

# Analyzing the Effects of Free Trade Agreements in a Melitz-CGE Model:

## Evidence from Turkey-UK FTA

by

Zeynep Akgul

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# Roadmap

- Motivation
- Model overview
  - GTAP-HET model
  - Towards GTAP-HET Version 2.0
  - Characterization in fixed costs
- Data and Parameterization
  - Pareto distribution and Power-law
- Turkey-UK FTA example
  - Hypothetical example: Cut in regulatory costs and fixed export costs
  - Sensitivity checks to parameters
- Going forward

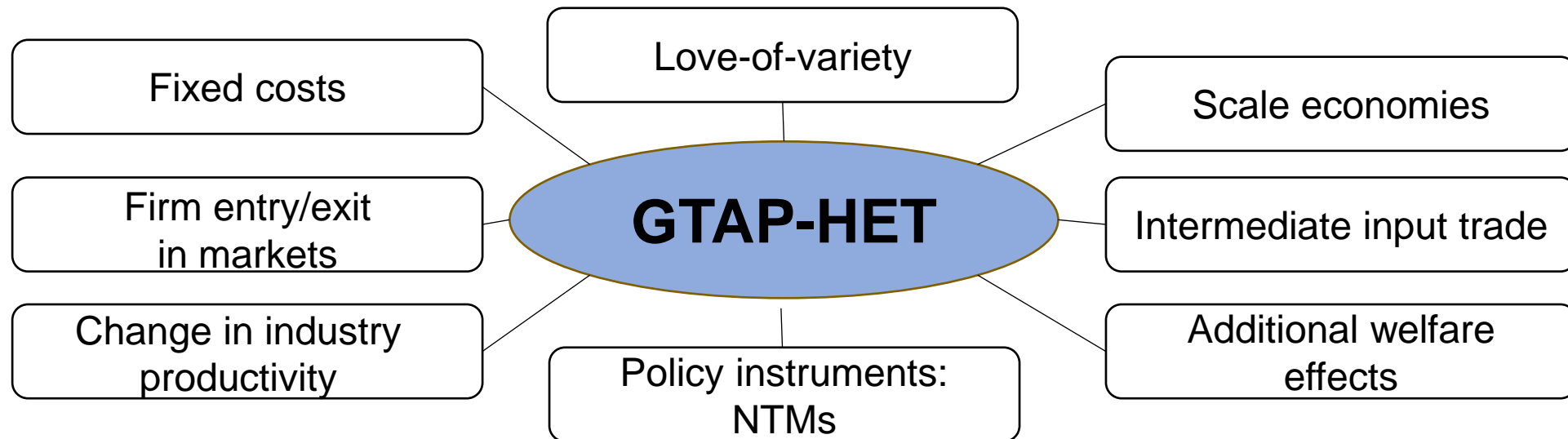
# Motivation

- Pre-Brexit:
  - UK-Turkey trading relationship was governed by the EU-Turkey Customs Union
  - UK is Turkey's second biggest export region
- Post-Brexit:
  - UK and Turkey signed an FTA that came into effect on January 1st, 2021
  - Room for improving customs and trade facilitation
- This study:
  - Lower regulatory costs in motor vehicles and parts sector of Turkey and the UK
  - Characterization of fixed costs - intermediate inputs

# Firm Heterogeneity in GTAP

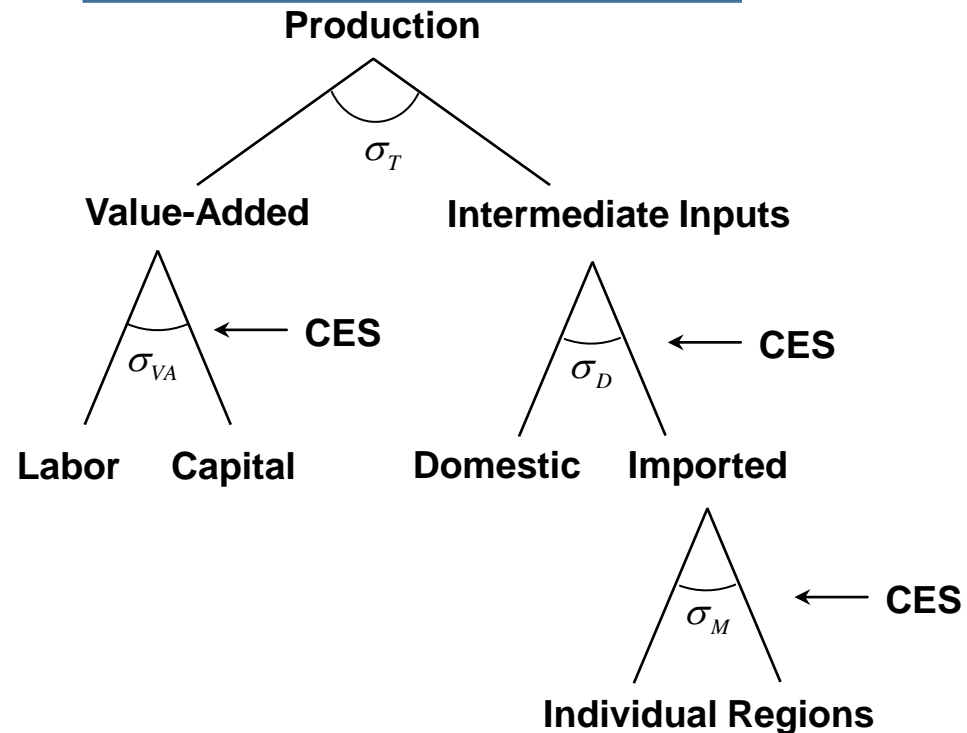
## ▪ Standard GTAP model

- Perfect competition
- Identical firms and varieties
- Exogenous total factor productivity
- Trade policies lead to changes in trade volumes of existing varieties in the market

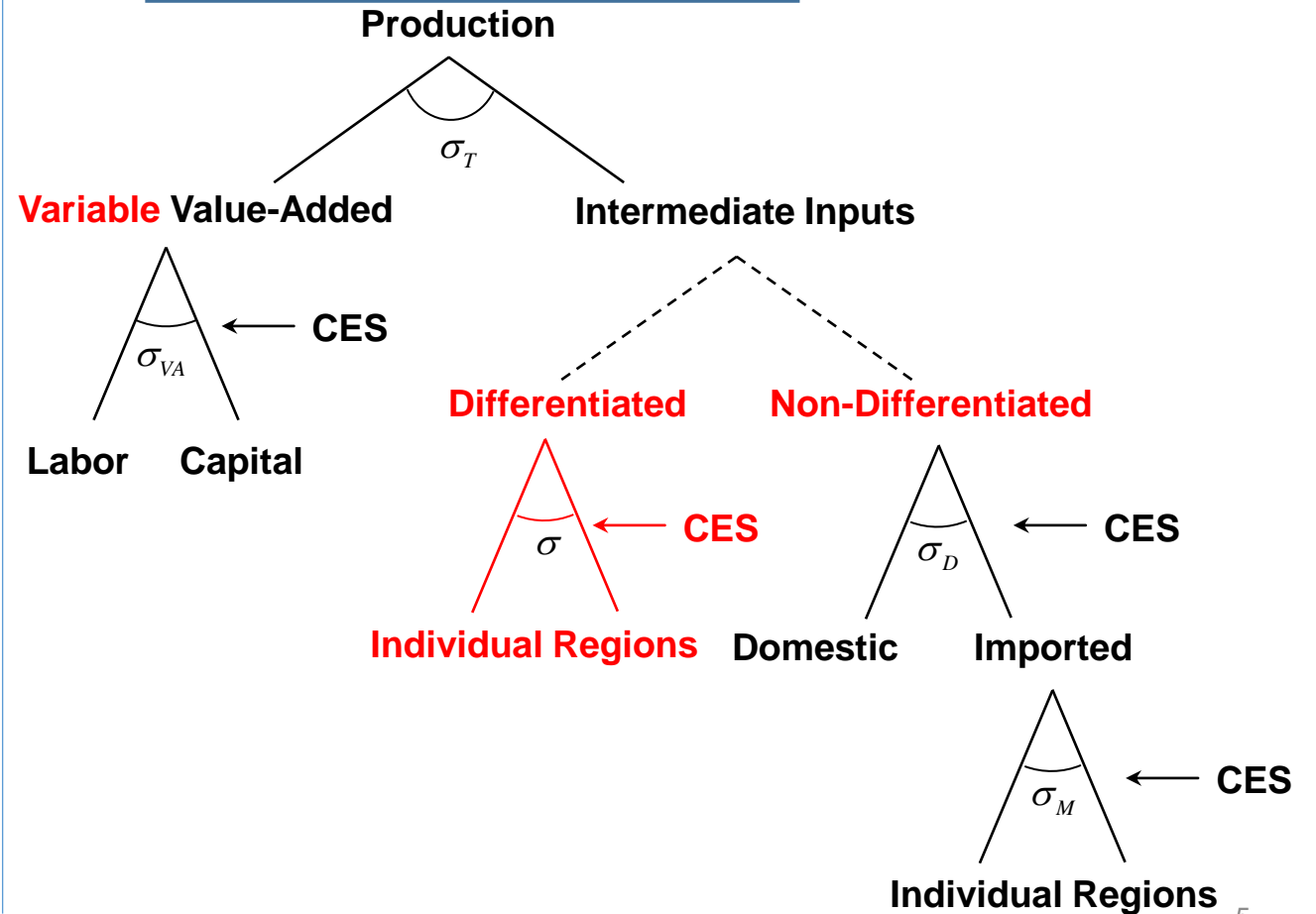


# Production and Supply Chain

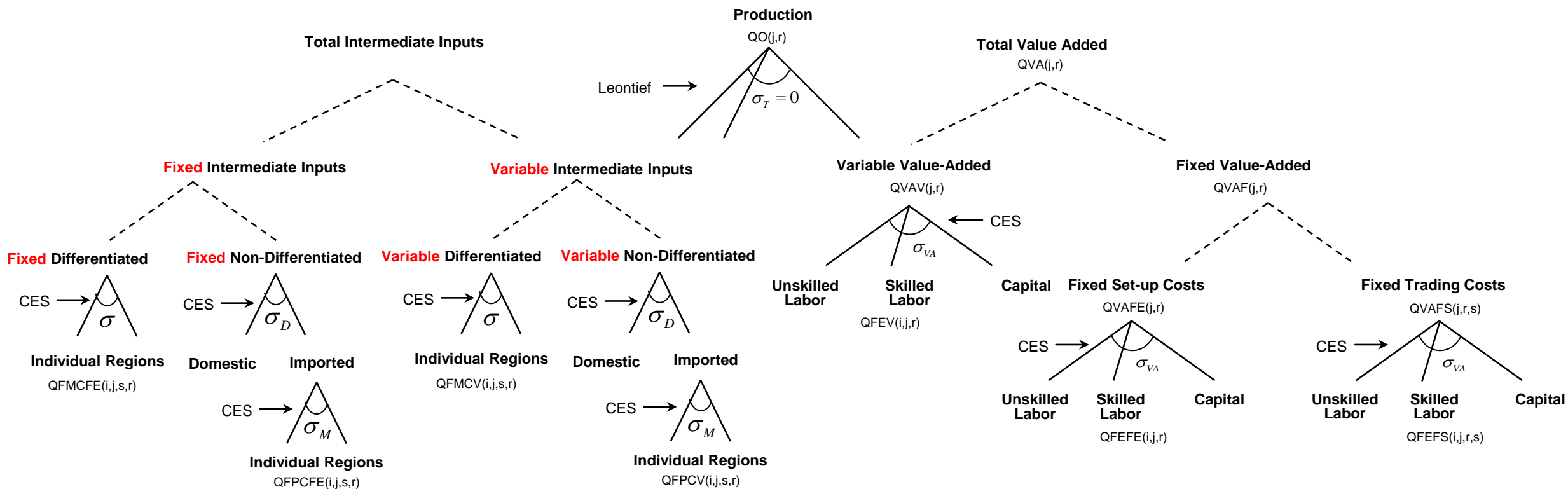
## Standard GTAP



## GTAP-HET



# Production and Fixed Costs in GTAP-HET Version 2.0



# Fixed Cost Calibration and Intermediate Input Demand

- Fixed cost calibration:

- Variable Costs:

- $\frac{\sigma-1}{\sigma}VOA(j,r)$

- Fixed Costs:

- $\frac{1}{\sigma}VOA(j,r)$

- Fixed Set-up Costs:

- $\frac{\sigma-1}{\sigma\gamma}VOA(j,r)$

- Fixed Trading Costs:

- $\frac{\gamma-\sigma+1}{\sigma\gamma}VOA(j,r)$

- Mathematical constraint,  $\gamma > \sigma - 1$  needs to be satisfied.

- GTAP-HET Version 2.0

- Equation INDMCV

- # industry j's demand in r for differentiated input i sourced from s for use in variable costs #*

- ```
(all,i,MCOMP_COMM)(all,j,MCOMP_COMM)(all,s,REG)(all,r,REG)
  qfmcv(i,j,s,r)
    = - ams(i,s,r) + qf(i,j,r) + vf(i,s,r)
      - SIGMA(i) * [pfs(i,j,s,r) - ams(i,s,r) - pfv(i,j,r)];
```

- Equation INDMCFE

- # industry j's demand in r for differentiated input i sourced from s for use in fixed costs #*

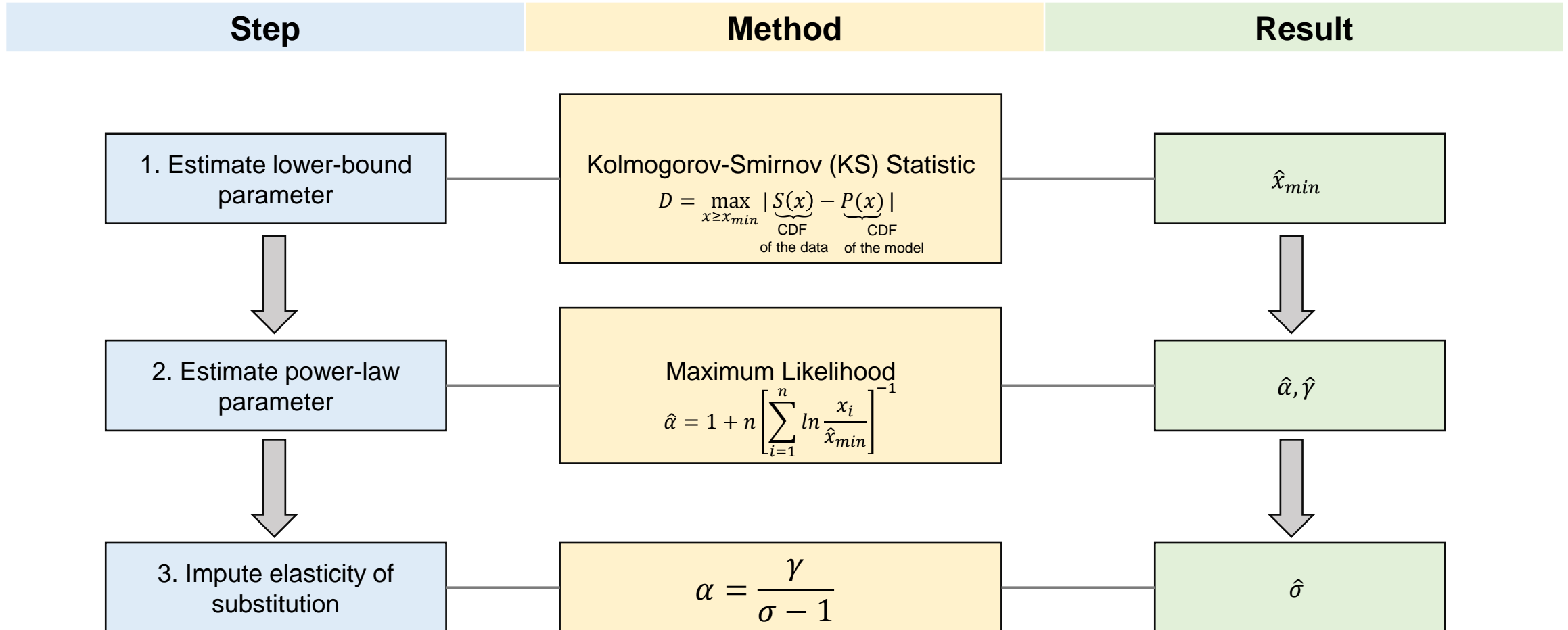
- ```
(all,i,MCOMP_COMM)(all,j,MCOMP_COMM)(all,s,REG)(all,r,REG)
  qfmcfe(i,j,s,r)
    = - affe(i,j,r) + np(j,r)
      - SIGMA(i) * [pfs(i,j,s,r) - pffe(i,j,r)];
```

# Ahmad and Akgul (2018)

- Omitting small firms due to poor performance in fitting the left-tail of export sales distribution (Head and Mayer, 2014; Sager and Timoshenko, 2016; Nigai, 2017).
- Empirical relevance may not apply to small firms since there may be a minimum size threshold for Power-laws to provide a good fit (di Giovanni et al., 2013).
- We use Pareto distribution for firm size and productivity
  - Analytical tractability in CGE
  - Good performance on the right tail above a lower-bound
  - When firm productivity is Pareto, firm size is also Pareto
- We estimate shape and elasticity values for GTAP Version 10 manufacturing sectors
  - improve the performance of the Power-law fit following Clauset, Shalizi and Newman (2009)



# Empirical methodology



# Data

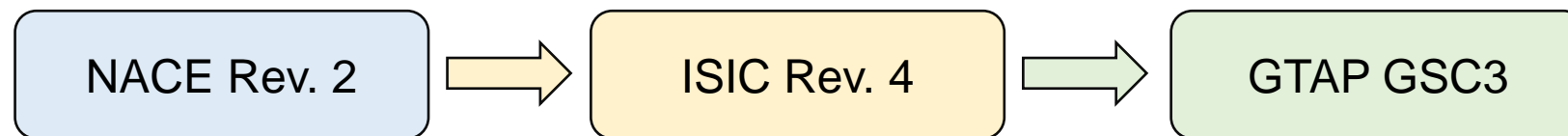
## ■ ORBIS

- Annual firm-level financial data on manufactures in the EU
- Industry classification based on the Statistical Classification of Economic Activities in the European Community (NACE)
- Level 4 of NACE Rev. 2 – 615 classes are identified by 4-digit codes

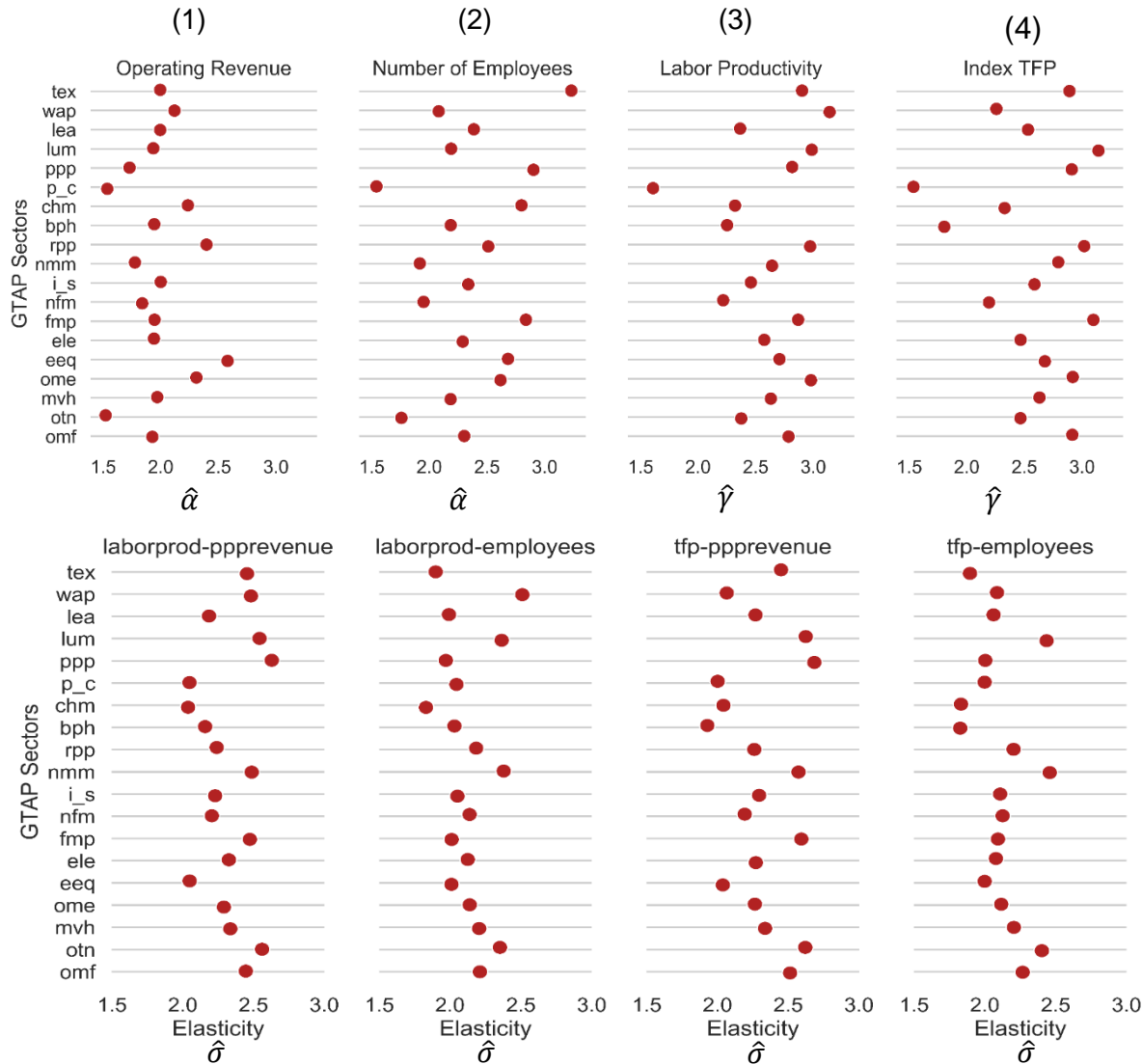
## ■ GTAP Version 10

- 65 sectors with 19 manufacturing
- GSC3 Sectoral Identification
- Provides mapping to ISIC Rev. 4

## ■ We map ORBIS firms to GTAP sectors via:



# Shape and Elasticity Values in GTAP

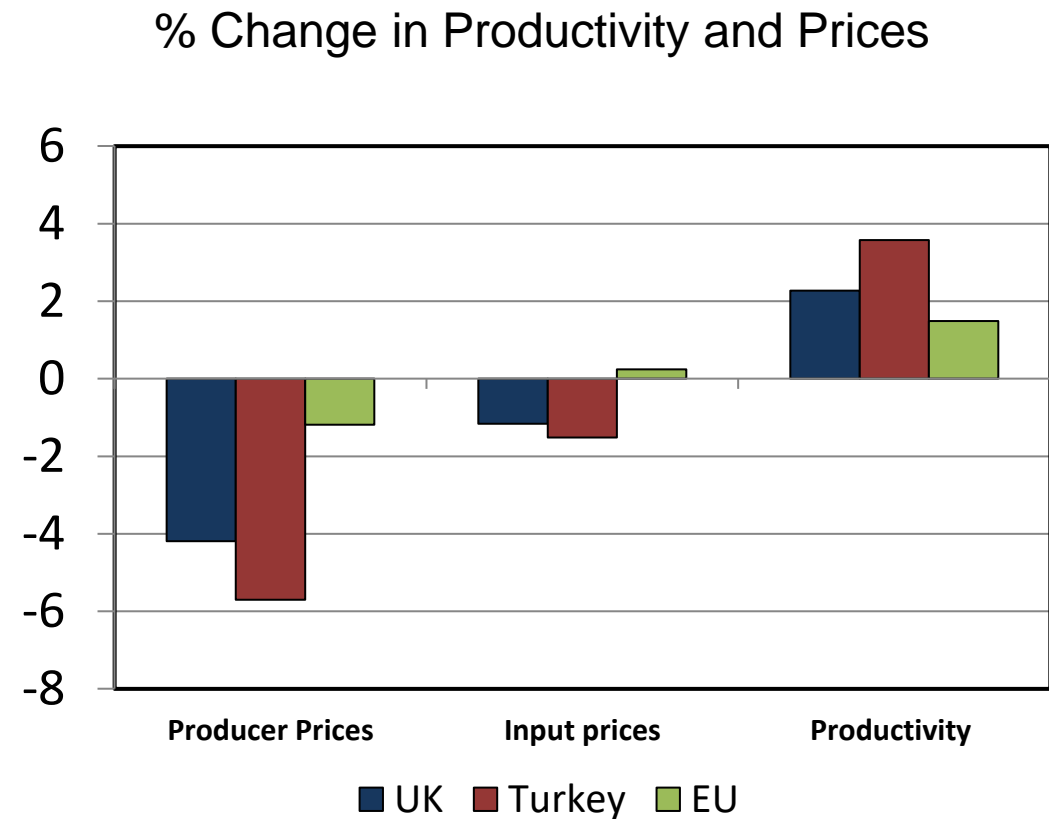
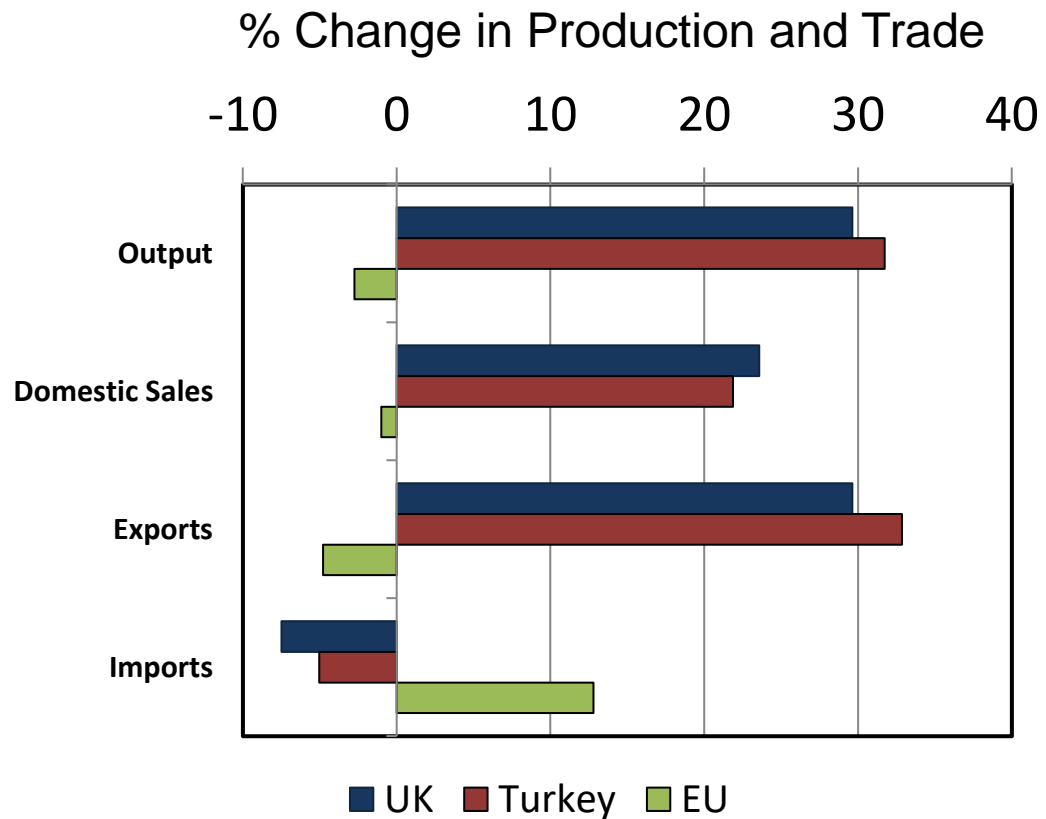


- Firm Size
  - Operating Revenue
  - Number of Employees
- Firm Productivity
  - Labor Productivity (Y/L)
  - Index TFP (Residual in a Cobb-Douglas production function)
- Estimates are based on optimal lower-bound
- Productivity is less heterogenous than firm size within the GTAP manufacturing sectors
- Mathematical constraint is satisfied,  $\gamma > \sigma - 1$

# Policy Experiment

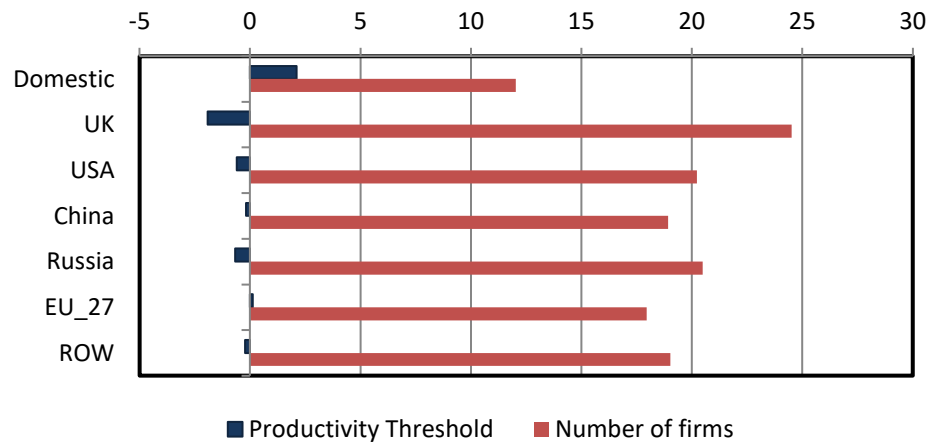
- **GTAP Version 10 Data Base**
  - Industry-source-specific bilateral trade data
- **Sectors: 7**
  - Motor Vehicles and Parts (MVH) (heterogeneous)
  - Light Manufacturing (heterogeneous)
  - Heavy Manufacturing (heterogeneous)
- **Regions: 7**
  - Turkey, UK, USA, China, Russia, EU and Rest of World
- **Focus on the MVH sector**
  - 5% cut in fixed set-up costs of MVH in Turkey and the UK
  - 5% cut in fixed export costs of bilateral sales of MVH between Turkey and the UK
  - Saving resources (efficiency of inputs)
  - $avafe(i,j,r)$  and  $affe(i,j,r)$

# Motor Vehicles and Parts

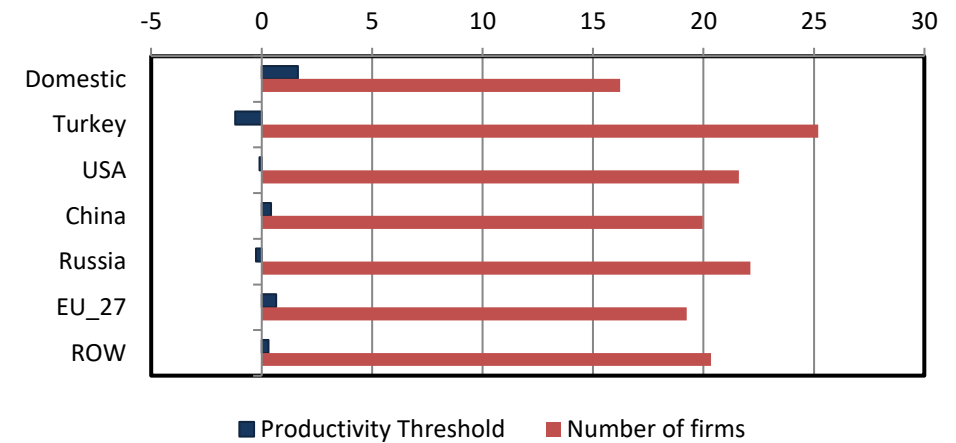


# Productivity Threshold and Firm Participation

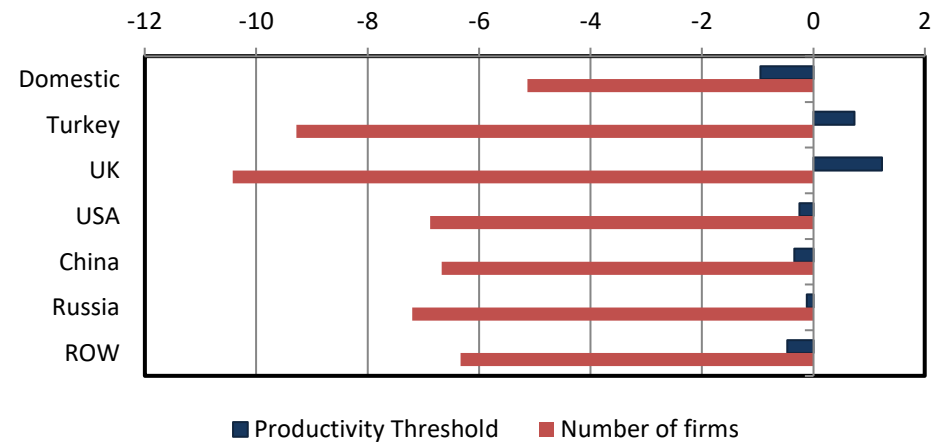
% Change in Thresholds and Firm Participation in Turkey (MVH)



% Change in Thresholds and Firm Participation in the UK (MVH)

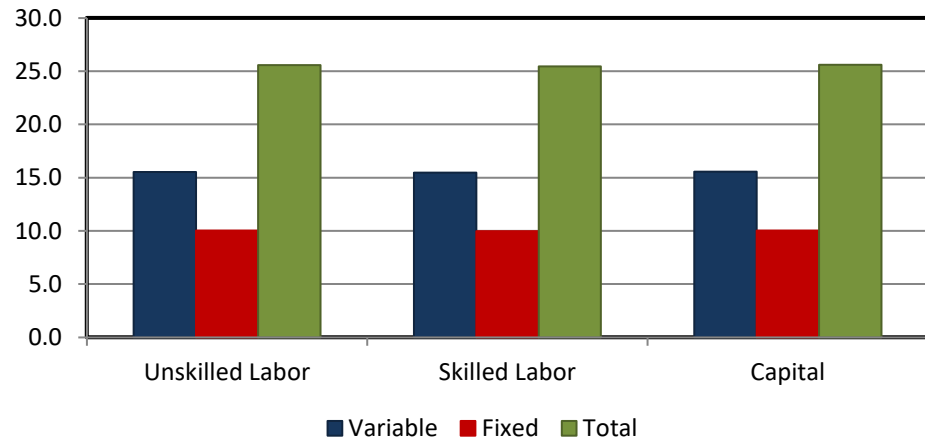


% Change in Thresholds and Firm Participation in the EU (MVH)

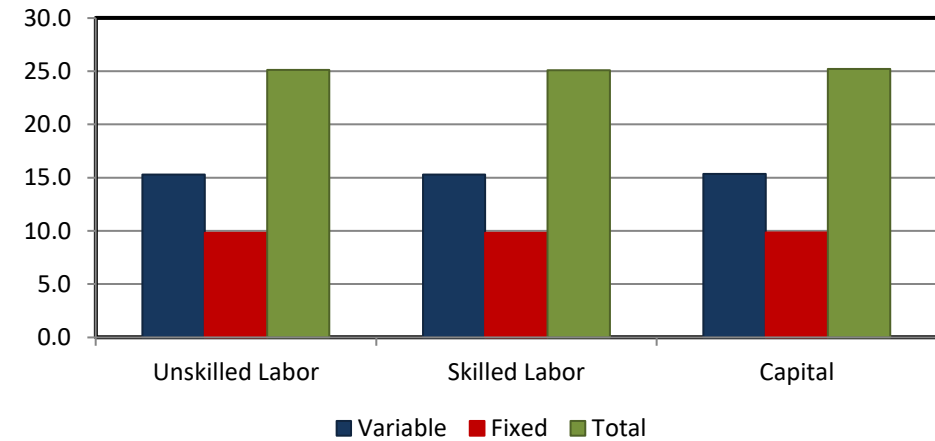


# Demand for Factors

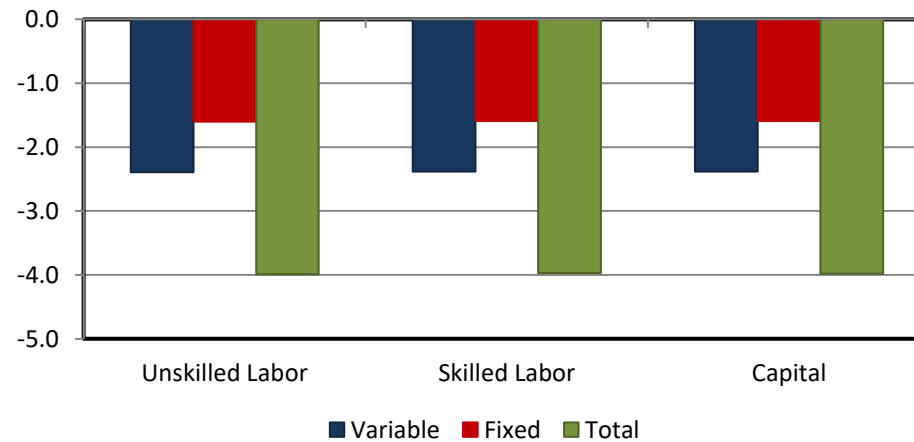
Intensive and Extensive Margins of Factor Demand in Turkey (MVH)



Intensive and Extensive Margins of Factor Demand in the UK (MVH)

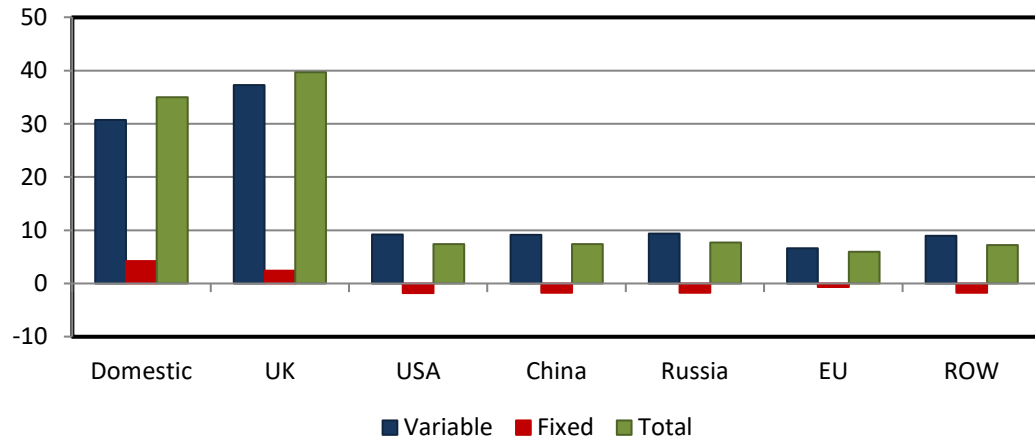


Intensive and Extensive Margins of Factor Demand in the EU (MVH)

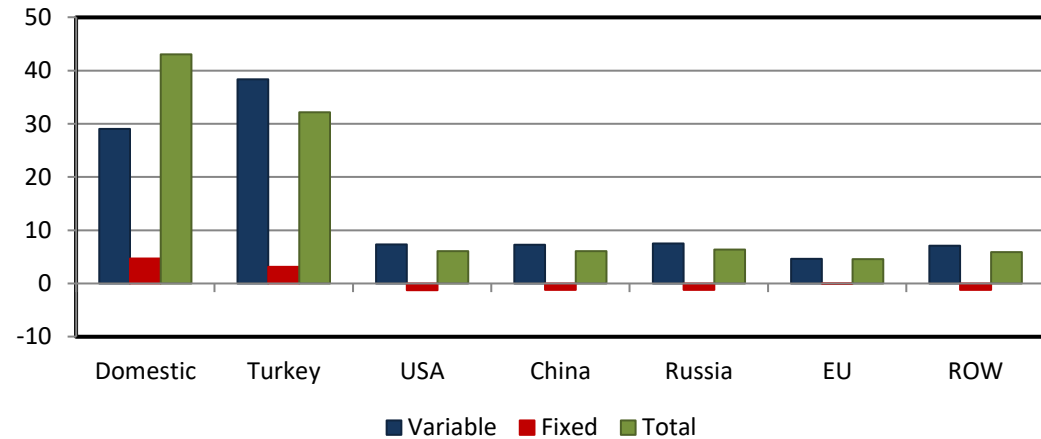


# Demand for Intermediate Inputs

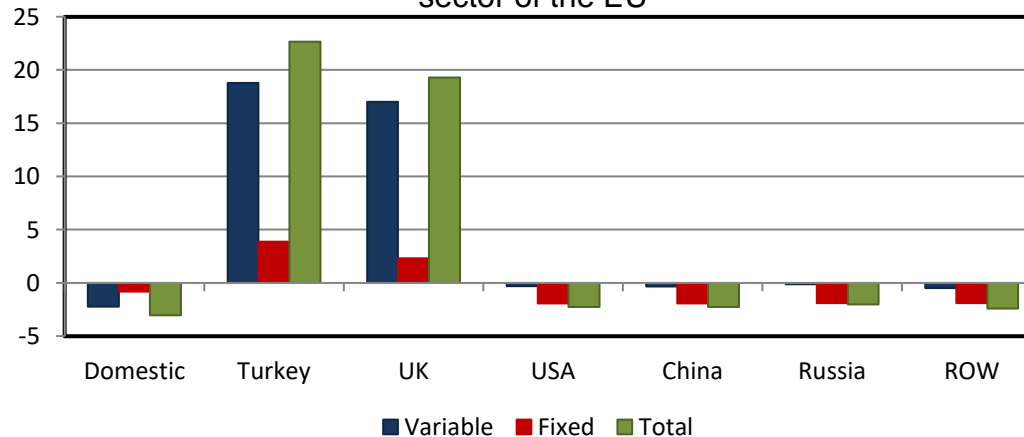
Intensive and Extensive Margins of MVH Demand in the MVH sector of Turkey



Intensive and Extensive Margins of MVH Demand in the MVH sector of the UK

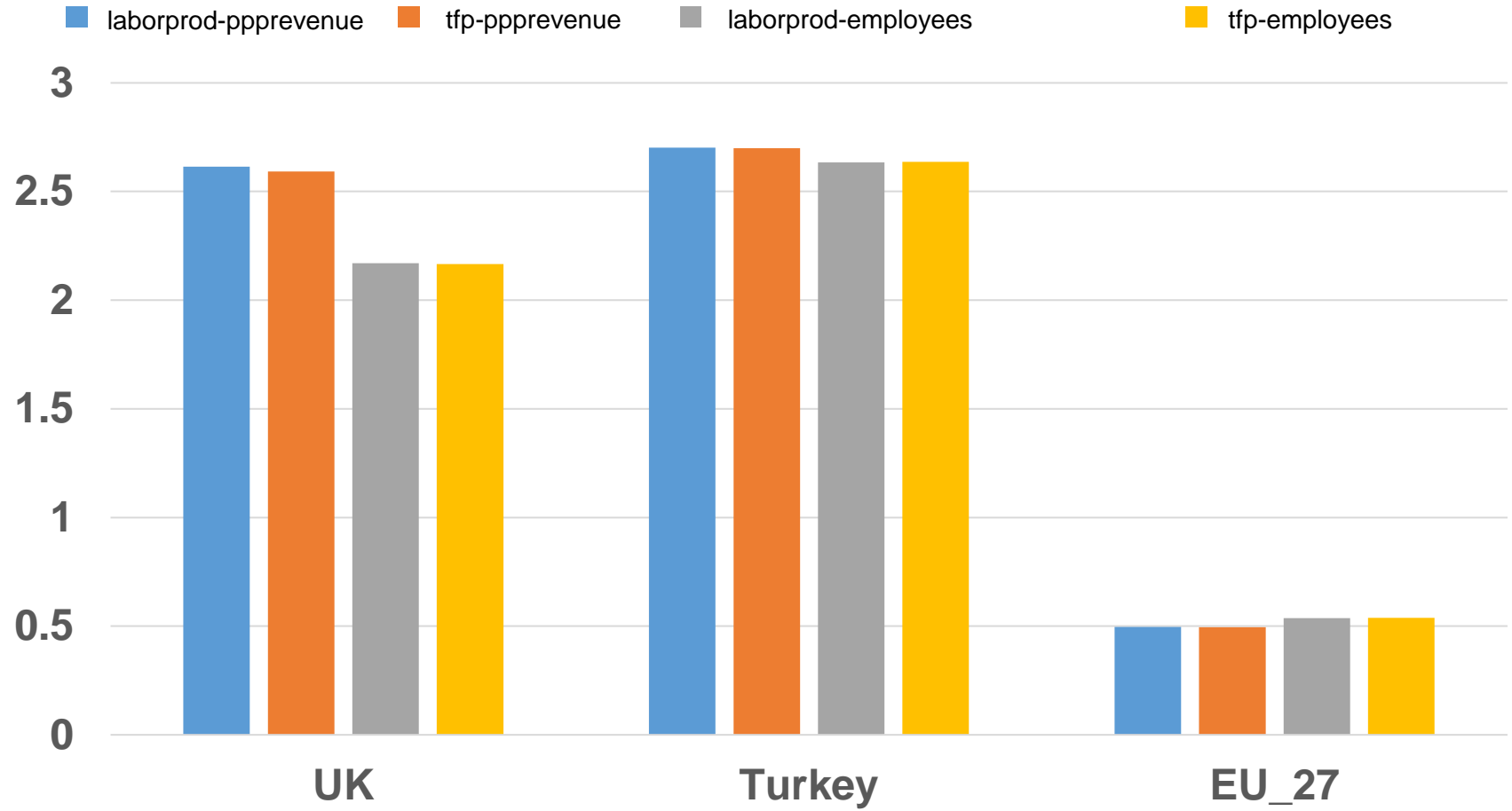


Intensive and Extensive Margins of MVH Demand in the MVH sector of the EU





# Sensitivity to Parameter Choice



# Going forward

- **Characterization of fixed costs is important in analyzing NTMs**
  - Intermediate inputs in fixed cost characterization
  - Intensive and extensive margins of input demand can be captured
  
- **GTAP-HET Version 2.0**
  - Producer price directly linked to bilateral productivity thresholds
  - Fixed export costs to include intermediate inputs
  - Model and nomenclature changes compatible with GTAP v7
  - Data base changes compatible with GTAP MRIO