Global Trade Analysis Project

Endogenous Knowledge Spillovers and Technical Change

Small group presentation

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Technological Spillover

• The spillover mechanism	Hsin
• Base Experiment	Peter
• Innovation in China	Manoj
• Innovation in Machinery	Qun, KJ
• GMO and the EU ban	Jun, Andreanne
• Trade liberalisation & endogenous spillovers	Nazneen, Marianne

TECHNOLOGICAL CHANGE

- Input augmenting tech. change

afall(j,i,r) $\longrightarrow$ spillover $\searrow$ afall(j,i,s)

- Productivity change using input (j) in the production of good(i) in region (s)
- Transmitted to other countries through trade (knowledge embodied in trade)

TECHNOLOGICAL CHANGE

$$\frac{a_s}{a_r} = \gamma(E_{rs}, H_{rs}, D_{rs})$$

$$= E_{rs}^{(1-H_{rs} \cdot D_{rs})}$$

- E index: amount of knowledge received through endogenous bilateral trade flows
- H: Absorption parameter
  - Number of years of schooling
- D: Structural Similarity Index
  - Land/labour ratios

TECHNOLOGICAL CHANGE

- Input augmenting tech. Change also translates to primary factor biased tech change

afeall(f,i,r)= beta*afall(j,i,r)

$\longrightarrow$ spillover

$\longrightarrow$ afeall(j,i,s)

.

- Productivity change using factor (f) in the production of good(i) in region (s)

Analogy: Water spillovers

- Imagine a canoe battle: Shock: **Nanette**
- Water spillovers higher:
  - The more you encounter Nannette the more water spillovers you get
  - The more similar you are (Niels and Mustafa also trouble makers)
  - The smarter you are (Tom full water spillovers)

Chemical Augmenting Shock (10%) in Grains in EU & China

With Land Factor Bias

Based on the Material Developed
by Meijl and Tongeren

1. Chemical Augmenting Shock (10%) in Grains in EU

Spillover factors:

- Large for JAP, ARG and CHN
- Small for AUS and NAM

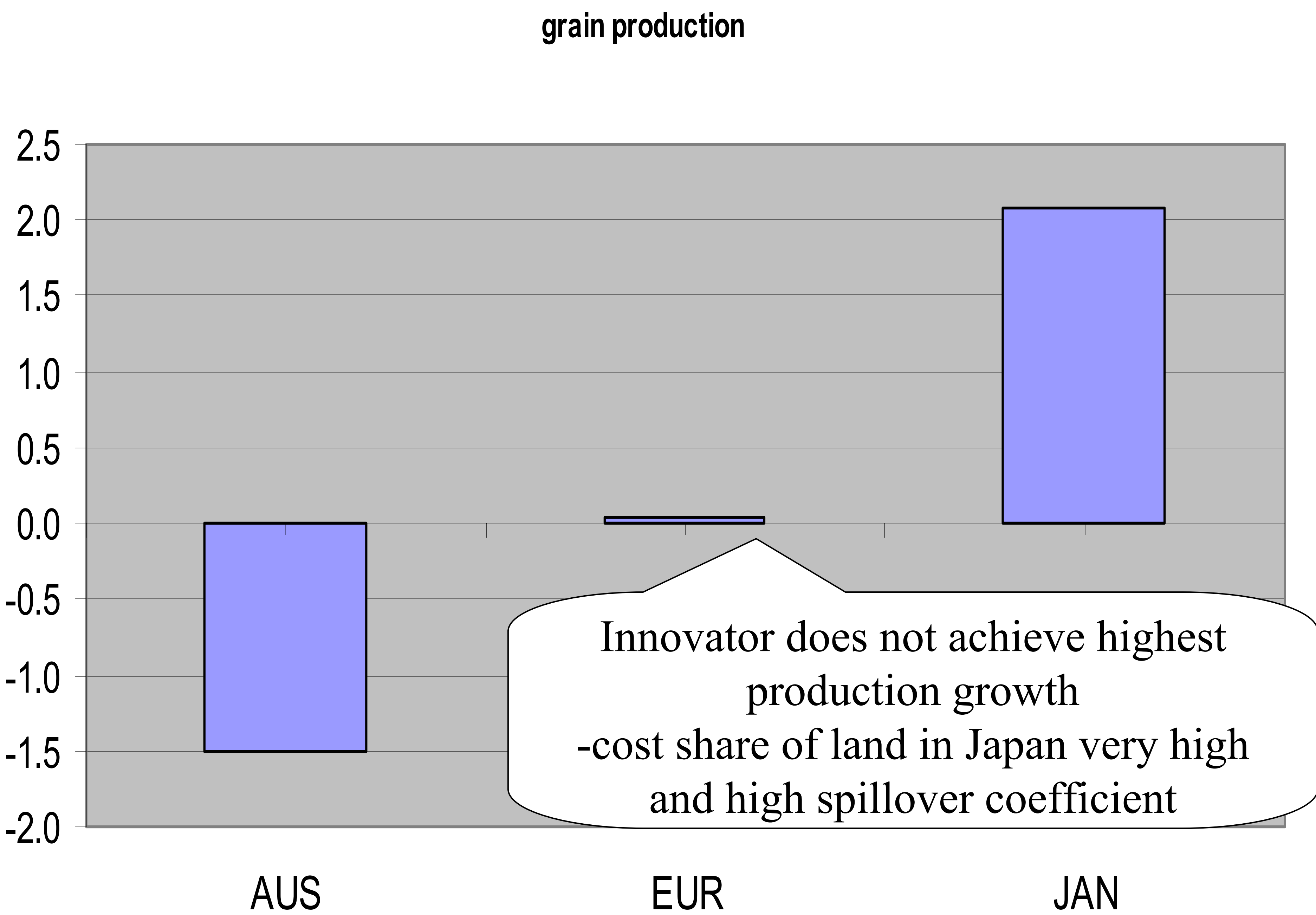
Absorption and structural similarity factors (spilldelta) are high for Japan and Argentina.

The share of chemical imports from EU are higher for Japan and Argentina.

Under the shock, the outputs of grain qo (gro, EUR) increase in Japan and Argentina.

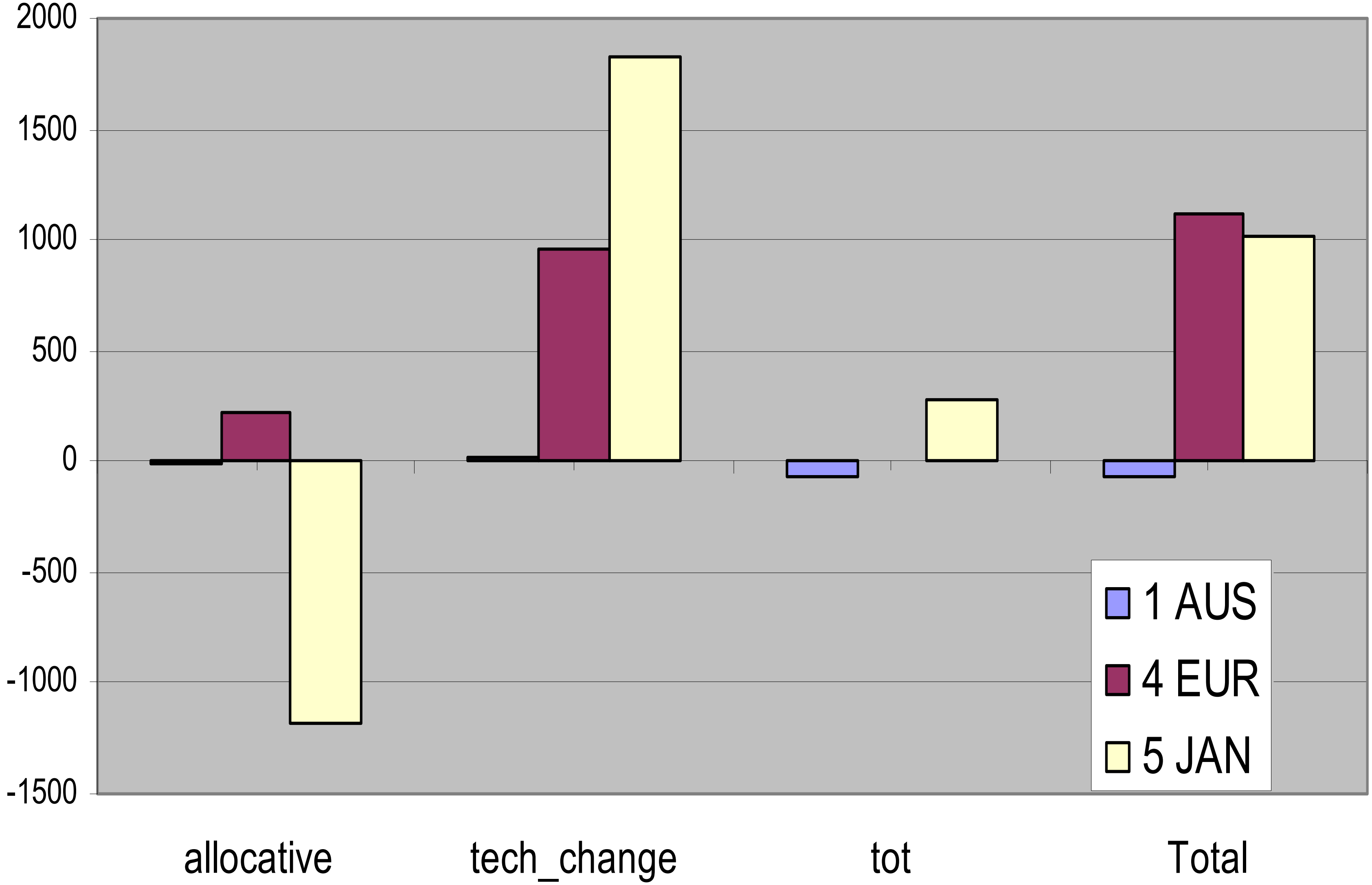
Japan and Argentina have higher negative prices in grain ps (gro, EUR).

Notes: Grain & oil – gro, Chemical – crp.


grain production
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
AUS
EUR
JAN
Innovator does not achieve highest production growth
-cost share of land in Japan very high and high spillover coefficient

	Japan	ARG
ps(gro, EUR):		
STC (contribution of endowments)	-	-
STC1 (contribution of intermediate factors)	-	-
Price of land: pfe (land, gro, EUR)	-	-
Primary factor: afe (land, gro, EUR)	-	-
Value-added: ava (gro, EUR)	-	-
qo decomposition qxs (gro, EUR):		
SHRDM	-	-
SHRXMD	-	-
qo decomposition qxs (crp, EUR):		
SHRDM	-	-
SHRXMD	-	-
Welfare (tech change) A:	-	-

Welfare Decomposition Base Case



2. Chemical Augmenting Shock (10%) in Grains sector in China

Spillover factors:

-Large for ROW (9.8),Japan (9.6), EUR (6.5) and ARG (3.5)

- Small for AUS (0.2), NAM(0.5)

Japan: Large share in chemical exports from China:35%, followed by EUR:23%.

Absorption and structural similarity factors are very high for ROW, Japan and EUR

Chemicals demand falls in all regions: China:8%, Japan: 6% . Note: <10% - expansion effect.

Largest price falls in Japan and next highest in China; prices fall in all regions.

Grain output increase is the highest in Japan (2.7%) which is higher than that of China (1.1); AUS: –2.4%

	Japan	China	AUS
STC	-4.17	-2.88	-0.46
STC1	0.76	-1.75	-0.09

qo decomposition (crp):

SHRDM	-0.78	-0.99	-0.01
SHRXMD	-0.03	-0.02	-0.01

qo decomposition (grain):

SHRDM	2.71	0.86	-0.25
SHRXMD	0.00	0.20	-2.20

	Japan	China	AUS
Pm grains	-0.514	–0.513	-0.513
Cost structure of grain sector			
Land	0.29	0.19	0.14
Labour	0.37	0.37	0.28
Capital	0.11	0.08	0.07
Crp	0.07	0.12	0.09
EV	1081	1835	-78

Endogenous International Technology Spillovers: The Case of machinery

Qun Shi

K.J. Park

Hsin Huang

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Machinery saving: No labor bias

Region	Spillover coefficient	output	Export component	Price of Grain	Cost share of Machinery in grain
AUS	0.5	0.12	0.12	-0.12	0.03
NAM	0.36	0.03	0.02	-0.09	0.02
ARG	0.59	-0.02	-0.05	-0.05	0.01
EUR		0.05	-0.14	-0.14	0.01
JAN	0.65	-0.03	-0.02	-0.02	0.00
CHI	0.43	-0.00	-0.04	-0.04	0.01

Welfare Changes and Main Conclusions

- Everybody is better off! (technology gain)
- EU, NAM (ROW) are the biggest winners. Why? (innovations and spillover + bigger producer)
- Exporters gain, but importer lose (terms of trade effect)

Endogenous International Technology Spillovers: The Case of GM Adoption

Andreanne Leger

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Technical Change

- GMOs: chemicals augmenting shock in grains sector, from North America, with land bias and full spillovers
- Shock afall(crp, gro, NAM):

afall(k, i, s) = **{**SIINT(k,i,r,s) / SDINT(k,i,r)**}**^(1spilldelta(s,r) *absflex)* spillflex* **afall**(k, i,r)

Where: **{…}** = embodied knowledge index $E_{irs}Xirs/\Sigma_k X_{irk}$)

Spilldelta =effectiveness of foreign knowledge

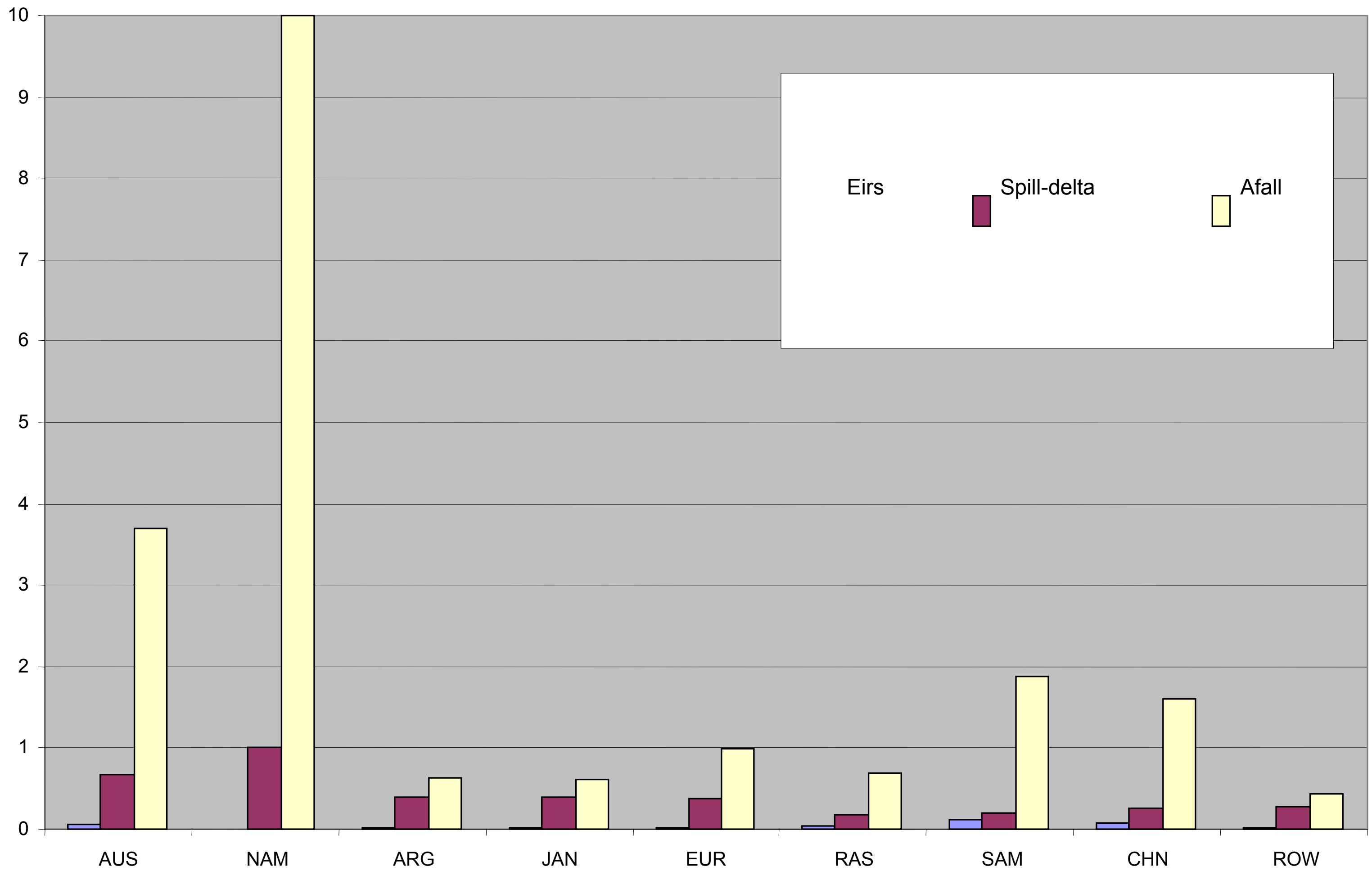
Results

	AUS	ARG	JAN	EUR	RAS	SAM	CHN	ROW	
Afall	3.691	0.632	0.608	0.991	0.697	1.868	1.599	0.434	
Eirs	0.051	0.011	0.010	0.026	0.040	0.124	0.088	0.013	0.496
Spill-delta	0.672	0.397	0.400	0.375	0.180	0.203	0.252	0.283	0.622

-In the other extensions, the embodied knowledge parameter (E) is not strongly correlated to the technical change (afall) while it explains here half of the change – especially important for China, which imports a large proportion of chemicals for grains from North America

-In general the shocks are not very important – because of the structural dissimilarities between USA and other countries (except Australia)

Graphical representation!



Why are grain prices going down?

- Diminution of chemical price in CHN -> decrease in grains price given the important chemical share in the cost structure
- In NAM, the driving force is the technological change
  - Land prices also go down, but the important effect is the aggregate as land is not a very important cost share
- But prices of chemicals go up!

Why do only NAM and CHN increase grain production?

- NAM: comes from an increase in domestic consumption but especially from an increase in exports (29% of grain use)
  - Change in technology
  - Relative price lower on world markets -> substitution towards NAM grains
- CHN: comes from an increase in domestic consumption, due to lower grain prices

Why is the price of chemical going up when you need less of it?

- Endowment price goes up: labour becoming scarce because of increase in food processing
- Processing more grains? No! Grains represent only 5% of inputs!
- Processing more livestock!
  - Decrease in grains price -> increase in livestock production (21% of cost is from grains)
  - Increased demand for livestock in food processing!
  - Labour intensive sectors!
- Therefore scarcity in labour caused by food processing induces an increase in chemical prices!

How are the benefits distributed?

- Results driven by the technological change, especially for NAM
- Terms of trade effect negative for NAM
  - World prices going down
  - Export price going down for NAM -> losing on the export side (Armington assumption)
- Import price also goes down -> small benefits

What about restricting spillovers?

- Assume AUS, EUR, JAN do not benefit from the technological change
- Almost no difference!
  – AUS, EUR, JAN did not benefit so much from spillovers in the first place -> main change
  – For EUR and JAN, allocative efficiency increases due to moving out of resources towards less distorted sectors

Endogenous International Technology Spillovers: Trade Liberalisaton

Marianne Kurzweil

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Trade Liberalization and Technological Spillover

- comparison of two scenarios:
    - base: output augmenting technological shock in the processed food sector (pcf); aoall (pcf, EUR) = +10%; H and D ignored; 2*E
    - base + import tariff abolishment tms (pcf; EUR; ALL_REG)

Base results:

	Spillover Coeff	**output**	**output decomp**	**deco dom use**	**supply price**	**qpd**
NAM	2.41	-1.3	both ('-0.7, '-0.6)	firm ('-0.84)	-3.23	exp. (0.26)
JAN	2.57	0.32	SHRDM (0.4)	cons (0.81)	-3.48	exp. (1.27)

Trade Liberalization and Technological Spillover

Reasons:

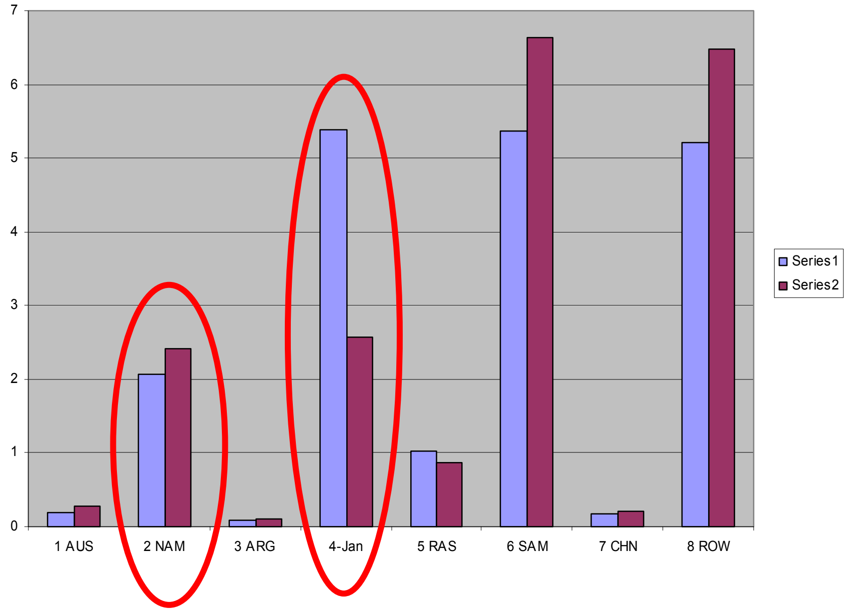
- NAM = net exporter, JAN = net importer
- world price decreases by 6.2%
- GDP and wage increase in JAN relatively higher than in NAM
- cost share in consumption in pcf higher in JAN

=> Higher private consumption demand in JAN for pcf

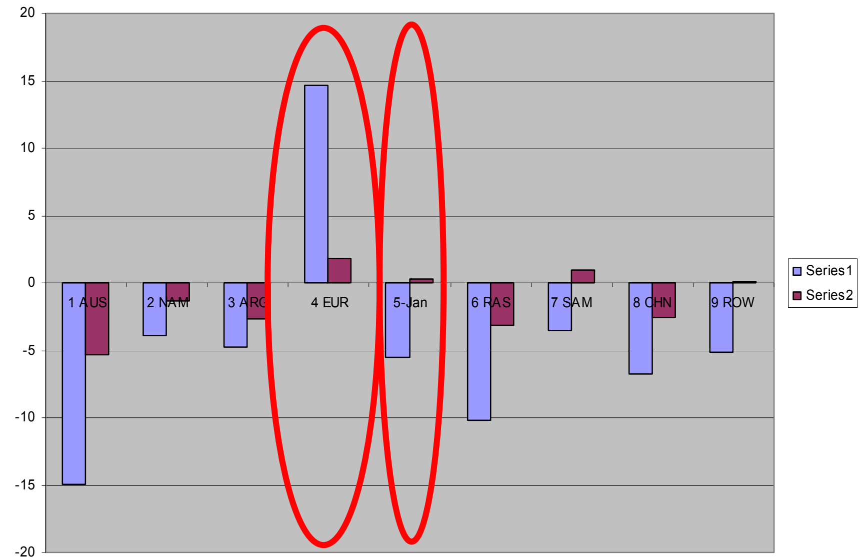
Trade Liberalization and Technological Spillover

Consideration of trade liberalization: comparison with base

Spillover coeff:



output:



Trade Liberalization and Technological Spillover

Reasons:

- domestic demand goes down
- intermediate demand in pcf sector declines
- tariff rates: JAN: 119%, imports from the EUR increase
- imports dominate domestic supply

Welfare:

- relatively less after liberalization in EUR
- JAN becomes net exporter
- alloc. efficiency in EUR goes down because pcf highly subsidized

=> More exports => more expenses due to subsidies