	(i-2)f

SYSTEM OF EQUATIONS:

[Following Lofgren *at al.* (2002)]

1. Production and Trade Block

Activity production function (CES technology):

$$(1) \quad QA_a = \alpha_a^a \cdot \left(\delta_a^a \cdot QVA_a^{-\rho_a^a} + (1 - \delta_a^a) \cdot QINTA_a^{-\rho_a^a} \right)^{\frac{1}{\rho_a^a}} \quad a \in ACES$$

Optimization condition (FOC):

$$(2) \quad \frac{QVA_a}{QINTA_a} = \left(\frac{PINTA_a}{PVA_a} \right)^{\frac{1}{1+\rho_a^a}} \quad a \in ACES$$

Demand for aggregate value-added (Leontief technology):

$$(3) \quad QVA_a = iva_a \cdot QA_a \quad a \in ALEO$$

Demand for aggregate intermediate input (Leontief technology):

$$(4) \quad QINTA_a = int a_a \cdot QA_a \quad a \in ALEO$$

Value-added and factor demands (CES function):

$$(5) \quad QVA_a = \alpha_a^{va} \cdot \left(\sum_{f \in F} \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}} \right)^{\frac{1}{\rho_a^{va}}} \quad a \in A$$

Factor demand:

$$(6) \quad WF_f \cdot \overline{WFDIST}_{fa} = PVA_a \cdot (1 - tva_a) \cdot QVA_a \cdot \left(\sum_{f \in F} \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}} \right)^{-1} \cdot \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}-1}$$

$a \in A; f \in F$

Disaggregated intermediate input demand:

$$(7) \quad QINT_{ca} = ica_{ca} \cdot QINTA_a \quad a \in A; c \in C$$

Commodity production and allocation:

$$(8) \quad QXAC_{ac} + \sum_{h \in H} QHA_{ach} = \theta_{ac} \cdot QA_a \quad a \in A; c \in CX$$

Output aggregate function (CES):

$$(9) \quad QX_c = \alpha_c^{ac} \left(\sum_{a \in A} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_a^{ac}} \right)^{\frac{1}{\rho_c^{ac}-1}} \quad c \in CX$$

Optimization condition for output aggregate function (FOC):

$$(10) \quad PXAC_{ac} = PX_c \cdot QX_c \left(\sum_{a \in A} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_a^{ac}} \right)^{-1} \cdot \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_a^{ac}-1} \quad a \in A; c \in CX$$

Output transformation (CES function):

$$(11) \quad QX_c = \alpha_c^t \left(\delta_c^t \cdot QE_c^{\rho_c^t} + (1 - \delta_c^t) \cdot QD_c^{\rho_c^t} \right)^{\frac{1}{\rho_c^t}} \quad c \in (CE \cap CD)$$

Optimization condition for output transformation (FOC):

$$(12) \quad \frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c} \cdot \frac{1 - \delta_c^t}{\delta_c^t} \right)^{\frac{1}{\rho_c^t-1}} \quad c \in (CE \cap CD)$$

Output transformation for non-exported commodities:

$$(13) \quad QX_c = QD_c + QE_c \quad c \in (CD \cap CEN) \cup (CE \cap CDN)$$

Composite supply (Armington) function:

$$(14) \quad QQ_c = \alpha_c^q \left(\delta_c^q \cdot QM_c^{-\rho_c^q} + (1 - \delta_c^q) \cdot QD_c^{-\rho_c^q} \right)^{\frac{1}{\rho_c^q}} \quad c \in (CM \cap CD)$$

Optimization condition (FOC):

$$(15) \frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c} \cdot \frac{\delta_c^q}{1 - \delta_c^q} \right)^{\frac{1}{1+\rho}} \quad c \in (CM \cap CD)$$

Composite supply for non-imported outputs and nonproduced imports:

$$(16) QQ_c = QD_c + QM_c \quad c \in (CD \cap CMN) \cup (CM \cap CDN)$$

Demand for transactions service:

$$(17) QT_c = \sum_{c' \in C} (icm_{cc'} \cdot QM_c + ice_{cc'} \cdot QE_c + icd_{cc'} \cdot QD_{c'}) \quad c \in CT$$

2. Institution Block

Factor income:

$$(18) YF_f = \sum_{c' \in C} (WF_f \cdot \overline{WFDIST}_{fa} \cdot QF_{fa}) \quad f \in F$$

Institutional factor income:

$$(19) YIF_{if} = shif_{if} \cdot \left[(1 - tf_f) YF_f - trnsfr_{rovf} \cdot EXR \right] \quad i \in INSD; f \in F$$

Income of domestic, nongovernment institutions:

$$(20) YI_i = \sum_{f \in F} YIF_{if} + \sum_{i' \in INSDNG} TRII_{ii'} + trnsfr_{i-gov} \cdot \overline{CPI} + \overline{TRNSFR}_{i-row} \cdot EXR$$

$$i \in INSDNG$$

Intra-institutional transfer:

$$(21) TRII_{ii'} = shii_{ii'} \cdot (1 - MPS_{i'}) \cdot (1 - TINS_{i'}) \cdot YI_{i'} \quad i \in INSDNG; i' \in INSDNG'$$

Household consumption expenditure:

$$(22) EH_h = \left(1 - \sum_{i \in INSDNG} shii_{ih} \right) \cdot (1 - MPS_h) \cdot (1 - TINS_h) \cdot YI_h \quad h \in H$$

Household consumption demand for marketed commodities:

$$(23) PQ_c \cdot QH_{ch} = PQ_c \cdot \gamma_{ch}^m + \beta_{ch}^m \cdot \left(EH_h - \sum_{c' \in C} PQ_{c'} \cdot \gamma_{c'h}^m - \sum_{a \in A} \sum_{c' \in C} PXAC_{ac'} \cdot \gamma_{ac'h}^h \right)$$

$$c \in C; h \in H$$

Household consumption demand for home commodities:

$$(24) \quad PXAC_{ac} \cdot QHA_{ach} = PXAC_{ac} \cdot \gamma_{ach}^m + \beta_{ach}^m \cdot \left(EH_h - \sum_{c' \in C} PQ_{c'} \cdot \gamma_{c'h}^m - \sum_{a \in A} \sum_{c' \in C} PXAC_{ac'} \cdot \gamma_{ac'h}^h \right)$$

$$a \in A; c \in C; h \in H$$

Investment demand:

$$(25) \quad QINV_c = \overline{IADJ} \cdot \overline{qinv}_c \quad c \in CINV$$

Government consumption demand:

$$(26) \quad QG_c = \overline{GADJ} \cdot \overline{qg}_c \quad c \in C$$

Government revenue:

$$(27) \quad YG = \sum_{i \in INSGNG} TINS \cdot YI_i + \sum_{f \in F} tf_f \cdot YF_f + \sum_{a \in A} tva_a \cdot PVA_a \cdot QVA_a$$

$$+ \sum_{a \in A} ta_a \cdot PA_a \cdot QA_a + \sum_{c \in CM} tm_c \cdot pwm_c \cdot QM_c \cdot EXR + \sum_{c \in CE} te_c \cdot pwe_c \cdot QE_c \cdot EXR$$

$$+ \sum_{c \in C} tq_c \cdot PQ_c \cdot QQ_c + \sum_{f \in F} YIF_{gov-f} + \overline{TRNSFR}_{gov-row} \cdot EXR$$

Government expenditure:

$$(28) \quad EG = \sum_{c \in C} PQ_c \cdot QG_c + \sum_{i \in INSDNG} trnsfr_{i-gov} \cdot \overline{CPI}$$

3. System Constraint Block

Factor market:

$$(29) \quad \sum_{a \in A} QF_{fa} = \overline{QFS}_f \quad f \in F$$

Composite commodity markets:

$$(30) \quad QQ_c = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + QG_c + QINV_c + qdst_c + QT_c \quad c \in C$$

Current account balance for rest of the world (in foreign currency):

$$(31) \quad \sum_{c \in CM} pwm_c \cdot QM_c + \sum_{f \in F} trnsfr_{row-f} = \sum_{c \in CE} pwe_c \cdot QE_c + \sum_{i \in INSD} \overline{TRNSFR}_{i-row} + \overline{FSAV}$$

Government balance:

$$(32) \quad YG = EG + GSAV$$

Direct institutional tax rates:

$$(33) \quad TINS_i = \overline{tins}_i \cdot \left(1 + \overline{TINSADJ} \cdot tins01_i\right) + \overline{DTINS} \cdot tins01_i \quad i \in INSDNG$$

Institutional savings rates:

$$(34) \quad MPS_i = \overline{mps}_i \cdot \left(1 + \overline{MPSADJ} \cdot mps01_i\right) + \overline{DMPS} \cdot mps01_i \quad i \in INSDNG$$

Saving-Investment balance:

$$(35) \quad \sum_{i \in INSDNG} MPS_i \cdot (1 - TINS_i) \cdot Y_i + GSAV + EXR \cdot \overline{FSAV} = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$$

4. Price Block

Import price:

$$(39) \quad PM_c = pwm_c \cdot (1 + tm_c) \cdot EXR + \sum_{c' \in C} PQ_{c'} \cdot icm_{c'c} \quad c \in CM$$

Export price:

$$(40) \quad PE_c = pwe_c \cdot (1 - te_c) \cdot EXR - \sum_{c' \in C} PQ_{c'} \cdot ice_{c'c} \quad c \in CE$$

Demand price of domestic nontraded goods:

$$(41) \quad PDD_c = PDS_c + \sum_{c' \in CT} PQ_{c'} \cdot icd_{c'c} \quad c \in CD$$

Absorption:

$$(42) \quad PQ_c \cdot (1 - tq_c) \cdot QQ_c = PDD_c \cdot QD_c + PM_c \cdot QM_c \quad c \in (CD \cup CM)$$

Market output value:

$$(43) \quad PX_c \cdot QX_c = PDS_c \cdot QD_c + PE_c \cdot QE_c \quad c \in CX$$

Activity price:

$$(44) \quad PA_a = \sum_{c \in C} PXAC_{ac} \cdot \theta_{ac} \quad a \in A$$

Aggregate intermediate input price:

$$(45) \quad PINTA_a = \sum_{c \in C} PQ_c \cdot ica_{ca} \quad a \in A$$

Activity revenue and costs:

$$(46) \quad PA_a \cdot (1 - ta_a) \cdot QA_a = PVA_a \cdot QVA_a + PINTA_a \cdot QINTA_a \quad a \in A$$

Consumer price index:

$$(47) \overline{CPI} = \sum_{c \in C} PQ_c \cdot cwtsc_c = 1$$

Producer price index for nontraded market output:

$$(48) DPI = \sum_{c \in C} PPS_c \cdot dwts_c$$

3.5. THE GAMS PROGRAM (CODING)

The whole program has been written in GAMS. After having been able to reproduce the initial SAM from the program, we proceed to the simulations. The following section reports the results.

4. SIMULATION RESULTS

4.1. SCENARIO 1: THE TOTAL AMOUNT OF REMITTANCES INCREASES BY 50%

----	PARAMETER dCPI	=	0.000	percentage change in consumer price index (PQ-based)
	PARAMETER dDPI	=	0.300	percentage change in index for domestic producer prices (PDS-based)
	PARAMETER dEG	=	0.019	percentage change in total current government expenditure
----	PARAMETER dEH	percentage change in household consumption expenditure		
		HHRUR	1.507,	HHURB 4.521
----	PARAMETER dEXR	=	-0.785	percentage change in exchange rate
	PARAMETER dGADJ	=	0.000	percentage change in government demand scaling factor
	PARAMETER dGOVSHR	=	-2.048	percentage change in govt consumption share of absorption
	PARAMETER dGSAV	=	0.949	percentage change in government savings
	PARAMETER dIADJ	=	1.740	percentage change in investment scaling factor (for fixed capital formation)
	PARAMETER dINVSHR	=	-0.447	percentage change in investment share of absorption
----	PARAMETER dPA	percentage change in output price of activity a		
		AAGR	0.101,	AIND -0.011, ASER 0.002
----	PARAMETER dPDD	percentage change in demand price for com'y c produced & sold domestically		
		CAGR	0.260,	CIND 0.355, CSER 0.122
----	PARAMETER dPDS	percentage change in supply price for com'y c produced & sold domestically		

CAGR 0.292, CIND 0.428, CSER 0.122

---- PARAMETER dPE percentage change in price of exports
CAGR -0.785, CIND -0.785, CSER -0.785

---- PARAMETER dPINTA percentage change in price of intermediate aggregate
AAGR 0.033, AIND -0.010, ASER -0.037

---- PARAMETER dPM percentage change in price of imports
CAGR -0.785, CIND -0.785, CSER -0.785

---- PARAMETER dPQ percentage change in price of composite good c
CAGR 0.230, CIND -0.082, CSER 0.029

---- PARAMETER dPVA percentage change in value added price
AAGR 0.135, AIND -0.012, ASER 0.031

---- PARAMETER dPWE percentage change in world price of exports
(ALL 0.000)

---- PARAMETER dPWM percentage change in world price of imports
(ALL 0.000)

---- PARAMETER dPX percentage change in average output price
CAGR 0.101, CIND -0.011, CSER 0.002

---- PARAMETER dPXAC percentage change in price of commodity c from activity a

	CAGR	CIND	CSER
AAGR	0.101		
AIND		-0.011	
ASER			0.002

---- PARAMETER dQA percentage change in level of domestic activity
AAGR 0.155, AIND -0.609, ASER 0.515

---- PARAMETER dQD percentage change in quantity of domestic sales
CAGR 0.264, CIND 0.124, CSER 0.570

---- PARAMETER dQE percentage change in quantity of exports
CAGR -1.079, CIND -2.279, CSER 0.114

---- PARAMETER dQF percentage change in quantity demanded of factor f from activity a

	AAGR	AIND	ASER
LABRUR	0.175	-0.681	0.461
LABURB	0.147	-0.704	0.434
CAP	0.366	-0.530	0.639

---- PARAMETER dQFS percentage change in quantity of factor supply
(ALL 0.000)

---- PARAMETER dQG percentage change in quantity of government consumption
(ALL 0.000)

---- PARAMETER dQH percentage change in quantity consumed of marketed commodity c by household h

	HHRUR	HHURB
CAGR	1.276	3.087
CIND	1.711	5.783
CSER	1.295	3.043

---- PARAMETER dQHA percentage change in quantity consumed of home commodity c fr act a by hhd h

	HHRUR	HHURB
AAGR.CAGR	1.368	4.138
AIND.CIND	1.423	4.194
ASER.CSER	1.416	4.188

---- PARAMETER dQINT percentage change in quantity of intermediate demand for c from activity a

	AAGR	AIND	ASER
CAGR	0.155	-0.609	0.515
CIND	0.155	-0.609	0.515
CSER	0.155	-0.609	0.515

---- PARAMETER dQINTA percentage change in quantity of aggregate intermediate input
AAGR 0.155, AIND -0.609, ASER 0.515

---- PARAMETER dQINV percentage change in quantity of fixed investment demand
CAGR 1.740, CIND 1.740

---- PARAMETER dQM percentage change in quantity of imports
CAGR 2.923, CIND 2.087, CSER 1.028

---- PARAMETER dQQ percentage change in quantity of composite goods supply
CAGR 0.338, CIND 0.869, CSER 0.616

---- PARAMETER dQT percentage change in quantity of trade and transport demand for commodity c

CSER 0.152

---- PARAMETER dQVA percentage change in quantity of aggregate value added

AAGR 0.155, AIND -0.609, ASER 0.515

---- PARAMETER dQX percentage change in quantity of aggregate marketed commodity output

CAGR 0.025, CIND -0.749, CSER 0.510

---- PARAMETER dQXAC percentage change in quantity of output of commodity c from activity a

	CAGR	CIND	CSER
AAGR	0.025		
AIND		-0.749	
ASER			0.510

---- PARAMETER dTABS = 2.121 percentage change in total absorption

---- PARAMETER dTRII percentage change in transfers to dom. inst. insdng from insdngp

	ENT
HHRUR	-0.076
HHURB	-0.076

---- PARAMETER dWF percentage change in economy-wide wage (rent) for factor f

LABRUR 0.109, LABURB 0.147, CAP -0.145, LAND 0.343

---- PARAMETER dWFDIST percentage change in factor wage distortion variable

(ALL 0.000)

---- PARAMETER dYF percentage change in factor income

LABRUR 0.109, LABURB 0.147, CAP -0.145, LAND 0.343

---- PARAMETER dYG = 0.210 percentage change in total current government income

---- PARAMETER dYIF percentage change in income of institution ins from factor f

	LABRUR	LABURB	CAP	LAND
HHRUR	0.109		-0.145	0.343
HHURB		0.147	-0.145	0.343
ENT			-0.145	

---- PARAMETER dYI percentage change in income of (domestic non-governmental) institution ins

HHRUR 1.507, HHURB 4.521, ENT -0.076

4.2. SCENARIO 2: DOULBE OF THE REMITTANCES

- PARAMETER dCPI = 0.000 percentage change in
consumer price index (PQ-based)
- PARAMETER dDPI = 0.603 percentage change in
index for domestic producer prices (PDS-based)
- PARAMETER dEG = 0.043 percentage change in
total current government expenditure
- PARAMETER dEH percentage change in household consumption expenditure
HHRUR 3.006, HHURB 8.986
- PARAMETER dEXR = -1.567 percentage change in exchange rate
- PARAMETER dGADJ = 0.000 percentage change in
government demand scaling factor
- PARAMETER dGOVSHR = -3.989 percentage change in
govt consumption share of absorption
- PARAMETER dGSAV = 1.936 percentage change in
government savings
- PARAMETER dIADJ = 3.486 percentage change in
investment scaling factor (for fixed capital formation)
- PARAMETER dINVSHR = -0.862 percentage change in
investment share of absorption
- PARAMETER dPA percentage change in output price of activity a
AAGR 0.211, AIND -0.018, ASER 0.014
- PARAMETER dPDD percentage change in demand price for com'y c produced & sold
domestically
CAGR 0.528, CIND 0.707, CSER 0.255
- PARAMETER dPDS percentage change in supply price for com'y c produced & sold
domestically
CAGR 0.593, CIND 0.850, CSER 0.255
- PARAMETER dPE percentage change in price of exports
CAGR -1.567, CIND -1.567, CSER -1.567
- PARAMETER dPINTA percentage change in price of intermediate aggregate
AAGR 0.064, AIND -0.023, ASER -0.074
- PARAMETER dPM percentage change in price of imports
CAGR -1.567, CIND -1.567, CSER -1.567

- PARAMETER dPQ percentage change in price of composite good c
CAGR 0.468, CIND -0.170, CSER 0.069
- PARAMETER dPVA percentage change in value added price
AAGR 0.286, AIND -0.005, ASER 0.080
- PARAMETER dPWE percentage change in world price of exports
(ALL 0.000)
- PARAMETER dPWM percentage change in world price of imports
(ALL 0.000)
- PARAMETER dPX percentage change in average output price
CAGR 0.211, CIND -0.017, CSER 0.014
- PARAMETER dPXAC percentage change in price of commodity c from activity a
- | | | | |
|------|-------|--------|-------|
| | CAGR | CIND | CSER |
| AAGR | 0.211 | | |
| AIND | | -0.017 | |
| ASER | | | 0.014 |
- PARAMETER dQA percentage change in level of domestic activity
AAGR 0.306, AIND -1.201, ASER 1.018
- PARAMETER dQD percentage change in quantity of domestic sales
CAGR 0.524, CIND 0.238, CSER 1.127
- PARAMETER dQE percentage change in quantity of exports
CAGR -2.167, CIND -4.509, CSER 0.204
- PARAMETER dQF percentage change in quantity demanded of factor f from activity a
- | | | | |
|--------|-------|--------|-------|
| | AAGR | AIND | ASER |
| LABRUR | 0.345 | -1.342 | 0.909 |
| LABURB | 0.288 | -1.387 | 0.856 |
| CAP | 0.722 | -1.046 | 1.263 |
- PARAMETER dQFS percentage change in quantity of factor supply
(ALL 0.000)
- PARAMETER dQG percentage change in quantity of government consumption
(ALL 0.000)

---- PARAMETER dQH percentage change in quantity consumed of marketed commodity c by household h

	HHRUR	HHURB
CAGR	2.533	6.116
CIND	3.418	11.507
CSER	2.577	6.041

---- PARAMETER dQHA percentage change in quantity consumed of home commodity c fr act a by hhd h

	HHRUR	HHURB
AAGR.CAGR	2.720	8.209
AIND.CIND	2.835	8.334
ASER.CSER	2.819	8.316

---- PARAMETER dQINT percentage change in quantity of intermediate demand for c from activity a

	AAGR	AIND	ASER
CAGR	0.306	-1.201	1.018
CIND	0.306	-1.201	1.018
CSER	0.306	-1.201	1.018

---- PARAMETER dQINTA percentage change in quantity of aggregate intermediate input

AAGR 0.306, AIND -1.201, ASER 1.018

---- PARAMETER dQINV percentage change in quantity of fixed investment demand

CAGR 3.486, CIND 3.486

---- PARAMETER dQM percentage change in quantity of imports

CAGR 5.958, CIND 4.206, CSER 2.059

---- PARAMETER dQQ percentage change in quantity of composite goods supply

CAGR 0.673, CIND 1.739, CSER 1.221

---- PARAMETER dQT percentage change in quantity of trade and transport demand for commodity c

CSER 0.294

---- PARAMETER dQVA percentage change in quantity of aggregate value added

AAGR 0.306, AIND -1.201, ASER 1.018

---- PARAMETER dQX percentage change in quantity of aggregate marketed commodity output

CAGR 0.047, CIND -1.479, CSER 1.006

---- PARAMETER dQXAC percentage change in quantity of output of commodity c from activity a

	CAGR	CIND	CSER
AAGR	0.047		
AIND		-1.479	
ASER			1.006

---- PARAMETER dTABS = 4.226 percentage change in total absorption

---- PARAMETER dTRII percentage change in transfers to dom. inst. insdng from insdngp

	ENT
HHRUR	-0.127
HHURB	-0.127

---- PARAMETER dWF percentage change in economy-wide wage (rent) for factor f

LABRUR	0.233,	LABURB	0.310,	CAP	-0.266,	LAND	0.695
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---- PARAMETER dWFDIST percentage change in factor wage distortion variable

(ALL 0.000)

---- PARAMETER dYF percentage change in factor income

LABRUR	0.233,	LABURB	0.310,	CAP	-0.266,	LAND	0.695
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---- PARAMETER dYG = 0.433 percentage change in total current government income

---- PARAMETER dYIF percentage change in income of institution ins from factor f

	LABRUR	LABURB	CAP	LAND
HHRUR	0.233		-0.266	0.695
HHURB		0.310	-0.266	0.695
ENT			-0.266	

---- PARAMETER dYI percentage change in income of (domestic non-governmental) institution ins

HHRUR 3.006, HHURB 8.986, ENT -0.127

5. CONCLUDING REMARKS AND DIRECTIONS FOR EXTENSION

The model presented above is only a benchmark one. The success of the programming will allow us to go further by extending the model with a more detailed disaggregated SAM, by which we can investigate the economy in a more sophisticated manner (more activities and more households). Welfare will be brought into consideration. Values of exogenous parameters will be

examined more carefully. More experiments will be done with different sets of macro closures. The scenarios for simulation will be enriched in combination with, for instance, alternative trade/tax reforms and different patterns by which the households employ their overseas remittances.

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