

Global Value Chain Participation and Current Account Imbalances

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Motivation

Two major developments

- Two salient developments in the world economy

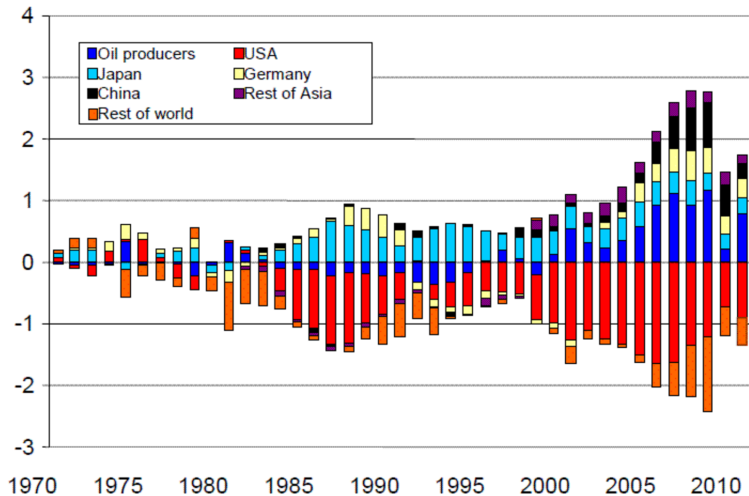
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- Two salient developments in the world economy
 - 1 Emergence of large and persistent external imbalances

Motivation

Global Imbalances



Motivation

Two major developments

- Two salient developments in the world economy
 - ① Emergence of large and persistent external imbalances
 - ② Increase in fragmentation and geographic dispersion of production processes
- This paper: Is there a connection between the two?

Motivation

Global Imbalances - Patterns we have a convincing story for

- Persistent CA deficit in the US, surplus in many newly industrialized economies (in particular China)
 - Heterogeneity in financial development affect *asset demand* and accumulation of foreign liabilities (Mendoza et al, 2009)
 - Interplay of increases in wealth and heterogeneity in *asset supply* (Caballero et al, 2015, 2008)

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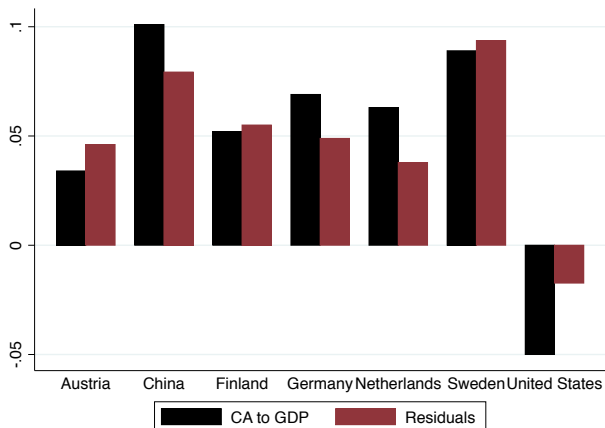
Global Imbalances - Patterns we have a convincing story for

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 - Heterogeneity in financial development affect *asset demand* and accumulation of foreign liabilities (Mendoza et al, 2009)
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- Such institutional differences explain *North-South* pattern in the broadest sense
- However, empirical evidence seems more complex...

Motivation

Global Imbalances - The limits of our understanding

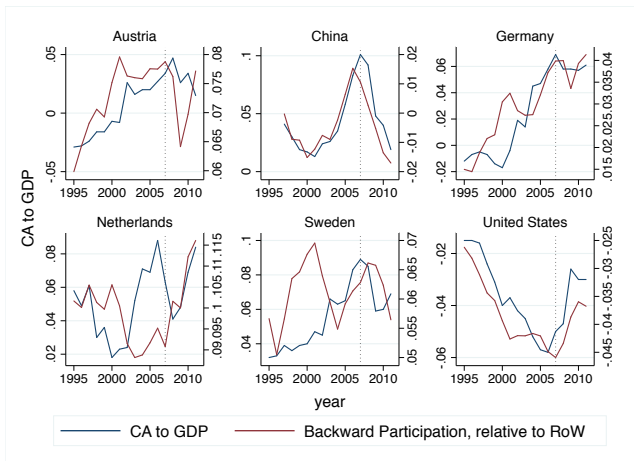
Figure: 2007 CA surplus countries and EBA residuals



Motivation

GVCP and Imbalances I

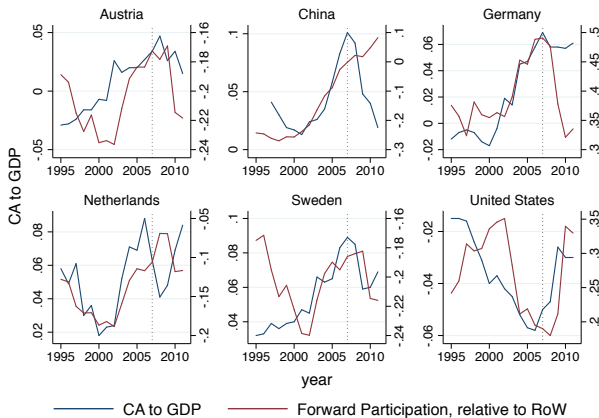
Figure: Backward Participation for high residual countries



Motivation

GVCP and Imbalances II

Figure: Forward Participation for high residual countries



This paper

Global Imbalances and Competitiveness through Integration

- Starting point: An empirical relation between higher CA surpluses and higher levels of GVCP
- How can we start thinking about this in the context of a standard macro model?

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- Integration in global value chains *triggered* by *temporary* (rel. to the rest of the world)
 - increases in the efficiency of the usage of foreign inputs
 - Iceberg trade costs
 - Interplay of sectoral technology shocks and differences in sectoral composition

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Global Imbalances and Competitiveness through Integration

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- How can we start thinking about this in the context of a standard macro model?
- Integration in global value chains *triggered* by *temporary* (rel. to the rest of the world)
 - increases in the efficiency of the usage of foreign inputs
 - Iceberg trade costs
 - Interplay of sectoral technology shocks and differences in sectoral composition
- Then
 - Higher levels of participation reflect (temporary) improvements in competitiveness
 - In the presence of a precautionary savings motive, additional income will be partly saved

1 Empirical Evidence

2 Model

3 Quantitative Exercises

4 Conclusion

Documenting Participation I

Data sources

- World Input Output Database for participation measures
- Global input output linkages on an annual basis from 1995 to 2011
- Sufficient to calculate our measures of interest on a country level

Documenting Participation II

Measures

- In the baseline, construct measure of both forward and backward participation in Global Value Chains
- Backward participation: Gross intermediate imports to gross output

$$BP_i = \frac{IM_i}{X_i}, \quad (1)$$

- Forward participation: Gross intermediate exports to gross output

$$FP_i = \frac{IX_i}{X_i} \quad (2)$$

- Crude measures of a country's upstream *and* downstream position

Documenting Participation II

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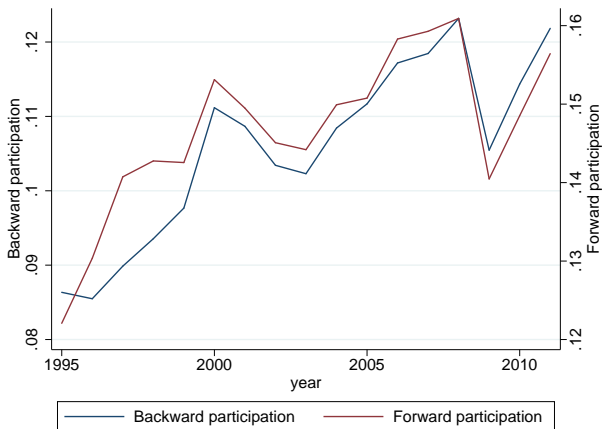
- Forward participation: Gross intermediate exports to gross output

$$FP_i = \frac{IX_i}{X_i} \quad (2)$$

- Crude measures of a country's upstream *and* downstream position
- Importantly, measure against the RoW:
 - avoid "logical fallacy" of postulating linear relationship

Documenting Participation III

Evolution of the Cross-Country Average of Backward and Forward Participation from 1995 to 2011



Note: The figure presents the evolution of the cross-country average of the measure of backward and forward participation as

Documenting Participation V

Relationship to other measures

Table: Correlation between Baseline Measure of Backward Participation and Alternative Measures of Backward Participation

| | count | b |
|----------------------------|-------|--------|
| VAX | 456 | -0.970 |
| VAX (Johnson, 2014) | 398 | -0.916 |
| Foreign value added (OECD) | 456 | 0.937 |

Empirical Framework

A large set of controls

- Goal is to establish the empirical relevance of GVC participation for the CA against a large set of controls

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A large set of controls

- Goal is to establish the empirical relevance of GVC participation for the CA against a large set of controls
- Embed measures in a reduced form specification using the IMF's EBA framework:

$$ca_{it} = \alpha + \mathbf{x}_{it}\beta + \delta \mathbf{gvc}_{it} + u_{it} \quad (3)$$

- Variables measured relative to the rest of the world
- \mathbf{x}_{it} : Explanatory variables include amongst others:
 - oil balance, output per worker, demographics, capital controls, growth, terms of trade, output gap, dummies for financial centers, measures of institutional strength

Empirical Results

Global Value Chains and the Current Account

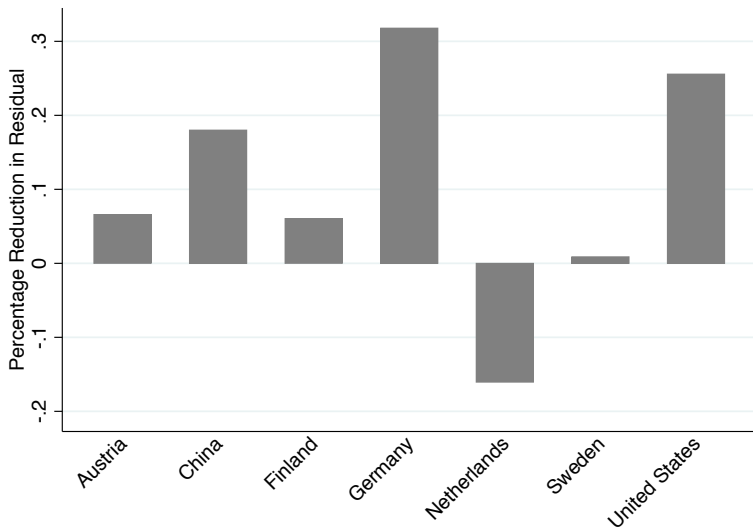
| | Baseline | VAX | FVA/IVA | WIOD sample | Fixed Effects | Pre-2008 |
|------------------------|----------|----------|---------|-------------|---------------|----------|
| Backward Participation | 0.17*** | | | 0.11* | 0.25*** | 0.18*** |
| Forward Participation | 0.04** | 0.03** | | 0.05*** | 0.13*** | 0.04** |
| VAX | | -0.12*** | | | | |
| Foreign value added | | | 0.07** | | | |
| Indirect value added | | | 0.08* | | | |
| Observations | 456 | 456 | 456 | 553 | 553 | 340 |
| R^2 | 0.40 | 0.41 | 0.39 | 0.42 | 0.42 | 0.47 |
| Number of countries | 29 | 29 | 29 | 38 | 29 | 29 |

Robust standard errors.

+ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Empirical Results

Improvement of fit - 2007



Model

Motivation

- Hypothesis: Global value chain participation positively affects the current account
- Now: Take a first step towards understanding this joint pattern
- Purpose: Flesh out key ingredients to rationalize observed patterns in a standard framework

Model

Outline

- Want to write a model where GVCP and current account imbalances can potentially comove as in the data

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- Write down the simplest open economy model which
 - features trade in final and intermediate goods
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- Want to write a model where GVCP and current account imbalances can potentially comove as in the data
- Write down the simplest open economy model which
 - features trade in final and intermediate goods
 - allows a country's current account balance and its position in the value chain to endogenously respond to the same underlying shock
- Key ingredients
 - **Input-augmenting shocks** for intermediates
 - **Incomplete Markets**
 - **Home bias** in consumption (and production)

Setup and Technology

- 2 countries, H and $F = RoW$, one sector producing a tradable good used as final good in consumption as well as intermediate input in production

Setup and Technology

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- Perfectly competitive markets with production technology in country $i \in \{H, F\}$ given by:

$$x_i = A_i \left[\alpha^{1-\eta} l_i^\eta + (1-\alpha)^{1-\eta} M_i (x_{ii}, x_{ji}, \tau_i)^\eta \right]^{1/\eta}, \quad (4)$$

- $\frac{1}{1-\eta}$: Elasticity of substitution between factors and inputs

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- $\frac{1}{1-\eta}$: Elasticity of substitution between factors and inputs

$$M_i = \left(\omega_i^{1-\phi} (x_{ii})^\phi + (1-\omega_i)^{1-\phi} (\tau_i x_{ji})^\phi \right)^{1/\phi} \quad (5)$$

Input-Augmenting Shocks

τ_H and τ_F

$$M_i = \left(\omega_i^{1-\phi} (x_{ii})^\phi + (1 - \omega_i)^{1-\phi} (\tau_i x_{ji})^\phi \right)^{1/\phi}$$

- We explore two types of shocks:
 - τ_H : A shock affecting backward participation
 - τ_F : A shock affecting forward participation
- Note that these are *not* symmetric shocks

Households

- Denoting histories by $s^t \in \Sigma$, households in i choose asset holdings and consumption to maximize expected life-time utility:

$$\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t u(c_i(t)) \right] = \sum_{t=0}^{\infty} \beta^t \sum_{s^t} \pi(s^t) u(c_i(s^t)), \quad (6)$$

$$u(c) = \frac{1}{1-\sigma} c^{1-\sigma}$$

- Consumption is over both domestic and foreign goods:

$$c_i(s^t) = \left(\nu_i^{1-\psi} c_{ii}^\psi + 1 - \nu_i^{1-\psi} c_{ji}^\psi \right)^{1/\psi}, \quad (7)$$

- ν_i : Governs home-bias in consumption
- $\frac{1}{1-\psi}$: Elasticity of substitution between consumption goods

Budget Constraint and Financial Markets

- Households in i supply labor L_i at wage w_i
- A one-period bond is traded at international financial markets at price $Q(s^t)$
- The budget constraint in country i then reads:

$$\sum_{j \in \mathcal{N}} p_j(s^t) c_{ji}(s^t) + Q(s^t) b^i(s^t) = w_i(s^t) L_i + b^i(s^{t-1}) \left(\sum_{j \in \mathcal{N}} p_j(s^t) \frac{L_j}{L^W} \right) \quad (8)$$

- Denomination is for symmetry

Current Account and GVC measures

- b^i coincides with a country's net foreign asset (*NFA*) holdings and thus CA is given by:

$$ca^i(s^t) = b^i(s^t) - b^i(s^{t-1}). \quad (9)$$

- Market clearing in asset markets requires that for all s^t :

$$\sum_{i \in \{H, F\}} b^i(s^t) = 0 \quad (10)$$

- All measures of GCV participation that we consider can be straightforwardly calculated from the model

Equilibrium

Definition

A competitive equilibrium, for the economy with initial bond holdings $\{b_0^H, b_0^F\}$, is a collection of prices

$$\{p_H(s^t), p_F(s^t), w_H(s^t), w_F(s^t), r(s^t)\}_{s^t \in \Sigma}$$

and allocations

$$\{c_{ij}(s^t), x_{ji}(s^t), x_{ij}(s^t), b^i(s^{t-1})\}_{i,j \in \{H,F\}, s^t \in \Sigma}$$

such that households and firms, taking those prices as given, solve their respective maximization problems and markets clear.

Quantitative Exploration

Two Exercises

- We calibrate the model to the "representative" country in our sample
- We ask the following questions:
 - ① How do macro variables of interest respond to shocks driving forward and backward participation?
 - ② Can the model replicate the relation between participation and current account imbalances?

Calibration

Shocks and parameter choices

- Specify shocks as autoregressive processes:

$$\log \tau_H (s^t) = \rho_{\tau_H} \log \tau_H (s^{t-1}) + \varepsilon_{\tau_H} (s^t) \quad (11)$$

$$\log \tau_F (s^t) = \rho_{\tau_F} \log \tau_F (s^{t-1}) + \varepsilon_{\tau_F} (s^t) \quad (12)$$

$$\log A_i (s^t) = \log \rho_A A_i (s^{t-1}) + \varepsilon_A (s^t) \quad (13)$$

- Innovations are jointly normal with relative standard deviations calibrated to match relative standard deviation of participation measures
- Other parameters are calibrated to match WIOD moments in steady state and/or are taken from the literature

Calibration

A representative economy in the WIOD sample

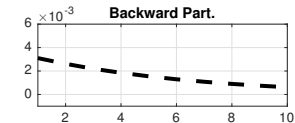
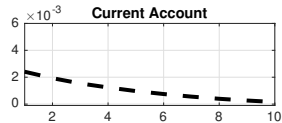
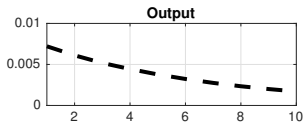
| Preferences | | |
|------------------------------|---------------------------------|-------|
| Discount Factor | β | 0.96 |
| EoS | $\frac{1}{1-\psi}$ | 1.5 |
| Curvature | σ | 2 |
| Home Bias | ν_H | 0.86 |
| Technology | | |
| EoS Intermediates | $\frac{1}{1-\phi}$ | 1.5 |
| Labor share | α | 0.5 |
| EoS Factors Inputs | $\frac{1}{1-\eta}$ | 1.2 |
| Home Bias | ω_H | 0.75 |
| Others | | |
| Relative Country Size | L_i/L^W | 1/67 |
| Std. dev. of Backward Shock | $\sigma_{\varepsilon_{\tau H}}$ | 0.025 |
| Std. dev. of Forward Shock | $\sigma_{\varepsilon_{\tau F}}$ | 0.055 |
| Std. dev. of Aggregate Shock | σ_{ε_A} | 0.01 |
| Shock persistence | ρ | 0.9 |
| Correl. of Volatility Shocks | | 0 |

Computation

- Decision rules are computed using third order approximation methods
 - Ensures that equilibrium bond holdings are stationary
 - Strengthens precautionary savings motive

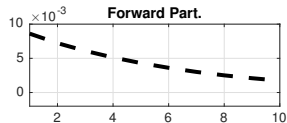
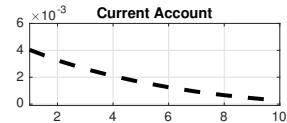
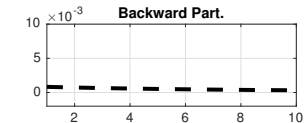
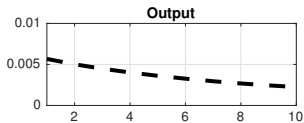
Calibration Results

Impulse Responses to a Domestic Shock τ_H



Calibration Results

Impulse Responses to a Foreign Shock τ_F



The importance of GVC shocks

Simulating the WIOD sample

- 1 40 simulations of two country model for 16 years under baseline calibration
- 2 Innovations hitting the RoW remain the same across 40 simulations of the two country model
- 3 For each simulation, compute participation relative to the RoW
- 4 Drop RoW, leaving a time series for 40 artificial countries, each facing the same partner
- 5 Use artificial dataset to regress the current account on baseline participation measures

Quantitative Exercise

Results

| | Data | Model | |
|--------------------------|---------|------------|---------------|
| Participation Statistics | | GVC shocks | No GVC shocks |
| $\sigma(fw)/\sigma(bw)$ | 2.24 | 2.24 | 0.9 |
| $\sigma fw/\sigma(ca)$ | 2.31 | 2.31 | 0.7 |
| Regression Coefficients | | | |
| $\hat{\delta}_{FW}$ | 0.05* | 0.15** | 0.01 |
| $\hat{\delta}_{BW}$ | 0.11*** | 0.41** | -0.02 |

Conclusion

- We connect two major developments in the world economy
- Asked to which degree a standard IRBC framework can help shed light on the data
- More work needed to establish (i) existence and (ii) quantitative relevance of proposed channels