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Distinguishing between genuine and non-genuine reasons for imposing technical barriers to trade: A proposal based on cost-benefit analysis

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Agenda

1. Introduction, motivation, and goals of the paper
2. Anecdotal fact and literature review
3. Presentation of the model
4. Illustration and application of the model
5. Conclusions

1. Introduction, motivation, and goals of the paper

Introduction

- Since GATT 1948, tariffs have fallen down and instead non-tariff measures (NTM) have received worldwide attention.
- *"Non-tariff measures (NTMs) are policy measures, other than ordinary customs tariffs, that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both."*
- Reasons for imposition of NTMs:
  1. Public policy: *human health or safety, animal or plant life or health, or the environment*
  2. Economic policy: *market efficiency and information improvement*
  3. Political economy: *protection for sale*

1. Introduction, motivation, and goals of the paper

Motivation

- NTMs are referred to as opaque and complex policy measures
  - *various causes leading to diverse effects*
- New regulations:
  - *mostly in line with domestic production*
  - *halt importation of non-complied products*
  - *impose a cost to foreign industries to comply with new standards*
  - *impact consumers differently based on their preferences*
  - *mainly by paternalistic evaluation of governments*
  - *causing disputes (COOL)*
- Governments are not transparent:
  - *I-TIP data during 1995-2011 shows only 251 out of 317 TBT STCs were notified directly*

1. Introduction, motivation, and goals of the paper

- **Goals and methodology**

- This paper can contribute to the existing literature by establishing a cost-benefit analysis on a partial equilibrium framework to help in judging the motivations of a government in imposing qualitative NTMs.

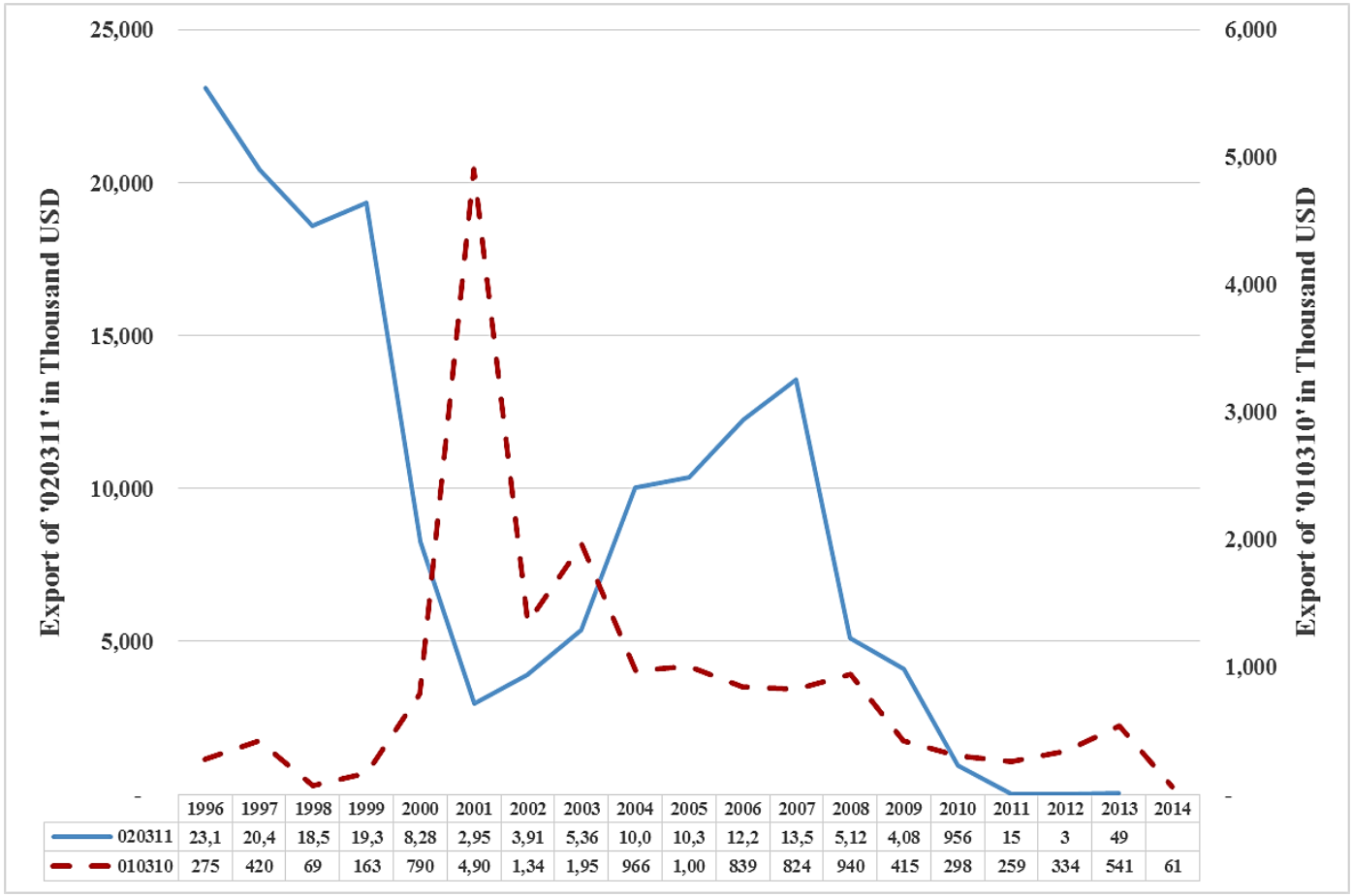
- Methodology of the paper is as follows:
  - *Establishment of a partial equilibrium framework*
  - *Providing welfare analysis of an NTM*
  - *Illustration and calibration of data*

2. Anecdotal Fact and literature review

- In September 1998, Canada requested for consultation (DS100) with the United States within Dispute Settlement Mechanism (DSM) in respect of certain measures, imposed by the US state of South Dakota and other states, prohibiting entry or transit to Canadian trucks carrying cattle, swine, and grain. Since then, this Dispute Settlement (DS) case had been pending until DS384 and DS386 were requested in December 2008.
- After some years of analyses and investigation in the DSM, the Appellate body issued its findings in June 2012. The USA was proved to be violating Article 2.1 of TBT agreement and promised to implement the rulings and recommendations of Dispute Settlement Body (DSB) until May 2013. (Figure 1 shows the pattern of export of swine)

2. Anecdotal Fact and literature review

Figure 1 – Export of swine from Canada to the USA during 1996–2014



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
020311	23,1	20,4	18,5	19,3	8,28	2,95	3,91	5,36	10,0	10,3	12,2	13,5	5,12	4,08	956	15	3	49	
010310	275	420	69	163	790	4,90	1,34	1,95	966	1,00	839	824	940	415	298	259	334	541	61

2. Anecdotal Fact and literature review

- Johnson (1960) *deadweight loss*
- Lindert (1991) *literature review*
- Paarlberg and Lee (1998) *partial equilibrium, FMD risks*
- Paarlberg and Lee (1998) *technical regulations in NAFTA*
- Van Tongeren et al. (2009) and Beghin et al. (2012) *partial equilibrium, shrimp imports*

3. Presentation of the model

- Two industries (Cournot): Home (H) whose country imposes the NTM, and Foreign (F) whose product has negative characteristics
- **Profits of industry *j*:**
- $\pi_j = p(Q)q_j - c_{1j}q_j - \frac{1}{2}c_{2j}q_j^2 - K_j$, for $j = \{H, F\}$
- **Benchmark utility of an individual *i* at Home:**
- $U_i(q_i, w_i) = aq_i - \overline{b}\, q_i^2/2 - I_i r q_i + w_i$
  - Products are not differentiable (no labeling)

3. Presentation of the model – Scenario A

- Consumers are aware of bad characteristics of foreign product, but they cannot distinguish between the good and bad products. They can assign probability τ for getting foreign product and probability $1-\tau$ for getting domestic product:
- $U_i(q_i, w_i) = \tau\left(aq_i - \bar{b}\, q_i^2/2 - I_i r q_i + w_i\right) + (1-\tau)\left(aq_i - \bar{b}\, q_i^2/2 + w_i\right)$

- Assume that $\eta = \frac{N_1}{N}$ is the proportion of consumers indifferent to negative characteristics; then, $I_i r q_i = 0\,, \forall i \in [1, N_1]$; and $I_i r q_i > 0\,, \forall i \in [N_1 + 1\,, N]$. Then, inverse demand function:

- $p_A^D(Q, r) = \begin{cases} a - \frac{b}{\eta}\, Q, \&0 \le Q \le \frac{\tau r \eta}{b} \\ a - \tau r(1-\eta) - bQ, \&Q \ge \frac{\tau r \eta}{b} \end{cases}$

3. Presentation of the model – Scenario A

- **Total Quantity Supplied in Scenario A in Oligopoly (Q_{AO})**
- $$Q_{AO} = \begin{cases} \frac{2\eta(a-c_1)}{3b+c_2\eta}, a-\frac{r}{2} \leq p \leq a \\ \frac{2\left(a-\frac{r}{2}(1-\eta)-c_1\right)}{3b+c_2}, 0 \leq p \leq a-\frac{r}{2} \end{cases}$$
- **The equilibrium price in this duopoly (P_{AO})**
- $$P_{AO} = \begin{cases} a-\frac{2b(a-c_1)}{3b+c_2\eta}, \&0 \leq Q \leq \frac{r\eta}{2b} \\ a-\frac{r}{2}(1-\eta)-\frac{2b\left(a-\frac{r}{2}(1-\eta)-c_1\right)}{3b+c_2}, \&Q \geq \frac{r\eta}{2b} \end{cases}$$
- **Consumer welfare in this oligopoly before new regulations (CA_{AO})**
- $$CS_{AO} = \int_0^{Q_{AO}} \left(p_A^D(Q,r) - P_{AO}\right) dQ = \begin{cases} 2b\eta\left[\frac{(a-c_1)}{3b+c_2\eta}\right]^2, \&a-\frac{r}{2} \leq p \leq a \\ \frac{b}{2}\left[\frac{2\left(a-\frac{r}{2}(1-\eta)-c_1\right)}{3b+c_2}\right]^2 + \frac{r^2\eta(1-\eta)}{8b}, \&0 \leq p \leq a-\frac{r}{2} \end{cases}$$

3. Presentation of the model – Scenario A – Post NTM

- **Case I**: Example is genetically modified organisms (GMOs)
  - Advertised by public and media

- **Case II**: Example is EU Commission Regulation No. 2257/94, which lays down restrictions on the import of bent bananas and curved cucumbers issued on 16 September 1994 and came into force on 1 January 1995
  - France, Italy and Spain, benefited economically
  - in place in Austria since 1967 without awareness of Austrians
  - Britain and Ireland, voted to reform the rules
  - ridiculed in the media and finally dropped in 2009

3. Presentation of the model – Scenario A – Post NTM – Case I

- **Complete information:** $(1-\tau)=1;\ \ rq_i=0; p_{AI}^{D}(Q,r)=a-bQ$
- **The equilibrium price (P_{AMI}) and quantity (Q_{AMI}) supplied by the home monopolist**
- $P_{AMI}=a-\frac{ab-bc_{1H}}{2b+c_{2H}}\ ;\ Q_{AMI}=\frac{a-c_{1H}}{2b+c_{2H}}$

- **Total consumer surplus in this case (CS_{AMI})**
- $CS_{AMI}=\int_0^{Q_{AMI}}\left(p_{AI}^{D}(Q,r)-P_{AMI}\right)dQ=\frac{b}{2}\left(\frac{a-c_{1H}}{2b+c_{2H}}\right)^2$

3. Presentation of the model – Scenario A – Post NTM – Case II

- **No information on NTM:** Subjective utility function remains as before

- **Total supply of monopoly** $Q_{AMII} = \begin{cases} \frac{a\eta - c_{1H}\eta}{2b + c_{2H}\eta}, & a - \frac{r}{2} \leq p \leq a \\ \frac{a - \frac{r}{2}(1-\eta) - c_{1H}}{2b + c_{2H}}, & 0 \leq p \leq a - \frac{r}{2} \end{cases}$

- **Equilibrium price** $P_{AMII} = \begin{cases} a - \frac{ab - bc_{1H}}{2b + c_{2H}\eta}, & 0 \leq Q \leq \frac{r\eta}{2b} \\ a - \frac{r}{2}(1-\eta) - b\frac{a - \frac{r}{2}(1-\eta) - c_{1H}}{2b + c_{2H}}, & Q \geq \frac{r\eta}{2b} \end{cases}$

3. Presentation of the model – Scenario A – Post NTM – Case II

- **Total consumer surplus** $CS_{AMII} = \int_0^{Q_{AMII}} (p_A^D(Q,r) - P_{AMII})dQ =$

$$\begin{cases} \frac{b\eta}{2}\left[\frac{a-c_{1H}}{2b+c_{2H}\eta}\right]^2, a-\frac{r}{2} \le p \le a \\ \frac{b}{2}\left[\frac{a-\frac{r}{2}(1-\eta)-c_{1H}}{2b+c_{2H}}\right]^2 + \frac{r^2\eta(1-\eta)}{8b}, 0 \le p \le a-\frac{r}{2} \end{cases}$$

- **Case IIb (Objective welfare)**: $CS_{AMIIb} = \int_0^{Q_{AMII}} (p_A^D(Q,r) - P_{AMII})dQ =$

$$\begin{cases} \frac{b\eta}{2}\left[\frac{a-c_{1H}}{2b+c_{2H}\eta}\right]^2, a-\frac{r}{2} \le p \le a \\ \frac{b}{2}\left[\frac{a-\frac{r}{2}(1-\eta)-c_{1H}}{2b+c_{2H}}\right]^2 + \frac{r^2\eta(1-\eta)}{8b} + \tau r Q(1-\eta), 0 \le p \le a-\frac{r}{2} \end{cases}$$

3. Presentation of the model – Scenario B

- Consumers are not aware of the harm of foreign product, only government knows and can measure the ad-valorem harm
- Assuming asymmetry of the two industries, Total equilibrium quantity, price, and consumer surplus before NTM:
- $Q_{BO} = \frac{(a-c_{1H})(b+c_{2F})+(a-c_{1F})(b+c_{2H})}{(2b+c_{2H})(2b+c_{2F})-b^2}$
- $P_{BO} = a - b\frac{(a-c_{1H})(b+c_{2F})+(a-c_{1F})(b+c_{2H})}{(2b+c_{2H})(2b+c_{2F})-b^2}$
- $CS_{CO} = \int_0^{Q_{CO}} (p_B^D(Q,r) - P_{BO})dQ = \frac{b}{2}\left(\frac{(a-c_{1H})(b+c_{2F})+(a-c_{1F})(b+c_{2H})}{(2b+c_{2H})(2b+c_{2F})-b^2}\right)^2 -$

  $\frac{r}{2}\left(\frac{(a-c_{1H})(b+c_{2F})+(a-c_{1F})(b+c_{2H})}{(2b+c_{2H})(2b+c_{2F})-b^2}\right)$

3. Presentation of the model – Scenario B – Post NTM

- Post NTM equilibrium is the same as Case I of Scenario A
- **Welfare changes by the NTM:**
- $\Delta CS_B = \frac{b}{2}\left(\frac{a-c_{1H}}{2b+c_{2H}}\right)^2 - \frac{b}{2}\left(\frac{(a-c_{1H})(b+c_{2F})+(a-c_{1F})(b+c_{2H})}{(2b+c_{2H})(2b+c_{2F})-b^2}\right)^2 + \frac{r}{2}\left(\frac{(a-c_{1H})(b+c_{2F})+(a-c_{1F})(b+c_{2H})}{(2b+c_{2H})(2b+c_{2F})-b^2}\right)$
- **NTMs in good faith:**
- $\Delta CS_B \geq 0 \Rightarrow r \geq b\left(Q_{BO} - \frac{Q_{BM}^2}{Q_{BO}}\right) = b\left(\frac{Q_{BO}^2 - Q_{BM}^2}{Q_{BO}}\right)$

4. Illustration and application of the model

Table 1 – Data on consumption of cattle (measured in head) in 2007

Variable	Description	Data for eight states[a]
q_H	Domestic cattle sold on the domestic market (in head)[b]	7,015,001
q_F	Import of cattle sold on the domestic market (in head)[c]	1,425,998
P	Average price per head (US$)[d]	781.63
ε_D	Own-price elasticity of demand[e]	-1.225
ε_S	Own-price elasticity of supply for both industries[f]	1.81
r	Per-unit damage of product (in USD)[g]	367.43

4. Illustration and application of the model

- **a**: Selection of eight US states is based on their imports from Canada. According to the Canadian Ministry of Agriculture and Agri-Food, the following states were the only US points of imports of cattle from Canada in 2007: Idaho, Maine, Michigan, Montana, New York, North Dakota, Vermont, and Washington.
- **b**: Sale of cattle in those states is gathered from the National Agricultural Statistical Service, US Department of Agriculture.
- **c**: Import of Cattle is gathered from the FAO Statistics Division.
- **d**: Average price per head is derived simply by dividing total cash receipts of sale by total sale in head, obtained from the sources mentioned in notes b and c.
- **e**: Own price elasticity of demand is calculated by Susanto et al. (2008) for live cattle.
- **f**: Own price elasticity of supply is calculated by Zhang et al. (2006) for live cattle.
- **g**: Perception of per unit damage of product is from the experiment by Beghin et al. (2012).

4. Illustration and application of the model

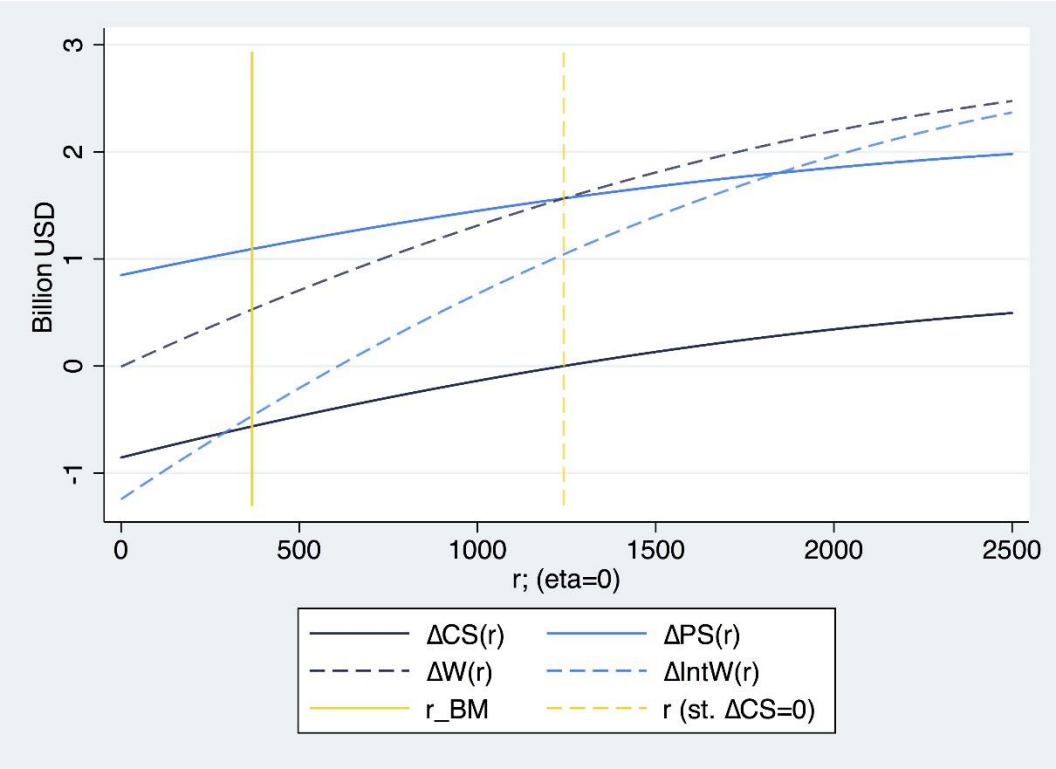
Table 2 – Calculated parameters of the model on consumption of cattle in 2007

Variable	Calculation	Description	Value
b	$b = -P/(\varepsilon_D Q)$	Slope of demand	0.000224
a	$a = (bQ) + P$	Demand intercept	1419.94
c_2	$c_2 = P/\left(\varepsilon_S \frac{Q}{2}\right)$	Cost parameter 2 of two symmetrical industries in Scenario A	0.000303
c_1	$c_1 = \left(c_2 \frac{Q}{2}\right) - P$	Cost parameter 1 of two symmetrical industries in Scenario A	-349.85
c_{2H}	$c_{2H} = P/(\varepsilon_S q_H)$	Cost parameter 2 of home industry in Scenario B	0.0000616
c_{1H}	$c_{1H} = (c_{2H} q_H) - P$	Cost parameter 1 of home industry in Scenario B	-349.85
c_{2F}	$c_{2F} = P/(\varepsilon_S q_F)$	Cost parameter 2 of foreign industry in Scenario B	0.000303
c_{1F}	$c_{1F} = (c_{2F} q_F) - P$	Cost parameter 1 of foreign industry in Scenario B	-349.85

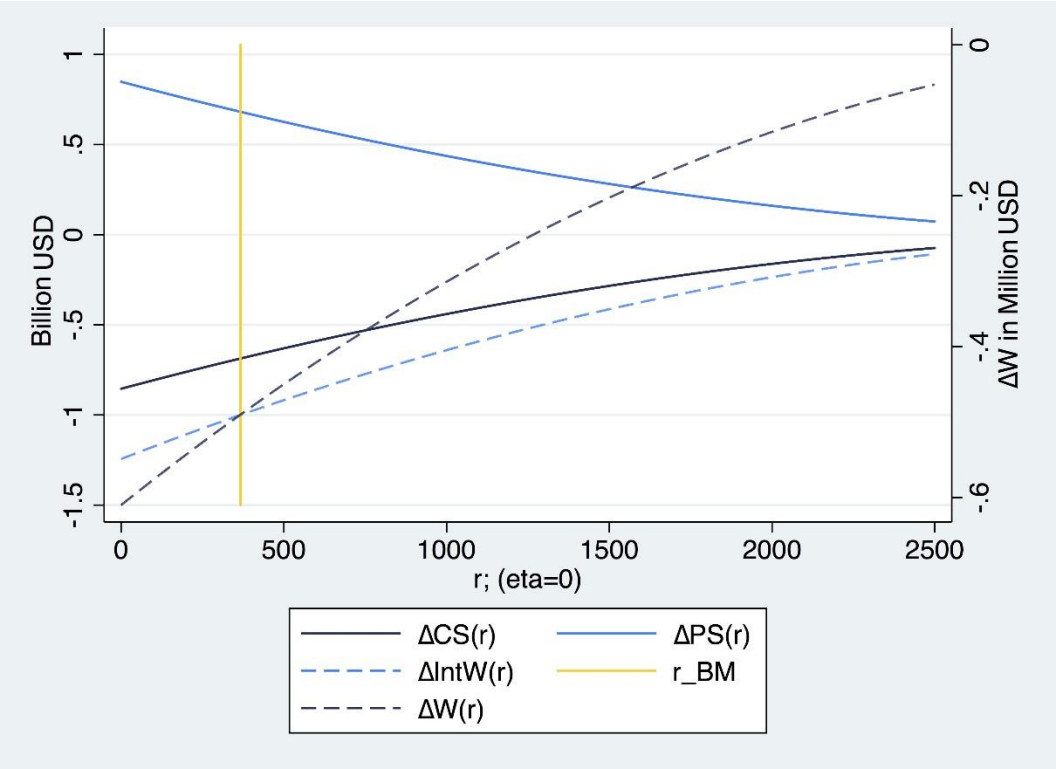
4. Illustration and application – Scenario A

Variables	$(\eta = 1)$			$(\eta = 0.5)$			$(\eta = 0)$		
	Case I	Case II	Case IIb	Case I	Case II	Case IIb	Case I	Case II	Case IIb
CS_O	1.48	1.48	1.48	1.35	1.35	1.35	1.19	1.19	1.19
PS_{OH}	1.24	1.24	1.24	1.11	1.11	1.11	1.00	1.00	1.00
CS_M	0.62	0.62	0.62	0.62	0.58	0.78	0.62	0.50	0.89
PS_M	2.09	2.09	2.09	2.09	1.88	1.88	2.09	1.68	1.68
ΔCS	-0.86	-0.86	-0.86	-0.72	-0.77	-0.56	-0.56	-0.69	-0.30
$\frac{\Delta CS}{CS_O}$	-0.06	-0.06	-0.06	-0.05	-0.06	-0.04	-0.05	-0.06	-0.03
ΔPS	0.85	0.85	0.85	0.97	0.76	0.76	1.09	0.68	0.68
$\frac{\Delta PS}{PS_O}$	0.069	0.069	0.069	0.087	0.069	0.069	0.110	0.069	0.069
ΔW	-0.006	-0.006	-0.006	0.25	-0.005	0.20	0.53	-0.005	0.38
$\frac{\Delta W}{W_O}$	-0.0002	-0.0002	-0.0002	0.0100	-0.0002	0.008	0.024	-0.0002	0.018
$\Delta IntW$	-1.24	-1.24	-1.24	-0.86	-1.12	-0.91	-0.47	-1.00	-0.61
$\frac{\Delta IntW}{IntW_O}$	-0.03	-0.03	-0.03	-0.02	-0.03	-0.03	-0.02	-0.03	-0.02

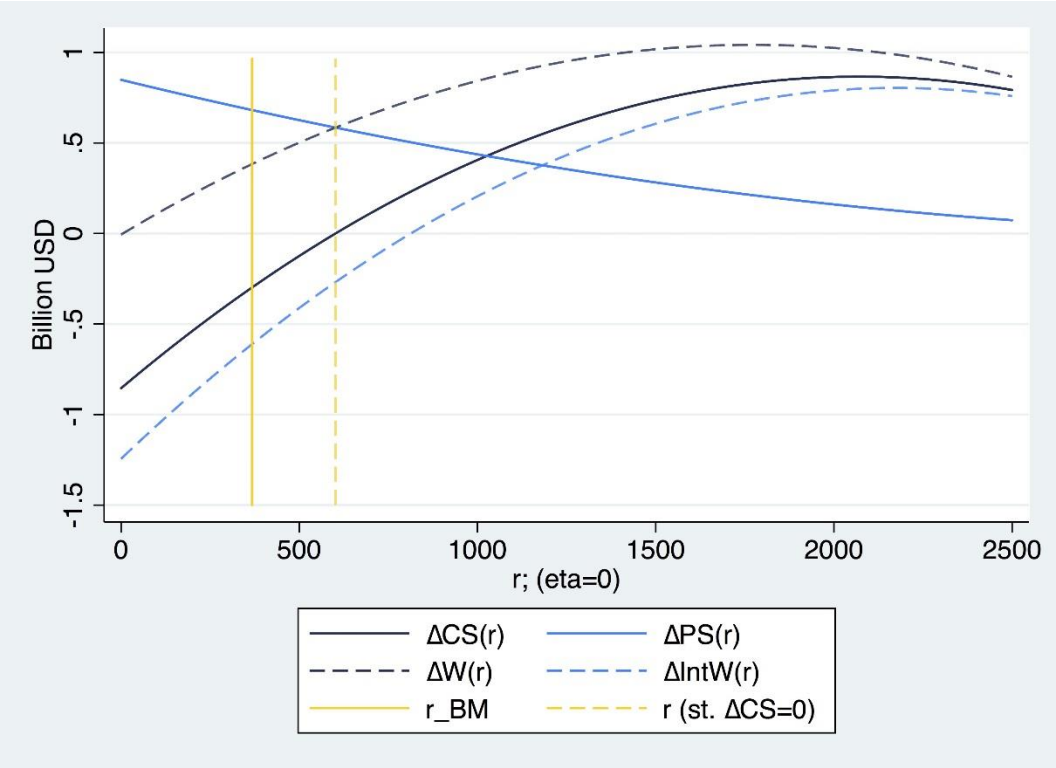
4. Illustration and application – Scenario A – Case I



4. Illustration and application – Scenario A – Case II



4. Illustration and application – Scenario A – Case IIb

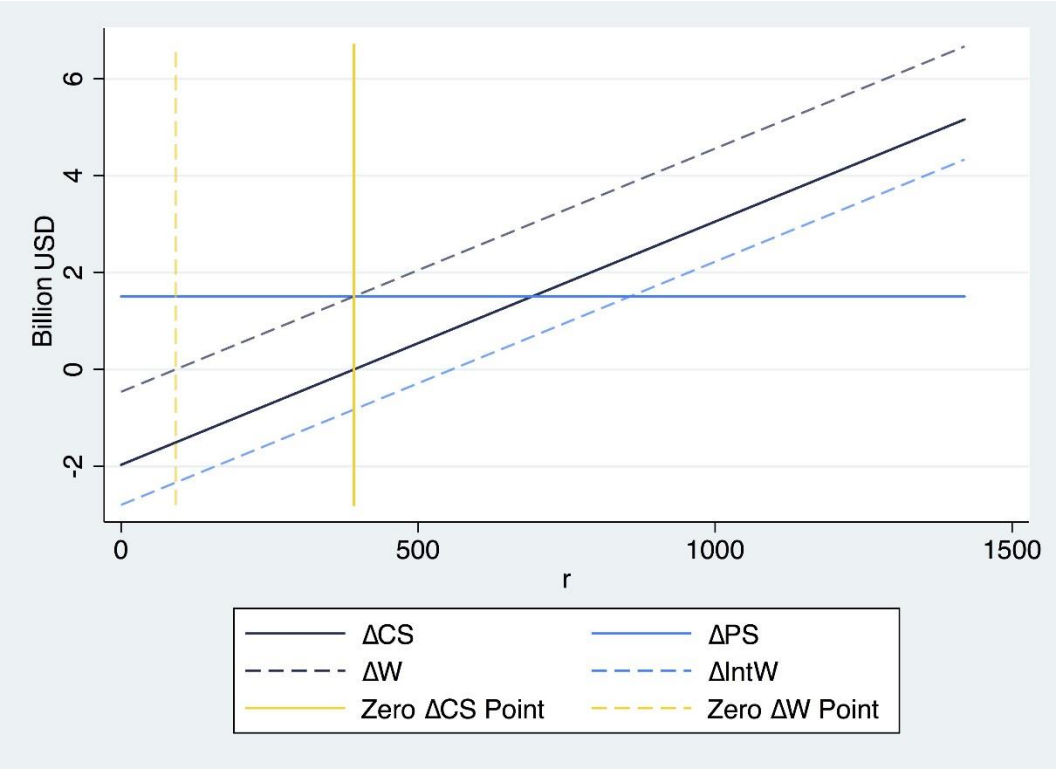


4. Illustration and application – Scenario B

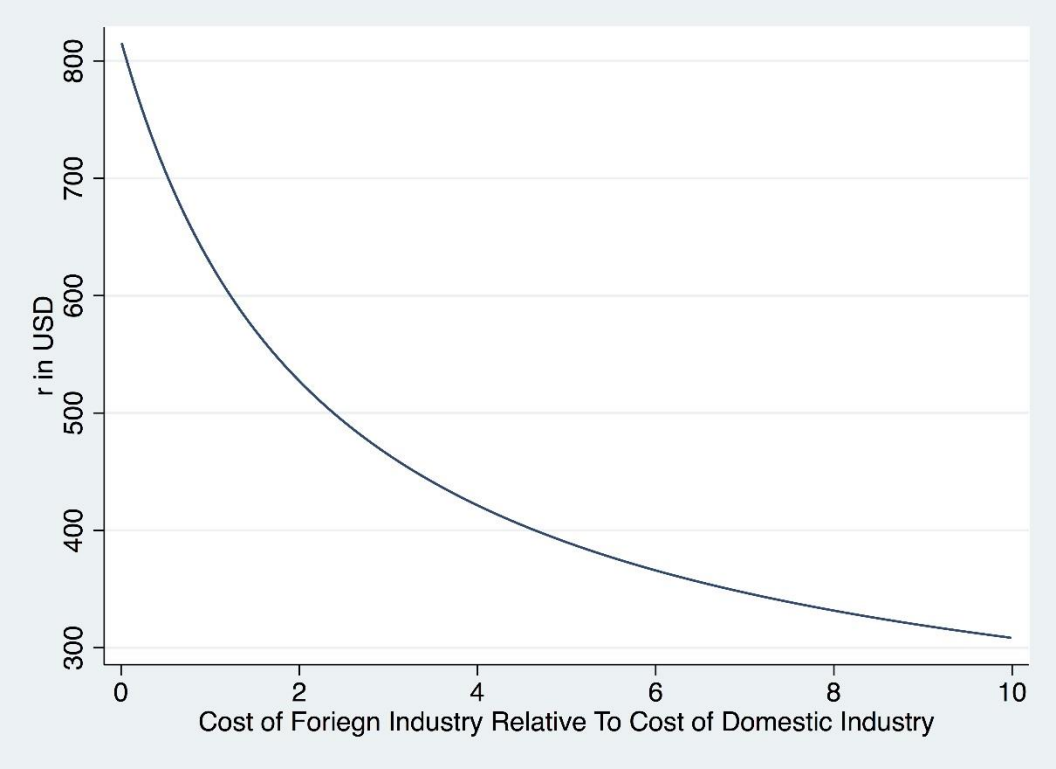
Variables	Symmetrical industries			Asymmetrical industries		
r	**Social welfare equalizer**	**Benchmark**	**Consumer welfare equalizer**	**Social welfare equalizer**	**Benchmark**	**Consumer welfare equalizer**
	3.41	367.43	470.48	91.88	367.43	392.08
CS_O	4.353	2.396	1.842	3.349	1.966	1.842
PS_{OH}	3.665	3.665	3.665	4.670	4.670	4.670
CS_M	1.842	1.842	1.842	1.842	1.842	1.842
PS_M	6.177	6.177	6.177	6.177	6.177	6.177
ΔCS	-2.511	-0.554	0.000	-1.507	-0.124	0.000
$\frac{\Delta CS}{CS_O}$	-0.057	-0.023	0.000	-0.045	-0.006	0.000
ΔPS	2.512	2.512	2.512	1.507	1.507	1.507
$\frac{\Delta PS}{PS_O}$	0.069	0.069	0.069	0.032	0.032	0.032
ΔW	0.000	1.958	2.512	0.000	1.383	1.507
$\frac{\Delta W}{W_O}$	0.000	0.032	0.046	0.000	0.021	0.023
$\Delta IntW$	-3.665	-1.708	-1.153	-2.334	-0.951	-0.828
$\frac{\Delta IntW}{IntW_O}$	-0.031	-0.018	-0.013	-0.023	-0.011	-0.009

4. Illustration and application – Scenario B

Asymmetric Industries



4. Illustration and application – Scenario B
ΔCS neutralizing r with respect to the relative industries' costs



5. Conclusions

- DS Appellate Body suggests that '… albeit for different reasons, the Panel's finding [is] that the COOL measure violates Article 2.1 of the TBT Agreement by according less favourable treatment to imported Canadian cattle and hogs than to like domestic cattle and hogs'
- Distinguishing between awareness and concerns
- Two-fold impact of prohibitive NTM on consumer welfare
  - Gains for concerned consumers
  - Losses of market structure change
- Post-NTM information matters
- NTMs in good faith with consumer welfare increasing evidence

Thank you for your attention