Productivity effects from inter-industry offshoring and inshoring: Firm-level evidence from Belgium

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Definitions

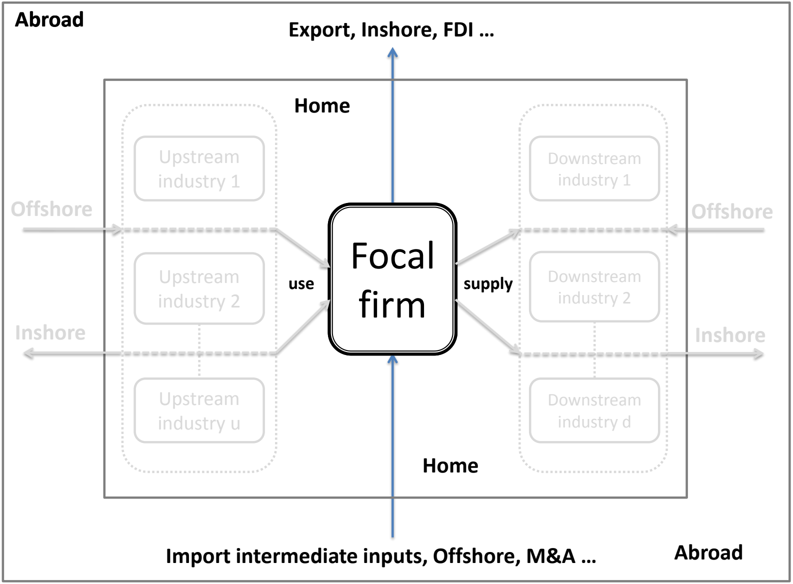
Offshoring

Situation in which a firm imports intermediate inputs, either from affiliated or unaffiliated foreign suppliers.

Inshoring

Situation in which a firm exports its final output abroad that will be used as intermediate input in the production process to both affiliated and unaffiliated customers.

Motivation: Intra-industry trade decisions



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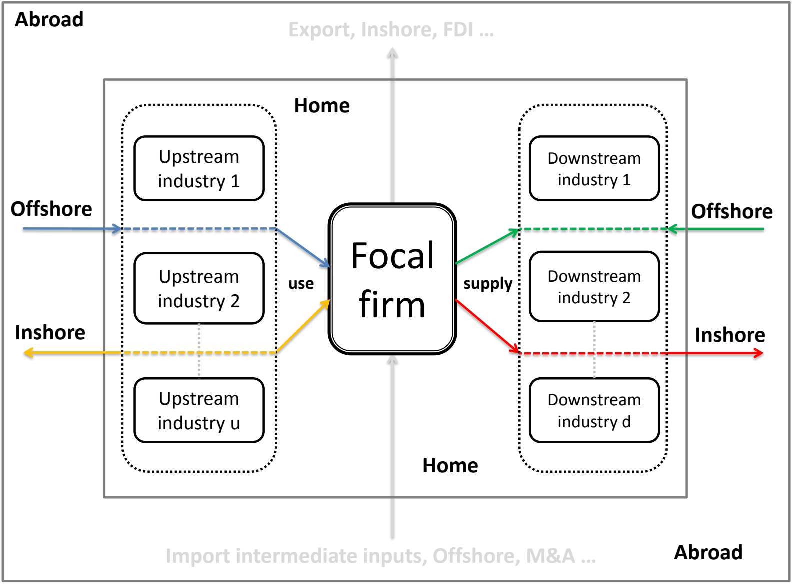


Motivation

- Firms operate in a complex environment with geographically fragmented value chains where they:
  - are supplied from domestic upstream industries.
  - supply domestic downstream industries.
- These domestic upstream and downstream industries include firms that decide to export, import, offshore, FDI, etc. affecting their productivity.
- Such decisions generate productivity effects that can be transmitted to the focal firm via upstream and downstream linkages. Possible mechanisms include:
  - knowledge and R&D spillovers
  - management practices and international networking,
  - organisational restructuring and X-inefficiencies reduction
  - import competition and quality standards

Motivation

- Literature is silent about these inter-industry effects on firm productivity except for:
  - Javorcik (2004), supports that the presence of FDI in downstream industries generates vertical technology transfers (backward spillovers).
  - Blalock and Veloso (2007), suggest that linkages of vertical supply relationships offer a channel through which import-driven technology transfers occur.

Research Questions

- First, we seek to identify the existence of effects on firm productivity as their domestic upstream and downstream clients become more internationalised and therefore offshore and inshore intensively.
- Second, we ask whether opening up to trade will impact firms productivity via the pre-mentioned inter-industry channels. China's accession to the WTO in 2001, is experienced from Belgian firms as an exogenous trade barrier reduction to a specific trade destination (quasi-trade liberalization).
- Finally, we explore the importance to our results of value-added bias in production function estimations and specification bias from ignoring the dynamic nature of productivity.

Data

- Amadeus Database by Bureau Van Dijk Electronic Publishing:
  - Firm-level data for an unbalanced panel of 2765 Belgian manufacturing firms for the period 2002-2007.
  - Operating revenue, tangible fixed assets, # of employees, costs of employees, material inputs, ownership and MNC status.
- World Input-Output Database (WIOD):
  - Input-Output and International Supply and Use tables for 40 countries worldwide and a model for the rest of the world.
  - 35 industries and 59 products.

Proxies

From WIOD we generate proxies at the **industry-year** level to quantify the effects from

- downstream linkages:

$$\underbrace{Down\_off_{jt} = \sum_{d \neq j} \theta_{jdt} \Phi_{jdt}}_{\text{Merlevede and Michel (2013)}} \quad \text{and} \quad Down\_in_{jt} = \sum_{d \neq j} \theta_{jdt} \Lambda_{jdt}$$

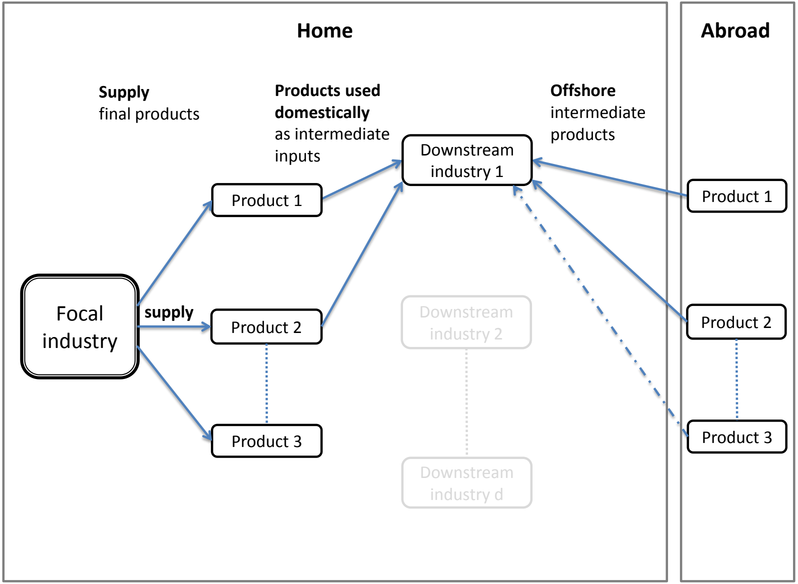
- upstream linkages:

$$Up\_off_{jt} = \sum_{u \neq j} \zeta_{jut} \Psi_{jut} \quad \text{and} \quad Up\_in_{jt} = \sum_{u \neq j} \zeta_{jut} \Xi_{jut}$$

Interpretation

Inherently relative measures where firms with relatively larger values for $Down\_off_{jt}$ face relatively more downstream offshoring.

Proxies: Downstream offshoring



Productivity

$$y_{it} = f_t(k_{it}, l_{it}, m_{it}) + \overbrace{\underbrace{\omega_{it}}_{\text{TFP known by firm}} + \underbrace{\epsilon_{it}}_{\text{ex-post shock}}}^{\text{unobserved by econometrician}}$$

- Simultaneity bias (Marschak and Andrews, 1944)
  - Dynamic panel methods (Arellano and Bond, 1991)
    - Linear restrictions on evolution of ω_{it} i.e AR(1) or MA(0)
    - All inputs are quasi-fixed (no flexible inputs)
  - Proxy variable methods
    - *simultaneity* $\Rightarrow i_{it} = \imath_t(k_{it}, \omega_{it})$ (Olley and Pakes, 1996)
    - *truncation* $\Rightarrow m_{it} = m_t(k_{it}, \omega_{it})$ (Levinsohn and Petrin, 2003)
    - *collinearity* $\Rightarrow$ adj. frictions in l_{it} (Ackerberg et al., 2006)
    - *efficiency* $\Rightarrow$ one-step estimation (Wooldridge, 2009)

Productivity

$$\underbrace{va_{it}}_{ln(Y_{it}-M_{it})} = f_t(k_{it}, l_{it}) + \tilde{\omega}_{it} + \tilde{\epsilon}_{it}$$

- Value-added bias $\Rightarrow \tilde{\omega}_{it} \neq \omega_{it} \equiv TFP$
  - more dispersed and heterogeneous estimates of $\tilde{\omega_{it}}$ vs ω_{it}
- Gandhi et al. (2012) (GNR) propose a **two-step** estimation procedure of **flexible**, **gross-output** production functions.

Empirical Methodology

- *Two-stage static specification:*

$$\hat{\omega}_{ijt} = \gamma_c + \gamma_p \ proxies_{jt-1} + \gamma_x \ X_{i(j)t-1} + \alpha_t + \alpha_j + \alpha_r + \xi_{ijt}$$

- *Two-stage dynamic specification:*

$$\hat{\omega}_{ijt} = \gamma_c + \rho \ \hat{\omega}_{ijt-1} + \gamma_p \ proxies_{jt-1} + \gamma_x X_{i(j)t-1} + \alpha_t + \alpha_j + \alpha_r + \xi_{ijt}$$

- *One-stage specification:*
  Within the two-step GNR estimation procedure, at step two, insert in the law of motion the relevant proxies:

$$\omega_{it} = g_{it}(\ \omega_{it-1}, proxies_{jt-1}, X_{i(j)t-1} \ ) + \xi_{it}$$

where $X_{i(j)t-1}$=(MNC, SHH_BE and SUB_BE status)

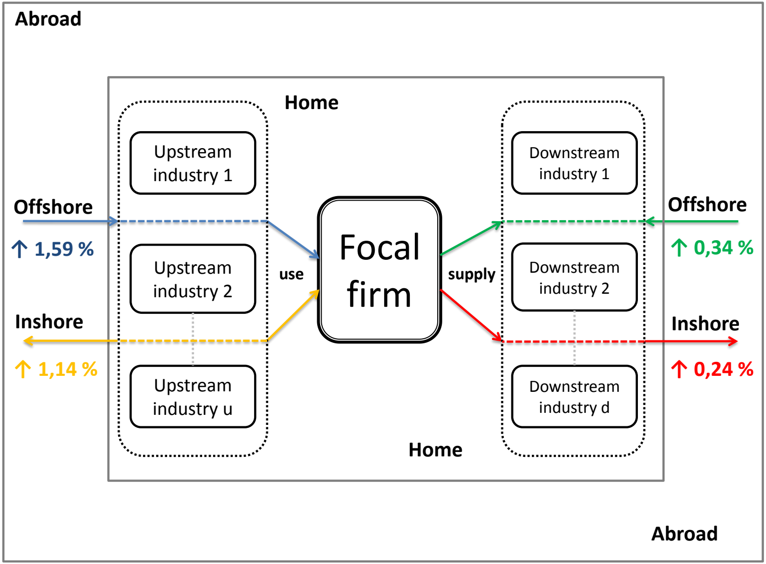
Table: Effects on TFP from inter-industry offshoring and inshoring Full

	FE	DFE	SGMM	One-Stage
TFP_{t-1}		0.921^{***}	0.986^{***}	0.933^{***}
		(0.023)	(0.013)	(0.012)
$Down\_off_{t-1}$	-0.015	0.067^{***}	0.109^{***}	0.067^{***}
	(0.012)	(0.010)	(0.012)	(0.012)
Up_off_{t-1}	-0.405^{***}	-0.394^{***}	-0.400^{***}	-0.474^{***}
	(0.093)	(0.062)	(0.109)	(0.067)
$Down\_in_{t-1}$	1.248^{***}	0.571^{***}	0.426^{**}	0.561^{***}
	(0.225)	(0.124)	(0.197)	(0.180)
Up_in_{t-1}	-0.684	6.356^{***}	10.275^{***}	6.161^{***}
	(1.243)	(0.845)	(1.671)	(1.012)
Observations	15496	15496	15496	12731

$^{*}(p < 0.05)$, $^{**}(p < 0.01)$, $^{***}(p < 0.001)$. Block bootstrapped 200 replications

Economic Interpretation

- During 2002-2007, avg TFP of Belgian manufacturing firms:

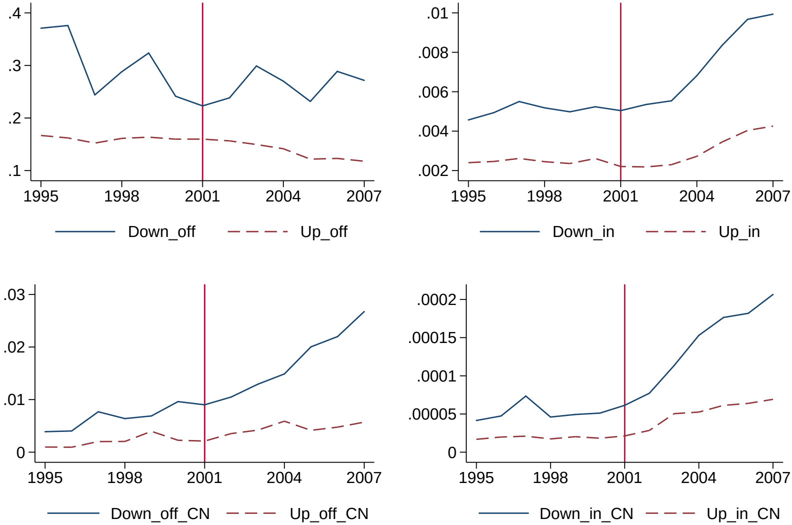


Economic Interpretation

- *Inter-industry offshoring and inshoring induce productivity enhancements, accounting for almost 2 times the increase in average productivity of Belgian firms during 2002-2007.*

- *Upstream linkages prevail.*

Opening up to trade with China



Source: Own calculations using World Input Output Database (WIOD)

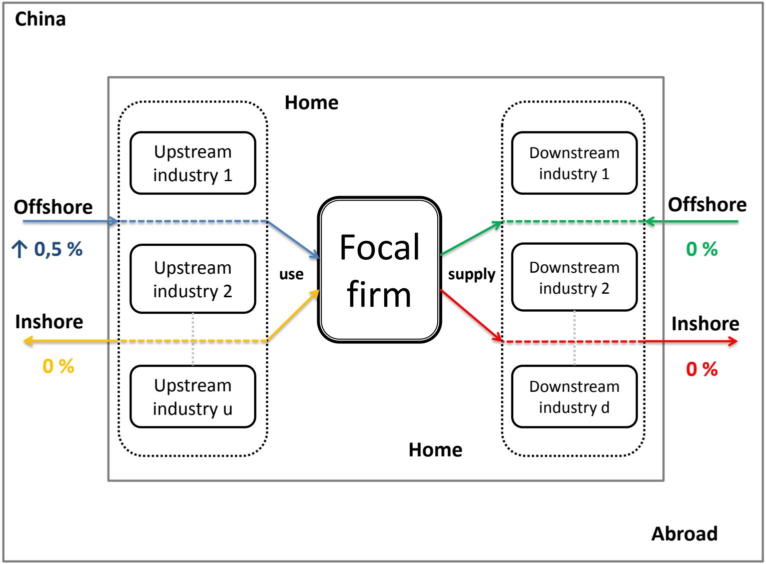
Table: Effects on TFP from inter-industry offshoring to and inshoring from China Full

	FE	DFE	SGMM	One-Stage
TFP_{t-1}		0.920***	0.970***	0.933***
		(0.023)	(0.016)	(0.014)
$Down\_off^{CN}_{t-1}$	-0.364	-0.429**	-0.354	-0.508
	(0.292)	(0.179)	(0.277)	(0.325)
$Up\_off^{CN}_{t-1}$	3.002**	3.240***	4.355***	4.121***
	(1.169)	(1.015)	(1.314)	(0.998)
$Down\_in^{CN}_{t-1}$	-142.645***	-4.161	14.421	-2.581
	(17.740)	(12.524)	(18.432)	(22.946)
$Up\_in^{CN}_{t-1}$	8.437	13.441	48.326*	13.376
	(18.413)	(20.466)	(27.079)	(37.138)
Observations	15496	15496	15496	12731

$^{*}(p < 0.05),^{**}(p < 0.01),^{***}(p < 0.001)$. Block bootstrapped 200 replications

Economic Interpretation

- During 2002-2007, avg TFP of Belgian manufacturing firms:



Economic Interpretation

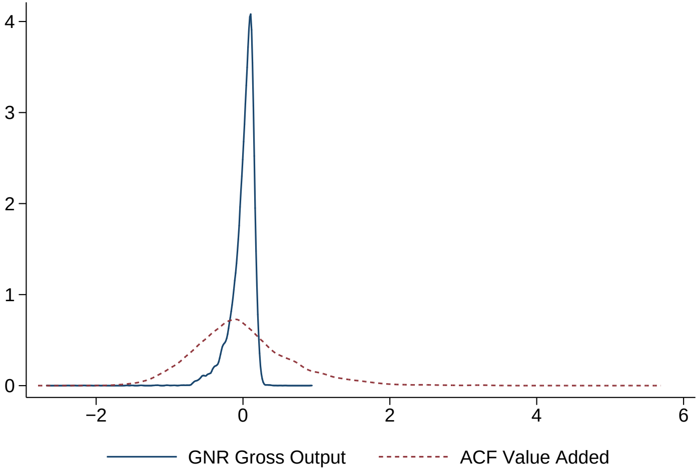
- *Opening up to trade can induce productivity enhancements from inter-industry linkages accounting for almost 30% of the increase in average productivity of Belgian firms during 2002-2007. . .*

  . . . up to the extent that China's accession to the WTO in 2001 can be considered as an exogenous quasi-trade liberalization event for Belgian firms i.e exogenous variation in trade statistics and thus proxies of interest.

Heterogeneity

- **Medium-Low Tech** vs High-Medium Tech industries
  - R&D intensive industries defragmented over time (Fally, 2011).
- **Labor Intensive** vs Capital Intensive industries.
  - Integrate vs Outsource decision (Antràs, 2003).
- **Relatively Upstream** vs Relatively Downstream industries
  - Shift of value-added to final stages of production (Fally, 2011).
  - Comparative advantage of developed countries in goods with fewer production stages and closer to final demand (Fally, 2011).
  - Better rule of law, strong financial development and relative skill intensity abundance correlated with propensity to export in relatively downstream industries (Antràs et al., 2012).

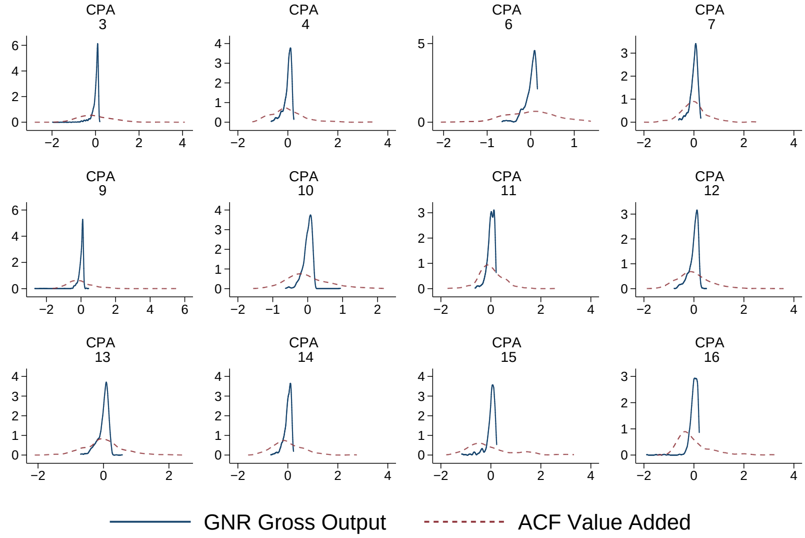
Value-added bias



Source: Own calculations

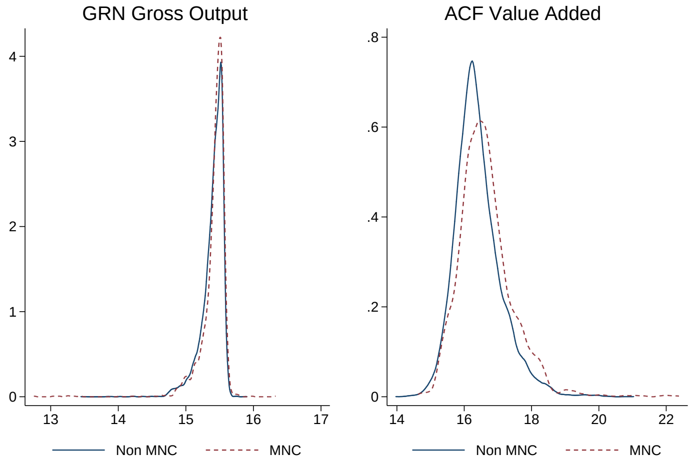
- More dispersed and heterogeneous TFP

Value-added bias



Source: Own calculations

Value-added bias



Source: Own calculations

- Statistically non-interpretable and spurious economic effects

Robustness

- Intra-industry proxies. Results
- Different values of proxies' technical coefficient. Results
- Trimming levels. Results
- Timing assumption for labor. Results
- Firm fixed effects. Results
- Imperfect competition in output market. Results

Concluding remarks

- Confirm the existence of improvements
  on firm productivity from inter-industry offshoring and inshoring
- Support the idea that these inter-industry effects on productivity can be induced from a quasi-trade liberalisation event i.e opening up to trade with China.
- Draw upon the importance to our results of value-added bias in production function estimations and specification bias from ignoring the dynamic nature of productivity.

Thank you

References I

Ackerberg, D., K. Caves, and G. Frazer (2006). Structural estimation of production functions. *manuscript. Department of Economics, UCLA*.

Antràs, P. (2003). Firms, contracts, and trade structure. *The Quarterly Journal of Economics 118*(4), 1375–1418.

Antràs, P., D. Chor, T. Fally, and R. Hillberry (2012). Measuring the upstreamness of production and trade flows. *The American Economic Review 102*(3), pp. 412–416.

Arellano, M. and S. Bond (1991). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *The review of economic studies 58*(2), 277–297.

Fally, T. (2011). On the fragmentation of production in the us. *University of Colorado-Boulder*.

References II

Gandhi, A., S. Navarro, and D. Rivers (2012). On the identification of production functions: How heterogeneous is productivity? Technical report, Working Paper U Winsconsin-Madison.

Levinsohn, J. and A. Petrin (2003). Estimating production functions using inputs to control for unobservables. *The Review of Economic Studies 70*(2), 317–341.

Marschak, J. and W. H. Andrews (1944). Random simultaneous equations and the theory of production. *Econometrica, Journal of the Econometric Society*, 143–205.

Merlevede, B. and B. Michel (2013). Downstream offshoring and firm-level employment: Evidence for belgian manufacturing firms. *Federal Planning Bureau Working Paper 16-13*, 308–347.

Olley, G. S. and A. Pakes (1996). the dynamic of productivity in the telecommunications equipment industry. *Econometrica*, 1263–1297.

References III

Wooldridge, J. M. (2009). On estimating firm-level production functions using proxy variables to control for unobservables. *Economics Letters 104*(3), 112–114.

Cobb Douglas - GNR 1st step

$$Y_{it} = K_{it}^{\alpha_K} \; L_{it}^{\alpha_L} \; M_{it}^{\alpha_M} \; \mathrm{e}^{(\omega_{it} + \epsilon_{it})}$$
$$P_t^M = P_t^Y \; \alpha_M \; \mathrm{e}^{\omega_{it}} \; \mathcal{E}, \quad where \; \mathcal{E} = E(\mathrm{e}^{\epsilon_{it}})$$

- Combining (31) and (31) we retrieve share equation net of ω_{it}:

$$ln \; s_{it} = \alpha_M + ln\mathcal{E} - \epsilon_{it}$$

  where $s_{it} = \frac{P_t^M M_{it}}{P_t^Y Y_{it}}$ is observed materials share of output.

- Since $E[\epsilon_{it} \mid k_{it}, l_{it}, m_{it}] = 0$ we identify ϵ_{it} $(hence \; \mathcal{E})$ and thus output elasticity of flexible input:

$$\hat{\alpha_M}$$

Back

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Back	FE	DFE	SGMM	One-Stage
TFP_{t-1}		0.921***	0.986***	0.933***
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$Down\_off_{t-1}$	-0.015	0.067***	0.109***	0.067***
	(0.012)	(0.010)	(0.012)	(0.012)
Up_off_{t-1}	-0.405***	-0.394***	-0.400***	-0.474***
	(0.093)	(0.062)	(0.109)	(0.067)
$Down\_in_{t-1}$	1.248***	0.571***	0.426**	0.561***
	(0.225)	(0.124)	(0.197)	(0.180)
Up_in_{t-1}	-0.684	6.356***	10.275***	6.161***
	(1.243)	(0.845)	(1.671)	(1.012)
SHH^{BE}_{t-1}	-0.017**	-0.001	-0.002	-0.000
	(0.007)	(0.002)	(0.004)	(0.001)
SUB^{BE}_{t-1}	0.009	-0.000	-0.004	0.001
	(0.008)	(0.001)	(0.005)	(0.004)
MNC_{t-1}	0.003	0.002	0.006	0.000
	(0.009)	(0.002)	(0.006)	(0.003)
Observations	15496	15496	15496	12731

$^{*}(p < 0.05),^{**}(p < 0.01),^{***}(p < 0.001)$. Block bootstrapped 200 replications

Table: Effects on TFP from inter-industry offshoring and inshoring

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$Down\_off^{CN}_{t-1}$	-0.364	-0.429**	-0.354	-0.508
	(0.292)	(0.179)	(0.277)	(0.325)
$Up\_off^{CN}_{t-1}$	3.002**	3.240***	4.355***	4.121***
	(1.169)	(1.015)	(1.314)	(0.998)
$Down\_in^{CN}_{t-1}$	-142.645***	-4.161	14.421	-2.581
	(17.740)	(12.524)	(18.432)	(22.946)
$Up\_in^{CN}_{t-1}$	8.437	13.441	48.326*	13.376
	(18.413)	(20.466)	(27.079)	(37.138)
SHH^{BE}_{t-1}	-0.017**	-0.001	-0.004	-0.000
	(0.007)	(0.002)	(0.004)	(0.002)
SUB^{BE}_{t-1}	0.009	-0.000	-0.002	0.001
	(0.008)	(0.001)	(0.005)	(0.003)
MNC_{t-1}	0.003	0.002	0.000	0.000
	(0.009)	(0.002)	(0.007)	(0.004)
$Down\_off^{excCN}_{t-1}$	-0.109**	0.099**	0.229***	0.107**
	(0.055)	(0.040)	(0.075)	(0.042)
$Up\_off^{excCN}_{t-1}$	-0.756***	-0.596***	-0.499***	-0.757***
	(0.137)	(0.106)	(0.175)	(0.120)
$Down\_in^{excCN}_{t-1}$	2.737***	0.470**	0.317	0.414
	(0.304)	(0.195)	(0.293)	(0.357)
$Up\_in^{excCN}_{t-1}$	2.902**	5.112***	7.653***	5.306***
	(1.202)	(0.918)	(1.878)	(1.102)
Observations	15496	15496	15496	12731

$^{*}(p < 0.05),^{**}(p < 0.01),^{***}(p < 0.001)$. Block bootstrapped 200 replications

Back	Adj. lag	Adj. costs
TFP_{t-1}	0.933***	0.933***
	(0.012)	(0.010)
$Down\_off_{t-1}$	0.067***	0.067***
	(0.012)	(0.008)
Up_off_{t-1}	-0.474***	-0.474***
	(0.067)	(0.062)
$Down\_in_{t-1}$	0.561***	0.561***
	(0.180)	(0.182)
Up_in_{t-1}	6.161***	6.161***
	(1.012)	(0.737)
TFP_{t-1}	0.933***	0.933***
	(0.014)	(0.009)
$Down\_off^{CN}_{t-1}$	-0.508	-0.508**
	(0.325)	(0.204)
$Up\_off^{CN}_{t-1}$	4.121***	4.120***
	(0.998)	(0.793)
$Down\_in^{CN}_{t-1}$	-2.581	-2.596
	(22.946)	(19.471)
$Up\_in^{CN}_{t-1}$	13.376	13.374
	(37.138)	(23.949)
Observations	12731	12731

$^{*}(p < 0.05),^{**}(p < 0.01),^{***}(p < 0.001)$. Block bootstrapped 200 replications

Back	No intra-industry	With intra-industry
TFP_{t-1}	0.933***	0.934***
	(0.012)	(0.011)
$Down\_off_{t-1}$	0.067***	0.060***
	(0.012)	(0.012)
Up_off_{t-1}	-0.474***	-0.375***
	(0.067)	(0.084)
$Down\_in_{t-1}$	0.561***	0.575***
	(0.180)	(0.193)
Up_in_{t-1}	6.161***	4.805***
	(1.012)	(1.028)
off_{t-1}		0.018
		(0.056)
in_{t-1}		0.055
		(0.038)
TFP_{t-1}	0.933***	0.933***
	(0.014)	(0.011)
$Down\_off^{CN}_{t-1}$	-0.508	-0.526**
	(0.325)	(0.247)
$Up\_off^{CN}_{t-1}$	4.121***	3.410**
	(0.998)	(1.361)
$Down\_in^{CN}_{t-1}$	-2.581	-3.557
	(22.946)	(24.310)
$Up\_in^{CN}_{t-1}$	13.376	26.928
	(37.138)	(28.229)
off_{t-1}		0.053
		(0.049)
in_{t-1}		-0.073
		(0.077)
Observations	12731	12731

$^{*}(p < 0.05),^{**}(p < 0.01),^{***}(p < 0.001)$. Block bootstrapped 200 replications

Back	No Firm FE	ll1	dl1	ll2	dl2
TFP_{t-1}	0.933***	-0.039	-0.031	-0.036	-0.008
	(0.012)	(0.076)	(0.053)	(0.081)	(0.049)
$Down\_off_{t-1}$	0.067***	0.053*	0.053**	0.053*	0.053***
	(0.012)	(0.027)	(0.025)	(0.028)	(0.016)
Up_off_{t-1}	-0.474***	-0.510**	-0.525***	-0.514***	-0.517***
	(0.067)	(0.204)	(0.107)	(0.186)	(0.102)
$Down\_in_{t-1}$	0.561***	1.169***	1.155**	1.164*	1.300***
	(0.180)	(0.433)	(0.506)	(0.645)	(0.376)
Up_in_{t-1}	6.161***	3.735	3.673	3.717	4.063*
	(1.012)	(3.642)	(2.634)	(3.506)	(2.126)
TFP_{t-1}	0.933***	-0.041	0.041	-0.039	0.042
	(0.014)	(0.073)	(0.062)	(0.065)	(0.047)
$Down\_off^{CN}_{t-1}$	-0.508	-0.090	-3.162***	-0.070	-2.941***
	(0.325)	(0.956)	(0.991)	(0.920)	(0.512)
$Up\_off^{CN}_{t-1}$	4.121***	4.406*	10.661***	4.392	9.273***
	(0.998)	(2.269)	(2.610)	(2.876)	(1.624)
$Down\_in^{CN}_{t-1}$	-2.581	-57.529*	24.191	-57.823	0.495
	(22.946)	(29.933)	(43.352)	(39.869)	(20.479)
$Up\_in^{CN}_{t-1}$	13.376	56.340	1.946	56.335	5.707
	(37.138)	(53.852)	(43.764)	(50.115)	(27.963)
Observations	12731	9966	9966	9966	9780

$^{*}(p < 0.05), ^{**}(p < 0.01), ^{***}(p < 0.001)$. Block bootstrapped 200 replications

Back	fix2000	fix2001	fix2002	varying
TFP_{t-1}	0.933***	0.934***	0.933***	0.933***
	(0.012)	(0.013)	(0.012)	(0.013)
$Down\_off_{t-1}$	0.067***	0.067***	0.066***	0.057***
	(0.012)	(0.008)	(0.010)	(0.009)
Up_off_{t-1}	-0.474***	-0.477***	-0.450***	-0.189*
	(0.067)	(0.081)	(0.064)	(0.100)
$Down\_in_{t-1}$	0.561***	0.616***	0.553***	0.486***
	(0.180)	(0.188)	(0.174)	(0.174)
Up_in_{t-1}	6.161***	5.668***	5.586***	1.540***
	(1.012)	(0.787)	(0.649)	(0.518)
TFP_{t-1}	0.933***	0.933***	0.933***	0.933***
	(0.014)	(0.011)	(0.013)	(0.013)
$Down\_off^{CN}_{t-1}$	-0.508	-0.512*	-0.520**	-0.346*
	(0.325)	(0.294)	(0.259)	(0.181)
$Up\_off^{CN}_{t-1}$	4.121***	4.128***	3.890***	4.504***
	(0.998)	(0.931)	(0.988)	(1.311)
$Down\_in^{CN}_{t-1}$	-2.581	1.205	10.137	2.158
	(22.946)	(19.281)	(19.297)	(18.729)
$Up\_in^{CN}_{t-1}$	13.376	19.436	15.395	11.671
	(37.138)	(24.171)	(33.237)	(24.536)
Observations	12731	12731	12731	12731

$^{*}(p<0.05),^{**}(p<0.01),^{***}(p<0.001)$. Block bootstrapped 200 replications

Back	10%	5%	15%	20%	No trimming
TFP_{t-1}	0.933***	0.939***	0.931***	0.838***	0.981***
	(0.012)	(0.025)	(0.007)	(0.013)	(0.032)
$Down\_off_{t-1}$	0.067***	0.066***	0.066***	0.057**	0.044*
	(0.012)	(0.023)	(0.008)	(0.023)	(0.025)
Up_off_{t-1}	-0.474***	-0.455***	-0.478***	-0.416***	-0.869***
	(0.067)	(0.099)	(0.059)	(0.077)	(0.196)
$Down\_in_{t-1}$	0.561***	0.594*	0.585***	0.620**	-0.711
	(0.180)	(0.312)	(0.122)	(0.312)	(1.187)
Up_in_{t-1}	6.161***	4.885***	6.587***	6.727***	6.522**
	(1.012)	(1.149)	(0.863)	(0.707)	(2.861)
TFP_{t-1}	0.933***	0.938***	0.930***	0.838***	0.981***
	(0.014)	(0.026)	(0.007)	(0.013)	(0.031)
$Down\_off^{CN}_{t-1}$	-0.508	-0.379	-0.487**	-0.203	-1.183**
	(0.325)	(0.378)	(0.190)	(0.372)	(0.570)
$Up\_off^{CN}_{t-1}$	4.121***	4.414**	4.222***	3.895***	-1.816
	(0.998)	(2.071)	(0.803)	(0.860)	(2.680)
$Down\_in^{CN}_{t-1}$	-2.581	-4.226	-5.695	-9.906	7.613
	(22.946)	(25.998)	(15.969)	(40.184)	(53.648)
$Up\_in^{CN}_{t-1}$	13.376	13.319	10.093	-21.113	48.287
	(37.138)	(45.565)	(21.248)	(20.374)	(81.911)
Observations	12731	12848	12601	12437	12948

$^{*}(p < 0.05),^{**}(p < 0.01),^{***}(p < 0.001)$. Block bootstrapped 200 replications

Back	PC	IC
TFP_{t-1}	0.933***	0.930***
	(0.012)	(0.015)
$Down\_off_{t-1}$	0.067***	0.061***
	(0.012)	(0.013)
Up_off_{t-1}	-0.474***	-0.388***
	(0.067)	(0.106)
$Down\_in_{t-1}$	0.561***	0.432*
	(0.180)	(0.247)
Up_in_{t-1}	6.161***	5.464***
	(1.012)	(1.022)
TFP_{t-1}	0.933***	0.930***
	(0.014)	(0.017)
$Down\_off^{CN}_{t-1}$	-0.508	-0.551*
	(0.325)	(0.291)
$Up\_off^{CN}_{t-1}$	4.121***	2.352**
	(0.998)	(0.977)
$Down\_in^{CN}_{t-1}$	-2.581	17.536
	(22.946)	(27.354)
$Up\_in^{CN}_{t-1}$	13.376	14.954
	(37.138)	(46.642)
Observations	12731	12731

$^{*}(p < 0.05),^{**}(p < 0.01),^{***}(p < 0.001)$. Block bootstrapped 200 replications