International trade in agricultural products at the U.S. state level

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Extended Abstract:

In this paper we develop and apply a new method for estimating state-level international trade in agricultural products. The method is based on a fundamental proposition from trade theory, which posits equal absorption shares of regionally differentiated goods in the absence of trade frictions. Adopting this as an assumption allows us to calibrate a commodity-specific Armington demand system to input-output accounts that establish supply and demand vectors for each state and each port. We then utilize the structure with trade frictions included to establish the benchmark flows of goods from the point of production to domestic uses and port-level exports. Similarly, we distribute port-level imports to their use in specific states. While our primary focus is on international trade the method yields a bilateral interstate trade matrix for each commodity.

Our work complements recent advancements in open-source calculations of state input-output accounts by the Wisconsin National Data Consortium (WiNDC).[1] The WiNDC project focuses on publicly available data sources and a series of routines that generate micro-consistent subnational accounts. Previously available subnational accounts where both expensive and proprietary, which made them less ideal for research.[2] The academic based WiNDC project has many advantages including its accessibility, transparency, and extensibility to particular research questions.

Representing bilateral interstate and state-level international trade in the WiNDC accounts remains as a challenge. A lack of reliable data on interstate trade favors a *pooled* national market formulation, which ultimately limits the structural options for researchers. At first the U.S. Department of Commerce's Bureau of Census (Census) reports in the Commodity Flow Survey (CFS) might be considered the best source for bilateral state trade, but these data suffer from a fundamental problem. The CFS tracks shipments of goods not the goods themselves. For example, a rail shipment of a bushel of corn from Eastern Nebraska to Kansas City plus the barge shipment of the same bushel from Kansas City to New Orleans escalates the quantity (and value) of the actual corn shipped. This problem, of double

[1] See https://windc.wisc.edu/.

[2] The IMPLAN (https://implan.com/) state accounts are an example of a closed-source commercial alternative.

counting in the CFS data, is noted by Anderson and van Wincoop (2003) who correct the CFS interstate trade flows assuming they are exaggerated by a factor of 2.08. Our proposed method for generating bilateral interstate trade imposes consistency between state-level production and aggregate absorption.

The state-level *international* trade in the core WiNDC accounts is also a known weakness. The WiNDC trade data is from Census reports of imports and exports by state, but these are actually measured by Port of Entry.[3] The port from which agricultural exports exit the United States, however, are not necessarily or even likely located in the States where those products are produced. For instance, corn exports departing the ports located in the New Orleans Port District were not necessarily grown in the State of Louisiana. In fact, the large volume of Louisiana exports of grains (as reported by Census and thus inferred in the WiNDC accounts) is only explained by Louisiana's purchase of grains through the pooled national market. On the supply side, the excess supply of corn in a state like Nebraska does not leave its Port of Entry in Omaha, but rather is absorbed by the pooled national market. Looking at the Census data Louisiana exports a significant quantity of corn but Nebraska, a key corn producer, does not. A better representation would attribute international exports (and imports) of agricultural products to the state of production (and absorption).

Faced with the problematic Census state-trade data, the U.S. Department of Agriculture's Economic Research Service (ERS) generates an alternative measure of state agricultural exports based on cash receipts. For these estimates, the products that make up U.S. agricultural exports are grouped to match the 24 product groups in U.S. farm sales estimates. For each of these 24 product groups, U.S. agricultural exports are allocated by State in approximate proportion to the State's share of national cash receipts for that product group. Thus, Nebraska, with 12.4 percent ($8.9 billion) of U.S. cash receipts for corn in 2021, is estimated to have accounted for 12.6 percent ($2.3 billion) of U.S. corn exports that year (U.S. Department of Agriculture, 2023a,b). In contrast, the Census Bureau's State Trade Data indicate Nebraska's corn exports (HS-6 100590) totaled about $609 million in 2021 (U.S. Department of Commerce, 2023).

Neither of these two estimates are based on a comprehensive assessment of the use of Nebraska's corn production, along the lines of USDA's PSD (Production, Supply, and Distribution) Online Database (U.S. Department of Agriculture, Foreign Agricultural Service, 2023). Some rough estimates are commonly circulated in the industry, however. For instance, Groskopf and Silva (2018) estimate that about 40 percent of Nebraska's 2018 corn crop was used as feedstock for ethanol production within the State. The Board (2023a) indicates that "about 16 percent of Nebraska's corn crop is fed to livestock within Nebraska" and that "about 40

[3] The Census Bureau disseminates export and import statistics by Port of Entry at the HS-6 level (U.S. Department of Commerce, 2023).

percent of the corn grown in Nebraska is fed to livestock somewhere in the United States or around the world." With respect to exports, the Board (2023b) estimates that international exports account for about 6 percent of the use of Nebraska's corn production.

Our purpose is to inform the key question of how much of a states production of specific agricultural goods are exported and how much is disbursed to each of the fifty states (plus D.C.). We use a structural gravity model following the theory of Anderson and van Wincoop (2003). A presentation of the full theory and its development is given by Yotov et al. (2016). There are two specific features of this theory that we leverage in developing our estimates of interstate agricultural trade and the flows of agricultural products between ports and states. First is the assumption of identical and homothetic preferences. This provides an anchor point for calibration, where in the absence of trade frictions expenditure shares on regionally differentiated goods are the same across regions. The second assumption is that trade cost are of the iceberg type. That is, they are paid in units of the good being shipped. This allows us to establish trade at normalized prices at both the frictionless anchor and the benchmark equilibrium.

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