The gravity model of international trade takes its name from its similarity to the law of universal gravitation in physics and is known as one of the strongest observed relationships in economics.
Trade may decline as the distance between two countries increases, reflecting transportation costs for goods.

The simplest form of the gravity model relates trade flows between two countries to their sizes—typically measured by their GDPs—and some measure of the distance between them. The reasoning behind the relevance of these factors is simple. A large destination country has a lot of income to spend and so attracts imports, while a large source country has a lot of goods to sell, so it tends to export a lot. Trade may decline as the distance between two countries increases, reflecting transportation costs for goods.

Charts 3 and 4 depict how trade between pairs of countries is related to the three factors of the gravity model—the size of each of the two countries and the distance between them. Here, distance is measured as the great-circle arc length between the capital cities of the two nations. More generally, including other measures of distance—such as whether countries share a border, a language or a free-trade agreement—is economically relevant as well. Chart data cover bilateral trade flows among a set of 22 countries in the Organization for Economic Cooperation and Development (OECD).

Chart 3 confirms that bilateral trade flows are positively related to the importer's size and the exporter's size: Larger countries export more and import more than smaller countries.

Chart 4 shows how relative trade...
shares between different pairs of countries depend on relative distance. Each point on the graph represents the fraction of a country’s exports to one destination relative to a second destination country, plotted against the ratio of the two distances involved. This relative measure is meant to isolate the impact of distance from that of country size, and indeed, the downward-sloping relationship in the chart suggests that distance is a significant factor in determining relative trade shares.

Among the factors affecting trade flows, the importance of distance is likely to remain relatively fixed over time, while the influence of country size fluctuates over the business cycle and contributes to trade-flow volatility. In this way, the gravity model helps explain why the pattern of relative trade shares across countries is fairly stable, as in Chart 2.

While the economic costs associated with distance—for example, shipping costs—vary over time, this has less impact on relative trade than on absolute levels of trade. As an example,
high oil prices raise the cost of sending container ships between China and the U.S., so we may expect to see U.S. imports from China fall. But at the same time, the cost of shipping from Germany to the U.S. rises as well, so the fractions of total imports that come from China and from Germany may not change much.

The growth of any particular bilateral trading relationship relative to others is due to factors that change slowly. For example, China’s economic reforms begun in the late 1970s and 1980s led to greater openness to international trade, and China’s accession to the World Trade Organization in 2001 marked the beginning of its growing importance for U.S. trade.

If the pattern of trade is so strongly related to permanent and slow-moving factors such as distance and trade policy, why does overall trade as a fraction of GDP vary so much over the business cycle? That is, why do the relative amounts the U.S. imports from two different countries seem to behave differently than the amount the U.S. imports relative to what it buys from itself?

Perhaps the factors that determine whether a consumer or firm imports a certain product from one country or another are different from the factors determining whether it is imported at all rather than bought domestically. For example, exchange rate movements over the business cycle can change the purchasing power of the U.S. dollar and significantly alter the relative cost of importing a good from anywhere versus buying it domestically. At the same time, the relative cost of importing from one country versus another may not change much.

At present, though recovery from the recession is proceeding at various speeds in different parts of the world, we shouldn’t expect drastic changes in the geographic pattern of U.S. trade. For example, for the past year, the prices of goods the U.S. imports from Canada are temporarily rising faster than the prices of items from China.

But the opposite happened from mid-2008 to early 2009, and the U.S.’s relative imports from these two countries remained fairly stable. While one country may gain a temporary advantage over another, it is costly to reallocate production between different locations. In the same way that permanent barriers such as distance significantly affect relative trade flows, so producers should be willing to reallocate production from one country to another only when there are extremely persistent or permanent changes to the relative benefits of doing so.

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Notes
2 The gravity model as an empirical model was first used by Jan Tinbergen in Shaping the World Economy: Suggestions for an International Economic Policy, New York: Twentieth Century Fund, 1962. Originally gaining popularity because of its success in explaining the pattern of trade in the data, the gravity model was later shown to be consistent with economic theories of international trade based on the costs and benefits of trade between different countries. See, for example, “Gravity with Gravitas: A Solution to the Border Puzzle,” by James E. Anderson and Eric van Wincoop, American Economic Review, vol. 93, no. 1, 2003, pp. 170–92; and “Technology, Geography, and Trade,” by Jonathan Eaton and Samuel Kortum, Econometrica, vol. 70, no. 5, 2002, pp. 1741–79.