

# **Quality Upgrading in Developing Countries**

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# Quality Upgrading

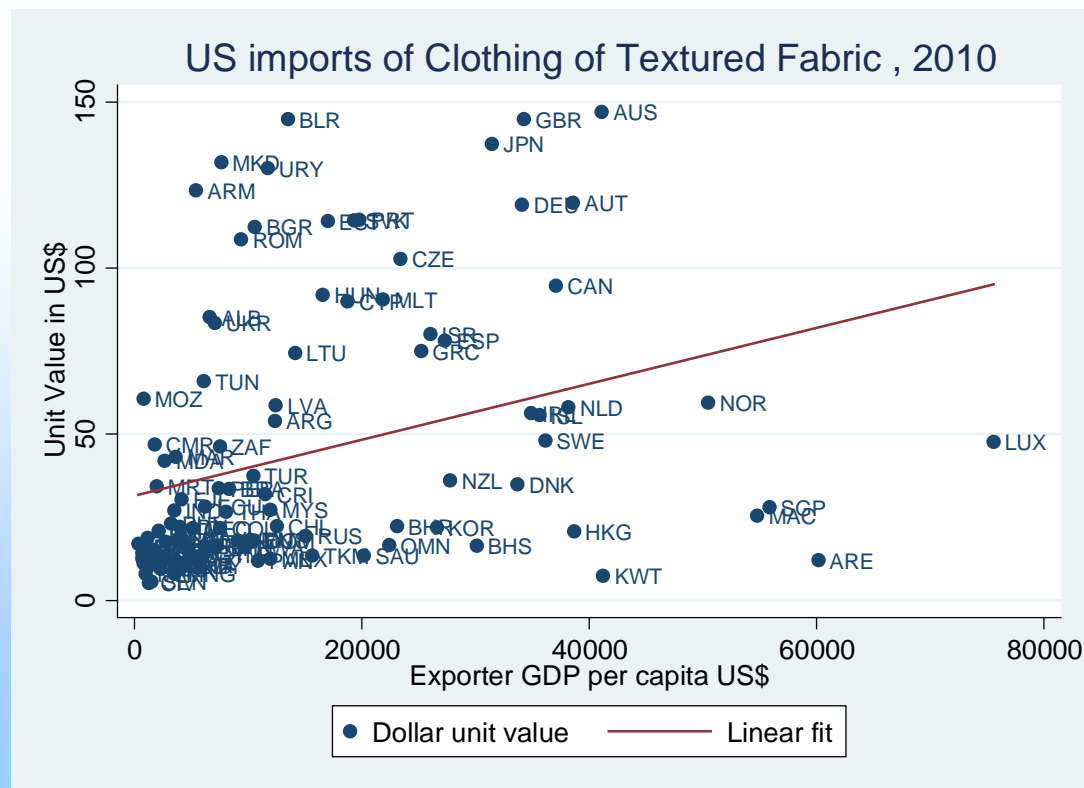
## Overview

- From Unit Values to Estimating Quality.
- Illustration of the Quality Toolkit.
  - Quality and unit values at the industry level.
  - Countries' potential for quality upgrading and potential need for horizontal diversification.
- Global stylized facts on quality.
- Determinants of quality upgrading.
  - Important—and somewhat neglected—policy question.
- Discussion: Empirical application using our dataset!

# Measures of Quality:

## Unit values as a first proxy

- Price is a good first proxy for quality and is observable.
- Unit values are *average* prices in any product category.
- Variation in Unit Values is very large (Schott, 2004 QJE)
  - May indicate noise if high-price varieties are “exotic”



# Measures of Quality

## Deriving a quality measure in 4 steps

- 1. Motivation:** Construct a large export quality dataset that can also adequately reflect developing countries.
  - Latest-generation quality literature models demand (and supply) from microfoundations, but data requirements high:
    - Khandelwal (2010, REStud): based on US imports only
    - Hallak and Schott (2011, QJE): 43 “top” exporters during 1989-2003; countries with trade surpluses inferred to offer higher quality than countries running trade deficits
    - Feenstra and Romalis (2012): back to 1984 only and requiring detailed tariff data often not available for developing countries

# Measures of Quality

## Deriving a quality measure in 4 steps

2. **Estimation:** Estimate a quality-augmented gravity equation, adapted from Hallak (2006), separately for 851 sectors. Objective is to adjust unit values for factors other than quality:
  - High prices may also be an indicator of high production costs. Quality is high when high prices are accompanied by high market shares.
  - Selection bias: only higher priced items shipped to far-away destinations.

# Measures of Quality

## Deriving a quality measure in 4 steps

- 3. Calculating quality estimates:** Resulting coefficients from gravity equation are used to derive quality estimates.
- 4. Normalization:** After we have obtained the quality estimates, we normalize them to be able to aggregate across sectors. For each sector we set the world frontier (=90<sup>th</sup> percentile) equal to 1.

# Estimation Methodology

## Deriving quality measures

Our methodology follows closely Hallak (2006, JIE).

- Unit values  $p$  are postulated to depend on quality  $\theta$ , production technology (proxied by GDP p.c.), and distance:

$$\ln p_{mxt} = \zeta_0 + \zeta_1 \ln \theta_{xt} + \zeta_2 \ln y_{xt} + \zeta_3 \ln \text{Dist}_{mx} + \xi_{mxt} \quad (1)$$

- We also specify a quality–augmented gravity equation, for each of 851 ISIC 4 digit products because preference for quality and trade costs vary by product.

$$\ln(\text{Imports})_{mxt} = \text{ImFE} + \text{ExFE} + \alpha \ln \text{Dist}_{mx} + \beta I_{mxt} + \delta \ln \theta_{mxt} \ln y_{mt} + \varepsilon_{mxt} \quad (2)$$

# Estimation Methodology

## Deriving quality measures

- Given that quality is unobservable, eliminate it from equation (2) by using the postulated relationship in equation (1). This gives our estimation equation:

$$\ln(\text{Imports})_{mxt} = \text{ImFE} + \text{ExFE} + \alpha \ln \text{Dist}_{mx} + \beta I_{mxt} + \zeta'_1 \ln p_{mxt} \ln y_{mt} + \zeta'_2 \ln y_{xt} \ln y_{mt} + \zeta'_3 \ln \text{Dist}_{mx} \ln y_{mt} + \xi'_{mxt}$$

$$\text{where } \zeta'_1 = \frac{\delta}{\zeta_1} \quad \zeta'_2 = -\frac{\delta \zeta_2}{\zeta_1} \quad \zeta'_3 = -\frac{\delta \zeta_3}{\zeta_1} \quad \xi'_{mxt} = -\frac{\delta \zeta'_0 + \delta \xi_{mxt}}{\zeta_1} \ln y_{mt} + \varepsilon_{mxt}$$

We obtain estimates by two stage least squares, because  $\xi_{mxt}$  is a component of  $p_{xmt}$ , so that the regressor  $\ln p_{xmt} \ln y_{mt}$  is correlated with the disturbance term  $\xi'_{mxt}$ . We thus use  $\ln p_{xmt-1} \ln y_{mt}$  as an instrument for  $\ln p_{xmt} \ln y_{mt}$ .



# Estimation Methodology

## Deriving quality measures

- Rearranging the price equation (1), we use the parameter estimates from our quality augmented gravity equation to calculate a comprehensive set of quality estimates for each of 851 products:

$$\text{Quality estimate}_{mxt} = \delta \ln \theta_{mxt} = \zeta_1' \ln p_{mxt} + \zeta_2' \ln y_{xt} + \zeta_3' \ln \text{Dist}_{mx}$$

- Note that quality is only identified jointly together with the preference for quality parameter  $\delta$ , as is common in this literature.

# Estimation Results

- Reassuringly, the estimation results yield intuitive coefficients on the common gravity variables and mirror those of Hallak (2006):

**Table 1: Two stage least squares estimation results**

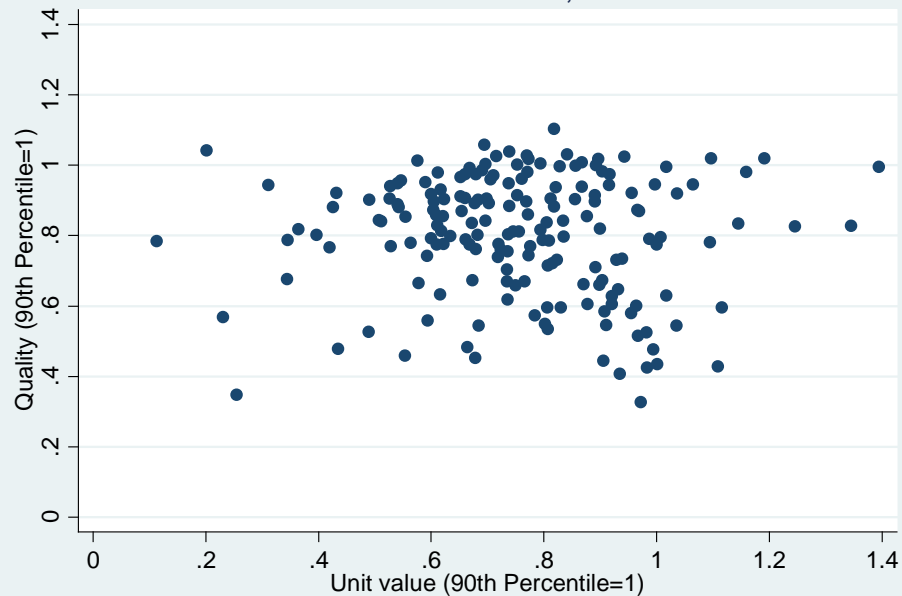
	In percent of SITC4plus sectors				Median coefficient value	
	Positive		Negative		This paper	Hallak (2006)
	Significant	Insignificant	Significant	Insignificant		
Common PTA	82	9	6	3	0.45	0.38
Colonial relationship	80	11	6	3	0.43	0.79
Common colonizer	50	20	16	14	0.20	0.29
Common language	71	14	9	5	0.28	0.53
Common border	82	9	6	3	0.38	0.33
Ln(distance)	6	8	10	76	-1.02	-1.04
Ln(distance)*Ln(ymt)	61	14	10	16	0.04	-0.02
Ln(yxt)*Ln(ymt)	90	5	4	2	0.10	0.08
Ln(pmxt)*Ln(ymt)	238	82	438	93	-0.01	0.19

# Unit Values Versus Quality

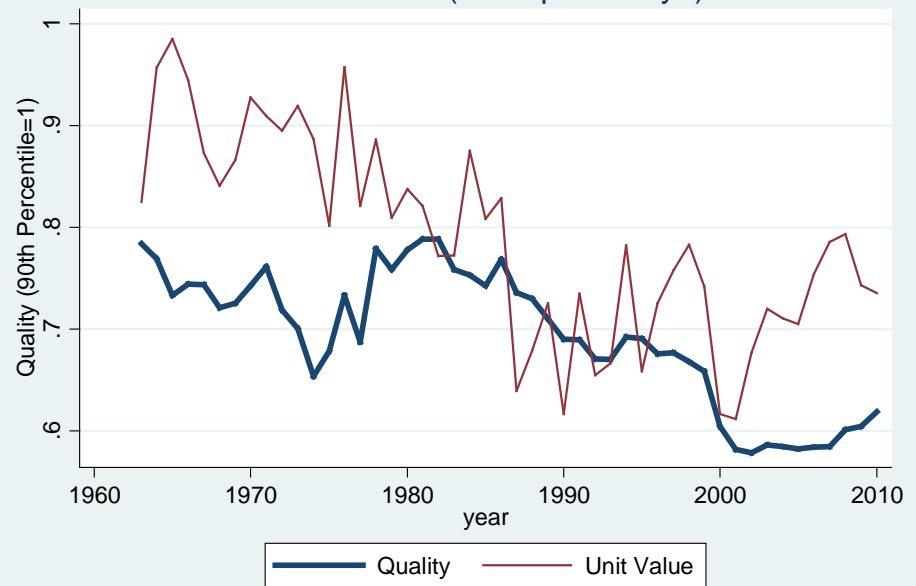
## A comparison

- Unit values are a lot more dispersed across countries and volatile across time than quality estimates.
- Quality generally evolves gradually over time.

Across countries, 2010



Across time (Example: Kenya)



*Quality Upgrading*  
**Illustrating the Toolkit**

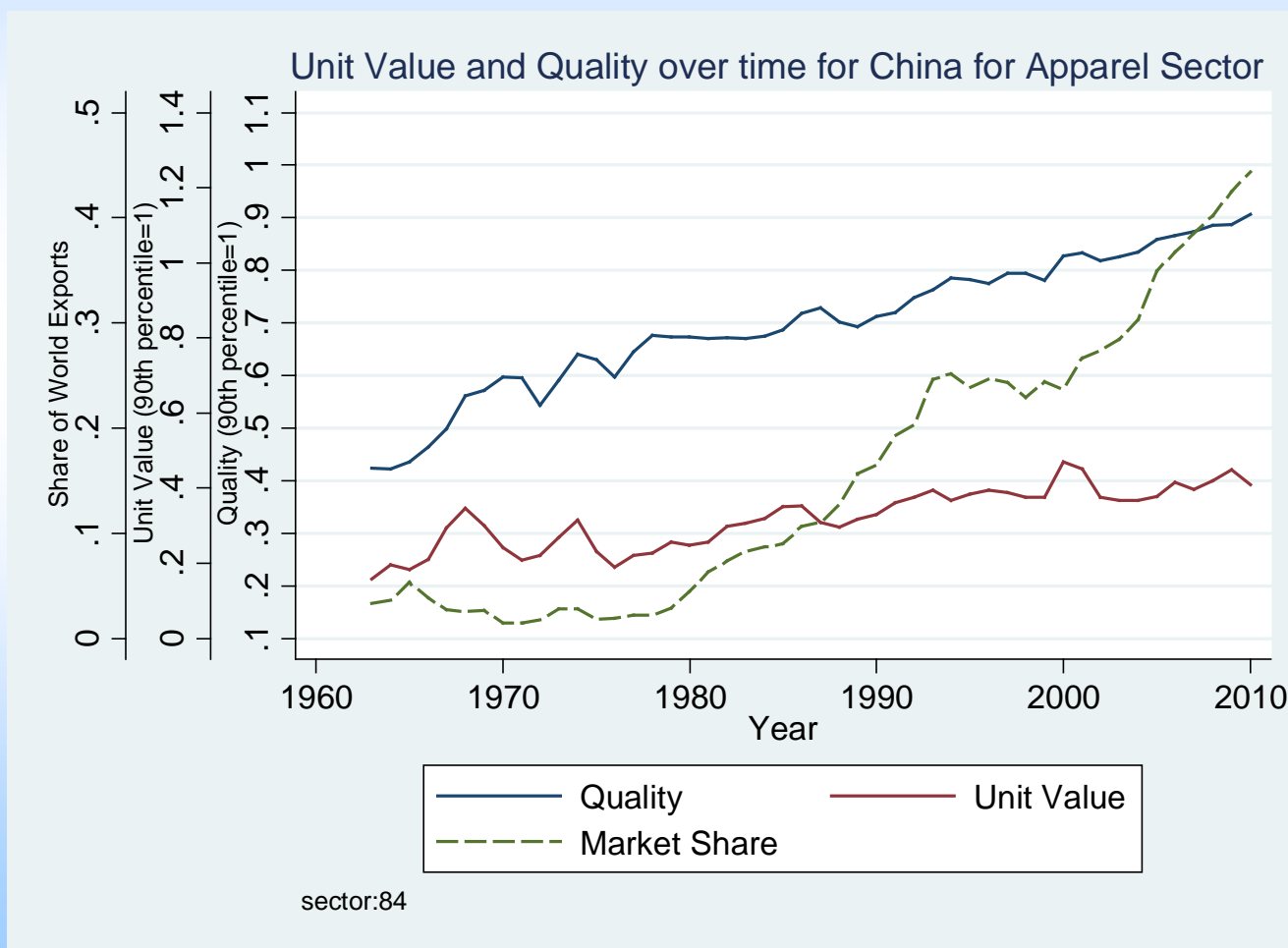
# The Toolkit

- Broadest set of quality estimates to date covering 178 countries during 1962-2010. More than 21 million quality estimates at ‘importer-exporter-year-product-unit of measurement’ level.
- Toolkit will be made publicly available and contains exporter country totals and 3 different breakdowns:
  - *SITC 4, 3, 2, 1 digit*
    - Over 1.5 million quality estimates available at the SITC 4-digit level (after aggregating over importers and units of measurement)
  - *BEC 3, 2, 1 digit*
    - BEC1: Useful breakdown into intermediate products, capital goods and consumer goods
    - BEC2: Distinguishes e.g. (i) between primary and processed varieties and (ii) consumer durables and non-durables.
  - *3 broad custom categories*
    - Manufactures, Agriculture, and Non-Agricultural Commodities

# China Apparel Exports

## SITC 84

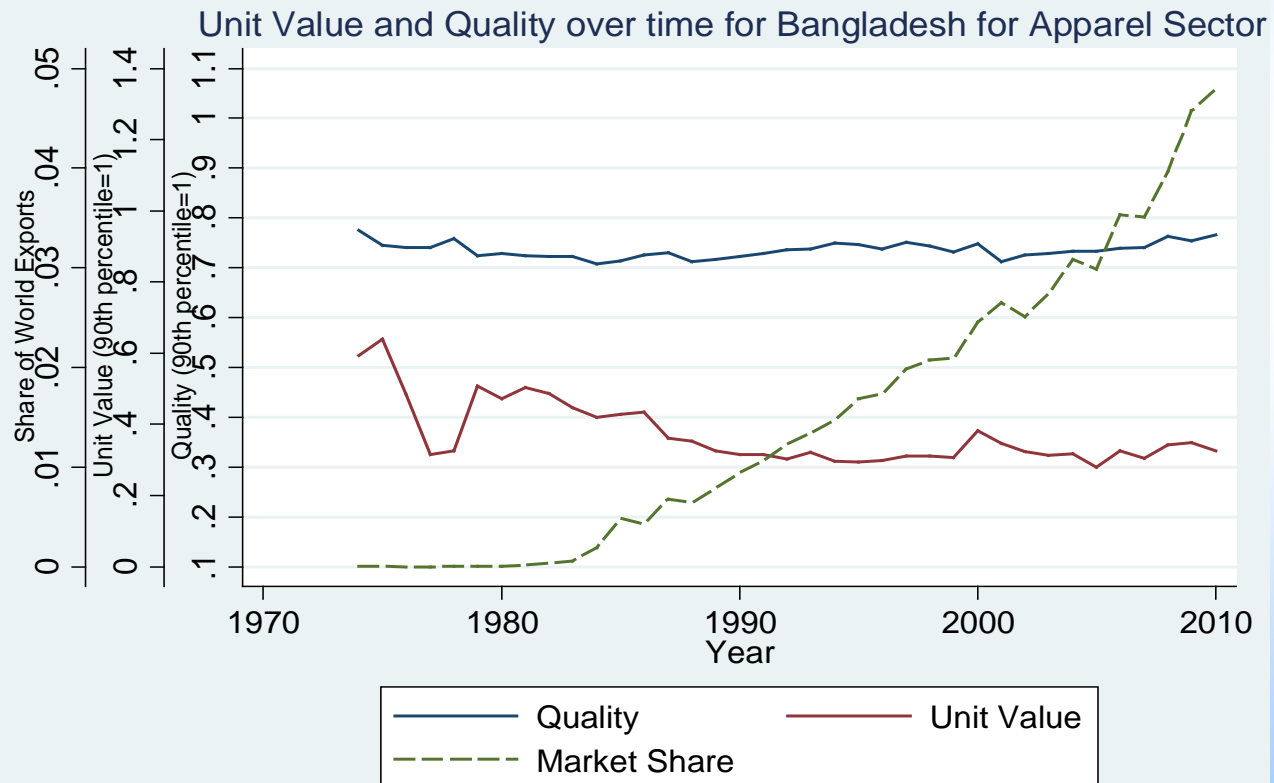
➤ Rising quality and rising—but still low—prices.



# Bangladesh Apparel Exports

SITC 84

- Prices remain low. Quality—although increasing—lags behind China.

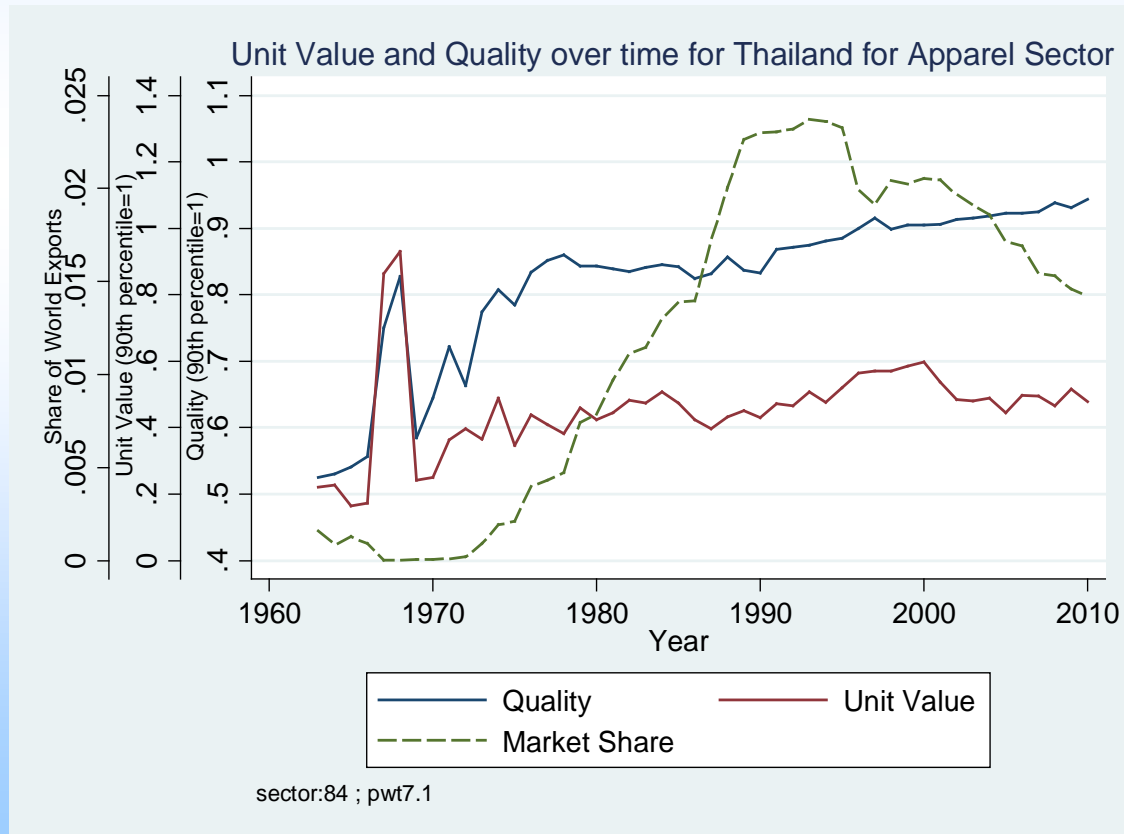


sector:84

# Thailand Apparel Exports

## SITC 84

- Quality continues to increase. Slows decline of textile sector as economy reorients to other sectors.

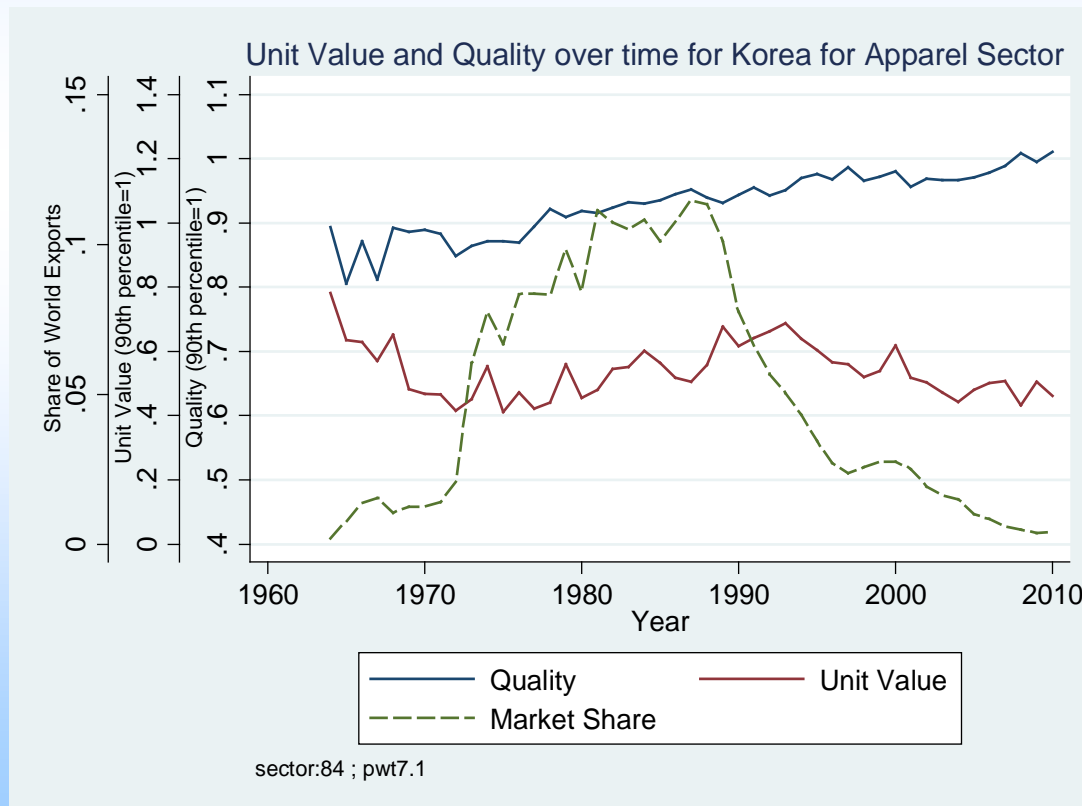




# Korea Apparel Exports

## SITC 84

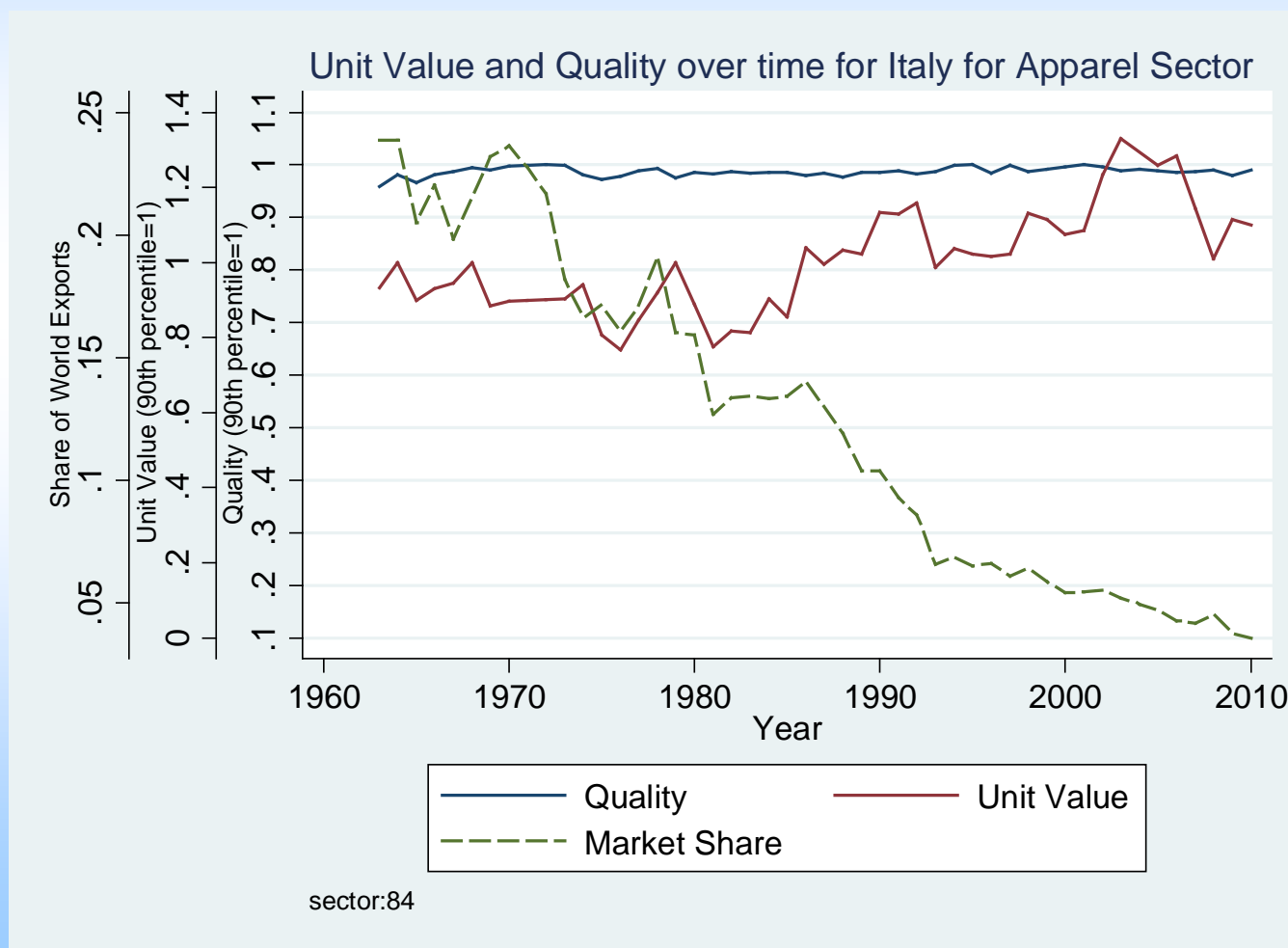
- Quality has concluded convergence to world frontier, as economy diversified away from apparel.



# Italy Apparel Exports

## SITC 84

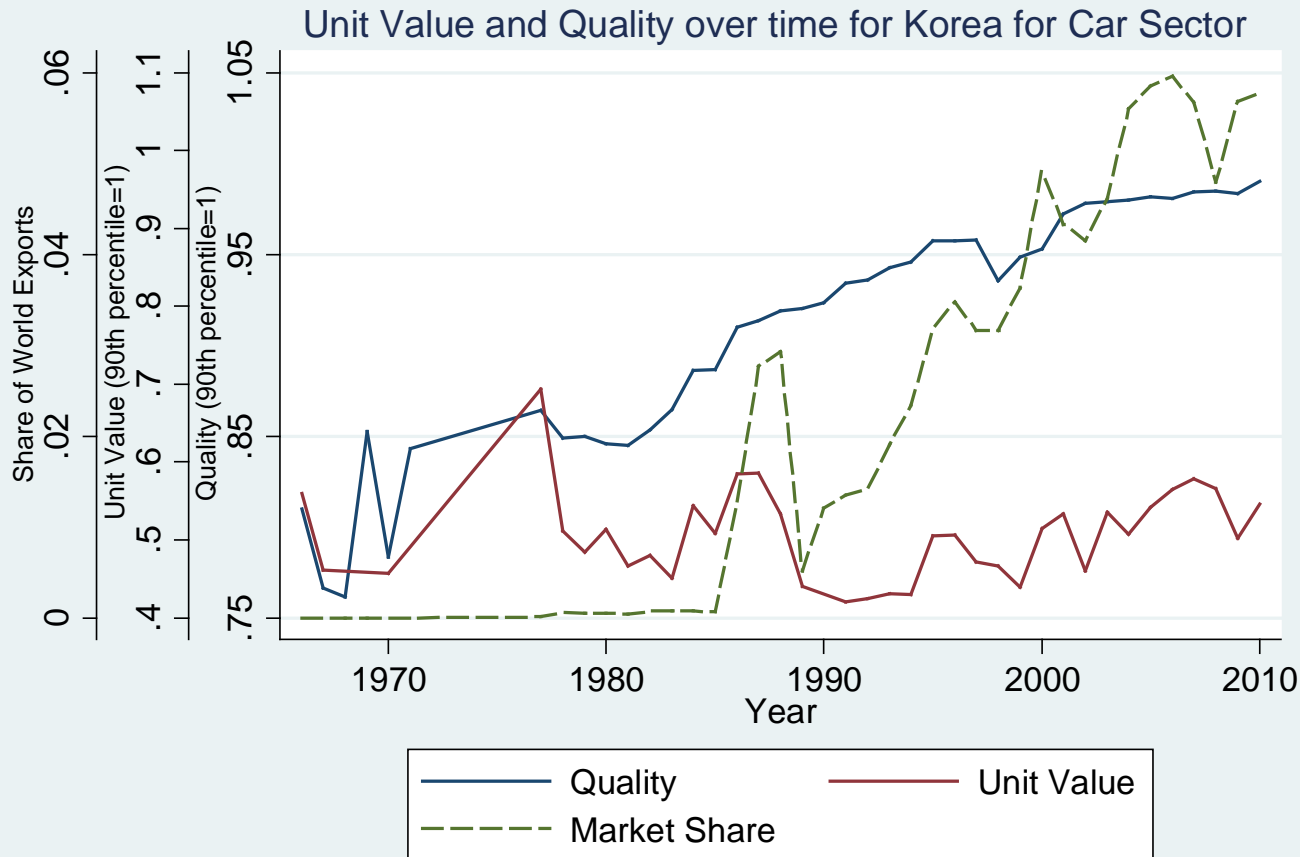
- High quality, but rising prices helped undermined market share.



# Korean car exports

SITC 7321

- Increasing market share, because rising quality but prices maintained low.

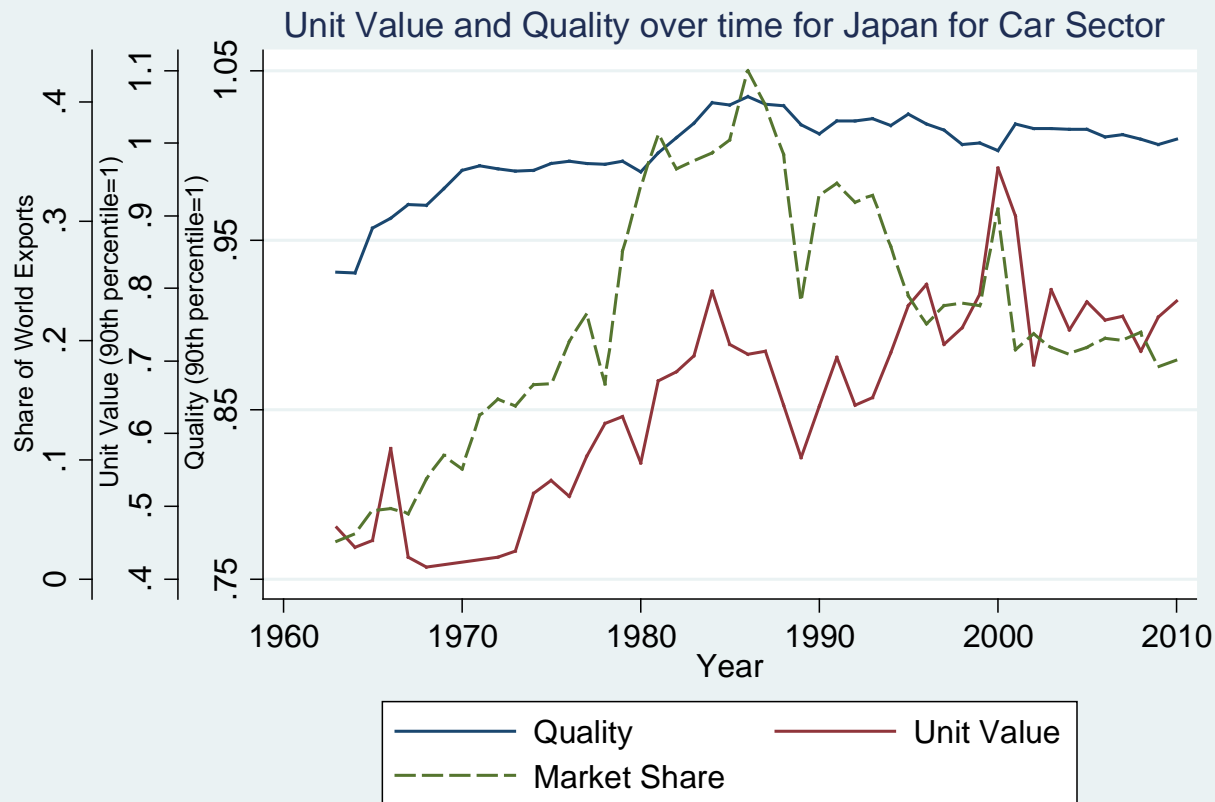


sector:SITC4=7321

# Japanese car exports

SITC 7321

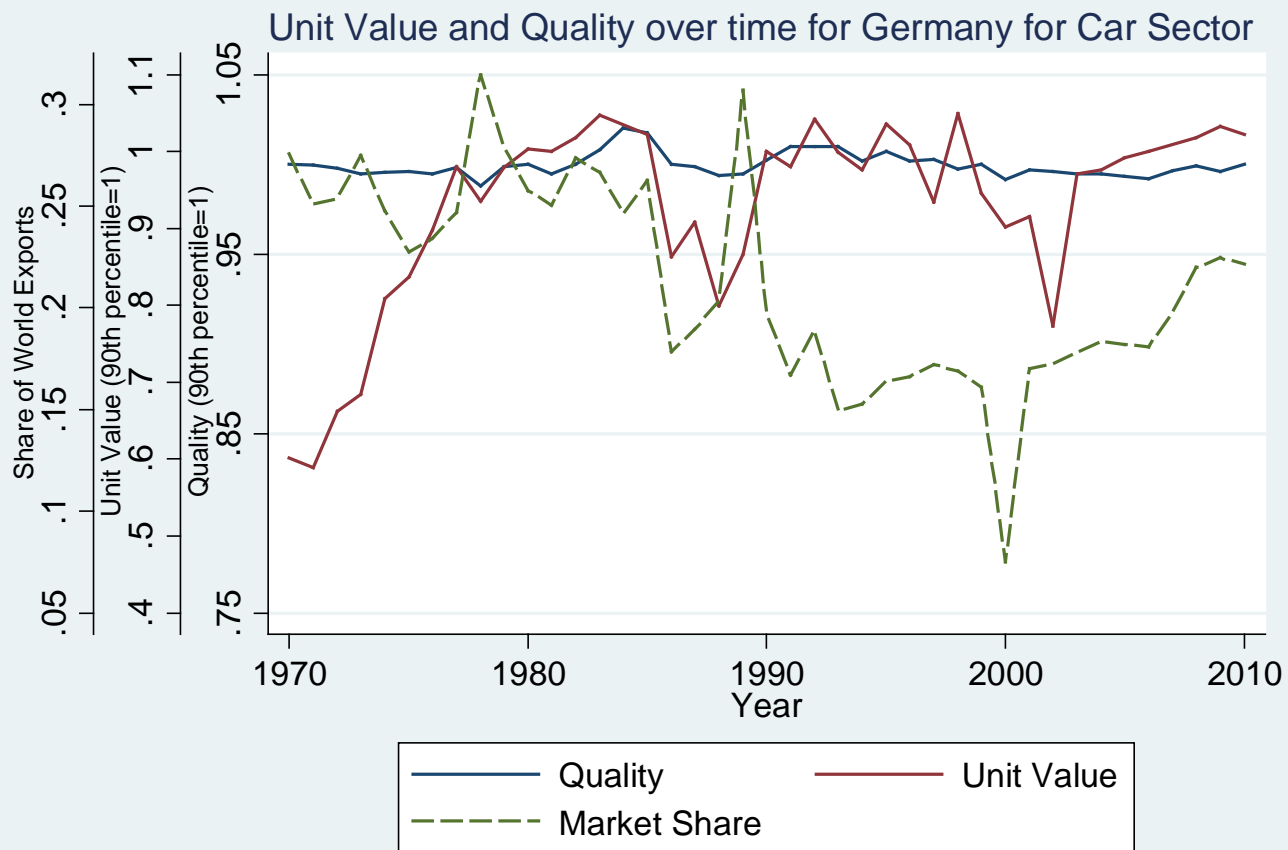
- Rising quality reached world frontier in the early 1970s. Rising prices put pressure on market share in 1990s.



# German car exports

SITC 7321

- High quality throughout and high price since the late 70s. Market share losses in 1990s likely in light of stronger competition.



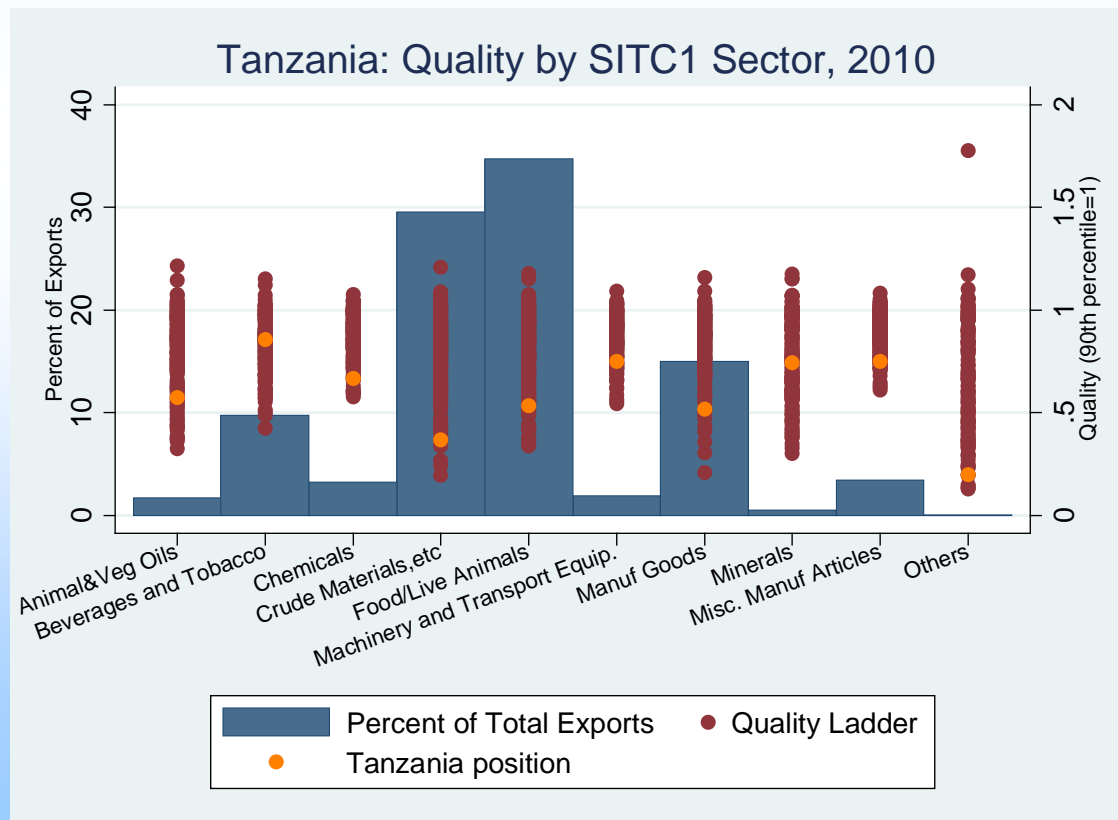
sector:SITC4=7321



# Potential Quality and Horizontal Diversification

## Tanzania

- Given its concentration in agricultural products and crude materials, Tanzania has potential for horizontal diversification but also for quality upgrading in agriculture.



# Potential for Further Quality Upgrading

## Vietnam

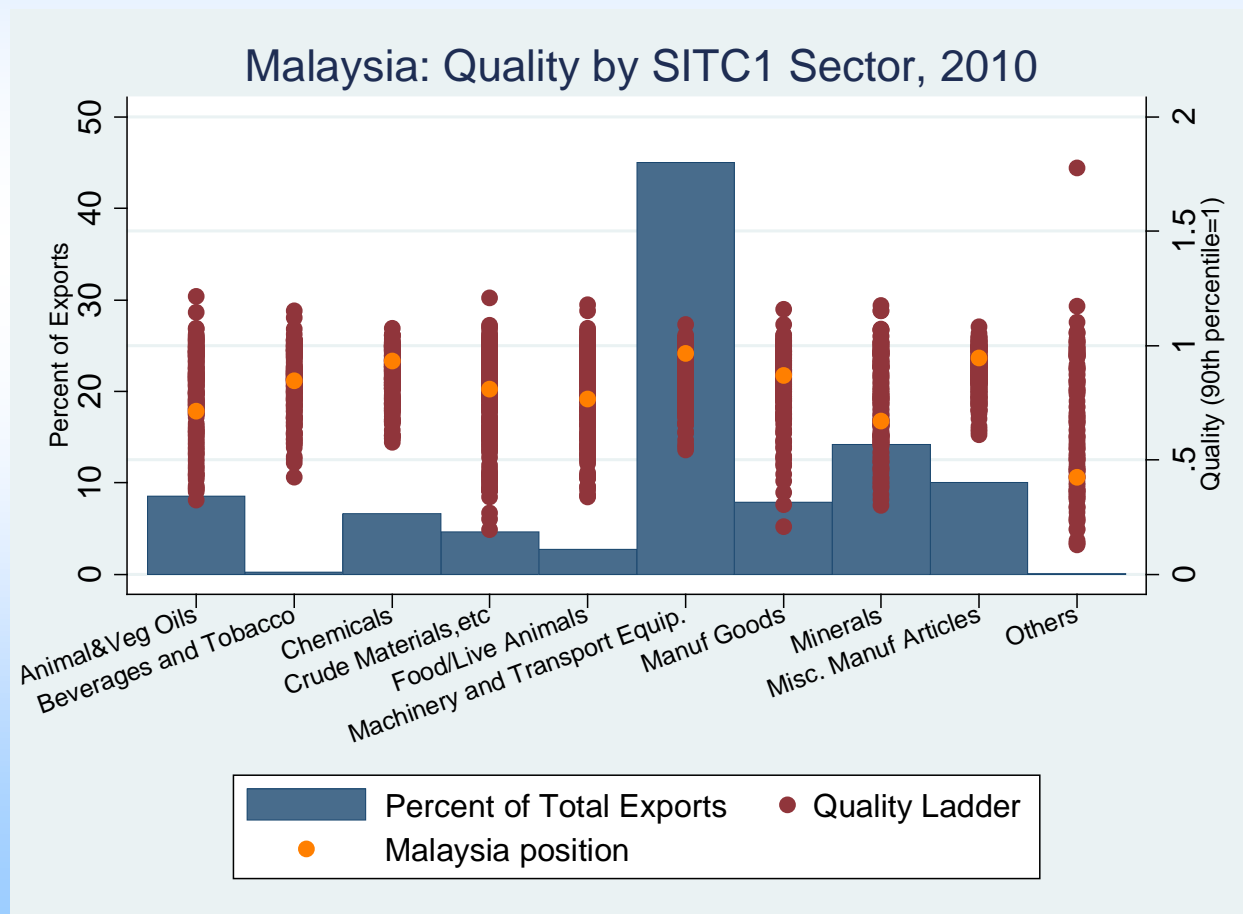
- Vietnam has a good amount of room to quality upgrade in various sectors, particularly its largest, misc. manufactures (includes garments/footwear).



# Horizontal Diversification useful

## Malaysia

- Malaysia is highly specialized in electronics and is close to the top of the quality ladder. Diversification to higher value-added products could be useful.

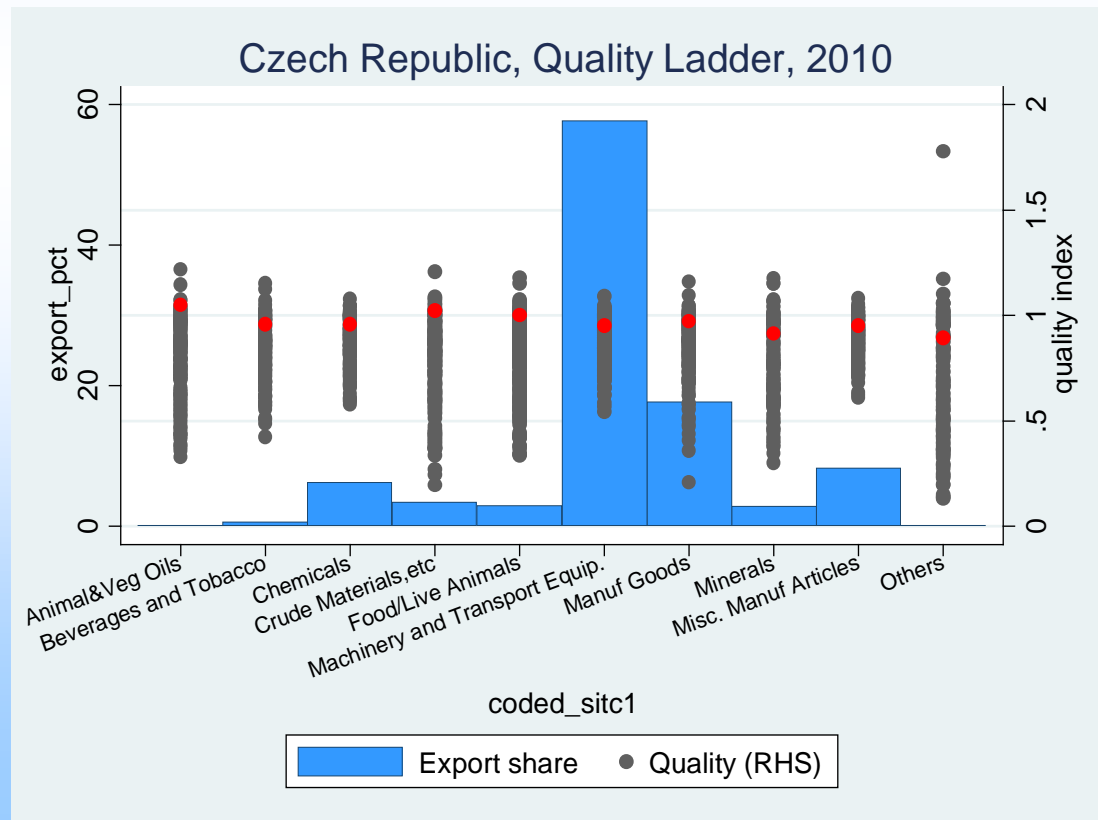




# Horizontal Diversification useful

## Czech Republic

- Czech Republic produces high quality across sectors, but is highly specialized in autos and transport equipment.
- Other CEE economies (Poland, Hungary, Romania), but also Germany, show similar export structure.



# What is next for China?

- China has some additional potential for quality upgrading, but may also aim to diversify further across products and upgrade the tasks it performs.



# Potential for within sector diversification

## China

- Within its two strongest SITC1 sectors, China's exports seem tilted towards less sophisticated products, e.g. transport equipment is lagging behind other machinery.



# Potential for within sector diversification

## China

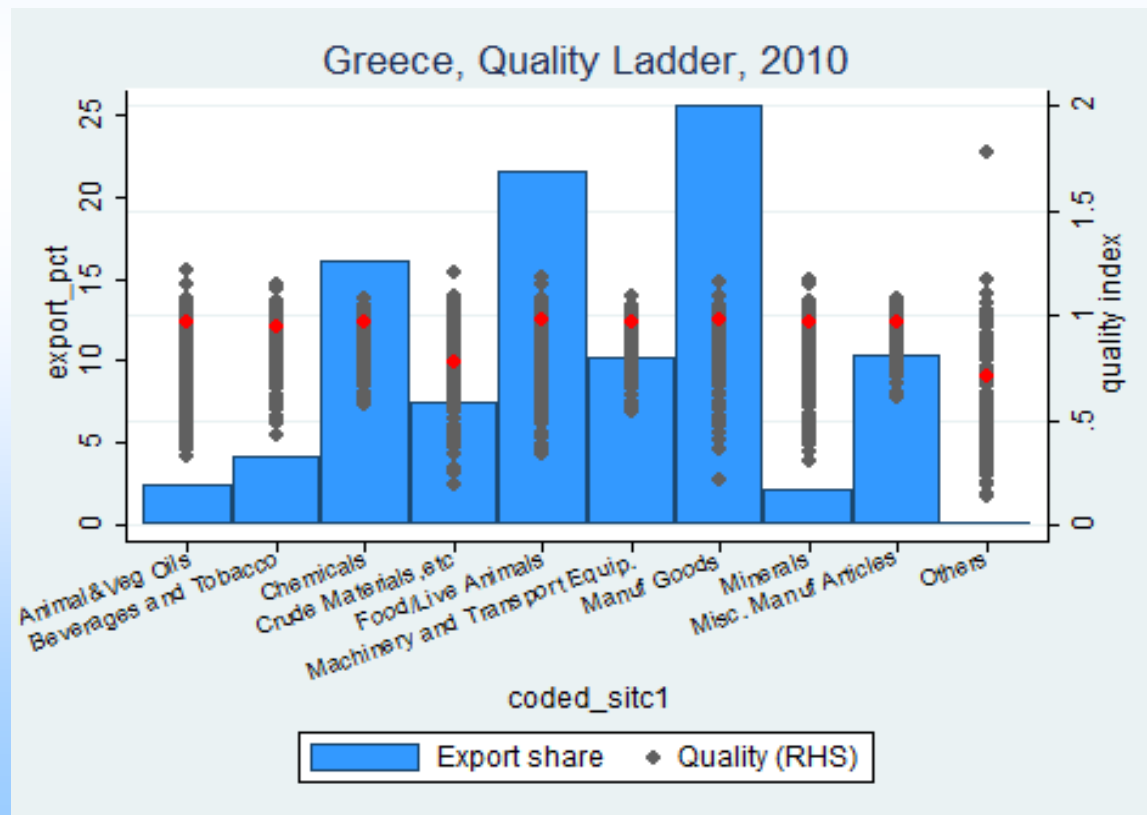
- Likewise clothing still dominates within Miscellaneous Manufactures.



# No easy answers based on export quality

## Southern Europe

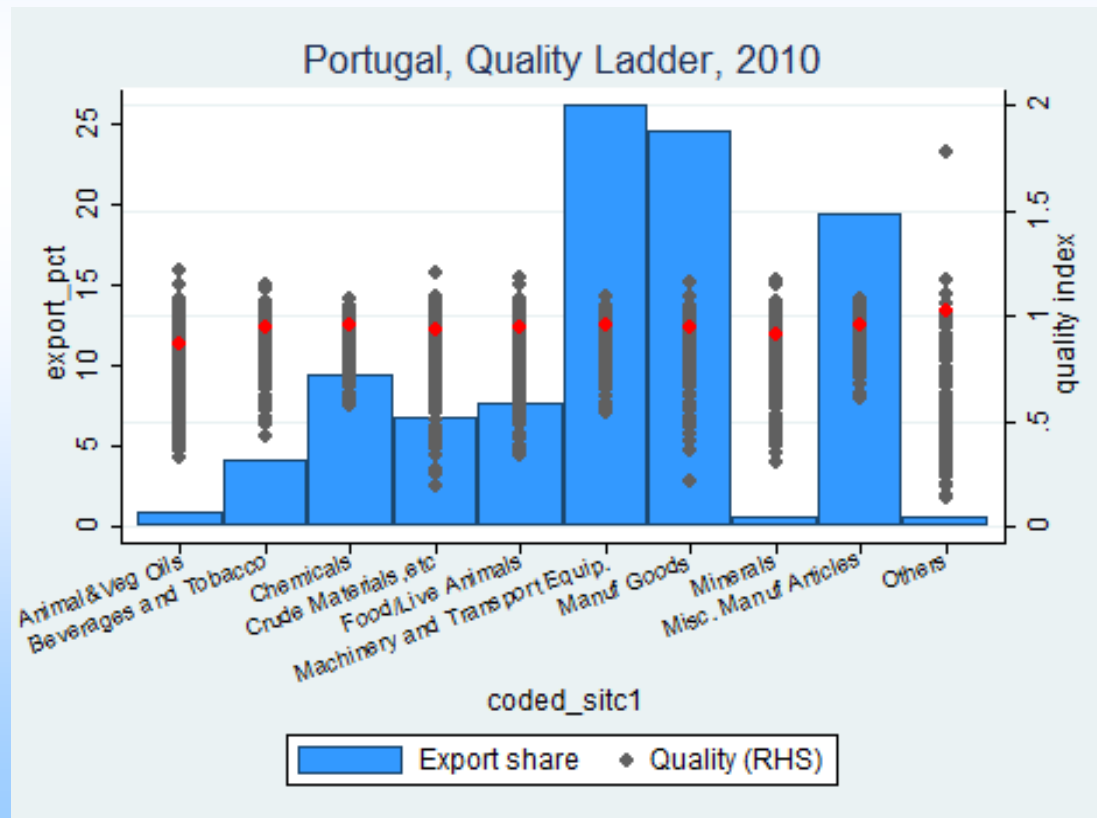
- Southern European countries have diversified production structures and produce high quality.
- Something else (competitiveness or sub-SITC1 industrial structure?) may be issue.



# No easy answers based on export quality

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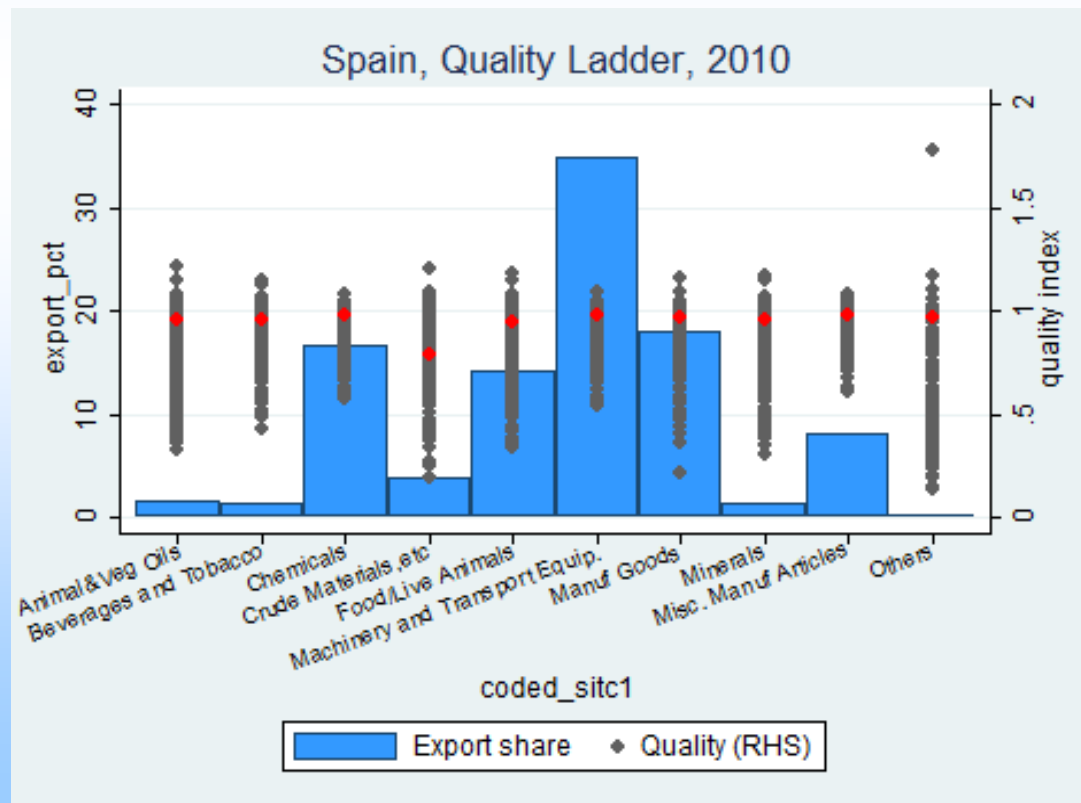
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# No easy answers based on export quality

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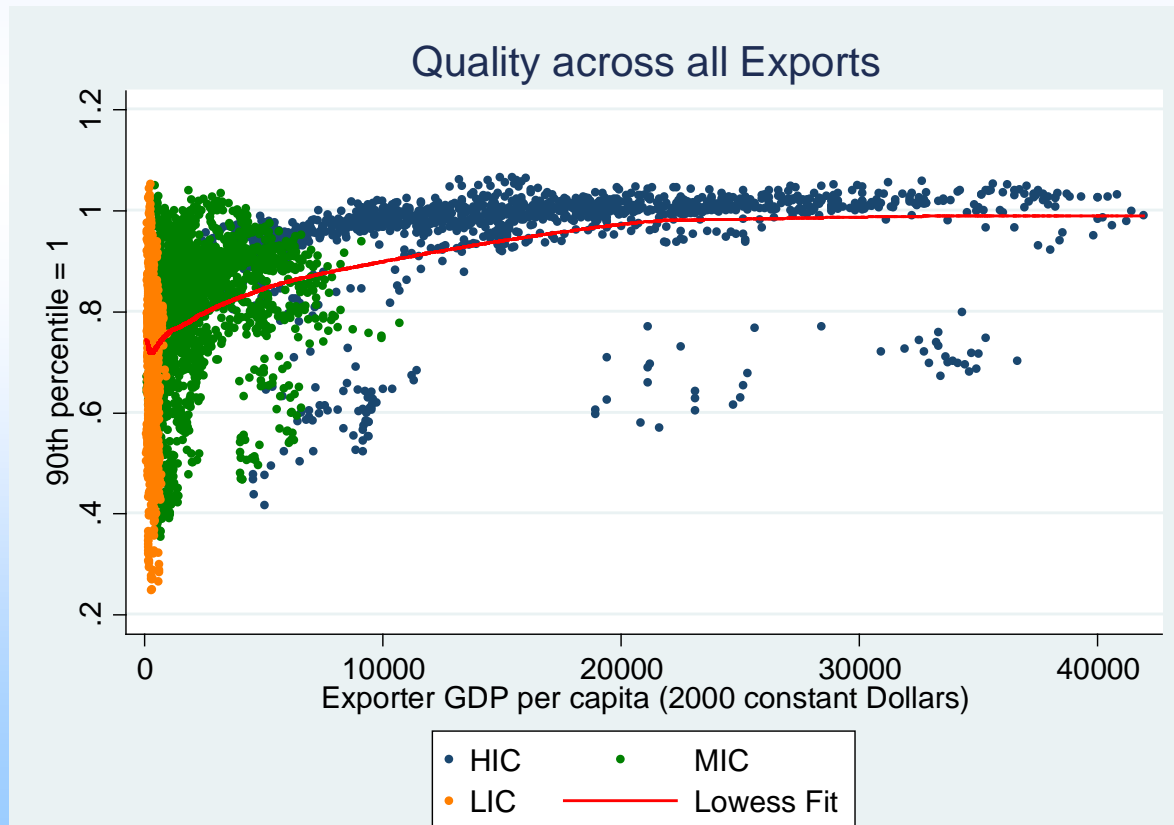


*Quality Upgrading*  
**Stylized Facts**



# Export Quality and Development

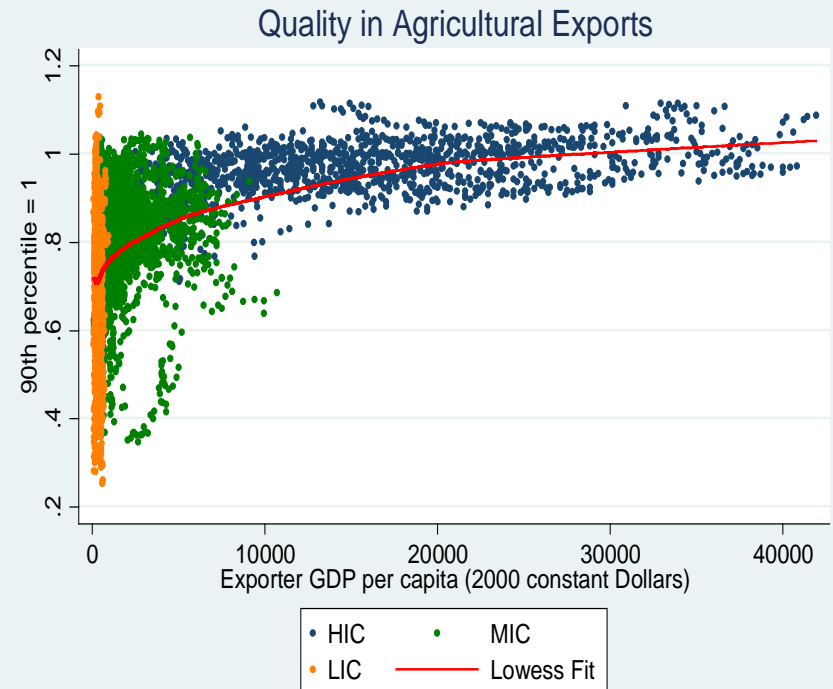
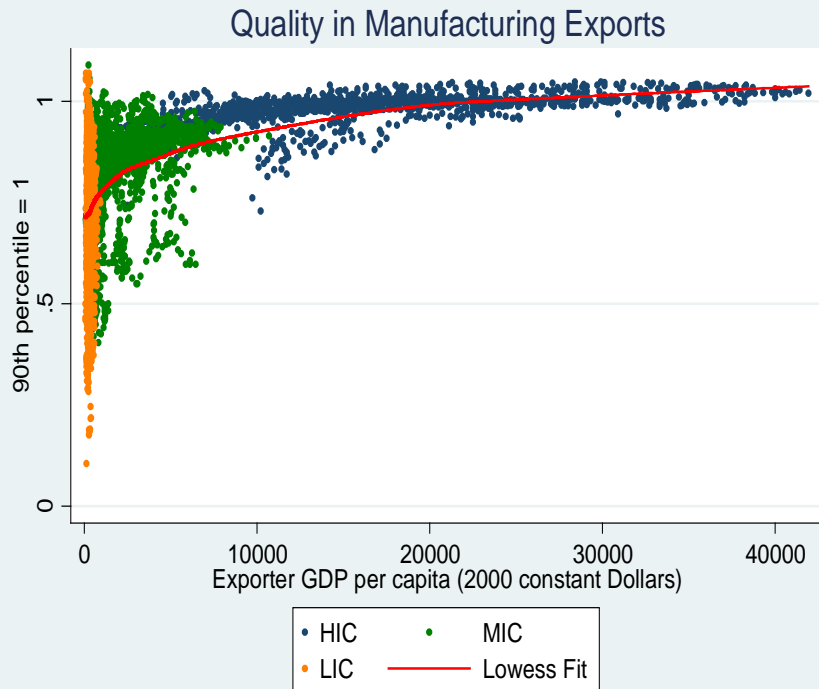
- Quality upgrading is a crucial component of development, particularly when trying to move to upper middle-income status
- Some LICs need diversification, others need quality upgrading.



# Export Quality and Development

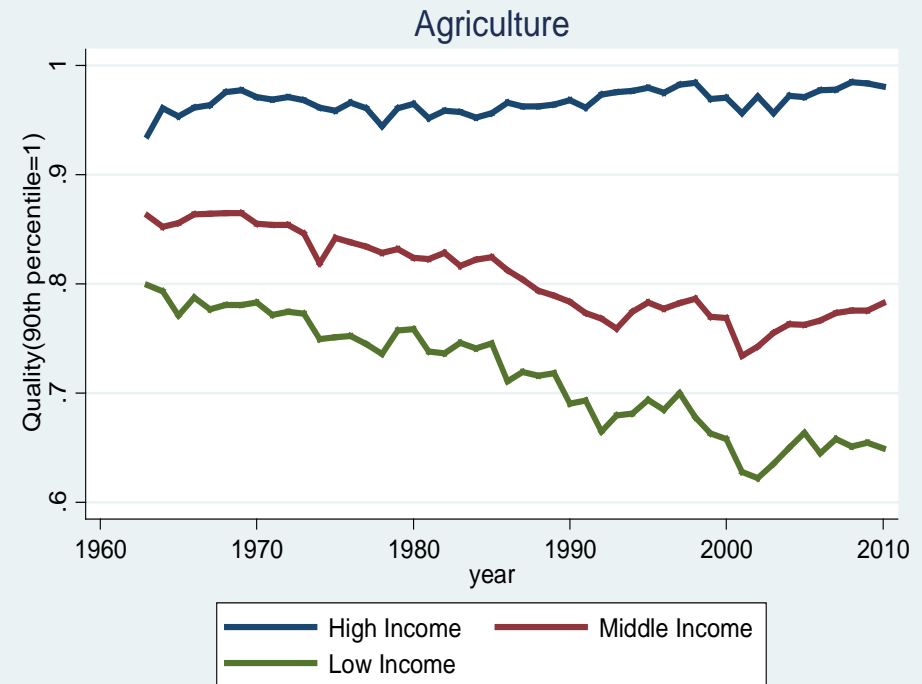
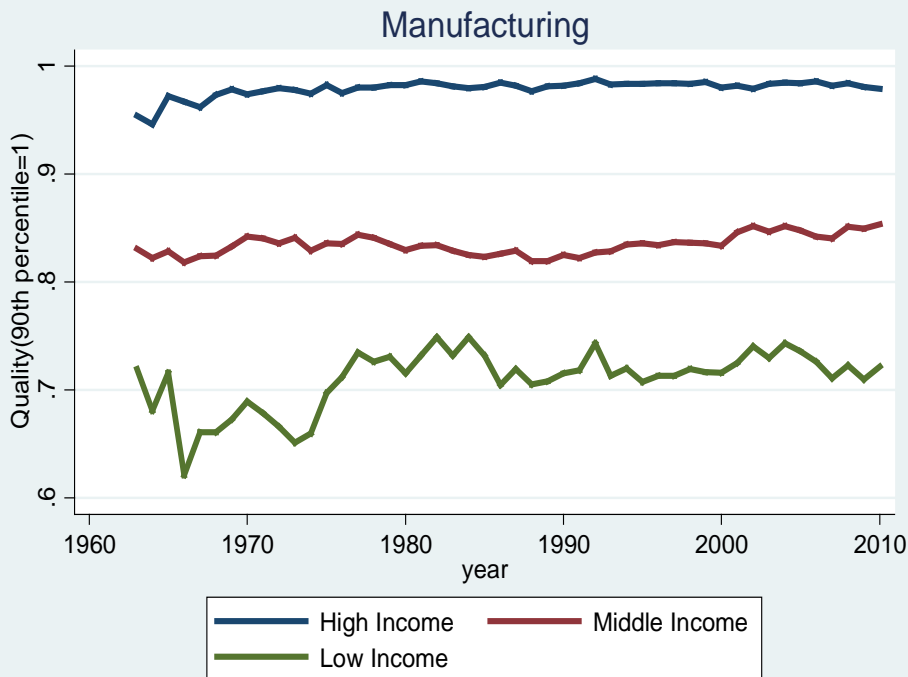
## Manufacturing and Agriculture

- There seems to be potential to also quality upgrade in agriculture, though it may be more constrained by soil and climate conditions.



# Quality by Income Group

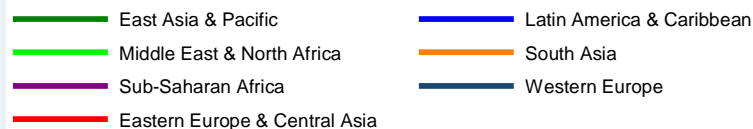
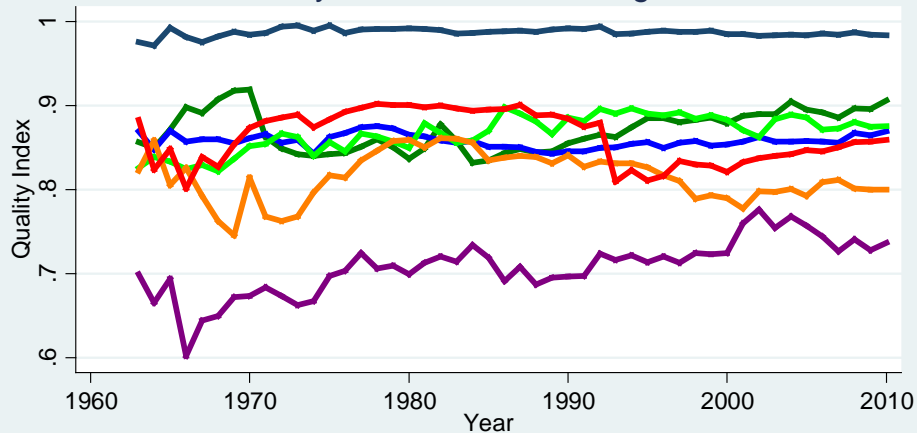
- Quality upgrading particularly visible for middle income countries.
- But there seems to be a lag between quality takeoffs in manufacturing and agriculture.



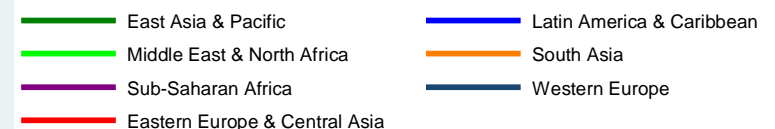
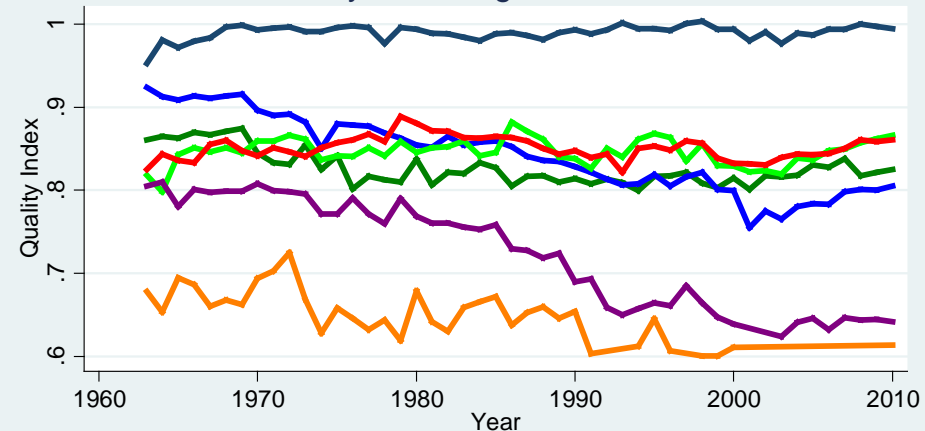
# Quality by Region

- Lag between Manufacturing and Agriculture for East Asia.
- South Asia is struggling to quality upgrade.
- Eastern Europe/Central Asia has gradually upgraded quality since mid/end-1990s.

Quality Index, Manufacturing Sector



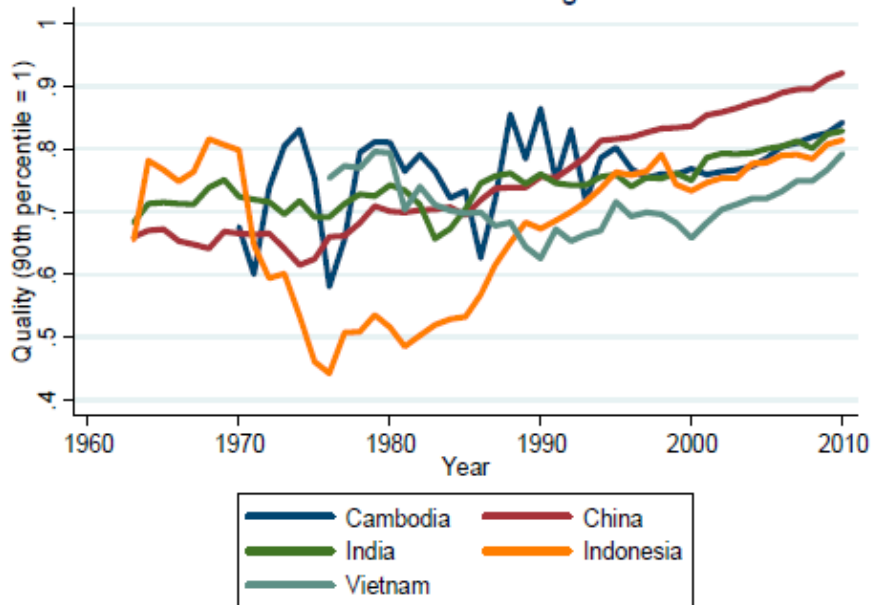
Quality Index, Agriculture Sector



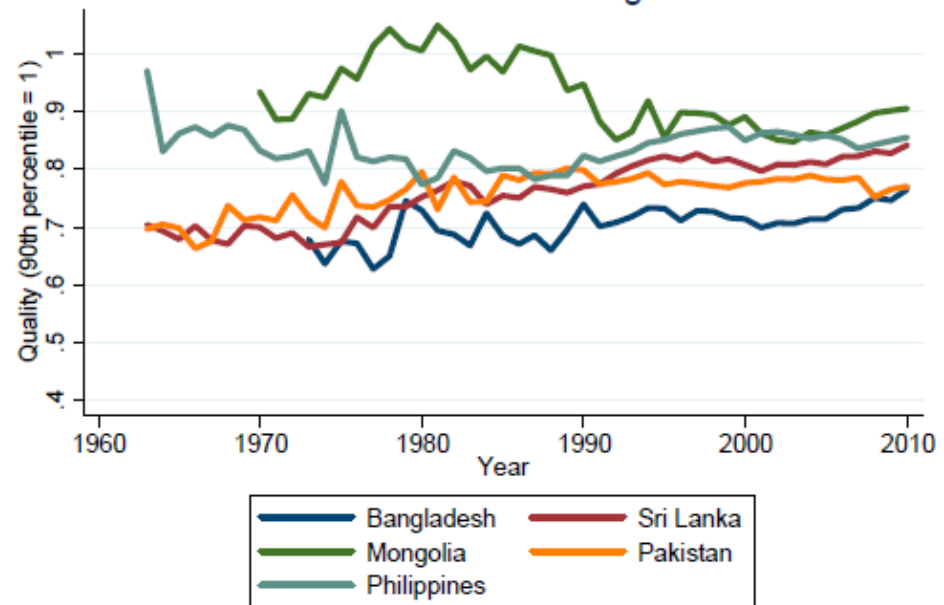
# Quality Upgrading in Asia

Considerable cross-country heterogeneity

Asia: Fast Convergers



Asia: Slower Convergers



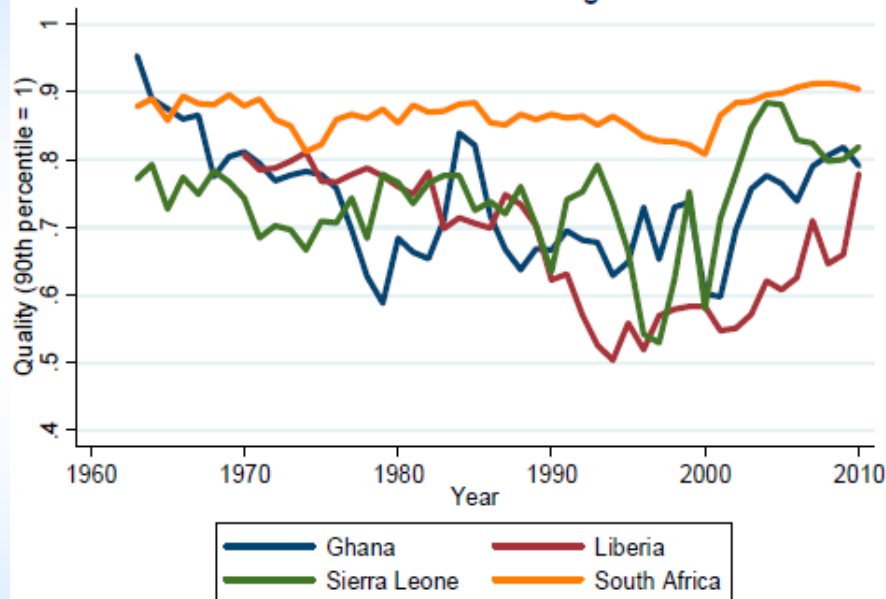
Note: Countries with quality convergence of at least 0.05 between the 1994-96 and 2008-10 periods are assigned to the fast converger group.



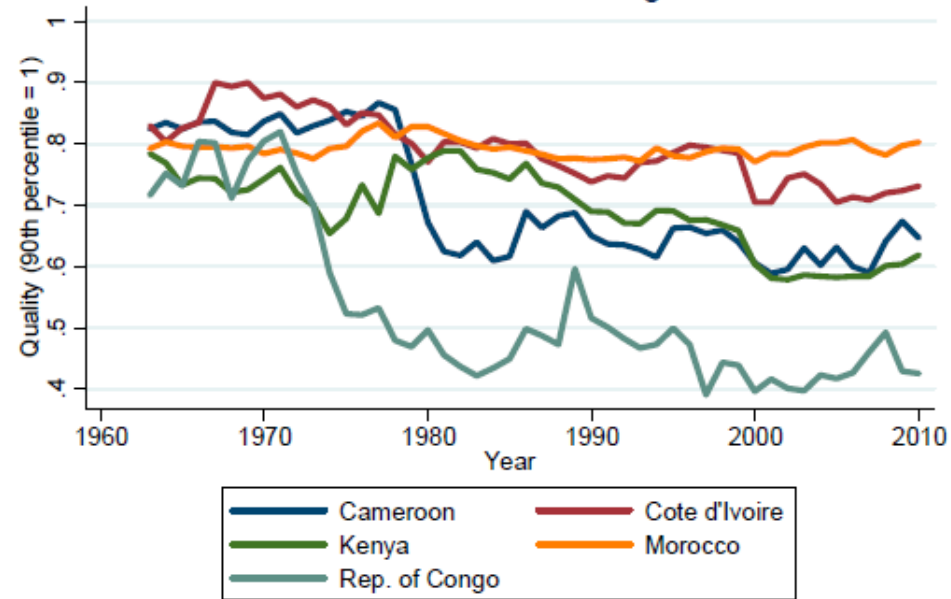
# Quality Upgrading in Africa

Considerable cross-country heterogeneity

Africa: Fast Convergers



Africa: Slower Convergers

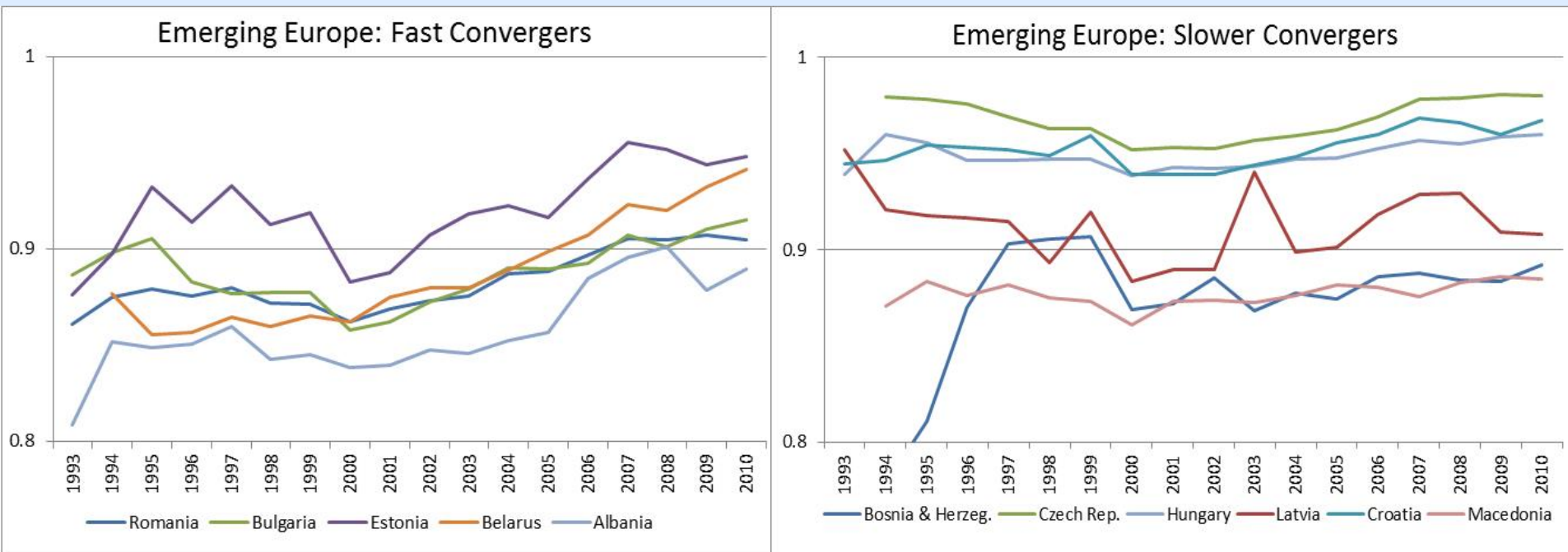


Note: Countries with quality convergence of at least 0.05 between the 1994-96 and 2008-10 periods are assigned to the fast converger group.



# Quality Upgrading in Emerging Europe

Cross-country differences muted, given high quality levels

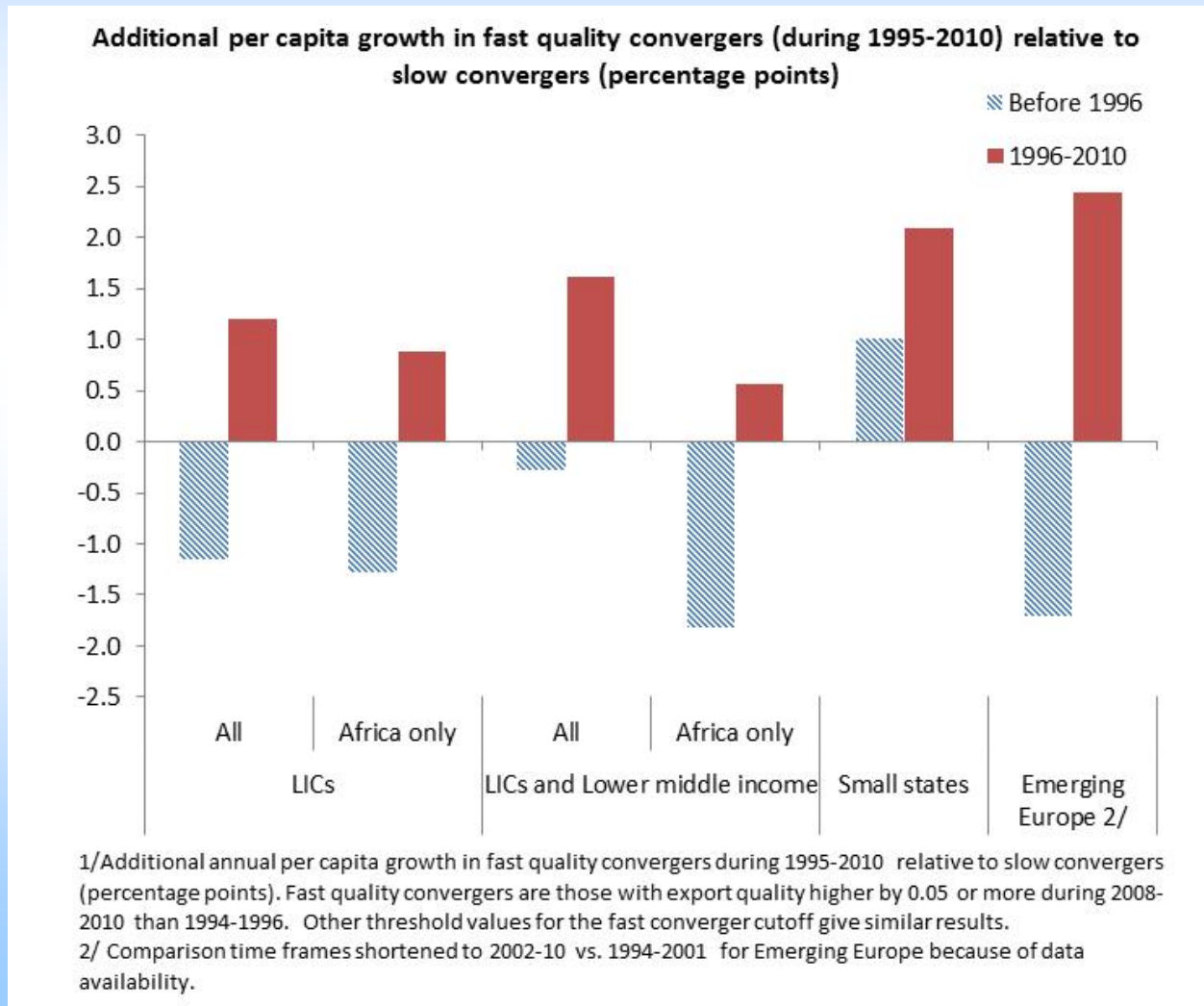


Note: Countries with quality convergence of at least 0.0375 between the 2000-02 and 2008-10 periods are assigned to the fast converger group.



# Quality Upgrading and Growth

- Countries experiencing faster quality convergence since 1995 may also have experienced faster growth in GDP per capita.

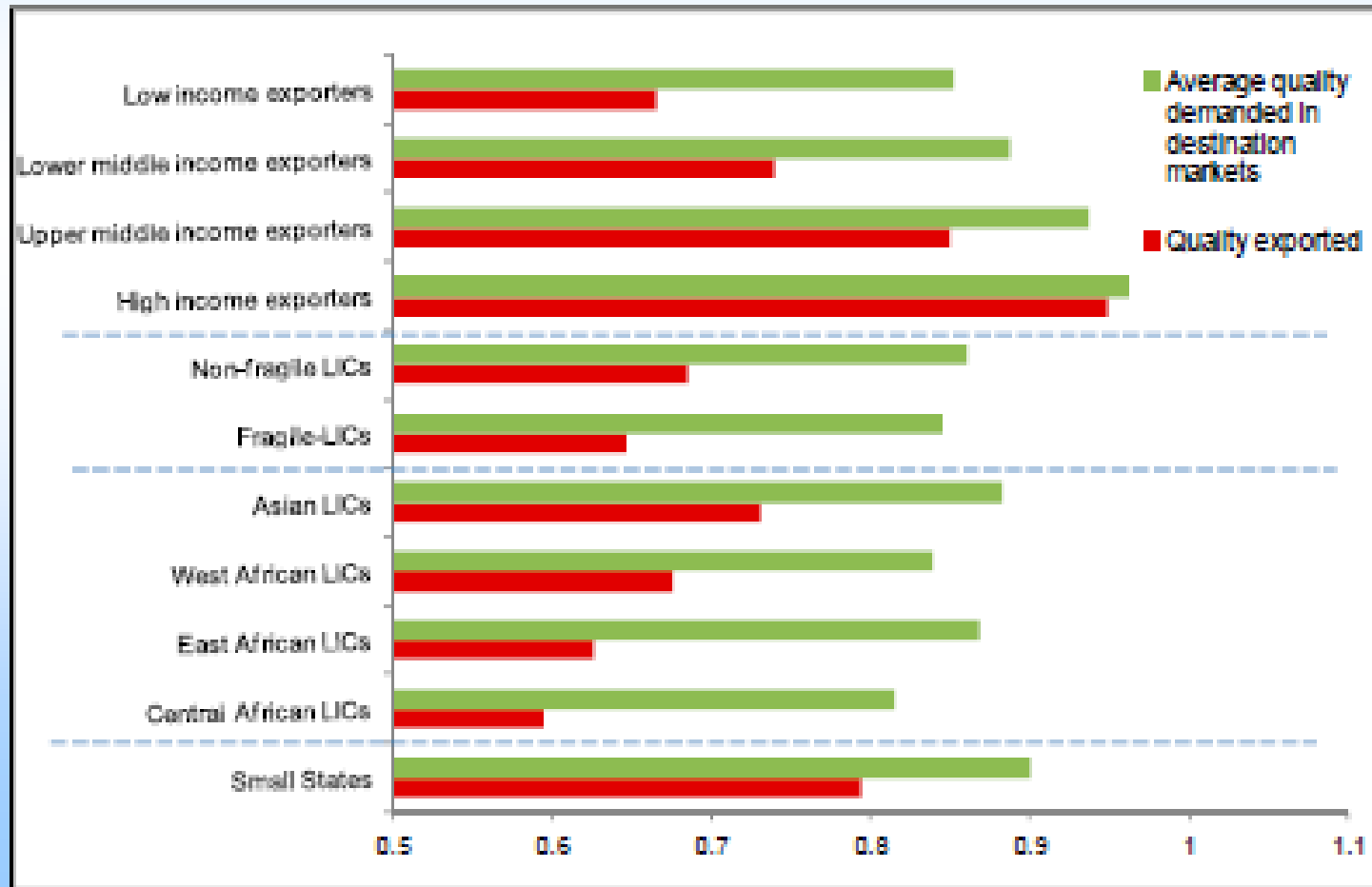




# Potential for quality upgrading

## Destination markets are no constraint for LICs

- Quality demanded in destination markets is not an apparent constraint. Policy may thus aim at encouraging domestic quality upgrading itself, rather than on helping domestic firms enter higher quality export markets.



# Determinants of Quality Upgrading

# Determinants of Quality Upgrading (I)

- Panel analysis, to investigate drivers of quality upgrading.
- Dependent variable: Growth Rate of Quality.
- One observation per exporter-4-digit-product-time period.  
Focus on 10-year averages.

Independent variables:

- \* Initial Quality Levels
- \* GDP per Capita
- \* Institutional Quality
- \* Trade, Agricultural, and Financial Liberalization indices
- \* Human Capital
- \* Country, product, and time fixed effects.

**Table 2. Quality Upgrading: Panel Regressions, for All Products**

<b>Growth in Product Quality</b>					
	(1)	(2)	(3)	(4)	(5)
<b>Ln Initial Quality</b>	-0.0502*** (0.00522)	-0.0472*** (0.00647)	-0.0431*** (0.00792)	-0.0420*** (0.00977)	-0.0413*** (0.0105)
<b>Ln Initial GDP per capita</b>	7.19e-05 (0.000285)	-0.000168 (0.000338)	0.000530 (0.000414)	0.000679 (0.000496)	0.000602 (0.000534)
<b>Initial Institutional Quality</b>	2.27e-05** (9.22e-06)	1.54e-05 (9.43e-06)	2.74e-05*** (7.51e-06)	2.28e-05** (9.24e-06)	2.38e-05*** (9.21e-06)
<b>Initial Trade Index</b>		0.00265*** (0.000580)	0.00467*** (0.000779)	0.00582*** (0.000965)	0.00554*** (0.000995)
<b>Initial Agriculture Index</b>			0.00149*** (0.000473)	0.00135** (0.000611)	0.00151** (0.000677)
<b>Initial Domestic Fin. Lib. Index</b>				0.00199** (0.00101)	0.00108 (0.00111)
<b>Initial Human Capital</b>					7.14e-05*** (2.64e-05)
<i>Memo Items:</i>					
Observations	211,131	167,329	127,008	104,484	100,118
Countries	149	129	93	76	68
Products	851	850	850	849	849
Time Period	2008 1962	2005 1962	2003 1962	2003 1973	2003 1973
R <sup>2</sup>	0.073	0.069	0.067	0.065	0.063

**Table 3. Quality Upgrading: Panel Regressions, for Manufacturing Alone**

<b>Growth in Product Quality</b>					
	(1)	(2)	(3)	(4)	(5)
Ln Initial Quality	-0.0756*** (0.00687)	-0.0667*** (0.00733)	-0.0608*** (0.00850)	-0.0568*** (0.0102)	-0.0567*** (0.0107)
Ln Initial GDP per capita	0.00109*** (0.000317)	0.00107*** (0.000368)	0.00123*** (0.000431)	0.00127*** (0.000433)	0.00127*** (0.000452)
Initial Institutional Quality	2.00e-05** (8.45e-06)	2.63e-05** (1.09e-05)	3.20e-05*** (8.14e-06)	2.61e-05** (1.05e-05)	2.71e-05*** (1.04e-05)
Initial Trade Index		0.00292*** (0.000689)	0.00442*** (0.000923)	0.00554*** (0.00108)	0.00522*** (0.00111)
Initial Agriculture Index			0.000537 (0.000489)	0.000729 (0.000630)	0.000442 (0.000695)
Initial Domestic Fin. Lib. Index				0.00140 (0.00109)	0.00110 (0.00124)
Initial Human Capital					2.83e-05 (3.28e-05)
<i>Memo Items</i>					
Observations	139,423	112,105	85,030	70,660	67,830
Countries	149	129	93	76	68
Products	568	567	567	566	566
Time Period	2008 1963	2005 1963	2003 1963	2003 1973	2003 1973
R <sup>2</sup>	0.113	0.094	0.092	0.087	0.086

# Determinants of Quality Upgrading (II)

- Significant evidence of within-product **quality convergence**, both conditional and unconditional.
- Both growth rates of quality, and speed of convergence, are on average higher in manufacturing than in primary sector.
- In addition, speed of quality upgrading positively associated with:

**Institutional Quality**

**Liberal Trade and Agricultural Policies**

# Summary of Findings

- Development is strongly associated with export quality.
  - Exploiting the quality margin may be as important for development in early stages as moving into new higher-value-added products.
  - Agriculture also holds quality improvement potential.
- Quality convergence likely associated with higher growth.
- Evidence of conditional and unconditional within-product quality convergence suggests that entrance into ‘long-quality-ladder’ sectors today may partly determine longer run growth.
- Strong quality convergence found in Asia’s success stories as well as Emerging Europe (since late 1990s).

# Policy implications

- Creating favorable conditions for quality upgrading can likely underpin LICs' and MICs' development:
  - Institutional development, market-oriented policies and education likely favor quality upgrading.
  - Meanwhile, absorption potential of destination markets for higher quality products is generally not a constraint.
  - However, each country is different, requiring a customized strategy. For some quality upgrading holds great promise, while others may need to diversify first into other sectors to build quality upgrading potential.

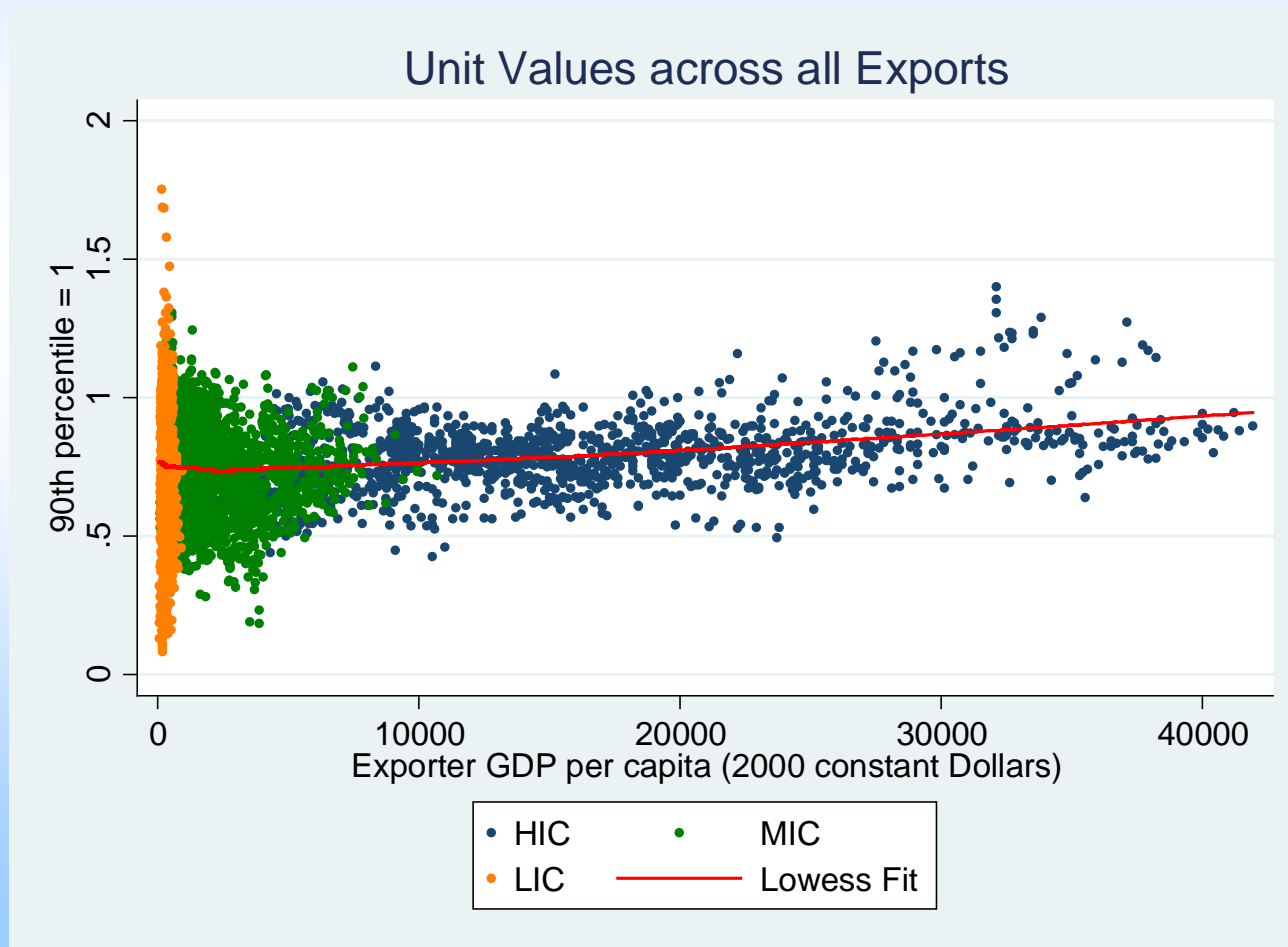


# Empirical application

- Currently work is starting on an empirical application exploiting product-level richness of data.
  - Option 1: Matching quality data with value-added trade data
    - then investigate whether quality upgrading is favored by higher integration into GVCs
  - Option 2: Matching quality data with tariff data
    - then investigate whether quality upgrading is favored by low/stable/WTO-bound tariffs, e.g. because stable trade policy favors multinationals' engagement
- Other ideas?

# Unit Values and Development

- Unit values give a different picture: That yields to upgrading are constant throughout and not frontloaded in the initial development phase.

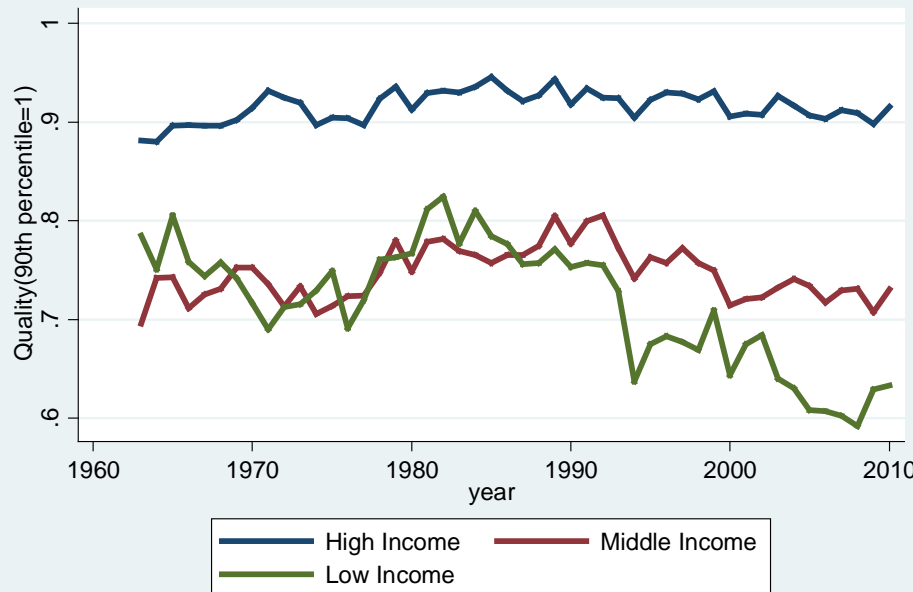


# Quality Upgrading in Commodities

➤ With the commodities boom, LICs have been increasingly focusing on producing primary commodities.

➤ Consequently, quality upgrading cannot be identified on an economy-wide basis for LICs.

Commodities



All Sectors

