Impact Analysis Toolkit: Survey of Simulation Models used for Trade Policy Analysis

Organized by Economics and Social Committee for Western Asia
(September 28, 2017)
Beirut

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1. Introduction

- To review the main approaches used in applied trade analysis
- An attempt to be as clear as possible
- To provide practical examples and to discuss them.
- To use some well-known trade theory concepts.

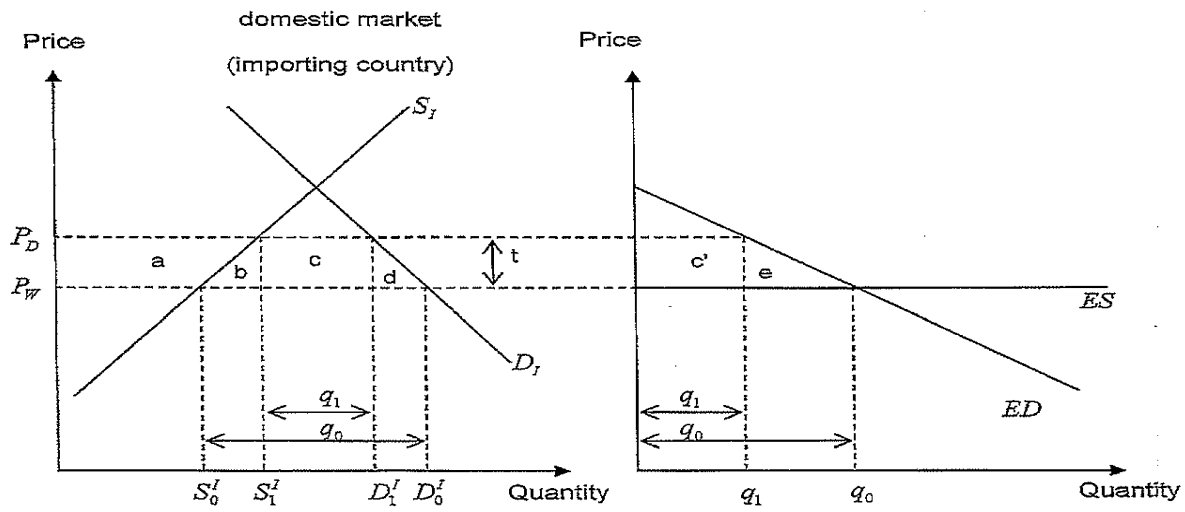
Outline of the presentation

Main quantitative approaches to analyze trade policies

1. A Brief Review on the Economic and Welfare Impacts of a Tariff Policy
2. Partial Equilibrium Trade Model: The Homogenous Product Case
3. Partial Equilibrium Trade Model: The National Product Differentiation Model
4. Computable General Equilibrium Model
5. The Gravity Model

1.

1. Brief Review of an economict and welfare impact of a tariff (small country case)

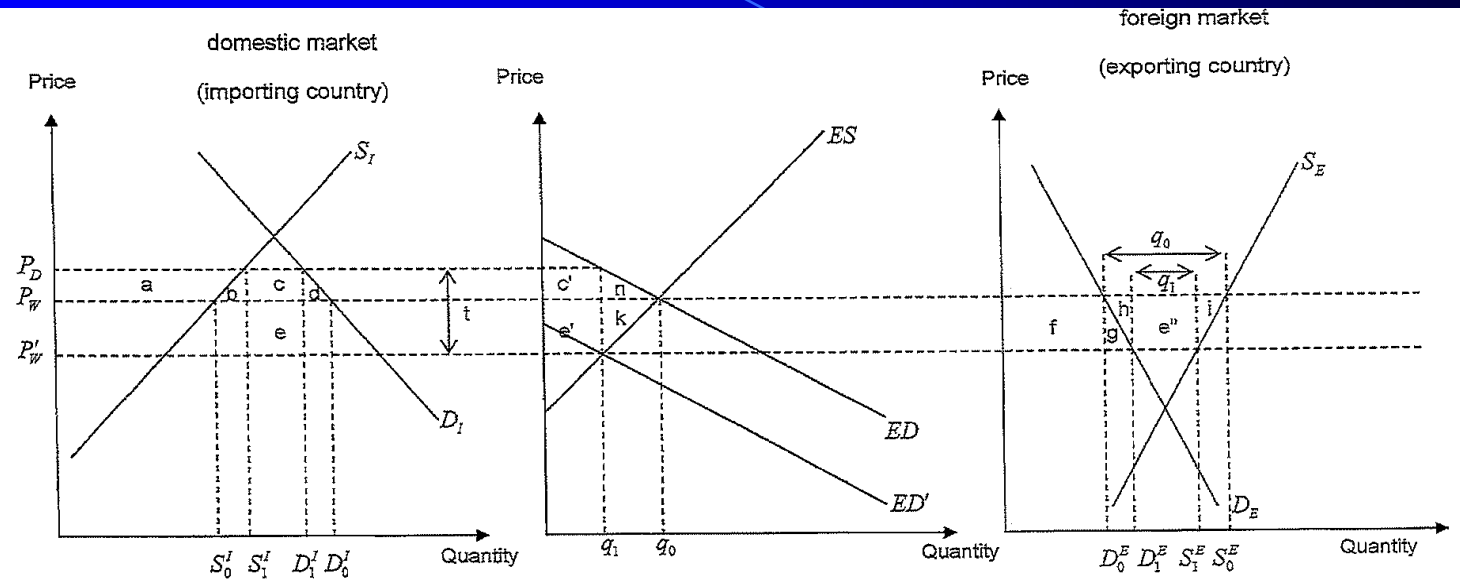


c = c'

b + d = e

Welfare effects	
	Importing country
Consumer surplus	- (a + b + c + d)
Producer surplus	+ a
Tariff revenue	+ c
National welfare	– (b + d)

1. Brief review of the economic and welfare impacts of a tariff (large country case)



c = c'

e = e' =e''

b + d = n

h + i = k

Terms of Trade effects = e = e' = e''

Welfare effects		
	Exporting country	Importing country
Consumer surplus	+ f + g	- (a + b + c + d)
Producer surplus	- (f + g + h + e'' + i)	+ a
Tariff revenue		c + e
National welfare	- (h + e'' + i)	e – (b + d)
World welfare	- (b + d + h + i)	

2. Partial equilibrium modeling approach: the Homogenous Product Model

- **Characteristics:**

-Homogenous product

-Unique world : ⇒ Law of one price is prevailing

-Each country is characterized by 1) domestic supply and demand functions, 2) net trade obtained by difference and 3) a price transmission equation linking domestic and world prices.

-The market equilibrium identity confronting all countries' net trade determines work equilibrium price which in turn determines each country domestic price and hence domestic supply and demand

- **Three country case**

- Three countries A, B and C: A and C are net importers and B is net exporter

-Linear supply and demand functions calibrated for the base period with known price elasticities

-

- **Welfare effects**

-Change in consumer and producer surpluses

-Government revenues or costs

- Deadweight losses:

2. The homogenous-product three-country model: Presentation

Model equations

Supply equation

$$QS_i = \alpha_i^S + \beta_i^S \times PINT_i \quad (1)$$

Demand equation

$$QD_i = \alpha_i^D + \beta_i^D \times PINT_i \quad (2)$$

Net trade

$$NT_i = QS_i - QD_i \quad (3)$$

Price transmission

$$PINT_i = PW \quad (4)$$

Net Trade equilibrium

$$\sum_i NT_i = 0 \quad \text{for } i = A, B \text{ and } C \quad (5)$$

Price transmission equations

Ad-valorem tariff: $PINT_{A,C} = PW \times (1 + TAR_{A,B})$ (6a)

Export subsidy : $PINT_B = PW \times (1 + SUBEXP_B)$ (6b)

Export tax: $PINT_B = PW \times (1 - TAXEXP_B)$ (6c)

Variables and parameters

QS_i: Domestic supply in country i
QD_i: Domestic demand in country i
NT_i: Net trade in country i
$PINT_i$: domestic price in country i
PW : World price
α_i^S, α_i^D, β_i^S and β_i^D are parameters

2. THE THREE-COUNTRY MODEL: EXCEL PRESENTATION

MODEL PARAMETERS	
DESIGNATION	VALUES
DOMESTIC SUPPLY ELASTICITY (Country A)	0.69
DOMESTIC DEMAND ELASTICITY (Country A)	-0.28
DOMESTIC SUPPLY ELASTICITY (Country B)	0.81
DOMESTIC DEMAND ELASTICITY (Country B)	-0.79
DOMESTIC SUPPLY ELASTICITY (Country C)	0.69
DOMESTIC DEMAND ELASTICITY (Country C)	-0.49
DOMESTIC SUPPLY SLOPE COEFFICIENT (Country A)	0.20
DOMESTIC DEMAND SLOPE COEFFICIENT (Country A)	-0.10
DOMESTIC SUPPLY SLOPE COEFFICIENT (Country B)	0.40
DOMESTIC DEMAND SLOPE COEFFICIENT (Country B)	-0.20
DOMESTIC SUPPLY SLOPE COEFFICIENT (Country C)	0.30
DOMESTIC DEMAND SLOPE COEFFICIENT (Country C)	-0.30
DOMESTIC SUPPLY INTERCEPT (Country A)	2.0
DOMESTIC DEMAND INTERCEPT (Country A)	10.0
DOMESTIC SUPPLY INTERCEPT (Country B)	2.0
DOMESTIC DEMAND INTERCEPT (Country B)	10.0
DOMESTIC SUPPLY INTERCEPT (Country C)	3.0
DOMESTIC DEMAND INTERCEPT (Country C)	20.0
POLICY INSTRUMENTS	
AD VALOREM TARIFF (Country A)	0.0
EXPORT SUBSIDY (Country B)	0.0
EXPORT TAX (Country B)	0.0
PRODUCTION QUOTA (Country B)	0.0
AD VALOREM TARIFF (Country C)	0.0

ENDOGENOUS VARIABLES			
DESIGNATION	BASE VALUES	SIMULATED VALUES	VARIATION (%)
DOMESTIC SUPPLY (Country A)	6.4	6.40	0.00%
DOMESTIC DEMAND (Country A)	7.8	7.80	0.00%
NET TRADE (Country A)	-1.4	-1.40	0.00%
DOMESTIC PRICE (Country A)	22.0	22.00	0.00%
DOMESTIC SUPPLY (Country B)	10.8	10.80	0.00%
DOMESTIC DEMAND (Country B)	5.6	5.60	0.00%
NET TRADE (Country B)	5.2	5.20	0.00%
DOMESTIC PRICE (Country B)	22.0	22.00	0.00%
DOMESTIC SUPPLY (Country C)	9.6	9.60	0.00%
DOMESTIC DEMAND (Country C)	13.4	13.40	0.00%
NET TRADE (Country C)	-3.8	-3.80	0.00%
DOMESTIC PRICE (Country C)	22.0	22.00	0.00%
WORLD PRICE	22.0	22.00	0.00%
WELFARE ANALYSIS			
RENT COUNTRY B	0.0	0.00	
PRODUCER SURPLUS (Country A)	92.4	92.40	0.00%
CONSUMER SURPLUS (Country A)	304.2	304.20	0.00%
PRODUCER SURPLUS (Country B)	140.8	140.80	0.00%
CONSUMER SURPLUS (Country B)	78.4	78.40	0.00%
PRODUCER SURPLUS (Country C)	138.6	138.60	0.00%
CONSUMER SURPLUS (Country C)	299.3	299.27	0.00%

MODEL RELATIONSHIPS	
DESIGNATION	EQUATIONS
DOMESTIC SUPPLY (Country A) (EQSUPA)	6.40
DOMESTIC DEMAND (Country A) (EQDEMA)	7.80
DOMESTIC SUPPLY (Country B) (EQSUPB)	10.80
DOMESTIC DEMAND (Country B) (EQDEMB)	5.60
DOMESTIC SUPPLY (Country C) (EQSUPC)	9.60
DOMESTIC DEMAND (Country C) (EQDEMC)	13.40
NET TRADE (Country A) (IDENTA)	-1.40
NET TRADE (Country B) (IDENTB)	5.20
NET TRADE (Country C) (IDENTC)	-3.80
SUPPLY-DEMAND MARKET EQUILIBRIUM (IDENTD)	0.00
PRICE EQUATION (Country A) (PRICEA)	22.00
PRICE EQUATION (Country B) (PRICEB)	22.00
PRICE EQUATION (Country C) (PRICEC)	22.00

SCENARIO ANALYSIS

METHOD: Simulate with the three-country model the impact of a tariff policy and compare the results with a free trade solution

ESTABLISHMENT OF SCENARIOS

- ***Scenario I***: 20% tariff by Country A
- ***Scenario II***: 50% tariff by Country C
- ***Scenario III***: Combining Scenarios I and II
- ***Scenario IV***: Countries A and C impose a tariff of 20%

WHAT TO EXPECT IN TERMS OF PRICES AND NET EXPORTS:

- In all cases world prices decrease.
- Total net exports decrease
- In Scenarios I and II, the importer which is not imposing a tariff receives the world price.
- In scenario III, the large decline in the world price could offset the 20% tariff in Country A and hence the price in Country A could decrase.

Scenario Simulations

	Free trade	Scenario I		Scenario II		Scenario III		Scenario IV	
		Simulated values	Change (%)	Simulated values	Change (%)	Simulated values	Change (%)	Simulated values	Change (%)
World price (PW)	22.00	21.15	-3.85%	18.33	-16.67%	17.74	-19.35%	19.64	-10.71%
Country A									
Domestic price ($PINT_A$)	22.00	25.38	15.38%	18.33	-16.67%	21.29	-3.23%	23.57	7.14%
Domestic Supply (QS_A)	6.40	7.08	10.58%	5.67	-11.46%	6.26	-2.22%	6.71	4.91%
Domestic demand (QD_A)	7.80	7.46	-4.34%	8.17	4.70%	7.87	0.91%	7.64	-2.01%
Net trade (NT_A)	-1.40	-0.38	-72.53%	-2.50	78.57%	-1.61	15.21%	-0.93	-33.67%
Country B									
Domestic price ($PINT_B$)	22.00	21.15	-3.85%	18.33	-16.67%	17.74	-19.35%	19.64	-10.71%
Domestic Supply (QS_B)	10.80	10.46	-3.13%	9.33	-13.58%	9.10	-15.77%	9.86	-8.73%
Domestic demand (QD_B)	5.60	5.77	3.02%	6.33	13.10%	6.45	15.21%	6.07	8.42%
Net trade (NT_B)	5.20	4.69	-9.76%	3.00	-42.31%	2.65	-49.13%	3.79	-27.20%
Country C									
Domestic price ($PINT_C$)	22.00	21.15	-3.85%	27.50	25.00%	26.61	20.97%	23.57	7.14%
Domestic Supply (QS_C)	9.60	9.35	-2.64%	11.25	17.19%	10.98	14.42%	10.07	4.91%
Domestic demand (QD_C)	13.40	13.65	1.89%	11.75	-12.31%	12.02	-10.33%	12.93	-3.52%
Net trade (NT_C)	-3.80	-4.31	13.36%	-0.50	-86.84%	-1.03	-72.84%	-2.86	-24.81%
Producer surplus (Country A)	92.40	115.21	24.68%	70.28	-23.94%	87.91	-4.86%	102.70	11.15%
Consumer surplus (Country A)	304.20	278.37	-8.49%	333.47	9.62%	309.76	1.83%	292.07	-3.99%
Producer surplus (Country B)	140.80	131.80	-6.39%	103.89	-26.22%	98.44	-30.09%	116.45	-17.29%
Consumer surplus (Country B)	78.40	83.21	6.14%	100.28	27.91%	104.06	32.73%	92.16	17.55%
Producer surplus (Country C)	138.60	130.58	-5.78%	195.94	41.37%	186.08	34.25%	154.06	11.15%
Consumer surplus (Country C)	299.27	310.71	3.82%	230.10	-23.11%	240.65	-19.59%	278.58	-6.91%

Notes: The four scenarios are defined as follows: ***Scenario I***: Imposition of a 20% tariff by importing Country A; ***Scenario II:*** Imposition of a 20% tariff by importing Country C. ***Scenario III***: Imposition of a 20% tariff by importing Country A and 50% by Country C; ***Scenario IV***: Imposition of a 20% tariff by importing Countries A and C

Welfare effects

	Scenario I	Scenario II	Scenario III	Scenario IV
Change in world prices (%)	-3.85%	-16.67%	-19.35%	-10.71%
Change in total net exports (%)	-9.76%	-42.31%	-49.13%	-33.67%
Country A				
Change in PS	22.81	-22.12	-4.49	10.30
Change in CS	-25.83	29.27	5.56	-12.13
Government revenues	1.63		5.72	3.65
National welfare	-1.39	7.15	6.79	1.82
Country B				
Change in PS	-9.00	-36.91	-42.36	-24.35
Change in CS	4.81	21.88	25.66	13.76
National welfare	-4.19	-15.03	-16.70	-10.59
Country C				
Change in PS	-8.02	57.34	47.48	15.46
Change in CS	11.45	-69.16	-58.62	-20.69
Government revenues		4.58	9.16	11.22
National welfare	3.43	-7.24	-1.99	5.99
World welfare	-2.15	-15.12	-11.90	-2.78

Notes: PS =Producer surplus, CS= Consumer surplus

Scenario I: Imposition of a 20% ad-valorem tariff by Country A

Scenario II: Imposition of a 50% ad-valorem tariff by Country C

Scenario III: Imposition of a 20% and 50% ad-valorem tariffs by Countries A and C

Scenario IV: Imposition of a common 20% ad-valorem tariff by Countries A and C

2. PARTIAL EQULIBRIUM TRADE MODEL: WRAPPING UP

- **The three-country model clearly shows how to implement a trade policy scenario**
- **The above model can be made more realistic:**

- The model can be made multi-commodity and multi-country
- Incorporating transportation costs and exchange rates in the price transmission equations
- Other trade policies can be incorporated: quantitative restrictions and domestic policies, tariff rate quotas

- **Numerous global models for agricultural commodities:**

- ATPSM (UNCTAD), AGLINK (OECD), COSIMO (FAO)

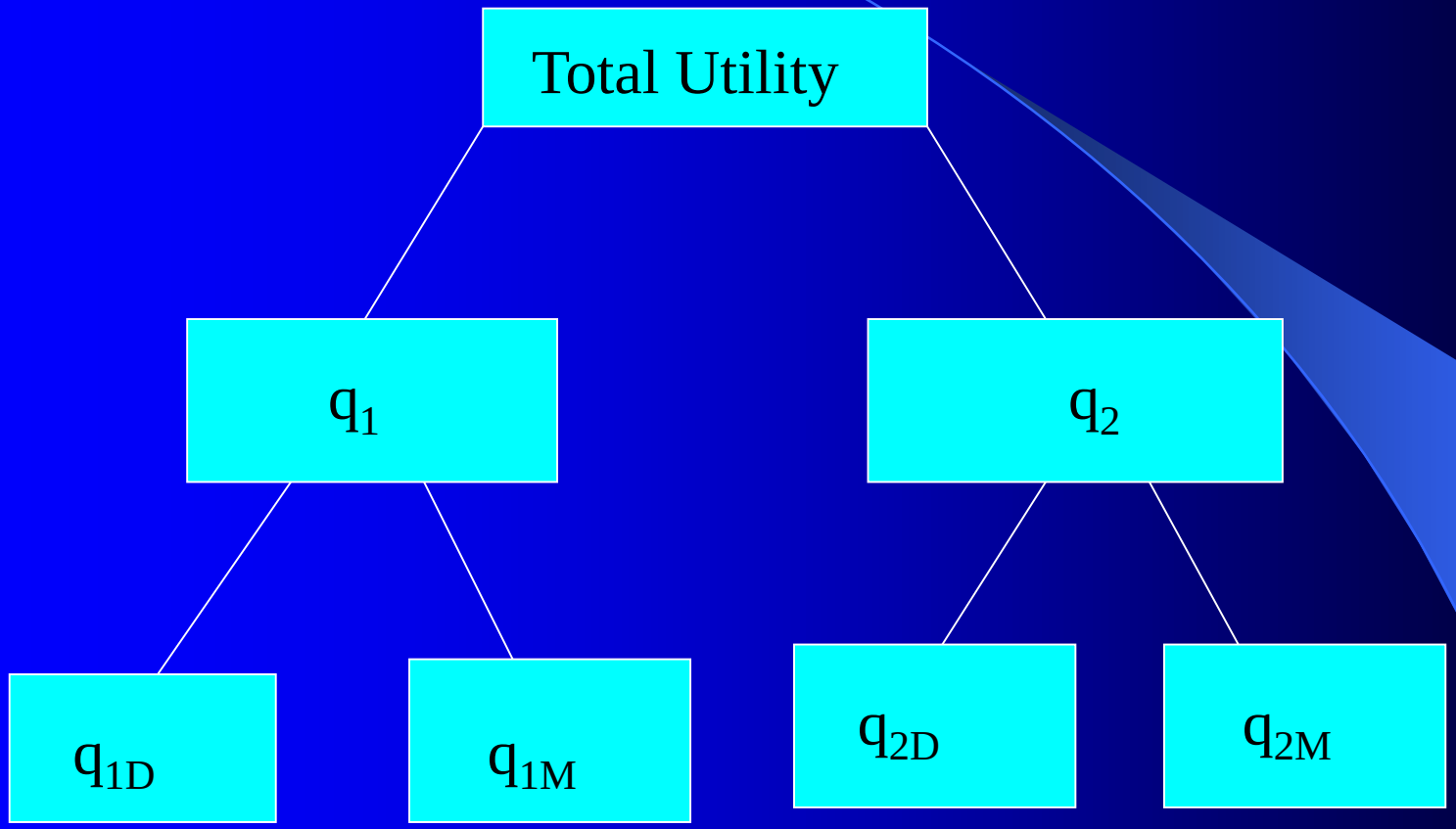
- **Limitations of the model**:

- Unique world price
- Net trade

3. PARTIAL EQUILIBRIUM TRADE MODEL: NATIONAL PRODUCT DIFFERENTIATION

- This model assumes imperfect substitution among products according the sources of origins. It is also called Armington trade model.
- The imperfect substitution is captured by a constant elasticity of substitution σ. This elasticity should be quite large. When its tends towards $+\infty$, we have perfect substitution among products and this is the same as the homogenous product model.
- The preferences of the consumer behind the Armingtom model is a CES (constant elasticity of substitution) utility function with arguments being the various imports and the consumption of domestically produced products. (see next slide).
- There are now as many product markets as there are exporters producing a different product. The law of one price does not prevail any more
- The imports and exports are modelled separately.

Separabilty of the consumer preferences



Armington model: Main characteristics

- **GSSIM model** : (Francois and Hall)
- **Assume each country with the following model specification**:
- - An export supply function
- - An aggregate demand function
- - CES import demand functions
- **For each country product, a market equilibrium condition for exports and imports determines the market equilibrium price**.
- **The GSSIM model is expressed in first order difference and solved using the EXCEL solver.**
- **There are two version of GSSIM: one for four countries and one for 24 countries.**

The 4×4 GSSIM model

INPUTS

trade at world prices:

Origin \ destination	USA	JAPAN	EU	ROW	Totals
USA	0	50	200	300	550
JAPAN	500	0	150	200	850
EU	300	100	200	200	800
ROW	50	100	110	20	280
Totals	850	250	660	720	

initial import tariffs

Origin \ destination	USA	JAPAN	EU	ROW
USA	1	1.21	1.41	1.22
JAPAN	1.37	1	1.31	1.23
EU	1.32	1.36	1	1.18
ROW	1.57	1.41	1.25	1.15

final import tariffs

Origin \ destination	USA	JAPAN	EU	ROW
USA	1	1.21	1.41	1.22
JAPAN	1.37	1	1.31	1.23
EU	1.32	1.36	1	1.18
ROW	1.57	1.41	1.25	1.15

Elasticities:

		USA	JAPAN	EU	ROW
Em	Import Demand	-1.25	-1.25	-1.25	-1.25
Ex	Export Supply	1.5	1.5	1.5	1.5
Es	Substitution	5	5	5	5

Calibrated values

θ Import shares at internal prices

		destination			
		USA	JAPAN	EU	ROW
origin	USA	0.00000	0.17926	0.34559	0.42021
	JAPAN	0.59077	0.00000	0.24081	0.28243
	EU	0.34153	0.40296	0.24510	0.27095
	ROW	0.06770	0.41778	0.16850	0.02641
	SUM	1	1	1	1

ϕ Export shares at world prices

		destination				
		USA	JAPAN	EU	ROW	SUM
origin	USA	0.0000	0.0909	0.3636	0.5455	1
	JAPAN	0.5882	0.0000	0.1765	0.2353	1
	EU	0.3750	0.1250	0.2500	0.2500	1
	ROW	0.1786	0.3571	0.3929	0.0714	1

N(i,v),(r,r) Own price elasticities

		destination			
		USA	JAPAN	EU	ROW
Origin	USA	-5.0000	-4.3278	-3.7040	-3.4242
	JAPAN	-2.7846	-5.0000	-4.0970	-3.9409
	EU	-3.7193	-3.4889	-4.0809	-3.9839
	ROW	-4.7461	-3.4333	-4.3681	-4.9010

N(i,v),(r,s) Cross price elasticities

		destination			
		USA	JAPAN	EU	ROW
origin	USA	0.0000	0.6722	1.2960	1.5758
	JAPAN	2.2154	0.0000	0.9030	1.0591
	EU	1.2807	1.5111	0.9191	1.0161
	ROW	0.2539	1.5667	0.6319	0.0990

MODEL SOLUTIONS

MARKET CLEARING CONDITIONS
Relative price changes

		benchmark prices	new prices	change in supply	change in demand	Excess Demand
origin	USA	0.0000	0.0000	0.0000	0.0000	0.0000
	JAPAN	0.0000	0.0000	0.0000	0.0000	0.0000
	EU	0.0000	0.0000	0.0000	0.0000	0.0000
	ROW	0.0000	0.0000	0.0000	0.0000	0.0000

FORMATION OF A CUSTOM UNION:EU- USA
What to expect ?

- EU and USA agree on a zero tariff on their bilateral trade and impose a common tariff on the imports from other regions.
- Due to elimination of of bilateral tariffs, export prices in the US and EU would increase but domestic prices of EU- and US-imported products would decline.
- Trade creation and diversion would be created.
- EU imports from the US and US imports from EU would increase.
- US and EU exports to other regions would decline.
- Change in trade flows with other regions would occur.

FORMATION OF A CUSTOM UNION EU-USA

- No tariff between EU and USA

- Common Tariff set at 25% with other countries

Initial import tariff — Destination

	USA	JAPAN	EU	ROW
USA	1	1.21	**1.41**	1.22
JAPAN	1.37	1	1.31	1.23
EU	**1.32**	1.36	1	1.18
ROW	1.57	1.41	1.25	1.15

final import tariffs — destination

	USA	JAPAN	EU	ROW
USA	1	1.21	**1**	1.22
JAPAN	**1.25**	1	**1.25**	1.23
EU	**1**	1.36	1	1.18
ROW	**1.25**	1.41	**1.25**	1.15

MODEL SOLUTIONS

MARKET CLEARING CONDITIONS
Relative price changes

		benchmark prices	new prices	change in supply	change in demand	Excess Demand
Origin	USA	0.0000	0.0818	0.1227	0.1227	0.0000
	JAPAN	0.0000	-0.0015	-0.0023	-0.0023	0.0000
	EU	0.0000	0.0389	0.0583	0.0583	0.0000
	ROW	0.0000	0.0061	0.0091	0.0091	0.0000

OTHER RESULTS

trade quantities: percent change

		Destination			
		USA	JAPAN	EU	ROW
Origin	USA	0.0	**-28.6**	**77.1**	**-24.2**
	JAPAN	-6.3	0.0	-3.7	17.5
	EU	**50.9**	**-7.1**	-46.8	**-2.7**
	ROW	48.0	9.3	-30.4	13.7

proportional change in internal prices

		Destination			
		USA	JAPAN	EU	ROW
Origin	USA	0.0818	0.0818	**-0.2328**	0.0818
	JAPAN	-0.0890	-0.0015	-0.0473	-0.0015
	EU	**-0.2130**	0.0389	0.0389	0.0389
	ROW	-0.1990	0.0061	0.0061	0.0061
	Composite price	-0.1388	0.0329	-0.0813	0.0446

total welfare effects

		A	B	C	D=A+B+C
		Producer surplus	Consumer surplus	Tariff revenue	Net welfare effect
Country	USA	47.7	174.9	-173.9	48.7
	JAPAN	-1.3	-11.3	0.4	-12.2
	EU	32.0	69.7	-100.7	1.0
	ROW	1.7	-39.9	-3.1	-41.3

TRADE CREATION AND DIVERSION

trade at world prices:

	destination				Totals
	USA	JAPAN	EU	ROW	
USA	0	50	200	300	550
JAPAN	500	0	150	200	850
EU	300	100	200	200	800
ROW	50	100	110	20	280
Totals	850	250	660	720	

trade at world prices: new values

	destination				Total
	USA	JAPAN	EU	ROW	
USA	0.0	38.6	383.2	246.1	667.9
JAPAN	467.9	0.0	144.2	234.6	846.7
EU	470.4	96.5	110.5	202.2	879.5
ROW	74.5	109.9	77.0	22.9	284.3

trade at world prices: change in values

	destination				
	USA	JAPAN	EU	ROW	
USA	0.0	-11.4	183.2	-53.9	117.9
JAPAN	-32.1	0.0	-5.8	34.6	-3.3
EU	170.4	-3.5	-89.5	2.2	79.5
ROW	24.5	9.9	-33.0	2.9	4.3

3. NATIONAL PRODUCT DIFFERENTIATION MODEL: WRAPPING UP

- Allows for the distinction of imports and exports: captures intra-industry trade
- Allows for multiple equilibrium prices: lows of one price is violated
- **Limitations:**

- Empirical estimates of elasticity of substitution
- Terms of trade effects

4. Computable general equilibrium models

•Computable general equilibrium (CGE) models provide an overall representation of a market economy so that its functioning could be modelled.

•The main purpose of a CGE model is analyze the economy-wide effects of an economy assuming that all resources are used efficiently and re-allocated among sectors.

• A CGE model is theoretically consistent in the sense that the behavior of economic agents included in a CGE model behave rationally.

• They have been used for several purposes and became the "toolkit" available for the economists to analyze various scenarios of economic instruments.

•Foreign shocks such as adverse changes in the terms of trade (for example an increase in the price of imported oil or a decline in the price of the country's main exports). Because foreign exchange is a scarce resource in many developing countries, the subject of foreign shocks and its impacts on the whole economy has played a central role in the empirical work.

•Changes in economic policies: taxes (Value added taxes) and subsidies are the most commonly analyzed policy instruments, particularly in the trade sector.

•CGE models were also used to analyze the impacts of global phenomenon's such as: reheating of the planet, trade liberalization, etc….

In general, to construct a CGE model, we have to be sure that the raised issues necessitate its use.

4. CGE models: Relevant disaggregation of the economy (1)

- Choice of the level of aggregation for an applied model is one of the more difficult design issues that any prospective modeler must confront.
- There is a natural desire to make the model as detailed as possible in the belief that this will increase its realism.
- On the other hand, more detail is not always beneficial, much of it may prove superfluous to the issues at hand.
- Excessive detail can be costly in terms of data gathering, and large dimension models can be difficult to solve and time consuming.

In practice three considerations enter the choice of aggregation level in applied models

4. CGE: Relevant disaggregation of the economy (2)

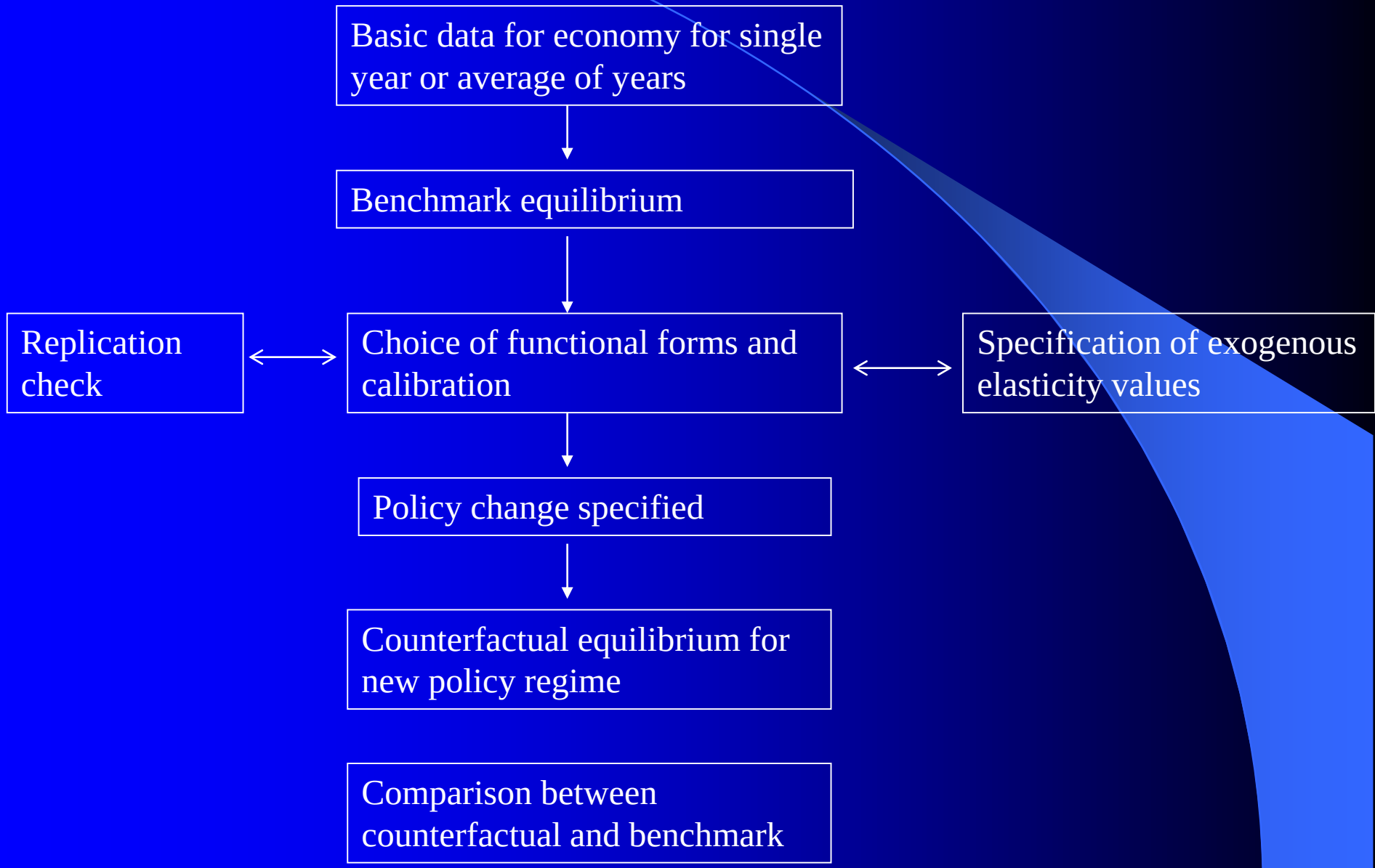
- The need to accurately capture the main features involved in the policy issues under discussion
- The limits of data availability
- The need to constrain computer costs by using a model structure that can be manipulated with relative ease.

In practice there is an inverse relationship between the level of disaggregation and inter-temporal dynamics. If the model is static, it tends to be highly disaggregated and if dynamic (agent's inter-temporal optimization) is introduced, the models are rather aggregated.

4. How to implement a CGE model?

- Formulation of the economic question and or research problem.
- Developing an appropriate theoretical CGE model specification.
- Collecting required data: developing a social accounting matrix (SAM).
- Calibrate the model to the SAM.
- Solve and validate the CGE model specification
- Implement poliy scenarios.

4. Model use in typical applied GE model



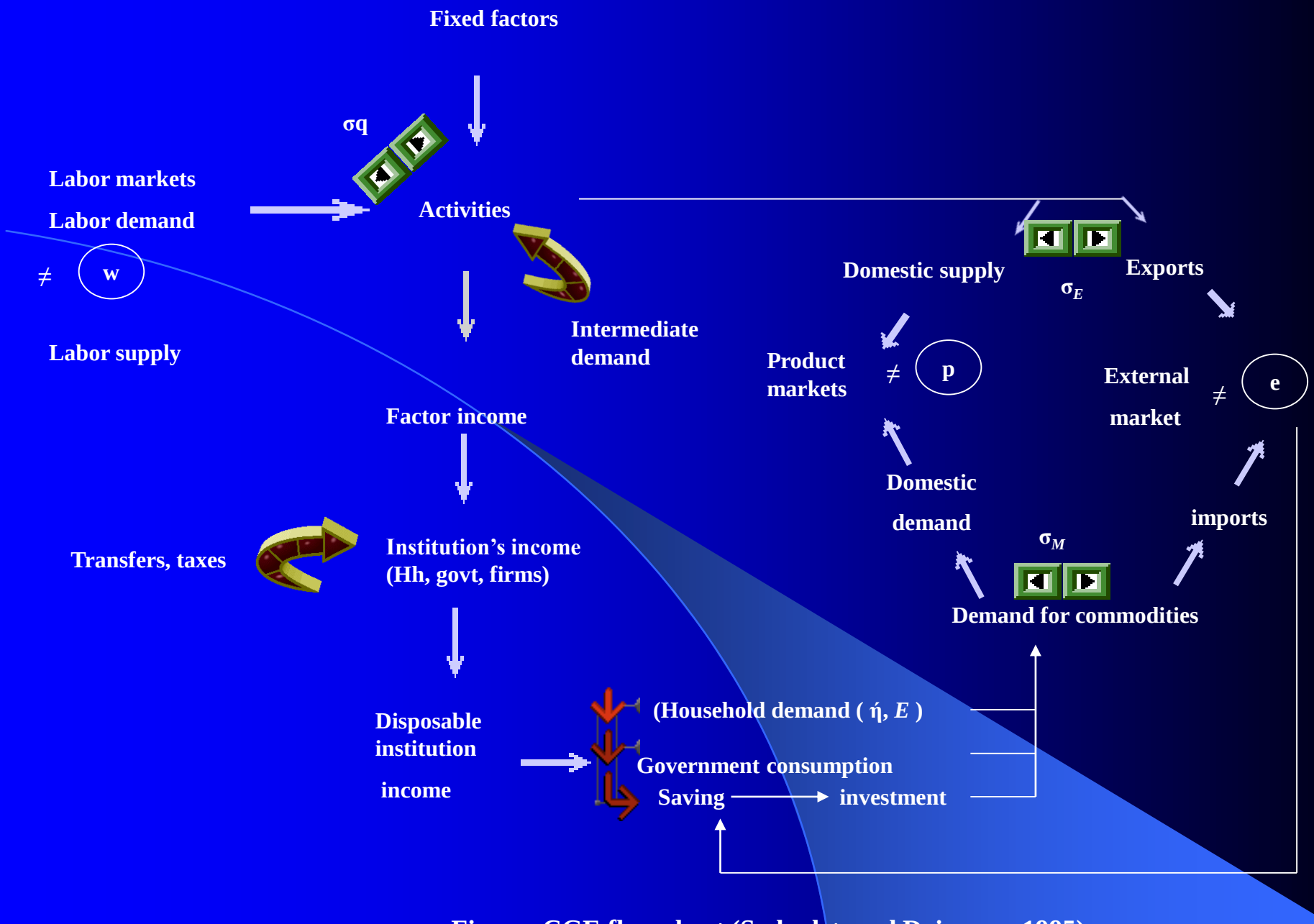


Figure: CGE flow chart (Sadoulet and Dejanvry, 1995)

5. The GRAVITY MODEL

- **The gravity model states that bilateral flows between two countries is an increasing function of their respective country size (GDP) and is inversely related to distance.**
- **Distance is a proxy for transportation costs**
- **The gravity has the following formulation:**
- **The gravity has the following formulation:**

$$\text{Log}\ (X_{ij}) = \text{Log}\,(G) + b_1 \text{Log}\ (Y_i) + b_2 \text{Log}\ (Y_2) - b_3 \text{Log}\ (d_{ij}) + \varepsilon_{ij}$$

- **The constant term G can also be interpreted as summarizing the effects of all factors, other than distance and size, that influence the amount of trade between two countries.**

5. The GRAVITY MODEL

Other things besides size matter for trade:

1. ***Distance*** between markets influences transportation costs and therefore the cost of imports and exports.
   - Distance may also influence personal contact and communication, which may influence trade.
2. ***Cultural affinity***: if two countries have cultural ties, it is likely that they also have strong economic ties.
3. ***Geography***: ocean harbours and a lack of mountain barriers make transportation and trade easier.
4. *Borders*: crossing borders involves formalities that take time and perhaps monetary costs like tariffs.
   - These implicit and explicit costs reduce trade.
   - The existence of borders may also indicate the existence of different languages or different currencies, either of which may impede trade more.
5. ***Free trade agreements***

All the above variables are often dummy (0/1) variables

5. GRAVITY MODEL

- The previous gravity model specification was rather "ad hoc" nas had no firm theoretical foundations, but provides reasonable explanatory power.
- Intensive research efforts have now developed firm theoretical foundations $\Rightarrow$ Structural gravity model (multilateral resistance terms, consistent with recent micro-trade theories and concepts of extensive and intensive margins)
- However, several econometric problems crop up: zero values, heteroscedasticity of residuals, endogeneity of explanatory variables (for instance FTA)
- **Gravity model is the workhorse of applied trade analysis**

ESTIMATES OF TYPICAL GRAVITY VARIABLES

	All Gravity				Structural			
Estimates:	median	mean	s.d.	#	median	mean	s.d.	#
Origin GDP	.97	.98	.42	700	.86	.74	.45	31
Destination GDP	.85	.84	.28	671	.67	.58	.41	29
Distance	-.89	-.93	.4	1835	-1.14	-1.1	.41	328
Contiguity	.49	.53	.57	1066	.52	.66	.65	266
Common language	.49	.54	.44	680	.33	.39	.29	205
Colonial link	.91	.92	.61	147	.84	.75	.49	60
RTA/FTA	.47	.59	.5	257	.28	.36	.42	108
EU	.23	.14	.56	329	.19	.16	.5	26
CUSA/NAFTA	.39	.43	.67	94	.53	.76	.64	17
Common currency	.87	.79	.48	104	.98	.86	.39	37
Home (border)	1.93	1.96	1.28	279	1.55	1.9	1.68	71

Source: Head and Meyer (2014)

Notes: The number of estimates is 2508, obtained from 159 papers. Structural gravity refers here to some use of country fixed effects or ratio-type method.

AGRICULTURAL AND INDUSTRIAL PRODUCTS

Sector	Manufactured	Agricultural
FTA-type	**North-South**	
EUMED	M (+) X(-)	M(-), X(ns)
EFTA-MED	M(ns) X(+)	M(ns) X(ns)
USA-Morocco	M (ns) X(+)	M(+) X(+)
USA-Jordan	M(+) X (ns)	M(+) X(+)
EU-Turkey	M(+) X(ns)	M(+) X(+)
FTA-type	**South-South**	
TURMED	M(+) X(ns)	M(-) X(+)
GAFTA	M(+)	M(+)
AGADIR	M(ns)	M(ns)
Jordan-Singapore	M(-) , X(+)	M(+) X(-)

X= Exports, M = Imports

ns: not significant

Source: Parra, Martinez-Zarzoso and Suàrez-Burguet (2016)

THANK YOU