Graduate Trade (II): ECON 8433

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Fall Semester 2020

Plan

| WEEK	TOPIC
Week 1	Introduction to Structural Gravity Equation
Week 2	Calibration and Estimation
Week 3	Mapping Models to the Data
Week 4	Designing Counterfactual Experiments in General Equilibrium
Week 5	Presentations (I) and Catch-up
Week 6	Heterogeneous Firms (I)
Week 7	Heterogeneous Firms (II)
Week 8	Ricardian Models
Week 9	Multi-Sector Models
Week 10	Global Value Chains
Week 11	Presentations (II) and Catch-up
Week 12	Extensions: Demand Side
Week 13	Extensions: Supply Side
Week 14	Extensions: Migration and Geography
Week 15	Presentations (III) and Catch-up

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Melitz Model

The impact of trade on aggregate industry productivity and intra-industry reallocations

Authors   Marc Melitz

Publication date   2003/11

Journal   Econometrica

Volume   71

Issue   6

Pages   1695-1725

Total citations   Cited by 15490
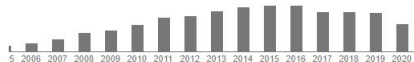
Source: Google Scholar

Melitz Model

The Melitz model has been used to study various questions in trade (and beyond):

- ▶ Variable Mark-ups
- ▶ Consumer Acquisition
- ▶ Income Inequality
- ▶ Trade and Environment
- ▶ Product Quality
- ▶ R&D Investments
- ▶ Financial Constraints

Melitz Model

The Melitz model has been used to study various questions in trade (and beyond):

- ▶ Variable Mark-ups: Melitz and Ottaviano (2008) & Simonovska (2015)
- ▶ Consumer Acquisition: Arkolakis (2008)
- ▶ Income Inequality: Egger and Kreickemeier (2009) & Helpman, Itskhoki and Redding (2010)
- ▶ Trade and Environment: Forslid, Okubo & Sanctuary (2017) & Forslid, Okubo & Ullveit-Moe (2018)
- ▶ Product Quality: Baldwin and Harrigan (2011)
- ▶ R&D Investments: Bustos (2011)
- ▶ Financial Constraints: Manova (2013)

Variable Mark-ups

Simonovska (2015)

- The Melitz model cannot replicate the positive relationship between per-capita income, prices and markups.
- Simonovska (2015) extends the Melitz model to study how levels of income affect firms' pricing decisions.

The main modification of the model is in non-CES preferences. The utility function looks as follows:

$$U_i = \sum_k \int_{\Phi_{ki}} \left(q_{ki}(\phi) + \bar{q} \right) d\phi,$$

where $\bar{q}$ is a constant. This utility function is called Stone-Geary. This leads to the following demand:

$$q_{ki}(\phi) = L_i \left(\frac{y_i + \bar{q} P_i}{N_i p_{ki}(\phi)} - \bar{q} \right),$$

where $N_i = \sum_k N_{ki}$ is the number of total varieties consumed in i and y_i is per-capital income in i.

Simonovska (2015)

Given the demand, firm ϕ maximizes the following profit function:

$$\pi_{ij}(\phi) = L_j \left(\frac{y_j + \bar{q}P_j}{N_j p_{ij}(\phi)} - \bar{q} \right) p_{ij}(\phi) - L_j \left(\frac{y_j + \bar{q}P_j}{N_j p_{ij}(\phi)} - \bar{q} \right) \frac{w_i \tau_{ij}}{\phi}$$

FOCs lead to the following optimal prices:

$$\pi_{ij}(\phi) = \left(\frac{w_i \tau_{ij}}{\phi} \frac{w_j + \bar{q}P_j}{N_j \bar{q}} \right).$$

This can be further rewritten as:

$$p_{ij}(\phi) = \left(\frac{\phi}{\phi_{ij}^*} \right)^{\frac{1}{2}} \frac{w_i \tau_{ij}}{\phi}.$$

Simonovska (2015)

- ▶ Testable predictions of the model are confronted with the data

- ▶ She finds strong link between per-capita income and export prices

- ▶ Variable markups also highlight pro-competitive effects of trade

Consumer Acquisition

Arkolakis (2008)

- ▶ Firms sell to individual consumers rather than markets
- ▶ Marketing costs to reach consumers explain export entry costs
- ▶ "New consumer" margin is important for explaining how small/large firms grow following trade liberalization

The main novelty is the introduction of a marketing technology:

- ▶ Let S denote the number of ads that firms send and L – total number of consumers
- ▶ The terms $n(S)$ is the probability that a consumers sees the at least once given the total number of ads
- ▶ Firms endogenously choose S

Arkolakis (2008)

The number of consumers who see each ad is defined as:

$$L^{1-\alpha} \text{ where } \alpha \in [0,1].$$

The probability that a new ad is seen by a consumer for the first time is:

$$[1 - n(S)]^\beta \text{ where } \beta \in [0, \infty).$$

Hence, the marginal change in the number of reached consumers:

$$n'(S)L = L^{1-\alpha}[1 - n(S)]^\beta$$

Save this differential equation to get:

$$n(S) = 1 - \left(1 - (1 - \beta)\frac{S}{L^\alpha}\right)^{\frac{1}{1-\beta}}.$$

Arkolakis (2008)

Suppose that the labor required to post 1 ad is $1/\psi$. Labor required to reach consumers can be characterized via the following function:

$$f(n, L) = \begin{cases} \dfrac{L^\alpha}{\psi} \dfrac{1 - (1-n)^{1-\beta}}{1 - \beta} & \text{if } \beta \in [0, 1) \bigcup (1, \infty) \\ -\dfrac{L^\alpha}{\psi} \ln(1-n) & \text{if } \beta = 1 \end{cases}.$$

The production function for ads is:

$$S = I_j^\gamma I_i^{1-\gamma}.$$

So that both domestic and foreign labor is used in marketing.

Arkolakis (2008)

Total effective demand in country j for a good produced by firm ϕ:

$$q_{ij}(\phi) = n_{ij}(\phi) L_j y_j \frac{p_{ij}(\phi)^{-\sigma}}{P_j^{1-\sigma}}.$$

Then the profit function is:

$$\pi_{ij}(p, n, \phi) = n_{ij}(\phi) L_j y_j \frac{p_{ij}(\phi)^{1-\sigma}}{P_j^{1-\sigma}} - n_{ij}(\phi) L_j y_j \frac{p_{ij}(\phi)^{-\sigma}}{P_j^{1-\sigma}} \frac{w_i}{\phi} - w_j^{\gamma} w_i^{1-\gamma} \frac{L_j^{\alpha}}{\psi} \frac{1-(1-n)^{1-\beta}}{1-\beta}$$

Income Inequality

Egger and Kreickemeier (2009)

- ▶ In the Melitz model workers are paid the same wages in all firms
- ▶ The data suggests that more productive firms pay higher wages
- ▶ Trade liberalization affects firms and workers in a heterogeneous way

Workers have a preference for fairness as in Akerlof and Yellen (1990). They condition effort on the wage that they are paid relative to "fair" wage $\hat{w}$. The effort is defined as:

$$\varepsilon = \min\left(\frac{w}{\hat{w}}, 1\right).$$

The fair wage consists of two components: firm-internal and market

$$\hat{w}(\phi) = \phi^{\theta}[(1-U)\bar{w}]^{1-\theta},$$

where θ is the fairness parameter.

Egger and Kreickemeier (2009)

In equilibrium, per capita wage income is a constant share ρ of per capital output such that:

$$(1 - U)\bar{w}L = \rho Y.$$

There is positive unemployment in equilibrium and wage are:

$$w(\phi) = \phi^{\theta} \left(\frac{\rho Y}{L} \right)^{1-\theta}.$$

Trade liberalization raises profits, unemployment, and inequality. These three results are driven by the selection effects in production and exporting.

TRADE AND ENVIRONMENT

Forslid, Okubo & Ullveit-Moe (2018)

CO2 emissions per output.

Dependent var: log(CO2emissions/output)					
	(1)	(2)	(3)	(4)	(5)
Export dummy	−0.317***	−0.251***	−0.121***	−0.133***	−0.010
	(0.045)	(0.045)	(0.039)	(0.039)	(0.026)
log(productivity)		−0.162***	−0.418***	−0.416***	−0.222***
		(0.032)	(0.034)	(0.035)	(0.026)
Sector fixed effects (5-digits)			✓	✓	✓
Year fixed effects				✓	✓
Firm fixed effects					✓
Number obs.	27224	27224	27224	27224	27224

Note: Errors are clustered at the firm level. *** significant at the 1% level, ** significant at the 5% level, *significant at the 10% level.

Source: Forslid, Okubo & Ullveit-Moe (2018)

Forslid, Okubo & Ullveit-Moe (2018)

- Each firm produces industrial good (x_i) and emissions (e_i)
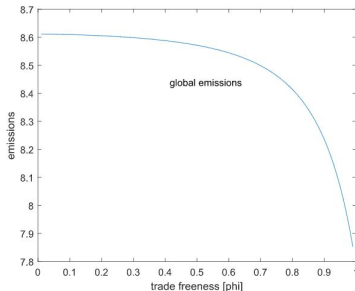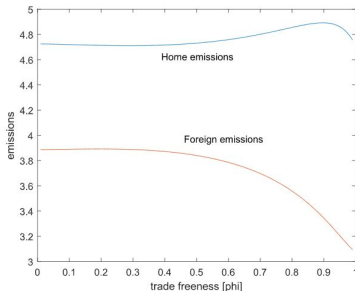- To reduce emissions, a firm can divert θ_i of labor away from producing x_i towards abatement costs.

This means that production and emissions are given by:

$$x_i = (1 - \theta_i)\frac{\ell_i}{\phi_i} \ \text{ and } \ e_i = \frac{(1 - \theta_i)^{1/\alpha}}{h(f_{ai})},$$

where $h'(f_{Ai}) > 0$ and $h(0) = 1$. Firms have incentives to abate due to the emission tax t.

Forslid, Okubo & Ullveit-Moe (2018)

The effects of trade liberalization on total emissions when $t < t^*$.

Source: Forslid, Okubo & Ullveit-Moe (2018)

Product Quality

Baldwin and Harrigan (2011)

- Bilateral product-level data exhibit high incidence of zeros
- Export unit values are positively correlated with distance
- The Melitz model cannot account for these facts

Baldwin and Harrigan (2011)

Linear distance	Distance step function		
Log distance	0.272***		
	(0.0667)		
$1 < \text{km} \leq 4{,}000$			0.0436
			(0.103)
$4{,}000 < \text{km} \leq 7{,}800$			0.427***
			(0.0894)
$7{,}800 < \text{km} \leq 14{,}000$			0.516***
			(0.0905)
$14{,}000 < \text{km}$			0.644***
			(0.0920)

Source: Baldwin and Harrigan (2011)

Baldwin and Harrigan (2011)

Introduce quality into an otherwise standard CES utility function:

$$U = \left(\int_\Theta (c_i q_i)^{1-1/\sigma} d_i \right)^{1/(1-1/\sigma)},$$

where c_i and q_i are the units consumed and quality of a variety.

The optimal expenditure on a typical variety is then:

$$p_i c_i = \left(\frac{p_i}{q_i} \right)^{1-\sigma} B.$$

Assume that higher quality is related to higher marginal cost such that:

$$q_i = \phi^{-1-\theta}$$

R&D Investments

Bustos (2011)

- ▶ Technology is not entirely random
- ▶ Firms can make R&D investments to increase productivity
- ▶ Trade liberalization may affect technology upgrade

Bustos (2011) introduces an additional selection effect that affect technology adoption. They can pay additional fixed cost to reduce marginal cost of production. Suppose there are two technologies, ℓ and h, where h requires a higher fixed cost (ηf) but leads to a lower marginal cost $1/(\gamma\phi)$. Effectively, firms choose their total cost:

$$TC_\ell(q, \phi) = f + \frac{q}{\phi} \ \text{ and } TC_\ell(q, \phi) = f\eta + \frac{q}{\gamma\phi}$$
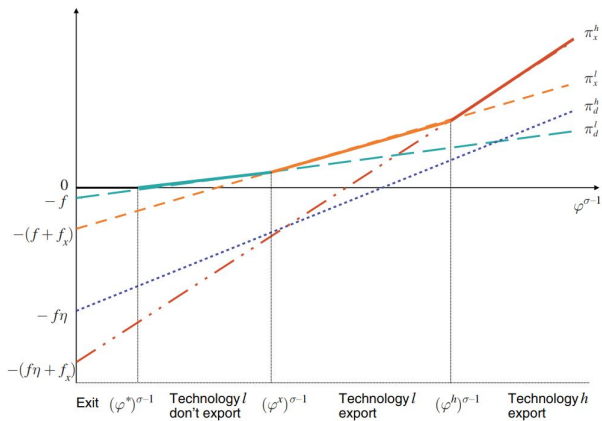
Bustos (2011)


Source: Bustos (2011)

Bustos (2011)

- ▶ Tests the predictions of the model using data on Argentina and Brazil

- ▶ Evidence that better export opportunities lead to better technology adoptions

- ▶ Trade agreements that eliminate tariffs lead to additional productivity gains

Financial Constraints

Manova (2013)

- ▶ Financial market imperfections are common
- ▶ Credit constraints interact with firm heterogeneity
- ▶ Interaction of heterogeneous productivities and credit constraints reinforce selection effects

Manova (2013)
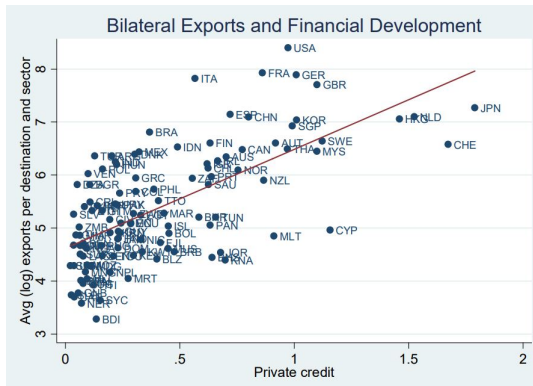
Source: Manova (2013)

Manova (2013)

- Firms require external finance for a d_s fraction of fixed export costs.
- They use t_s fraction of entry cost as collateral.
- Financial contracting is imperfect.
- With probability λ_j the financial contract is enforced and investors get repaid
- With probability $1 - \lambda_j$ the firm defaults, investors get the collateral. In this case, firms keep revenues but replace collateral to continue production.

Firms face the following profit function:

$$\pi_{ij} = p_{ij}q_{ij} - q_{ij}w_i\tau_{ij}a - (1 - d_s)w_if_{ij} - \lambda_i F(a) - (1 - \lambda_i)t_s w_j f_{ei},$$

where $1/a$ is drawn from Pareto.

Manova (2013)

- ▶ Week financial institutions distort trade

- ▶ Export activity is disproportionately affected by credit constraints

- ▶ Credit constraints affect both the extensive and intensive margins of trade

Assignment

▶ Modify the original Melitz model in one dimension

▶ Borrow parameters from the most closely related paper and/or fix fundamentals yourself

▶ Solve the modified version of the model for 2 countries (makes things easier)

▶ Highlight how your modification affects the results

▶ Make a 5-10 min presentation