Chapter 21
The Use of Econometrics in International Economics: Outline

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Abstract Abstract for print

21.1 Introduction

International economics – in particular reasoning about the causes and effects of international trade – is one of the oldest fields of economics. Moreover, keeping track of the sales of produce – foremost the one coming into a region from elsewhere – constitutes a major interest for *authorities* from legal landlords to criminal organizations with an interest in partaking in the value of sales by way of legal taxes or rent extraction. Not surprisingly, the latter leads to a wealth of data on trade starting with historical accounting-type data from Assyrian times (see Barjamovic, Chaney, Coşar & Hortaçsu, 2019) and around the times of the Roman empire (Boehm & Chaney, 2024) to modern transaction-type data on trade collected at customs or from tax data.

What makes trade data special is that, for sales, the value and, occasionally, separately the price and quantity, of goods sold are collected and available for many (ideally all) customer markets for any producer and for many (ideally all) producer markets for any customer. This permits addressing customer demand – from business to business (B2B) or from final consumers to business (C2B), often the sum of the two – for pairs of suppliers and customers at different levels of aggregation.

The literature on the determinants of this demand and, particularly, on the impact of frictions – natural or man-made – on demand (nominal or real) is the object of interest in a large research agenda focusing on the so-called *gravity equation*. Due to the volume of research devoted to this agenda, the first section of this chapter will be devoted to the gravity equation. One particular challenge regarding empirical research in this context are the need of respecting strong theoretical foundations guiding the functional form and parametrization of estimating equations. This is the case, because,

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when respecting these foundations, the estimated parameters – foremost ones related to variable trade costs but also ones related to the supply potential of producers and to fixed market-entry costs – can be used to inform equilibrium models used for counterfactual analyses.

Trade frictions or trade freeness are at the center stage of the literature on gravity models, and what can be changed in the short run are mainly man-made barriers to trade such as tariff or nontariff policy barriers. Tariffs are a form of taxes, while nontariff barriers (such as quotas, sanitary and phytosanitary provisions, etc.) are not. There is a rich micro-theoretical literature analysing the costs and benefits of having such instruments in place for producers, consumers, and the government itself. Quantifying these effects is interesting for academics as well as policy makers, and what it requires are trustworthy parameters obtained from empirical research. Not surprisingly, significant efforts are made to obtain such parameters from various trade-related policy variables, including measures of tariff and nontariff barriers themselves as well as coarser measures of their relaxation withing trade agreements. As one would expect, significant attention is put on the endogeneity of man-made policy barriers and their relief as well as on assumptions elated to their effects on trade.

A last section of the chapter will survey work on three other topics in econometric work related to trade: the effects of trade on labor markets; the effects of announced trade-policy changes on stock-market outcomes; and the estimation of firm selection and sorting into markets.

However, while the determinants of trade are important for consumers, what factor owners mostly care about is what trade changes for them in terms of factor demand and income. But also there, the supplier-customer disaggregation of trade permits tracing factor-demand and -income effects to particular sources. We will devote the second section to this line of interest and the methods proposed to address the relevant questions. Because factor demand depends on trade and trade is endogenous and a function of factor prices as per the insights of the aforementioned gravity-model literature, it should not come as a surprise that endogeneity and identification issues are of particular importance to that strand of research.

Stock-market effects of announced trade-policy measures occur prior to their coming into effect. Related research is very different from the one discussed in the first two chapters in that it uses high(er)-frequency data on stock prices in conjunction with event-study designs to estimate the associated effects.

Finally, the so-called *new trade theory* with the work of Melitz (2003) started a rich structural literature in international economics and the endogenous selection of heterogeneous suppliers into markets and the market-specific truncation of their distribution. Selection can be motivated by the existence of fixed costs (see Melitz, 2003, ?, ?, or Arkolakis, 2010) or by the existence of a choke price even in the absence of fixed market-entry costs (see Melitz & Ottaviano, 2008). In any case, with selection and sorting the truncation of the distribution of producers in a market is important, and specific methods had been proposed to address said truncation, which is why this research deserves a specific discussion.

- Trade as an interesting field of application for econometrics, as it covers a wide range of data situations from micro to macro, from cross section to panel, and from structural to reduced form.
- A key challenge: balancing strong theoretical foundations for estimating equations and the need for parameters for model calibration with statistical foundations for inference.
- Apart from presenting an eclectic range of methods applied, particularly focus on two areas of empirical research: the one on estimating the gravity equation; and the one on estimating local labor market effects.

21.2 The Gravity Model

- **[reduced-form vesus structural models of bilateral trade]** Reduced-form versus structural models of bilateral trade. Tinbergen (1962) and Pöyhönen (1963) were arguably the first to propose log-linear models of bilateral trade that resemble the form of the gravity equation in physics. Theoretical foundations in Anderson (1979) and particularly in Anderson and van Wincoop (2003) and in Eaton and Kortum (2002) paved the way for an explicitly structural treatment.
- **[functional form: loglinear vs exponential]** For a long time since the early days of the estimation of gravity models of trade the leading approach was a log-linear transformation of the gravity equation which is multiplicative in its arguments. However, log-transforming multiplicative structural equations can run at risk of obtaining biased regression parameters if the variance of the disturbances is related particularly to the conditional mean of the regression. This had been demonstrated to be of great importance by Santos Silva and Tenreyro (2006) with gravity models of international trade. The latter authors proposed exponential-family models and, particularly Poisson pseudo-maximum-likelihood models for estimation.
- **[data dimensionality; high-dimensional fixed effects; point estimation and inference)]** Gravity models of trade involve sales from exporters to importers at a minimum. Eventually, they address data with an additional product dimension. And they can be origin-region-sector by destination-region-sector by time variant. With labor-flow data, they can carry region-sector-occupation indices for the origin as well as the destination as well as a time index. Hence, gravity models are naturally of a high-index (at least cross-sectionally double-indexed) data dimension. This calls for the use of high-dimensional (at least two-way) random or fixed effects. See Mátyás (1997, 1998); P. Egger (2000); Baltagi, Egger and Pfaffermayr (2003); P. Egger and Pfaffermayr (2003); Fally (2015); Weidner and Zylkin (2021)
- **[zeros]** Depending on the outcome – aggregate export, import, foreign direct investment, migration, or commuting – and on the level of cross-sectional aggregation (country pair, country-sector pair, region-sector-pair, etc. – as well as the time frequency – years, year-intervals, quarters, months, days – flow data can contain a smaller or a substantial mass of zeros. Clearly, a log transformation leads to a

loss of observations of zero flows,[1] while using an exponential-family model on the multiplicative process does not. However, a large mass of zeros naturally calls for a separate process to model zero versus positive outcome and the extent of positive outcome. See Helpman, Melitz and Rubinstein (2008) for Heckman-type estimation of log-linear models. See P. H. Egger, Larch, Staub and Winkelmann (2011) for two-part-model type estimation of exponential-family models.

- **[dynamics]** P. H. Egger (2001) suggests that bilateral trade and investment costs may depend on adjustment costs which can be parameterized as a function of lagged bilateral trade or investment, respectively. Jung (2009) establishes adjustment costs. P. H. Egger, Foellmi, Schetter and Torun (2025) provide a structural approach towards a dynamic gravity framework based on the idea of downward-drifting market-entry costs for incumbent firms.
- **[spatial interdependence]** LeSage and Fischer (2009), LeSage and Thomas-Agnan (2015), P. H. Egger and Pfaffermayr (2016), Jin, Lee and Yu (2023). But also Cai, Caliendo, Parro and Xiang (2022), P. H. Egger, Loumeau and Loumeau (2023),
- **[estimating parameters on time-invariant endogenous trade-cost measures with country-pair-time panel data]** Only smaller body of work using gravity models addresses concerns of endogenous variables other than using fixed effects. The strand of work which addresses endogeneity concerns mostly focuses on the cases of endogenous time-variant trade costs (see Baier & Bergstrand, 2004, Bergstrand & Egger, 2013, P. Egger & Wamser, 2013b). However, while time-invariant determinants of trade costs – such as bilateral distance, common official language, etc. – may not be affected directly by economic behavior in the short run, such variables may still be stochastic (endogenous) due to measurement error, omitted correlated variables, etc. P. Egger and Pfaffermayr (2004) suggest that bilateral distance may be endogenous for those reasons. Then, as long as the parameter on log distance or measures thereof is of interest (see, e.g., Eaton & Kortum, 2002, Anderson & van Wincoop, 2003, 2004; Disdier & Head, 2008), resorting to country-pair or region-pair fixed effects is not an option. Yet, relying on pooled or random-effects estimation is not an option either due to endogenous time-invariant effects. P. Egger and Pfaffermayr (2004) propose an instrumental-variables approach following Hausman and Taylor (1981). P. H. Egger (2005) uses the same idea for identifying the parameters on endogenous country-level variables in country-pair data of bilateral trade.
- **[interregional trade and transport infrastructure (historical IVs, etc.)]** See Desmet, Nagy and Rossi-Hansberg (2018). P. H. Egger et al. (2023) for use instruments following the optimal-transport literature as proposed by Monge (1781) and Kantorovitch (1958). Anderson and van Wincoop (2003) and Hillberry and Hummels (2008) for interregional trade empirics;
- **[nonparametric trade-cost functions]** Eaton and Kortum (2002), Hillberry and Hummels (2008), Henderson and Millimet (2008), P. H. Egger and Lassmann (2015), Blank and Egger (2021), P. H. Egger and Erhardt (2024).

[1] Other transformations such as the hyperbolic sine transformation do not. However, applying such such transformations is not innocuous and they may lead to substantial parameter bias.

21.3 Treatment Effects in International Economics

In the previous section, the gravity model had been in the limelight. A key focus of such models is the estimation of trade costs or the trade-cost function. The regressors with a primary concern regarding endogeneity in that function are ones that can be influenced by policy makers, and those are continuous tariff as well as nontariff policy barriers to trade (see Caliendo & Parro, 2015, P. H. Egger & Erhardt, 2024) and binary agreement membership indicators such as for preferential trade agreements (Aitken, 1973, Baier & Bergstrand, 2004, Baier & Bergstrand, 2007), bilateral investment agreements (Tobin & Busch, 2010, Bergstrand & Egger, 2013), bilateral tax agreements (P. H. Egger, Larch, Pfaffermayr & Winner, 2006, Blonigen, Oldenski & Sly, 2014), common currency unions (Glick & Rose, 2002, P. H. Egger, 2008), and bilateral environmental agreements (see Larch & Wanner, 2022).

- static models assuming random assignment; Aitken (1973)
- static models assuming self-selection with selection on observables
  - fixed effects Baier and Bergstrand (2007), P. H. Egger, Larch and Yotov (2022), Nagengast and Yotov (2025)
  - matching H. Egger, Egger and Greenaway (2008), Baier and Bergstrand (2009),
  - balancing P. H. Egger and Tarlea (2021)
- static models assuming self-selection with selection on unobservables [instrumental variable estimation]; P. H. Egger et al. (2011), P. Egger and Wamser (2013b)
- in the woods with multiple agreements (trade, investment, tax agreements); P. Egger and Wamser (2013a, 2013b)
- dynamics (duration analysis; staggered treatments; etc.). See Bergstrand, Egger and Larch (2016) and Arroyo and Castillo-Ponce (2019) for duration analysis. See P. H. Egger and Pfaffermayr (2013) and Nagengast and Yotov (2025) for staggered treatment effects.

21.4 A Smorgasbord of Further Topics

21.4.1 Local Labor Market Effects of Trade

- Bartik and other instruments; Bartik (1996), Autor, Dorn and Hanson (2013), Autor, Dorn and Hanson (2016), Yi, Müller and Stegmaier (2024)
- interregional mobility and effects; Artuç, Chaudhuri and McLaren (2010), Artuç and McLaren (2015), Caliendo, Dvorkin and Parro (2019), Cai et al. (2022), P. Egger, Erhardt and Suverato (2024).
- exchange rates

21.4.2 Stock-market Effects of Trade Shocks in Event-study Designs

Breinlich (2014), Moser and Rose (2014), Breinlich, Leromain, Novy, Sampson and Usman (2018), Davies and Studnicka (2018), P. H. Egger and Zhu (2020).

21.4.3 Estimating Exporting-threshold Productivity Levels

ROC: Costa, Sallusti, Vicarelli and Zurlo (2019), Costa, Sallusti, Vicarelli and Zurlo (2022), Duan (2023), using binary indicator as outcome; **Unobserved threshold estimation:** P. H. Egger and Wang (2025), using continuous profit data as outcome.

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