How and Why Does Trade Grow?

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Outline:

1. Much of the growth of trade after a trade liberalization experience is growth on the extensive margin. Models need to allow for corner solutions or fixed costs.

2. Fixed costs seem better than Ricardian corner solutions for reconciling time series data on real exchange rate fluctuations with data on trade growth after liberalization experiences.

3. Models of trade with heterogeneous firms typically impose fixed costs on firms that decide to export. The focus is on the decision to export. The theory and the data indicate that there is a lot of room for focusing on the decision to import.

4. Models with uniform fixed cost across firms with heterogeneous productivity have implications that are sharply at odds with micro data. A model with increasing costs of accessing a fraction of a market has many of features of models with fixed costs without these undesirable properties.

1. **Much of the growth of trade after a trade liberalization experience is growth on the extensive margin. Models need to allow for corner solutions or fixed costs.**

T. J. Kehoe and K. J. Ruhl, "How Important is the New Goods Margin in International Trade?" Federal Reserve Bank of Minneapolis, 2002.

How Does Trade Grow?

- **Intensive Margin:** growth in goods already traded
- **Extensive Margin:** trade in goods not traded before

The Extensive Margin

- The Extensive Margin has recently gained attention
- **Models**
  - Melitz (2003)
  - Alessandria and Choi (2003)
  - Ruhl (2004)
- **Empirically**
  - Hummels and Klenow (2002)
  - Eaton, Kortum and Kramarz (2004)

What Happens to the Extensive Margin?

- During trade liberalization?
  - Large changes in the extensive margin
- Over the business cycle?
  - Little change in extensive margin

Evidence from Trade Agreements

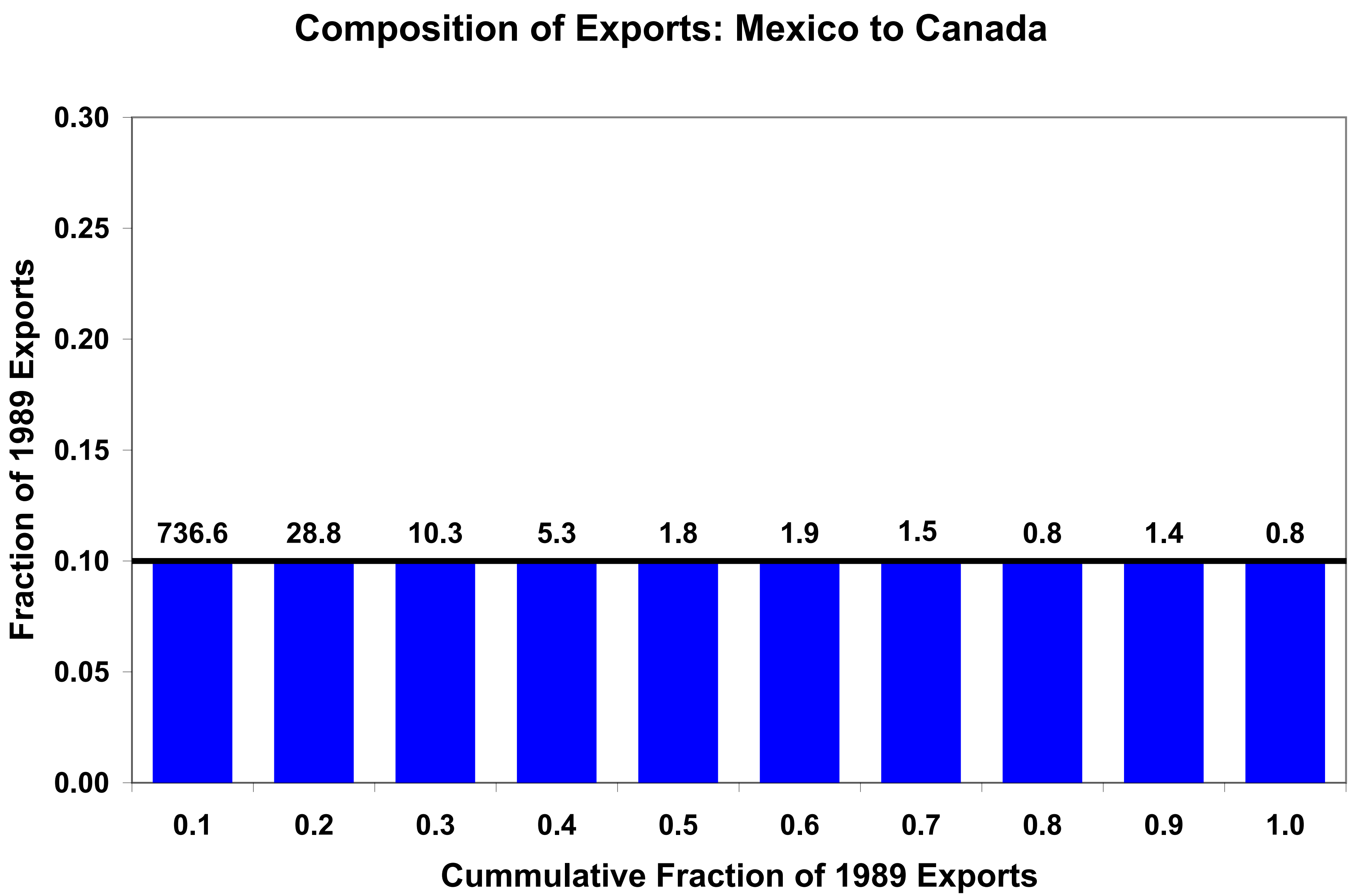
- **Events**
  - Greece's Accession to the European Econ. Community - 1981
  - Portugal's Accession to the European Community - 1986
  - Spain's Accession to the European Community - 1986
  - U.S.-Canada Free Trade Agreement - 1989
  - North American Free Trade Agreement - 1994
- **Data**
  - Four-digit SITC bilateral trade data (OECD)
    - 789 codes in revision 2
- Indirect Evidence

Measure One

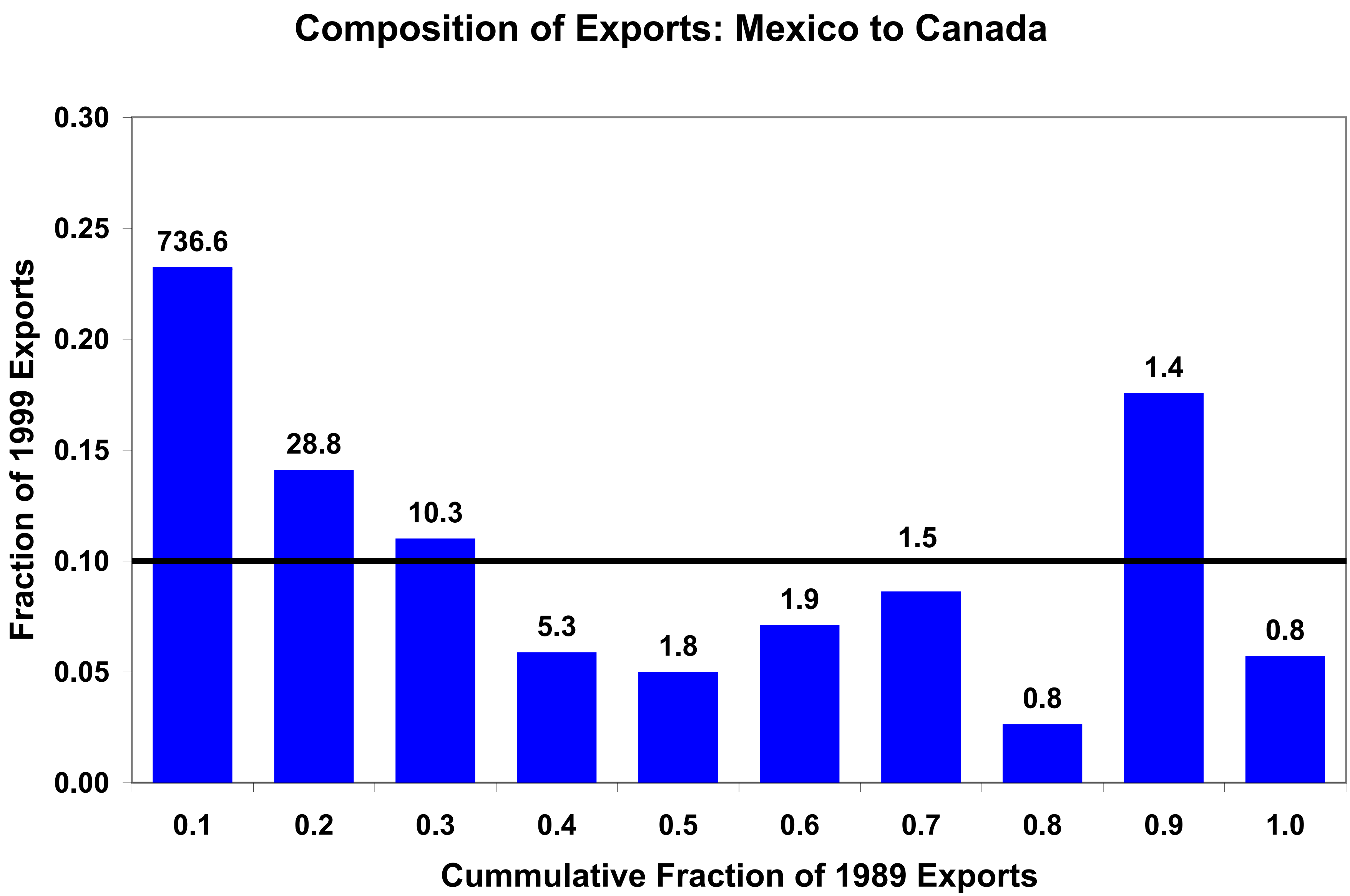
1. Rank codes from lowest value of exports to highest value of exports based on average of first 3 years

2. Form sets of codes by cumulating exports: the first 736.6 codes make up 10 percent of exports; the next 28.8 codes make up 10 percent of exports; and so on.

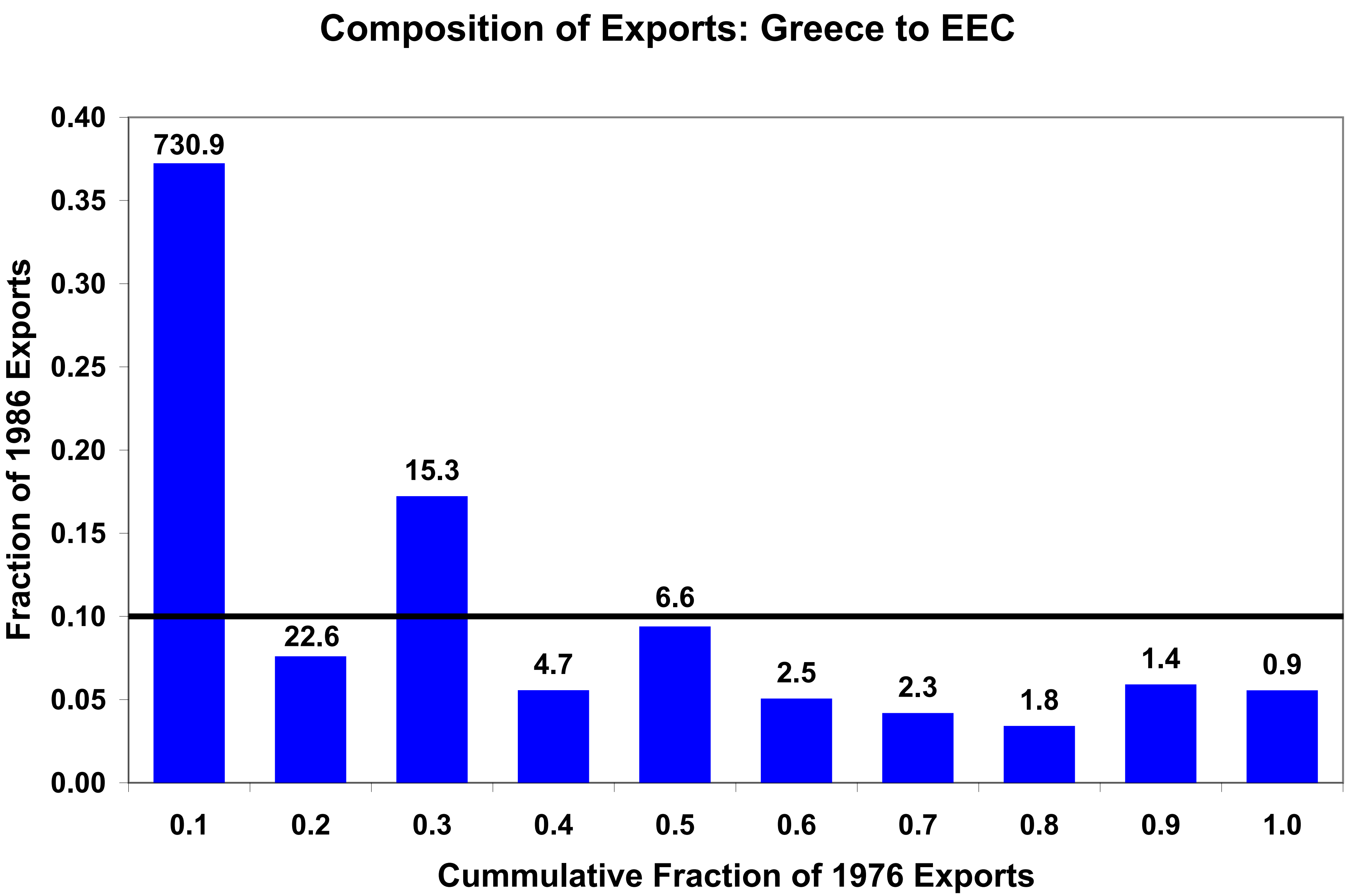
3. Calculate each set's share of export value at the end of the sample period.



Composition of Exports: Mexico to Canada
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Fraction of 1989 Exports
736.6
28.8
10.3
5.3
1.8
1.9
1.5
0.8
1.4
0.8
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Cummulative Fraction of 1989 Exports



Composition of Exports: Mexico to Canada
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Fraction of 1999 Exports
736.6
28.8
10.3
5.3
1.8
1.9
1.5
0.8
1.4
0.8
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Cummulative Fraction of 1989 Exports



Composition of Exports: Greece to EEC
Fraction of 1986 Exports
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
730.9
22.6
15.3
4.7
6.6
2.5
2.3
1.8
1.4
0.9
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Cummulative Fraction of 1976 Exports

Measure Two

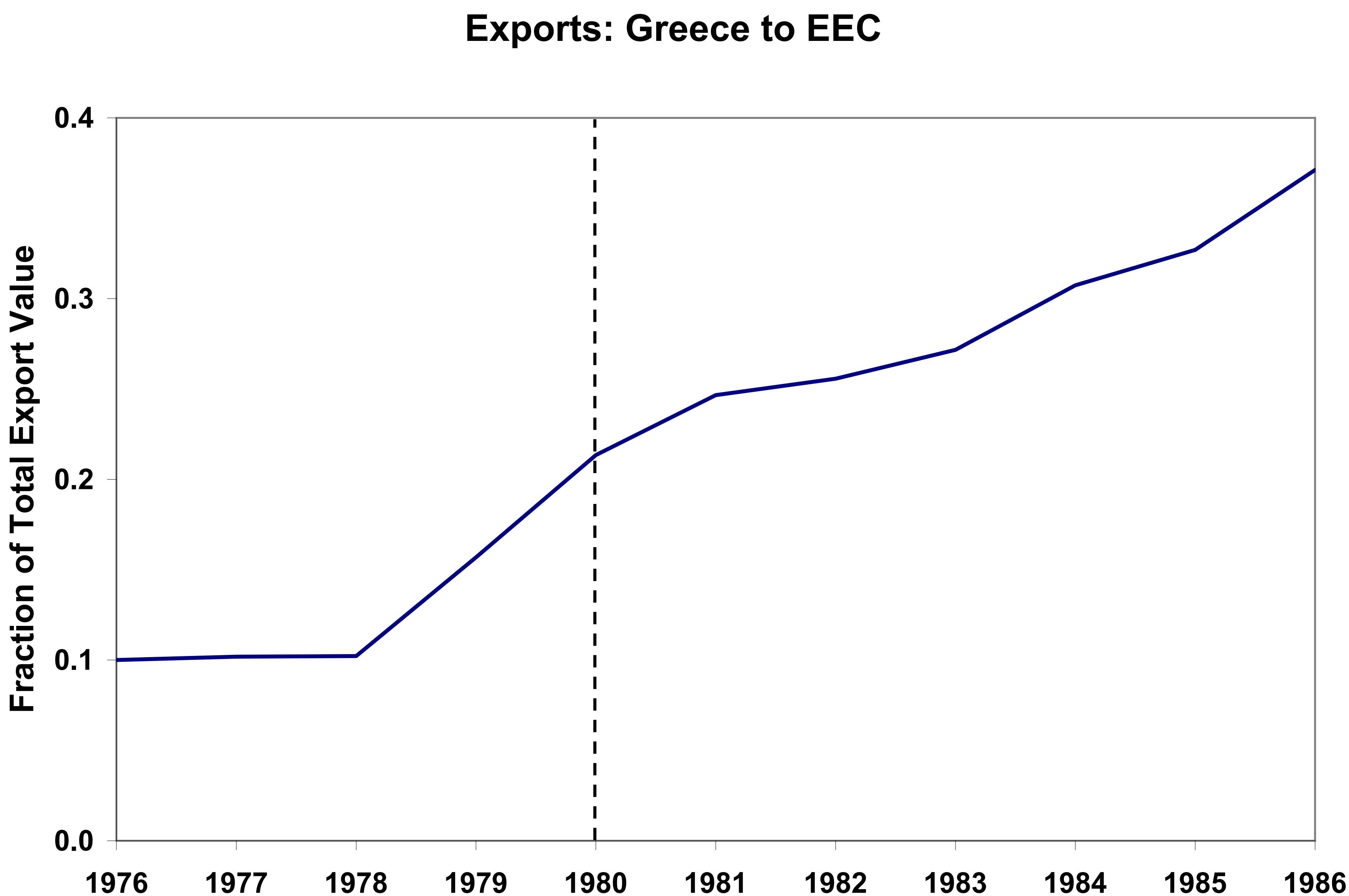
1. Order codes as before.

2. Cumulate exports as before.

3. Follow the evolution of the first (least-traded) set's share of total exports before, during, and after the liberalization.


Exports: Mexico to Canada
Fraction of Total Export Value
0.30
0.20
0.10
0.00
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999

Exports: Canada to Mexico
Fraction of Total Export Value
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999


Exports: Greece to EEC
Fraction of Total Export Value
0.0
0.1
0.2
0.3
0.4
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986

A Serious Problem in the Data

- Prior to 1988, data was collected by the individual nations according to their respective classification, and was then converted into STIC.R2. For example, the United States collected data on imports and exports under the Tariff Schedule of the United States Annotated (TSUSA) system and the "Schedule B," respectively. Canada also used a national classification system. Most European countries used the Customs Cooperation Council Nomenclature (CCCN) or a derivation of it.

- In 1988 and 1989 most countries switched to the Harmonized System for reporting imports and exports.

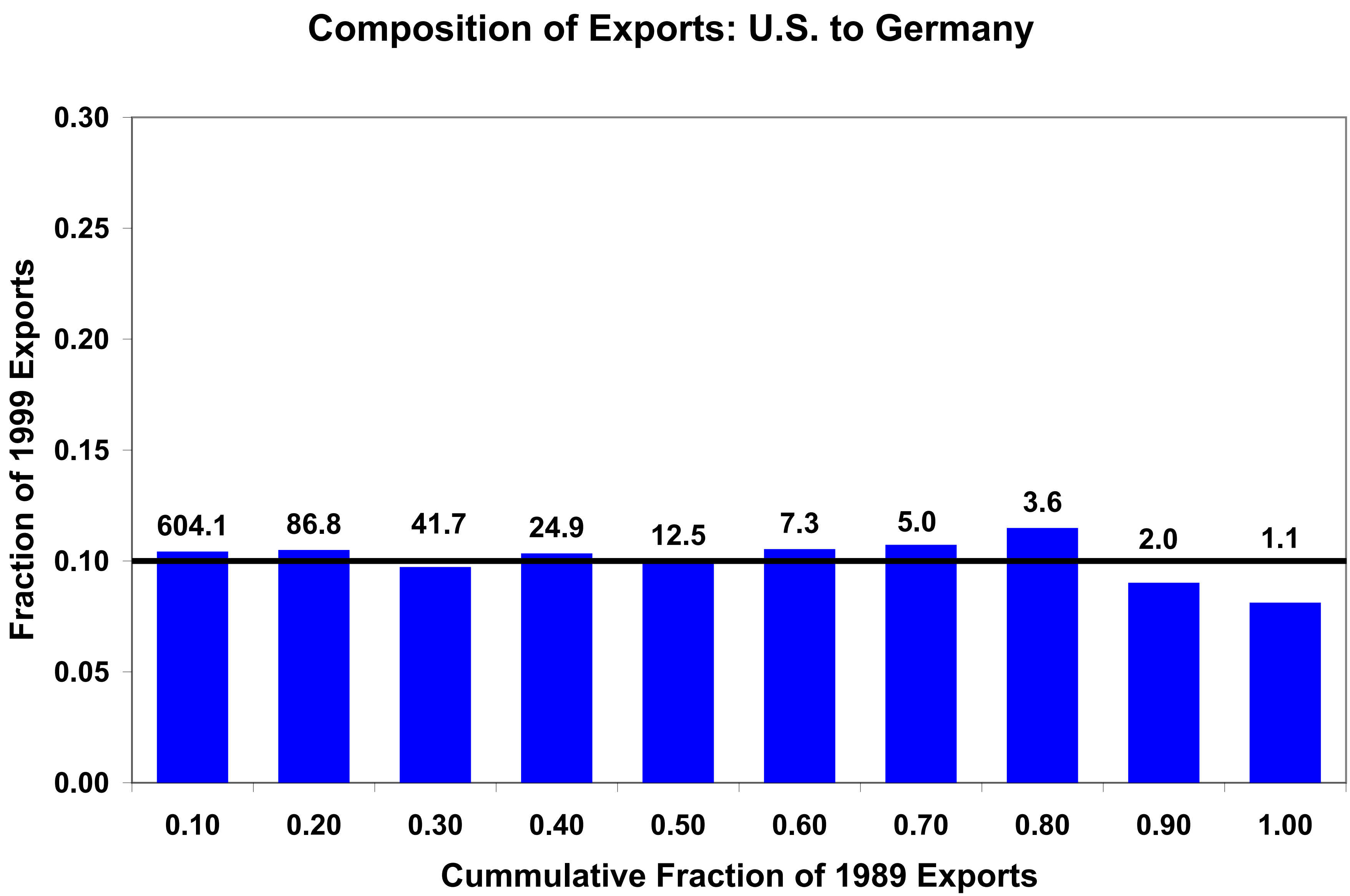
- Although efforts have been made to make data collected after the switch to the Harmonized System compatible with data from before the switch, it appears that there are serious inconsistencies, especially in data from countries that did not employ the CCCN before the switch.

Trade Liberalization and the Extensive Margin

Period	Trade Flow	Share of Export Growth
1989-1999	Mexico - U.S.	0.153
1989-1999	U.S. – Mexico	0.118
1989-1999	Mexico - Canada	0.231
1989-1999	Canada - Mexico	0.307
1989-1999	Canada - U.S.	0.162
1989-1999	U.S. – Canada	0.130
1978-1986	Greece to the EEC	0.371
1982-1987	Spain to the EC	0.128
1982-1987	Portugal to the EC	0.147

Business Cycles and the Extensive Margin

- Over same period, consider countries with stable policy
    - U.S. – Japan
    - U.S. – U.K.
    - U.S. – Germany



Composition of Exports: U.S. to Germany
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Fraction of 1999 Exports
604.1
86.8
41.7
24.9
12.5
7.3
5.0
3.6
2.0
1.1
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Cummulative Fraction of 1989 Exports

Exports: United States to Germany
Fraction of Total Export Value
0.30
0.25
0.20
0.15
0.10
0.05
0.00
U.S. Exports to Germany
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999

Exports: Germany and the United States
Fraction of Total Export Value
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
German Exports to U.S.
U.S. Exports to Germany

Business Cycles and the Extensive Margin

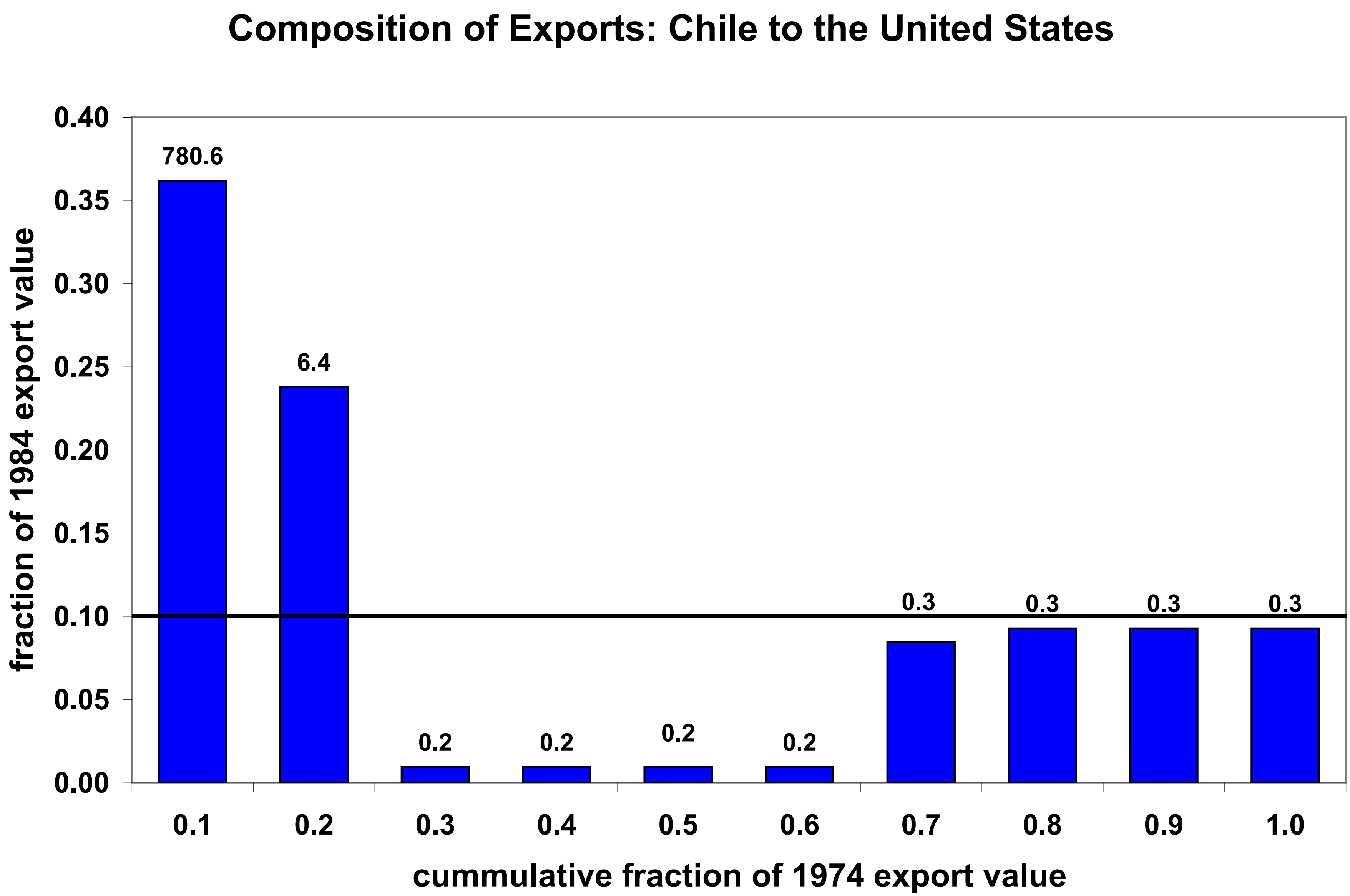
Period	Trade Flow	Share of Export Growth
1989-1999	U.S. - U.K.	0.096
1989-1999	U.K. - U.S.	0.128
1989-1999	U.S. - Japan	0.130
1989-1999	Japan - U.S.	0.103
1989-1999	U.S. - Germany	0.104
1989-1999	Germany - U.S.	0.103

Lessons from data

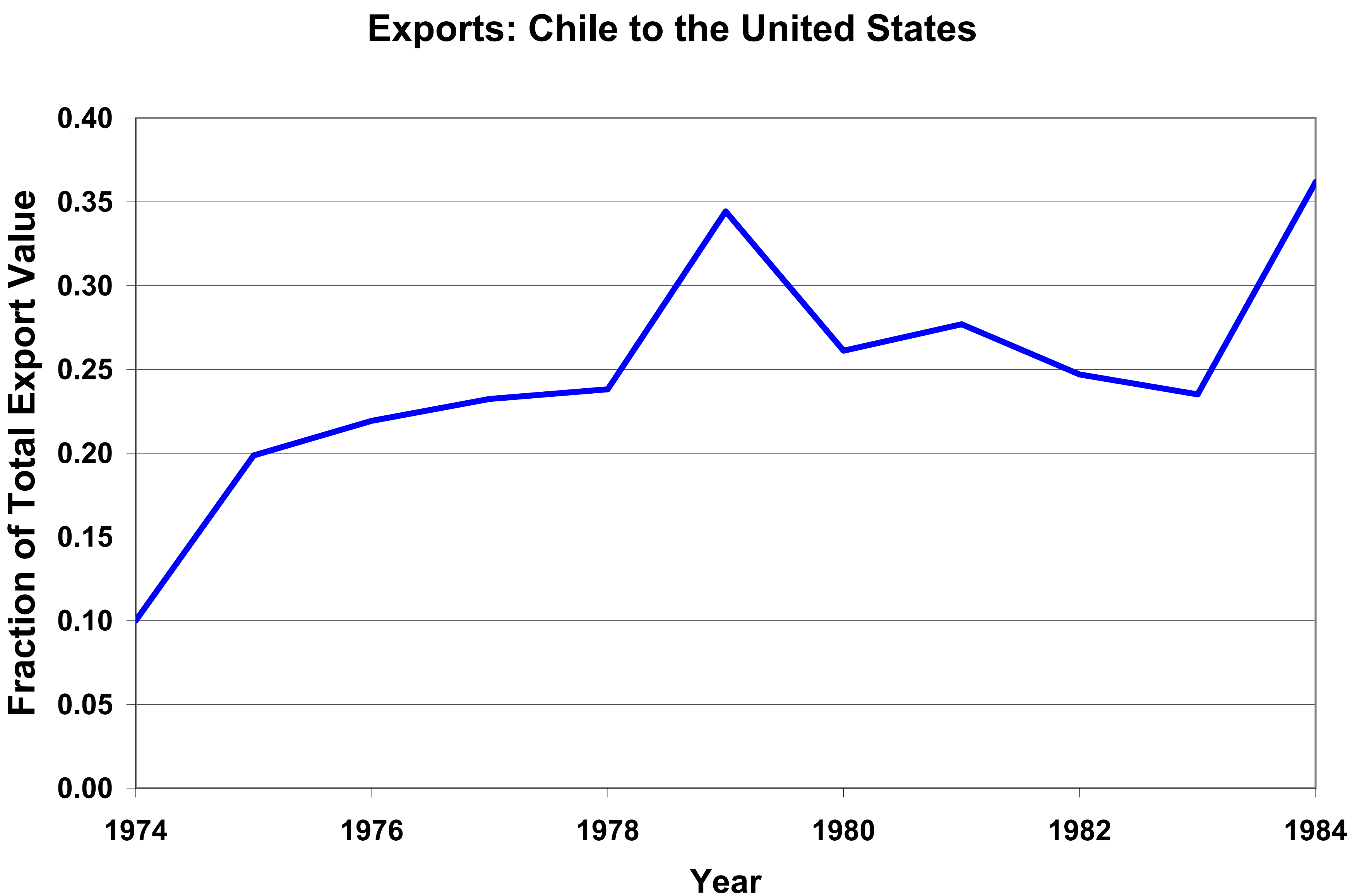
Trade liberalization increases trade on the extensive margin, business cycle fluctuations do not.

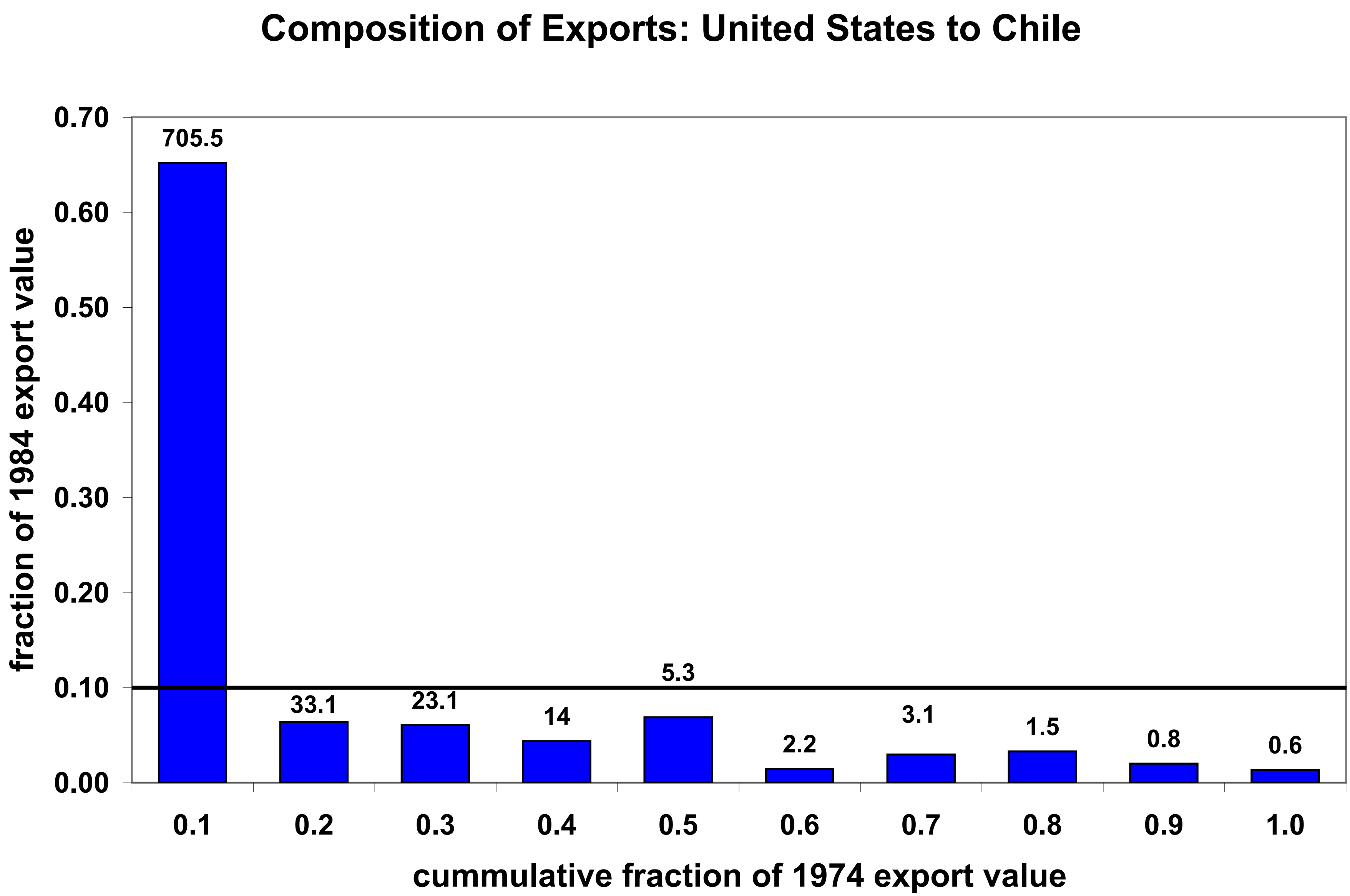
Structural changes may increase trade on the extensive margin.

A country increasing its exports on the extensive margin because of trade liberalization may increase its exports on the extensive margin to other countries.



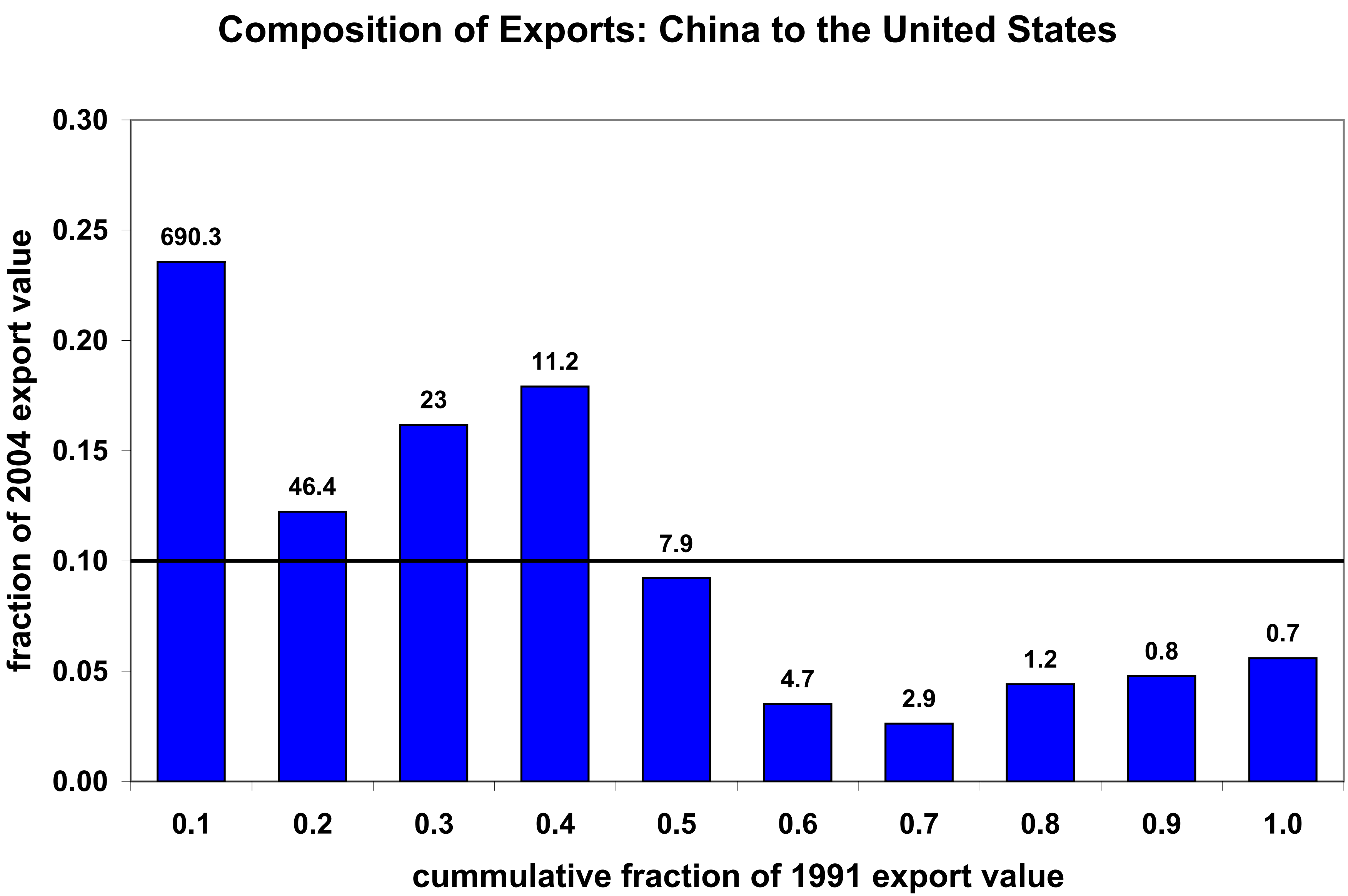
Composition of Exports: Chile to the United States
fraction of 1984 export value
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
780.6
6.4
0.2
0.2
0.2
0.2
0.3
0.3
0.3
0.3
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
cummulative fraction of 1974 export value

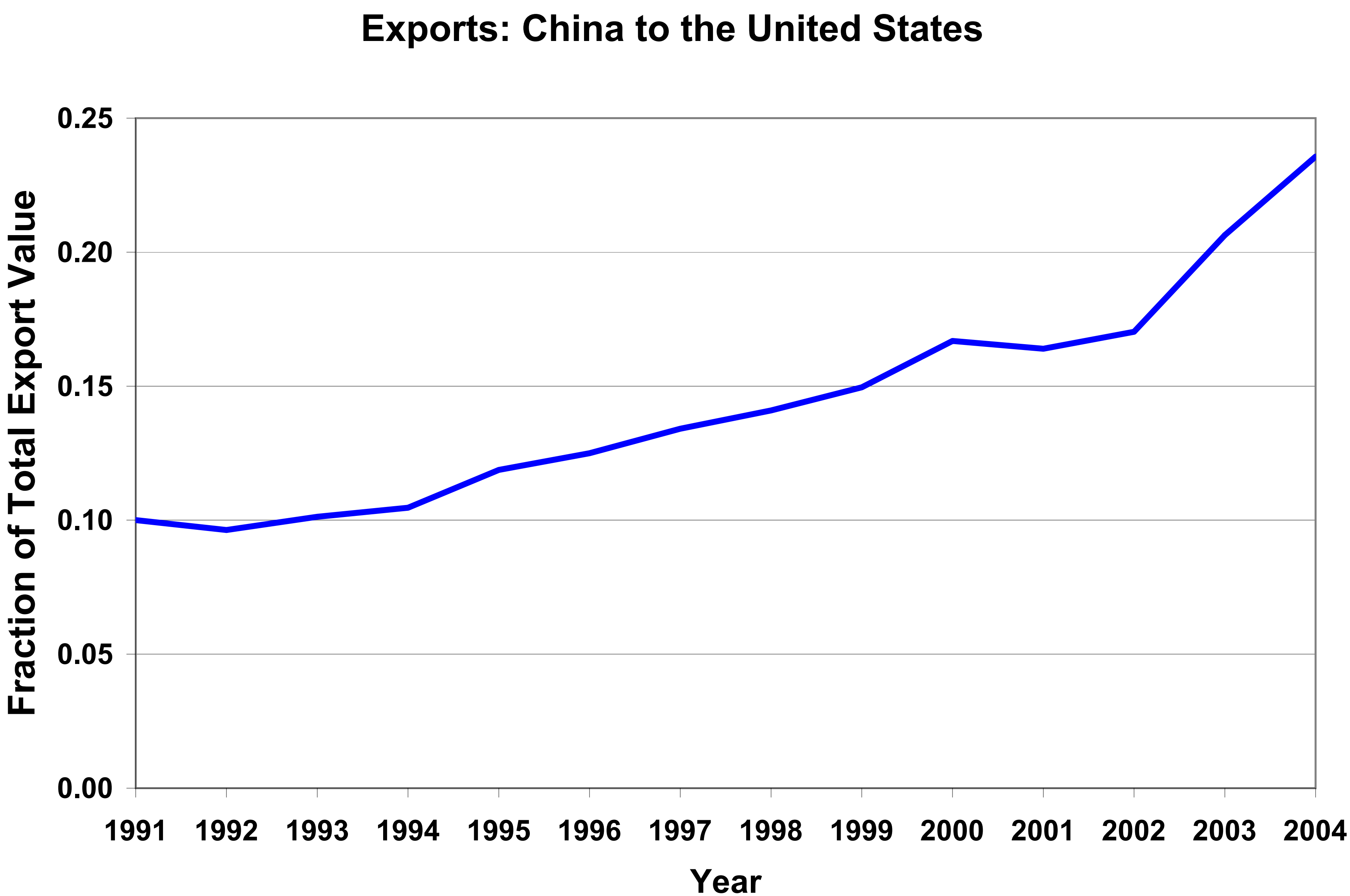

Exports: Chile to the United States
Fraction of Total Export Value
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1974
1976
1978
1980
1982
1984
Year



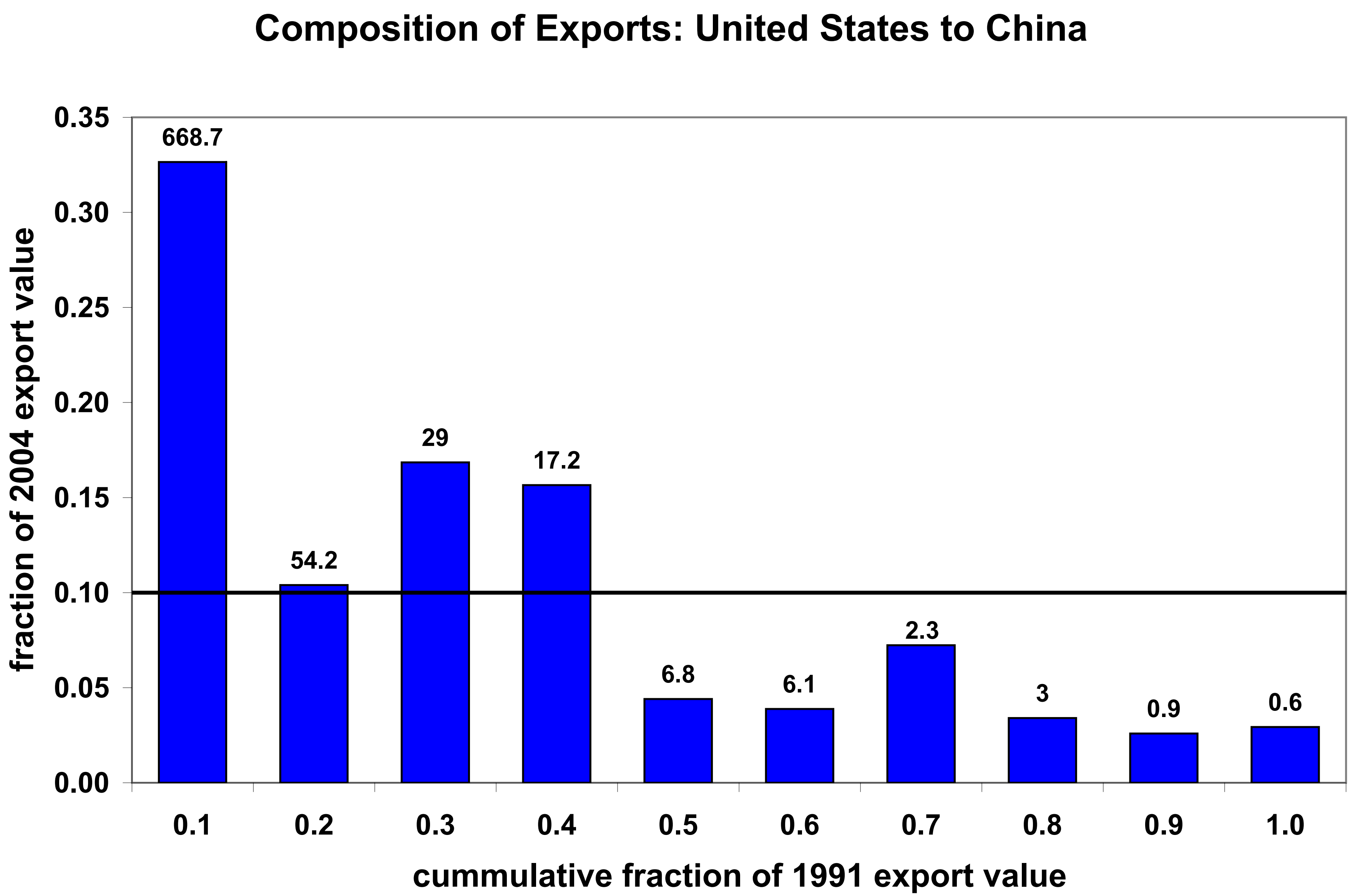
Composition of Exports: United States to Chile
fraction of 1984 export value
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
705.5
33.1
23.1
14
5.3
2.2
3.1
1.5
0.8
0.6
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
cummulative fraction of 1974 export value

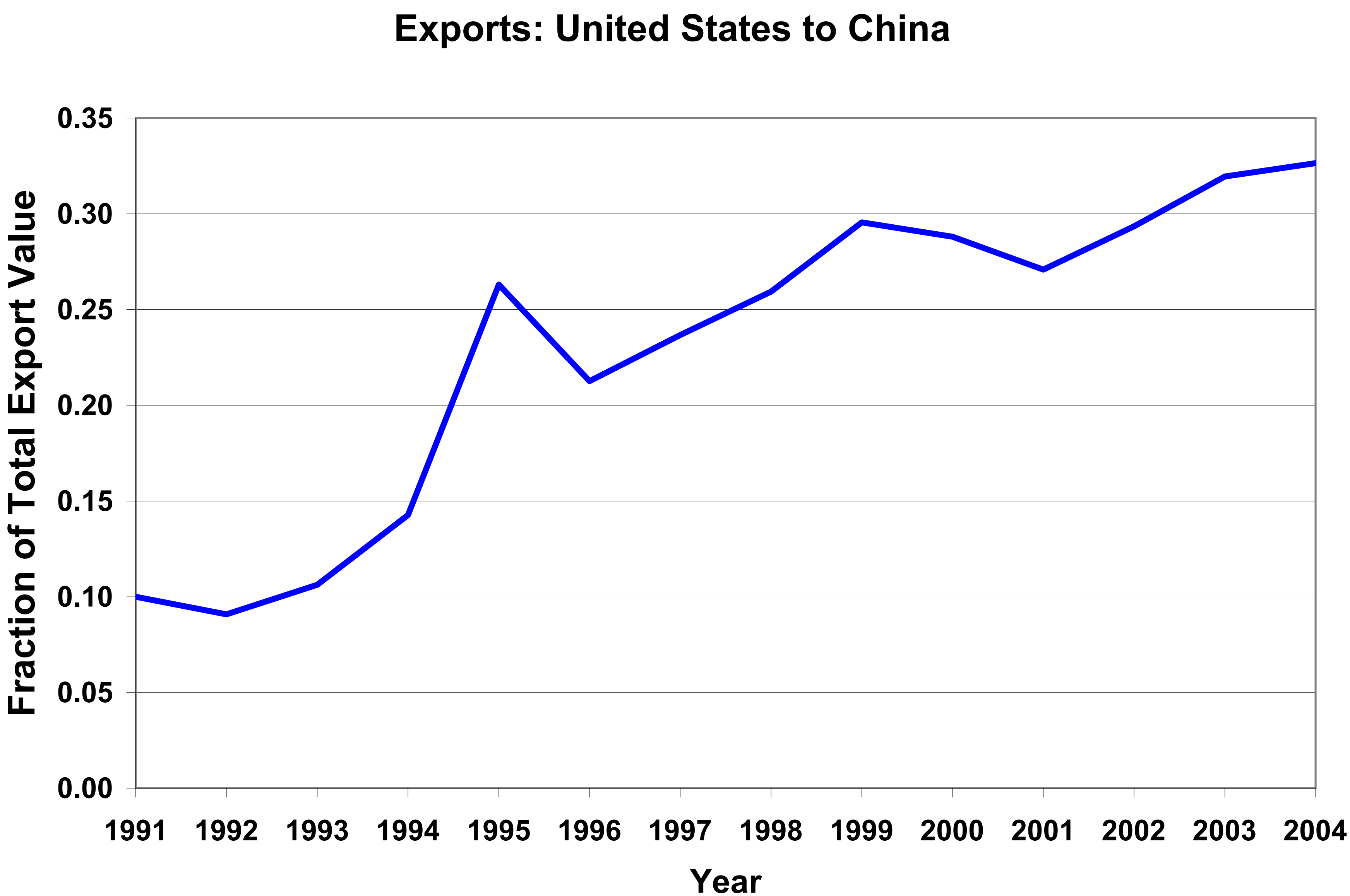

Exports: United States to Chile
Fraction of Total Export Value
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1976
1978
1980
1982
1984
Year


Composition of Exports: China to the United States
0.30
0.25
0.20
0.15
0.10
0.05
0.00
fraction of 2004 export value
690.3
46.4
23
11.2
7.9
4.7
2.9
1.2
0.8
0.7
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
cummulative fraction of 1991 export value

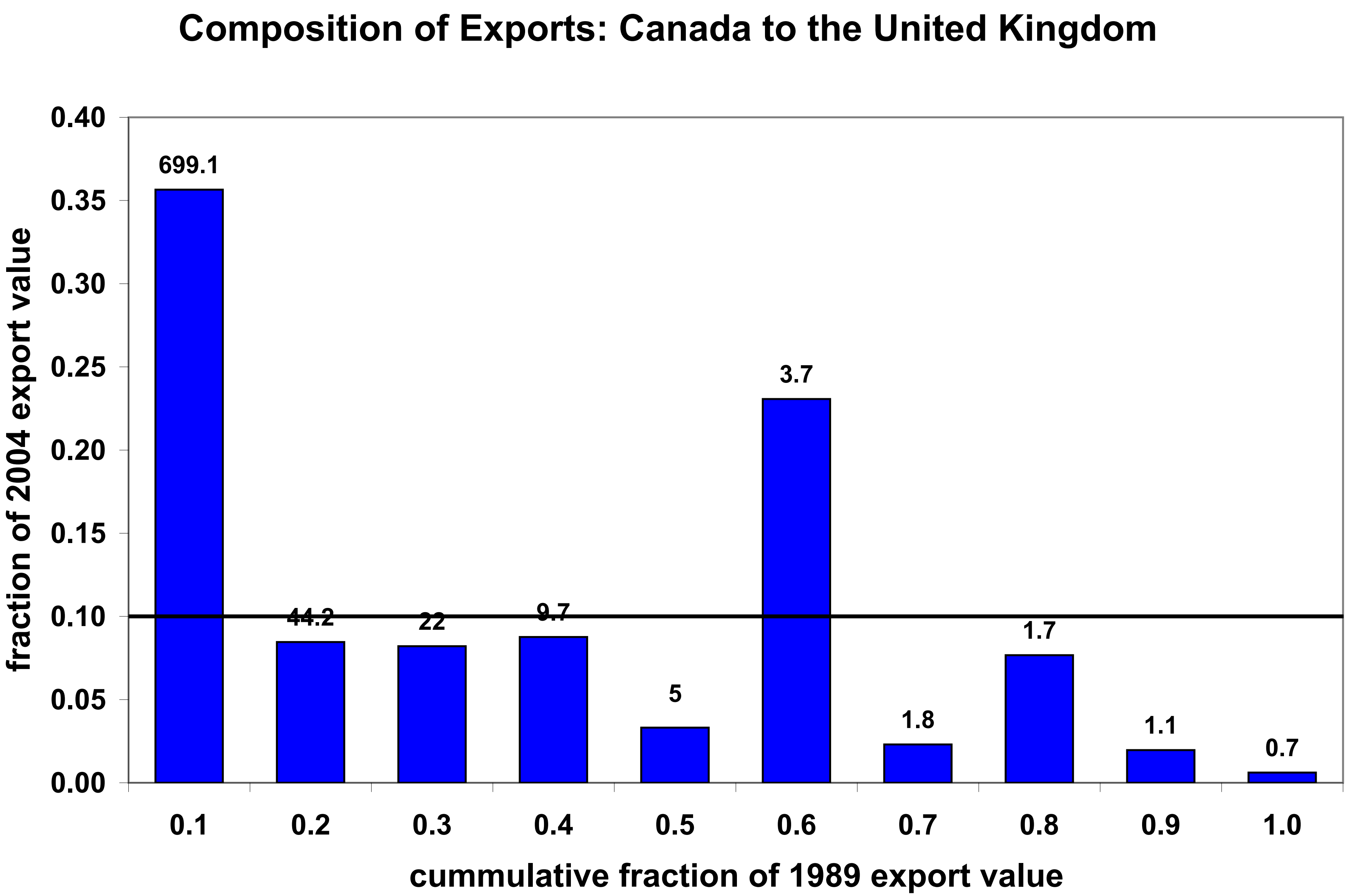


Exports: China to the United States
0.25
0.20
0.15
0.10
0.05
0.00
Fraction of Total Export Value
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Year


Composition of Exports: United States to China
fraction of 2004 export value
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
668.7
54.2
29
17.2
6.8
6.1
2.3
3
0.9
0.6
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
cummulative fraction of 1991 export value

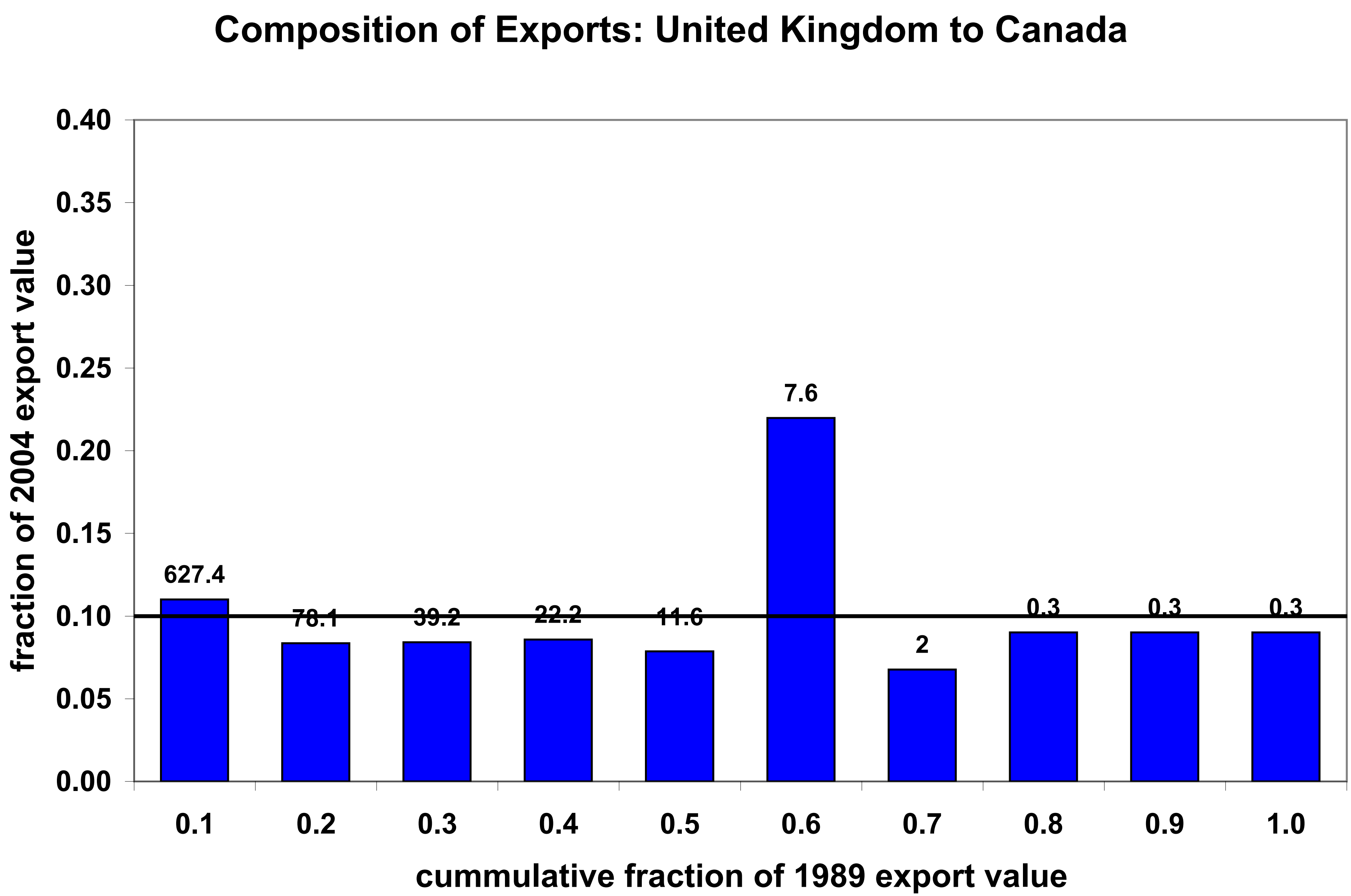


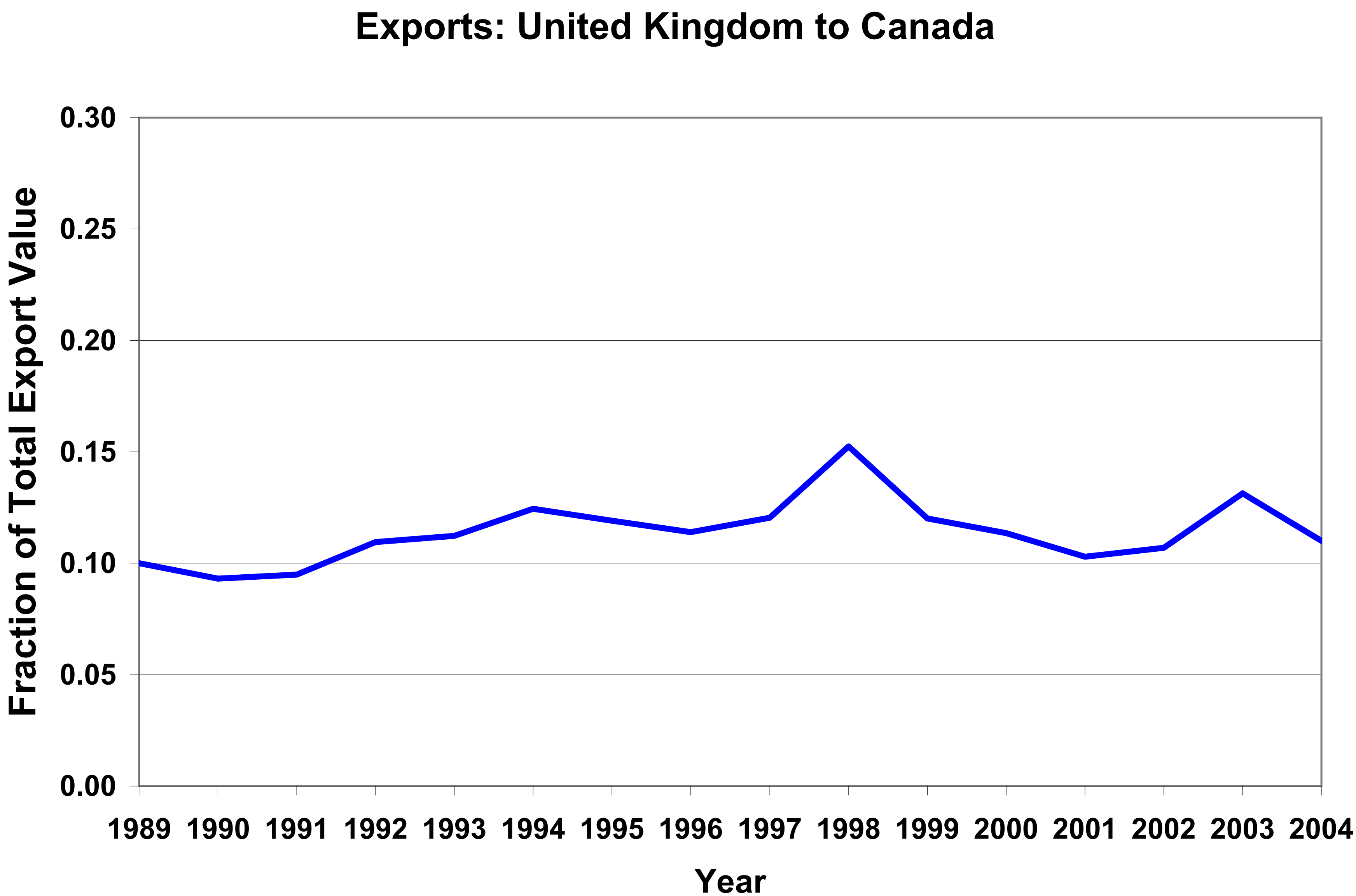
Exports: United States to China
Fraction of Total Export Value
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Year



Composition of Exports: Canada to the United Kingdom
fraction of 2004 export value
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
699.1
44.2
22
9.7
5
3.7
1.8
1.7
1.1
0.7
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
cummulative fraction of 1989 export value


Exports: Canada to the United Kingdom
Fraction of Total Export Value
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
Year


Composition of Exports: United Kingdom to Canada
fraction of 2004 export value
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
627.4
78.1
39.2
22.2
11.6
7.6
2
0.3
0.3
0.3
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
cummulative fraction of 1989 export value


Exports: United Kingdom to Canada
Fraction of Total Export Value
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Year

2. Fixed costs seem better than Ricardian corner solutions for reconciling time series data on real exchange rate fluctuations with data on trade growth after liberalization experiences.

K. J. Ruhl, "Solving the Elasticity Puzzle in International Economics," University of Texas at Austin, 2005.

The “Armington” Elasticity

- Elasticity of substitution between domestic and foreign goods
- Crucial elasticity in international economic models
- International Real Business Cycle (IRBC) models:
    - Terms of trade volatility
    - Net exports and terms of trade co-movements
- Applied General Equilibrium (AGE) Trade models:
    - Trade response to tariff changes

The Elasticity Puzzle

- Time series (Business Cycles):
  - Estimates are low
  - Relative prices volatile
  - Quantities less volatile

- Panel studies (Trade agreement):
  - Estimates are high
  - Small change in tariffs (prices)
  - Large change in quantities

Time Series Estimates: Low Elasticity (1.5)

Study	Range
Reinert and Roland Holst (1992)	[0.1, 3.5]
Reinert and Shiells (1993)	[0.1, 1.5]
Gallaway et al. (2003)	[0.2, 4.9]

Trade Liberalization Estimates: High Elasticity (9.0)

Study	Range
Clausing (2001)	[8.9, 11.0]
Head and Reis (2001)	[7.9, 11.4]
Romalis (2002)	[4.0, 13.0]

Why do the Estimates Differ?

- Time series – no liberalization:
  - Change in trade volume from goods already traded
  - Change mostly on the *intensive margin*

- Trade liberalization:
  - Change in intensive margin *plus*
  - New types of goods being traded
  - Change on the *extensive margin*

Modeling the Extensive Margin

- Model: extensive margin from export entry costs
- Empirical evidence of entry costs
    - Roberts and Tybout (1997)
    - Bernard and Wagner (2001)
    - Bernard and Jensen (2003)
    - Bernard, Jensen and Schott (2003)

The Effects of Entry Costs

- Business cycle shocks:
  - Small extensive margin effect

- Trade liberalization:
  - Big extensive margin effect

- Asymmetry creates different empirical elasticities

Model Overview

- Two countries: $\{h, f\}$, with labor L
- Infinitely lived consumers
- No international borrowing/lending
- Continuum of traded goods plants in each country
    - Differentiated goods
    - Monopolistic competitors
    - Heterogeneous productivity
- Export entry costs
    - Differs across plants: second source of heterogeneity
- Non-traded good, competitive market: A
- Tariff on traded goods (iceberg): τ

Uncertainty

- At date t, H possible events, $\eta_t = 1, \ldots, \mathrm{H}$
- Each event is associated with a vector of productivity shocks:

$$z_t = \left[z_h(\eta_t), z_f(\eta_t) \right]$$

- First-order Markov process with transition matrix Λ

$$\lambda_{\eta\eta'} = \mathrm{pr}\left(\eta_{t+1} = \eta' \middle| \eta_t = \eta \right)$$

Traded Good Plants

- Traded good technology:

$$y(\phi,\kappa) = z\phi\, l$$

- Plant heterogeneity (ϕ,κ)
  - constant, idiosyncratic productivity: ϕ
  - export entry cost: κ
  - plant of type (ϕ,κ)

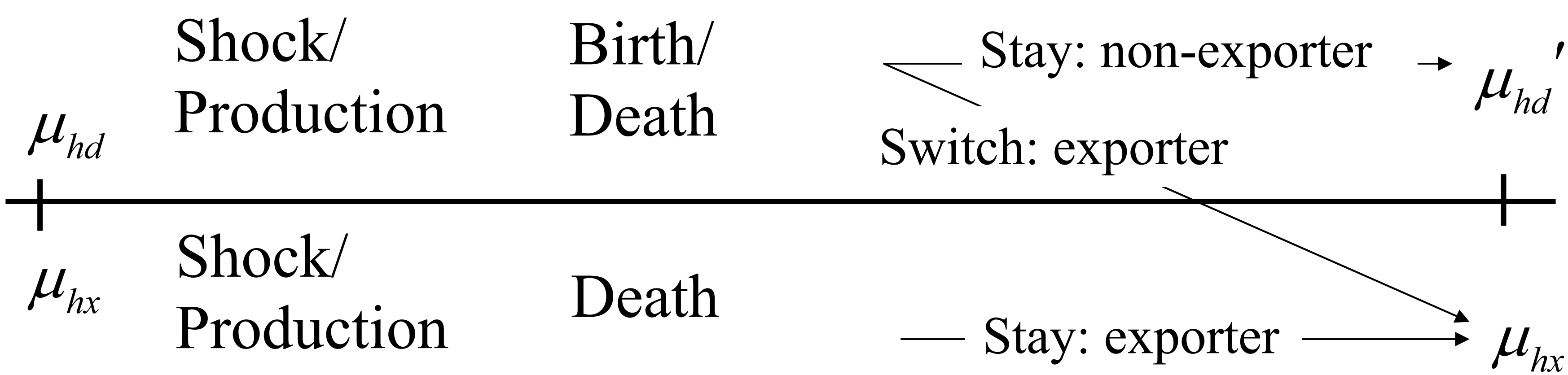
- ν plants born each period with distribution $F(\phi,\kappa)$
- Fraction δ of plants exogenously die each period

Timing

$\mu_{hx}(\phi,\kappa)$: plants of type (ϕ,κ) who paid entry cost

$\mu_{hd}(\phi,\kappa)$: plants of type (ϕ,κ) who have not paid entry cost

$\mu = (\mu_{hd}, \mu_{hx}, \mu_{fd}, \mu_{fx})$



Consumers

$$\max_{q, c_h^h(\iota), c_f^h(\iota)} \gamma \log(C) + (1-\gamma)\log(A)$$

s.t.

$$C = \left[\int_{\iota \in \mathrm{I}_h^h(\mu)} c_h^h(\iota)^{\rho} d\iota + \int_{\iota \in \mathrm{I}_f^h(\mu)} c_f^h(\iota)^{\rho} d\iota \right]^{\frac{1}{\rho}}$$

$$\int_{\iota \in \mathrm{I}_h^h(\mu)} p_h^h(\iota) c_h^h(\iota) d\iota + \int_{\iota \in \mathrm{I}_f^h(\mu)} (1+\tau) p_f^h(\iota) c_f^h(\iota) d\iota + p_{hA} A = L + \Pi_h$$

Non-traded Good

$$\max \; p_{hA}(\eta,\mu)A - l$$
$$\text{s.t. } \; A = z_h(\eta)l$$

Normalize $w_h = 1$, implying $p_{hA}(\eta,\mu) = z_h(\eta)$

Traded Goods: Static Profit Maximization

$$\pi_d\left(p_h^h, l; \phi, \kappa, \eta, \mu\right) = \max_{p_h^h,\, l} \; p_h^h z(\eta)\phi l - l$$

$$\text{s.t.} \qquad z(\eta)\phi l = \tilde{c}_h^h\left(p_h^h; \eta, \mu\right)$$

$$\pi_x\left(p_h^f, l; \phi, \kappa, \eta, \mu\right) = \max_{p_h^f,\, l} \; p_h^f z(\eta)\phi l - l$$

$$\text{s.t.} \qquad z(\eta)\phi l = \tilde{c}_h^f\left(p_h^f; \eta, \mu\right)$$

Pricing rules:

$$p_h^h(\phi, \kappa, \eta, \mu) = p_h^f(\phi, \kappa, \eta, \mu) = \frac{1}{\rho\phi z(\eta)}$$

Dynamic Choice: Export or Sell Domestically

- Exporter's Value Function:

$$V_x(\phi,\kappa,\eta,\mu) = d(\eta,\mu)\left(\pi_d(\phi,\kappa,\eta,\mu) + \pi_x(\phi,\kappa,\eta,\mu)\right) + (1-\delta)\beta\sum_{\eta'} V_x(\phi,\kappa,\eta',\mu')\lambda_{\eta\eta'}$$

s.t. $\mu' = \mathrm{M}(\eta,\mu)$

- $d(\eta,\mu)$ = multiplier on budget constraint

• Non-exporter's Value Function:

$$V_d(\phi,\kappa,\eta,\mu) =$$

$$\max\Big\{\pi_d(\phi,\kappa,\eta,\mu)\,d(\eta,\mu)+\beta(1-\delta)\sum_{\eta'}V_d(\phi,\kappa,\eta',\mu')\lambda_{\eta\eta'},$$

$$\big[\pi_d(\phi,\kappa,\eta,\mu)-\kappa\big]d(\eta,\mu)+\beta(1-\delta)\sum_{\eta'}V_x(\phi,\kappa,\eta',\mu')\lambda_{\eta\eta'}\Big\}$$

s.t. $\mu' = \mathrm{M}(\eta,\mu)$

Equilibrium

- Cutoff level of productivity for each value of the entry cost
- For a plant of type (ϕ, κ)

  If $\phi \geq \hat{\phi}_{\kappa}(\eta, \mu)$ export and sell domestically

  If $\phi < \hat{\phi}_{\kappa}(\eta, \mu)$ only sell domestically

- In Equilibrium
  - "Low" productivity/"high" entry cost plants sell domestic
  - "High" productivity/"low" entry cost plants also export
  - Similar to Melitz (2003)

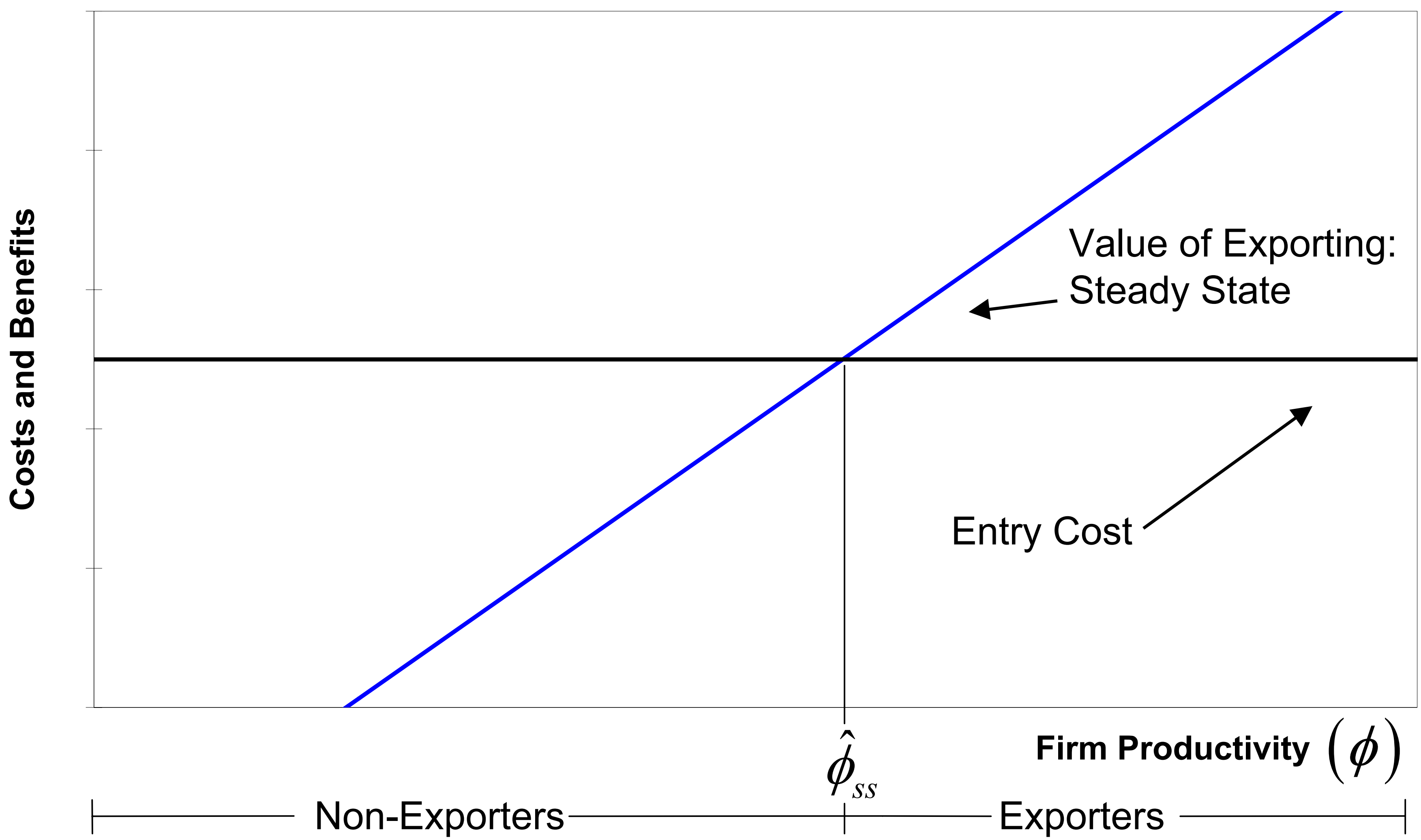
Determining Cutoffs

- For the cutoff plant:
  - entry cost = discounted, expected value of exporting

- $\hat{\phi}_{\kappa}(\eta,\mu)$ is the level of productivity, ϕ, that solves:

$$\underbrace{d\,(\eta,\mu)\kappa}_{\text{entry cost}} = \underbrace{(1-\delta)\beta\left[\sum_{\eta'} V_x(\phi,\kappa,\eta',\mu')\lambda_{\eta\eta'} - \sum_{\eta'} V_d(\phi,\kappa,\eta',\mu')\lambda_{\eta\eta'}\right]}_{\text{expected value of exporting}}$$

Finding the Cutoff Producer



Choosing Parameters

- Set $\sigma = \dfrac{1}{1-\rho} = 2$ and $\tau = 0.15$
- Calibrate to the United States (1987) and a symmetric partner.

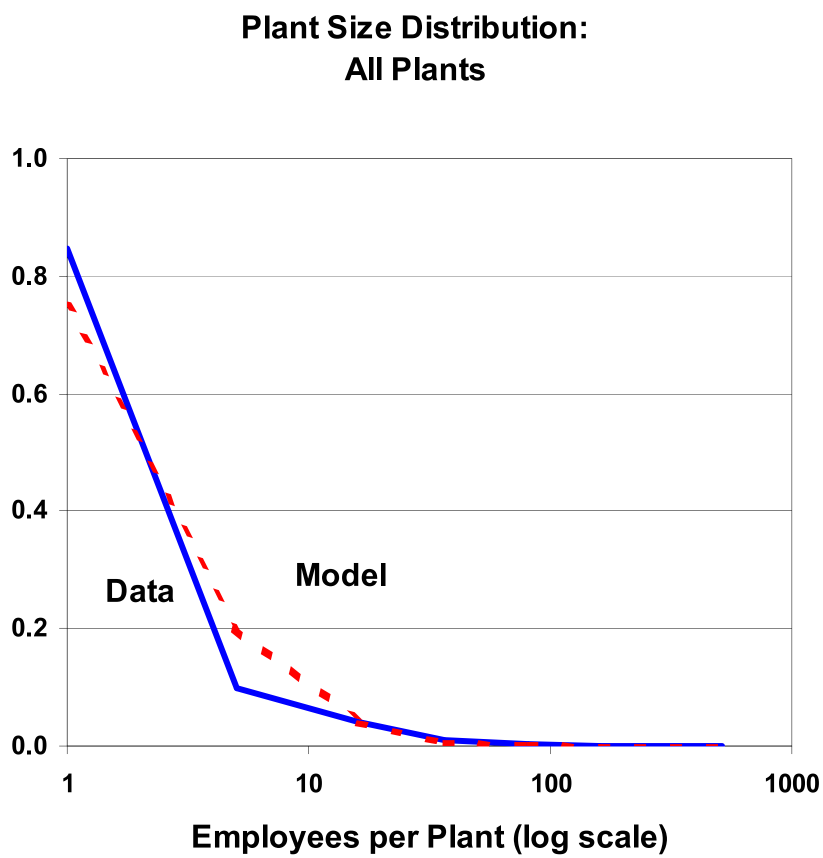
Parameters	
β	Annual real interest rate (4%)
γ	Share of manufactures in GDP (18%)
δ	Annual loss of jobs from plant deaths as percentage of employment (Davis et. al., 1996) (6%)

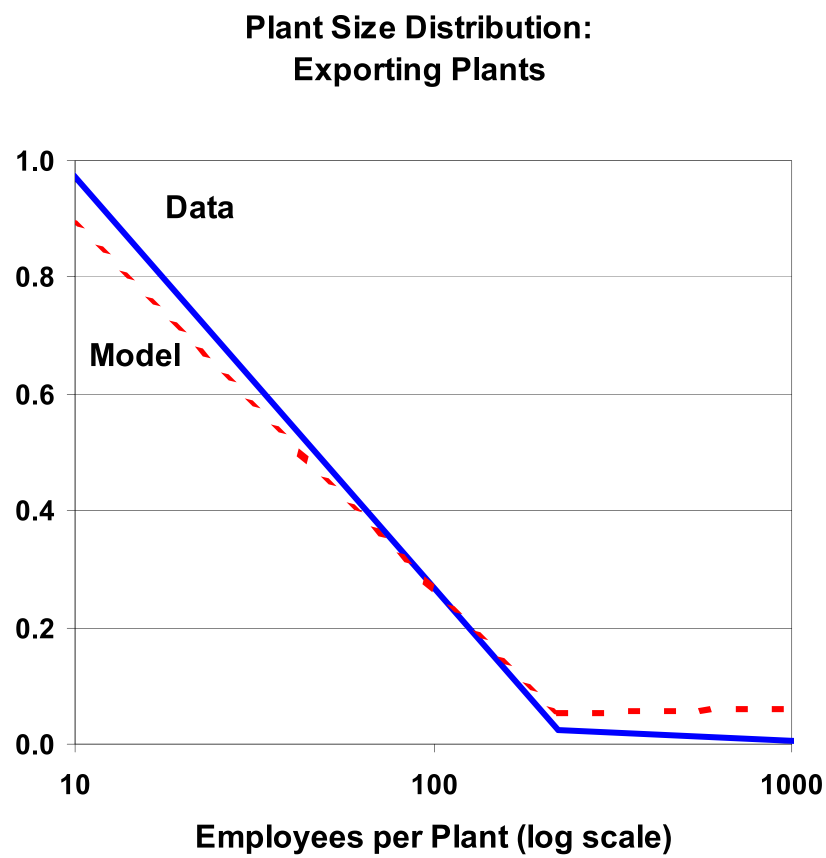
Other Parameters

- Distribution over new plants:

$$F_{\kappa}(\phi) = \frac{1}{\phi^{\theta_{\phi}}} \qquad F_{\phi}(\kappa) = \frac{1}{(\bar{\kappa} - \kappa)^{\theta_{\kappa}}}$$

- $\bar{\kappa}$, $\bar{\phi}$, ν, $\theta_{\phi}, \theta_{\kappa}$ jointly determine:
  - Average plant size (12 employees)
  - Standard deviation of plant sizes (892)
  - Average exporting plant size (15 employees)
  - Standard deviation of exporting plant sizes (912)
  - Fraction of production that is exported (9%)


Plant Size Distribution:
All Plants
1.0
0.8
0.6
0.4
0.2
0.0
1
10
100
1000
Data
Model
Employees per Plant (log scale)


Plant Size Distribution:
Exporting Plants
1.0
0.8
0.6
0.4
0.2
0.0
10
100
1000
Data
Model
Employees per Plant (log scale)

Productivity Process

- Two shocks, low and high:

$$z_i = 1 - \varepsilon$$

$$z_i = 1 + \varepsilon$$

- Countries have symmetric processes with Markov Matrix

$$\Lambda_i = \begin{bmatrix} \bar{\lambda} & 1-\bar{\lambda} \\ 1-\bar{\lambda} & \bar{\lambda} \end{bmatrix}$$

- ε: standard deviation of the U.S. Solow Residuals (1.0%)
- $\bar{\lambda}$: autocorrelation of the U.S. Solow Residuals (0.90)

How does Trade Liberalization Differ from Business Cycles?

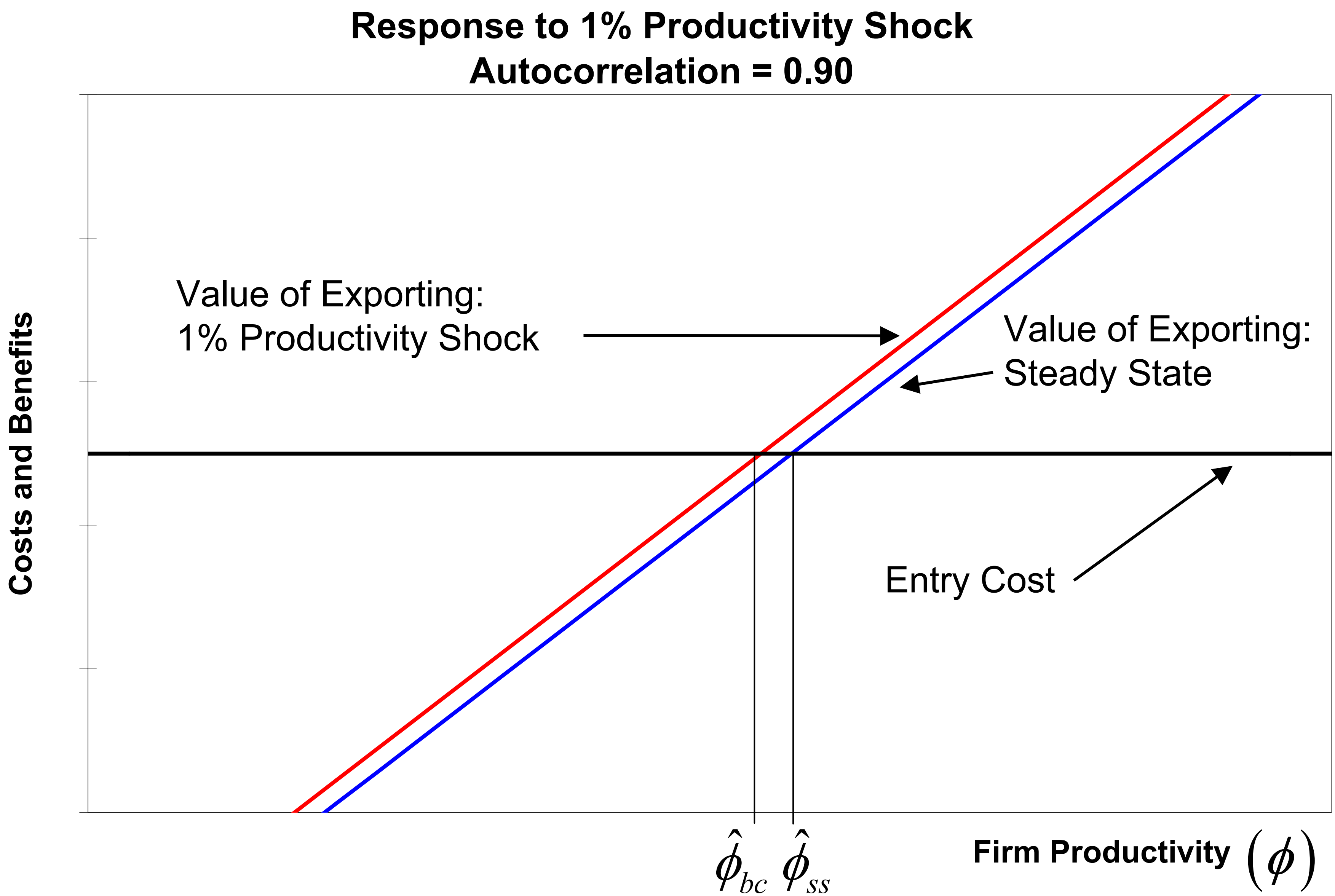
- Trade liberalization
  - Permanent changes
  - Large magnitudes

- Business cycles
  - Persistent, but not permanent changes
  - Small magnitudes

Developing Intuition: Persistent vs. Permanent Shocks

- 1% positive productivity shock in foreign country
    - Shock is persistent – autocorrelation of 0.90

- 1% decrease in tariffs
    - Change in tariffs is permanent



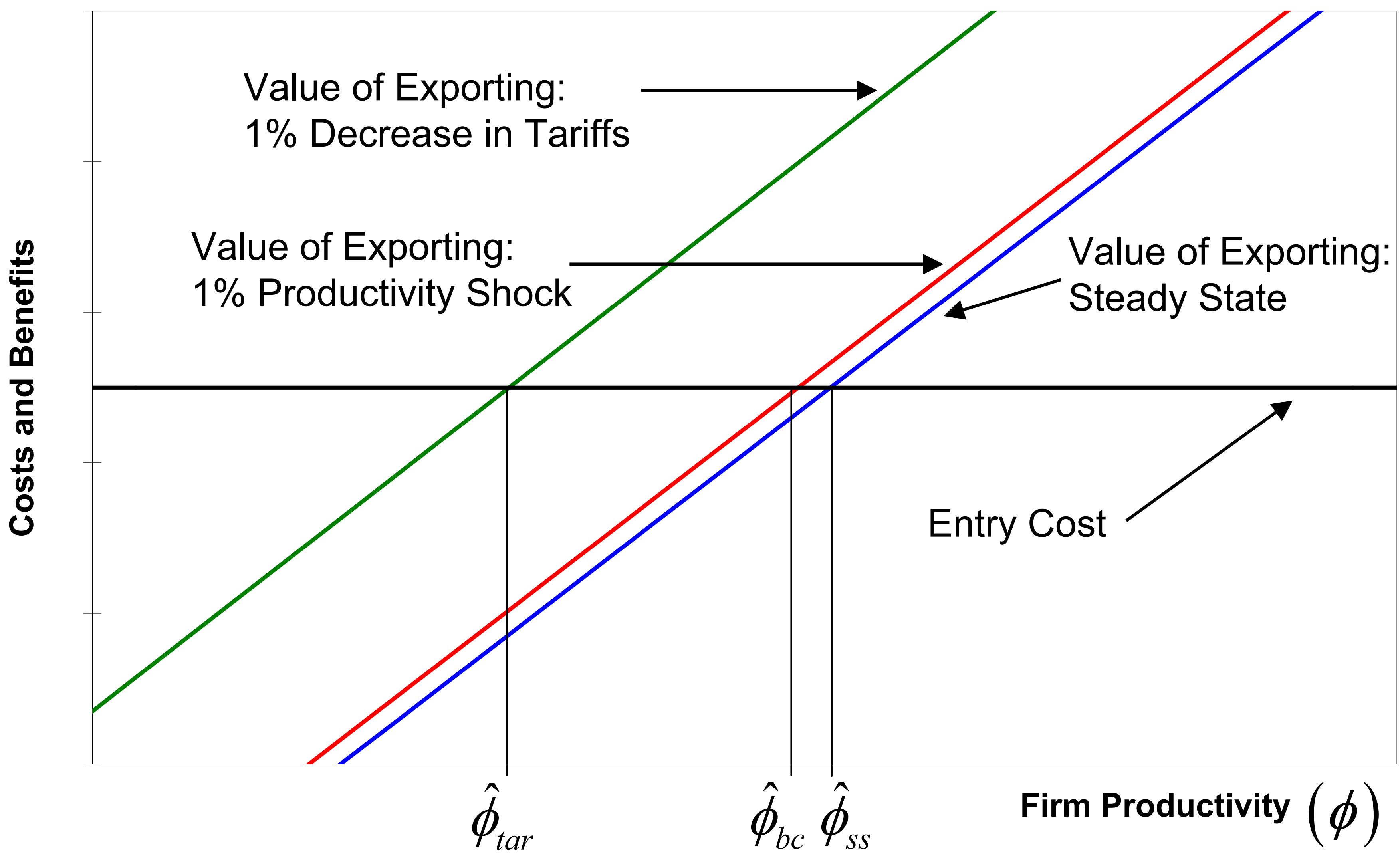
Response to 1% Productivity Shock
Autocorrelation = 0.90
Costs and Benefits
Value of Exporting:
1% Productivity Shock
Value of Exporting:
Steady State
Entry Cost
$\hat{\phi}_{bc}$ $\hat{\phi}_{ss}$
Firm Productivity (ϕ)

Response to a 1% Foreign Productivity Shock

Increase in imports on intensive margin	=	1.89%
Increase in imports on extensive margin	=	0.16%
Total increase in imports	=	2.05%
Change in consumption of home goods	=	-0.10%

$$\frac{\text{\% Change Imports/Dom. Cons.}}{\text{\% Change Price}} = \frac{2.17}{0.99} = 2.19$$

Response to 1% Permanent Decrease in Tariffs



Response to a 1% Tariff Reduction

Increase in imports on intensive margin	=	1.42%
Increase in imports on extensive margin	=	3.04%
Total increase in imports	=	4.46%
Change in consumption of home goods	=	-0.33%

$$\frac{\text{\% Change Imports/Dom. Cons.}}{\text{\% Change Tariff}} = \frac{4.81}{1.00} = 4.81$$

Quantitative Results

- Two experiments

- Trade liberalization
  - Eliminate 15% tariff
  - Compute elasticity across tariff regimes

- Time series regressions
  - Use model to generate simulated data
  - Estimate elasticity as in the literature

Trade Liberalization Elasticity

Variable	Entry Costs (% change)	No Entry Costs (% change)
Exports	87.1	30.5
Imports/Dom. Cons.	93.0	32.2
Exporting Plants	37.7	0.0
Implied Elasticity	6.2	2.1

Elasticity in the Time Series

- Simulate: produce price/quantity time series
- Regress:

$$\log\left(C_{f,t} / C_{h,t}\right) = \alpha + \sigma \log\left(p_{h,t} / p_{f,t}\right) + \varepsilon_t$$

Parameter	Estimate
α (standard error)	-0.015 (6.36e-04)
σ (standard error)	1.39 (0.06)
R- squared	0.30

Conclusion

- Gap between dynamic macro models and trade models
  - Partially closes the gap
  - Modeling firm behavior as motivated by the data
  - Step towards better modeling of trade policy

- Single model can account for the elasticity puzzle
  - Time series elasticity of 1.4
  - Trade liberalization elasticity of 6.2

3. Models of trade with heterogeneous firms imposed fixed costs on firms that decide to export. The focus is on the decision to export. The theory and the data indicate that there is a lot of room for focusing on the decision to import.

A. Ramanarayanan, "International Trade Dynamics with Intermediate Inputs," University of Minnesota, 2006. http://www.econ.umn.edu/~tkehoe/papers/Ramanarayan.pdf.

Motivation

Dynamics of international trade flows

Long-run: Large, gradual changes
(tariff reform)

Short-run: Small changes
(fluctuations in relative prices)

Standard Theory: does not capture difference

Constant elasticity of substitution between imports and domestic goods

Question

What accounts for slow-moving dynamics of international trade flows?

This Paper's Answer

Trade in intermediate inputs

Costly, irreversible importing decision at producer-level

Previous Literature's Answers

Lags or costs of adjustment: contracting / distribution
Parameterize to generate slow-moving dynamics

This paper's contribution:
Model mechanism based on micro-level evidence

Quantitative test of theory:
Endogenous aggregate dynamics in line with data

Significance of Results

Effects of trade reform
1. Timing and magnitude of trade growth
2. Welfare gains

Data: Aggregate Dynamics

Armington (1969) elasticity: elasticity of substitution between aggregate imported and domestic goods

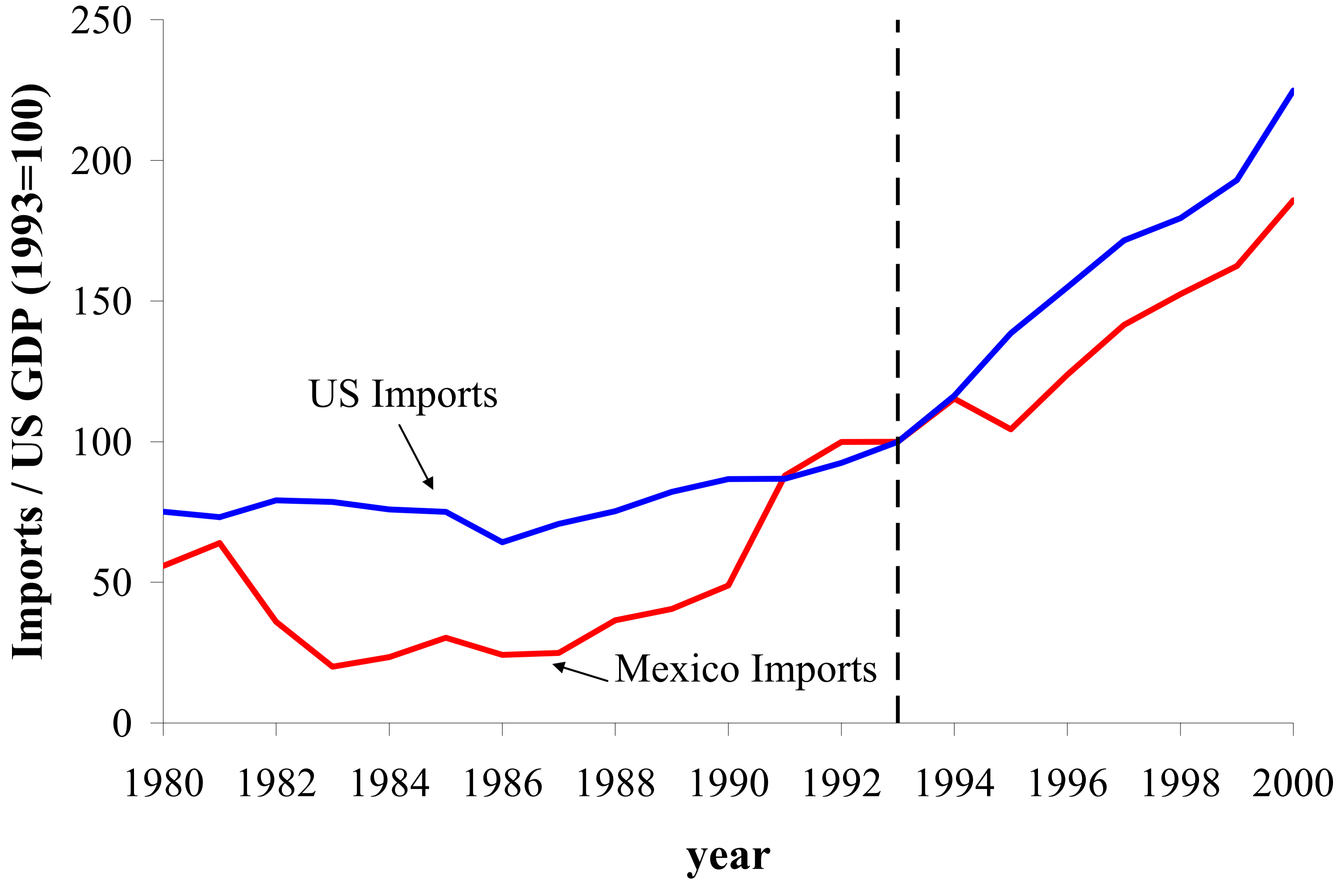
Low estimates from time-series data (< 2)

High estimates from trade liberalization (> 6)

Data: Aggregate Dynamics

Gradual increase in trade after liberalization

NAFTA (Jan 1, 1994)



Data: Plant-level

Cross-section

Not all plants use imported intermediate inputs

Importing plants larger than non-importing plants

Panel

Reallocation between importers / non-importers is significant

Data: Plant-level Cross-section

		% use imports	Avg. size ratio to non-importers
Chile	average 1979-86	24.1	3.4
US (Kurz, 2006)	1992	23.8	2.3

Data: Plant-level Dynamics

Decompose changes in aggregate trade volumes

e.g., increase in aggregate imported/total inputs due to:

1. Importers increase ratio (*Within*) +
2. Importers expand, non-importers shrink (*Between*) +
3. Interaction between the two (*Cross*) +
4. Non-importers switch to importing (*Switch*) +
5. Higher proportion of new entrants are importers (*Entry*)

Baily, Hulten, Campbell (1992): productivity growth

Data: Plant-level Dynamics

Imported / Total Intermediate Inputs: Chile, 1979-1986

	TOTAL	Fraction of Total (%)				
		Within	Between	Cross	Switch	Entry
Avg of 1-year changes	-18%	**79**	**26**	**-10**	**3**	**2**
7-year change	-77%	**74**	**42**	**-30**	**5**	**10**

Model

Heterogeneous Plants

- Produce using intermediate inputs
- Importing costly, irreversible
- Trade growth through *Between* and *Entry* margins

2-country, 2-good real business cycle model

- Technology shocks: short-run changes
- Tariff reduction: long-run changes

Time and Uncertainty

Dates $t = 0, 1, 2, \ldots$

Event at date *t*: s_t. State at date *t*: $s^t = (s_0, s_1, \ldots, s_t)$.

$$\Pr(s_t \mid s^{t-1}) = \phi(s_t \mid s_{t-1})$$
$$\tilde{\phi}(s^t) = \phi(s_t \mid s_{t-1})\phi(s_{t-1} \mid s_{t-2})\cdots\phi(s_1 \mid s_0)$$

Commodities and prices are functions $x(s^t) \to x_t$

Technology shocks $A(s^t), A^*(s^t)$

Representative Consumer

Preferences:

$$E\sum_{t=0}^{\infty}\beta^t U(C_t,1-N_t)=\sum_{t=0}^{\infty}\sum_{s^t}\beta^t\tilde{\phi}(s^t)U(C(s^t),1-N(s^t))$$

Budget constraint:

$$C_t+\sum_{s_{t+1}}Q(s^t,s_{t+1})B(s^t,s_{t+1})\leq w_t N_t+B(s^t)+\Pi_t+T_t$$

Consumer owns plants

Plants

Heterogeneous in inherent efficiency z.

Aggregate technology shocks A_t

Within each country, produce homogeneous output

Perfectly competitive, decreasing returns to scale technologies

Two types of decisions

1. Existing plants: static profit maximization
2. New plants: technology choice (import or not)

Plant technologies

Non-importing

$$f_d(n,d;z) = z^{1-\alpha-\theta} d^{\alpha} n^{\theta}$$

Importing

$$f_m(n,d,m;z) = z^{1-\alpha-\theta}\left(\gamma \min\left\{\frac{d}{\omega},\frac{m}{1-\omega}\right\}\right)^{\alpha} n^{\theta}$$

$\alpha+\theta<1,\ \omega<1,$

γ : efficiency gain from importing

Static profit maximization

Non-importing plant with efficiency z operating at date t

$$\pi_{dt}(z) = \max_{n,d} A_t f_d(n,d;z) - w_t n - d$$

Importing plant

$$\pi_{mt}(z) = \max_{n,d,m} A_t f_m(n,d,m;z) - w_t n - d - (1+\tau) p_t m$$

No dependence on date of entry

Plant technologies, costs

Non-importing

$$f_d(n,d;z) = z^{1-\alpha-\theta} d^{\alpha} n^{\theta}$$

Price of intermediate input: 1

Importing

$$f_m(n,d,m;z) = z^{1-\alpha-\theta} \left(\gamma \min\left\{ \frac{d}{\omega}, \frac{m}{1-\omega} \right\} \right)^{\alpha} n^{\theta}$$

Price of composite intermediate input: $\dfrac{1}{\gamma}(\omega + (1+\tau)p_t(1-\omega))$

Plant technologies, costs

Importing technology is more cost-efficient if

$$\gamma > \omega + (1+\tau) p_t (1-\omega)$$

Depends on equilibrium price p_t

Estimate γ from plant data

Check that inequality holds along equilibrium path

Dynamic problem: Timing

Plant pays cost κ_e to get a draw of z from distribution g

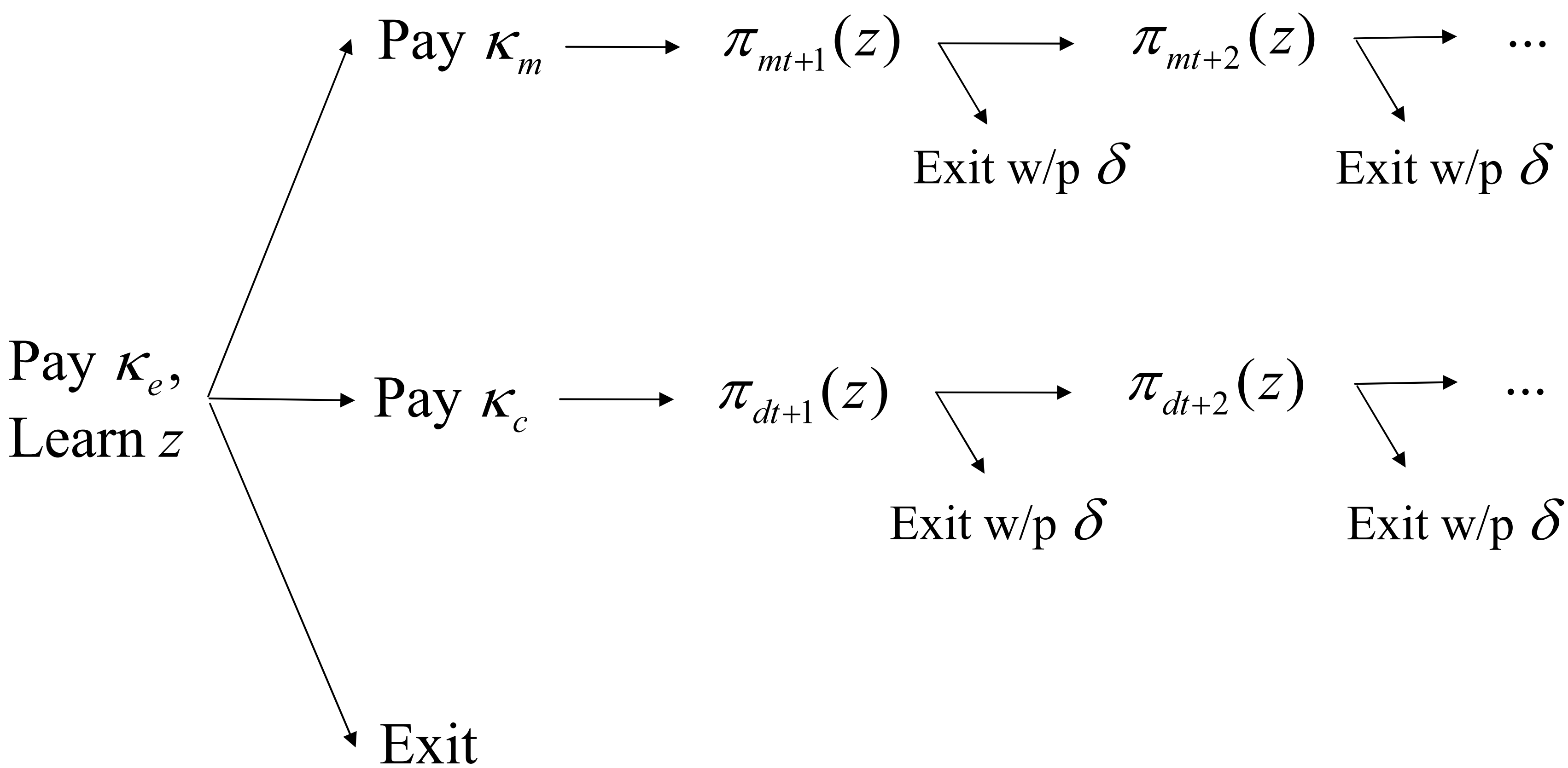
Decide whether to start producing or exit

Pay sunk investment
κ_c to use non-importing technology, or
κ_m to use importing technology
$\kappa_m > \kappa_c$

Face static profit maximization problem each period

Probability δ of exit after production each period

Timing: Plant Entering at date *t*



Dynamic Problem: Plant entering at date *t*

Present values of static profits:

$$V_{dt}(z) = E_t \sum_{k=1}^{\infty} (1-\delta)^{k-1} P_{t,t+k} \pi_{dt+k}(z)$$

$$V_{mt}(z) = E_t \sum_{k=1}^{\infty} (1-\delta)^{k-1} P_{t,t+k} \pi_{mt+k}(z)$$

with $P_{t,t+k} = \beta^k \frac{U_{Ct+k}}{U_{Ct}}$ (consumer owns plants)

Technology Choice

$$V_t(z) = \max\left\{0, -\kappa_c + V_{dt}(z), -\kappa_m + V_{mt}(z)\right\}$$

Produce using non-importing technology if

$$-\kappa_c + V_{dt}(z) > \max\left\{0, -\kappa_m + V_{mt}(z)\right\}$$

Produce using importing technology if

$$-\kappa_m + V_{mt}(z) > \max\left\{0, -\kappa_c + V_{dt}(z)\right\}$$

Otherwise exit

Technology Choice

$V_{dt}(z)$ and $V_{mt}(z)-V_{dt}(z)$ increasing in z

Cutoffs $\hat{z}_{dt}$ and $\hat{z}_{mt}$,

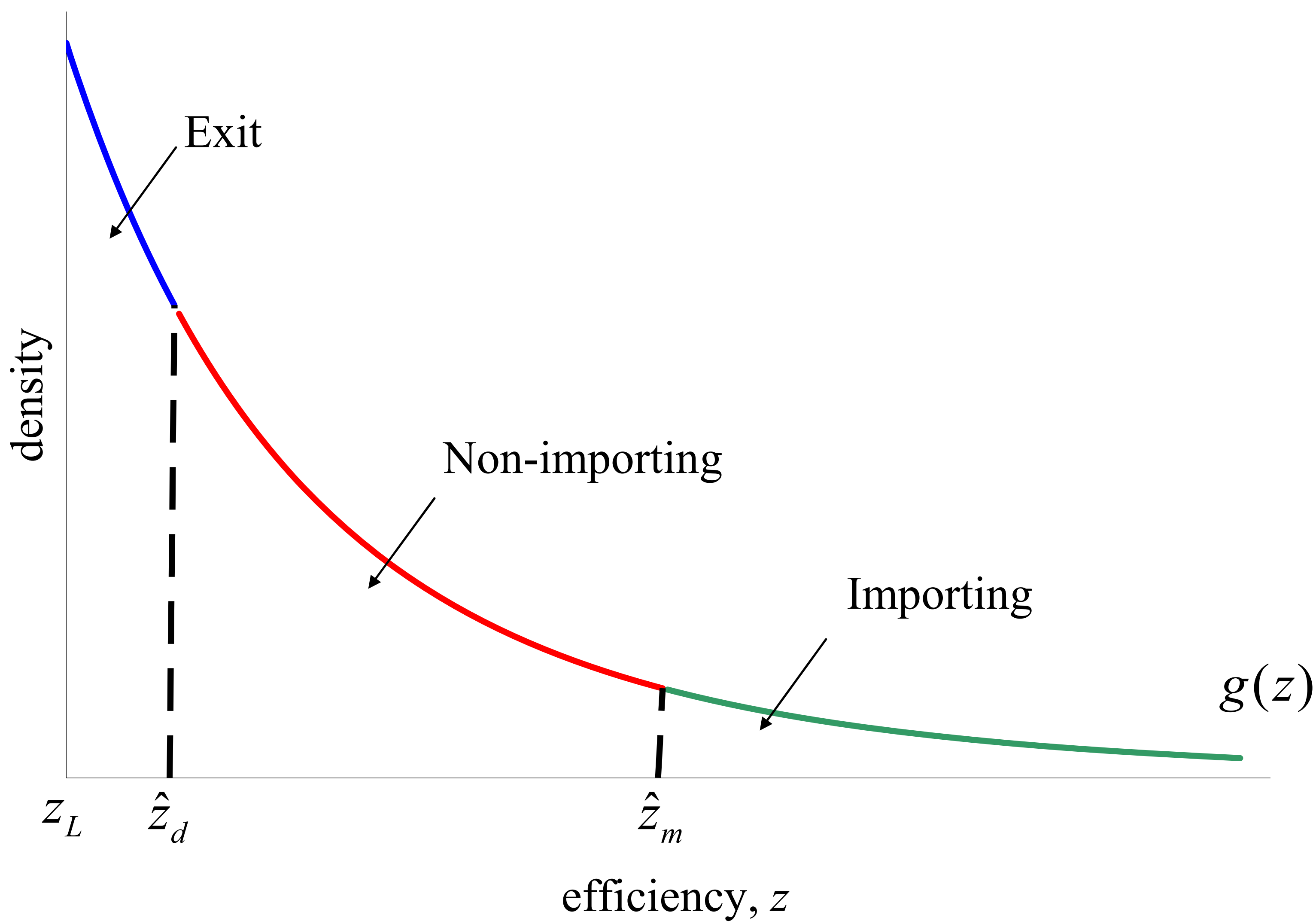
$$V_{dt}(\hat{z}_{dt})=\kappa_c$$
$$V_{mt}(\hat{z}_{mt})-V_{dt}(\hat{z}_{mt})=\kappa_m$$

Use importing technology if $z\in[\hat{z}_{mt},\infty)$

Use non-importing technology if $z\in[\hat{z}_{dt},\hat{z}_{mt})$

Otherwise exit

Technology Choice: cutoffs



Equilibrium Conditions: Plant Dynamics

$\mu_{dt}(z)$: Mass of non-importing plants, efficiency z at date t.

X_t: Mass of entrants at date t (start producing at date $t+1$)

Dynamics of distribution:

$$\mu_{dt+1}(z) = \begin{cases} (1-\delta)\mu_{dt}(z) + X_t g(z) \text{ if } z \in [\hat{z}_{dt}, \hat{z}_{mt}] \\ (1-\delta)\mu_{dt}(z) \text{ otherwise} \end{cases}$$

Equilibrium Conditions: Plant Dynamics

$\mu_{mt}(z)$: Mass of importing plants, efficiency z at date t.

X_t: Mass of entrants at date t (start producing at date $t+1$)

Dynamics of distribution:

$$\mu_{mt+1}(z) = \begin{cases} (1-\delta)\mu_{mt}(z) + X_t g(z) \text{ if } z > \hat{z}_{mt} \\ (1-\delta)\mu_{mt}(z) \text{ otherwise} \end{cases}$$

Equilibrium Conditions: Feasibility

Goods

$$C_t + X_t \left(\kappa_e + \kappa_c \int_{\hat{z}_{dt}}^{\hat{z}_{mt}} g(z)\mathrm{d}z + \kappa_m \int_{\hat{z}_{mt}}^{\infty} g(z)\mathrm{d}z \right)$$
$$+ \int d_{dt}(z)\mu_{dt}(z)\mathrm{d}z + \int d_{mt}(z)\mu_{mt}(z)\mathrm{d}z + \int m_t^*(z)\mu_{mt}^*(z)\mathrm{d}z$$
$$= \int y_{dt}(z)\mu_{dt}(z)\mathrm{d}z + \int y_{mt}(z)\mu_{mt}(z)\mathrm{d}z$$

Labor

$$\int n_{dt}(z)\mu_{dt}(z)\mathrm{d}z + \int n_{mt}(z)\mu_{mt}(z)\mathrm{d}z = N_t$$

Equilibrium Conditions: Free Entry and Asset Market

Expected value of entry is

$$V_{et} = -\kappa_e + \int_{z_L}^{\infty} V_t(z) g(z) \mathrm{d}z$$

Free Entry:

$$V_{et} \leq 0, \quad = \text{ if } X_t > 0$$

Asset Market Clearing:

$$B(s^t) + B^*(s^t) = 0$$

Aggregation

To solve equilibrium conditions, need $\mu_{dt}(\bullet),\ \mu_{mt}(\bullet)$

For example: $\int n_{dt}(z)\mu_{dt}(z)\mathrm{d}z$

Let $Z_{dt} = \int z\mu_{dt}(z)\mathrm{d}z$

Plants make decisions proportional to efficiency z:

$$n_{dt}(z) = \tilde{n}_{dt} \times z$$

So,

$$\int n_{dt}(z)\mu_{dt}(z)\mathrm{d}z = \tilde{n}_{dt} Z_{dt}$$

Aggregation

Replace $\mu_{dt}(\bullet)$ with Z_{dt} as state variable:

$$\mu_{dt+1}(z) = \begin{cases} (1-\delta)\mu_{dt}(z) + X_t g(z) \text{ if } z \in [\hat{z}_{dt}, \hat{z}_{mt}] \\ (1-\delta)\mu_{dt}(z) \text{ otherwise} \end{cases}$$

$$\Downarrow$$

$$Z_{dt+1} = (1-\delta)Z_{dt} + X_t \int_{\hat{z}_{dt}}^{\hat{z}_{mt}} g(z)\mathrm{d}z$$

Same with $\mu_{mt}(\bullet)$, $\mu^*_{dt}(\bullet)$, $\mu^*_{mt}(\bullet)$

Analysis of Model

1. Aggregate imported / domestic intermediate ratio – what determines substitutability?

    Static allocation across plants

    Investment decisions of new plants

2. Quantitative analysis

    Parameterization

    Business Cycle simulation – short-run elasticity

    Trade Reform – long-run elasticity; speed of trade growth

Import / domestic ratio

Plant level:

Non-importing plant: fixed, *zero*.

Importing plant: fixed, $\dfrac{m_t(z)}{d_{mt}(z)} = \dfrac{1-\omega}{\omega}$

Import / domestic ratio

Aggregate:

$$\frac{M_t}{D_{mt}+D_{dt}} = \frac{\tilde{m}_t Z_{mt}}{\tilde{d}_{mt} Z_{mt} + \tilde{d}_{dt} Z_{dt}}$$

$$= \frac{\frac{1-\omega}{\omega}\tilde{d}_{mt} Z_{mt}}{\tilde{d}_{mt} Z_{mt} + \tilde{d}_{dt} Z_{dt}}$$

Increasing in:

$\frac{\tilde{d}_{mt}}{\tilde{d}_{dt}}$: non-importing / importing plant with same z;

$\frac{Z_{mt}}{Z_{dt}}$: mass of importers / non-importers (z-weighted)

Effects of increase in relative price $(1+\tau)p_t$:

1. At date t: allocation between plants,

$$\frac{\tilde{d}_{mt}}{\tilde{d}_{dt}} = \left(\frac{\gamma}{\omega + (1+\tau)p_t(1-\omega)} \right)^{\alpha/(1-\alpha-\theta)}$$

Decreasing in $(1+\tau)p_t$

Importers less profitable; allocated less inputs in equilibrium

Effects of increase in relative price $(1+\tau)p_t$ *if persistent*:

2. At date $t+1$: new plants *entering at date t*,

$$\frac{Z_{mt+1}}{Z_{dt+1}} = \frac{(1-\delta)Z_{mt} + X_t \int_{\hat{z}_{mt}}^{\infty} g(z)\mathrm{d}z}{(1-\delta)Z_{dt} + X_t \int_{\hat{z}_{dt}}^{\hat{z}_{mt}} g(z)\mathrm{d}z}$$

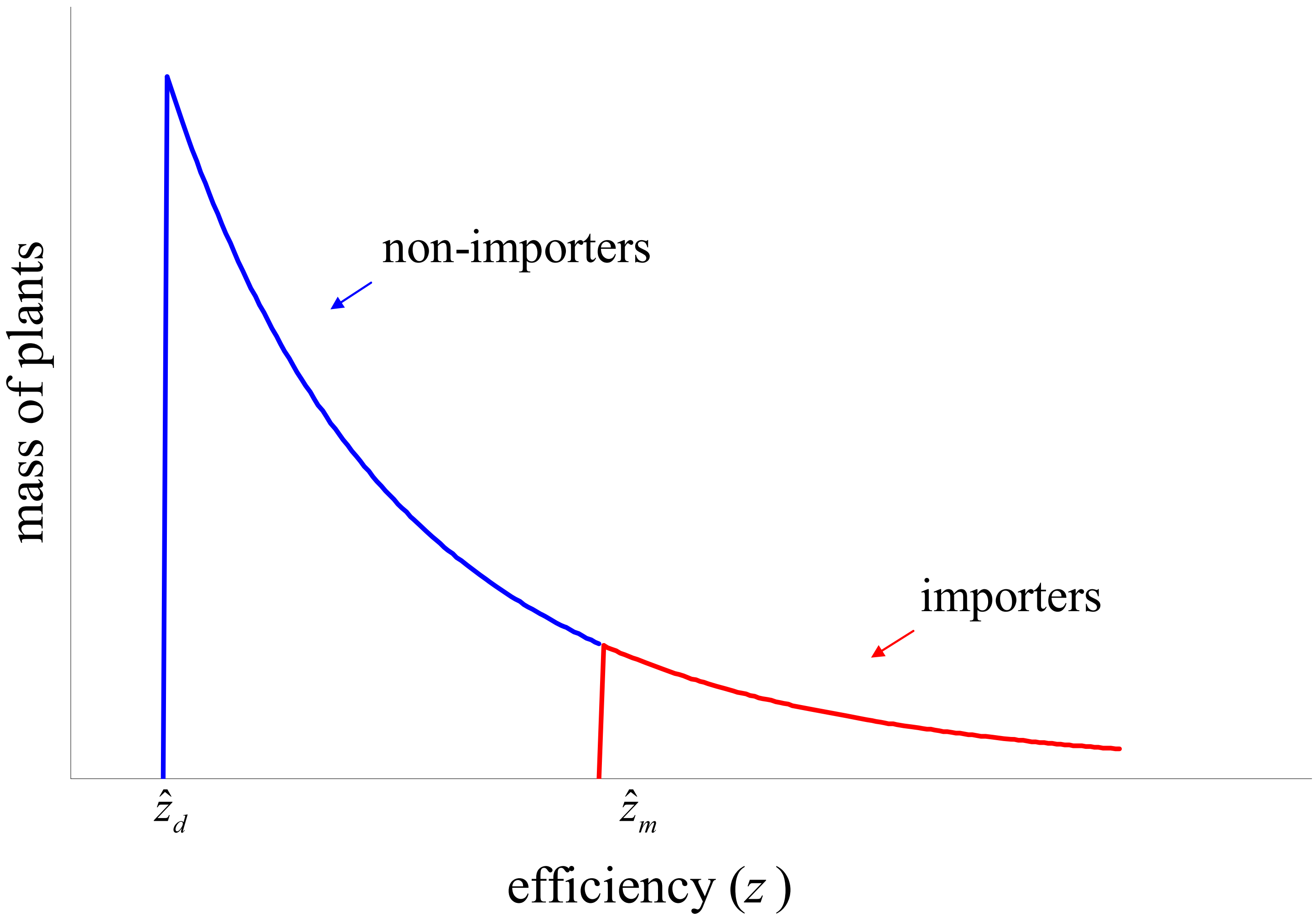
Decreasing in $(1+\tau)p_t$

Importing less profitable; fewer new plants choose importing.

$\hat{z}_{mt}\downarrow$, $\hat{z}_{dt}\uparrow$

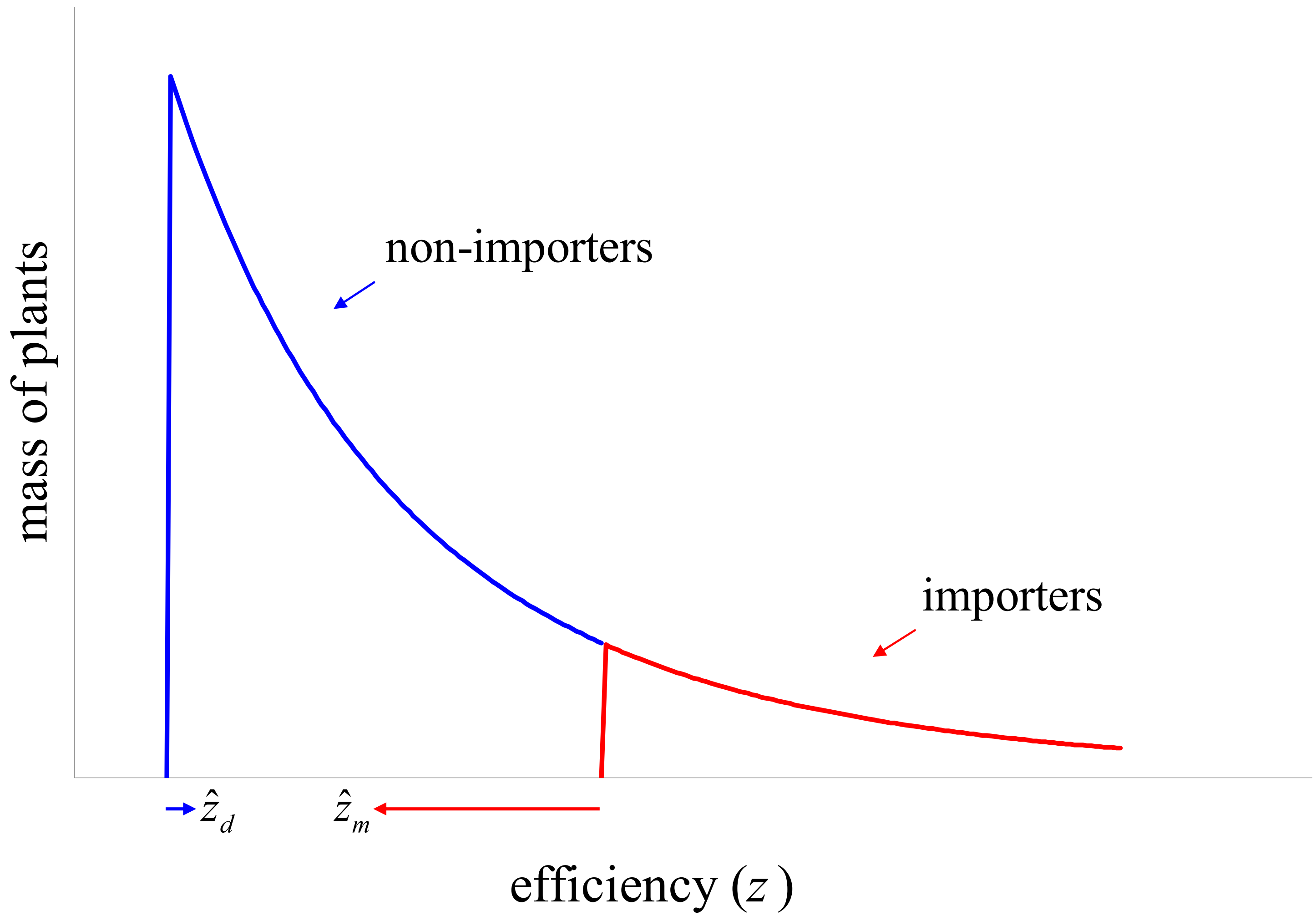
Dynamic effect of increase in $(1+\tau)p_t$

Distribution of Plants, t



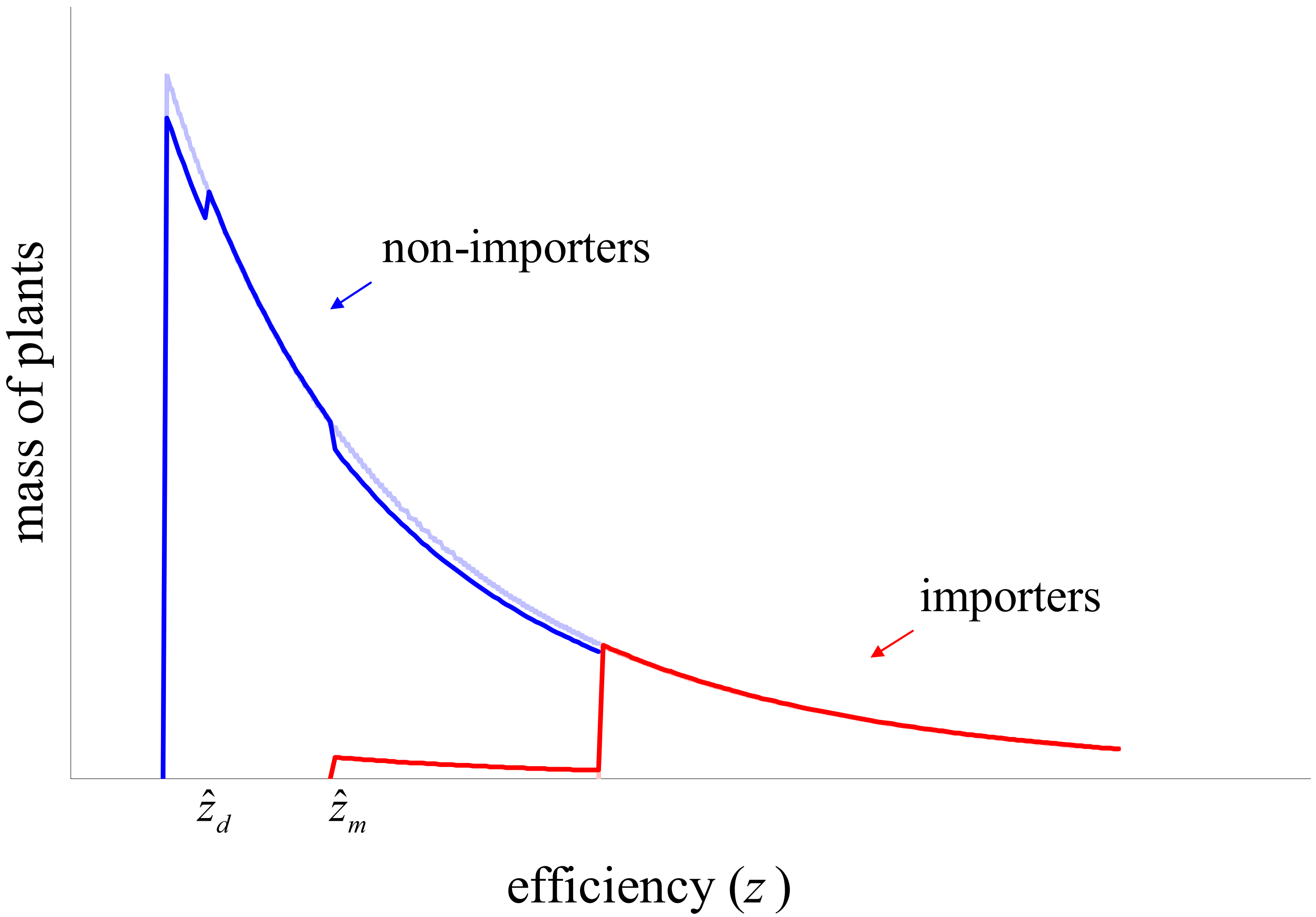
Dynamic effect of increase in $(1+\tau)p_t$

Distribution of Plants, t



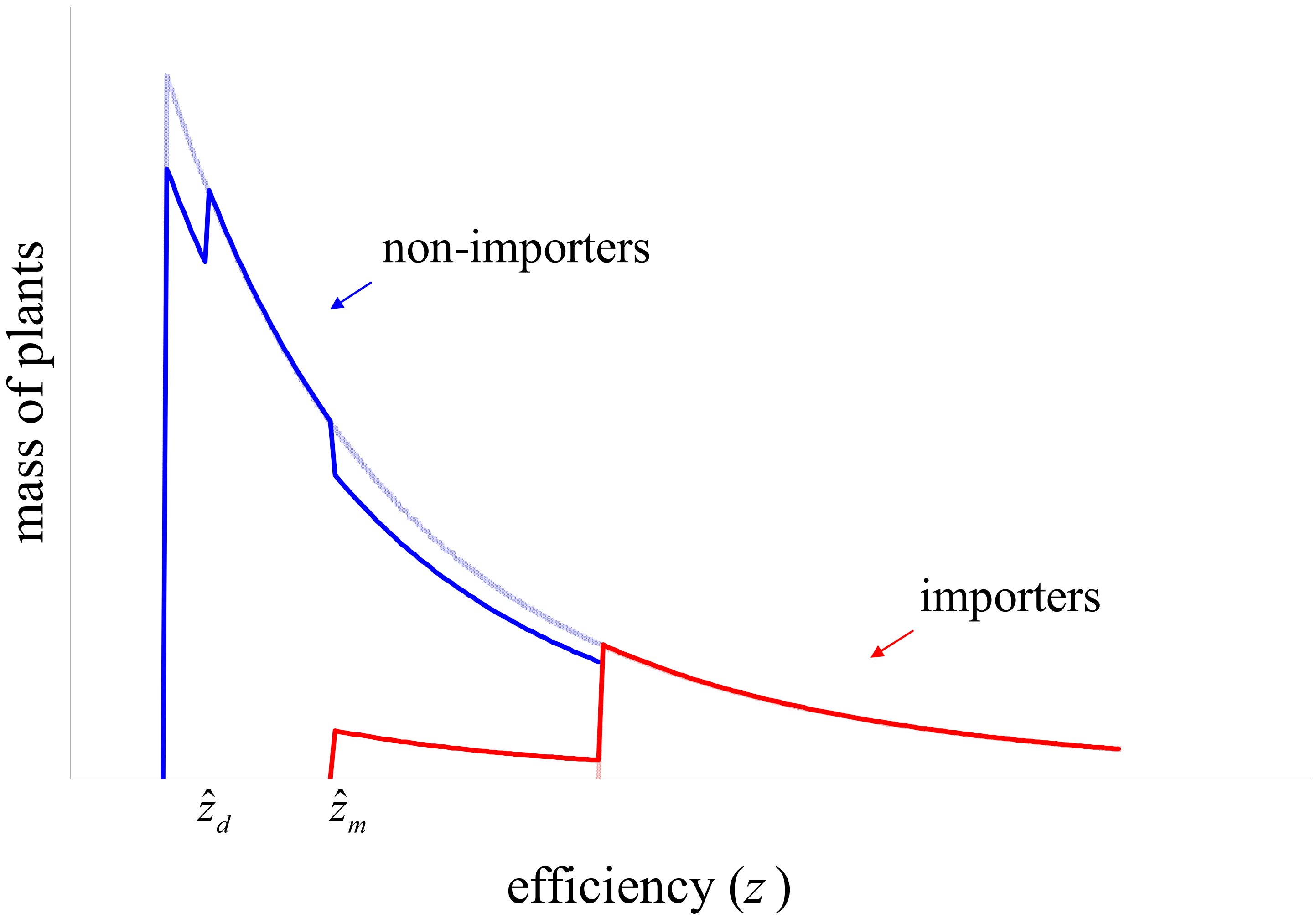
Dynamic effect of increase in $(1+\tau)p_t$

Distribution of Plants, *t+1*



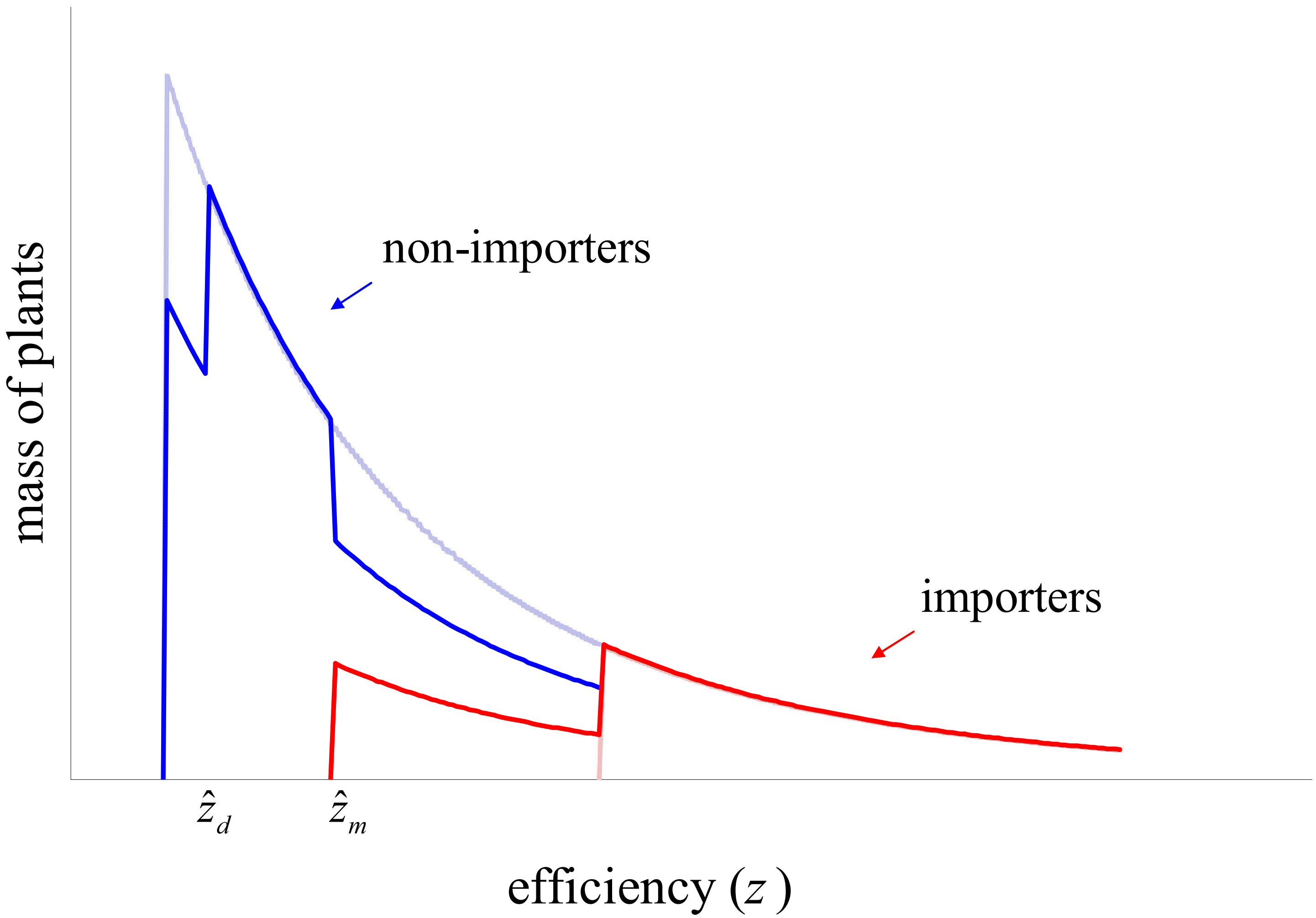
Dynamic effect of increase in $(1+\tau)p_t$

Distribution of Plants, *t+2*



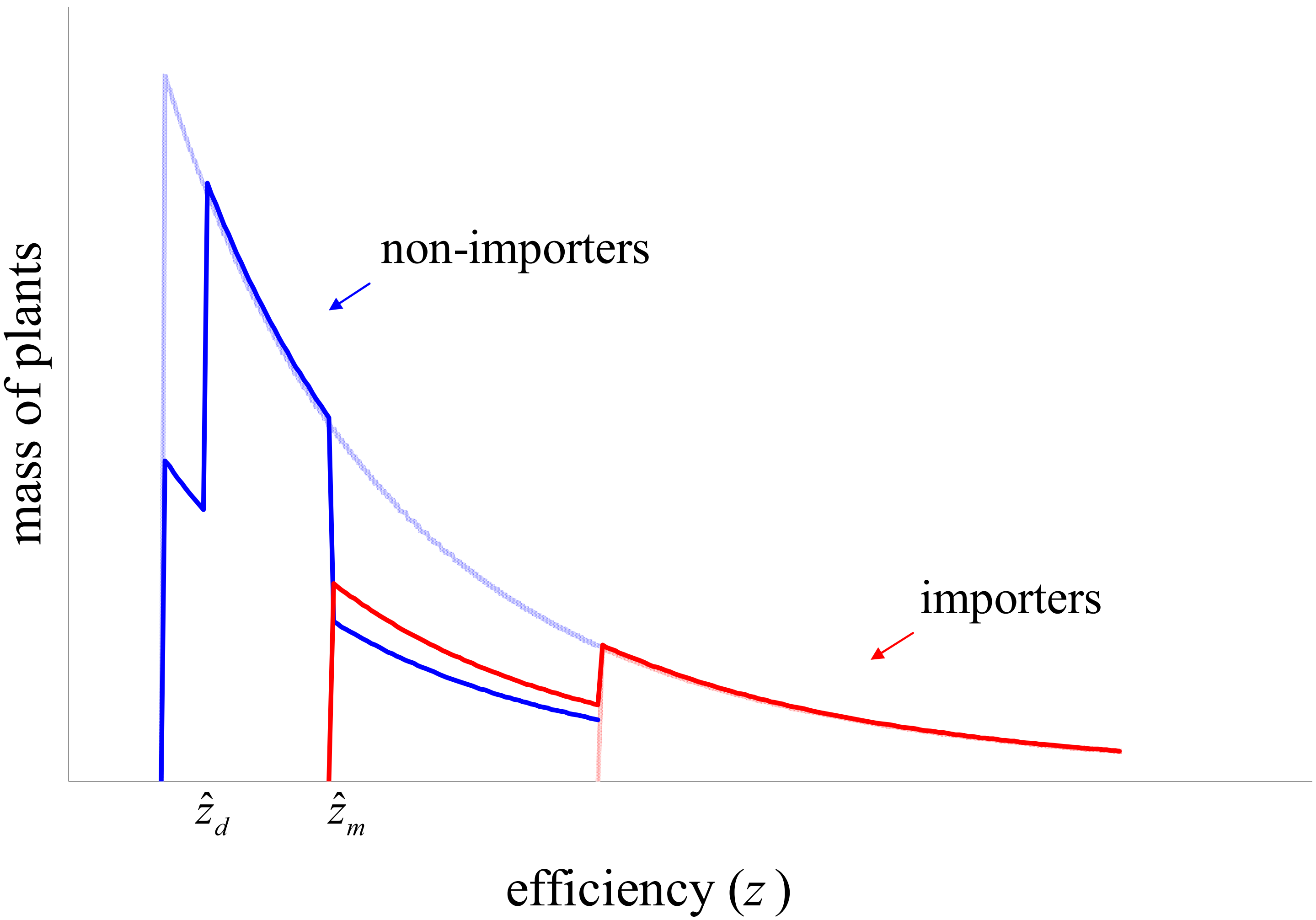
Dynamic effect of increase in $(1+\tau)p_t$

Distribution of Plants, *t+5*



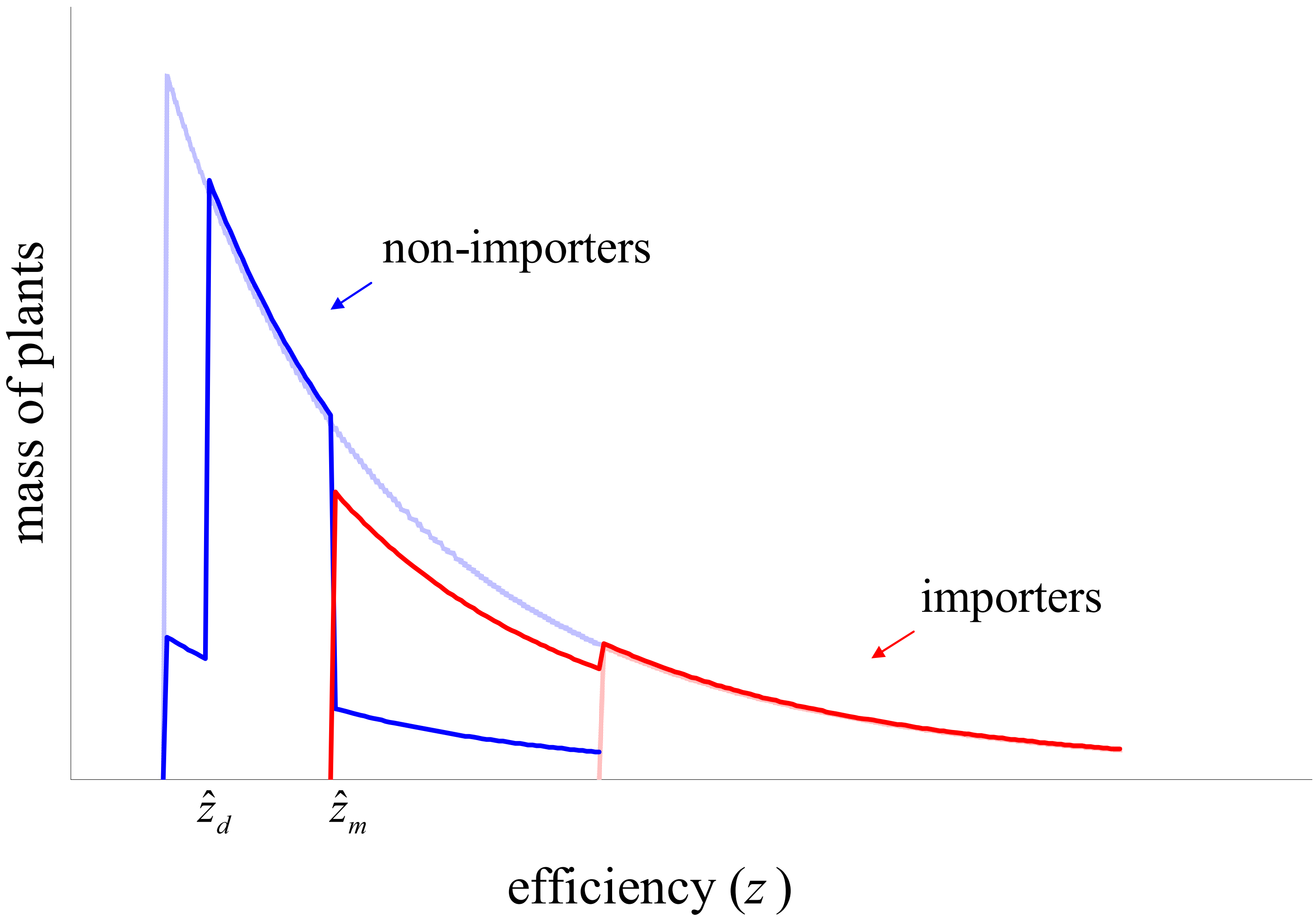
Dynamic effect of increase in $(1+\tau)p_t$

Distribution of Plants, *t+10*



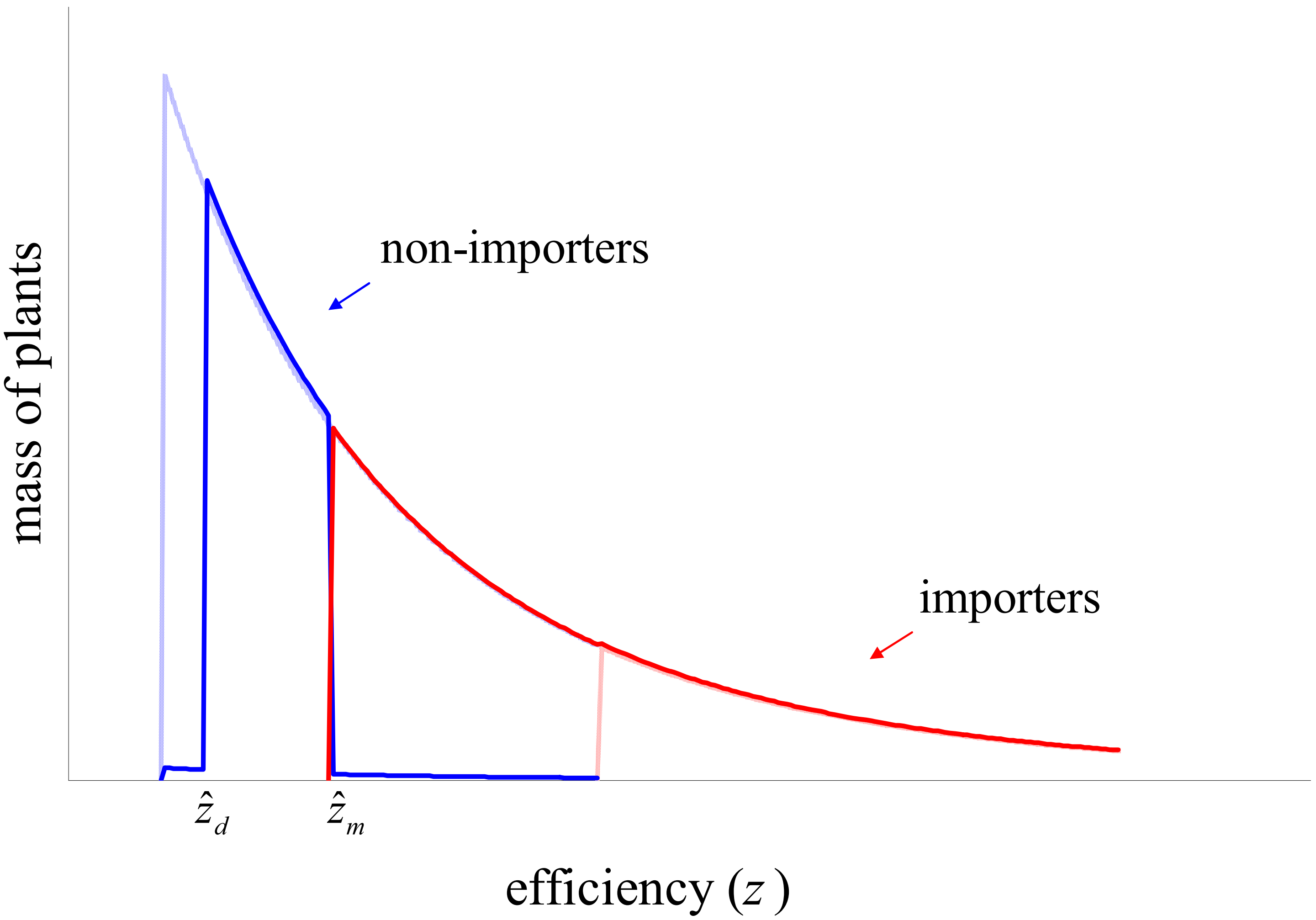
Dynamic effect of increase in $(1+\tau)p_t$

Distribution of Plants, *t+20*



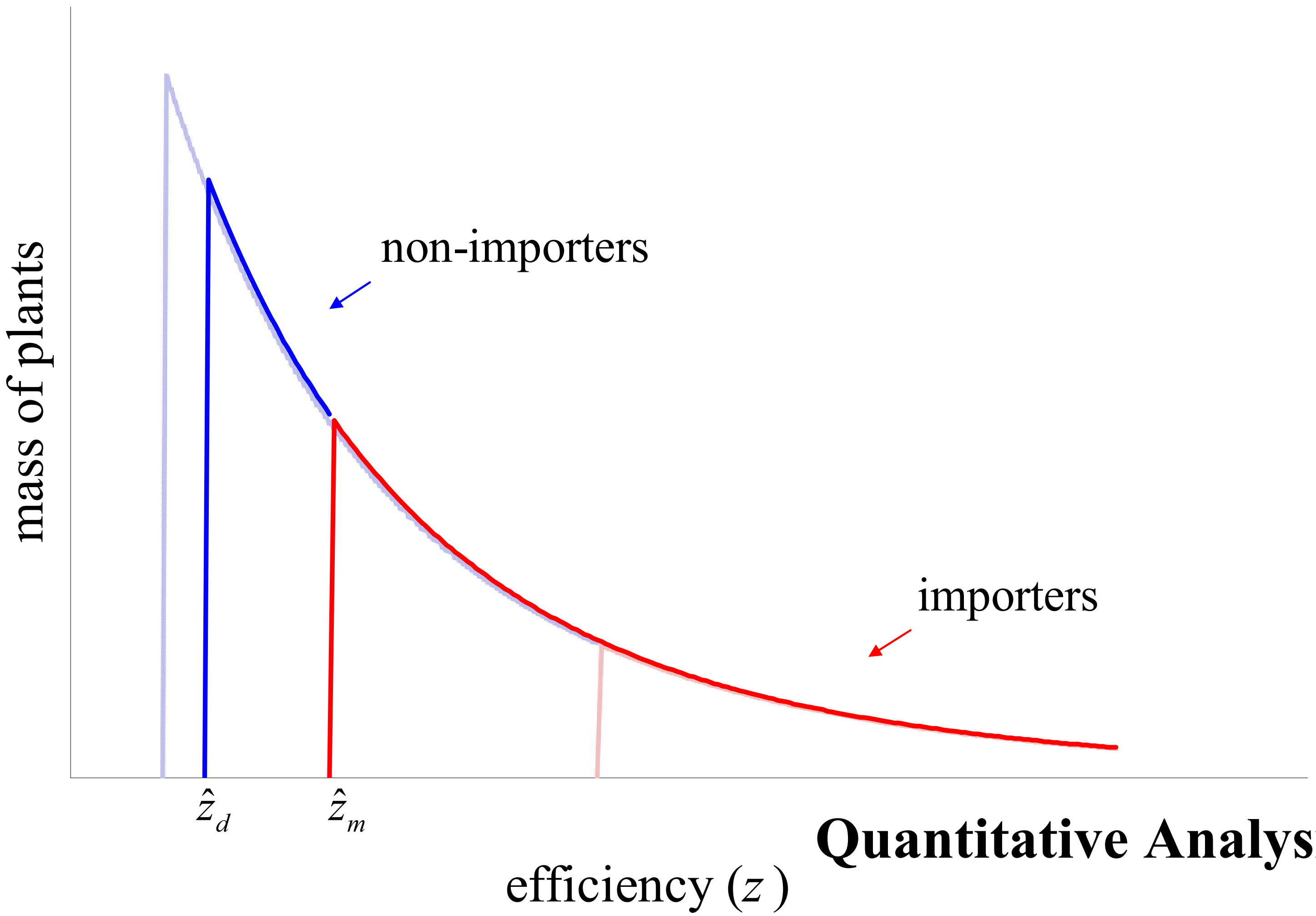
Dynamic effect of increase in $(1+\tau)p_t$

Distribution of Plants, *t+50*



Dynamic effect of increase in $(1+\tau)p_t$

Distribution of Plants, $t+\infty$



Quantitative Analysis

1. Cyclical fluctuations: static reallocation dominant

   Low aggregate elasticity of substitution (~ 1.3)

2. Trade liberalization: gradual change in ratio of plants

   High aggregate elasticity of substitution (~ 7)

   Gradual increase in trade

Conclusions

Heterogeneity and irreversibility in importing at producer level

Slow-moving dynamics at aggregate level

Significant implications for welfare gains from trade reform

4. Models with uniform fixed cost across firms with heterogeneous productivity have implications that are sharply at odds with micro data. A model with increasing costs of accessing a fraction of a market has many of features of models with fixed costs without these undesirable properties.

C. Arkolakis, "Market Access Costs and the New Consumers Margin in International Trade," University of Minnesota, 2006. http://www.econ.umn.edu/~tkehoe/papers/Arkolakis.pdf.

Two Key Observations in Trade Data

Key Observation 1: Who exports and how much

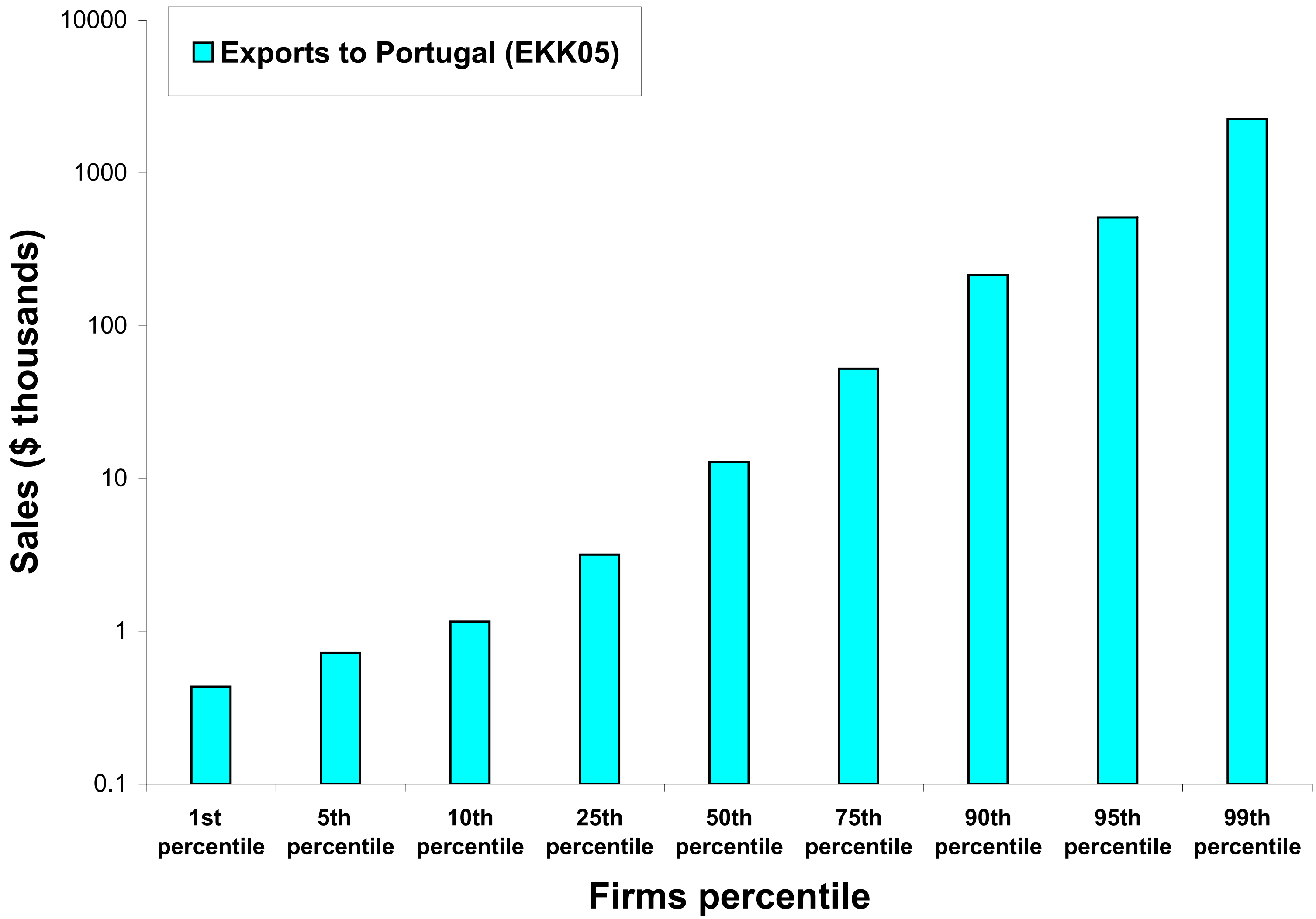
(Eaton Kortum and Kramarz '05)

- Most firms do not export **and**
- Large fraction of firms exporting to each country sell tiny amounts there

Example

- Only 1.9% of French firms export to Portugal **and**
- More than 25% of French firms exporting to Portugal $<$ 10K there

Example: 1.9% of French firms export to Portugal, mostly tiny amounts



Two Key Observations in Trade Data

Key Observation 1: Who exports and how much

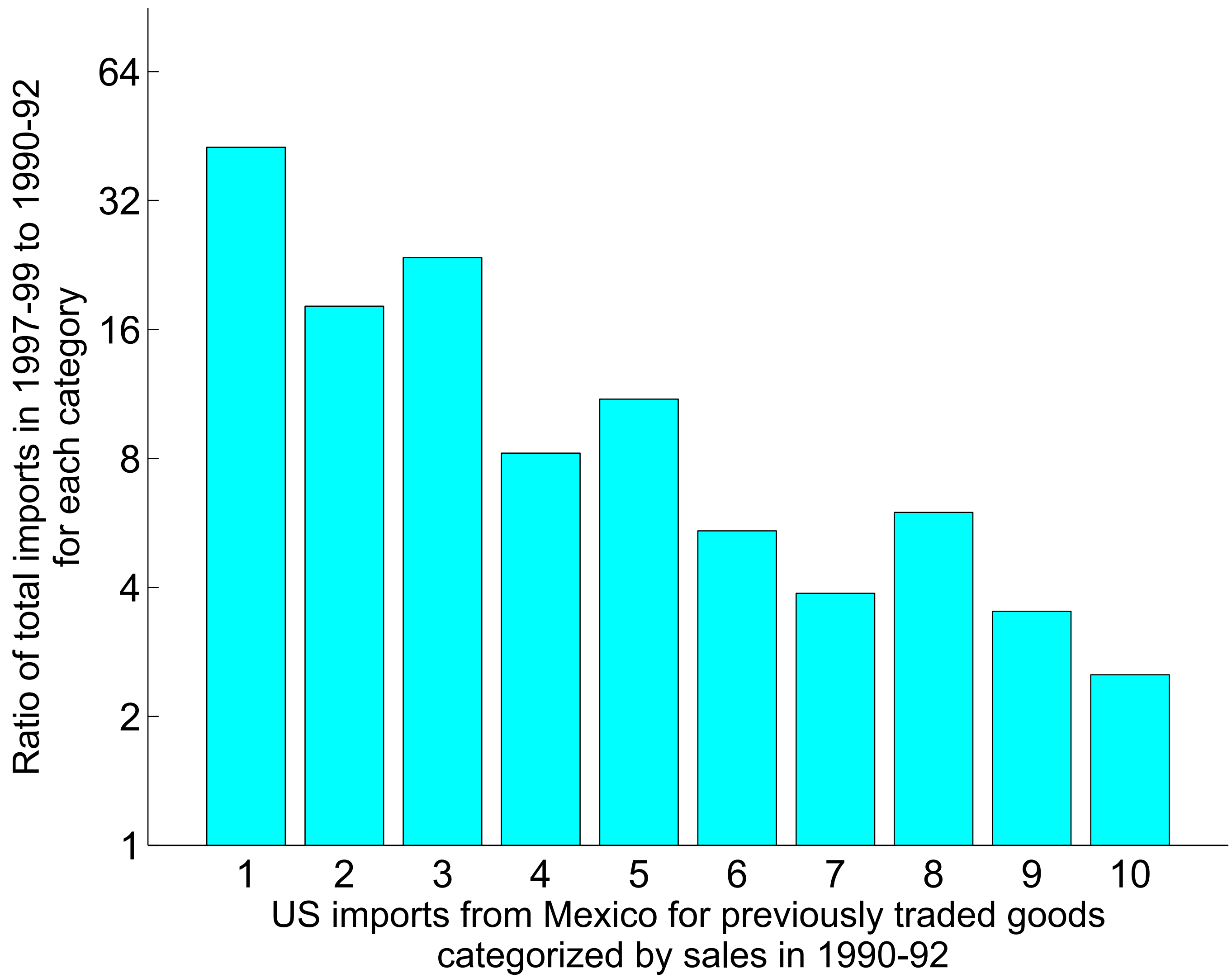
- Most firms do not export **and**
- Large fraction of firms exporting to each country sell tiny amounts there

Key Observation 2: Trading decisions after a trade liberalization

(Kehoe '05, Kehoe & Ruhl '03)

- Large increases in trade for goods with positive but little trade

Example: Large increases in goods with positive but little trade prior NAFTA



Existing Firm-Level Models of Trade

- Models such as those of Melitz '03 and Chaney '06 assume
  - Differentiated products
  - Heterogeneous productivity firms
  - Fixed market access cost of exporting

- Yield 2 puzzles related to 2 key observations

Two Puzzles for Theory with Fixed Costs

- **Puzzle 1: Fixed Cost model needs**
  - Large fixed cost for most firms not to export
  - Small fixed cost for small exporters

- **Puzzle 2: Fixed Cost model relies solely on Dixit-Stiglitz demand**
  - Predicts symmetric changes for all previously positively traded goods

- This paper points out the shortcomings of the Fixed Cost model
  - Proposes **a theory of marketing** that can resolve them

A Theory of Marketing: The Basic Idea

Example: TV channel, each ad randomly reaches 50% of consumers

	1st ad	2nd ad	3rd ad
fraction reached	50%		
cost per consumer	2		

A Theory of Marketing: The Basic Idea

Example: TV channel, each ad randomly reaches 50% of consumers

	1st ad	**2nd ad**	**3rd ad**
fraction reached	50%	+25%	
cost per consumer	2	4	

A Theory of Marketing: The Basic Idea

Example: TV channel, each ad randomly reaches 50% of consumers

	1st ad	**2nd ad**	**3rd ad**
fraction reached	50%	+25%	+12.5%
cost per consumer	2	4	8

A Theory of Marketing: The Basic Idea

Example: TV channel, each ad randomly reaches 50% of consumers

	1st ad	**2nd ad**	**3rd ad**
fraction reached	50%	+25%	+12.5%
cost per consumer	2	4	8

Properties of marketing cost per consumer

a) Costly to reach first consumer

b) Increasing marketing cost per consumer to reach additional consumers

A Theory of Marketing: The Basic Idea

Example: TV channel, each ad randomly reaches 50% of consumers

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fraction reached	50%	+25%	+12.5%
cost per consumer	2	4	8

Properties of marketing cost per consumer

a) Costly to reach first consumer

b) Increasing marketing cost per consumer to reach additional consumers

Model with a)+b) can account for observation 1, namely,

- Most firms do not export **and**
- Large fraction of firms exporting to each country sell tiny amounts there

A Theory of Marketing: The Basic Idea

Example: TV channel, each ad randomly reaches 50% of consumers

	1st ad	**2nd ad**	**3rd ad**
fraction reached	50%	+25%	+12.5%
cost per consumer	2	4	8

Properties of marketing cost per consumer

a) Costly to reach first consumer

b) Increasing marketing cost per consumer to reach additional consumers

c) More ads bring fewer new consumers (saturation)

A Theory of Marketing: The Basic Idea

Example: TV channel, each ad randomly reaches 50% of consumers

	1st ad	**2nd ad**	**3rd ad**
fraction reached	50%	+25%	+12.5%
cost per consumer	2	4	8

Properties of marketing cost per consumer

a) Costly to reach first consumer

b) Increasing marketing cost per consumer to reach additional consumers

c) More ads bring fewer new consumers (saturation)

Model with c) can account for observation 2, namely,

- Large increases in trade for goods with positive but little trade

Model Environment

Builds on Melitz '03 and Chaney '06

- **Countries**
  - Index by i when exporting, j when importing, $i, j = 1, ..., N$
  - L_j consumers
  - Firms sell locally and/or export

Model Environment

Builds on Melitz '03 and Chaney '06

- **Representative Consumers**
  - Sell unit of labor, own shares of domestic firms
  - Symmetric CES Dixit-Stiglitz preferences over continuum of goods
  - Buy the goods they have access to
- **Firms**
  - Indexed by productivity ϕ (drawn from same distribution), nationality i
  - Each sells 1 good
  - Determine probability a consumer in a market has access to their good

Demand Faced by a Type ϕ Firm from Country i

- $n_{ij}(\phi)$: probability a type ϕ firm from i reaches a repres. consumer in j

- Large number of consumers
  - thus firm **reaches** fraction $n_{ij}(\phi)$ of them

- Effective demand for firm ϕ:

$$\underbrace{n_{ij}(\phi) L_j}_{\text{consumers that firm reaches}} \underbrace{\frac{p_{ij}(\phi)^{-\sigma}}{P_j^{1-\sigma}} y_j}_{\text{D-S demand per consumer}}$$

$p_{ij}(\phi)$: price that type ϕ firm from i charges in j, y_j: output (income) per capita

P_j : D-S price aggregator, σ : elasticity of substitution ($\sigma > 1$, demand is elastic)

Firm's Problem

Type ϕ firm from country i solves for each country $j = 1, ..., N$

$$\pi_{ij} = \max_{n_{ij}, p_{ij}, q_{ij}} \; p_{ij} q_{ij} - w_i \frac{\tau_{ij} q_{ij}}{\phi} - w_i f(n_{ij}, L_j)$$

$$s.t. \qquad q_{ij} = n_{ij} L_j \frac{p_{ij}^{-\sigma}}{P_j^{1-\sigma}} y_j, \quad n_{ij} \in [0,1]$$

- Uses production function $q_{ij} = \phi l_{ij}$ to produce good
- τ_{ij} : iceberg cost to ship a unit of good from i to j (in terms of labor)
- $f(n_{ij}, L_j)$: marketing to reach fraction n_{ij} of a population with size L_j

Firm's Problem

- **Result:** Price is the usual markup over unit production cost,

$$p_{ij}(\phi) = \tilde{\sigma}\frac{\tau_{ij} w_j}{\phi},\ \tilde{\sigma} = \frac{\sigma}{\sigma - 1}$$

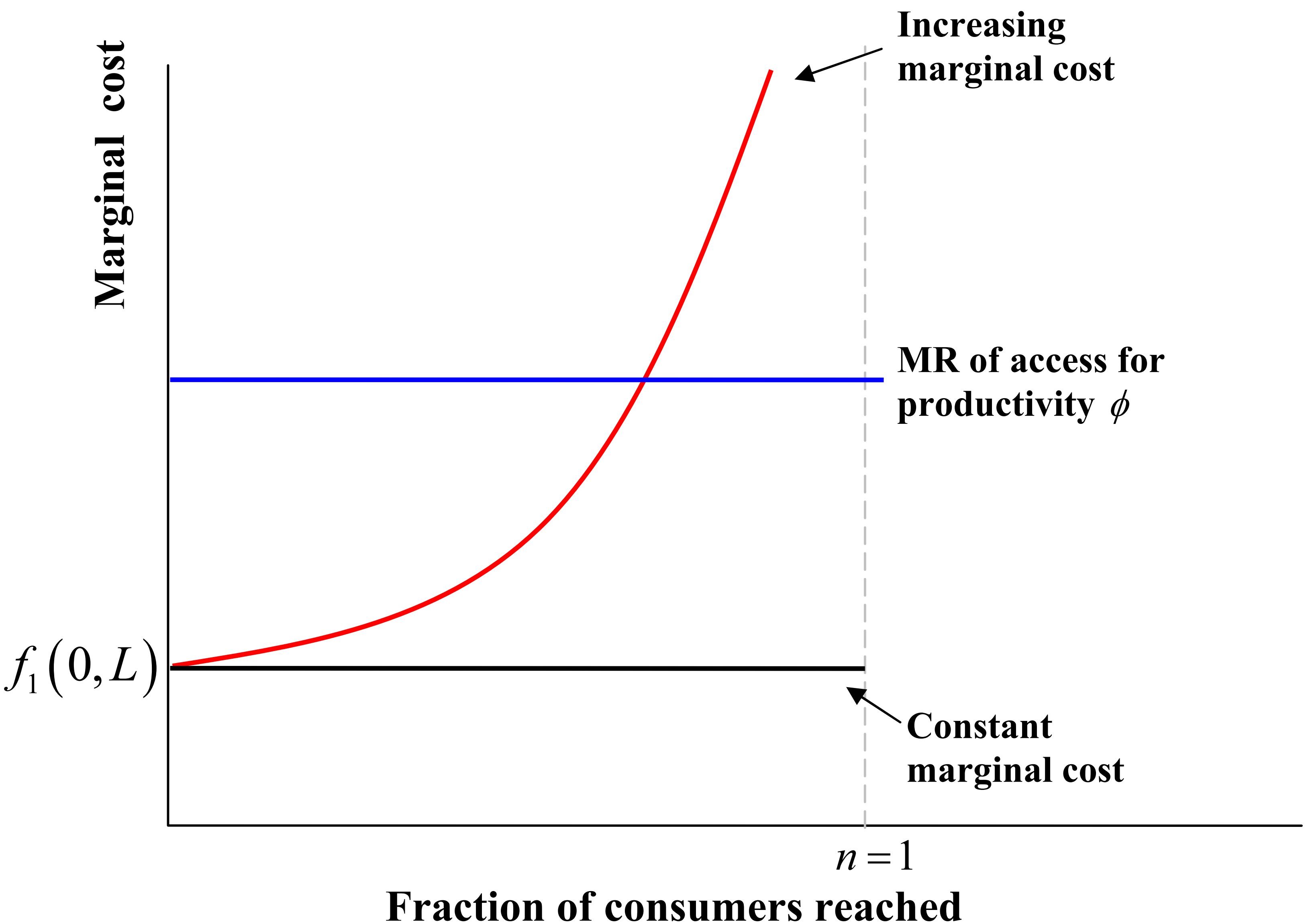
- Given price markup rule firm solves:

$$\pi_{ij} = \max_{n_{ij}} n_{ij} L_j \underbrace{\phi^{\sigma-1} \frac{(\tau_{ij} w_j \tilde{\sigma})^{1-\sigma}}{P_j^{1-\sigma}} \frac{y_j}{\sigma}}_{\substack{\text{Revenue per consumer} \\ \text{(net of labor production cost)}}} - w_j f(n_{ij}, L_j)$$

$$\text{s.t} \qquad n_{ij} \in [0, 1]$$

- Look at marginal decision of reaching additional fractions of consumers

Marginal Revenue & Cost from Reaching Additional Consumers



The Market Access Cost Function

- Solve the differential equation

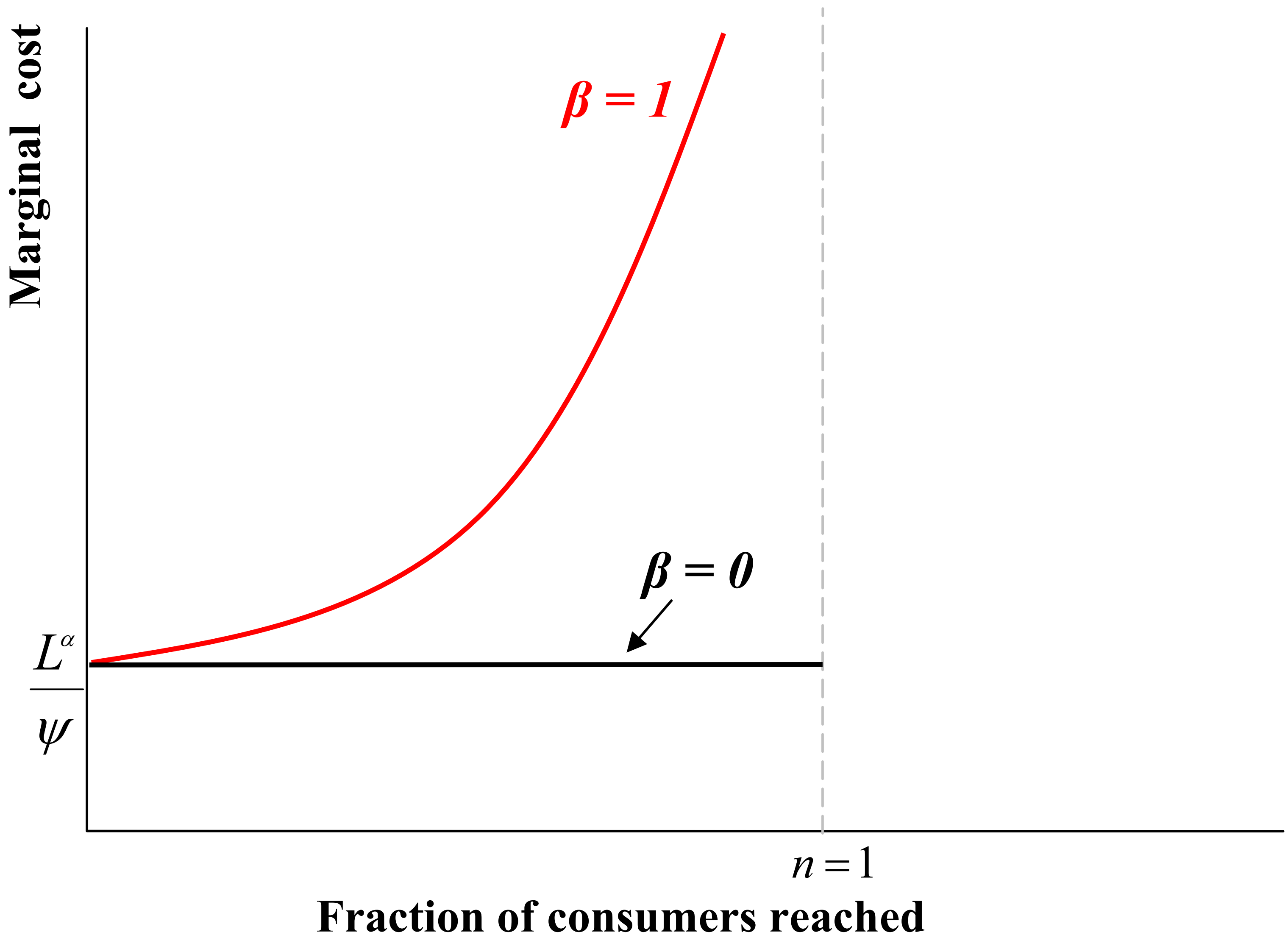
$$n'(S) = [1 - n(S)]^{\beta} L^{1-\alpha} \frac{1}{L}, \quad \text{s.t. } n(0) = 0$$

- Obtain Market Access Cost function
  - Assuming that $\frac{1}{\psi}$ is the labor required for each ad

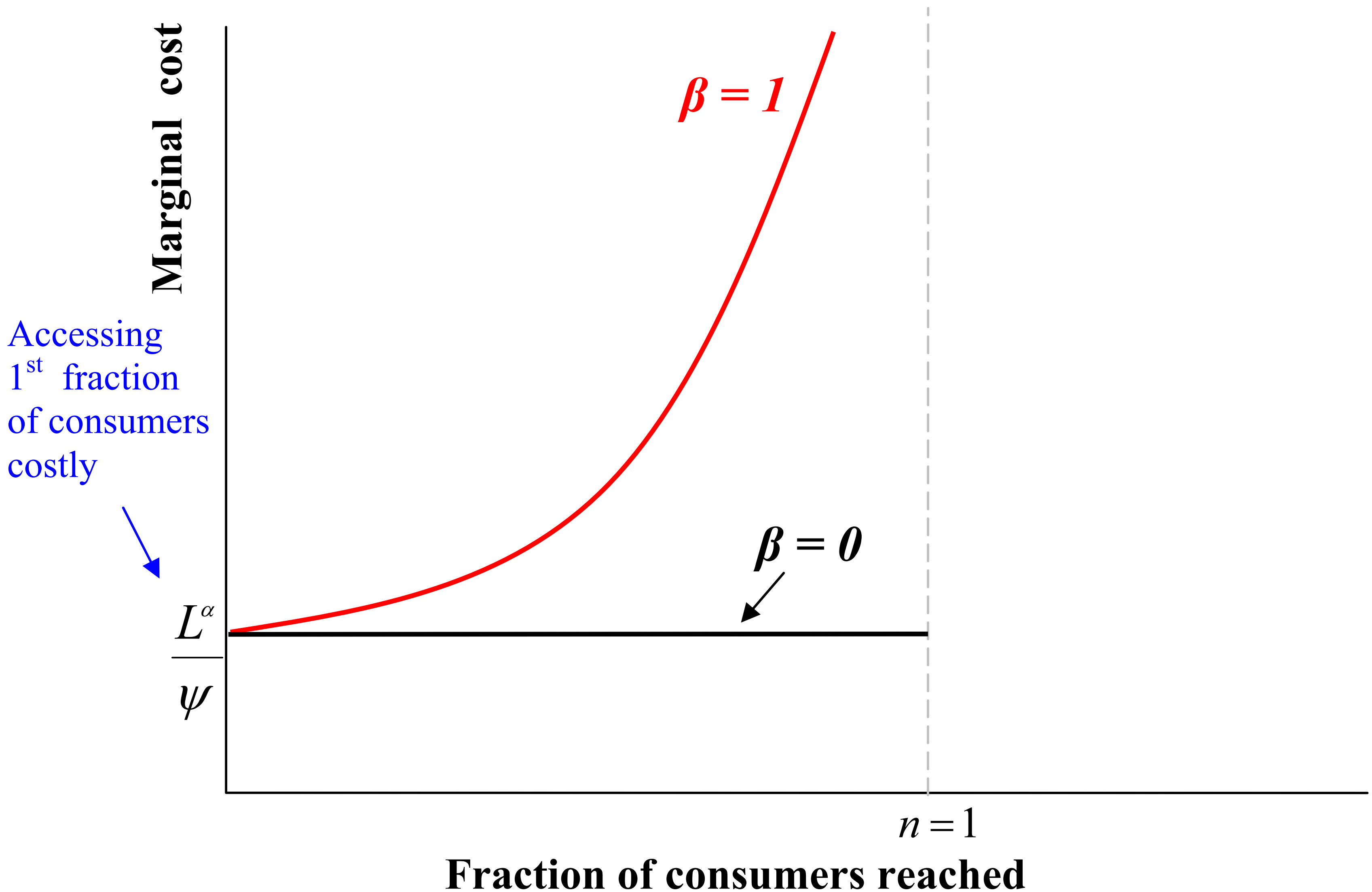
$$f(n, L) = \begin{cases} \frac{L^{\alpha}}{\psi} \frac{1-(1-n)^{-\beta+1}}{-\beta+1} & \text{if } \beta \in [0,1) \cup (1, +\infty) \\ \\ -\frac{L^{\alpha}}{\psi} log(1-n) & \text{if } \beta = 1 \end{cases}$$

where $\alpha \in [0,1]$

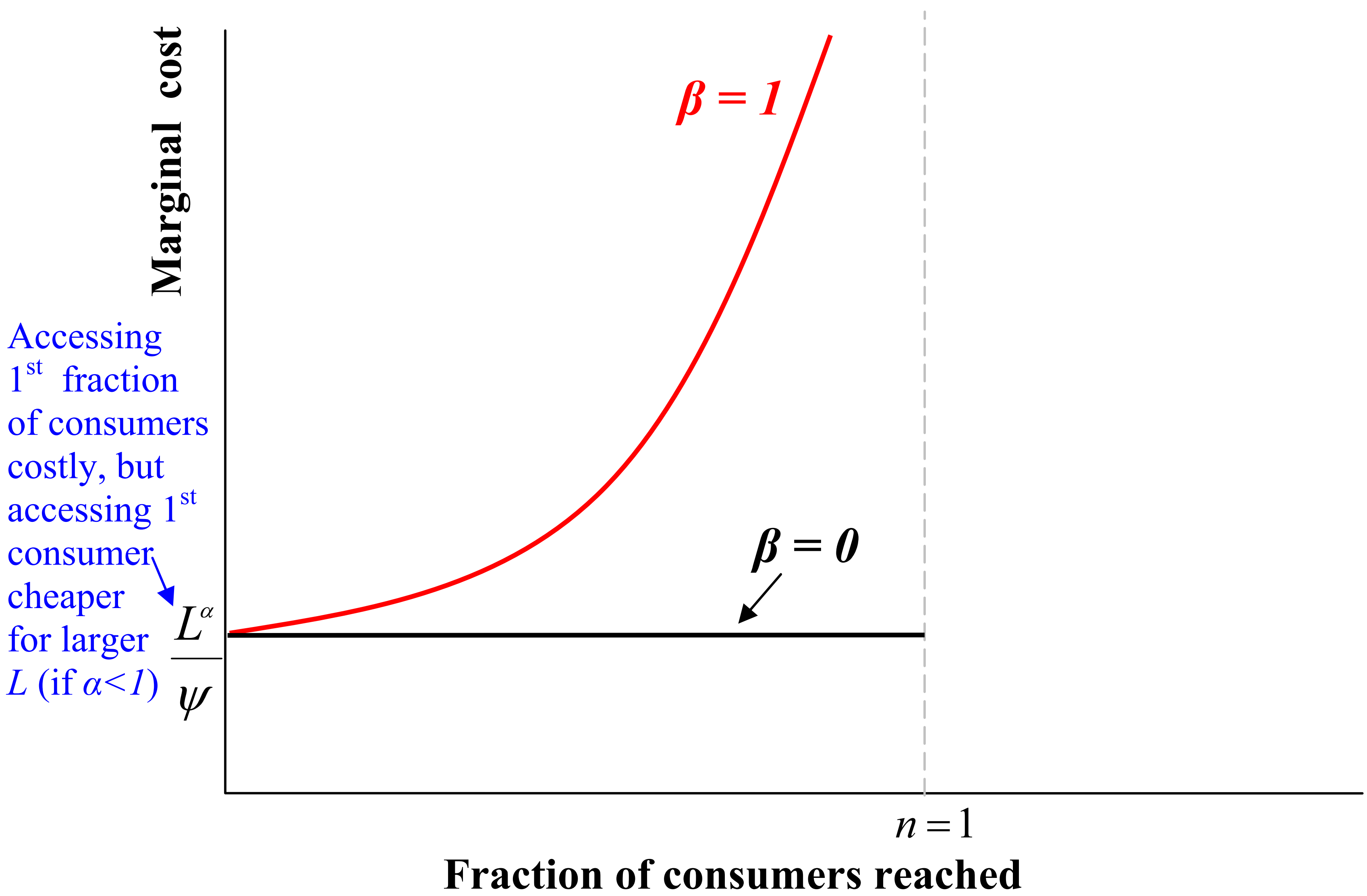
The properties of the Market Access Cost function



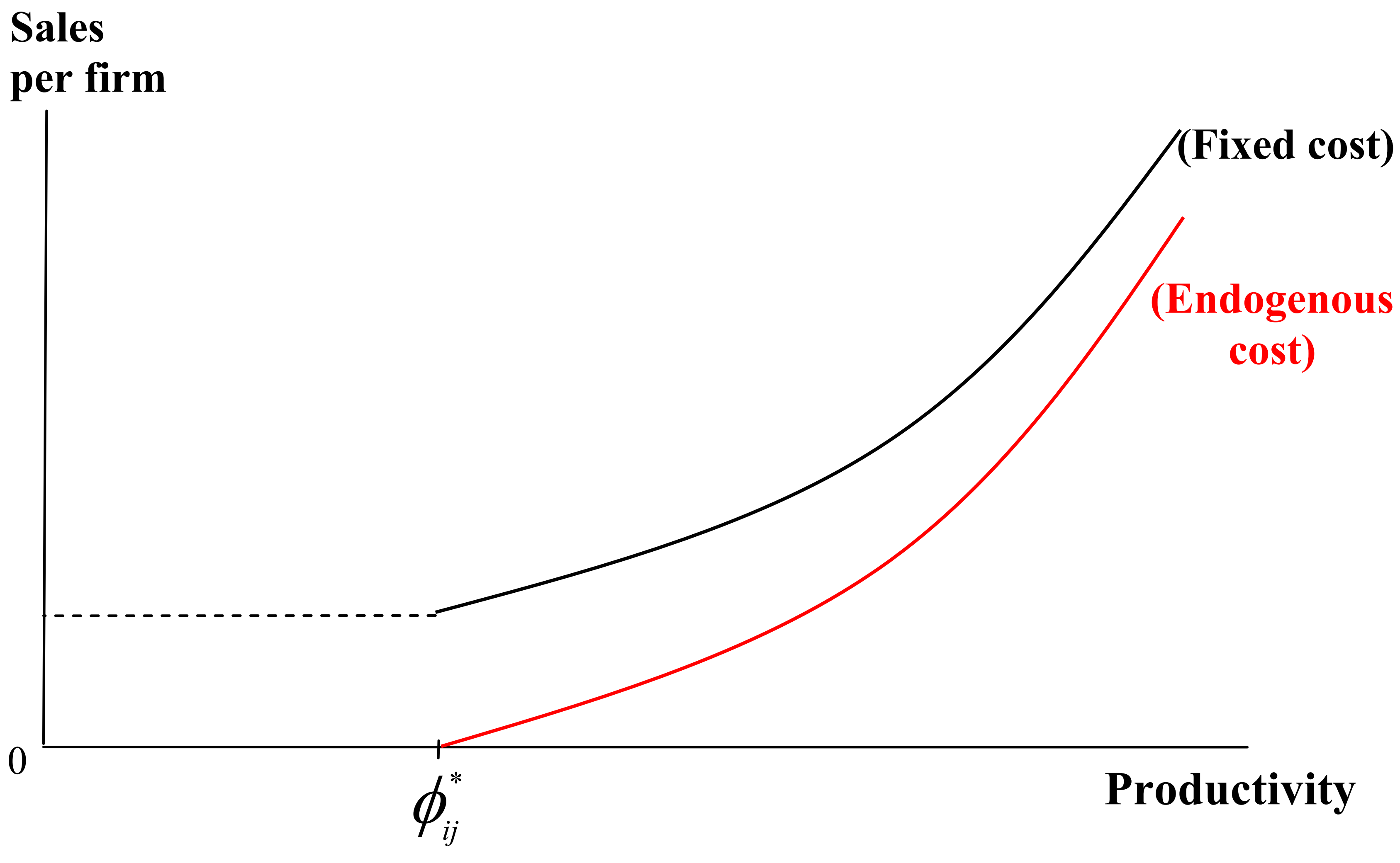
The properties of the Market Access Cost function



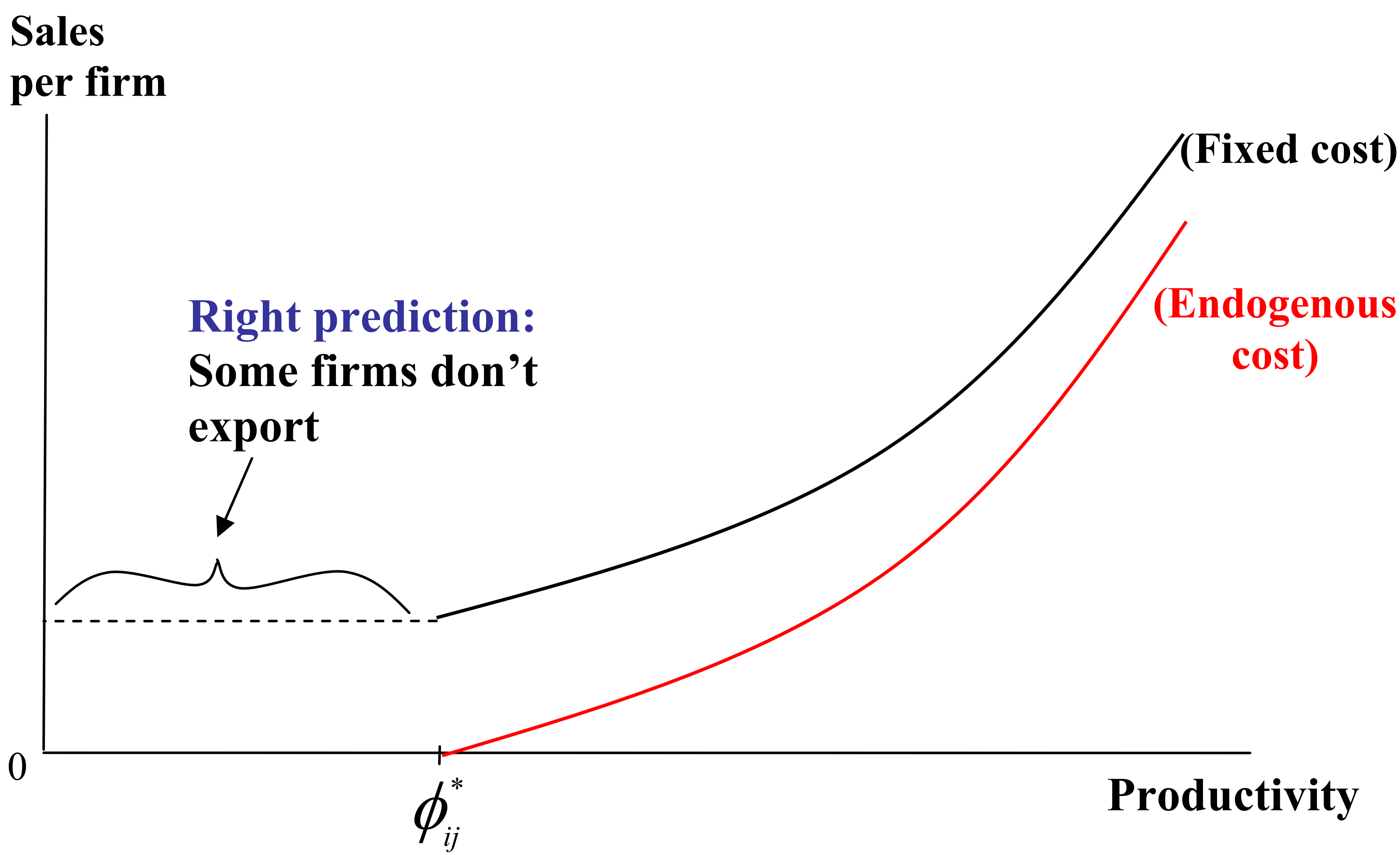
The properties of the Market Access Cost function



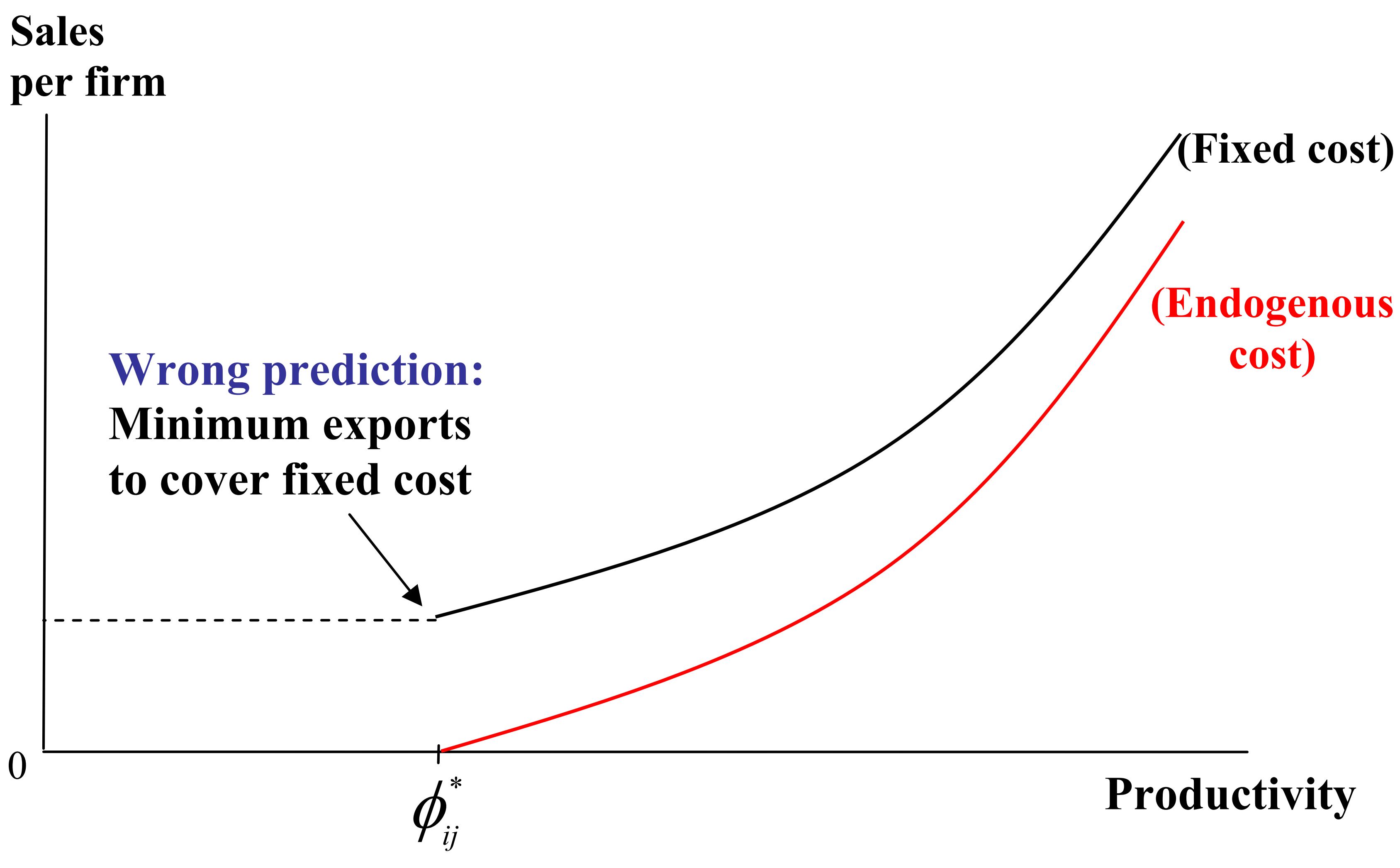
The product of the two margins: total sales per firm



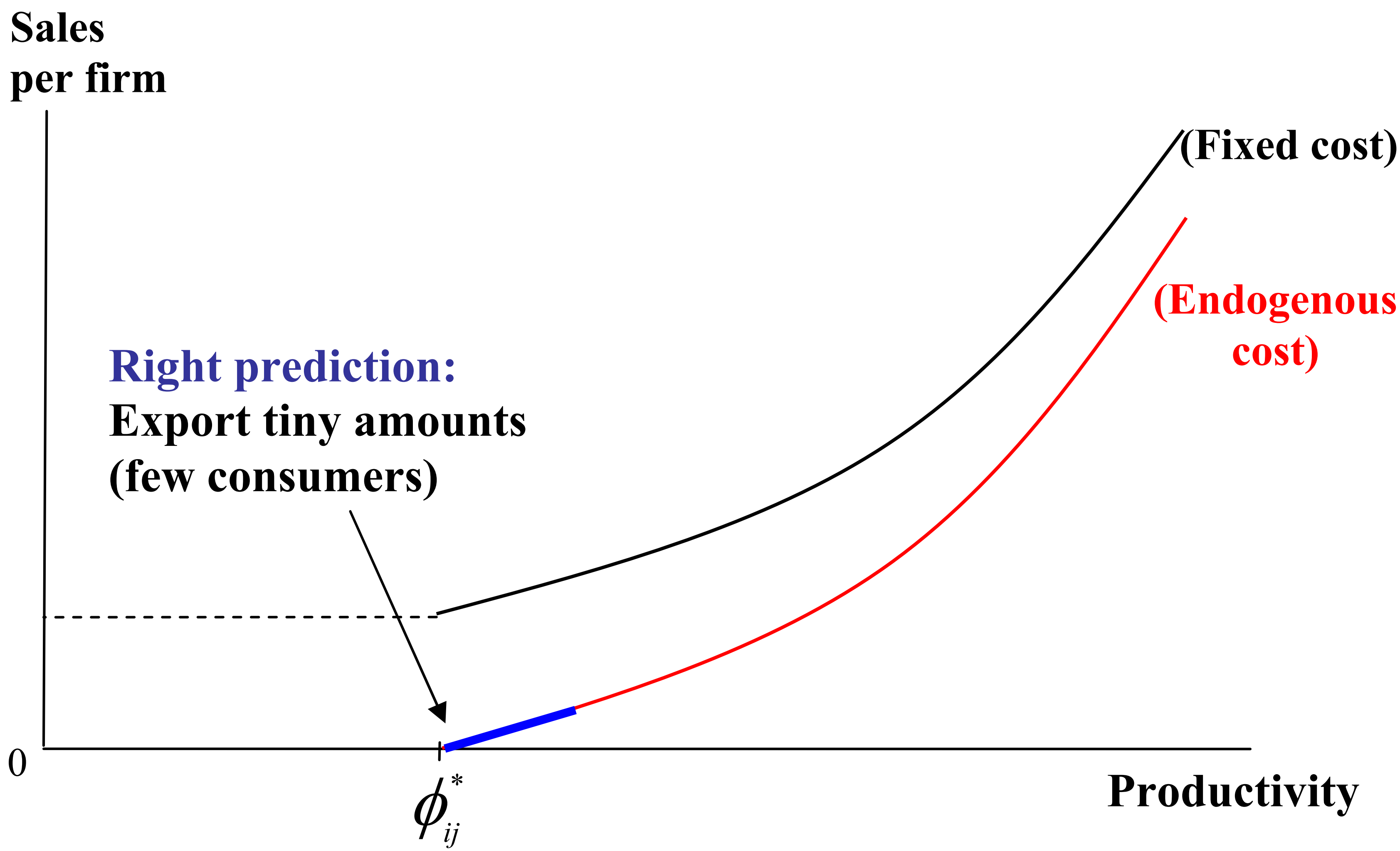
Models' predictions on which firms export



Models' predictions on how much firms export



Models' predictions on how much firms export



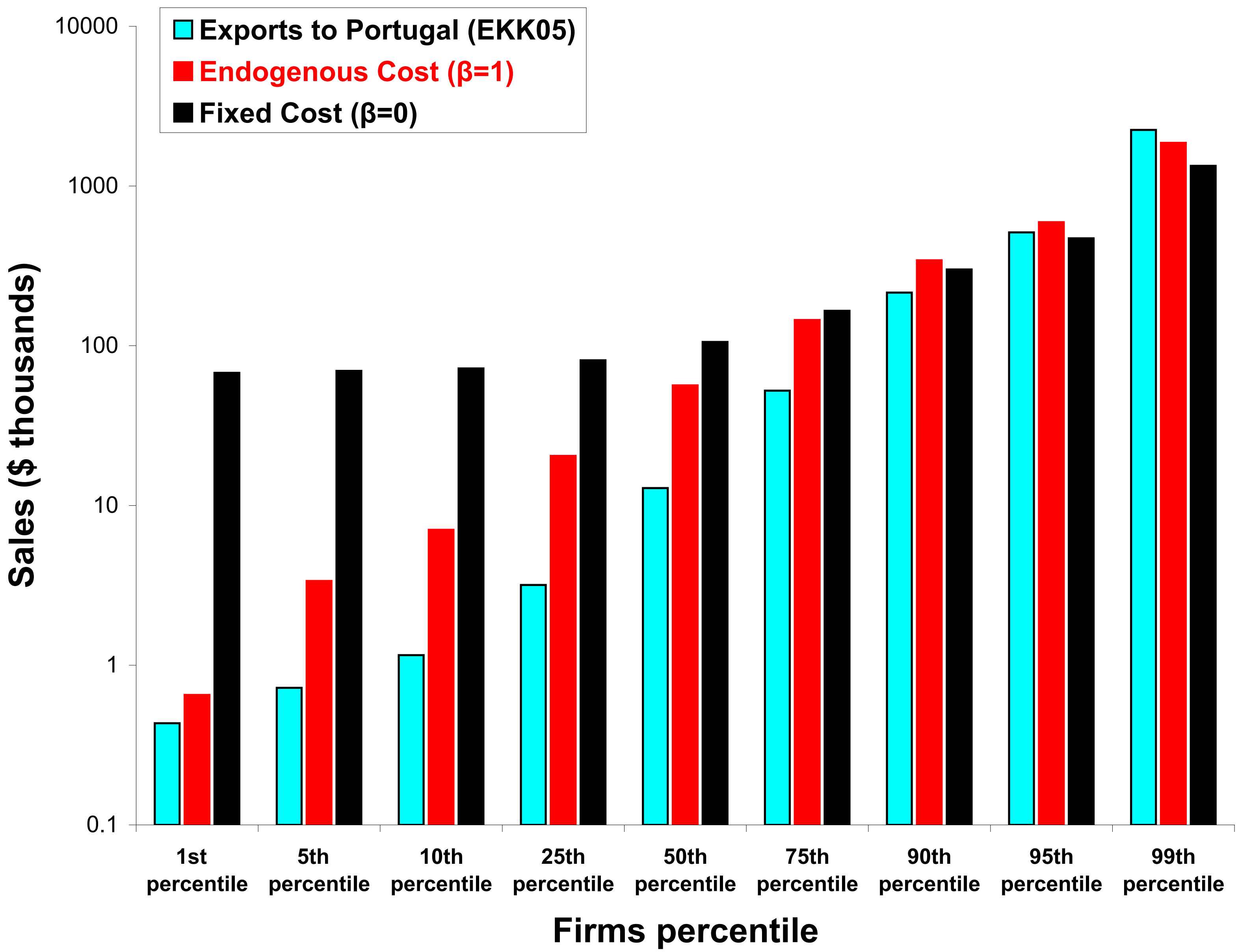
Comparing the Calibrated Model to French Data

- Look at the sales distribution for the model with $\beta = 0, 1$

- Remember: $\beta = 1$ calibrated to match higher sales in France of French firms exporting to more countries

- $\frac{1}{\psi}, \alpha$ calibrated to match number of French exporters to each country

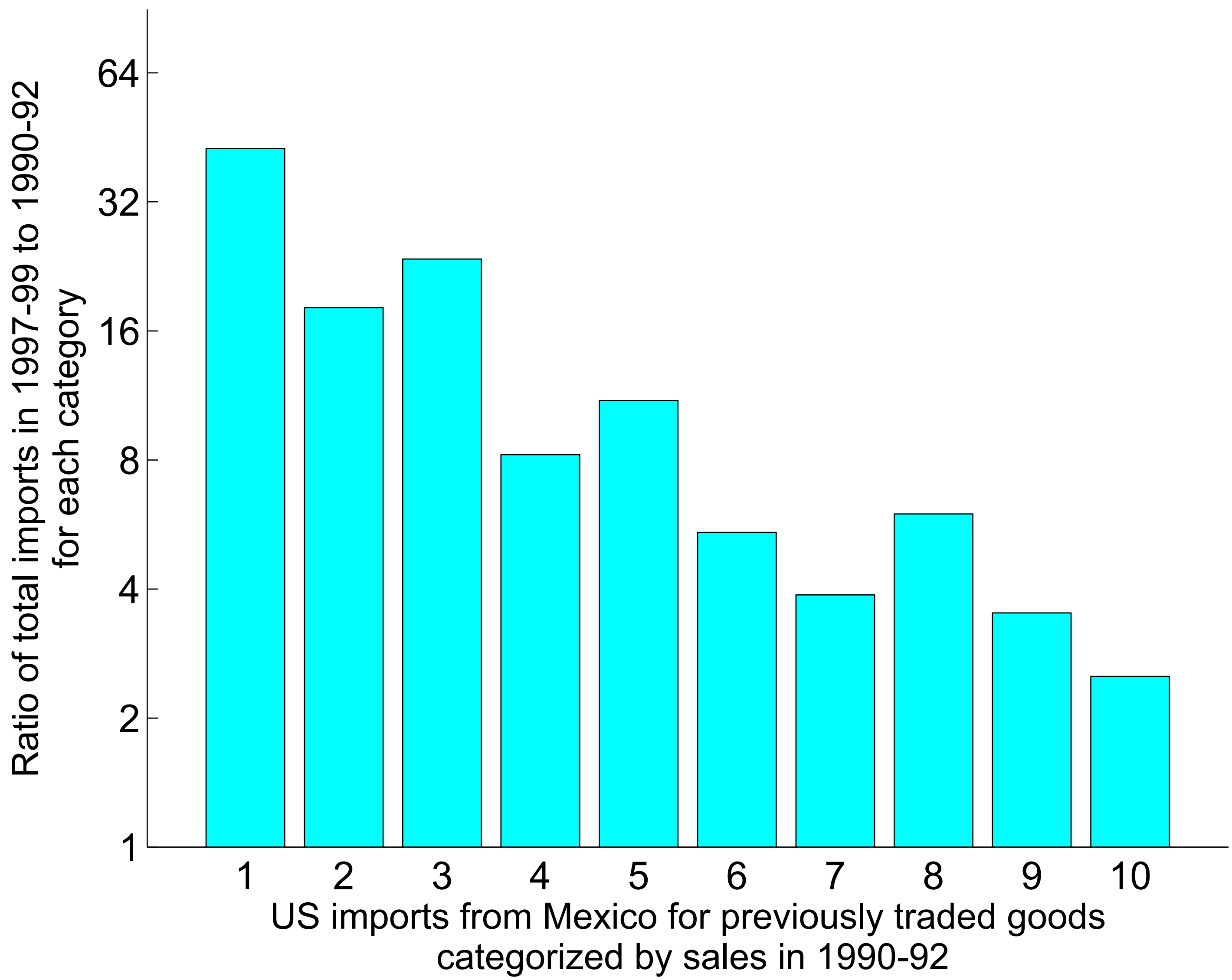
Calibrated Endogenous Cost model accounts for large fraction of small exporters



Observation 2: Trading Decisions After Trade Liberalization

- **Data:** Large increases in trade in least traded goods, Kehoe & Ruhl '03
- Look at US-Mexico trade liberalization; extend Kehoe-Ruhl analysis
- **Compute growth of positively traded goods prior to NAFTA**
  1. Data: US imports from Mexico '90-'99, 6-digit HS, $\approx$ 5400 goods
  2. Keep goods traded throughout '90-'92, $\approx$ 2900 goods
  3. Rank goods in terms of sales '90-'92
  4. Categorize **traded** goods in 10 bins

Large increases in trade for least traded goods



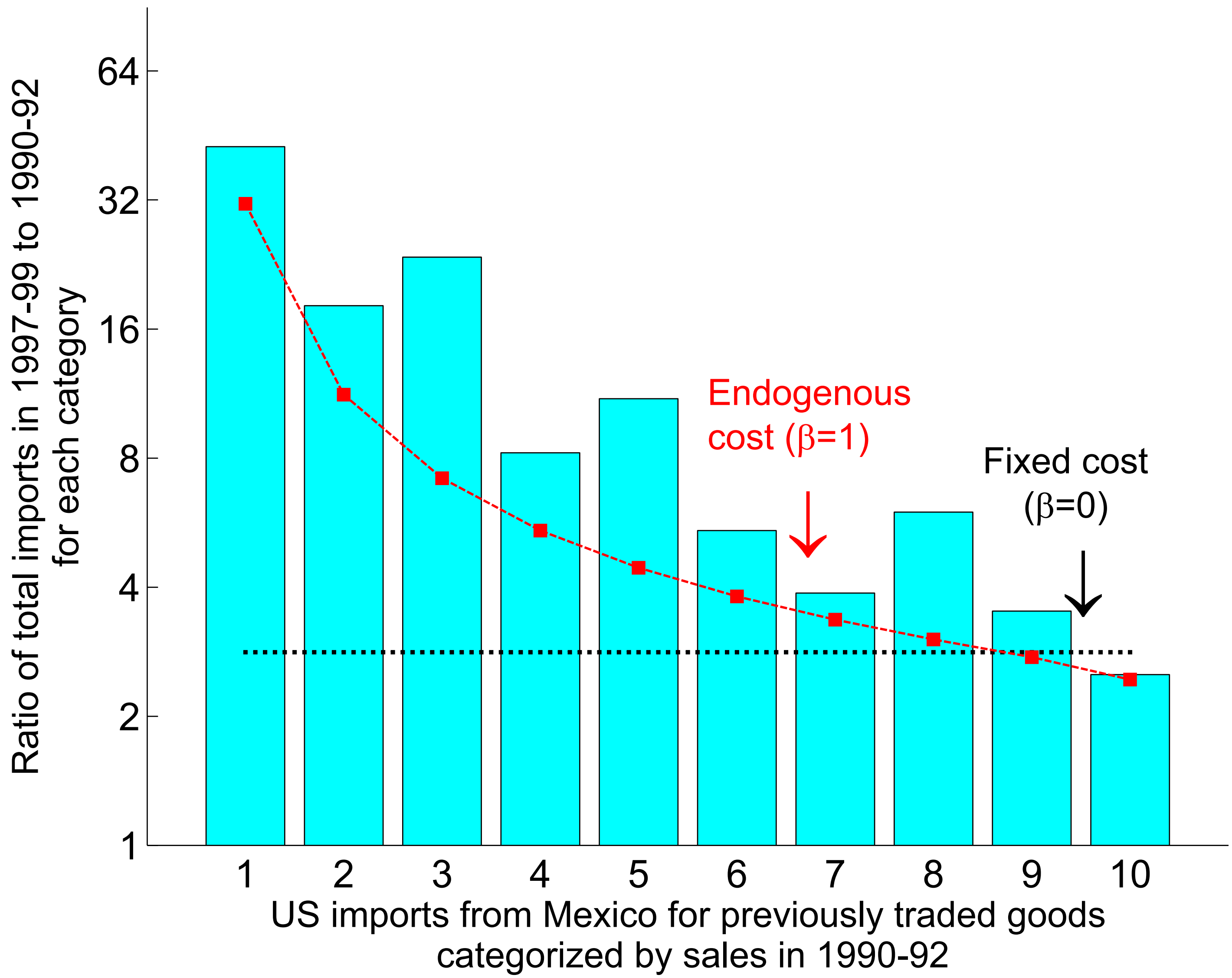
Comparing Calibrated Model to Data from NAFTA Episode

- Look at growth of trade for previously traded goods for $\beta = 0, 1$

- Use calibrated parameters, consider a firm as a good

- Change variable trade costs symmetrically across goods
  - Match increase in trade in previously traded goods
    - Fixed Cost model: 12.5% decrease in variable trade costs
    - My model: 9.5% decrease in variable trade costs (e.g. $\tau'_{ij} = 0.905\tau_{ij}$)

Calibrated Endogenous Cost model predicts increases in trade for least traded goods

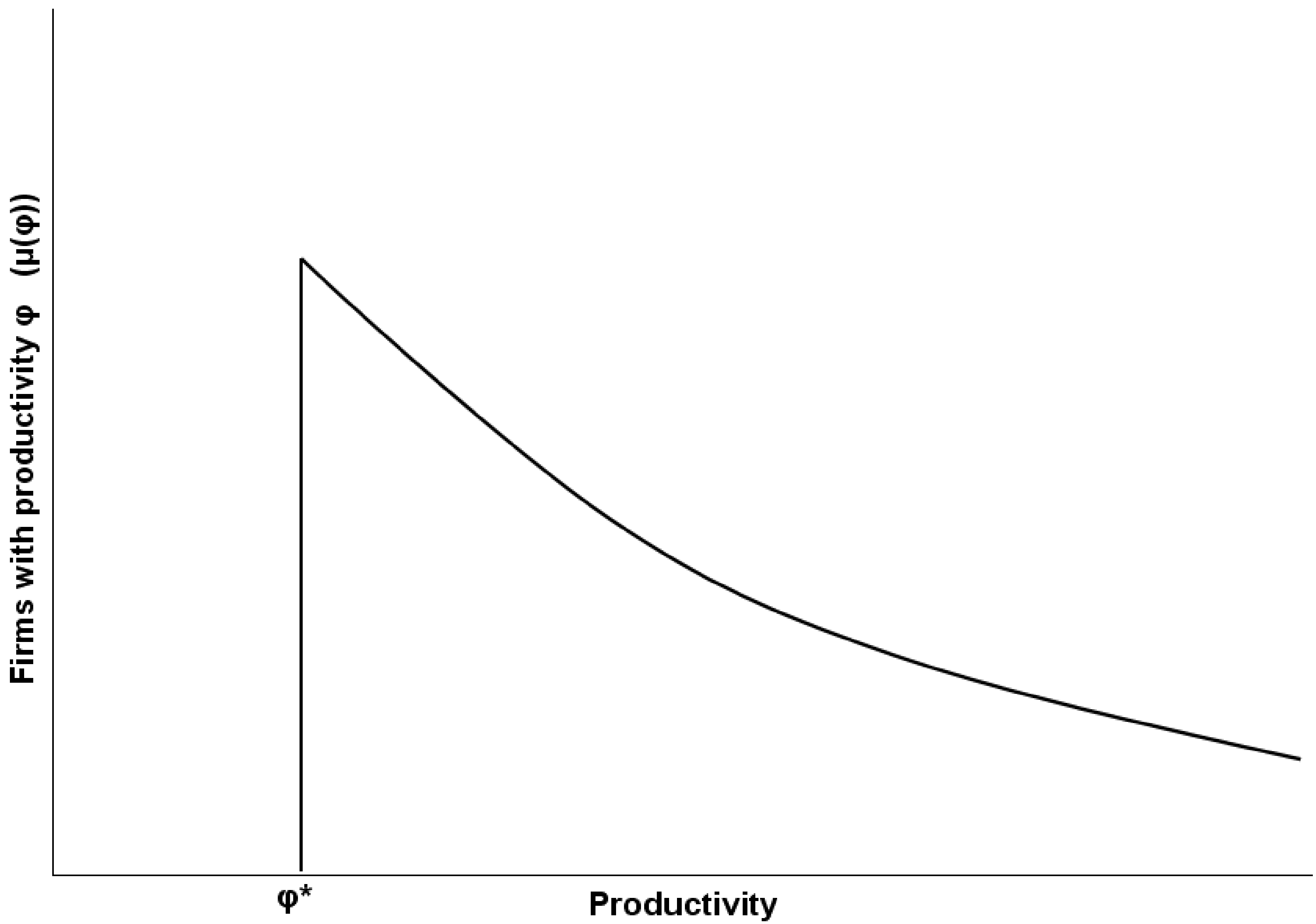


New Consumers Margin and New Trade

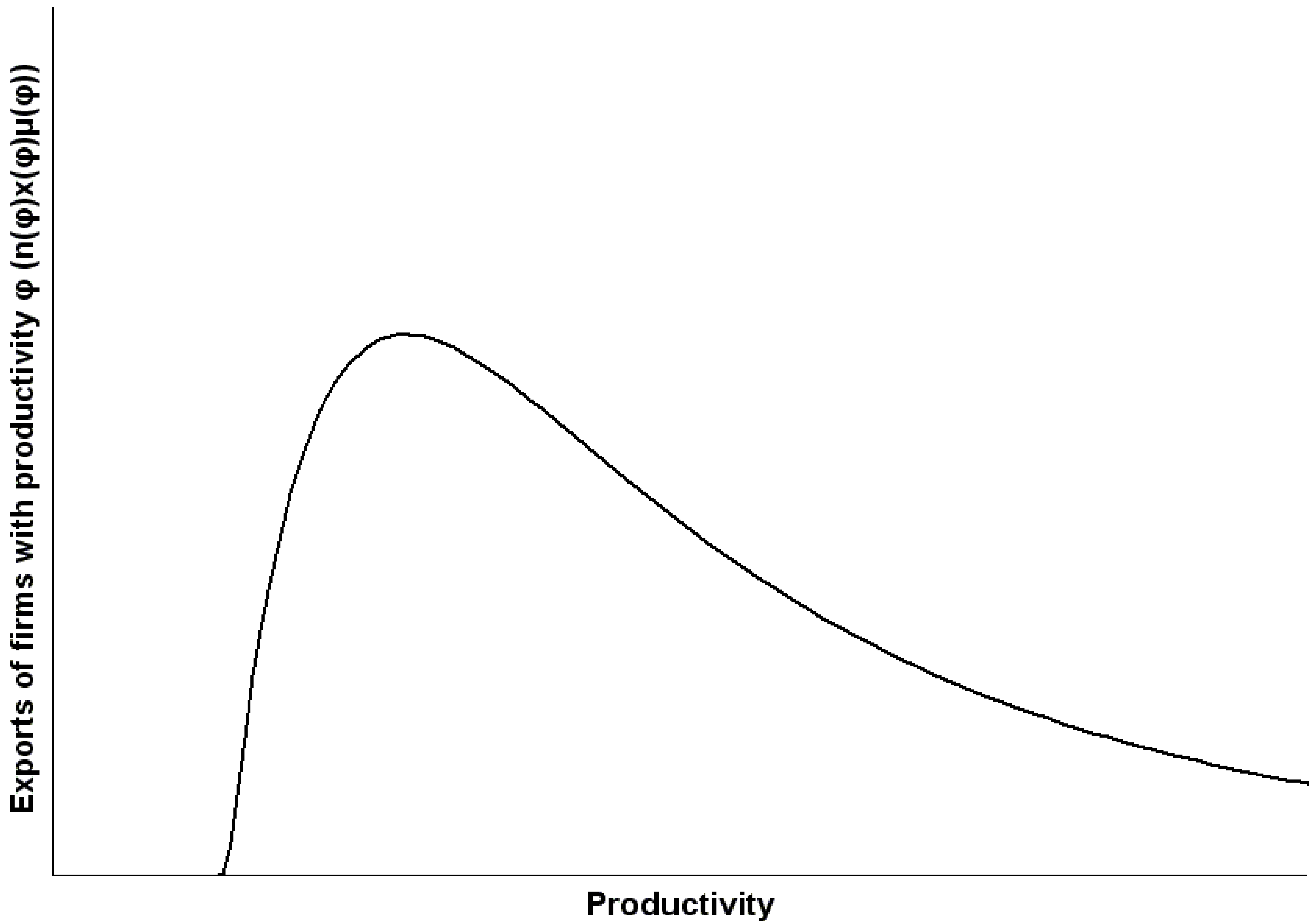
- Recent theory emphasizes increase in trade due to **many** new firms (EK02, Chaney '06 à la Melitz '03)

- **Decompose contribution of the 3 margins to total trade**
  - Intensive margin growth (total growth in sales per consumer)
  - New consumers margin (total growth in extensive margin of consumers)
  - New firms margin (total growth in extensive margin of firms)

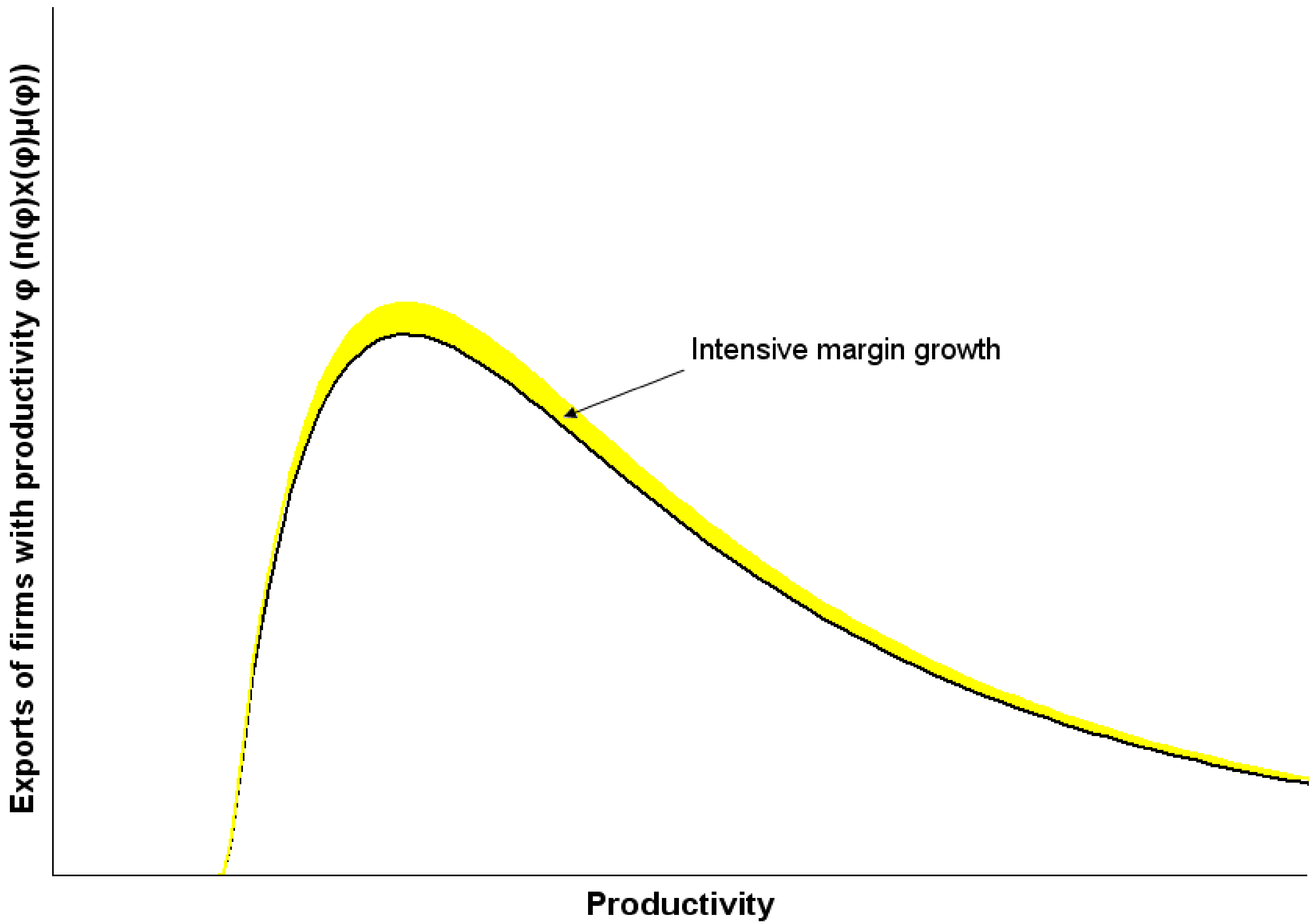
Pareto Density and Number of Firms with Productivity ϕ



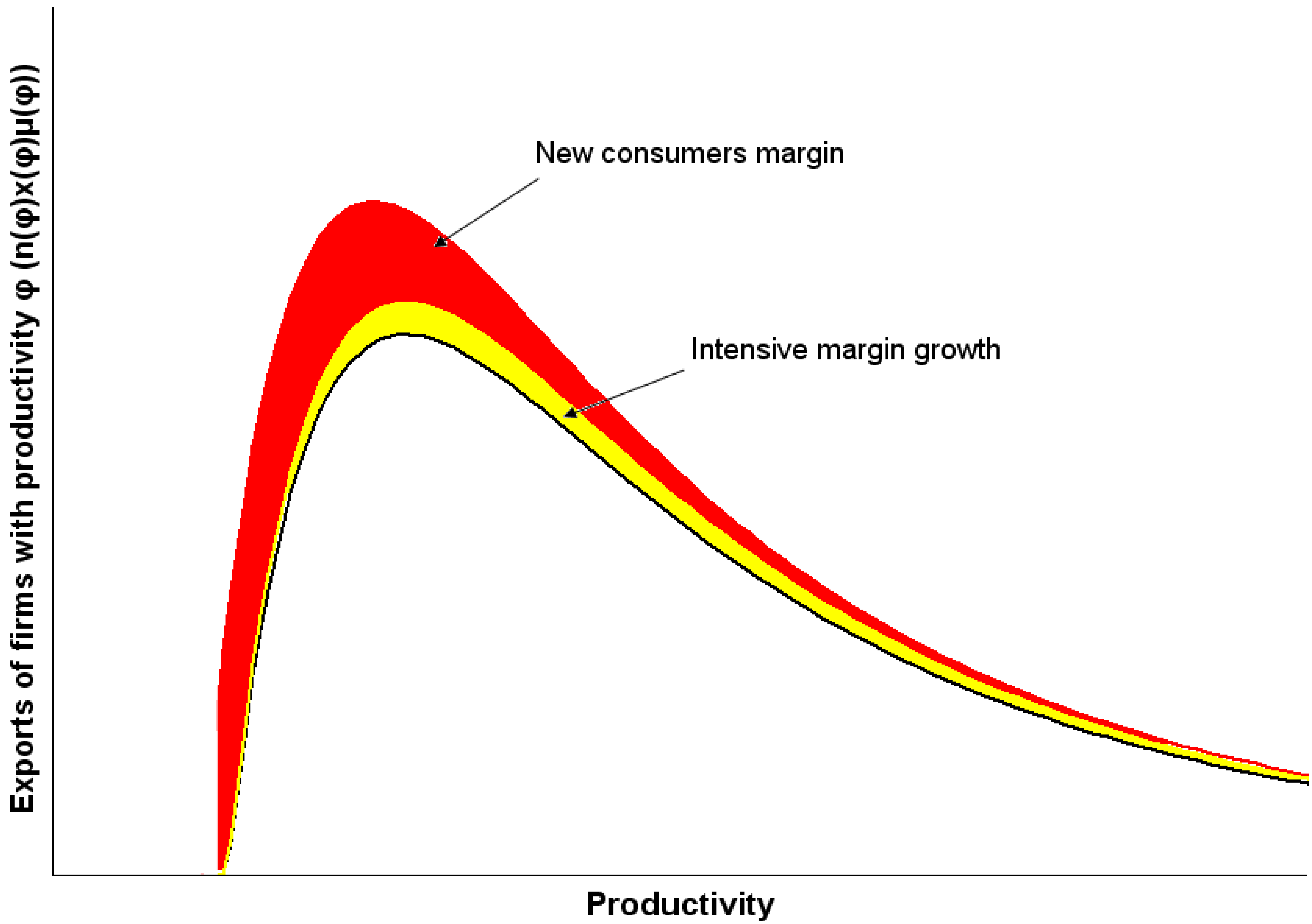
Density of exports



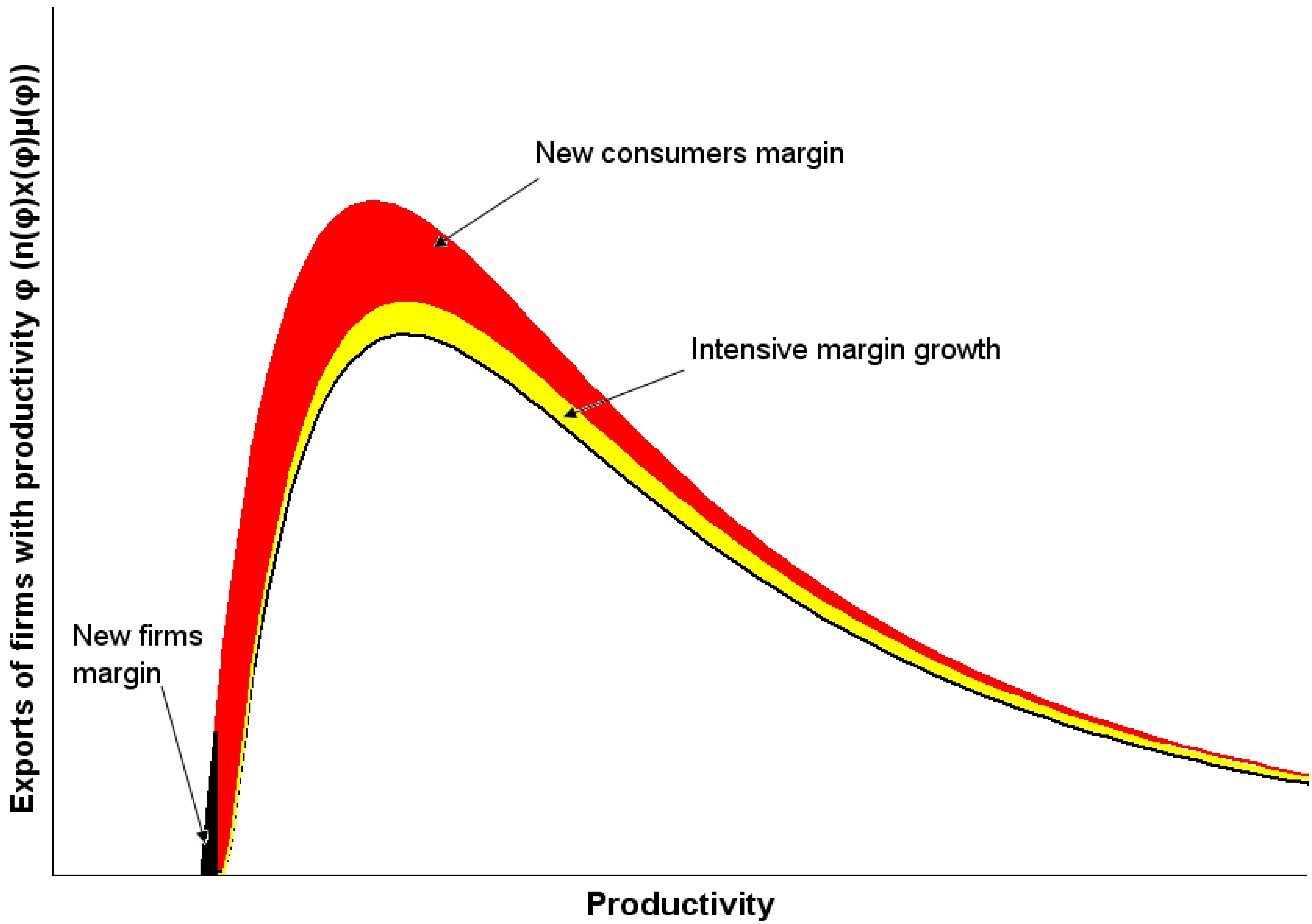
New Consumers Margin and new trade



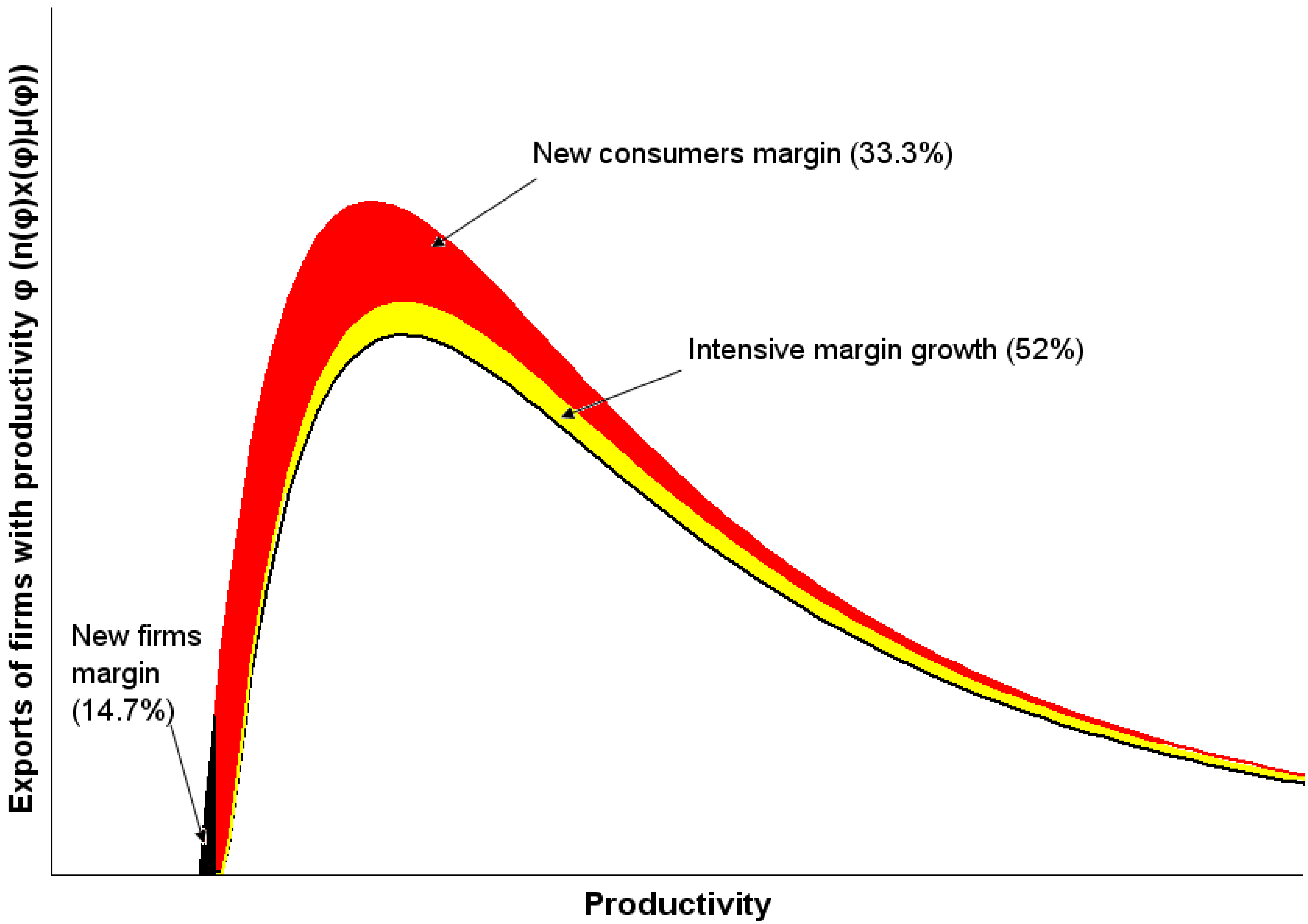
New Consumers Margin and new trade



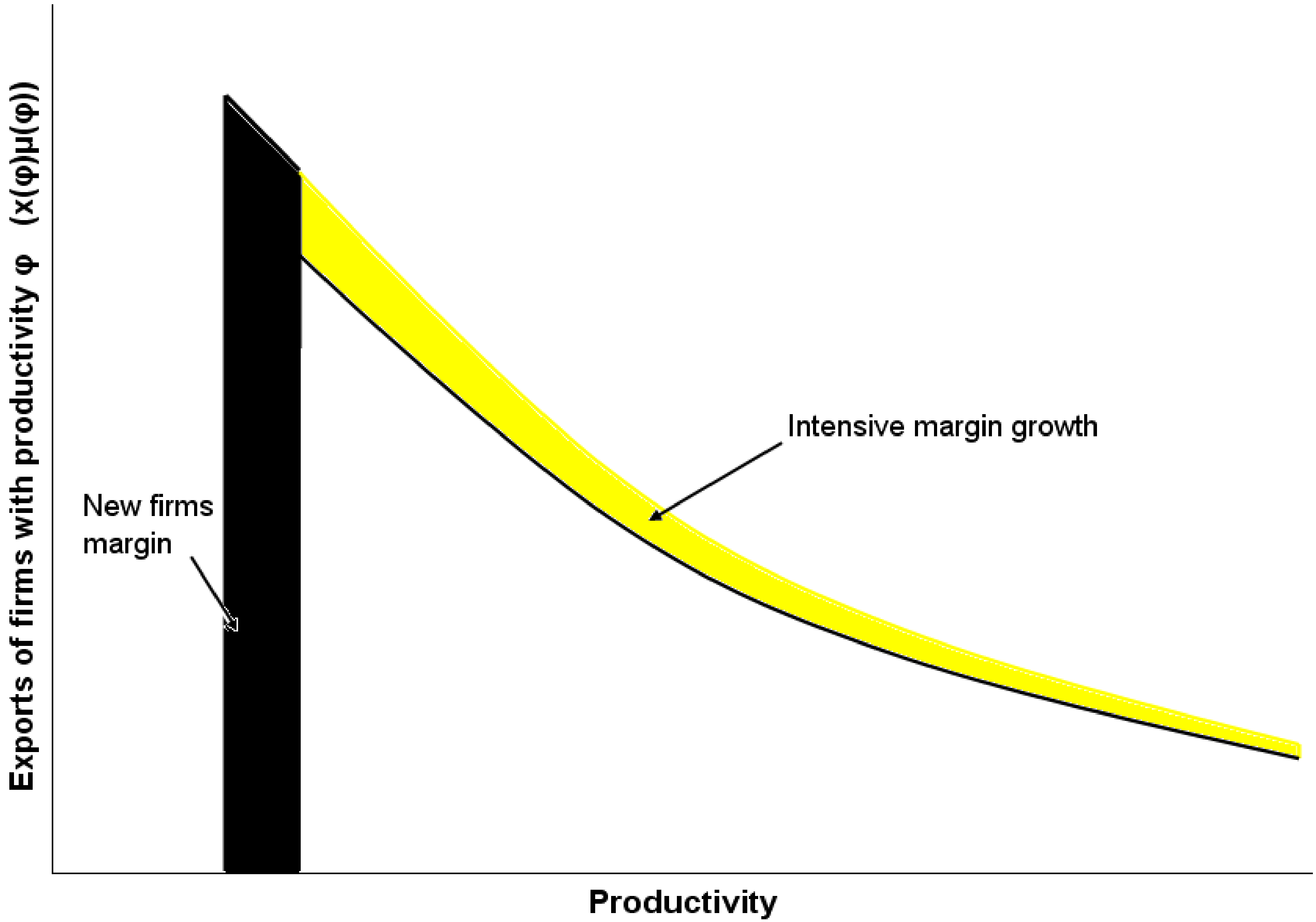
New Consumers Margin and new trade



New Consumers Margin and new trade



New Firms Margin and the Fixed Cost model ($\beta = 0$)



New Firms Margin and new trade ($\beta = 0$)