Export Networks and the Incidence of Cross-Border M&A

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Warm Up / Motivation

- M&A as the most important foreign entry mode
  - UNCTAD reports that 80% of FDI flows are cross-border M&As

- Prior literature on cross-border M&A
  - Recent studies describe different theoretical motives for cross-border M&A activity
    - productive capabilities (Nocke & Yeaple, 2007, 2008),
    - market-specific expertise (Head and Ries, 2007),
    - strategic motives (Neary, 2007)

  $\Longrightarrow$ No template model in I.O. or finance literature!

Warm Up / Motivation

- Another important issue from the literature: the "cherries" versus "lemons" debate
  - Some models and evidence suggest acquirers choose Lemons (Lichtenberg and Siegel, 1987; Head and Ries, 2007; Nocke and Yeaple, 2007; Neary, 2007)
  - Others suggest acquirers choose Cherries (Guadalupe et al., 2012)

    $\Longrightarrow$ Why would the assets of a high-performing firm be more valuable under the management of another firm?

$\Longrightarrow$ What motivates foreign firms to acquire domestic targets?

First Contribution

1. A new motivation for cross-border M&A: Export networks
   - Larger export networks are attractive to foreign acquirers as export platforms to proximate market
   - More valuable whenever the targets and the acquirers have different networks.

Second Contribution

2. Resolution to the Cherries versus Lemons stories
   - Firms with high productivity set up large export networks which are valuable to both them and potential acquirers: cherries.
   - When a firm experiences a negative productivity shock, its existing export network is no longer as valuable to the firm as would be to potential acquirers: it's for sale.
   - Foreign firms are less likely to have the same export networks as the domestic target due to different location in a world of transportation costs.
   - Thus, getting export networks for sale is uniquely a motive for cross-border M&A, not domestic M&A

$\Longrightarrow$ **Punchline**: Firms target cherries, but wait for when they are on sale

Third Contribution

3. Derive a dynamic panel binary choice model
   - Predicts which targets are acquired by multinationals across time
   - Empirical model circumvents the *initial conditions problem* as the export entry (sunk) costs are unobserved

   $\Longrightarrow$ Derive an empirical specification that incorporates a measure of previously observed export activity, which is conditional on the unobserved firm-specific sunk costs to export and previous levels of firm productivity

Outline

Motivation

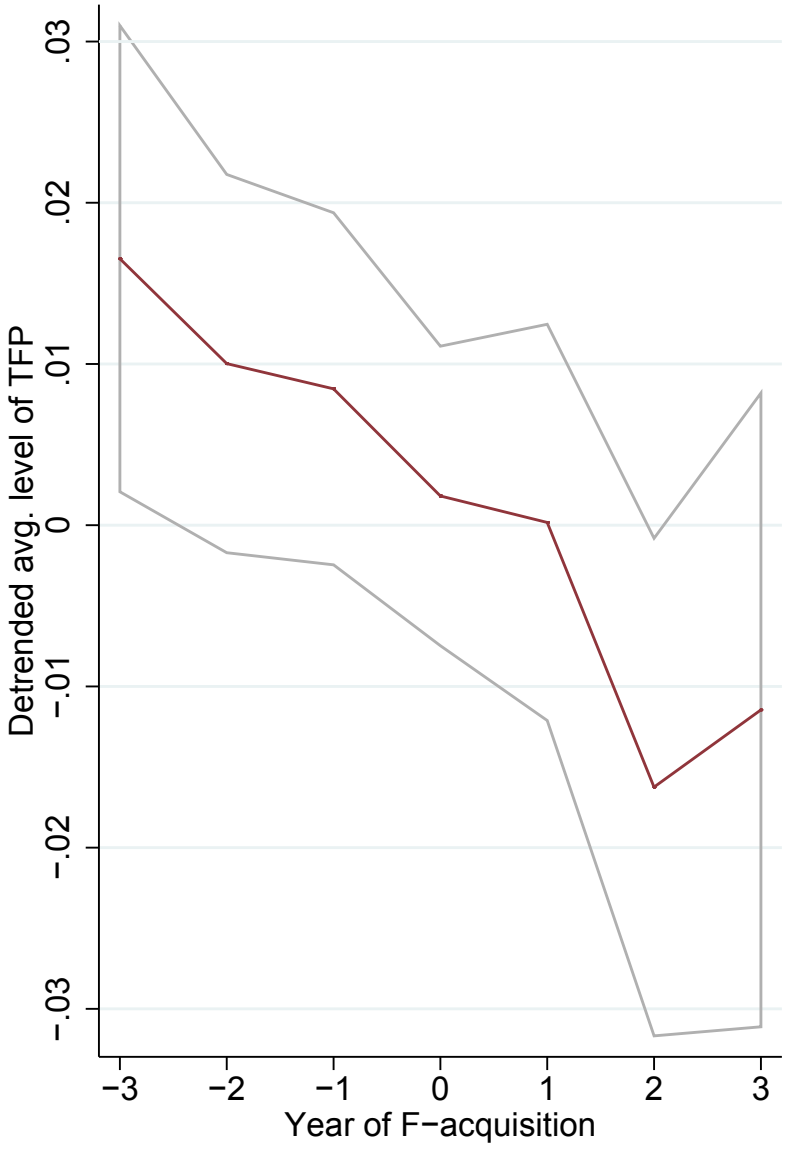
Patterns in the Data

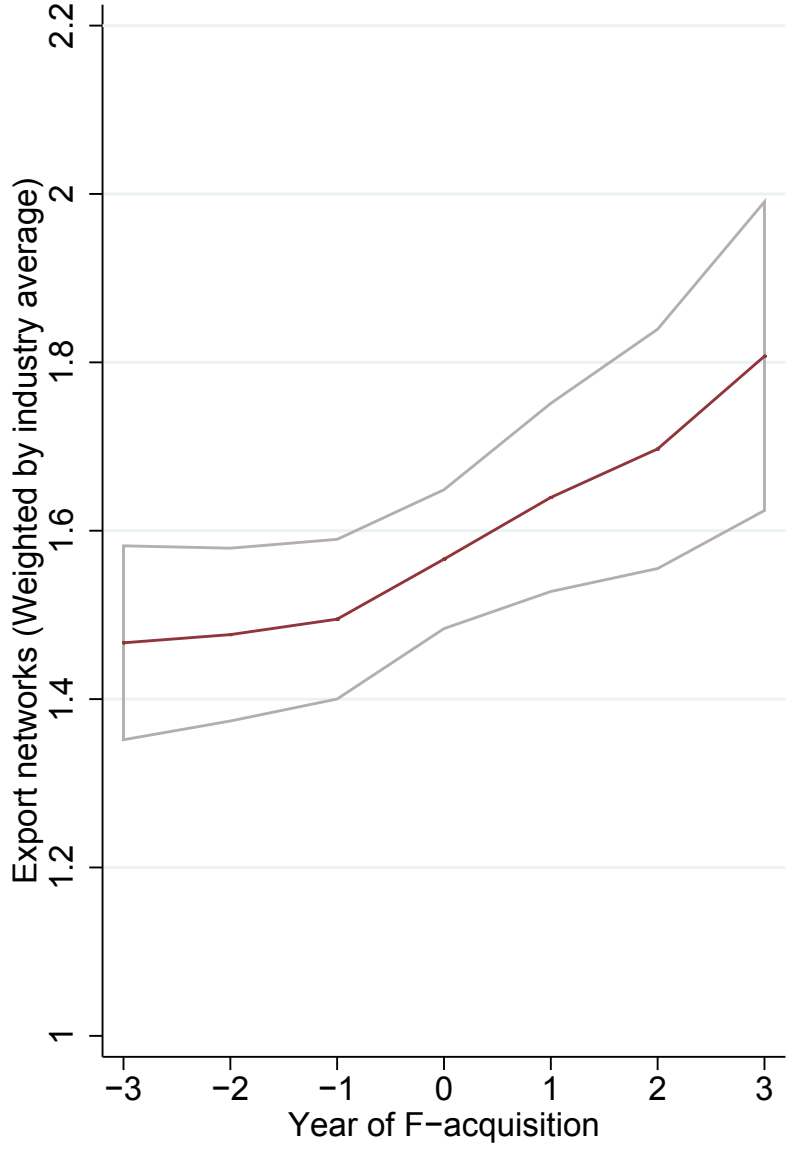
Model

Empirical Strategy

Data & Empirical Results

Target Productivity and Export Networks Margins Across Time





Timing

Period 1: Heterogeneous firms draw a productivity parameter and export cost parameter, and then choose which foreign markets they will serve, given varying destination trade costs they face

Period 2: Each firm realizes a persistent shock to its productivity

Period 3: M&A market clears in each country

Consumption

- World comprised of a mass of countries indexed by $j \in [1, J]$, each populated by consumers with identical preferences

$$U = \ln \left[\int_{l \in B_j} x_j(l)^{(\epsilon-1)/\epsilon} dl \right]^{\frac{\epsilon}{\epsilon-1}}, \quad \epsilon > 1, \tag{1}$$

- B_j is the set of products available for consumption in country j. Letting E_j denote the expenditure (or income) level of country j, its demand for product l is derived as

$$x_j(l) = \frac{p_j(l)^{-\epsilon} E_j}{P_j^{1-\epsilon}}, \tag{2}$$

Production

- Each country has a mass M_j of risk-neutral firms, each producing a unique variety in a monopolistically-competitive sector

- Unit cost of production of a firm in country j is $c_j a$,
  - a is a firm-specific measure of the number of bundles of the country's inputs required during production,
  - c_j is a country-specific measure of the cost of this bundle

- Each firm gets a random draw of their a parameter from cumulative distribution function $G_a(a)$, with support $[a_L, a_H]$: firm productivity is the inverse of a

Stage 1: Establishing Export Networks

- Start with a similar set-up as Helpman *et al.* (2008)
- In order for country j to sell its product in country i≠j, it must incur
  1. Iceberg transportation costs, τ_{ij}
  2. One-time sunk costs are defined as $bc_j f_{ij}$
     - c_j is a country-specific measure of the cost of inputs
     - f_{ij} is the domestic inputs used for the fixed costs to export to country i
     - b is a firm-specific parameter. It is drawn from distribution $G_b(b)$ with support $[b_L, b_H]$ and accounts for differences in firms abilities to establish export networks

Stage 1: Establishing Export Networks

- For each country j, we order the set of potential export destinations in terms of their relative trade costs, $c_j^{\epsilon} f_{ij} \tau_{ij}^{\epsilon-1}$, and denote this set as $\mathcal{D}_j \subset [1, J]$
- $N_j(a, b) \subset \mathcal{D}_j$: endogenously determined set of destinations that a firm with characteristics (a, b) in country j chooses to serve
- Operating profit a firm in country j receives from its sales of variety l to consumers in country i conditional on its productivity parameter a

$$\pi_{ij}^{l}(a) = \frac{Y_i}{\epsilon} \left(\frac{\tau_{ij} c_j a}{P_i} \right)^{1-\epsilon} \tag{3}$$

Stage 2: Shocks in firm productivity

- Firms experience a persistent (infinitesimal) shock to their productivity of $1/\psi \iff$ productivity parameter is a/ψ
- We assume the productivity shocks are independent of initial productivity and a random walk process following a log-normal distribution
- Total firm profit after productivity shock is

$$V_j(a\psi) = \int_{i \in N_j(a,b)} \pi_{ij}^{I}(a\psi) d(i) \tag{4}$$

Stage 3: M&A

- What happens when a firm acquires another firm?
  - Acquiring firm substitutes its own productivity, a', for the targets $a\psi$

- Denote s_i^{jh}: the source of production that minimizes the transportation cost of serving market $i \in N_j(a,b) \cap N_h(a',b')$
- Denote I: one time fixed-cost of integration
- Denote μ: probability of meeting a potential acquirer in a period

Stage 3: M&A

- We express the total per-period earning profits of the merged firm as

$$Z_{jh}(a', b', a, b) = \int_{N_j(a,b) \cup N_h(a',b')} [\pi^{l}_{is_i^{jh}}(a') + \pi^{m}_{is_i^{jh}}(a')] d(i) \qquad (5)$$

1. **Production relocation gains**: firm can choose new production locations from which to serve each existing destination-variety pair to minimize costs

2. **New market gains**: additional profits that can be earned by selling the target (acquiring) firm's product on the export network of the acquiring (target) firm.

Equilibrium Acquisition Activity

- Let $Q_{jh}(a', b', a, b, \psi)$ be the strike price a firm
- Price of the acquisition is determined non-cooperatively. β is the share of surplus retained by the acquirer.
- Express the probability that a firm in country j at time t will be acquired by a firm in country h as

$$Y_{jht}(a,b) = Pr\Big[\, Z_{jh}(a',b',a,b) - Q_{jh}(a',b',a,b,\psi) - I - V_h(a') > Q_{jh}(a',b',a,b,\psi) - V_j(a\psi) \mid M_h, \mu\Big], \quad (6)$$

- where M_h is the mass of firms in country h
- μ is the probability that the target encounters a potential acquirer during time t

Equilibrium Acquisition Activity

- Define $A_{jh}(b', a, b)$ as the productivity parameter of a firm in country h that it is indifferent between acquiring and not acquiring a target in j with initial parameters (a, b) and given b'

- Let M_W be the mass of firms worldwide, so that the probability that the acquirer that meets a domestic target is from country h is given by $\frac{M_h}{M_W}$

- Then we can derive the probability that a firm in country j at time t will be acquired by a firm in country h as

$$Y_{jht}(a, b) = \mu \frac{M_h}{M_W} \int_{b_L}^{b_H} G_a \left(A_{jh}(b', a, b) \right) dG_b(b'). \tag{7}$$

Analysis of Cross-Border M&A activity

Proposition

Domestic firms that set up relatively large export networks are more likely to be acquired by a foreign multinational firm.

$$\frac{dY_{jht}(a,b)}{db} = \mu \frac{M_h}{M_W} \int_{b_L}^{b_H} g_a\left(A_{jh}(a,b,b')\right) dG_b(b') \frac{dA_{jh}(a,b,b')}{db} < 0$$

- Note that firms endowed with greater values of b set up smaller export networks, all else equal
- Key to signing the partial derivative is that $\frac{dA_{jh}(a,b,b')}{db} < 0$ because greater costs of setting up export networks reduces the mass of potential acquirers

Analysis of Cross-Border M&A activity

Proposition

Firms that realize a persistent negative shock to their productivity level, after their export networks have been established, are more likely to be acquired relative to other targets.

$$\left.\frac{dY_{jht}(a,b)}{da}\right|_{N_j(a,b)} = \mu \frac{M_h}{M_W} \int_{b_L}^{b_H} g_a\left(A_{jh}(a,b,b')\right) dG_b(b') \left.\frac{dA_{jh}(a,b,b')}{da}\right|_{N_j(a,b)} > 0$$

- Increase in a : negative productivity shock
- But taking derivative conditional on initial export networks
  $\implies \left.\frac{dA_{jh}(a,b,b')}{da}\right|_{N_j(a,b)} > 0$ lower productivity increases the mass of potential acquirers

Empirical Strategy

- Outcome variable: probability that a domestic (French) firm (d) in sector (s) is acquired by a foreign firm (h) at time (t) conditional on the domestic firms initial parameters (a, b) and productivity parameter after the shock:

$$Y_{dsht} \equiv Pr\left(Acquisition_{dt} | a_{d,t-1}, a_{d,t-2}, b_d\right)$$

- We specify this conditional probability as having a logistical distribution such that

$$Y_{dsht} = \Lambda(z_{dsht}) + \xi_{dsht} \equiv \frac{exp(z_{dsht})}{1 - exp(z_{dsht})} + \xi_{dsht}$$

- where we define

$$z_{dsht} = \beta_0 - \beta_1 \ln(a_{d,t-2}) - \beta_2 \ln(a_{d,t-1}) + \beta_3 b_d + X_{dsht}\beta$$

Empirical Strategy

1. Note that $-\ln(a_{d,t})$ is simply the observed ln $TFP_{d,t}$ for firm d at time t

$$z_{dsht} = \beta_0 + \beta_1 \ln TFP_{d,t-2} + \beta_2 \ln TFP_{d,t-1} + \beta_3 b_d + X_{dsht}\beta$$

2. The parameter b_d is unobserved and may be correlated with TFP. This cannot be controlled for with unobserved fixed effects in a non-linear model in what is known as *the initial conditions problem* (Arellano and Carrasco, 2003)

$\Longrightarrow$ Our model suggests that a firms number of export networks is determined by its draws of (a, b)

$$\ln ExpNet_{dt-2} = \gamma_0 + \gamma_1 \ln TFP_{dt-2} + \gamma_2 b_d$$

Empirical Strategy

- Using this relationship, we can substitute in for b_d in the z index function:

$$z_{dsht} = \left(\beta_0 - \frac{\beta_3\gamma_0}{\gamma_2}\right) + \left(\beta_1 - \frac{\beta_3\gamma_1}{\gamma_2}\right) \ln TFP_{d,t-2} + \beta_2 \ln TFP_{d,t-1} + \frac{\beta_3}{\gamma_2} \ln ExpNet_{dt-2} + X_{dsht}\beta$$

- Firm-level productivities evolve through time as a random walk $\ln TFP_{dt-1} = \ln TFP_{dt-2} + \ln(1/\psi)_{dt-1}$
- We can substitute this in to get our final z index function:

$$z_{dsht} = \theta_0 + \overbrace{\theta_1}^{+} ExpNet_{d,t-2} + \overbrace{\theta_2}^{-} \Delta \ln TFP_{d,t-1} + \overbrace{\theta_3}^{+} \ln TFP_{d,t-1} + X_{sdht}\Theta$$

Data

- Time span: 1999-2006
- Ownership data from LIFI
- Trade data for export network measures from the French customs
- Balance and income sheet data from the EAE
- Information on intangibles from Benefice Reel Normal
- Skill-ratio from DADS
- Payment Incidents from Banque du France

Results: Logistic Estimation with Sector Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{ExportNetwork})_{t-2}$	0.028***			0.011***	0.008***	0.008***
	(0.002)			(0.002)	(0.002)	(0.003)
$\Delta \ln(\text{TFP})_{t-1}$		-0.001	-0.018***	-0.014***	-0.014***	-0.013*
		(0.005)	(0.005)	(0.005)	(0.005)	(0.007)
$\ln(\text{TFP})_{t-1}$			0.039***	0.032***	0.033***	0.037***
			(0.003)	(0.003)	(0.003)	(0.003)
Share of Intangible_{t-1}					0.025*	0.032*
					(0.013)	(0.016)
Share of Skill_{t-1}					0.107***	0.118***
					(0.015)	(0.018)
Payment Incidents_{t-1}					0.003*	0.006
					(0.002)	(0.005)
Ile de France					-0.017***	-0.017**
					(0.006)	(0.008)
$\Delta \ln(\text{TFP})_{t-2}$						-0.004
						(0.006)
Sector FE	yes	yes	yes	yes	yes	yes
Year Effects	yes	yes	yes	yes	yes	yes
Observations	32,883	32,883	32,883	32,883	32,883	25,063
Pseudo R^2	0.133	0.104	0.158	0.162	0.175	0.175

Robust standard errors clustered at firm-level in parentheses.
***, **, * significantly different from 0 at 1%, 5% and 10% level.

Marginal Effects

1. Export network
   - Standard deviation increase (66%) leads to a 0.54 percentage point increase in the probability of foreign acquisition
   - With a 1.5% likelihood of foreign acquisition in the sample, this translates into about a 36% increase in the foreign acquisition probability

2. Productvity
   - A 10% increase in a firms productivity shock leads to 0.13 percentage point, or a 8.7%, decrease in the probability of foreign acquisition

Results: Logistic Estimation with Firm Fixed Effects

	(1)	(2)	(3)	(4)	(5)
$\ln(\text{Export Network})_{it-2}$	1.097***		1.080***	0.936***	0.732***
	(0.193)		(0.193)	(0.230)	(0.267)
$\Delta \ln(\text{TFP})_{it-1}$		-0.581***	-0.526***	-2.145***	-3.488***
		(0.193)	(0.195)	(0.328)	(0.684)
$\Delta \ln(\text{TFP})_{it-2}$					-2.288***
					(0.503)
Firm Controls	no	no	no	yes	yes
Firm FE	yes	yes	yes	yes	yes
Year Effects	yes	yes	yes	yes	yes
Observations	2,728	2,728	2,728	2,601	1,587
Pseudo R^2	0.029	0.006	0.033	0.218	0.201
No. of Switchers	512	512	512	498	352

Robust standard errors clustered at firm-level in parentheses.
***, **, * significantly different from 0 at 1%, 5% and 10% level, respectively.

Results from Alternative Specifications of Export Networks

	(1)	(2)	(3)	(4)	(5)	(6)
ln(Export Network)$^{CP}_{it-2}$	0.004**	0.004*	0.619***	0.362*		
	(0.002)	(0.002)	(0.166)	(0.198)		
ln(Export Network)$^{C}_{it-2}$					0.011***	0.834***
					(0.004)	(0.292)
ln(Export Network)$^{P}_{it-2}$					-0.004	-0.225
					(0.004)	(0.209)
Δ ln(TFP)$_{it-1}$	-0.014***	-0.014**	-2.154***	-3.545***	-0.014**	-3.501***
	(0.005)	(0.007)	(0.326)	(0.675)	(0.007)	(0.683)
Δ ln(TFP)$_{it-2}$		-0.004		-2.336***	-0.004	-2.321***
		(0.006)		(0.493)	(0.006)	(0.502)
Firm Controls	yes	yes	yes	yes	yes	yes
Sector FE	yes	yes	no	no	yes	no
Firm FE	no	no	yes	yes	no	yes
Year Effects	yes	yes	yes	yes	yes	yes
Observations	32,883	25,063	2,601	1,587	25,063	1,587
Pseudo R^2	0.174	0.174	0.213	0.194	0.175	0.200
No. of Switchers	.	.	498	352	.	352

Robust standard errors clustered at firm-level in parentheses.
***, **, * significantly different from 0 at 1%, 5% and 10% levels, respectively.

Conclusions

- Developed a new model of cross-border M&A activity with a new motive for cross-border M&A, and a potential resolution to the opposing lemons and cherries stories from the literature.
- Foreign multinationals seek targets that
  1. Established large export networks
  2. Suffered recent negative productivity shocks, and are more likely to accept acquisition offers