

Overview of Modeling Approaches

Projecting and explaining historical shifts for U.S. and global trade requires taking into account numerous drivers of structural changes, such as global population growth, demographics, capital stocks, labor force, and income-related changes on consumption patterns, as well as macroeconomic variables, such as exchange rates, interest rates, savings, and investment. Because no single empirical model is capable of capturing all of these factors and their interactions, we employ two independent models to examine growth and macroeconomic influences separately.

Because global growth and macroeconomic factors involve an economy-wide perspective, we employ computable general equilibrium (CGE) models to simulate growth effects and macroeconomic change on agricultural trade. Such models are typically employed to gain broad insights on multiple economic interactions that would not be captured easily in other types of models. Capturing global economic interactions is important when major markets are growing at different rates. Countries are linked by international trade and capital flows, so that one country's economic growth affects that of its trading partners. Modeling these linkages provides more breadth and richness to economic analysis. However, a valid critique of this methodological approach is the highly aggregate structure used in such models. Some loss in detail of important features of actual food markets, such as product attributes, supply response, market structures, and consumer behavior, is one limitation of this approach (see appendix B for a fuller explanation of the models used in this analysis). However, the loss of detail is less critical when the analysis focuses on broader issues, as this study does, such as the effects of global growth on aggregate U.S. agricultural trade.

Modeling Global Growth Impacts

To evaluate the impacts of global economic growth and population changes on U.S. exports and imports, we employ the GTAP (Global Trade Analysis Project) model.¹⁵ In this approach, world trade is simulated by exogenous shocks of historical and projected real GDP, capital, labor force, total factor productivity, and population changes.¹⁶ The historical influence of these variables on trade is measured by conducting a “backcast” (backward forecast) to 1990. Backcasting allows us to compare the model's simulated growth projections of historical trade with actual historical changes in trade, and to assess the relative importance of economic growth for explaining historical trade growth. Using projections of economic growth with the same variables, the model simulates global trade forward to 2016. To underscore some key findings, our discussion of results focuses on the changing levels of U.S. exports to aggregated groups of “high-income” and “faster growing” economies.

Modeling Macroeconomic Impacts

Impacts of potential changes in foreign demand for U.S. financial assets on the U.S. economy and agricultural trade are examined using a single country model known as USAGE (United States Applied General Equilibrium). USAGE is a dynamic, computable general equilibrium model of the U.S. economy based on the theoretical structure of the Australian-based CGE

¹⁵See <https://www.gtap.agecon.purdue.edu/>

¹⁶This was the framework employed by Coyle et al. (1998) and Gehlhar and Coyle (2001) to perform a growth simulation with the GTAP model.

model known as MONASH, which has been applied widely in forecasting and policy analysis.¹⁷ In this study, we use an aggregate version of the full U.S. model consisting of 40 aggregated sectors, with agriculture comprising two industries: primary agriculture (crops and livestock) and food manufacturing. We focus on two hypothetical scenarios centered around a basic macroeconomic shock—changes in foreign investor demand (“confidence”) for U.S. financial assets¹⁸—and trace out the effects of resulting exchange rate, interest rate, and other macroeconomic changes on domestic consumption and agricultural trade. The effects are measured as year-to-year deviations from a baseline projection, with the year 2002 as the starting point.¹⁹ Two macroeconomic scenarios are considered:

- Scenario 1 simulates the effects of increased foreign demand for U.S. financial assets beginning in 2002 and represents enhanced confidence in the U.S. economy relative to foreign opportunities. This scenario is used to illustrate how increased foreign demand for U.S. financial assets feeds through the U.S. economy, affecting interest rates, exchange rates, consumption, and aggregate imports and exports. We introduce the shock in 2002 as a historical shock emulating effects of dollar appreciation on trade. The scenario is not meant to precisely reproduce actual historical developments. Instead, the scenario broadly simulates macroeconomic developments similar to those that led to the dollar’s appreciation beginning in the mid-1990s and demonstrates how a single shock produces lasting trade effects.
- Scenario 2 is a shock capturing the effects of reduced foreign demand (confidence) for U.S. financial assets. This scenario reflects potential changes caused by improved investment opportunities abroad or concerns about the sustainability of the U.S. current account deficit that requires increased returns on U.S. assets. The shock is implemented in the same year. The purpose of this analysis is to illustrate a plausible outcome stemming from a change in foreign investor behavior, not a predicted outcome. As stated previously, we can trace out the impacts on aggregate U.S. trade, as well as agricultural trade, by targeting a change in foreign demand for U.S. assets that produces a 20-percent depreciation of the dollar.

¹⁷See <http://www.monash.edu.au/policy/mon-usa.htm>

¹⁸Changes in demand are represented by a change in the required rate of return by foreign investors. A gain of confidence lowers the required rate of return by foreign investors, while reduced confidence raises the required rate of return.

¹⁹The USAGE model’s base year is updatable to any recent year depending on availability of both macroeconomic and factors of production data, including capital and labor statistics for the U.S. economy.