Managing Export Complexity: the Role of Service Outsourcing

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HOW DO MANUFACTURERS ORGANIZE MARKET ACCESS SERVICES?

- ▶ Expenditure on **service inputs (PBS)** by manufacturing firms is large (forward linkage, export content)

- ▶ Market access/exporting involves **sunk + fixed costs** in terms of such service inputs

  - ▶ Advertising, Legal, Translation, Market Research

  - ▶ Explain multiple salient patterns in int'l trade

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- **Make-or-buy** potentially a key organizational margin
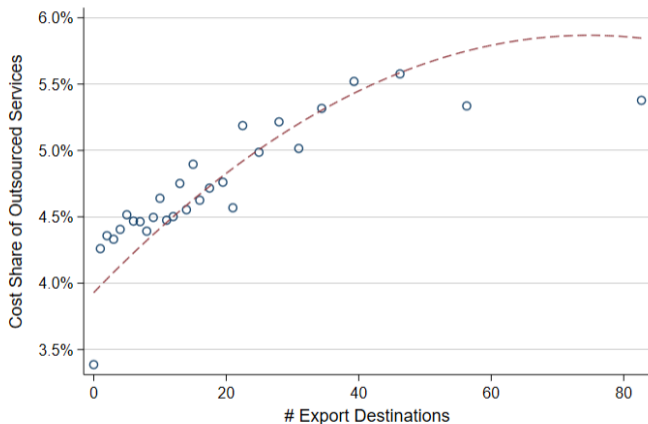
  - Affects size and functional form of sunk + fixed costs

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Main Finding

- Empirical evidence from confidential and detailed French firm-level data 1996-2007

MAIN FINDING

▶ Empirical evidence from confidential and detailed French firm-level data 1996-2007

▶ Novel IV: exogenous foreign demand shocks for firm-level extensive country margin over time
▶ External service spending ↑ by $\approx 750k€$/firm due to market access over sample period

Black box of sunk + fixed costs of exporting

- ▶ Novel **conceptual framework** for empirical guidance
    - ▶ To export, complete destination-specific service tasks (sunk + fixed costs)
        - ▶ Trade-off: managerial strain (internal) vs. ex-post adaptation costs (external)
    - ▶ Main Prediction: Exporting to more countries increases *complexity* and thus PBS outsourcing

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- ▶ **Additional empirical evidence** for the trade-off
  - ▶ Adaptation costs and managerial capability
    - ▶ Novel proxies based on matched employer-employee data and occupation-level task content (O*NET)
    - ▶ *Finding:* Adaptation costly ⇒ more integration; outsourcing ↑ when complexity ↑
    - ▶ *Finding:* High managerial capacity ⇒ more integration; empirically no difference when complexity ↑

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- ▶ **Key Implication:** Sunk + fixed costs path-dependent, sub-linear, depend on managerial capability

Related Literature

- Firm boundaries, globalization and services
    - Re-organization within and across firms in manufacturing
      (e.g., Garicano and Rossi-Hansberg, 2015; Caliendo and Rossi-Hansberg, 2012; Caliendo et al., 2015; Fally and Hillberry, 2018; Caliendo et al., 2020; Ding et al., 2022)
    - Make-or-buy for physical and service inputs
      (see Antràs, 2015; Abraham and Taylor, 1996; Azoulay, 2004; Gil and Ruzzier, 2018; Espinosa, 2021)

  Here: how firms organize provision of PBSs during internationalization

- Sunk + fixed costs of (int'l) market access
    - To explain patterns in the data
      (e.g., Baldwin, 1988; Bernard and Jensen, 2004; Eaton et al., 2004; Chaney, 2014; Bernard and Moxnes, 2018; Alessandria et al., 2021)
    - In structural work
      (e.g., Das et al., 2007; Arkolakis, 2010; Moxnes, 2010; Eaton et al., 2011; Morales et al., 2019; Adão et al., 2020)

  Here: data-consistent micro-foundation for endogeneity and path-dependency

Outline

EMPIRICAL APPROACH
BASELINE SPECIFICATION

▶ The baseline regression is:

$$y_{f(j)t} = \beta_1 N_{ft} + \boldsymbol{X}_{ft}'\vartheta + \gamma_{jt} + \gamma_f + \epsilon_{ft}$$

with level of obs firm f in year t

- ▶ y_{ft}: measure of outsourcing

- ▶ N_{ft}: $log \#$ export destinations

- ▶ $\boldsymbol{X}_{ft}$: employment scale, skill and capital intensity

- ▶ γ_{jt}, γ_f: industry $\times$ year and firm fixed effects

- ▶ clustering at firm level

EMPIRICAL APPROACH
INSTRUMENTAL VARIABLE FOR EXTENSIVE COUNTRY MARGIN

- ▶ Despite demanding set of FEs and controls: concerns about OVB and measurement error

- ▶ IV strategy based on plausibly exogenous demand shocks ("shift-share-style"):

$$IV\_N_{ft} = \max \left\{ \max_{p \in P_{ft_0}} \left\{ N_{fpt_0} + \Delta_{t_0} N_{pt}^{ROW \to EEU} \right\}, 1 \right\}.$$

  - ▶ P_{ft_0}, N_{fpt_0}: initial set of products, initial set of product-destinations
  - ▶ $\Delta_{t_0} N_{pt}^{ROW \to EEU}$: change in # of exporter countries to new Eastern European EU member states
    - ▶ exogenous demand shocks

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    ▶ exogenous demand shocks

▶ Comprehensive robustness: exclusion restriction and quasi-random assignment, demand shocks used, and functional form

EMPIRICAL APPROACH
DATA

- Firm-level data from France for the period 1996-2007

  1. **Panel (EAE)**: *balance sheet data* for firms > 20 employees

     - Outsourced expenditure on advertising, market research, IT services and software
       (French accounting code)

  2. **Cross-Section (ERSI, 2005)**: *survey data* for firms > 20 employees (all firms > 250 employees)

     - Outsourcing indicators for > 30 detailed services at firm level

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    3. **Trade data** from the French Customs

        - ▶ # export destinations

    4. **Matched employer-employee data (DADS)**

        - ▶ Combine with O*NET to construct proxies for adaptation costs and managerial capability

- ▶ Summary Statistics ▶ Details

MAIN RESULT: OLS
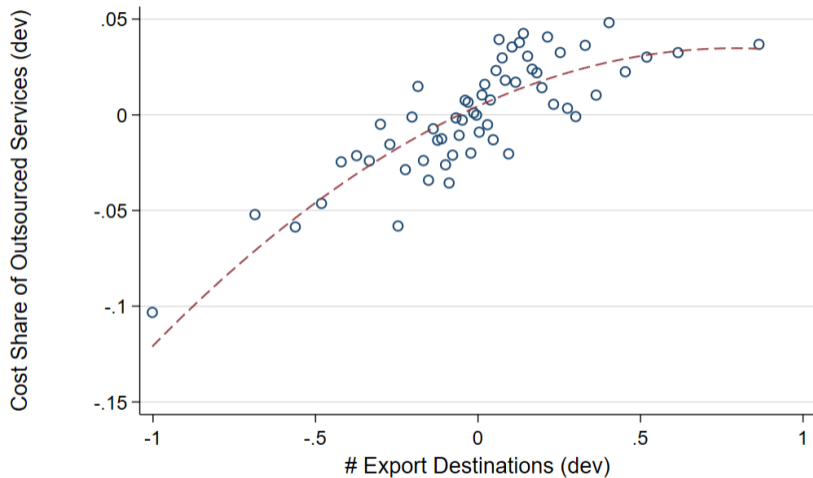
Note: variables de-meaned by firm, industry-year, employment, capital intensity, skill intensity.

Main Results

		Outcome: Cost Share of Outsourced Services				
	(1)	(2)	(3)	(4)	(5)	(6)
N	0.197***	0.197***	0.092***	0.083***	0.082***	0.282***
	(0.009)	(0.009)	(0.010)	(0.010)	(0.011)	(0.091)
Observations	175,564	175,564	175,564	175,564	169,137	169,137
Number of firms	25,665	25,665	25,665	25,665	24,490	24,490
R-Square	0.126	0.131	0.746	0.746	0.746	0.745
Controls				Yes	Yes	Yes
KP-Stat						239.1
IV Type						NewEU-Imp exFRA
Firm FE			Yes	Yes	Yes	Yes
Year FE	Yes					
Industry FE	Yes					
Ind#Year FE		Yes	Yes	Yes	Yes	Yes

▶ IV: $N \uparrow$ explains 45% of total PBS outsourcing $\uparrow$ (OLS: 13 %)

▶ Up to +750k € external spending on PBS due to int'l market access; $\approx$ 2.6 workers per year

Mechanisms and Robustness

▶ Pure scale or overall complexity effect?

  ▶ Scale control and firm-level trends `▶ Details`

  ▶ Extra controls: intensive margin of exporting, import side `▶ Details`

  ▶ Placebos: employment sub-contracting, industrial outsourcing, administrative activities `▶ Details`

▶ Internal production of services?

  ▶ Servitization and general trend towards services `▶ Details`

  ▶ Exclude service provision inside business group `▶ Details`

▶ Specification and Sample `▶ Details`

▶ IV robustness `▶ Details`

SERVICE INPUTS AND THE NATURE OF TASKS
## ALTERNATIVE MEASURES OF COMPLEXITY

	(1)	(2)	(3)	(4)
N	0.101***	0.091***	0.092***	0.093***
	(0.013)	(0.013)	(0.020)	(0.032)
N × N		-0.047***	-0.067**	-0.118**
		(0.014)	(0.029)	(0.053)
Num Languages			-0.001	
			(0.016)	
N × Num Languages			0.028	
			(0.038)	
N (Complexity)				-0.001
				(0.029)
N × N (Complexity)				0.072
				(0.052)
Observations	175,544	175,544	175,544	175,544
Number of firms	25,663	25,663	25,663	25,663
R-Square	0.746	0.746	0.746	0.747
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes

|	(5)	(6)
N	0.074***	0.092***
	(0.014)	(0.017)
N × N	-0.050***	
	(0.019)	
NP	0.029***	
	(0.011)	
N × NP	0.005	
	(0.019)	
Re-entry × N		0.004
		(0.015)
New Entry × N		0.028**
		(0.014)
New&Re-entry × N		0.038**
		(0.017)
Observations	175,544	147,444
Number of firms	25,663	22,283
R-Square	0.747	0.764
Controls	Yes	Yes
Firm FE	Yes	Yes
Ind#Year FE	Yes	Yes

Service Inputs and the Nature of Tasks

Evidence from Detailed Services (ERSI)
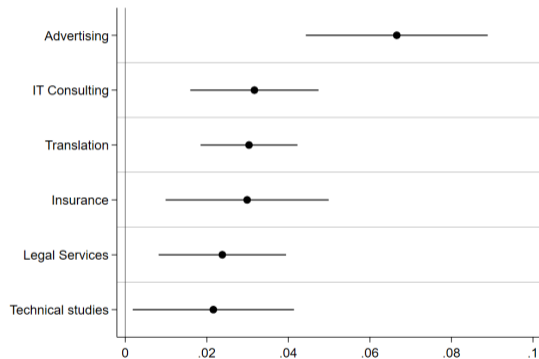
(A) Market Access Services   (B) Placebo Services
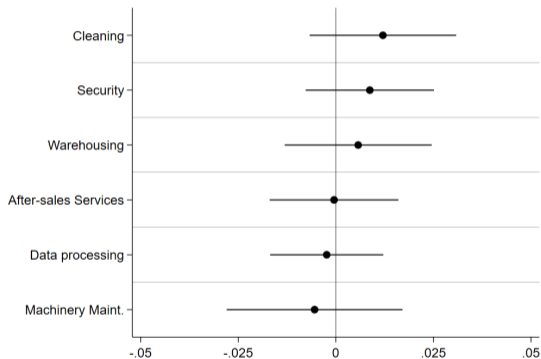
$$\mathbb{1}(outsourced)_{f(j)} = \beta_1 N_f + \boldsymbol{X'_f}\boldsymbol{\vartheta} + \gamma_j + \epsilon_f$$

Outline

▶ Exporting requires one worker per destination-specific task: sunk/fixed cost

  ▶ External agency:

  Worker takes decisions $\rightarrow$ coordination/under-investment problematic $\rightarrow$ **costly ex-post adaption**

  ▶ Employment:

  Actions dictated by manager $\rightarrow$ coordination/investment works well $\rightarrow$ but **high managerial strain**

  ▶ managerial costs to communicate with and monitor employees

  ▶ bounded rationality of manager leads to "convexity in complexity"
    (micro-foundation based on Crémer et al. (2007) in the paper)

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        - bounded rationality of manager leads to "convexity in complexity"
          (micro-foundation based on Crémer et al. (2007) in the paper)

- **Internationalization** as a driver of complexity

- TCE view of the firm with diminishing returns to management

Conceptual Framework

Proposition (1)

Let $\mathcal{O} \equiv (N - t^*)/N$ be the share of outsourced service tasks; then

$$\frac{\partial}{\partial N}\mathcal{O} > 0 \quad and \quad \frac{\partial^2}{(\partial N)^2}\mathcal{O} < 0$$

▶ As N/complexity ↑, managerial strain ↑ more than adaptation costs
▶ Concavity due to a) mechanical effect, b) endogenous response due to time-saving effect of outsourcing

Corollary (Fixed Costs of Exporting)

The sunk and fixed costs of exporting
▶ *increase in N, but less than proportionally due to reorganization*
▶ *are path-dependent*

Conceptual Framework

Proposition (2)

For the share of outsourced service tasks $\mathcal{O}$:

$$\frac{\partial}{\partial\delta}\mathcal{O} < 0 \quad \text{and} \quad \frac{\partial^2}{\partial N\partial\delta}\mathcal{O} > 0,$$

where δ is the need for and cost of adaptation.

CONCEPTUAL FRAMEWORK

PROPOSITION (2)

For the share of outsourced service tasks $\mathcal{O}$:

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where δ is the need for and cost of adaptation.

PROPOSITION (3)

For the share of outsourced service tasks $\mathcal{O}$:

$$\frac{\partial}{\partial K}\mathcal{O} < 0 \quad \text{and} \quad \frac{\partial^2}{\partial N \partial K}\mathcal{O} > 0,$$

where K is managerial capability.

Implication: sunk and fixed costs of exporting not independent firm's core productivity

▶ Empirical implementation with additional assumptions on technology and demand

    ▶ **Predictions robust for outsourcing cost shares (vs. task shares)** `▶ Details`

    ▶ Further testable implications wrt. variable costs and demand elasticities `▶ Details`

    ▶ Endogenous decisions regarding N `▶ Details`

    ▶ **Consistent with IV strategy based on foreign demand shocks**

▶ Coordinating workers' actions to a common one `▶ Details`

▶ Employment contracts rather than fiat within the firm `▶ Details`

Outline

EMPIRICAL IMPLEMENTATION

▶ Adaptation costs of the **upstream service**

  ▶ Non-routine task share of workers employed in each service industry (Costinot et al., 2011)

  ▶ Labor cost share dispersion among upstream service providers

  ▶ Inverse elasticity of service demand (Gervais and Jensen, 2019)

▶ Managerial capability of the **downstream manufacturing firm**

  ▶ Employment share weighted task-intensity at the firm level from O*NET

  ▶ Tasks: monitoring, coordinating, communicating

▶ In-progress **quantitative exercises** ▶

ADAPTATION COSTS

	All Services						Market Access Services		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Serv. NonRoutiness	-0.152*** (0.051)								
Serv. Dispersion		-0.072*** (0.006)							
Serv. Inv Elasticity			-0.112*** (0.013)						
N × Serv. NonRoutiness				0.008 (0.010)			0.043*** (0.013)		
N × Serv. Dispersion					0.001 (0.001)			0.004** (0.002)	
N × Serv. Inv Elasticity						-0.004 (0.003)			0.003 (0.004)
Observations	126,482	126,482	110,673	126,482	126,482	110,673	59,283	59,283	51,375
Number of firms	3,959	3,959	3,959	3,959	3,959	3,959	3,959	3,959	3,959
R-Square	0.105	0.146	0.124	0.438	0.438	0.438	0.434	0.434	0.423
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Service Cat FE				Yes	Yes	Yes	Yes	Yes	Yes

$$\mathbb{1}(outsourced)_{f(j)s} = \beta_1 Adapt_s + \beta_2 N_f \times Adapt_s + \gamma_f \, (+\gamma_s) + \epsilon_{fs}$$

Managerial Capability

	Outcome: Cost Share of Outsourced Services								
	(1) Full	(2) Full	(3) Full	(4) VarCosts	(5) VarCosts	(6) VarCosts	(7) Diff	(8) Diff	(9) Diff
N	0.083*** (0.010)	0.082*** (0.010)	0.083*** (0.010)	0.107*** (0.020)	0.107*** (0.020)	0.106*** (0.020)	0.071*** (0.013)	0.071*** (0.013)	0.071*** (0.013)
Monitoring	-0.013* (0.007)			-0.028** (0.013)			-0.011 (0.011)		
Coordination		-0.024*** (0.009)			-0.045*** (0.015)			-0.006 (0.013)	
Communication			-0.019*** (0.007)			-0.031** (0.012)			-0.000 (0.009)
N × Monitoring	-0.016 (0.017)			-0.028 (0.037)			0.003 (0.026)		
N × Coordination		-0.005 (0.020)			-0.008 (0.045)			0.006 (0.029)	
N × Communication			0.008 (0.019)			0.004 (0.042)			-0.005 (0.026)
Observations	175,544	175,544	175,544	85,320	85,320	85,320	85,583	85,583	85,583
Number of firms	25,661	25,661	25,661	13,662	13,662	13,662	15,868	15,868	15,868
R-Square	0.746	0.747	0.747	0.780	0.780	0.780	0.734	0.734	0.734
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Outline

Concluding Discussion

- How do manufacturers organize the provision of market access related services?

    - Conceptual model: Outsource to save on managerial inputs, even if ex post adaption costs ↑

    - Confirmed in French firm-level data using

        - a novel instrumental variable for extensive country margin

        - information for detailed services

- Broader Implications of our findings

    - sunk + fixed export costs are path-dependent, firm-specific, not independent of core productivity

    - novel link between globalization and inequality (e.g., Bilal and Lhuillier, 2021)

    - novel link between globalization and structural change (e.g., Ding et al., 2022)

	1996						2007					
	mean	sd	p25	p50	p75	obs	mean	sd	p25	p50	p75	obs
PBS outsourcing sh	0.045	0.072	0.0040	0.015	0.051	16,521	0.050	0.080	0.0037	0.016	0.063	14,102
PBS outsourcing (k€)	1615.2	14505.0	21.0	98.5	436.8	16,522	3285.7	47352.8	34	176	798	14,102
PBS outsourcing rel to wage bill	0.17	0.33	0.014	0.053	0.17	16,327	0.21	0.35	0.015	0.065	0.23	13,887
Firm average wage (k€)	22.7	8.19	18.0	21.3	25.5	17,993	30.1	10.8	24.2	28.1	33.5	15,579
# export destinations (N)	11.8	15.4	2	6	15	18,033	14.1	17.3	3	7	19	15,692
Export intensive margin (k€)	327.7	1381.6	19.9	67.0	217.8	18,033	620.8	4404.5	33.0	112.6	360.4	15,692
# import origins	5.33	5.42	1	4	8	18,033	7.14	6.88	2	6	10	15,692
Import intensive margin (k€)	488.5	2358.0	36.2	110.3	332.6	14,797	823.1	5371.4	71.5	203.6	574.7	13,347
# products (NP)	13.4	24.8	2	6	14	18,033	15.2	29.4	2	6	16	15,692
# exp. dest., complexity-weighted	15.7	17.8	3.46	9.00	21.5	18,033	18.2	20.1	3.69	10.7	25.6	15,692
# languages	8.20	7.18	3	6	11	18,033	9.87	8.64	4	7	13	15,692
Employment	153.6	786.5	30	47	109	18,026	158.7	862.3	31	49	119	15,670
Skill intensity	0.62	2.50	0.17	0.30	0.54	16,984	1.22	17.0	0.24	0.41	0.77	15,297
Capital intensity	81.9	2125.0	16.8	32.5	59.3	17,996	111.8	1874.0	23.0	47.7	93.4	15,582
# hierarchical layers	4.33	0.78	4	4	5	17,047	4.26	0.73	4	4	5	15,408
Professional share (CS3)	0.080	0.099	0.026	0.054	0.098	17,047	0.13	0.14	0.047	0.087	0.15	15,408
Employment outsourcing sh	0.018	0.027	0.0029	0.0090	0.023	11,189	0.025	0.030	0.0062	0.016	0.034	11,456
Industrial outsourcing sh	0.088	0.11	0.014	0.047	0.12	12,728	0.087	0.11	0.014	0.048	0.12	11,086
Administrative task outsourcing sh	0.045	0.076	0.0025	0.013	0.050	8,639	0.037	0.063	0.0025	0.011	0.043	8,057
Variable costs ratio	4.17	1.84	2.99	4.20	5.38	18,033	4.67	1.87	3.50	4.72	5.89	15,692
Differentiation of exp. products	0.76	0.39	0.62	1.00	1	18,033	0.74	0.40	0.47	1.00	1	15,692
Monitoring capability	33.0	1.31	32.3	32.8	33.4	17,047	33.0	1.15	32.3	32.8	33.4	15,408
Coordination capability	56.4	0.95	56.0	56.4	56.8	17,047	56.6	0.92	56.1	56.6	57.0	15,408
Communication capability	68.2	1.11	67.9	68.5	68.9	17,047	68.6	1.01	68.2	68.8	69.2	15,408

The table shows summary statistics for the full sample of exporting manufacturing firms in the EAE in 1996 and 2007.

	mean	sd	p25	p50	p75	obs
Panel A. Variables in ERSI (2005 only)						
Service out. indicator	0.51	0.16	0.41	0.52	0.62	4,033
MA Service out. indicator	0.55	0.20	0.40	0.53	0.67	4,033
# export destinations (N)	20.9	22.2	5	13	30	4,033
Employment	370.9	1757.1	56	138	329	4,029
Skill intensity	1.51	4.99	0.29	0.49	1	3,976
Capital intensity	173.9	3476.7	25.7	53.1	102.2	4,023
Panel B. Service Characteristics (2005 only)						
Service Routiness	32.1	6.18	28.3	33.0	35.0	32
Service HHI DADS	0.038	0.081	0.0040	0.013	0.037	32
Service Elasticity	3.13	4.05	1.75	2.19	2.88	28

The table shows summary statistics for the full sample of exporting manufacturing firms in the ERSI survey in 2005. *Service out. indicator* reports the summary statistics for the firm-level average probability of outsourcing across all service types. *MA Service out. indicator* reports the statistics restricted to 'market access' services only, i.e., characterized by an above median elasticity with respect to the (log) number of export destinations.

	(1) Base	(2) Out	(3) Out	(4) Out	(5) Out	(6) Empl	(7) Ind-Cap	(8) Ind-Spec	(9) Admin	(10) VarCosts	(11) Diff
N	0.083*** (0.010)	0.083*** (0.010)	0.086*** (0.012)	0.053*** (0.011)	0.083*** (0.010)	0.003 (0.009)	0.000 (0.000)	0.000 (0.001)	0.009 (0.015)	0.108*** (0.020)	0.071*** (0.013)
Exp Intensive Margin		0.001 (0.005)	-0.000 (0.005)			0.012*** (0.004)	0.001*** (0.000)	0.001*** (0.000)			
N Imp			0.010 (0.011)								
Imp Intensive Margin			0.003 (0.005)								
L.N				0.020* (0.011)							
F.N				0.054*** (0.011)							
Num. Layers					-0.000 (0.007)						
Professional Share (CS3)					0.057 (0.084)						
Observations	175,564	175,564	149,636	120,502	175,544	142,006	76,066	76,066	91,523	85,332	85,596
Number of firms	25,665	25,665	22,035	19,102	25,661	22,034	16,027	16,027	15,566	13,666	15,872
R-Square	0.746	0.746	0.753	0.777	0.746	0.681	0.682	0.811	0.735	0.780	0.734
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SERVITIZATION · BACK

<div align="center">TABLE: Controlling for Internal Service Production</div>

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
N	0.083***	0.078***	0.083***	0.078***	0.083***	0.083***	0.083***	0.083***
	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)
Num. Layers	-0.001	0.001	-0.001	0.001	-0.001	-0.000	-0.000	-0.000
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
HQ Share (Rev)	-0.065							-0.065
	(0.042)							(0.042)
HQ Share (Empl)		-0.012						
		(0.048)						
PBS Share (Rev)			-0.068					
			(0.355)					
PBS Share (Empl)				-0.206				
				(0.417)				
HQ Est. (Salaries)					0.051			
					(0.070)			
HQ Est. (Empl)						0.007		
						(0.075)		
Professional Share (CS3)							0.057	0.065
							(0.084)	(0.083)
Observations	175,337	161,652	175,337	161,652	175,421	175,466	175,544	175,317
Number of firms	25,653	24,958	25,653	24,958	25,649	25,656	25,661	25,649
R-Square	0.747	0.751	0.747	0.751	0.747	0.746	0.746	0.747
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

FURTHER ROBUSTNESS

TABLE: Miscellaneous Robustness Exercises

	(1) Clust Ind	(2) No Frac	(3) Lag Ctrls	(4) Extra Ctrls	(5) Firm trends	(6) Long Diff	(7) Non-exp	(8) No < Thr	(9) > 20 Empl	(10) No PBS Group	(11) No For Group
N	0.083***	0.080***	0.087***	0.091***	0.040***	0.094***		0.086***	0.083***	0.075***	0.074***
	(0.014)	(0.010)	(0.011)	(0.012)	(0.011)	(0.021)		(0.011)	(0.011)	(0.012)	(0.011)
NC (ihs)							0.086***				
							(0.009)				
Observations	175,564	175,568	152,255	143,390	175,564	33,286	220,082	163,647	169,029	102,826	143,164
Number of firms	25,665	25,666	23,194	21,290	25,665	13,488	32,169	24,356	24,442	18,289	22,767
R-Square	0.746	0.830	0.761	0.751	0.838	0.783	0.746	0.749	0.744	0.759	0.747
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm trends					Yes						

The dependent variable is the (log) share of purchased services in total costs, apart from column (2) where it is the (log) *expenditure* on purchased services. The main regressor N is the (log) number of export destination countries at the firm-year level. Coefficient estimates for the baseline control variables employment, skill intensity, and capital intensity (all in logs) are not shown. The full baseline sample contains all French manufacturing exporters in the EAE during 1996-2007. In column (2), we control for total costs (in logs). In column (3), we lag the baseline controls by one period. In column (4), we include the export intensive margin, the number of origins, the import intensive margin, the number of imported products, and a measure of contract intensity of as additional control variables (all in logs). In column (5), we add firm-level time trends. In column (6), we estimate a long difference specification with 1996 and 2007. In column (7), we add non-exporters to the baseline sample and use the inverse hyperbolic sine transformation. In column (8), we eliminate exporters who trade volumes below the full reporting threshold (for which we do not have product-level information). In column (9), we use only firms with more than 20 employees, where the EAE is a census. In column (10), we exclude firms that belong to business groups that include: i) firms operating in the PBS industries that produce the services considered in our analysis (correspondence available upon request); ii) firms in the industry 'Management activities of holding companies' (741J in the NAF Rev. 1 classification), i.e., the headquarters that may provide these services. In column (11), we exclude firms that belong to foreign business groups. Numbers of observations differ across columns due to sample restrictions and data availability. Standard errors in parentheses are clustered at the 3 digit industry level in column (1), and at the firm level in all other exercises. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

TABLE: IV Robustness

	(1) Base	(2) Exp Ctrl	(3) Imp Ctrl	(4) Excl EU15	(5) Base L5	(6) BRICS Imp	(7) China Imp	(8) Avw	(9) NoLev1 max	(10) Base Pos
N	0.282*** (0.091)	0.290*** (0.094)	0.245** (0.111)	0.273*** (0.090)		0.264** (0.131)	0.349*** (0.106)	0.255*** (0.094)	0.450* (0.239)	0.323*** (0.085)
Exp Intensive Margin		-0.011* (0.006)	-0.008 (0.007)							
N Imp			-0.016 (0.018)							
Imp Intensive Margin			-0.001 (0.006)							
IV (N)					0.009 (0.020)					
Observations	169,137	169,137	146,078	169,137	62,828	169,177	168,693	169,137	169,137	169,137
Number of firms	24,490	24,490	21,353	24,490	12,890	24,491	24,442	24,490	24,490	24,490
R-Square	0.745	0.745	0.752	0.745	0.788	0.745	0.743	0.745	0.741	0.744
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KP-Stat	239.1	249.3	311.8	238.7		134.0	143.7	267.4	61.9	218.5
IV Type	NewEU-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exEU15		BRICS-Imp exFRA	China-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exFRA
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the (log) share of purchased services in total costs. The main regressor N is the (log) number of export destination countries at the firm-year-level. Exp Intensive Margin is the (log) average sales across destinations; N Imp is the (log) number of import origin countries; Imp Intensive Margin is the (log) average imported value across origins. Coefficient estimates for the baseline control variables employment, skill intensity, and capital intensity (all in logs) are not shown. The full baseline sample contains all French manufacturing exporters in the EAE during 1996-2007. Column (1) reports the baseline for comparison. In column (2), we include a firm's export intensive margin, and in column (3) the number of origin countries for imports, and import intensive margin as further controls. In column (4), we exclude all EU 15 countries in the computation of the shock variable. In column (5), we regress the 5-year lagged outsourcing share on the baseline instrumental variable. In column (6), we use the baseline instrument based on the BRICS economies. In column (7), we use the baseline instrument based on China. In column (8), we use the trade volume-weighted mean as a measure of exposure in the instrument. In column (9), we replace the initial number of destination countries, $NC_{ifp_{0}}$, by 1 for all firms in the computation of the instrument. In column (10), instead of truncating our instrument whenever the predicted shock drops below one, we rely on only positive shocks for estimation, i.e., $\Delta N'_{pt} = \Delta N_{pt}$ if $\Delta N_{pt} > 0$ and $\Delta N'_{pt} = 0$ otherwise. Numbers of observations differ across columns due to data availability. Standard errors in parentheses are clustered by 3 digit industry.

CONCEPTUAL FRAMEWORK ▸ BACK

SERVICE PROVISION

▶ Workers maximize:

$$\pi^s(i) = P(i) - (a(i) - \theta(i))^2 - f$$

▶ $P(i)$: compensation based on contract ▸ Optimal Contracts

▶ $\theta(i)$: input condition:

  ▶ the "best" way for the worker to produce input i
  ▶ drawn i.i.d. from known distribution with mean $\hat{\theta}_i$ and variance σ^2;

▶ $a(i)$: action to be taken by worker

  ▶ specified by employer under internal provision, $a^v(i)$
  ▶ free under outsourcing, $a^o(i)$

▶ f: training costs

▶ Labour market is competitive: $E[\pi^s(i)] = 0$.

CONCEPTUAL FRAMEWORK

TECHNOLOGY

▶ Total fixed costs of exporting to N countries (for now exogenous) are

$$F(N) = \int_0^N P(i)di + \underbrace{\delta \int_0^N (a(i) - \hat{\theta}^c)^2 di}_{\text{adaptation costs}} + \underbrace{\frac{t^3}{NK}}_{\text{managerial costs}}$$

where $\hat{\theta}^c$ is a firm's ideal action and $\delta > 0$ scales adaptation costs

Conceptual Framework
Technology

▶ Total fixed costs of exporting to N countries (for now exogenous) are

$$F(N) = \int_0^N P(i)di + \underbrace{\delta \int_0^N (a(i) - \hat{\theta}^c)^2 di}_{\text{adaptation costs}} + \underbrace{\frac{t^3}{NK}}_{\text{managerial costs}}$$

where $\hat{\theta}^c$ is a firm's ideal action and $\delta > 0$ scales adaptation costs

▶ Adapt service inputs if not in line with firm's characteristics/strategy (Dessein and Santos, 2006)

▶ Managers *boundedly rational* (micro-foundation in the paper, Crémer et al. (2007))

  ▶ coordinating employees t is costly due to communication and monitoring

  ▶ costs fall in managerial capability K

  ▶ outsourcing frees up precious time and bandwidth for the manager (e.g., Aghion and Tirole, 1995)
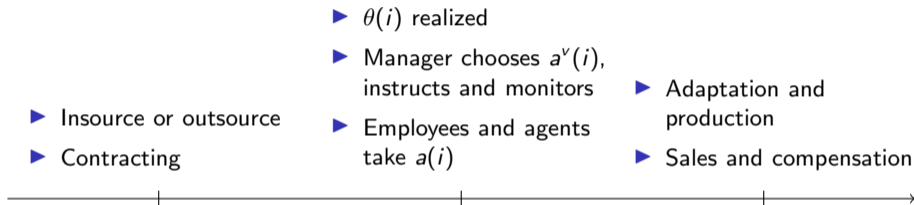
Conceptual Framework

- $\theta(i)$ realized
- Manager chooses $a^v(i)$, instructs and monitors
- Adaptation and production
- Insource or outsource
- Employees and agents take $a(i)$
- Sales and compensation
- Contracting

Figure: Timing of the Model

▸ Detailed Solution

OPTIMAL CONTRACTS

▶ Employment contract:
$$P(a(i)) = (a^v(i) - \theta(i))^2$$
where $a^v(i)$ is an action specified by the manager.

▶ Outsourcing t external agent
$$P(a(i)) = P(i) = 0$$

▶ Idea of proof (normalizing training costs f to zero)

  ▶ agent's and employee's PCs are satisfied with equality → workers indifferent and firm has no profitable downwards deviation

  ▶ external agent's action not verifiable → no profitable deviation for the firm to a non-fixed-price contract

  ▶ compensation beyond the employee's inconvenience costs does not alter the employee's action → no profitable deviation for the firm either

SOLUTION I (▸ BACK)

Optimal actions

▶ Outsourcing: less communication and monitoring, but worse coordination

$$a^o(i) = \theta(i)$$

▶ Employment: requires more management, but coordinates optimally

$$\min_{\{a^v(i)\}} \int_0^t (a^v(i) - \theta(i))^2 di + \delta \int_0^t (a^v(i) - \hat{\theta}^c)^2 di + E\left[\delta \int_t^N (a^o(j) - \hat{\theta}^c)^2 dj\right]$$

$$a^{v*}(\theta(i), \hat{\theta}^c) = \frac{1}{1+\delta}\theta(i) + \frac{\delta}{1+\delta}\hat{\theta}^c$$

▶ The expected costs at time 0 are:

$$E[F] = \left[\frac{\delta}{1+\delta}t + \delta(N-t)\right](\sigma^2 + r^2) + \frac{t^3}{NK}$$

▶ In case of no monitoring costs: efficient outcome is producing everything in-house ($t^* = N$)

▶ Monitoring costs $\implies$ trade-off between outsourcing and integration

SOLUTION III ▸ Back

SMALL: Optimal share of inputs produced in-house and Cost Function

▶ the optimal measure of inputs internally produced is given by

$$t^* = \delta\sqrt{\frac{KN\psi^2}{3(1+\delta)}} \qquad \text{where: } \psi^2 = \sigma^2 + r^2$$

▶ expected fixed costs are:

$$E[F] = \overbrace{\delta\psi^2\,(N - t^*)}^{F^O} + \overbrace{\frac{3+\delta}{3(1+\delta)}\delta\psi^2 t^*}^{F^I} = \delta N\psi^2 - \frac{2}{3}\frac{\delta^3\psi^3}{(1+\delta)}\sqrt{\frac{KN}{3(1+\delta)}}$$

FURTHER ASSUMPTIONS ON DEMAND AND TECH ▸ BACK

ASSUMPTION (DEMAND AND TECHNOLOGY)

We further specify that

- ▶ *downstream demand in every market is derived from CES preferences/technology with elasticity of substitution $e > 1$*
- ▶ *there are destination specific iceberg trade costs $\tau(i) \geq 1$*
- ▶ *exporters produce with potentially heterogeneous constant marginal costs $1/K > 0$*

- ▶ Total expected profit of a firm that exports to N symmetric countries is:

$$E[\pi] = (1-\rho)R\left(\rho KP\right)^{\frac{\rho}{1-\rho}} \int_0^N \left(\frac{1}{\tau(i)}\right)^{\frac{\rho}{1-\rho}} di - N\delta\psi^2 + \frac{2}{3}\frac{\delta^3\psi^3}{(1+\delta)^{\frac{3}{2}}}K^{\frac{1}{2}}N^{\frac{1}{2}}$$

▶ Total expected costs are

$$\mathbb{E}\left[C^T\right] = \underbrace{\rho R \left(\rho K P\right)^{\frac{\rho}{1-\rho}} \int_0^N \left(\frac{1}{\tau(i)}\right)^{\frac{\rho}{1-\rho}} di}_{\equiv\, C^V} + \underbrace{\delta\psi^2 N - \frac{2}{3}\frac{\delta^2}{1+\delta}\psi^2 t^*}_{\equiv\, F},$$

▶ so that the outsourcing cost share is defined as

$$\mathcal{O}^C = \frac{\delta\psi^2(N - t^*)}{C^V + F} = \frac{F^O}{C^V + F}.$$

PROPOSITION (COST SHARE OF OUTSOURCING AND MARKET ACCESS)

The share of outsourced service expenditures in total costs rises in the number of export destination markets, but at a decreasing rate:

$$\frac{\partial}{\partial N}\mathcal{O}^C > 0 \quad and \quad \frac{\partial^2}{(\partial N)^2}\mathcal{O}^C < 0$$

Proposition (Managerial Capability)

The share of outsourced service expenditures in total costs $\mathcal{O}^C$

1. *falls in the managerial capability of a company (K),*

$$\frac{\partial}{\partial K}\mathcal{O}^C < 0.$$

2. *displays a cross partial derivative with respect to the number of export destination markets and managerial capability that decreases in the share of variable costs in total costs and in the elasticity of demand e:*

$$\frac{\partial^2}{\partial N \partial K}\mathcal{O}^C = f\left(\underbrace{\frac{C^V}{C^V + F}}_{-}, \underbrace{e}_{-}\right).$$

ADDITIONAL PREDICTIONS

▶ Total expected costs are

$$\mathbb{E}\left[C^T\right] = \underbrace{\rho R \left(\rho KP\right)^{\frac{\rho}{1-\rho}} \int_0^N \left(\frac{1}{\tau(i)}\right)^{\frac{\rho}{1-\rho}} di}_{\equiv\, C^V} + \underbrace{\delta\psi^2 N - \frac{2}{3}\frac{\delta^2}{1+\delta}\psi^2 t^*}_{\equiv\, F},$$

▶ so that the outsourcing cost share is defined as

$$\mathcal{O}^C = \frac{\delta\psi^2(N - t^*)}{C^V + F} = \frac{F^O}{C^V + F}.$$

PROPOSITION (MAGNITUDE OF OUTSOURCING ELASTICITIES)

The magnitude of the elasticities of the share of outsourced service expenditures in total costs with respect to the number of destination countries and managerial capability increases in the share of variable costs in total costs and in the elasticity of demand e:

$$\frac{\partial\mathcal{E}_{\mathcal{O}^C,N}}{\partial C^V} > 0, \frac{\partial\mathcal{E}_{\mathcal{O}^C,N}}{\partial e} > 0 \qquad \text{and} \qquad \frac{\partial\mathcal{E}_{\mathcal{O}^C,K}}{\partial C^V} < 0, \frac{\partial\mathcal{E}_{\mathcal{O}^C,K}}{\partial e} < 0$$

▶ Total expected profit of a firm that exports to N symmetric countries is:

$$E[\pi] = (1-\rho)R(\rho KP)^{\frac{\rho}{1-\rho}} \int_0^N \left(\frac{1}{\tau(i)}\right)^{\frac{\rho}{1-\rho}} di - N\delta\psi^2 + \frac{2}{3}\frac{\delta^3\psi^3}{(1+\delta)^{\frac{3}{2}}}K^{\frac{1}{2}}N^{\frac{1}{2}}$$

PROPOSITION (OPTIMAL N AND MANAGERIAL CAPABILITY)

A firm with a more capable manager exports to a higher number of destination markets.

$$\mathcal{E}_{N^*,K} > 0$$

ADAPTING TO AVERAGE ACTION ► Back

► Discrete task space, $\hat{\theta}(i)^c = 1/N \sum_0^N a(i) \equiv \bar{a}$

► Manager solves

$$\min_{\{a^v(i)\}} \sum_{i \in T} (a^v(i) - \theta(i))^2 + \delta \sum_{i \in T} (a^v(i) - \bar{a})^2 + \delta \sum_{j \notin T} (a^o(j) - \bar{a})^2$$

► Using Sherman-Morrison formula and exploiting i.i.d. input conditions

$$E[F] = \left[\frac{N + \delta(N - t) - 1}{N + \delta(N - t)} \frac{\delta}{1 + \delta} t + \frac{N + \delta(N - t) - (1 + \delta)}{N + \delta(N - t)} \delta(N - t) \right] \sigma^2 + M(t, N, K)$$

► Note:

  ► Externalities across tasks internalized under employment
  ► Shown to converge to continuous function above as $N \to \infty$

▶ Contract offered to employee strikes balance b/n minimizing adaptation and input costs

Conjecture (Optimal Contracts Without Fiat)

The prevailing contract with every

▶ *external agent is*

$$P(a(i)) = P(i) = 0.$$

▶ *employee is*

$$P(a(i)) = \Delta(\omega^*) + \omega^* \left\{ [a(i) - \theta(i)]^2 - \left[a(i) - \hat{\theta}(i)^c \right]^2 \right\},$$

where $\omega^* = \delta/(1+\delta)$ and $\Delta(\omega^*) = \omega(1-\omega) \left[\hat{\theta}(i)^c - \theta(i) \right]^2$.

OVERVIEW QUANTIFICATION

- ▶ Observable variables (data)
    - ▶ N_{ft}: customs data
    - ▶ $R(i)$ and $P(i)$ ($R(i)/P(i)^{1-\rho}$): total manufacturing absorption (gross production plus imports, minus exports; see Eaton et al. 2004)
    - ▶ $\tau(i)$: foreign import tariffs (WITS), gravity variables (CEPII)
    - ▶ F^O, C^x: expenditure on PBS, different costs from EAE

- ▶ Parameters we have to calibrate
    - ▶ k, a_{min}: Pareto shape and location parameters
    - ▶ e: demand elasticity (may want to use σ here to be consistent with literature)
    - ▶ ψ, δ: need for and cost of adaptation
    - ▶ α, β, γ: parameters for the iso-elastic managerial cost function
    - ▶ (f: fixed learning cost)

- ▶ Question mark: K_{ft}
    - ▶ If observable variable: three proxies in O*NET? # of managers in the company? Weighted by skill and managerial task share?
    - ▶ If calibrated: proportional to productivity φ? Maybe identify separately from φ by looking at export values (driven by φ) and the number of exporters (driven by both)?

Calibration and Moments

▶ Calibrate

  ▶ e: 6 as in Arkolakis (2010)

  ▶ k, a_{min}: 8.25 as in Arkolakis; confirmed by reg log(sales) on rank in sales dist

▶ Decide: K_{ft} is modelled as $\lambda \varphi_{ft}$

▶ Sets of moments for SMM (inspired by EKK 2011 and Chaney 2014)

  ▶ share of firms exporting to 1 countries, to 2 countries, etc.

  ▶ average share of outsourced expenditure in total/labour costs of firms that export to 1 destination, to 2 destinations, etc.

  ▶ put the firms into export value bins according to the 50, 75, and 95 percent quantiles across firms exporting to 1, 2, etc. destinations $\rightarrow$ use the respective shares of such firms as moments

  ▶ do the same for domestic sales