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Economic Letter

Economic Shocks Reverberate in World of Interconnected Trade Ties

by Matthieu Bussière, Alexander Chudik and Giulia Sestieri

As the world economy slowly recovers from the Great Recession and global trade flows remain weak, net trade contributions to domestic growth become more critical.

Renewed debate about currency wars and the question of global trade imbalances are part of a longer-running economic discussion about what drives a country's exports and imports.

More specifically, what determines international trade flows? As the world economy slowly recovers from the Great Recession and global trade flows remain weak, net trade contributions to domestic growth become more critical and the factors affecting exports and imports tend to become more intensely scrutinized.

Studies of the current account—the balance of goods and services traded internationally, plus net income from abroad and net cross-border transfer payments—have long emphasized the role of the exchange rate in adjusting to excessive current account surpluses and deficits. In the context of global imbalances, several efforts have been made to estimate the magnitude of the dollar depreciation needed to reduce the U.S. trade deficit, which reached around 6 percent of gross domestic product (GDP) in the year preceding the 2008 financial crisis.[1] However, it's also important to take into account the role of demand because its fluctuations at home and abroad can offset relative price movements.

Based on a global vector autoregression (GVAR) macroeconomic model of trade flows, it appears that world exports respond more to an unexpected event, or shock, affecting U.S. output than to a comparable unplanned event involving the dollar. Additionally, shocks abroad bring wide-ranging responses that tend to be felt among countries with strong trading relationships. A positive bump to German output would increase output and exports among other European economies. Surprisingly, perhaps, it would also increase exports and GDP in more distant countries such as Mexico. The effect of a positive shock to Chinese imports would be especially large among other Asian countries but less so in Europe.

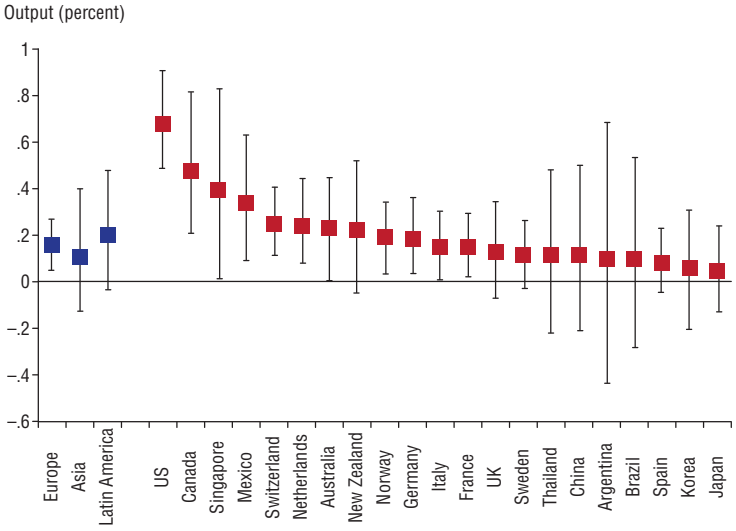
Modeling Economic Spillovers

The multilateral nature of international trade deserves particular attention, given that trade is increasingly fragmented. For example, a slowdown in economic activity in country A affects not only its trading partner, country B, but also country B's trading partners, C and D. This is particularly true if B imports from C and D the components needed to produce the goods exported to A.

GVAR modeling, which looks at relationships among series of data over time and across countries, offers a convenient and flexible way to study international trade because it takes into account cross-country interdependencies.

The model can capture strong links between exports and imports that occur

Chart 1 Global Output Rises in Response to Shock to U.S. Output



NOTE: Chart shows the impact of a U.S. output shock on global output after one year, with 90 percent confidence bounds.

SOURCE: Authors' calculations.

because of vertical integration of production chains—an exported finished product includes imported components, for example. As a result, the model can look at global trade flows and the effect of unanticipated changes to variables such as aggregate demand—proxied here by GDP—and exchange rates.[2] These shocks may be correlated and may differ from the independent, economically unrelated shocks depicted in so-called structural macroeconomic models.[3]

The trade model covers 21 countries—14 advanced and seven emerging markets. The modeling strategy uses a handful of key variables: exports and imports of goods and services, GDP, effective exchange rates, and oil prices (all in real, or inflation-adjusted, terms), plus country-specific foreign data aggregates. These foreign aggregates are constructed as weighted cross-section averages of exports, imports, output and exchange rates.

Data cover 1980 to 2007, an endpoint just before the onset of the Great Recession and ensuing trade collapse.

Unanticipated Rise in U.S. Output

Consider a positive shock to domestic output in the U.S., an unexpected/unpredictable rise in GDP over the period covered in the data sample. In the model, a one-standard-error shock to U.S. output—a size considered statistically typical—is equal to 0.6 percent of GDP at the time of impact. One noticeable result is a large effect on U.S. imports, which increase around 2 percent after one year and 1.3 percent after three years. In addition, the impact on other countries is significant and large.

Unsurprisingly, such a positive shock to U.S. output has expansionary effects on the output of almost all foreign countries (*Chart 1*). The squares in the chart represent the mean effect after one year, while the length of the associated bars indicates the degree of statistical uncertainty around the estimates. Although the effect is particularly large in neighboring Canada and Mexico, European economies are significantly affected, too, especially the smaller ones. The effect is positive but not statistically different from zero in several Asian countries, especially larger ones such as China and Japan.

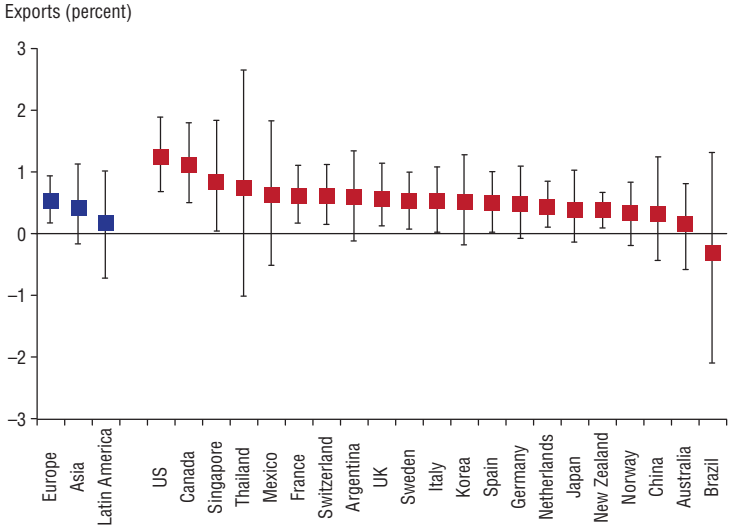
Similarly, exports increase significantly in almost all countries (*Chart 2*). The effects of higher growth abroad generate a rise in U.S. exports. The positive feedback to U.S. exports is statistically and economically significant in the first couple of years after the shock.

The rankings of countries in Charts 1 and 2 are similar, suggesting that geographic proximity and trade linkages are important channels of transmission. The model is symmetric—when an increase in U.S. output causes a substantial export increase, it follows that a U.S. recession would likely be associated with a significant fall in world trade.

U.S. Dollar Appreciation

Next, suppose a positive shock occurs to the U.S. real effective exchange rate, which corresponds to an appreciation of 2.5 percent on impact.[4] The stronger dollar has an unambiguous effect on U.S. exports,

Chart 2 Global Exports Increase as U.S. Output Rises



NOTE: Chart shows the impact of a U.S. output shock on exports after one year, with 90 percent confidence bounds.

SOURCE: Authors' calculations.

which fall 1.3 percent in the first year (*Chart 3*).[5]

Japanese exports are affected by the U.S. exchange rate appreciation more than those of other foreign economies, in line with Japan experiencing the greatest resulting currency depreciation.[6] The stronger dollar also significantly affects exports from European countries. The overall effect on Asian and Latin American exports tends to be subdued. A possible explanation: The currencies of these regions tend to follow U.S. exchange-rate appreciation and gain little competitiveness when the dollar strengthens.

Thus, world exports respond more to a U.S. output shock than to a shock involving dollar appreciation. This appears to be consistent with what occurred after the 2008 financial crisis, when, contrary to what many observers expected, adjustment to global imbalances was not accompanied by a sharp dollar depreciation.

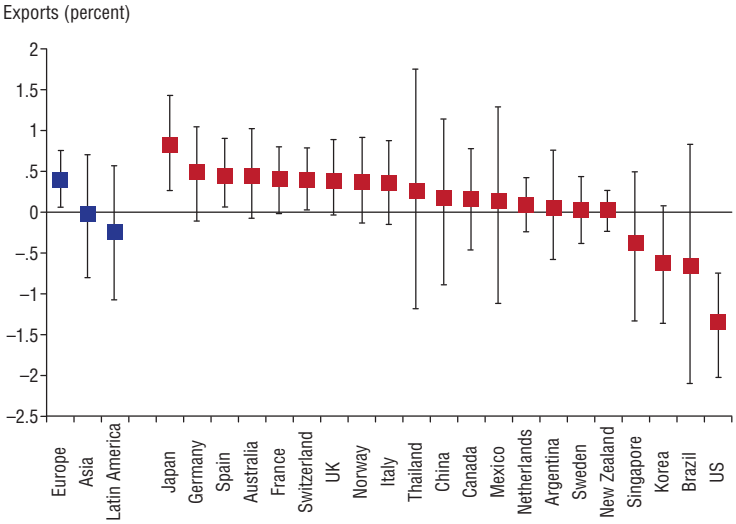
Other Country Shocks

Although the U.S. clearly has a leading role in the global business cycle, other countries play important roles. Accordingly, it is interesting to look at Germany and China to illustrate regional and global dynamics. Both countries are systemically important to the global economy and are forces in their own regions.

Germany is the world's fourth-largest economy and the foremost one in the euro area, as well as the second-largest global exporter after China. A positive, one-standard-deviation shock to German GDP, corresponding to a 0.8 percent increase at the time of impact, has a broad impact on exports after one year and carries economically and statistically significant effects on other countries, especially in Europe (*Chart 4*). This is not surprising given the strength of linkages in Europe. Interestingly, the effect on U.S. exports is also significant, at about 0.4 percent.

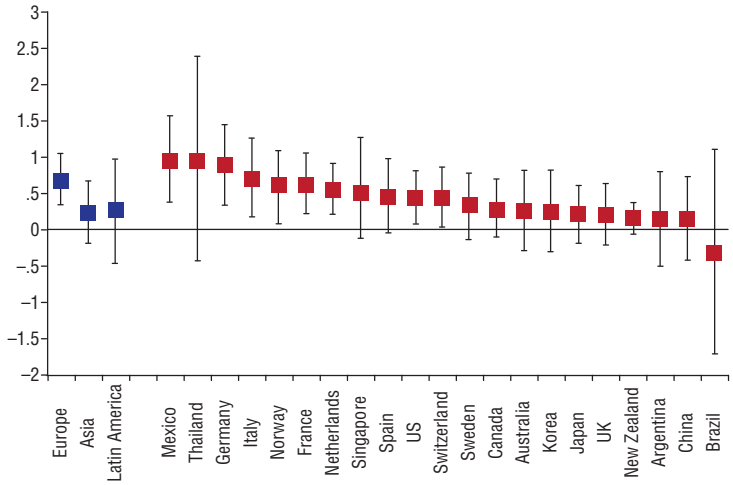
Finally, consider the effect on exports from a positive shock to Chinese imports, given the increasing importance of China in global trade (*Chart 5*). Although some of the estimated effects are uncertain, the general pattern is relatively clear: A one-standard-error shock to Chinese imports, which corresponds to an increase of 1.9 percent at the time of the impact, has a large positive effect on exports from other Asian countries and, to a lesser extent, exports from Europe after one year. This result clearly suggests the presence of strong trade integration among Asian economies.[7]

Chart 3 U.S. Dollar Appreciation Felt Most in Japan and Europe



NOTE: Chart shows the impact of a U.S. dollar shock on exports after one year, with 90 percent confidence bounds.
SOURCE: Authors' calculations.

Chart 4 Response to Rising German Output Most Widely Felt in Europe

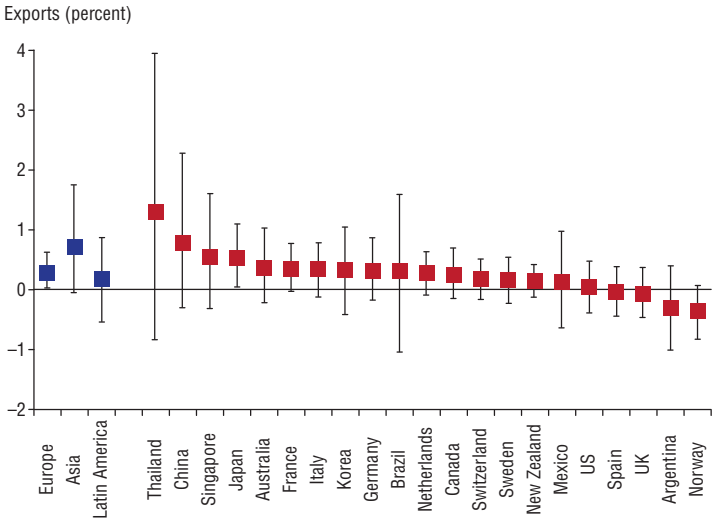


NOTE: Chart shows the impact of a German output shock on exports after one year, with 90 percent confidence bounds.
SOURCE: Authors' calculations.

Global Trade Flows

GVAR trade modeling, helpful in showing cross-country interdependence, suggests that changes in domestic demand have a strong effect on international trade flows and on foreign GDP. This underlines the importance of policy coordination across countries: In a strongly interconnected world in which economic shocks reverberate through international trade linkages, international spillover effects cannot be ignored. Policy measures in a given country affect its trading partners directly, and the effects quickly spread to the rest of the world, ultimately feeding back to the domestic economy itself.

Chart 5 Global Exports Respond to Unexpected Rise in Chinese Imports



NOTE: Chart shows the impact of a Chinese import shock on exports after one year, with 90 percent confidence bounds.
SOURCE: Authors' calculations.

The G-20, representing the largest and some of the most influential economies, offers a natural forum for policy coordination among systemically important countries.[8] This is particularly true of the G-20 working group on the Framework for Strong, Sustainable and Balanced Growth, which seeks to address global imbalances.

Rebalancing the world economy—for instance, by stimulating demand in countries experiencing trade surpluses—is important to ensure that global growth does not rely on a small number of countries, each susceptible to downturns, but instead becomes more evenly spread among all nations.

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Notes

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[1] See, for example, the survey "A Framework for Assessing Global Imbalances," by Thierry Bracke, Matthieu Bussière, Michael Fidora and Roland Straub, *The World Economy*, vol. 33, no. 9, 2009, pp. 1,140–74 and the references cited therein.

[2] Technically, the GVAR approach consists of estimating a set of small-scale country-specific dynamic models, which link domestic and foreign variables. The GVAR formulation is a rich dynamic model, which also allows for cointegration within and across countries. See "Modeling Global Trade Flows: Results from a GVAR Model," by Matthieu Bussière, Alexander Chudik and Giulia Sestieri, Globalization and Monetary Policy Institute Working Paper no. 119, Federal Reserve Bank of Dallas, 2012, for details of the GVAR model used to generate these results and for a complete description of the data.

[3] Generalized impulse response functions (GIRF) reported here (and originally proposed in "Impulse Response Analysis in Nonlinear Multivariate Models," by Gary Koop, M. Hashem Pesaran and Simon M. Potter, *Journal of Econometrics*, vol. 74, no. 1, 1996, pp. 119–47) give a sense of the expected impact of a change in one variable (demand or exchange rates) on other variables (trade flows) in the model.

[4] The real effective exchange rate of the dollar is a weighted average value of the dollar relative to an index or basket of other major currencies, adjusted for the effects of inflation.

[5] Preliminary results imply that a 10 percent appreciation of the dollar would trigger a more than 5 percent decline in U.S. real exports, which appears to be on the high side. Other researchers also find substantial effects (see, for example, "The New OECD International Trade Model," by Nigel Pain, Annabelle Mourougane, Franck Sédillot and Laurence Le Fouler, OECD Economics Department Working Papers no. 440, 2005, or "Trade Elasticities for the G-7 Countries," by Peter Hooper, Karen Johnson and Jaime Marquez, International Finance Discussion Paper no. 119, Federal Reserve Board of Governors, 1998. These comparisons are not without caveats because they refer to different definitions of relative prices and different country and time samples.

[6] See note 2 (Figure 2).

[7] Many papers have documented the increase in vertical specialization—the international fragmentation of production—and its important role in international transmission of business cycles. See, for example, "The Nature and Growth of Vertical Specialization in World Trade," by David Hummels, Jun Ishii and Kei-Mu Yi, *Journal of International Economics*, vol. 54, no. 1, 2001, pp. 75–96.

[8] G-20 participants are Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea (Republic of), Mexico, Russia, Saudi Arabia, South Africa, Turkey, the U.K. and the U.S. in addition to the European Union.

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