The Gravity Equation

A gravity model expresses an empirical regularity well known to trade economists, stating that trade flows between two countries are directly proportional to their economic size and inversely proportional to the distance between them, as follows:

$$X_{ij} = A\ \frac{Y_i Y_j}{D_{ij}}\ (1)$$

(X: trade flows, Y: GDP, D: distance)

Taking logarithms of both sides results in a standard log-linear form of the gravity equation, which is occasionally augmented by several other variables, according to the theoretical origins of the model or else thought to be of empirical importance. Those variables are assumed to be contained in the vector A.

However, the intuitive appeal of this specification was, until recently, not grounded in formal economic theory. Work by Anderson (1979), Deardorff (1998) and Anderson and van Wincoop (2003) established that to avoid the omitted variable bias and ad hoc specification, the gravity equation should be formally derived from theory. Following Anderson and van Wincoop (2003), among others, we used the following gravity equation:

$$ln\ X_j = ln\ Y_j + lnD_{Cj} + lnP_{ij} + WTO_j + FTA_j + LAND_j + EN_j + FR_j + EME_j (2)$$

where X is Canadian exports to country j, Y is its real GDP, D is its distance from Canada, P_{ij} is the relative producer price index, and the other terms are dummy variables for WTO membership, free trade agreement (FTA) with Canada, being landlocked, having English or French widely spoken, and being an emerging or developing economy according to the IMF in 2008.

flows (70-80 percent) and doing so consistently across countries and time periods.

We estimated this equation for the 2000-2007 period, modeling Canadian exports to all destinations where data permits (over 170 countries in all), and allowing for time variation across the years. Exports are explained by GDP, distance, price levels, WTO membership, FTA with Canada, use of English/French, being landlocked, and being an emerging/developing economy. The estimated coefficients were then used to generate predictions for 2007 Canadian export trade values that stem from the gravity theory. The difference between these predictions and the actual observed values determines whether we are, according to the model, over- or under-exporting to a particular country or region.

Our key finding was that the "emerging and developing markets" effect was positive (0.35) and strongly significant. This means that between 2000 and 2007, Canada was exporting **42 percent more** to an average emerging or developing country than to a developed country, after adjusting for size, distance and all other factors considered by the model.

These results show that rather than missing opportunities and under-exporting to the emerging world, Canada is trading more than expected with the emerging and developing world. How can we explain this result? Several factors could be at play. First, the Canadian export product mix may be more attractive and better suited to the current