Sessions 3/4: Summing Up and Brainstorming

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ARTNeT Capacity Building Workshop for Trade Research:
“Behind the Border” Gravity Modeling

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Gravity modeling started as a sensible, intuitive way of understanding the factors that influence bilateral trade.

The basic intuition is sound, and captures some important stylized facts that are present in the data.

However, the basic model is deficient in a number of respects. In broad terms, its deficiencies can be said to relate to its failure to take account of general equilibrium effects.
In addition to its strong empirics, the gravity model now also stands on solid theoretical foundations.

Anderson and Van Wincoop (2003, 2004) present a general microeconomic framework incorporating monopolistic competition. They show that it can be used to derive a gravity-like equation.

Other contributions have shown that similar equations can be derived from a wide range of theoretical models. However, as more features are introduced, the model usually becomes more complex.
The AvW model brings gravity more closely into contact with the general equilibrium nature of trade in a many country world.

It emphasizes that it is relative prices that matter, and thus, relative trade costs.

AvW’s theoretical model introduces two new unobservable terms into gravity:

- Outward multilateral resistance: Exports from i to j depend on all barriers faced by i’s exporters;
- Inward multilateral resistance: Exports from i to j depend on all barriers faced by j’s importers.
Including multilateral resistance terms in the model makes it possible to:

- Highlight the importance of relative price effects;
- Account for the fact that trade costs between i and j can affect trade with third parties;
- Account for the fact that trade costs with third parties can affect trade between i and j.

All of these effects are highly intuitive and theoretically grounded. But they are absent from the basic (traditional) gravity model.
The AvW model also has important implications for the way in which empirical researchers estimate and interpret gravity models.

These implications cover:

- Data;
- Estimation method;
- Counterfactuals.
Traditional gravity models used various combinations of import and export data.

The AvW model suggests that what we want is unidirectional trade, i.e. treat exports from i to j as one observation, and exports from j to i as another observation.

Using total trade (exports + imports) or averaging over exports and imports generally does not fit with the theory.
AvW’s multilateral resistance terms effectively take care of the question of deflating prices, whether we are talking about trade values, GDP, etc.

Thus, it is appropriate to use value data in nominal terms...

Provided, of course, that we properly take account of multilateral resistance when estimating the model.
Although the AvW MR terms are effectively price indices, they cannot be directly observed. They do not correspond to common measures of prices, such as CPI, PPI, etc.

Some traditional gravity models used atheoretical “remoteness” indices to capture effects similar to those captured by the MR terms. However, the MR terms are defined in a very precise way, and are generally not equivalent to remoteness indices used elsewhere.

In addition to the exclusion of price and remoteness terms, AvW theory suggests that per capita GDP should probably not be systematically included in gravity models.

- If you are interested in income effects, justify this variable explicitly via a theory!
The AvW MR terms are unobservable.

In econometric terms, they represent a particular manifestation of the more general problem of unobserved heterogeneity.

Panel data methods are particularly well-suited to dealing with such problems.
The most common panel data method in the gravity context is the fixed effects estimator.

It is usually preferred to random effects estimation because:

- It imposes less structure on the data;
- Is simple and transparent to estimate, even in multiple dimensions.

The main disadvantage of fixed effects estimation is that it makes it impossible to separately identify variables that are collinear with the fixed effects.
Fixed effects models need to be set up so as to include fixed effects that vary in the same dimensions as the MR terms they are supposed to be capturing.

In a basic model using a single year of data on total trade (all products), fixed effects in the exporter dimension and the importer dimension are appropriate.

In a total trade model with more than one year of data, fixed effects in the exporter-year, importer-year, and year dimensions are required.
In a sectoral model with a single year of data, fixed effects in the exporter-sector, importer-sector, and sector dimensions are appropriate. In addition, trade cost variables should be interacted with sector dummies, to allow for possible changes in the intra-sectoral elasticity of substitution.

Alternatively, sectoral models can be estimated individually for each sector, with fixed effects by exporter and importer.
If sectoral data and multiple years are used, fixed effects by exporter-sector-year, importer-sector-year, and sector-year are required. Interactions between sector dummies and trade costs are again required.

Again, an alternative is to estimate sectoral models individually, with fixed effects by exporter-year, importer-year, and year.
In general terms, the gravity literature is going more and more towards sectoral models.

To make these models “talk”, think about using sectoral disaggregations that are of particular relevance for the research question being studied:

- Djankov et al. (2008) look at time sensitive products, using the Hummels classification;
- Helble et al. (2008) look at differentiated vs. homogeneous goods, using the Levinsohn classification.

In sectoral models, issues of aggregation and clustering are particularly important: make sure that results are robust to different assumptions regarding the errors, and to different levels of aggregation.
Two other techniques are increasingly being used as an alternative or complement to fixed effects:

- First differencing of data (with respect to a comparator country) to eliminate one or both MR terms;
- Use of Baier-Bergstrand’s Taylor series expansion to generate approximate MR corrections.

Use of one or both of these alternatives is particularly attractive in contexts where:

- It is important to be able to include variables that are collinear with fixed effects;
- Detailed sectoral disaggregation leads to a very large number of FEs to estimate.
Counterfactual simulations based on gravity models should be taken with a grain of salt. Think of them as an aid to interpretation, particularly in policy environments, but little more than that.

The AvW model suggests that trade cost shocks have two types of effects:

- Direct effects through the bilateral trade of involved parties;
- Indirect effects through the MR terms.

Counterfactuals based on estimates of a traditional gravity model, or even a FE gravity model, only take account of the first set of effects.
Basing counterfactuals on the Baier-Bergstrand model offers one way of accounting for both direct and indirect effects.

It is only approximate, so counterfactuals should involve generally small shocks. They should be presented with appropriate caveats.

More generally, counterfactuals rely on estimated parameters, and are therefore uncertain. Whenever possible, a range should be presented, rather than a single figure. This range can be based on (eg) +/- 1 sd of the relevant coefficient estimate.

When quantification is important, consider backing up results with a CGE model: it is important to look at welfare, not just trade effects.
Grossman/Helpman’s “Protection for Sale” model makes it clear that tariffs, and probably other trade costs too, should be endogenous to imports.

Gravity modelers need to use IV methods more often in order to:

- Assess the extent of endogeneity bias, and correct for it if necessary; and
- Provide additional evidence that they are identifying a genuine, causal effect, and not just an empirical association.

As people doing policy work, we need to pay particular attention to this.
New trade theories incorporating firm heterogeneity are providing some cogent explanations for the presence of zero elements in the bilateral trade matrix.

HMR (2008) develop a gravity-like model based on such an approach, and show that it suggests a modified Heckman selection model as an appropriate tool for estimating the gravity model.

The literature is still unsettled as to the best way to deal with zeros, so it is generally prudent to compare Heckman and Poisson estimates.
Traditionally, data accessibility has been a major constraint for applied researchers in this area, particularly in a development context.

This constraint is getting looser by the year:

- Data available for free through the web: World Bank, UNCTAD, UN Comtrade, NBER trade and tariff data, ComExt, Doing Business, Enterprise Surveys, ITC Market Access Tools, ...
- Datasets made available by other researchers: for a good deal of policy work, it is no longer necessary to reinvent the wheel for basic data (distance, colony dummies, language, country groups, etc.)

Theory makes some clear suggestions regarding data, but applied research is always a compromise between theoretical purity and analytical tractability/feasibility.
Some of the most interesting applications of gravity in recent years have been to behind the border barriers:

- Djankov et al.: export/import times
- Ranjan Lee: contract enforcement
- Anderson Marcouiller: corruption and insecurity
- Manova: financial sector development and credit constraints
- Freund/Weinhold: internet availability
- HMR: costs of domestic market entry (indirectly...)
- Moenius, Chen/Mattoo, (and me): product standards and harmonization.
WMO started the trade facilitation ball rolling with a set of very broad indicators that arguably capture much broader features of the economy than just TF.

More recently, the literature seems to be going towards more focused, objective measures:

- Doing Business
- Blonigen & (Wesley, not John) Wilson: measures of port efficiency
- Hummels: direct measures of trade and transport costs
- Corruption is also moving towards firm level data on bribe prevalence and amount.
What do we know about the performance of various RTAs in reducing trade costs?

Did APEC really reach its 5% target, and is it on track for the next one?

Which measures within APEC had the greatest payoff in terms of reducing trade costs? What can we learn from the data available through individual action plans?

Gravity might be useful for these questions, and so might closely related approaches: Novy, Novy & Chen, Novy Chen & Meissner.
Transnational production networks are widely associated with the “Asian model”.

But we know surprisingly little about how they work, and how their spread relates to trade costs.

Do trade cost reductions tend to stimulate trade more strongly in networked sectors than in traditional ones? Which types of trade costs are most important: tariffs, time, contract enforcement, information, product standards, etc.?

What are the links among trade costs affecting goods, services, and capital (FDI) in a networked context?
APEC and ASEAN have both discussed product standards of various types.

But we know almost nothing about how product standards work in the Asia-Pacific.

Are product standards a serious constraint to trade? In which sectors are they most serious? Have harmonization and mutual recognition been widely used? Have they been effective in reducing trade costs?
Trade in Services and Trade in Goods

- Open, competitive, and efficient services markets can provide important inputs into goods trade performance. Think transport, ICTs, finance, etc.

- How open are services markets in the region? What do we know about the performance of key “backbone” providers that traders rely on at key points in the supply chain? What do we know about the logistics sector, and the performance of the supply chain as a whole?

- How can we develop objective measures of services sector efficiency that go beyond perceptions? How can we relate them to trade in goods?
Brainstorming: New Applications in the Asia-Pacific?
Institutions, Governance, and Trade Costs

- Which aspects of institutions, regulation, and governance are most important as determinants of trade costs in the region? Have we observed any of these costs declining over time? In which countries, and why?
- How do the impacts of institutions and governance differ from one sector to another? Which sectors are the most “institutions intensive”? Are there any links to production networking?
- Does corruption tend to increase or decrease the overall level of trade costs? What about uncertainty effects and risk? What do we know about the policies available to influence corruption prevalence over the short-medium term? Which tradeable sectors are most affected by corruption?