The North American Integration Model (NAIM): description and preliminary results

CoPS

By

Peter B. Dixon and Maureen T. Rimmer
Centre of Policy Studies, Victoria University, Melbourne
and
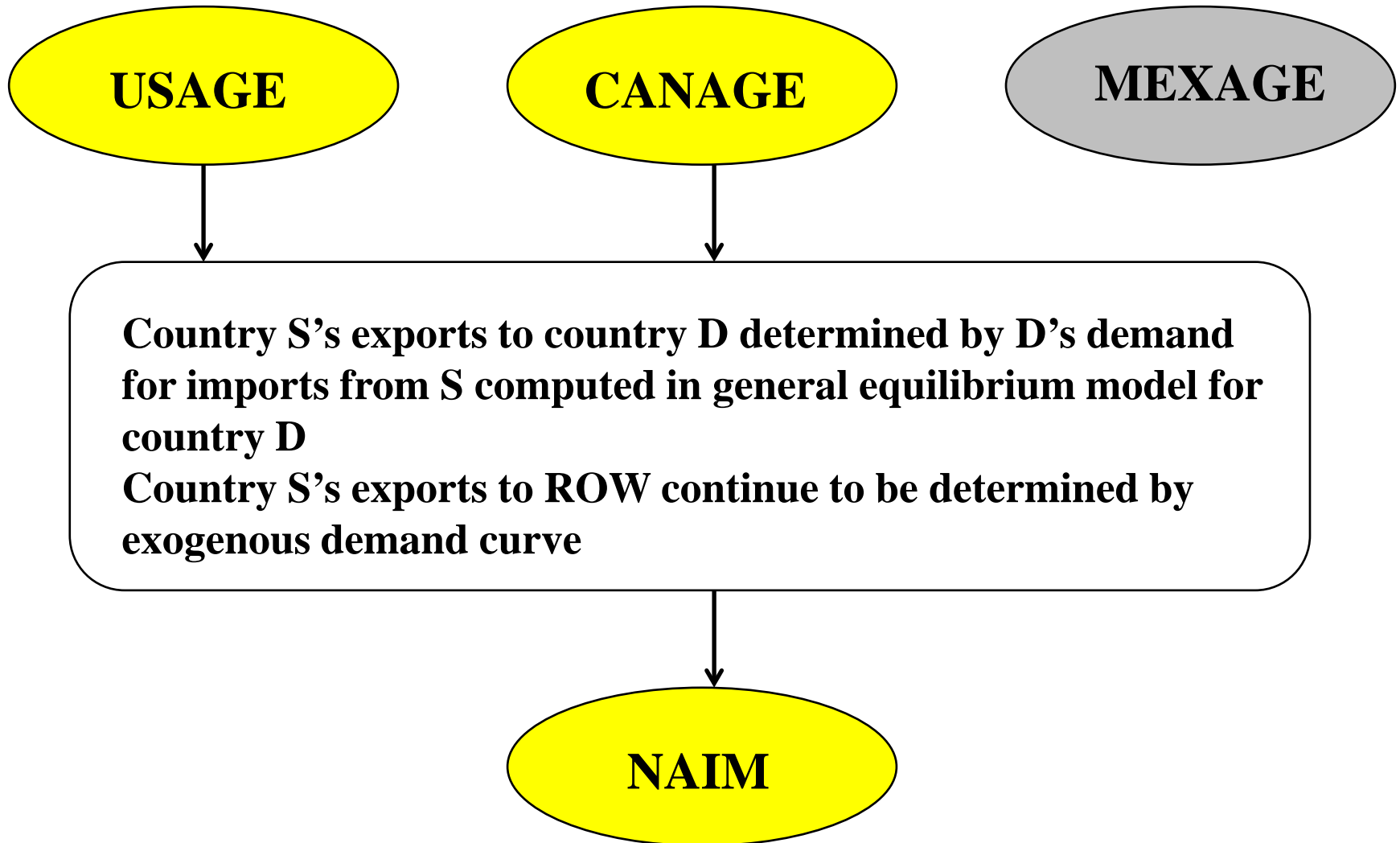**Shenjie Chen and Catherine A. Milot**
Department of Foreign Affairs , Trade and Development, Ottawa

Aim

To give DFATD a tool for assessing the effects on Canada and its North American trade partners of:

- **proposed changes in US border fees**

- **outcomes of trade disputes**

- **further streamlining of the passage of goods between the NAFTA trade partners**

- **harmonization between the partners in standards governing sales of goods and services**

NAIM: an integration of 3 standalone 1-country models

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USAGE

CANAGE

MEXAGE

Country S's exports to country D determined by D's demand for imports from S computed in general equilibrium model for country D

Country S's exports to ROW continue to be determined by exogenous demand curve

NAIM

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Starting point: Why USAGE?

USAGE model of the U.S.

- continuously developed by CoPS with USITC since 2002

Identifies

- up to 500 commodities/industries
- up to 23 trade partners
- up to 400 occupations
- up to 51 regions (states plus DC)
- up to 3000 counties (under development at CoPS)
- up to 70 households (under development at USITC)

Four modes of analysis

- historical
- decomposition
- forecast
- policy

USAGE applied by and on behalf of

CoPS

USITC *on import restraints, free trade agreements, baseline forecasting & validation*

U.S. Treasury *on Waxman-Markey greenhouse bill*

Dept. of Commerce *on illegal immigration, Obama stimulus, national export initiative, biofuel policy, environmental regulation*

Dept. of Agriculture *on illegal immigration, biofuels*

Dept. of Homeland Security *on terrorist events and counterterrorism policies (e.g. closing ports), H1N1 epidemic, illegal immigration*

Dept. of Energy *on greenhouse policies, biofuel policies*

Dept. of Transportation *on costs/benefits of road infrastructure*

Canadian embassy, DC *on US jobs from trade with Canada*

Cato Institute *on low-skilled immigration*

Mitre Corporation *on airport infrastructure (NextGen)*

Constructing multi-country NAIM from single country USAGE

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1. **Single country model for Canada:**

    CANAGE = USAGE computer code
       implemented with Canadian data

2. **Two country model with no inter-country connection**

    NAIM-1 = USAGE computer code + country subscript
       implemented with US and Canadian data

3. **Two country model with Canada/US connecting equations**

    NAIM-2 = NAIM-1 computer code + connecting equations
       implemented with US and Canadian data

4. **Test simulations with NAIM-2**

5 features of the data

Test simulations with NAIM-2: Macro stimulus packages

Short-run effects on the U.S. and Canada of a 1% increase in absorption (C+I+G) in the U.S.

Short-run effects on the U.S. and Canada of a 1% increase in absorption (C+I+G) in Canada

Macro effects of US & Canadian stimulus (%) *CoPS*

		1% U.S. stimulus	1% Canada stimulus
	U.S. variables		
1-3	**C+I+G**	**1.00**	-0.00
4	**Exports**	-4.64	-0.03
7	**Imports**	1.89	-0.02
10	**GDP**	0.15	-0.00
12	**Employment**	0.36	-0.00
15	**Terms of trade**	1.61	0.00
	Canadian variables		
1-3	**C+I+G**	0.02	**1.00**
4	**Exports**	-0.01	-1.10
7	**Imports**	-0.03	1.06
10	**GDP**	0.03	0.37
12	**Employment**	0.03	0.50
15	**Terms of trade**	-0.21	0.41

Questions answered in the paper by BOTE analysis:
Stimulus increases employment even though real wages are fixed. Why?
Employment is more sensitive to stimulus in Canada than in the US. Why?
The terms of trade are more sensitive to stimulus in the US than Canada. Why?
U.S. trade reacts more sharply to stimulus than Canadian trade. Why?

Explaining the employment results

$$W = P_{gdp} * A * F_l \left(\frac{K}{L} \right)$$

Explaining the employment results

$$\overline{\frac{W}{P_c}} = \left(\frac{P_{gdp}}{P_c}\right) * \overline{A} * F_I\left(\overline{\frac{K}{L}}\right) \downarrow \quad \longrightarrow \quad \textcolor{red}{\textbf{L increases}}$$

But

	%Δ P_{gdp}/P_c	%Δ L
U.S.	**0.346**	**0.360**
Canada	**0.161**	**0.502**

Extra effect for Canadian employment is labor intensity of non-traded production

Check: re-compute with L intensities the same in Canada as in U.S.

Are the differences in labor intensities real?

Factor share in 2010

	USA			Canada		
	Labor	**Capital**	**Share in GDP**	**Labor**	**Capital**	**Share in GDP**
Non-traded	**0.586**	**0.414**	**0.669**	**0.721**	**0.279**	**0.583**
Traded	**0.729**	**0.271**	**0.331**	**0.555**	**0.445**	**0.417**
Total	**0.633**	**0.367**	**1.000**	**0.652**	**0.348**	**1.000**

Differences between results for Canada and US in NAIM-2 depend on: *CoPS*

1) the larger share of trade in GDP for Canada than for the US;

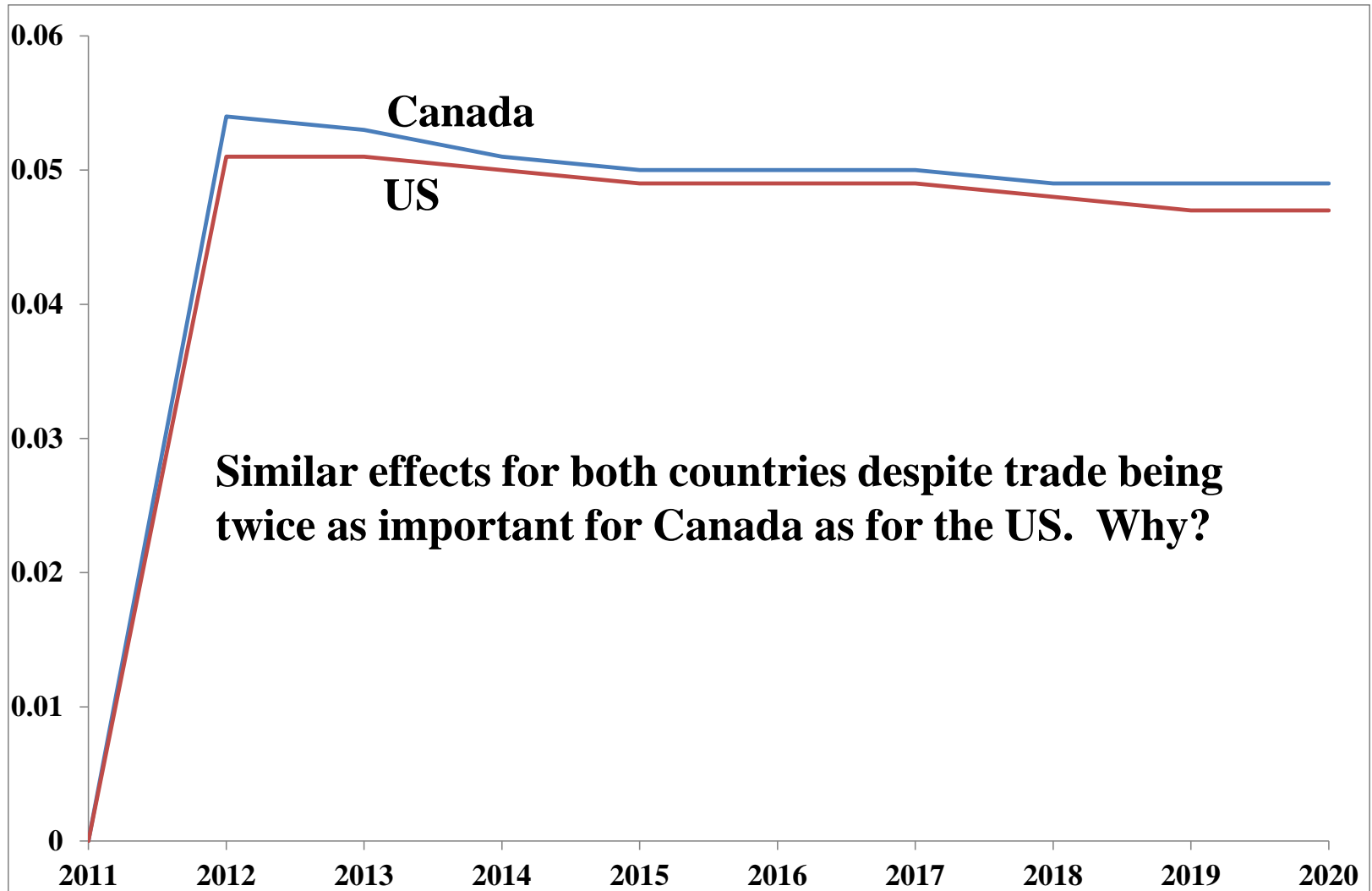2) the high labour intensity of non-traded production in Canada relative to the US;

Test simulations with NAIM-2: NAFTA2 policy

5 per cent cut in Canadian wholesale margins associated with Canadian exports

+

5 per cent cut in US wholesale margins associated with US exports

Cuts in export-related wholesale margins: *CoPS* % effects on total factor productivity

Canada

US

Similar effects for both countries despite trade being twice as important for Canada as for the US. Why?

Cuts in export-related wholesale margins: % effects on aggregate capital

Relative to Canada, the US deviation goes higher and takes longer to flatten out. Why?
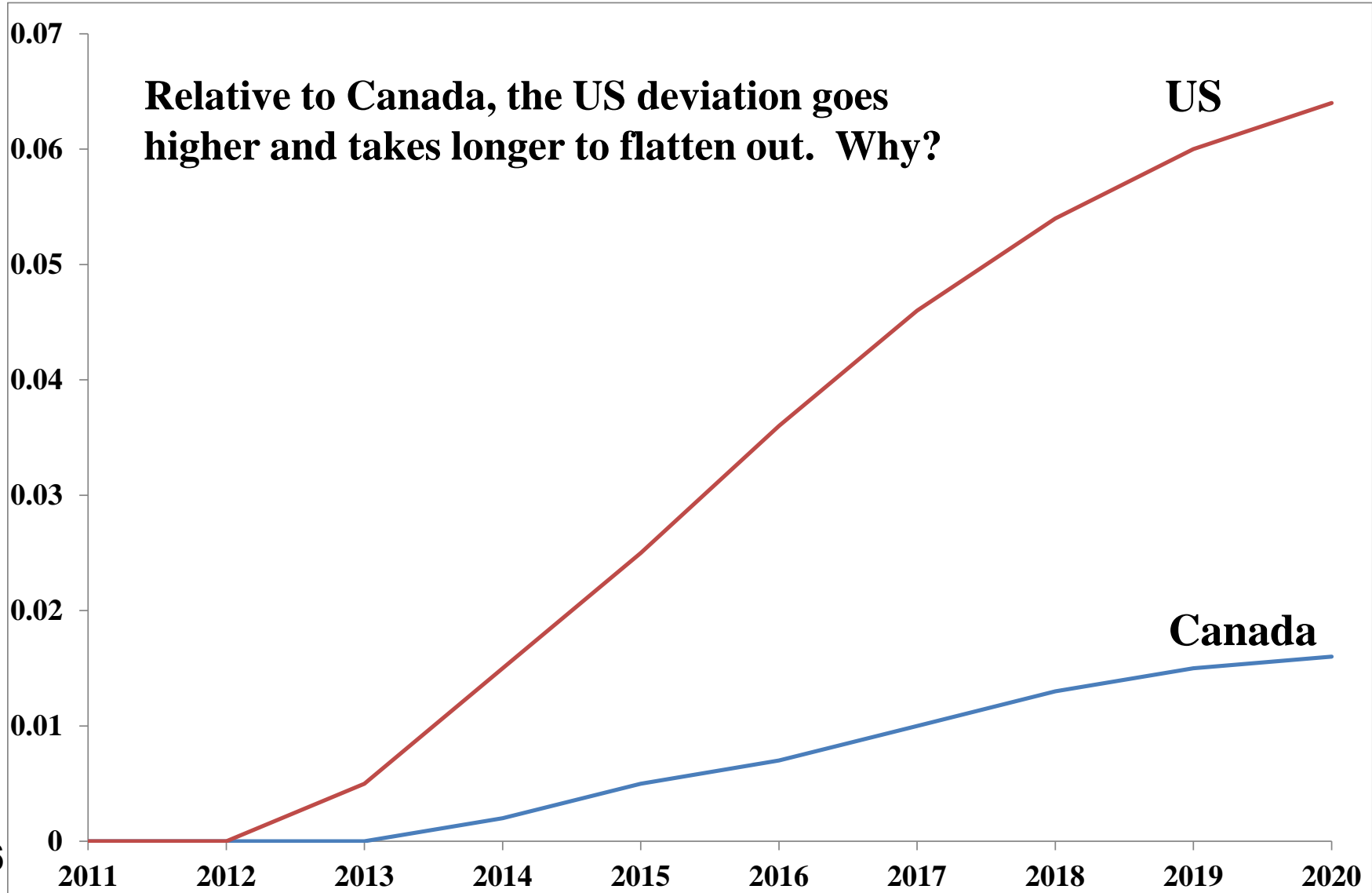
US

Canada

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Differences between results for Canada and US in NAIM-2 depend on: *CoPS*

1) the larger share of trade in GDP for Canada than for the US;

2) the greater dependence of Canada on trade with the US than vice versa;

3) the high labour intensity of non-traded production in Canada relative to the US;

4) the much higher wholesale margin requirement per unit of exports in the US than in Canada; and

5) the higher capital intensity of the Canadian wholesale industry relative to that of the US industry.

1) and 2) reflect reality but 3), 4) and 5) are probably data incompatibilities

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5. **Two country model with Canada/US connecting equations**
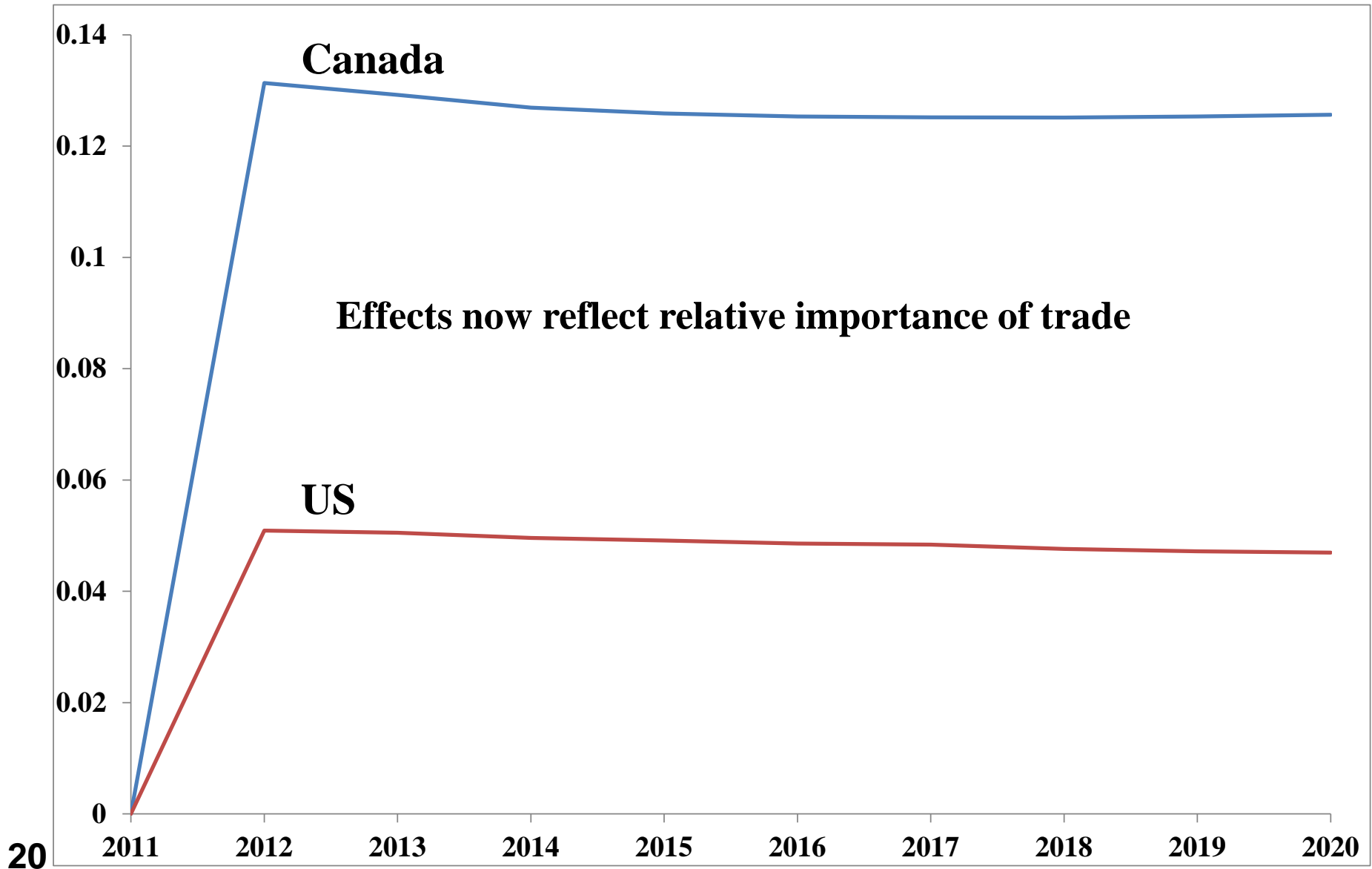
    NAIM-3 = NAIM-2 computer code
        implemented with US data and Canadian data
        under common technology assumption

# Common technology assumption to reduce data incompatibilities

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A US/Canada model under the common technology assumption can reflect differences between the two countries in their responses to policy changes based on differences in:

- the industrial composition of their output and employment;

- the commodity composition of their exports and imports;

- the structure of their taxes and tariffs;

- the destinations of their exports and the sources of their imports;

- the size of the public sector and the nature of its activities;

- household preferences (the commodity composition of household expenditures);

- wage fixing systems; and

- natural resource endowments.

Cuts in export-related wholesale margins: % effects on total factor productivity, NAIM-3

CoPS

Canada

Effects now reflect relative importance of trade

US

Cuts in export-related wholesale margins: % effects on aggregate capital, NAIM-3

CoPS

Capital paths now reflect differences in total factor productivity effects

Canada

US
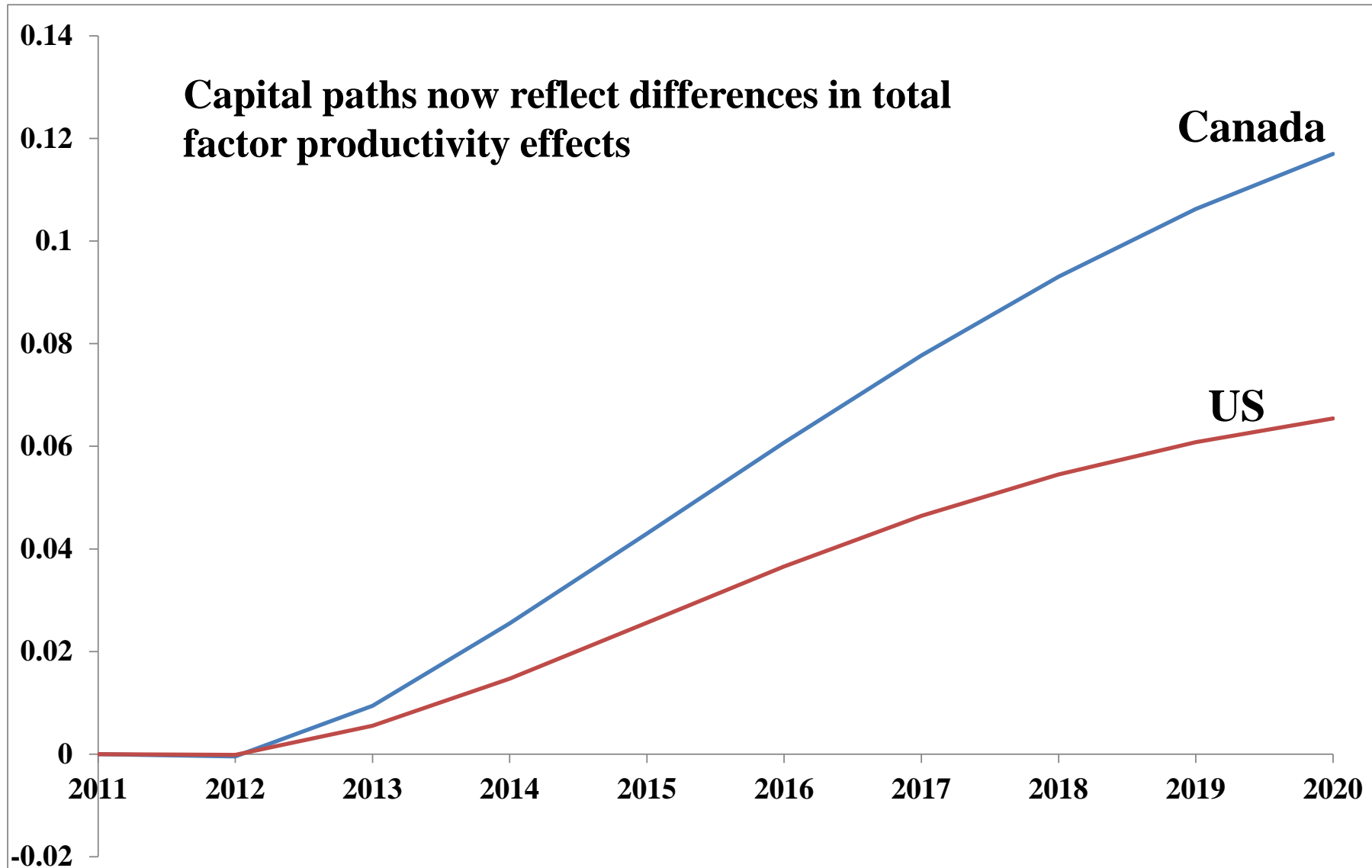
Next steps

(1) **More bells and whistles for CANAGE**
       Current account
       Foreign assets and liabilities
       Greater disaggregation

(2) **More applications with CANAGE and NAIM models**

(3) **U.S./Canada labor-market links in NAIM**

(4) **U.S./Canada capital-market links in NAIM**

(5) **MEXAGE?**