Awards issued prior to January 20, 2025, were funded under previous Administrations and may not reflect the priorities and policies of the current Administration.

United States Department of Agriculture
Project Initiation

Project Data for Accession Number 1034603

Project Title

The Spatial Structure of Economic Exchange and Rural Prosperity in the United States

Project Details

Sponsoring Institution National Institute of Food and Agriculture	**Project Status** ACTIVE
Funding Source NIFA Non Formula	**Grant Year** 2026
Grant No. 2026-67023-46428	**Cumulative Award Amt.** $591,499.00
Proposal No. 2024-10929	**Multistate No.** (N/A)
Project Start Date Jun 30, 2026	**Project End Date** Jun 29, 2029
Program Code [A1661] Innovation for Rural Entrepreneurs and Communities	

Project Director

Babkin, A.

Recipient Organization

UNIVERSITY OF WISCONSIN SYSTEM
21 N PARK ST STE 6301
Madison, WISCONSIN 537151218

Performing Department

(N/A)

Non Technical Summary

The economies of rural America continue to lag those in metropolitan areas with many experiencing significant hardship. Policy makers have posited that rural areas may be disadvantaged by their location within the supply-chain as providers of raw and minimally processed intermediate inputs to centers of production located elsewhere. In response, USDA leadership has recently proposed to incentivize a reorganization of economic activity toward a circular economy that would increase the share of economic output used locally. Currently, however, there is a lack of research identifying the potential benefits and costs of directing economic development resources toward reshaping production and trade networks within the United States.A significant challenge to rigorously studying how the spatial distribution of intermediate production and trade affects rural prosperity is the lack of a rigorous theoretical framework that generates quantifiable metrics that characterize the shape of economic activity.Therefore, our proposal makes several important contributions to this emerging policy discussion. First, we develop a model of economic activity to

formalize the concept of intermediate circularity that allows us to derive a collection of measures that quantify the shape of intermediate production and trade. Second, we demonstrate that these measures can be calculated using administrative business data applying the input-output framework. Third, we estimate the causal effects of these measures of intermediate circularity on economic, demographic, population health outcomes to inform rural development policy, including potential heterogeneity across intermediate industry (extractive versus non-extractive), industry structure, and community sociodemographic attributes.

Animal Health Component

Animal Health Component: 0%

Research Effort Categories

Basic	0%
Applied	100%
Developmental	0%

Classification

Knowledge Area (KA)	Subject of Investigation (SOI)	Field of Science (FOS)	Percent
608	6110	3010	100%

Knowledge Area

[608] Community Resource Planning and Development

Subject Of Investigation

[6110] Economy of the United States and sectors thereof

Field Of Science

[3010] Economics

Keywords

circular economy; intermediate trade; rural prosperity; economic development; racial disparity

Goals / Objectives

The economies of rural America continue to lag those in metropolitan areas, and some rural regions are experiencing significant economic hardship. The vitality of many rural communities depends critically on reversing their economic decline. Identifying the attributes of rural economies that explain why they lag their urban counterparts and the characteristics that cause some rural areas to flourish while others flounder are critically important lines of inquiry in public policy research.Recently, policymakers have proposed that rural areas may be disadvantaged by their location within the supply-chain as providers of raw and minimally processed inputs to centers of production located elsewhere. To support rural economic development, in his February 2022 address to the National Association of Counties, Secretary of Agriculture Vilsack stated, "At the U.S. Department of Agriculture, we're looking for ways to develop what is called a 'circular economy,' in which wealth and new opportunities and jobs are created in rural

communities and stay in those rural communities".Our proposal makes several important contributions to this emerging policy discussion. First, the circular economy concept is most commonly used to describe a system of environmentally sustainable production that reduces the entry and waste of resources. We formalize a new concept of intermediate circularity that characterizes the production and trade of intermediates, i.e., goods and services that are transformed and combined to produce other goods and services. Second, we use this model to derive a collection of measures that quantify economic activity. Third, we propose to calculate measures of intermediate circularity using federal administrative business data applying the input-output framework. Finally, we propose to estimate the relationship between measures of intermediate circularity and a set of community prosperity and resilience indicators (social, economic, demographic, population health outcomes) in rural counties over five decades (1977-2022).A rich literature investigates the role of uneven development on individual and community prosperity and resilience. Scholars have identified historical trajectories of economic development which often favor core, metropolitan sites of production and population and relegate rural places to peripheral sources of lower value-added raw material, which generates persistent rural-urban inequality in the United States. Researchers have identified areas dependent on agriculture, forestry, and mining (AFM) as particularly vulnerable to unequal development, as resources are extracted from one location to largely support economic development and prosperity in other, extra-local places. Nevertheless, a local economy's dependence on extractive, natural resource-based industries does not automatically transform a place into a peripheral production site. Several examples exist of successful economic development strategies based on natural resource trade, e.g., Norway, Chile, Botswana. Conversely, uneven development can also arise from manufacturing and service industries.There is little direct evidence that circular economic systems will lead to higher prosperity and resilience in rural areas and none that reasonably quantify the potential gains relative to the costs necessary to alter the existing spatial distribution of economic activity in the United States. The lack of research identifying the potential benefits and costs of directing economic development resources toward reshaping production and trade networks within the United States is a serious impediment to policymakers and researchers.A significant challenge to rigorously studying how the spatial distribution of intermediate trade affects community prosperity and resilience is the lack of an empirical framework that quantifies each of the many dimensions characterizing trade in intermediate production inputs. To overcome this problem, we have constructed a model for formalizing the investigation of intermediate trade by building on the seminal work of Cantillon and Quésnay in the mid-1700s who characterized economic systems as a circular flow. Our model: 1) formalizes the mechanisms through which economic trade can influence community prosperity and resilience and generate rural-urban disparities; 2) generate a collection of well-defined measures that allow us quantify those mechanisms; and 3) motivate a rigorous empirical analysis that can inform stakeholders who wish to increase rural prosperity, reduce urban-rural inequality, improve the resilience of rural economies, and ensure economic surplus is more equitably distributed by incentivizing the spatial reorganization of economic activity. We apply the tools of input-output analysis to county-level information on industry output to generate a dataset that can be combined with information on county-level economic, social, demographic, and population health outcomes from other sources.Industry heterogeneity- The specific industries producing and using intermediate inputs can directly influence how economic shape affects prosperity. We will examine how intermediate circularity varies in its association with community prosperity according to type of industry. The distribution of surplus from trade in extractive intermediates may be especially skewed toward extra local users and away from local communities. The costs to local producing-communities (including natural resource depletion) may accumulate and contribute to persistent and worsening inequality over time relative to extra-local using-communities.Industry structure-We will augment our analysis to consider whether industrial diversification improves prosperity and resiliency to economic shocks. Specifically, we will explore whether areas with a diverse set of intermediate industries tend to be more versus less prosperous than areas where intermediate production is highly concentrated.Dynamic response- We will leverage the panel nature of our data to identify whether more circular economies also grow faster and consider the role of intermediate circularity in resilience. As one example, the COVID-19 pandemic revealed fragility in the complex economic ecosystem when the consequences of broken supply chain linkages rippled across the country as workers lost their jobs because of events unfolding hundreds or thousands of miles away. We will therefore examine how intermediate circularity is associated with recovery from external shocks to supply and demand.This proposal advances ongoing research efforts by the project team that seeks to identify the attributes of rural areas that cause their economies to lag urban ones and our

project objectives have been specifically designed to meet high priority research needs related to economic opportunity, entrepreneurship, employment, and the effect of external shocks in rural communities. Documenting the ways in which the economic activities undertaken in rural areas disadvantages them relative to urban ones will provide policy-makers actionable information that can be used to improve rural economic development programs.Therefore, we propose the following specific project objectives:Construct indicators of intermediate circularity;Identify causal effects of intermediate circularity on economic growth;Estimate the role of industry structure and concentration in mediating the relationship between intermediate circularity and economic growth;Estimate the relationship between intermediate circularity indicators and community resilience in response to external shocks to supply and demand; Estimate the association between circularity indicators and measures of community prosperity particularly meaningful for rural communities along the economic, social, demographic and health axes.

Project Methods

Objective 1: Construct indicators of intermediate circularityInput-output (I-O) analysis is a tool from production economics that links inputs to outputs through assumptions about technological relationships. The approach makes studying large economic systems tractable by imposing a local approximation about the true production function. Within the federal statistical system, the Bureau of Economic Analysis (BEA) is responsible for publishing national I-O tables. Applying a NAICS-to-BEA industry crosswalk, we can calculate industry-county output for each non-farm industry from the sales information in the Longitudinal Business Database (LDB). For the 10 BEA farm industries, we use county-level commodity sales from the Census of Agriculture. To construct supply and demand of intermediate commodities, we apply the national Supply and Use tables published by the BEA to our estimates of local industry output.The shape of intermediate trade flows in a local economy depends on three edges: intermediates produced and used locally, intermediate exports, intermediate imports. By selecting meaningful combinations of these shape parameters, we construct the following intuitive measures of intermediate circularity that fully characterize intermediate production and trade flows: production capacity, trade capacity, retention, production dependency, trade dependency, autonomy, trade balance, and trade openness.County-industry estimates of output, intermediate supply and demand, and circularity indicators will be calculated for every U.S. county in years where LBD, Census of Agriculture and detailed Input-Output tables are available - every five years from 1977 to 2022.Because these are newly defined measures characterizing local economic activity, our first important contribution will be describing their statistical and spatial distributions, with particular emphasis on urban-rural differences and changes over the past half-century. A key component of this set of analyses is documenting the possible determinants of differences in intermediate circularity across US counties. We will estimate a set of regression models with circularity indicators as outcomes and industry structure, size and rural indicator as explanatory variables.Objective 2: Identify causal effects of intermediate circularity on economic growthIn this objective, we propose a range of econometric analyses to determine to what extent our preliminary estimates of the relationship between circularity and rural prosperity can be considered causal, and thus useful for policymaking. While each proposed specification is limited by its underlying assumptions, they address different sources of potential endogeneity and are thus collectively informative.In the baseline specification, we estimate a repeated cross-sectional static model regressing the size of local economy on circularity and a set of control variables. To identify if more circular economies are not just bigger, but also grow faster, we will estimate the same specification using outcome growth rates between base year t and future year t+5. By leveraging the time dimension of our data in this manner, we reduce the possibility of outcomes having a reverse causal effect on the circularity measure. Next, we will estimate a panel regression model with fixed effects to control for unobserved heterogeneity.Counties in close proximity can affect each other in a wide range of ways, potentially introducing spatial autocorrelation into our models. We will address potential invalidation of statistical inference by utilizing a spatial error model approach.Partitioning county economies into circularity increasing and decreasing industries, we will leverage the time dimension of our data to design a quasi-experiment. If circularity has a positive causal effect on growth, growth in circularity increasing industries should be more strongly associated with subsequent growth of the economy than growth in circularity reducing industries.In a final set of regressions, we will apply the shift-share instrumental variables design to derive identification from an exogenous variable, constructed using a combination of nation-wide shocks (shift) and heterogeneous county exposure to them (share).Objective 3: Estimate the role of industry structure

and concentration in mediating the relationship between intermediate circularity and economic growthWe propose to identify whether circularity effects on growth are amplified when specific industries constitute a larger share of the local economy. Policy discussion around the concept of circular economy implies that it might be particularly beneficial in places predominantly engaged in agricultural, forestry and mining (AFM) industries. We propose to test this hypothesis by estimating an econometric model that includes an interaction with the share of the AFM sector in the local economy. For example, if counties with high levels of intermediate autonomy (i.e. local production satisfies local input needs) have higher employment growth rates, then a positive estimate on the interaction term implies that counties with larger share of activity concentrated in the AFM sector, will tend to have even higher employment growth rates. In addition, we will use a local industry concentration measure test if two places have the same total production and trade of intermediates, will the economy with a diversified set of intermediates perform better than the economy producing and trading a narrower set.Objective 4: Estimate the effect of intermediate circularity on the resiliency to shocksWe aim to test which intermediate circularity indicators and by how much they can determine a community's responsiveness and subsequent resilience to external shocks, and how these factors may differ in rural vs. non-rural areas, focusing on measures of economic growth as outcomes mostly related to the supply chain mechanism.We expand on the methods of Han and Goetz (2015 and 2019) to specify and estimate a resilience metric. A region that exhibits smaller relative relapse and larger relative rebound is more resilient. We will calculate resilience thus defined for every episode of negative shocks that affected a significant number of counties, including both nation-wide and more localized events. Data on economic outcomes are available on annual frequency as needed for this analysis. Objective 5: Estimate the temporal and spatial associations between intermediate circularity indicators and prosperity outcomesOur preliminary findings from 2012 public data indicate that there is a negative association between retention and premature mortality. Here we propose to use a broad set of social, economic, demographic, and health outcomes that are of contemporary policy importance.Mechanisms that potentially connect intermediate circularity to a broader set of prosperity outcomes are less intuitive than the effect it has on business outcomes, explored in Objective 2. One channel is the indirect effect on social, health and demographic outcomes through economic growth. A more direct effect is possible if, for example, higher economic circularity also builds greater social capital through shared goals and tighter relationships between local community members.To investigate these alternative channels, we will first establish causal effects of circularity on the broader set of prosperity measures, using them as outcomes in the models proposed in Objective 2 and including additional controls, known as determinants of a particular outcome in the literature. Given our focus on rural prosperity and the potential role that extractive activities play in disadvantaging rural economies, we will estimate these equations over all counties and the subset of non-metro counties, and allow for different rural regimes in the spatial specification.