A Comparison of Armington Elasticity Estimates in the Trade Literature

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Overview

Table of Contents

Introduction

- The Armington elasticity plays an essential role in trade policy analysis
  - Knowledge of elasticity, along with trade shares, sufficient to quantify response in trade flows (Arkolakis et al, 2012)
  - Value of Armington elasticity has significant effect on welfare gains or losses in simulations (McDaniel and Balistreri, 2003)
- There are many empirical studies that estimate this parameter:
  - e.g. Feenstra (1994), Broda and Weinstein (2006), Hertel et al (2007), Soderbery (2015), Soderbery (2018), Ahmad and Riker (2019)
- This presentation explores patterns within and across studies by analyzing estimates at the study and sector level. Estimates across studies are compared using a common concordance.

Table of Contents

System of Equations Method

- Feenstra (1994) uses insights from Leamer (1981) to develop a method for estimating Armington elasticities from import data.
- Demand and supply for a differentiated good can be represented with the following log-linear system of equations ($\theta < 0$, $\omega > 0$):

$$ln(q_t) = \alpha + \theta\ ln(p_t) + \epsilon_t \tag{1}$$

$$ln(q_t) = \gamma + \omega\ ln(p_t) + \mu_t \tag{2}$$

- If the demand error (ϵ_t) is uncorrelated with the supply error (μ_t), then the demand (θ) and supply (ω) elasticity parameters are related by the following hyperbolic function:

$$(\theta - b)(\omega - b) = (\frac{b}{b_r} - 1)(b_r * b) \tag{3}$$

System of Equations Method

Extensions and Improvements

- Broda and Weinstein (2006) reduce computation time by only searching for parameter values within a plausible parameter space
  - They estimate elasticities at different levels of aggregation and find that more disaggregated sectors appear to produce higher elasticity values
- Soderbery (2015) proposes a Limited Information Maximum Likelihood (LIML) estimator
- Feenstra et al. (2018) apply this methodology to the import-domestic elasticities using a unique set of U.S. production data.
  - They find that for between two-thirds and three-quarters of goods sampled, there is no significant difference between import-domestic and import-import elasticities.
- Soderbery (2018) uses variation in prices and quantities across multiple markets to identify heterogeneous supply elasticities.

Trade Cost Method

- This method uses price variation from differing trade costs to identify the Armington elasticity
- Elasticities are obtained by estimating a simple gravity equation of trade, with bilateral trade flows X_{ij}, fixed effects α_i, and trade costs τ_{ij}:

$$ln(X_{ij}) = \alpha_i + \alpha_j + (1 - \sigma)\ ln(\tau_{ij}) + \epsilon_{ij} \tag{4}$$

- Hertel et al. (2007) and Caliendo and Parro (2015) are two studies that employ this method

Markup Method

- This method leverages the structural relationship between the price-cost markup and the elasticity of substitution in industries with monopolistic competition (as in Krugman (1980) and Melitz (2003))
- Under a monopolistic competition market structure, a firm's markup equals the reciprocal of the substitution elasticity:

$$\frac{1}{\sigma} = \frac{p - c}{p} \tag{5}$$

- Ahmad and Riker (2019) use publicly available data from the 2012 Economic Census to compute industry markups with the following equation:

$$\frac{1}{\sigma} = \frac{TR - TVC}{TR} \tag{6}$$

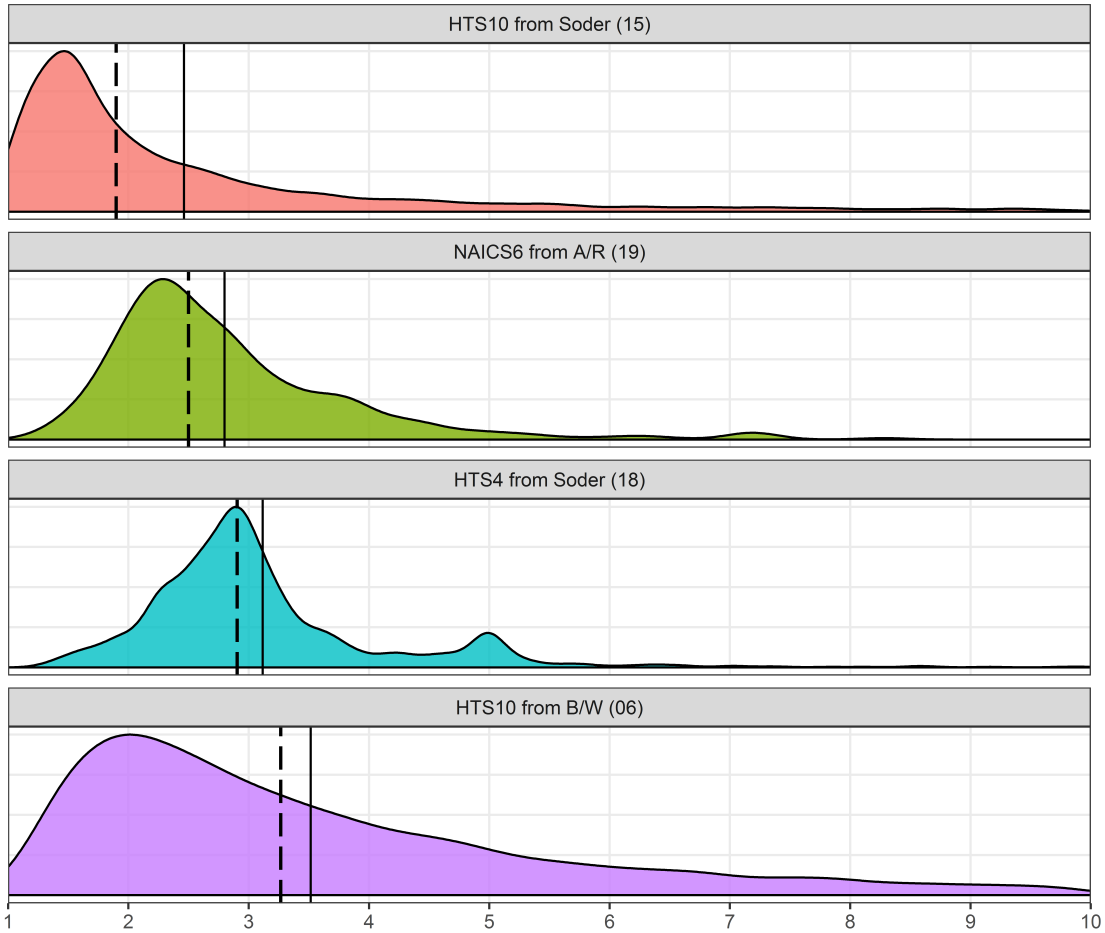
Table of Contents

Summary of Armington Elasticity Estimates Across Studies

Study	Method	Armington Interval	Level of Aggregation
Reinert and Roland-Holst (1992)	Import price	σ from [0.1, 3.0], Median=0.97	163 sectors, BEA classification
Gallaway et al. (2003)	Import price	σ from [1.0, 5.0], Median=0.9	4-digit US SIC level
Broda and Weinstein (2006)	System of equations	σ from [1.2,17.1], Median=3.1	10-digit HTS, and 3-5 digit SITC
Hertel et al. (2007)	Trade costs	σ from [1.8,34.4], Median=6.5,	5-digit SITC agg to 40 GTAP sec
Caliendo and Parro (2015)	Trade costs	σ from [0.4,51.0], Median=3.9	2-digit ISIC Rev. 3
Ossa (2015)	System of equations	σ from [1.5,25.1], Median=2.93	SITC Rev 3
Soderbery (2015)	System of equations	σ from [1.0,131], Median=1.9	8 and 10-digit HTS
Soderbery (2018)	System of equations	σ from [1.3,3312.3], Median=2.9	4-digit HS
Ahmad and Riker (2019)	Markup	σ from [1.3,11.6], Median=2.5	4 and 6-digit NAICS

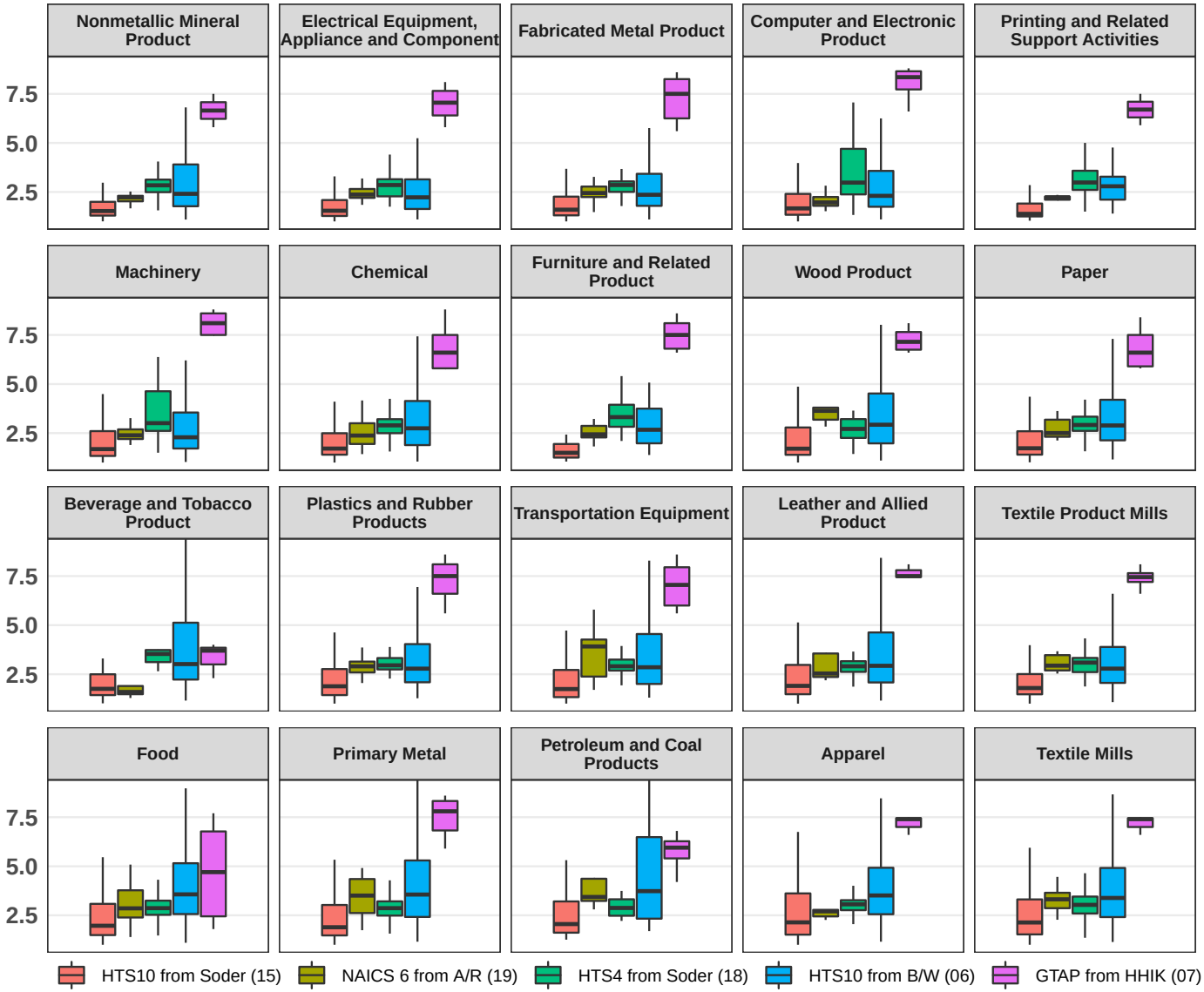
- Estimation method, level of aggregation, and data source all contribute to heterogeneity across studies
- Time-series approaches (import price) tend to have smaller estimates than cross-sectional approaches
- Trade cost method tends to have higher estimates on average (Head and Mayer, 2014)

Distribution of Elasticity Estimates for Select Studies

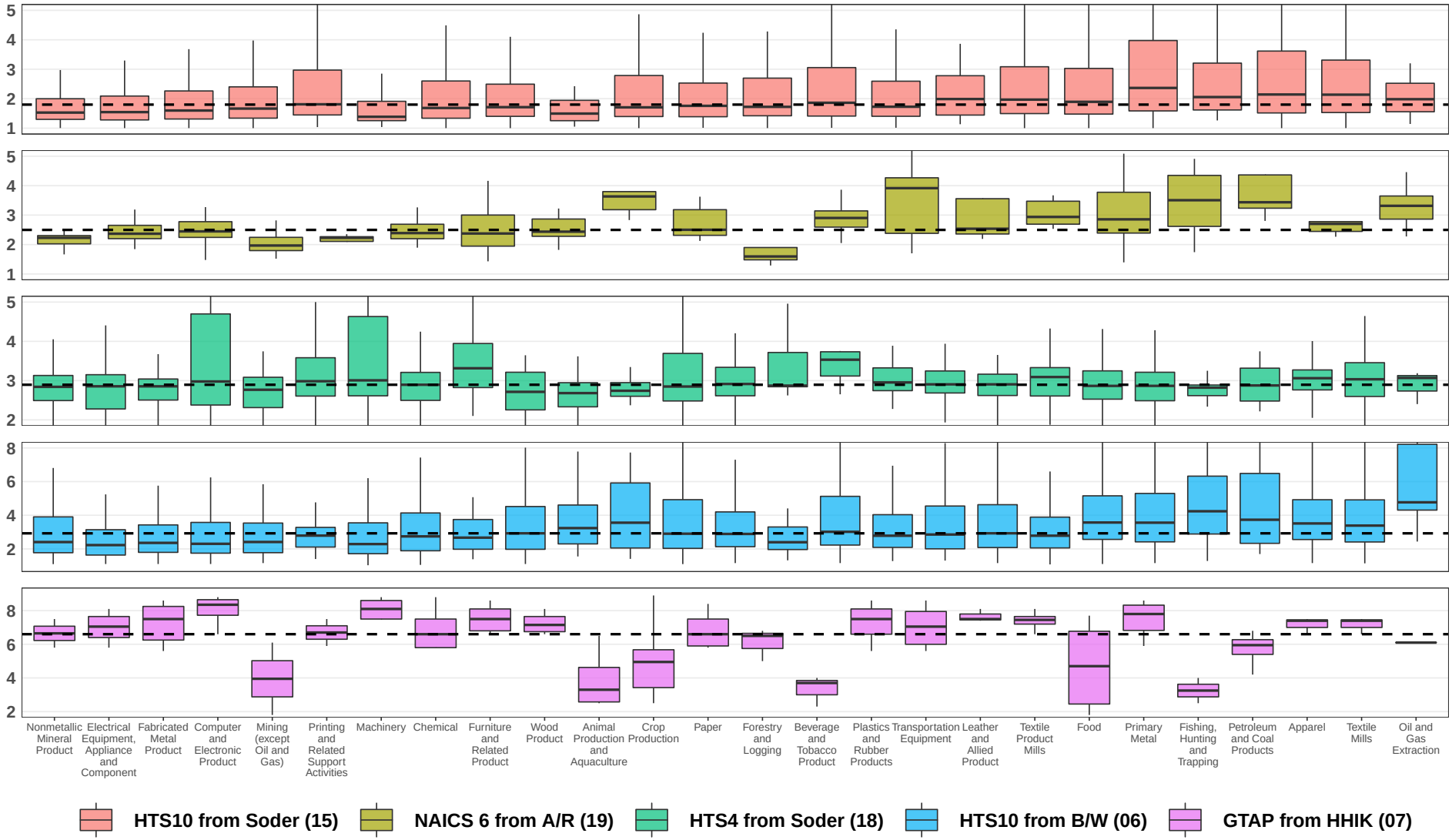


- Soderbery (2015) has the lowest mean and median, Broda and Weinstein (2006) highest

Elasticity Estimates by 3-digit NAICS Sectors



Sector-Level Analysis, Continued



Sector-Level Analysis, Continued

- Broda and Weinstein (2006) and Soderbery (2015) have the same level of sectoral aggregation (HTS10) and similar estimation strategy
- Plotting estimates for both studies shows weak relationship

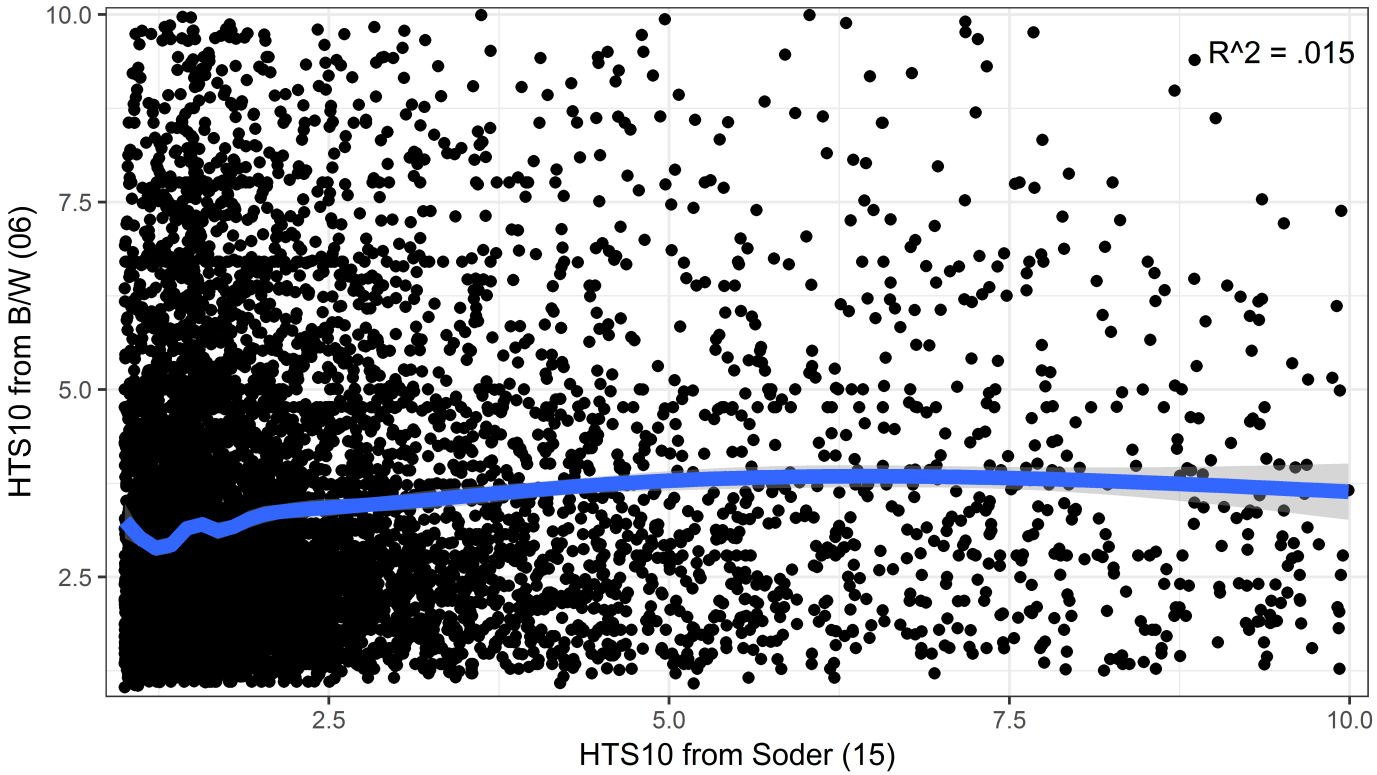


Table of Contents

Conclusion

- The Armington elasticity plays an essential role in trade policy analysis, yet there are still many open questions in the literature on what parameter values to use in policy analysis
- Visual inspection shows heterogeneity across studies:
  - Trade cost method estimates are highest across all sectors analyzed
  - Commodities tend to have highest elasticities, differentiated products have lowest average elasticities, consistent with basic economic theory
  - Weak correlation between Broda and Weinstein (2006) and Soderbery (2015) studies at same level of aggregation and similar methodology

Thank you!