

# The determinants of structural change in the global economy: an analysis based on historical simulations

Gianmarco Cariola and Eddy Bekkers

World Trade Organization and Graduate Institute of International and  
Development Studies

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# Introduction

- ▶ According to WIOD data in 1995-2011:
  - ▶ The global manufacturing share of value added declined from 19% to 16% (15% to 11% in US, 19% to 14% in WEU);
  - ▶ The global share of imports from China increased from 3% to 12% (5% to 17% in US, 1% to 6% in WEU);
  - ▶ Trade as a proportion of GDP increased from 19% to 26% at the global level (11% to 15% in US, 29% to 37% in WEU);
  - ▶ Imported intermediates as a proportion of global gross output increased from 6% to 9% (4% to 6% in US, 10% to 14% in WEU) ;
- ▶ How much did trade contribute to structural change?
  - ▶ Impact of import competition on manufacturing (Autor, Dorn and Hanson, 2013);
  - ▶ Comparative advantage (Uy, Yi and Zhang, 2013);
  - ▶ Reverse causality: structural change reduces trade (Lewis et al., 2018).
- ▶ Alternative sources of structural change.

## Our contribution

- ▶ A recursive dynamic Eaton-Kortum model with multiple sectors, intermediate linkages and non-homothetic CES preferences;
- ▶ Methodology: historical simulations, comparison of alternative scenarios with observed WIOD data;
- ▶ Calibration: WIOD Input-Output tables (1995-2011), aggregated to 14 sectors and 15 regions;

# Scenarios

1. **LAB**: Target labor force growth (IMF); impose the productivity growth of frontier countries, Cobb Douglass preferences and non fixed trade balance;
2. **SKI**: Skill composition growth (WIOD SEA);
3. **GDC**: GDP per capita (IMF);
4. **NHC**: Non-homothetic CES, coefficients from Comin, Lakshari and Mestieri (2021), 10-sectors calibration;
5. **TFP**: Differential productivity growth per sector (EU-KLEMS);
6. **SAV**: Savings rate (WIOD);

## Scenarios (2)

- 7. **BAL**: Trade balance (WIOD);
- 8. **POL**: Trade policy shocks, tariffs (TRAINS) and NTMs (DESTA);
- 9. **SKL**: Cost neutral twist on the demand of primary factors;
- 10. **CAP**: Capital share of value added (WIOD SEA);
- 11. **VAD**: Intermediates share of output (WIOD);
- 12. **INT**: Cost-neutral intermediate demand twist;
- 13. **TEC**: Induced (technology) trade cost shock;

# Macroeconomic shocks

|                   | Population<br>(% change, annual) | GDP per capita<br>(% change, annual) | Savings rate<br>(simple change) | Trade balance<br>(simple change) |
|-------------------|----------------------------------|--------------------------------------|---------------------------------|----------------------------------|
| Asia              | 1,23                             | 2,44                                 | -1,04                           | -0,38                            |
| Brazil            | 1,16                             | 1,90                                 | 1,14                            | 0,78                             |
| Canada            | 0,93                             | 1,56                                 | -1,04                           | -5,21                            |
| China             | 0,60                             | 8,58                                 | 7,56                            | 0,32                             |
| Germany           | -0,09                            | 1,41                                 | 1,59                            | 5,21                             |
| Eastern Europe    | -0,27                            | 3,32                                 | 0,73                            | 1,68                             |
| United Kingdom    | 0,53                             | 1,49                                 | -4,73                           | -2,02                            |
| India             | 1,52                             | 4,93                                 | 5,67                            | -1,92                            |
| Korea, Rep. Of    | 0,58                             | 3,84                                 | -11,00                          | -2,12                            |
| Mexico            | 1,36                             | 0,98                                 | -3,59                           | 4,10                             |
| Japan             | 0,10                             | 0,44                                 | -3,37                           | -3,06                            |
| Russia            | -0,22                            | 4,29                                 | 9,47                            | 8,84                             |
| Rest of the World | 2,14                             | 1,86                                 | 1,41                            | 1,29                             |
| United States     | 0,92                             | 1,36                                 | -4,50                           | -2,79                            |
| Western Europe    | 0,55                             | 1,16                                 | -1,91                           | -1,97                            |

**Table 1:** Population and real GDP per capita data come from IMF, savings and trade balance are induced from WIOD I-O tables; the first two columns report the annual average percentage change in 1995-2011, columns 3 and 4 report simple changes in 1995-2011 (not annualized).

## Labor supply by skill type

|                   | High skilled       | Medium skilled | Low skilled |
|-------------------|--------------------|----------------|-------------|
|                   | (% change, annual) |                |             |
| Asia              | 4,97               | 2,35           | -0,09       |
| Brazil            | 5,30               | 5,45           | -0,82       |
| Canada            | 2,83               | 0,78           | -3,90       |
| China             | 7,83               | 2,63           | 0,75        |
| Germany           | 1,57               | -0,64          | -0,90       |
| Eastern Europe    | 3,48               | -0,14          | -1,52       |
| United Kingdom    | 3,27               | 0,81           | -3,30       |
| India             | 4,80               | 2,67           | 0,58        |
| Korea, Rep. Of    | 0,67               | -1,40          | -6,06       |
| Mexico            | 3,12               | -0,29          | -4,80       |
| Japan             | 2,11               | 4,46           | 0,77        |
| Russia            | 4,39               | 3,62           | 1,54        |
| Rest of the World | 1,33               | 0,05           | -3,04       |
| United States     | 1,76               | -0,18          | -1,43       |
| Western Europe    | 3,85               | 1,37           | -1,73       |

**Table 2:** Labor force data come from WIOD SEA, which reports the number of hours worked by skill type. The table reports the annual average percentage change in 1995-2011.

## Capital and intermediates share

|                   | Capital share      | Intermediates share |
|-------------------|--------------------|---------------------|
|                   | (change 1995-2011) |                     |
| Asia              | 2,25               | -0,90               |
| Brazil            | -4,23              | 2,01                |
| Canada            | -0,30              | -0,07               |
| China             | 13,19              | 2,87                |
| Germany           | 1,98               | 0,10                |
| Eastern Europe    | 5,38               | 0,46                |
| United Kingdom    | -1,12              | -0,06               |
| India             | 5,96               | -0,97               |
| Korea, Rep. Of    | 5,55               | 0,97                |
| Mexico            | 3,35               | -0,04               |
| Japan             | 6,25               | 1,29                |
| Russia            | -0,22              | -1,25               |
| Rest of the World | 8,17               | 0,39                |
| United States     | 0,81               | -0,58               |
| Western Europe    | 1,19               | 0,00                |

**Table 3:** The capital share of value added comes from WIOD SEA, the intermediates share of output is induced from WIOD I-O tables. Both columns report simple changes in 1995-2011.

# Income elasticity and differential productivity

|                                | Income elasticity | Diff. productivity |
|--------------------------------|-------------------|--------------------|
| Agriculture                    | 0,33              | 3,80               |
| Business services              | 1,47              | -2,16              |
| Chemicals                      | 0,74              | 3,45               |
| Electric and optical equipment | 0,75              | 2,38               |
| Food beverages and tobacco     | 0,76              | 3,29               |
| Financial intermediation       | 1,47              | 1,96               |
| Other heavy manufacturing      | 0,75              | 2,32               |
| Other light manufacturing      | 0,75              | 2,35               |
| Mining                         | 0,37              | 0,95               |
| Other services                 | 1,12              | -1,87              |
| Post and telecommunications    | 1,01              | 2,75               |
| Wholesale and resale trade     | 1,12              | 1,18               |
| Transport equipment            | 0,74              | 2,30               |
| Utilities                      | 1,07              | -0,69              |

**Table 4:** Income elasticities are computed based on Comin, Lashkari and Mestieri (2021); productivity data come from EU-KLEMS, differential productivity is defined as the difference between sectoral TFP and average TFP.

# Tariffs and NTMs

|                   | Tariff rate<br>(% change, annual) | NTM (AVE) |
|-------------------|-----------------------------------|-----------|
| Asia              | -0,209                            | -0,20     |
| Brazil            | -0,107                            | -0,01     |
| Canada            | -0,028                            | -0,15     |
| China             | -0,051                            | -0,37     |
| Germany           | -0,120                            | -0,04     |
| Eastern Europe    | -0,211                            | -0,14     |
| United Kingdom    | -0,082                            | -0,02     |
| India             | -0,106                            | -0,07     |
| Korea, Rep. Of    | -0,233                            | -0,02     |
| Mexico            | -0,240                            | -0,05     |
| Japan             | -0,094                            | -0,56     |
| Russia            | -0,121                            | 0,00      |
| Rest of the World | -0,057                            | 0,00      |
| United States     | -0,108                            | -0,05     |
| Western Europe    | -0,077                            | -0,03     |

**Table 5:** Tariffs come from UNCTAD TRAINS; AVEs of regional trade agreements are calculated based on Egger et al. (2015) using DESTA; the WTO AVE is based on Larch et al. (2019). Both columns report annual average percentage changes in 1995-2011.

## Inferred trade costs and demand twists

- ▶ From EK, trade flows  $X_{csd}$  are inversely related to  $\tau_{csd}$ ;
- ▶ Inverting the EK expression of trade, assuming  $\tau_{csd} = \tau_{c ds}$  and  $\tau_{css} = 1$ , we can show that:

$$\tilde{\tau}_{c ds} = \left( \left( \frac{\hat{X}_{csd} \hat{X}_{c ds}}{\hat{X}_{css} \hat{X}_{c dd}} \right)^{-\frac{1}{2\theta_c}} - 1 \right) \cdot 100$$

- ▶ Intermediate demand twists are computed comparing simulated and observed intermediate demand shares and relative prices in 2011;
  - ▶ Cost neutrality from  $\sum_c VFP_{car}(\alpha_{car}^{sim} - \beta_{ar}^{sim}) = 0$ ;
- ▶ Analogous approach for labor demand twists;

## Inferred costs and intermediate demand twists: results

|                                | Trade cost        | Intermediate demand |
|--------------------------------|-------------------|---------------------|
|                                | (% shock, annual) |                     |
| Agriculture                    | -0,32             | -0,90               |
| Business services              | -0,09             | 2,01                |
| Chemicals                      | -0,98             | -0,07               |
| Electric and optical equipment | 0,14              | 2,87                |
| Food beverages and tobacco     | -0,73             | 0,10                |
| Financial intermediation       | -0,31             | 0,46                |
| Other heavy manufacturing      | -0,17             | -0,06               |
| Other light manufacturing      | 0,13              | -0,97               |
| Mining                         | -0,19             | 0,97                |
| Other services                 | 0,33              | -0,04               |
| Post and telecommunications    | 0,76              | 1,29                |
| Wholesale and resale trade     | -0,41             | -1,25               |
| Transport equipment            | -2,24             | 0,39                |
| Utilities                      | 0,20              | -0,58               |

Table 6: Both columns report annualized shocks (1995-2011)

## Labor demand twists

|                   | High skilled | Medium skilled<br>(annual shock %) | Low skilled |
|-------------------|--------------|------------------------------------|-------------|
| Asia              | 4,19         | 2,14                               | 0,90        |
| Brazil            | 12,79        | 13,22                              | 8,55        |
| Canada            | 5,03         | 3,14                               | -1,39       |
| China             | 8,06         | 1,93                               | 1,79        |
| Germany           | 2,92         | 0,76                               | 0,00        |
| Eastern Europe    | 8,02         | 4,32                               | 3,84        |
| United Kingdom    | 4,61         | 2,62                               | -1,66       |
| India             | 3,71         | 2,00                               | 1,49        |
| Korea, Rep. Of    | 0,47         | -1,43                              | -5,85       |
| Mexico            | 0,51         | -2,36                              | -6,43       |
| Japan             | 6,22         | 8,89                               | 4,35        |
| Russia            | 5,10         | 4,93                               | 2,71        |
| Rest of the World | 8,92         | 7,07                               | 3,90        |
| United States     | 3,49         | 1,30                               | -0,03       |
| Western Europe    | 5,05         | 3,42                               | 0,36        |

Table 7: All columns report annualized shocks (1995-2011)

# Results: import competition from China

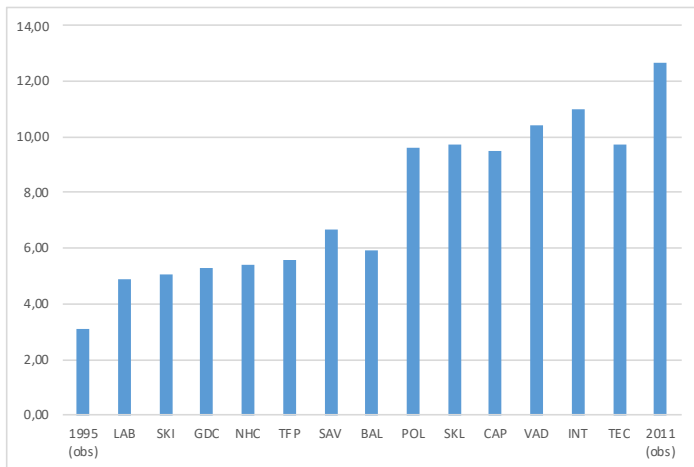


Figure 1: Share of global imports coming from China (%)

# Structural change at the global level

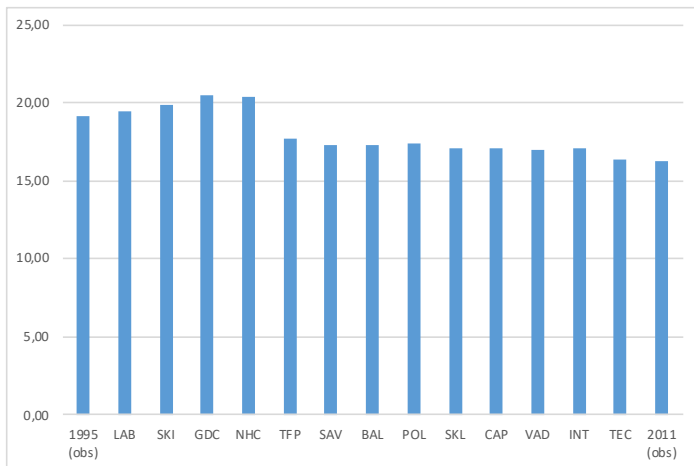


Figure 2: Global value added share of manufacturing (%)

# Manufacturing shares in selected countries

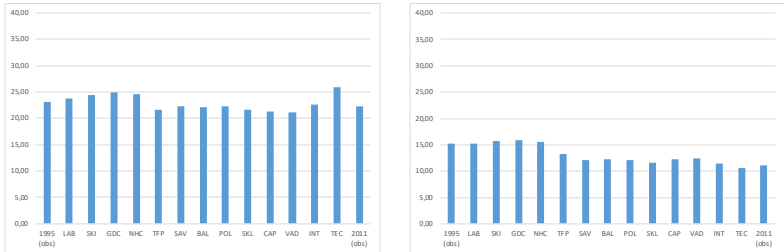


Figure 3: Value added share of manufacturing (%) in Germany (left) and US (right).

## Manufacturing shares in selected countries (2)

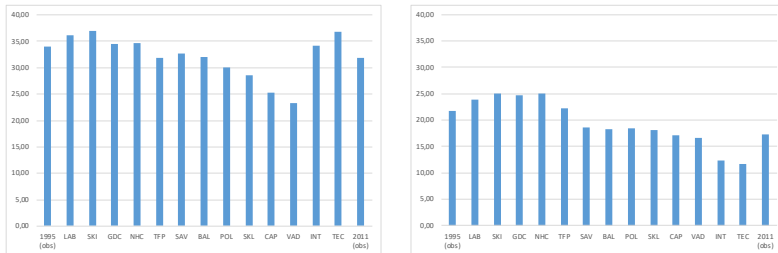


Figure 4: Value added share of manufacturing (%) in China (left) and Japan (right).

# Trade elasticity

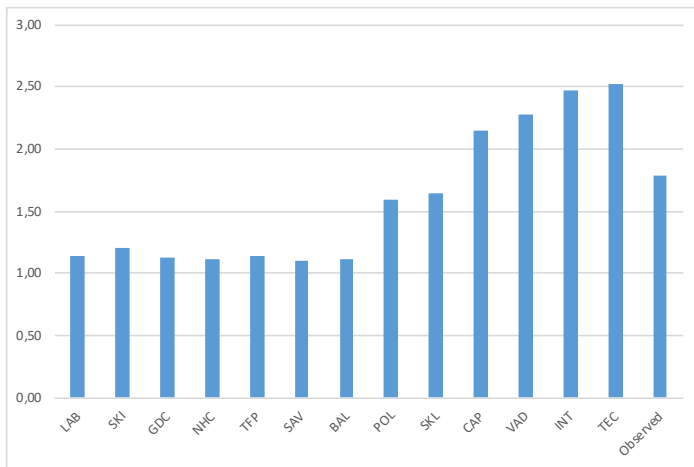


Figure 5: Real elasticity of trade with respect to GDP, from WTO data.

## Concluding remarks

- ▶ Calibration of the EK Global Trade Model to WIOD I-O tables;
- ▶ Trade, productivity and structural change:
  - ▶ Trade policy shocks matter for trade elasticity and import competition;
  - ▶ Trade policy seems to have a weak effect on structural change;
  - ▶ Differential productivity growth is the main driver of structural change in our framework;
  - ▶ A potentially new channel: savings and investments;
- ▶ NHC seems relatively powerless
  - ▶ Private vs government demand, future extensions.