On the Measurement of Upstreamness and Downstreamness in Global Value Chains

Pol Antràs	Davin Chor
Harvard & NBER	NUS

Dec 2017

Overview

- Backdrop: Production processes are now global in nature, with intermediate inputs obtained from multiple countries and industries along global value chains (GVCs).
- Spurred an increased interest in understanding:
  - (i) Where are countries and industries located along GVCs?
  - (ii) What are the underlying determinants of country positioning along GVCs?

Overview

- Backdrop: Production processes are now global in nature, with intermediate inputs obtained from multiple countries and industries along global value chains (GVCs).
- Spurred an increased interest in understanding:
  - (i) Where are countries and industries located along GVCs?
  - (ii) What are the underlying determinants of country positioning along GVCs?
- On (i): Recent work employing techniques and concepts from input-output analysis to provide descriptive answers.

  (Fally 2012, Antràs *et al.* 2012, Antràs and Chor 2013, Alfaro *et al.* 2017, Miller and Temurshoev 2017, Wang *et al.* 2017)

Overview

- Backdrop: Production processes are now global in nature, with intermediate inputs obtained from multiple countries and industries along global value chains (GVCs).
- Spurred an increased interest in understanding:
  - (i) Where are countries and industries located along GVCs?
  - (ii) What are the underlying determinants of country positioning along GVCs?
- On (ii): An emerging body of general equilibrium models, though not easy to structurally discipline these models.

  (Yi 2003, Kohler 2004, Yi 2010, Harms *et al.* 2012, Baldwin and Venables 2013, Costinot *et al.* 2013, Antràs and Chor 2013, Fally and Hillberry 2014, Kikuchi *et al.* 2017, Tyazhelnikov 2017, Alexander 2017, Antràs and de Gortari 2017, de Gortari 2017)

What we do

This paper: Attempts to provide a bridge between these two strands of work.

1. Review four measures that have been used to capture countries' and industries' GVC positioning (that are based on patterns of intermediate input and final-use purchases)

2. Document how these measures have evolved over time in the 1995-2011 World Input-Output Database (WIOD).

   Will report several salient patterns and puzzling correlations

3. Develop an extension of Caliendo and Parro (2015) that can match *all* entries of a WIOD (i.e., the full pattern of intermediate input purchases and final-use expenditures)

4. Perform model-based counterfactuals to explore the role of: (i) trade cost movements; and (ii) changes in final consumption shares, in explaining the evolution of GVC positioning.

Roadmap for this talk

1. Motivation and Introduction
2. Review of GVC Measures
3. The Evolution of GVC Positioning from 1995-2011
4. Proximate Explanations
5. Structural Model
6. Counterfactuals
7. Conclusion

Measures of GVC Positioning

World Input-Output Table (WIOT)

GVC measures are defined with a WIOT in mind:

- Unit of analysis: Industry *r* in country *i*
- *J* countries and *S* industries/sectors
- *JS* by *JS* block of intermediate-use values
- *JS* by *J* block of final-use values

			Input use & value added							**Final use**			**Total use**
			Country 1			⋯	Country J			Country 1	⋯	Country J	
			Industry 1	⋯	Industry S	⋯	Industry 1	⋯	Industry S				
		Industry 1	Z_{11}^{11}	⋯	Z_{11}^{1S}	⋯	Z_{1J}^{11}	⋯	Z_{1J}^{1S}	F_{11}^{1}	⋯	F_{1J}^{1}	Y_1^1
Intermediate	Country 1	⋯	⋯	Z_{11}^{rs}	⋯	⋯	⋯	Z_{1J}^{rs}	⋯	⋯	⋯	⋯	⋯
		Industry S	Z_{11}^{S1}	⋯	Z_{11}^{SS}	⋯	Z_{1J}^{S1}	⋯	Z_{1J}^{SS}	F_{11}^{S}	⋯	F_{1J}^{S}	Y_1^S
inputs	⋯	⋯	⋯	⋯	⋯	Z_{ij}^{rs}	⋯	⋯	⋯	⋯	F_{ij}^{r}	⋯	Y_i^r
		Industry 1	Z_{J1}^{11}	⋯	Z_{J1}^{1S}	⋯	Z_{JJ}^{11}	⋯	Z_{JJ}^{1S}	F_{J1}^{1}	⋯	F_{JJ}^{1}	Y_J^1
supplied	Country J	⋯	⋯	Z_{J1}^{rs}	⋯	⋯	⋯	Z_{JJ}^{rs}	⋯	⋯	⋯	⋯	⋯
		Industry S	Z_{J1}^{S1}	⋯	Z_{J1}^{SS}	⋯	Z_{JJ}^{S1}	⋯	Z_{JJ}^{SS}	F_{J1}^{S}	⋯	F_{JJ}^{S}	Y_J^S
Value added			VA_1^1	⋯	VA_1^S	VA_j^s	VA_J^1	⋯	VA_J^S				
Gross output			Y_1^1	⋯	Y_1^S	Y_j^s	Y_J^1	⋯	Y_J^S	⋯			

World Input-Output Table (WIOT)

GVC measures are defined with a WIOT in mind:

- Rows: Uses of output from industry *r* in country *i*
- Columns: Value-add and input-use in the production of industry *s* in country *j*

			Input use & value added							Final use			Total use
			Country 1			⋯	Country J			Country 1	⋯	Country J	
			Industry 1	⋯	Industry S	⋯	Industry 1	⋯	Industry S				
		Industry 1	Z_{11}^{11}	⋯	Z_{11}^{1S}	⋯	Z_{1J}^{11}	⋯	Z_{1J}^{1S}	F_{11}^{1}	⋯	F_{1J}^{1}	Y_{1}^{1}
Intermediate	Country 1	⋯	⋯	Z_{11}^{rs}	⋯	⋯	⋯	Z_{1J}^{rs}	⋯	⋯	⋯	⋯	⋯
		Industry S	Z_{11}^{S1}	⋯	Z_{11}^{SS}	⋯	Z_{1J}^{S1}	⋯	Z_{1J}^{SS}	F_{11}^{S}	⋯	F_{1J}^{S}	Y_{1}^{S}
inputs	⋯	⋯	⋯	⋯	⋯	Z_{ij}^{rs}	⋯	⋯	⋯	⋯	F_{ij}^{r}	⋯	Y_{i}^{r}
		Industry 1	Z_{J1}^{11}	⋯	Z_{J1}^{1S}	⋯	Z_{JJ}^{11}	⋯	Z_{JJ}^{1S}	F_{J1}^{1}	⋯	F_{JJ}^{1}	Y_{J}^{1}
supplied	Country J	⋯	⋯	Z_{J1}^{rs}	⋯	⋯	⋯	Z_{JJ}^{rs}	⋯	⋯	⋯	⋯	⋯
		Industry S	Z_{J1}^{S1}	⋯	Z_{J1}^{SS}	⋯	Z_{JJ}^{S1}	⋯	Z_{JJ}^{SS}	F_{J1}^{S}	⋯	F_{JJ}^{S}	Y_{J}^{S}
Value added			VA_{1}^{1}	⋯	VA_{1}^{S}	VA_{j}^{s}	VA_{J}^{1}	⋯	VA_{J}^{S}				
Gross output			Y_{1}^{1}	⋯	Y_{1}^{S}	Y_{j}^{s}	Y_{J}^{1}	⋯	Y_{J}^{S}	⋯			

Upstreamness from Final Use

Define the direct requirements coefficient: $a_{ij}^{rs} = Z_{ij}^{rs} / Y_j^s$.

- Start from the output accounting identity:

$$Y_i^r = \sum_{s=1}^{S} \sum_{j=1}^{J} a_{ij}^{rs} Y_j^s + F_i^r. \quad (1)$$

- Iterate to obtain:

$$Y_i^r = F_i^r + \sum_{s=1}^{S} \sum_{j=1}^{J} a_{ij}^{rs} F_j^s + \sum_{s=1}^{S} \sum_{j=1}^{J} \sum_{t=1}^{S} \sum_{k=1}^{J} a_{ij}^{rs} a_{jk}^{st} F_k^t + \ldots \quad (2)$$

Upstreamness from Final Use

Define the direct requirements coefficient: $a_{ij}^{rs} = Z_{ij}^{rs} / Y_j^s$.

- Start from the output accounting identity:

$$Y_i^r = \sum_{s=1}^{S} \sum_{j=1}^{J} a_{ij}^{rs} Y_j^s + F_i^r. \tag{1}$$

- Iterate to obtain:

$$Y_i^r = F_i^r + \sum_{s=1}^{S} \sum_{j=1}^{J} a_{ij}^{rs} F_j^s + \sum_{s=1}^{S} \sum_{j=1}^{J} \sum_{t=1}^{S} \sum_{k=1}^{J} a_{ij}^{rs} a_{jk}^{st} F_k^t + \dots \tag{2}$$

Simple measure: Final use share in gross output

$$F/GO = F_i^r / Y_i^r \tag{3}$$

Upstreamness from Final Use

Richer measure: Taking into account production-staging distance from final use

$$U_i^r = 1 \times \frac{F_i^r}{Y_i^r} + 2 \times \frac{\sum_{s=1}^{S} \sum_{j=1}^{J} a_{ij}^{rs} F_j^s}{Y_i^r} + 3 \times \frac{\sum_{s=1}^{S} \sum_{j=1}^{J} \sum_{t=1}^{S} \sum_{k=1}^{J} a_{ij}^{rs} a_{jk}^{st} F_k^t}{Y_i^r} + \ldots \qquad (4)$$

Remarks:

- $U_i^r \geq 1$
- U_i^r larger if use occurs on average more stages upstream from final demand
- Computation:
  - Numerator $= [I - \mathbf{A}]^{-2}\mathbf{F}$
  - Denominator $= [I - \mathbf{A}]^{-1}\mathbf{F}$

where $\mathbf{A}$ is the JS by JS matrix of the a_{ij}^{rs}'s (direct requirements matrix); and $\mathbf{F}$ is the JS by 1 vector of the F_i^r's.

Upstreamness from Final Use

- An alternative recursive formulation:

$$\tilde{U}_i^r = 1 + \sum_{s=1}^{S} \sum_{j=1}^{J} b_{ij}^{rs} \tilde{U}_j^s \quad (5)$$

so industries are upstream if they sell to industries that are themselves relatively upstream.

- Equivalence result from Antràs *et al.* (2012):

$$\tilde{U}_i^r = U_i^r$$

Downstreamness from Primary Factors

Define: $b_{ij}^{rs} = Z_{ij}^{rs} / Y_i^r$.

- Output accounting identity from the perspective of sources of value-added:

$$Y_j^s = \sum_{r=1}^{S} \sum_{i=1}^{J} b_{ij}^{rs} Y_i^r + VA_j^s.$$

- Iterate to obtain:

$$Y_j^s = VA_j^s + \sum_{r=1}^{S} \sum_{i=1}^{J} b_{ij}^{rs} VA_i^r + \sum_{r=1}^{S} \sum_{i=1}^{J} \sum_{t=1}^{S} \sum_{k=1}^{J} b_{ki}^{tr} b_{ij}^{rs} VA_k^t + \ldots$$

Downstreamness from Primary Factors

Define: $b_{ij}^{rs} = Z_{ij}^{rs} / Y_i^r$.

- Output accounting identity from the perspective of sources of value-added:

$$Y_j^s = \sum_{r=1}^{S} \sum_{i=1}^{J} b_{ij}^{rs} Y_i^r + VA_j^s.$$

- Iterate to obtain:

$$Y_j^s = VA_j^s + \sum_{r=1}^{S} \sum_{i=1}^{J} b_{ij}^{rs} VA_i^r + \sum_{r=1}^{S} \sum_{i=1}^{J} \sum_{t=1}^{S} \sum_{k=1}^{J} b_{ki}^{tr} b_{ij}^{rs} VA_k^t + \ldots$$

Simple measure: Value-added share in gross output

$$VA/GO = VA_j^s / Y_j^s \tag{6}$$

Downstreamness from Primary Factors

Richer measure:

$$D_j^s = 1 \times \frac{VA_j^s}{Y_j^s} + 2 \times \frac{\sum_{r=1}^{S}\sum_{i=1}^{J} b_{ij}^{rs} VA_i^r}{Y_j^s} + 3 \times \frac{\sum_{r=1}^{S}\sum_{i=1}^{J}\sum_{t=1}^{S}\sum_{k=1}^{J} b_{ki}^{tr} b_{ij}^{rs} VA_k^t}{Y_j^s} + \ldots \quad (7)$$

Remarks:

- $D_j^s \geq 1$
- D_j^s larger if use occurs on average more stages downstream from primary factors
- Computation:
  - Numerator $= [I - \mathbf{B}]^{-2}\mathbf{V}$
  - Denominator $= [I - \mathbf{B}]^{-1}\mathbf{V}$

  where $\mathbf{B}$ is the JS by JS matrix of the b_{ij}^{rs}'s (allocation matrix); and $\mathbf{V}$ is the JS by 1 vector of the VA_j^s's.

Downstreamness from Primary Factors

- Alternative recursive formulation:

$$\tilde{D}_j^s = 1 + \sum_{i=1}^{J} \sum_{r=1}^{S} a_{ij}^{rs} \tilde{D}_i^r . \quad (8)$$

so industries are downstream if they purchase inputs from industries that are themselves relatively downstream.

Result from Fally (2012) and Miller and Temurshoev (2017):

$$\tilde{D}_j^s = D_j^s$$

Aggregation

Four GVC measures at the country-industry level: F/GO, U, VA/GO, D.

Two approaches to aggregate to the country level:

(i) Take a GO-weighted average of the country-industry GVC measures

(ii) Collapse the WIOT to a country-by-country I-O table, and compute the GVC measures

- Both approaches clearly equivalent for F/GO and VA/GO.
- Not equivalent, but very highly correlated for U and D.

Aggregation

Four GVC measures at the country-industry level: F/GO, U, VA/GO, D.

Two approaches can be applied to aggregate to the world level as well:

- Both approaches clearly equivalent for F/GO and VA/GO still.
- But at the world level, aggregate finale expenditures equal aggregate payments to primary factors, so:

$$\bar{F}/\overline{GO} = \overline{VA}/\overline{GO}$$

- Far less obvious, but GO-weighted U and D at the world level are also equal (Miller and Temurshoev 2017):

$$\bar{U} = \bar{D}$$

- Thus: At the world-level, view these more as measures of production complexity, rather than positioning.

GVC Positioning from 1995-2011
(from the World Input-Output Database)

To the WIOD Data...

Use 2013 edition of the World Input-Output Database, c.f. Timmer *et al.* (2015)

- $J = 41$ countries
- $S = 35$ industries/sectors
- 16 years: 1995-2011
- A lot of data points!

  Z_{ij}^{rs} matrix in any year: $(35 \times 41)^2 = 2,059,225$

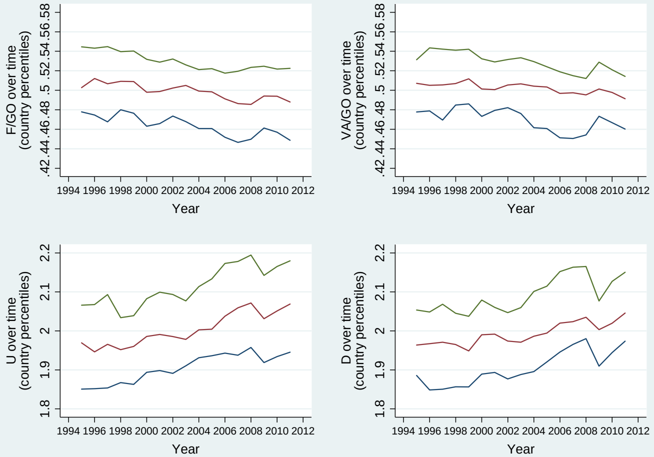
  F_{ij}^{r} matrix in any year: $35 \times 41^2 = 58,835$
- Computational detail: Apply a net inventories correction Antràs *et al.* (2012)

For the World as a whole...

- $\overline{F}/\overline{GO}$ and $\overline{VA}/\overline{GO}$ on the decline
- $\overline{U}$ and $\overline{D}$ on the rise
- Upshot: GVCs appear to be “lengthening”

Country-level GVC Measures over Time

- Similar patterns present across different percentiles of the country-level distribution of the respective GVC measures



Country-level GVC Measures over Time (cont.)

- Striking stability and persistence in rank order

Rank:	F/GO (1995)		F/GO (2011)	
1.	China	0.384	Luxembourg	0.296
2.	Luxembourg	0.388	China	0.340
3.	Slovakia	0.394	Korea	0.377
4.	Czech Rep.	0.408	Taiwan	0.396
5.	Russia	0.444	Czech Rep.	0.401
37.	Denmark	0.558	Brazil	0.557
38.	Brazil	0.572	USA	0.569
39.	Turkey	0.605	Mexico	0.586
40.	Greece	0.625	Cyprus	0.637
41.	Cyprus	0.709	Greece	0.668

Rank:	VA/GO (1995)		VA/GO (2011)	
1.	China	0.373	China	0.325
2.	Czech Rep.	0.403	Luxembourg	0.362
3.	Slovakia	0.416	Korea	0.372
4.	Estonia	0.430	Czech Rep.	0.383
5.	Romania	0.454	Bulgaria	0.401
37.	Austria	0.563	Brazil	0.561
38.	Turkey	0.575	USA	0.562
39.	Brazil	0.575	Mexico	0.581
40.	Greece	0.576	Cyprus	0.586
41.	Cyprus	0.625	Greece	0.628

Rank:	U (1995)		U (2011)	
1.	Cyprus	1.451	Greece	1.546
2.	Greece	1.611	Cyprus	1.617
3.	Turkey	1.666	Mexico	1.737
4.	Brazil	1.755	USA	1.786
5.	Denmark	1.810	Brazil	1.824
37.	Russia	2.185	Czech Rep.	2.358
38.	Luxembourg	2.242	Taiwan	2.463
39.	Czech Rep.	2.331	Korea	2.544
40.	Slovakia	2.389	Luxembourg	2.581
41.	China	2.535	China	2.819

Rank:	D (1995)		D (2011)	
1.	Cyprus	1.662	Greece	1.657
2.	Brazil	1.748	Cyprus	1.763
3.	Turkey	1.758	Mexico	1.779
4.	Greece	1.759	Brazil	1.806
5.	Austria	1.800	USA	1.808
37.	Romania	2.155	Luxembourg	2.348
38.	Estonia	2.209	Bulgaria	2.370
39.	Slovakia	2.306	Czech Rep.	2.444
40.	Czech Rep.	2.344	Korea	2.534
41.	China	2.591	China	2.900

Country-industry GVC Measures over Time

- Focusing on the "pure" within-component of the variation:
  Still find F/GO and VA/GO on the decline; U and D on the rise

$$GVC^s_{j,t} = \beta_1 Year_t + FE^s_j + \epsilon^s_{j,t}. \quad (9)$$

Dependent variable:	$F/GO^s_{j,t}$	$F/GO^s_{j,t}$	$VA/GO^s_{j,t}$	$VA/GO^s_{j,t}$	$(U)^s_{j,t}$	$(U)^s_{j,t}$	$(D)^s_{j,t}$	$(D)^s_{j,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year	-0.0009*		-0.0017***		0.0064***		0.0084***	
	[0.0004]		[0.0005]		[0.0015]		[0.0017]	
(Dum: Year=1996)		-0.0002		-0.0012		-0.0060		0.0019
		[0.0025]		[0.0026]		[0.0083]		[0.0079]
(Dum: Year=1997)		-0.0015		-0.0024		0.0026		0.0061
		[0.0020]		[0.0020]		[0.0068]		[0.0062]
(Dum: Year=1998)		0.0026**		0.0002		-0.0129***		-0.0085*
		[0.0010]		[0.0015]		[0.0032]		[0.0043]
(Dum: Year=1999)		0.0029***		-0.0005		-0.0086***		-0.0073***
		[0.0004]		[0.0005]		[0.0010]		[0.0025]
(Dum: Year=2000)		-0.0015		-0.0094***		0.0140***		0.0311***
		[0.0014]		[0.0016]		[0.0045]		[0.0044]
(Dum: Year=2001)		-0.0022		-0.0122***		0.0182**		0.0394***
		[0.0020]		[0.0021]		[0.0065]		[0.0053]
(Dum: Year=2002)		-0.0010		-0.0091***		0.0069		0.0218***
		[0.0024]		[0.0022]		[0.0069]		[0.0054]
(Dum: Year=2003)		-0.0033		-0.0102***		0.0204**		0.0334***
		[0.0027]		[0.0022]		[0.0082]		[0.0059]
(Dum: Year=2004)		-0.0052		-0.0135***		0.0346***		0.0490***
		[0.0030]		[0.0025]		[0.0100]		[0.0079]
(Dum: Year=2005)		-0.0061*		-0.0153***		0.0421***		0.0657***
		[0.0031]		[0.0032]		[0.0099]		[0.0101]

Correlations in GVC Measures across Countries

- In an autarkic world, aggregate F and VA would be equal as a national accounting identity.

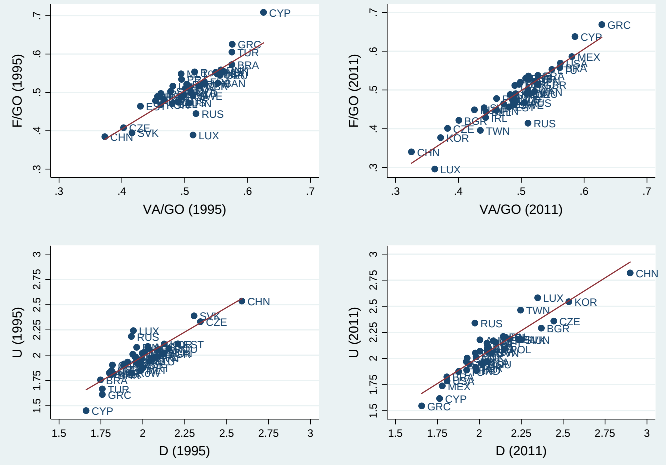
$\Rightarrow$ Would expect a perfect positive correlation in F/GO and VA/GO across countries

- Conversely, would expect that as trade costs fall and production becomes more fragmented, this tight correlation between F/GO and VA/GO would weaken.

- Logic should carry over to correlation between U and D as well, since F/GO and U are negatively correlated (as are VA/GO and D)

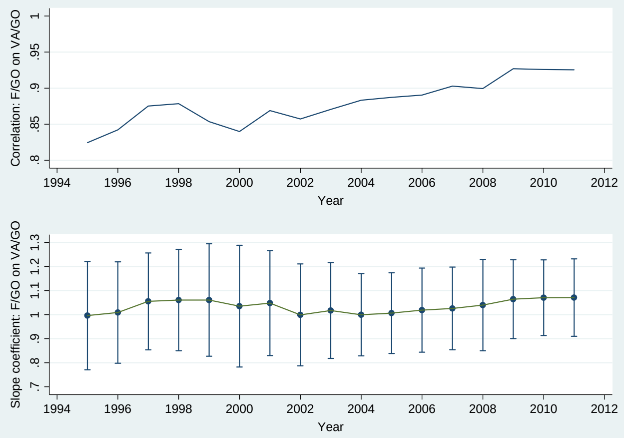
Puzzling Correlations

- Correlation between F/GO and VA/GO (as well as between U and D) shows no signs of weakening!



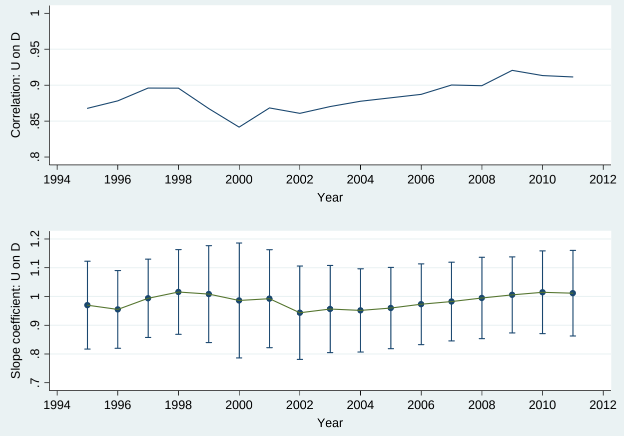
Puzzling Correlations

- Correlation between F/GO and VA/GO (as well as between U and D) shows no signs of weakening!



Puzzling Correlations

- Correlation between F/GO and VA/GO (as well as between U and D) shows no signs of weakening!



Puzzling Correlations (at the country-industry level)

- Positive slope coefficient even in the country-industry GVC measures

$$F/GO_{j,t}^{s} \quad = \quad \beta_1 VA/GO_{j,t}^{s} + FE_j + FE^s + \epsilon_{j,t}^{s}, \tag{10}$$

Dependent variable:	$F/GO_{j,t}^{s}$ 1995 (1)	$F/GO_{j,t}^{s}$ 1995 (2)	$F/GO_{j,t}^{s}$ 1995 (3)	$F/GO_{j,t}^{s}$ 2011 (4)	$F/GO_{j,t}^{s}$ 2011 (5)	$F/GO_{j,t}^{s}$ 2011 (6)
$VA/GO_{j,t}^{s}$	0.5438***	0.5196**	0.0775	0.6543***	0.6373***	0.2647***
	[0.1815]	[0.1924]	[0.0543]	[0.1647]	[0.1740]	[0.0527]
Country FE?	N	Y	Y	N	Y	Y
Industry FE?	N	N	Y	N	N	Y
Observations	1,417	1,417	1,417	1,414	1,414	1,414
R^2	0.1285	0.1488	0.8392	0.1927	0.2033	0.8479

Dependent variable:	$U_{j,t}^{s}$ 1995 (7)	$U_{j,t}^{s}$ 1995 (8)	$U_{j,t}^{s}$ 1995 (9)	$U_{j,t}^{s}$ 2011 (10)	$U_{j,t}^{s}$ 2011 (11)	$U_{j,t}^{s}$ 2011 (12)
$D_{j,t}^{s}$	0.5308***	0.4820**	0.2413***	0.6213***	0.5707***	0.3772***
	[0.1640]	[0.1902]	[0.0604]	[0.1454]	[0.1698]	[0.0617]
Country FE?	N	Y	Y	N	Y	Y
Industry FE?	N	N	Y	N	N	Y
Observations	1,435	1,435	1,435	1,435	1,435	1,435
R^2	0.1350	0.1742	0.8264	0.1946	0.2232	0.8325

Two Candidate Explanations

1. Trade Costs

- Could be that trade costs remain high in absolute levels
- Use the Head-Reis index to get an empirical handle on this:

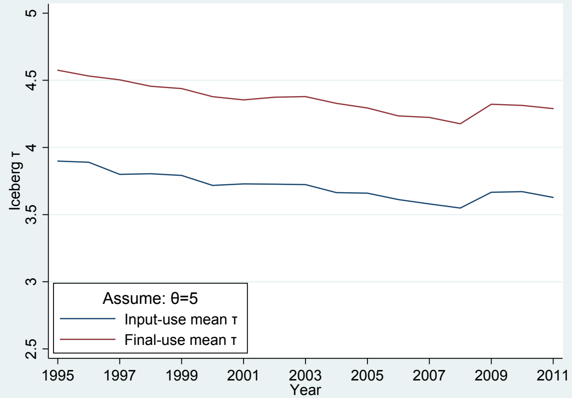
$$\tau_{ij}^{rs} = \left(\frac{Z_{ij}^{rs} Z_{ji}^{rs}}{Z_{ii}^{rs} Z_{jj}^{rs}} \right)^{-\frac{1}{2\theta}} \text{, and} \tag{11}$$

$$\tau_{ij}^{rF} = \left(\frac{F_{ij}^{r} F_{ji}^{r}}{F_{ii}^{r} F_{jj}^{r}} \right)^{-\frac{1}{2\theta}} . \tag{12}$$

(Assume either: (i) $\theta = 5$; or (ii) use Caliendo-Parro (2015) sectoral-level estimates.)

1. Trade Costs

- Average τ remains high at the end of the period...
- **However:** Clear overall downward trend particularly in the earlier half of the period



1. Trade Costs

- Decline in trade costs borne out robustly in regressions

$$\ln \tau_{ij,t}^{rs} \quad = \quad \beta_0 Year_t + FE_{ij}^{rs} + \epsilon_{ij,t}^{rs}, \text{ and} \tag{13}$$

Dependent variable:	log Trade Costs for Intermediate Inputs					
	(1)	(2)	(3)	(4)	(3)	(4)
Industries:	All	All	Goods	Goods	Services	Services
Year	-0.0164***		-0.0181***		-0.0150***	
	[0.0022]		[0.0024]		[0.0026]	
Dum: Year=1996		-0.0052		-0.0211*		0.0085
		[0.0093]		[0.0108]		[0.0142]
Dum: Year=1997		-0.0782***		-0.0982***		-0.0609***
		[0.0048]		[0.0075]		[0.0061]
Dum: Year=1998		-0.1108***		-0.1503***		-0.0768***
		[0.0039]		[0.0077]		[0.0055]
Dum: Year=1999		-0.1129***		-0.1598***		-0.0725***
		[0.0048]		[0.0074]		[0.0063]
Dum: Year=2000		-0.1562***		-0.1850***		-0.1313***
		[0.0056]		[0.0079]		[0.0086]
Dum: Year=2001		-0.1653***		-0.2021***		-0.1336***
		[0.0067]		[0.0093]		[0.0099]
Dum: Year=2002		-0.1594***		-0.1936***		-0.1299***
		[0.0064]		[0.0079]		[0.0107]
Dum: Year=2003		-0.1778***		-0.2141***		-0.1465***
		[0.0100]		[0.0123]		[0.0154]
Dum: Year=2004		-0.2019***		-0.2219***		-0.1846***
		[0.0097]		[0.0115]		[0.0155]
Dum: Year=2005		-0.2239***		-0.2558***		-0.1965***
		[0.0109]		[0.0147]		[0.0159]

1. Trade Costs

- Decline in trade costs borne out robustly in regressions

$$\ln \tau_{ij,t}^{rF} = \beta_0 Year_t + FE_{ij}^{r} + \epsilon_{ij,t}^{r}. \quad (14)$$

Dependent variable:	log Trade Costs for Final Goods/Services					
	(1)	(2)	(3)	(4)	(3)	(4)
Industries:	All	All	Goods	Goods	Services	Services
Year	-0.0212***		-0.0231***		-0.0196***	
	[0.0039]		[0.0041]		[0.0051]	
Dum: Year=1996		-0.0217		-0.0510*		0.0029
		[0.0332]		[0.0278]		[0.0550]
Dum: Year=1997		-0.1123***		-0.1306***		-0.0968***
		[0.0104]		[0.0146]		[0.0115]
Dum: Year=1998		-0.1588***		-0.2095***		-0.1161***
		[0.0099]		[0.0116]		[0.0168]
Dum: Year=1999		-0.1479***		-0.1910***		-0.1115**
		[0.0193]		[0.0090]		[0.0441]
Dum: Year=2000		-0.2001***		-0.2445***		-0.1628***
		[0.0257]		[0.0162]		[0.0456]
Dum: Year=2001		-0.2370***		-0.2708***		-0.2084***
		[0.0233]		[0.0245]		[0.0360]
Dum: Year=2002		-0.2295***		-0.2589***		-0.2047***
		[0.0179]		[0.0238]		[0.0359]
Dum: Year=2003		-0.2500***		-0.2825***		-0.2225***
		[0.0251]		[0.0251]		[0.0423]
Dum: Year=2004		-0.2814***		-0.2951***		-0.2699***
		[0.0304]		[0.0303]		[0.0435]
Dum: Year=2005		-0.3024***		-0.3417***		-0.2693***
		[0.0323]		[0.0372]		[0.0435]

2. Sectoral Composition

- Key observation: Services tend to feature a higher share of output going straight to final demand, as well as a higher share of use of primary factors

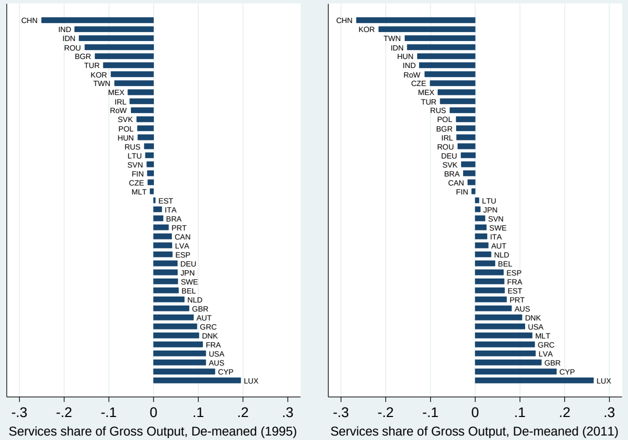
  In other words: Services are in "short chains", while goods are in "long chains" Details

- If some countries are more specialized in goods and others in industries, this can account for the positive cross-country correlation between F/GO and VA/GO (as well as between U and D)

- Could be consistent with a decline in trade costs, if this decline reinforces pre-existing patterns of specialization

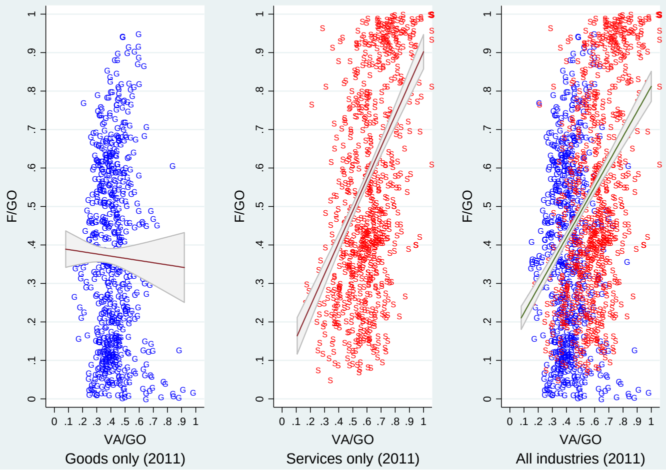
2. Sectoral Composition

- A secular rise over time in service share of gross output. . .
- **BUT:** Some signs that patterns of specialization in services have become more concentrated over time



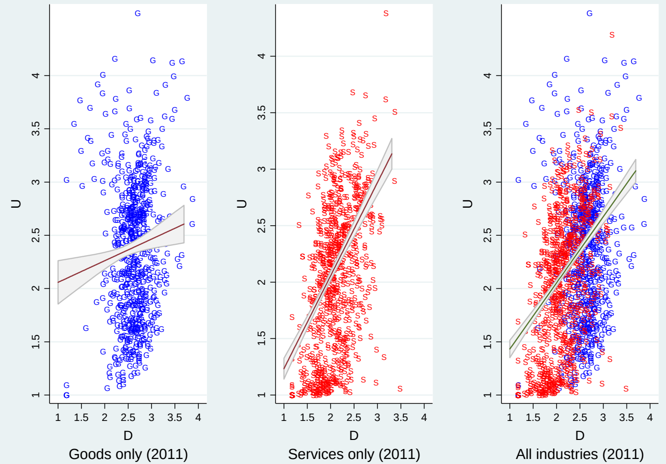
2. Sectoral Composition

- At the country-industry level: Positive slope coefficient between GVC measures is driven by services



2. Sectoral Composition

- At the country-industry level: Positive slope coefficient between GVC measures is driven by services



2. Sectoral Composition

- Share of services in *final expenditures* has been on the rise, while that for goods has fallen

$$\ln \alpha^s_{j,t} = \beta_0 Year_t + FE^s_j + \epsilon^s_{j,t}. \quad (15)$$

Dependent variable:	log Expenditure Shares, α_j^s					
	(1)	(2)	(3)	(4)	(5)	(6)
Industries:	All	All	Goods	Goods	Services	Services
Year	-0.0038		-0.0127***		0.0037	
	[0.0025]		[0.0037]		[0.0025]	
Dum: Year=1996		0.0016		-0.0087		0.0104
		[0.0148]		[0.0183]		[0.0200]
Dum: Year=1997		-0.0078		-0.0230*		0.0050
		[0.0117]		[0.0127]		[0.0137]
Dum: Year=1998		-0.0139		-0.0493***		0.0160**
		[0.0081]		[0.0158]		[0.0059]
Dum: Year=1999		-0.0070***		-0.0633***		0.0405***
		[0.0022]		[0.0077]		[0.0036]
Dum: Year=2000		0.0028		-0.0497***		0.0470***
		[0.0060]		[0.0130]		[0.0086]
Dum: Year=2001		-0.0013		-0.0718***		0.0582***
		[0.0099]		[0.0119]		[0.0155]
Dum: Year=2002		-0.0123		-0.0991***		0.0609**
		[0.0144]		[0.0104]		[0.0231]
Dum: Year=2003		-0.0192		-0.1171***		0.0633**
		[0.0159]		[0.0134]		[0.0222]
Dum: Year=2004		-0.0165		-0.1130***		0.0648***
		[0.0185]		[0.0250]		[0.0212]
Dum: Year=2005		-0.0136		-0.1123***		0.0697***
		[0.0216]		[0.0344]		[0.0232]

2. Sectoral Composition

- Share of services in *input purchases* has been on the rise, while that for goods has fallen

$$\ln \gamma_{j,t}^{rs} = \beta_0 Year_t + FE_j^{rs} + \epsilon_{j,t}^{rs}, \tag{16}$$

Dependent variable:	log Input-Use Shares, γ_j^{rs}					
	(1)	(2)	(3)	(4)	(5)	(6)
Industries:	All	All	Goods	Goods	Services	Services
Year	0.0000		-0.0113**		0.0097***	
	[0.0031]		[0.0043]		[0.0031]	
Dum: Year=1996		0.0098		-0.0050		0.0227
		[0.0160]		[0.0186]		[0.0142]
Dum: Year=1997		0.0093		-0.0209		0.0351**
		[0.0134]		[0.0167]		[0.0131]
Dum: Year=1998		-0.0031		-0.0580***		0.0437***
		[0.0110]		[0.0186]		[0.0130]
Dum: Year=1999		0.0013		-0.0728***		0.0643***
		[0.0043]		[0.0087]		[0.0087]
Dum: Year=2000		0.0204***		-0.0544***		0.0840***
		[0.0032]		[0.0091]		[0.0062]
Dum: Year=2001		0.0450***		-0.0660***		0.1391***
		[0.0119]		[0.0103]		[0.0157]
Dum: Year=2002		0.0335**		-0.0894***		0.1377***
		[0.0154]		[0.0116]		[0.0193]
Dum: Year=2003		0.0234		-0.1068***		0.1337***
		[0.0183]		[0.0166]		[0.0209]
Dum: Year=2004		0.0353		-0.1028***		0.1524***
		[0.0230]		[0.0276]		[0.0242]
Dum: Year=2005		0.0353		-0.1032**		0.1526***
		[0.0260]		[0.0372]		[0.0250]

Model

Recap: Caliendo-Parro (2015)

General equilibrium model of cross-country production and trade with inter-sectoral linkages, that builds on the Eaton-Kortum machinery

Setup:

- i and j denote countries; ij subscript indicates a shipment from i to j
- r and s denote industries; rs superscript indicates a shipment from r to s

Preferences: Cobb-Douglas

$$u(C_j) = \prod_{s=1}^{S} \left(C_j^s\right)^{\alpha_j^s} \tag{17}$$

where C_j^s is a sector-s composite over a unit measure of varieties (see below)

Recap: Caliendo-Parro (2015)

General equilibrium model of cross-country production and trade with inter-sectoral linkages, that builds on the Eaton-Kortum machinery

Setup:

- i and j denote countries; ij subscript indicates a shipment from i to j
- r and s denote industries; rs superscript indicates a shipment from r to s

Production: Cobb-Douglas over labor and intermediates from all sectors

$$y_j^s(\omega^s) = z_j^s(\omega^s)\left(l_j^s(\omega^s)\right)^{1-\sum_{r=1}^{S}\gamma_j^{rs}} \prod_{r=1}^{S}\left(\mathcal{M}_j^{rs}(\omega^s)\right)^{\gamma_j^{rs}} \tag{18}$$

where $z_j^s(\omega^s)$ are iid draws from a Fréchet distribution: $\exp\{-T_j^s z^{-\theta^s}\}$.

Recap: Caliendo-Parro (2015)

General equilibrium model of cross-country production and trade with inter-sectoral linkages, that builds on the Eaton-Kortum machinery

Setup:

- i and j denote countries; ij subscript indicates a shipment from i to j
- r and s denote industries; rs superscript indicates a shipment from r to s

CES aggregator for C_j^s and $\mathcal{M}_j^{sr}$ composites:

$$Q_j^s = \left(\int q_j^s(\omega^s)^{1-1/\sigma^s} \, d\omega^s \right)^{\sigma^s/(\sigma^s-1)} \tag{19}$$

Iceberg trade costs: $\tau_{ij}^r \geq 1$.

Caliendo-Parro (2015): Equilibrium System

$$\pi_{ij}^{s} = \frac{T_i^s (c_i^s \tau_{ij}^s)^{-\theta^s}}{\sum_{k=1}^{J} T_k^s (c_k^s \tau_{kj}^s)^{-\theta^s}} \tag{20}$$

$$c_j^s = \Upsilon_j^s w_j^{1-\sum_{r=1}^{S} \gamma_j^{rs}} \prod_{r=1}^{S} \left(P_j^r\right)^{\gamma_j^{rs}} \tag{21}$$

$$P_j^r = A^r \left[\sum_{i=1}^{J} T_i^r \left(c_i^r \tau_{ij}^r\right)^{-\theta^r} \right]^{-1/\theta^r} \tag{22}$$

$$X_j^s = \sum_{r=1}^{S} \gamma_j^{sr} \underbrace{\sum_{i=1}^{J} X_i^r \pi_{ji}^r}_{Y_j^r} + \alpha_j^s \left(w_j L_j + D_j\right) \tag{23}$$

$$\sum_{s=1}^{S} X_j^s = \sum_{s=1}^{S} \sum_{i=1}^{J} X_j^s \pi_{ij}^s = \sum_{s=1}^{S} \sum_{i=1}^{J} X_i^s \pi_{ji}^s + D_j \tag{24}$$

Limitation

- Trade shares π_{ij}^{s} do not differ by the identity of the purchaser, i.e., whether this is used to meet final demand or as an intermediate input.
- When mapping to the data:

$$\pi_{ij}^{r} = \frac{\tilde{F}_{ij}^{r}}{\sum_{k=1}^{J} \tilde{F}_{kj}^{r}} = \frac{\tilde{Z}_{ij}^{rs}}{\sum_{k=1}^{J} \tilde{Z}_{kj}^{rs}} \quad \text{for } j = 1, \ldots, J. \tag{25}$$

- Would *not* be satisfied for a generic WIOT
- Why this matters: As GVC measures are computed from final-use and intermediate-use shares, desirable to have a model that can match these shares exactly

A More Flexible Model

Consider trade costs from country i to j in industry r:

- Now allow these to differ by identity of the purchasing entity.
- If used as an input by another industry s: τ_{ij}^{rs}
- If used to meet final demand: τ_{ij}^{rF}
- Implies that trade share expressions (and hence price indices) will depend on the identity of the purchaser.

New equilibrium system:

$$\pi_{ij}^{rs} = \frac{T_i^r \left(c_i^r \tau_{ij}^{rs}\right)^{-\theta^r}}{\sum_{k=1}^{J} T_k^r \left(c_k^r \tau_{kj}^{rs}\right)^{-\theta^r}} \quad (26)$$

$$\pi_{ij}^{rF} = \frac{T_i^r \left(c_i^r \tau_{ij}^{rF}\right)^{-\theta^r}}{\sum_{k=1}^{J} T_k^r \left(c_k^r \tau_{kj}^{rF}\right)^{-\theta^r}} \quad (27)$$

A More Flexible Model

$$c_j^s = \Upsilon_j^s w_j^{1-\sum_{r=1}^{S}\gamma_j^{rs}} \prod_{r=1}^{S} \left(P_j^{rs}\right)^{\gamma_j^{rs}} \tag{28}$$

$$P_j^{rs} = A^r \left[\sum_{i=1}^{J} T_i^r \left(c_i^r \tau_{ij}^{rs}\right)^{-\theta^r}\right]^{-1/\theta^r} \tag{29}$$

$$P_j^{rF} = A^r \left[\sum_{i=1}^{J} T_i^r \left(c_i^r \tau_{ij}^{rF}\right)^{-\theta^r}\right]^{-1/\theta^r} \tag{30}$$

$$P_j^F = \prod_{s=1}^{S} \left(P_j^{sF}/\alpha_j^s\right)^{\alpha_j^s} \tag{31}$$

$$Y_j^s = \sum_{k=1}^{J} \pi_{jk}^{sF} \alpha_k^s \left(w_k L_k + D_k\right) + \sum_{r=1}^{S}\sum_{k=1}^{J} \pi_{jk}^{sr} \gamma_k^{sr} Y_k^r \tag{32}$$

$$\sum_{i=1}^{J}\sum_{r=1}^{S}\sum_{s=1}^{S} \pi_{ij}^{sr}\gamma_j^{sr} Y_j^r + w_j L_j = \sum_{i=1}^{J}\sum_{r=1}^{S}\sum_{s=1}^{S} \pi_{ji}^{sr}\gamma_i^{sr} Y_i^r + \sum_{s=1}^{S}\sum_{i=1}^{J} \pi_{ji}^{sF}\alpha_i^s \left(w_i L_i + D_i\right) \tag{33}$$

Mapping to the WIOD

- Recover final expenditure share and input use share parameters in a standard way:

$$\gamma_j^{rs} = \frac{\sum_{i=1}^{J} \tilde{Z}_{ij}^{rs}}{\tilde{Y}_j^s} \tag{34}$$

$$\alpha_j^s = \frac{\sum_{i=1}^{J} \tilde{F}_{ij}^s}{\sum_{r=1}^{S} \widetilde{VA}_j^r + \tilde{D}_j} \tag{35}$$

Mapping to the WIOD

- Recover final expenditure share and input use share parameters in a standard way:

$$\gamma_j^{rs} = \frac{\sum_{i=1}^{J} \tilde{Z}_{ij}^{rs}}{\tilde{Y}_j^s} \quad (34)$$

$$\alpha_j^s = \frac{\sum_{i=1}^{J} \tilde{F}_{ij}^s}{\sum_{r=1}^{S} \widetilde{VA}_j^r + \tilde{D}_j} \quad (35)$$

- Theoretical result: Suppose that these and all other underlying model parameters – other than the trade costs – are given. Then, there exist a unique set of values of τ_{ij}^{rs} and τ_{ij}^{rF} that will exactly match the observed $\tilde{Z}_{ij}^{rs}$'s and $\tilde{F}_{ij}^{s}$.

- **Upshot:** The more flexible model can now exactly match *all* entries of a WIOT.

Counterfactual Changes via the "Hat Algebra"

- Caveat: While the set of τ_{ij}^{rs}'s and τ_{ij}^{rF}'s exist that fully match a WIOT, these are computationally not easy to back out.

- Instead: Turn to "hat-algebra" techniques.

  Re-express the equilibrium system of equations in changes, following Dekle *et al.* (2008) and Caliendo and Parro (2015).

- Denote change in variable X by X'; and percentage changes by $\hat{X} = X'/X$.

- To evaluate counterfactual changes, need only:
  (i) the initial trade shares, π_{ij}^{rs} and π_{ij}^{rF};
  (ii) the demand and technological Cobb-Douglas parameters γ_j^{rs} and α_j^s;
  (iii) a vector of θ^r's.

Counterfactual Changes via the "Hat Algebra"

$$\hat{\pi}_{ij}^{rs} = \left(\frac{\hat{c}_i^r \hat{\tau}_{ij}^{rs}}{\hat{P}_j^{rs}} \right)^{-\theta^r} \tag{36}$$

$$\hat{\pi}_{ij}^{rF} = \left(\frac{\hat{c}_i^r \hat{\tau}_{ij}^{rF}}{\hat{P}_j^{rF}} \right)^{-\theta^r} \tag{37}$$

$$\hat{c}_j^s = (\hat{w}_j)^{1-\sum_{r=1}^{S} \gamma_j^{rs}} \prod_{r=1}^{S} \left(\hat{P}_j^{rs} \right)^{\gamma_j^{rs}} \tag{38}$$

$$\hat{P}_j^{rs} = \left[\sum_{i=1}^{J} \pi_{ij}^{rs} \left(\hat{c}_i^r \hat{\tau}_{ij}^{rs} \right)^{-\theta^r} \right]^{-1/\theta^r} \tag{39}$$

$$\hat{P}_j^{rF} = \left[\sum_{i=1}^{J} \pi_{ij}^{rF} \left(\hat{c}_i^r \hat{\tau}_{ij}^{rF} \right)^{-\theta^r} \right]^{-1/\theta^r} \tag{40}$$

Counterfactual Changes via the "Hat Algebra"

$$\left(Y_j^s\right)' = \sum_{k=1}^{J}\left(\pi_{jk}^{sF}\right)'(\alpha_k^s)'(\hat{w}_k w_k L_k + D_k) + \sum_{r=1}^{S}\sum_{k=1}^{J}\left(\pi_{jk}^{sr}\right)'\gamma_k^{sr}(Y_k^r)' \quad (41)$$

$$\sum_{i=1}^{J}\sum_{r=1}^{S}\sum_{s=1}^{S}\left(\pi_{ij}^{sr}\right)'\gamma_j^{sr}\left(Y_j^r\right)' + \hat{w}_j w_j L_j = \sum_{i=1}^{J}\sum_{r=1}^{S}\sum_{s=1}^{S}\left(\pi_{ji}^{sr}\right)'\gamma_i^{sr}(Y_i^r)' + \sum_{s=1}^{S}\sum_{i=1}^{J}\left(\pi_{ji}^{sF}\right)'(\alpha_i^s)'(\hat{w}_i w_i L_i + D_i) \quad (42)$$

Counterfactuals

Two exercises

1. Initialize to 1995 and – holding deficits constant – evaluate whether changes in the τ's and/or changes in the α's can explain observed evolution of GVC measures
2. Initialize to 2011 – holding deficits constant – explore how changes in the τ's and/or changes in the α's are projected to affect the future movements in country GVC positioning

Note: Not meant to be a definitive decomposition.

- Put aside changes in the T's, since harder to discipline this empirically
- Also: "hat algebra" in the current Cobb-Douglas framework not equipped to handle changes in γ's.

1. Changes from 1995 to 2011

- Consider $\hat{\tau}_{ij}^{rs}$'s and $\hat{\tau}_{ij}^{rF}$'s from 1995-2011 (from Head-Reis, for goods vs services).
- Consider actual changes in the final-use shares for the α's.
- Set: $\theta = 5$.

A: Country-level GVC measures	Mean F/GO	Mean VA/GO	Correlation F/GO, VA/GO	Mean U	Mean D	Correlation U, D	Real wage change (Min, Mean, Max)
1995 baseline (from data)	0.507	0.503	0.825	1.976	1.987	0.868	---
2011 baseline (from data)	0.484	0.487	0.925	2.085	2.070	0.912	---
1995 to 2011 Shifts							
Change trade costs	0.518	0.502	0.612	1.940	1.984	0.666	(1.003, 1.104, 1.512)
Change expenditure shares	0.516	0.513	0.857	1.945	1.953	0.889	(0.993, 1.001, 1.017)
Both changes	0.525	0.511	0.660	1.917	1.952	0.705	(1.002, 1.093, 1.434)
B: Country-industry GVC measures	**Regress $F/GO_{j,t}^s$ on $VA/GO_{j,t}^s$ (Coefficient on $VA/GO_{j,t}^s$)**			**Regress $U_{j,t}^s$ on $D_{j,t}^s$ (Coefficient on $D_{j,t}^s$)**			
1995 baseline (from data)	0.5434***	0.5184**	0.0851	0.5337***	0.4839**	0.2564***	---
2011 baseline (from data)	0.6543***	0.6373***	0.2647***	0.6286***	0.5785***	0.4156***	---
1995 to 2011 Shifts							
Change trade costs	0.5534***	0.5321***	0.1101*	0.5270***	0.4844**	0.2474***	---
Change expenditure shares	0.5942***	0.5760***	0.1029*	0.5930***	0.5540***	0.2753***	---
Both changes	0.6009***	0.5854***	0.1193**	0.5856***	0.5512***	0.2609***	---
Country FE?	N	Y	Y	N	Y	Y	---
Industry FE?	N	N	Y	N	N	Y	---

1. Changes from 1995 to 2011

- Observed trade costs tend to weaken the key cross-country correlation between F/GO and VA/GO (as well as that between U and D)
- Conversely, rise in importance of services (relative to goods) moves these correlations in the opposite direction

A: Country-level GVC measures	**Mean F/GO**	**Mean VA/GO**	**Correlation F/GO, VA/GO**	**Mean U**	**Mean D**	**Correlation U, D**	**Real wage change (Min, Mean, Max)**
1995 baseline (from data)	0.507	0.503	0.825	1.976	1.987	0.868	---
2011 baseline (from data)	0.484	0.487	0.925	2.085	2.070	0.912	---
1995 to 2011 Shifts							
Change trade costs	0.518	0.502	0.612	1.940	1.984	0.666	(1.003, 1.104, 1.512)
Change expenditure shares	0.516	0.513	0.857	1.945	1.953	0.889	(0.993, 1.001, 1.017)
Both changes	0.525	0.511	0.660	1.917	1.952	0.705	(1.002, 1.093, 1.434)
B: Country-industry GVC measures	**Regress $F/GO_{j,t}^s$ on $VA/GO_{j,t}^s$ (Coefficient on $VA/GO_{j,t}^s$)**			**Regress $U_{j,t}^s$ on $D_{j,t}^s$ (Coefficient on $D_{j,t}^s$)**			
1995 baseline (from data)	0.5434***	0.5184**	0.0851	0.5337***	0.4839**	0.2564***	---
2011 baseline (from data)	0.6543***	0.6373***	0.2647***	0.6286***	0.5785***	0.4156***	---
1995 to 2011 Shifts							
Change trade costs	0.5534***	0.5321***	0.1101*	0.5270***	0.4844**	0.2474***	---
Change expenditure shares	0.5942***	0.5760***	0.1029*	0.5930***	0.5540***	0.2753***	---
Both changes	0.6009***	0.5854***	0.1193**	0.5856***	0.5512***	0.2609***	---
Country FE?	N	Y	Y	N	Y	Y	---
Industry FE?	N	N	Y	N	N	Y	---

1. Changes from 1995 to 2011

- Lower panel: These two forces go some way towards accounting for the rise in the slope-coefficient between the country-industry GVC measures

A: Country-level GVC measures	**Mean F/GO**	**Mean VA/GO**	**Correlation F/GO, VA/GO**	**Mean U**	**Mean D**	**Correlation U, D**	**Real wage change (Min, Mean, Max)**
1995 baseline (from data)	0.507	0.503	0.825	1.976	1.987	0.868	---
2011 baseline (from data)	0.484	0.487	0.925	2.085	2.070	0.912	---
1995 to 2011 Shifts							
Change trade costs	0.518	0.502	0.612	1.940	1.984	0.666	(1.003, 1.104, 1.512)
Change expenditure shares	0.516	0.513	0.857	1.945	1.953	0.889	(0.993, 1.001, 1.017)
Both changes	0.525	0.511	0.660	1.917	1.952	0.705	(1.002, 1.093, 1.434)
B: Country-industry GVC measures	**Regress $F/GO_{j,t}^{s}$ on $VA/GO_{j,t}^{s}$ (Coefficient on $VA/GO_{j,t}^{s}$)**			**Regress $U_{j,t}^{s}$ on $D_{j,t}^{s}$ (Coefficient on $D_{j,t}^{s}$)**			
1995 baseline (from data)	0.5434***	0.5184**	0.0851	0.5337***	0.4839**	0.2564***	---
2011 baseline (from data)	0.6543***	0.6373***	0.2647***	0.6286***	0.5785***	0.4156***	---
1995 to 2011 Shifts							
Change trade costs	0.5534***	0.5321***	0.1101*	0.5270***	0.4844**	0.2474***	---
Change expenditure shares	0.5942***	0.5760***	0.1029*	0.5930***	0.5540***	0.2753***	---
Both changes	0.6009***	0.5854***	0.1193**	0.5856***	0.5512***	0.2609***	---
Country FE?	N	Y	Y	N	Y	Y	---
Industry FE?	N	N	Y	N	N	Y	---

2. Forward Projections

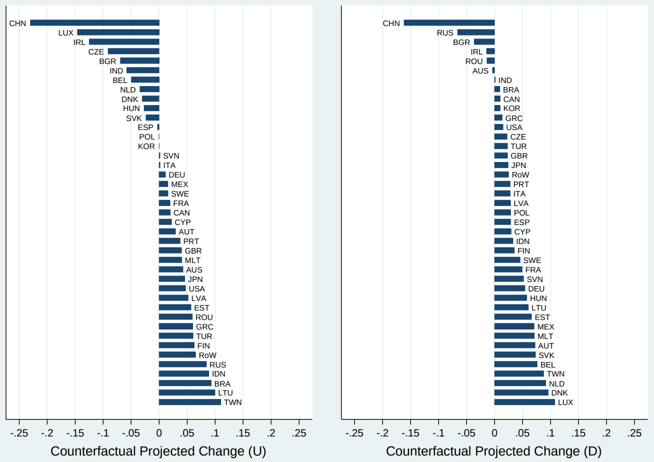
- Consider a further decline in trade costs and/or the α's for another 16 years, based on per annum rate of change from earlier regression estimates
- Interestingly: a decline in trade costs that is biased towards services appears to induce greater specialization in services for countries with pre-existing comparative advantage...

  and this actually strengthens the correlation between F/GO and VA/GO (and between U and D)

Country-level measures	Mean F/GO	Mean VA/GO	Correlation F/GO, VA/GO	Mean U	Mean D	Correlation U, D	Real wage change (Min, Mean, Max)
2011 baseline (from data)	0.484	0.487	0.925	2.085	2.070	0.912	---
1995 to 2011 Shifts							
Change trade costs	0.482	0.476	0.840	2.095	2.101	0.815	(1.070, 1.207, 1.485)
Change trade costs (Goods only)	0.483	0.480	0.836	2.089	2.091	0.811	(1.058, 1.151, 1.269)
Change trade costs (Services only)	0.486	0.485	0.914	2.081	2.073	0.908	(1.010, 1.048, 1.286)
Change expenditure shares	0.492	0.494	0.934	2.054	2.042	0.923	(0.997, 1.000, 1.006)
Change trade costs (goods & services) and expenditure shares	0.489	0.483	0.867	2.066	2.072	0.849	(1.064, 1.189, 1.456)

2. Forward Projections

Changes in individual countries' GVC positioning (U and D) from a further trade cost decline:



Concluding Remarks

Conclusion

- Documented the evolution of GVC positioning of countries and industries, in the 1995-2011 WIOD
- Uncovered several salient facts and puzzling correlations:
  - Countries (and country-industries) that are far removed from final demand also have a high production-staging distance from primary factors
- Explored the possible role of two forces: (i) declines in trade costs; and (ii) the rising importance of services in final consumption shares.
- Done through the lens of a model (extending Caliendo-Parro), that fully rationalizes all the entries of a WIOT, and thus provides a more flexible basis for counterfactual exercise on countries' GVC positioning.

Supplementary Slides

Summary Statistics ▸ Back

	10th	Median	90th	Mean	Std Dev	N
F/GO						
All industries	0.125	0.444	0.901	0.473	0.271	24,076
Goods industries only	0.076	0.373	0.700	0.379	0.240	11,105
Service industries only	0.216	0.496	0.956	0.553	0.270	12,971
VA/GO						
All industries	0.279	0.456	0.738	0.489	0.186	24,395
Goods industries only	0.247	0.360	0.499	0.371	0.118	11,152
Service industries only	0.378	0.575	0.812	0.589	0.175	13,243
U						
All industries	1.153	2.126	2.914	2.098	0.649	24,395
Goods industries only	1.523	2.298	3.048	2.291	0.605	11,152
Service industries only	1.055	1.982	2.771	1.936	0.640	13,243
D						
All industries	1.502	2.141	2.624	2.092	0.450	24,395
Goods industries only	2.033	2.381	2.728	2.376	0.316	11,152
Service industries only	1.356	1.846	2.363	1.852	0.404	13,243