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Beyond the Climate: Multiple Sources of Risk in the United States, Brazil and Argentina

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January 13, 2025

***farmdoc daily* (15): 8**

Recommended citation format: Cabrini, S., J. Colussi, G. Schnitkey, and S. Irwin. "Beyond the Climate: Multiple Sources of Risk in the United States, Brazil and Argentina." *farmdoc daily* (15): 8, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, January 13, 2025.

Permalink: https://farmdocdaily.illinois.edu/2025/01/beyond-the-climate-multiple-sources-of-risk-in-agriculture-in-argentina-brazil-and-the-united-states.html

This report presents the results of a survey on farmers' perceptions in the U.S. Midwest, the Argentine Pampas, and southern Brazil regarding the main sources of risk facing their businesses. Conducted in 2022 and 2023, the survey included 475 crop producers from the United States (137), Argentina (158), and Brazil (180), the main grain production areas in the world. Farmers across all three regions identified multiple sources of business risk, with significant differences observed among the countries in the frequency of selected risk sources.

Types of Risk in Agricultural Production

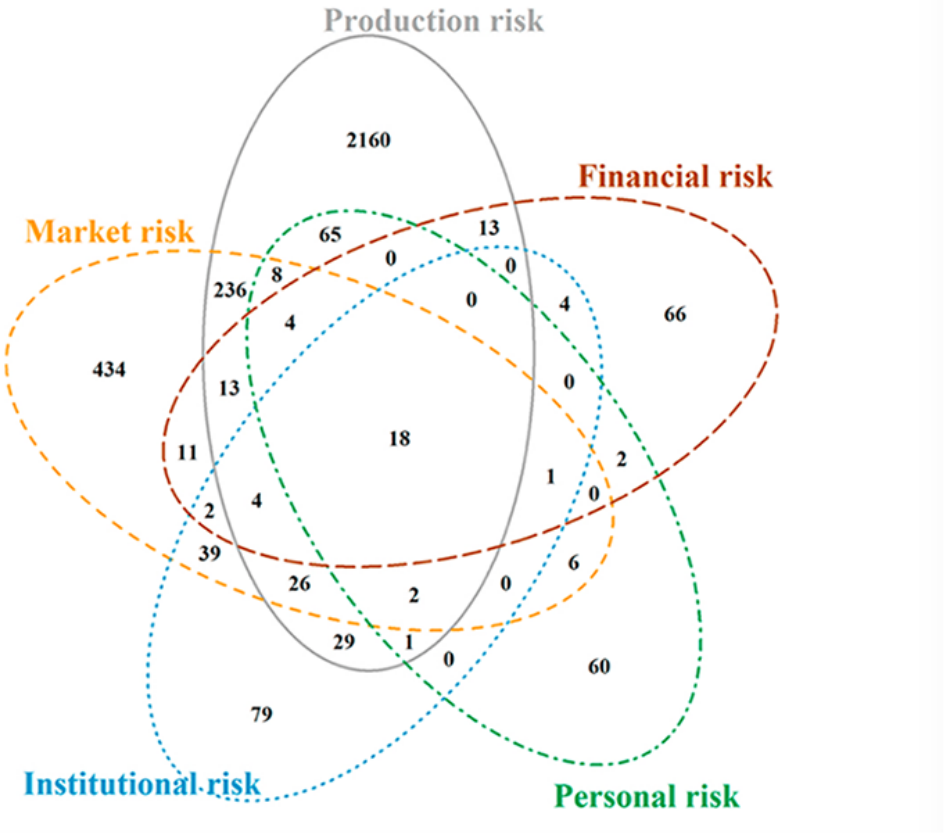
In economic activities, agriculture has specific characteristics that lead to high levels of risk: production processes are highly dependent on climatic conditions, there is a prevalence of small and family-owned businesses, and governments frequently intervene in production and trade activities. Therefore, agricultural production occupies a central place in the study of risk. Agricultural risks can be classified into five main types (USDA, 2024; Komarek et al., 2020):

- **Production risks** arise from uncertainty in crop and animal growth processes. Typical sources of these risks include climate variability, pests, and diseases.
- **Market risk** is related to uncertainties in prices, costs, and market access. Price volatility mainly depends on weather conditions in major production areas or changes in consumer demand.
- **Institutional risks** are linked to unpredictable changes in policies and regulations that affect agriculture.

- **Personal risks** are related to human health issues or personal relationships that impact family-run farms.
- **Financial risk** is associated with changes in interest rates and credit conditions. It is defined as the additional variability in the farm's operating cash flow due to fixed financial obligations inherent in the use of credit.

Figure 1 illustrates that all types of risk have been studied in the academic literature, but with very different levels of attention. Production risk has received the most attention, followed by market risk (Komarek et al., 2020). The most frequently studied combination of risks includes production and market risks, while very few studies cover all five types of risk.

Figure 1. Venn Diagram Shows the Distribution of the Number of Studies on the Five Types of Risk Between 1974 and 2019



Source: Komarek et al., 2020

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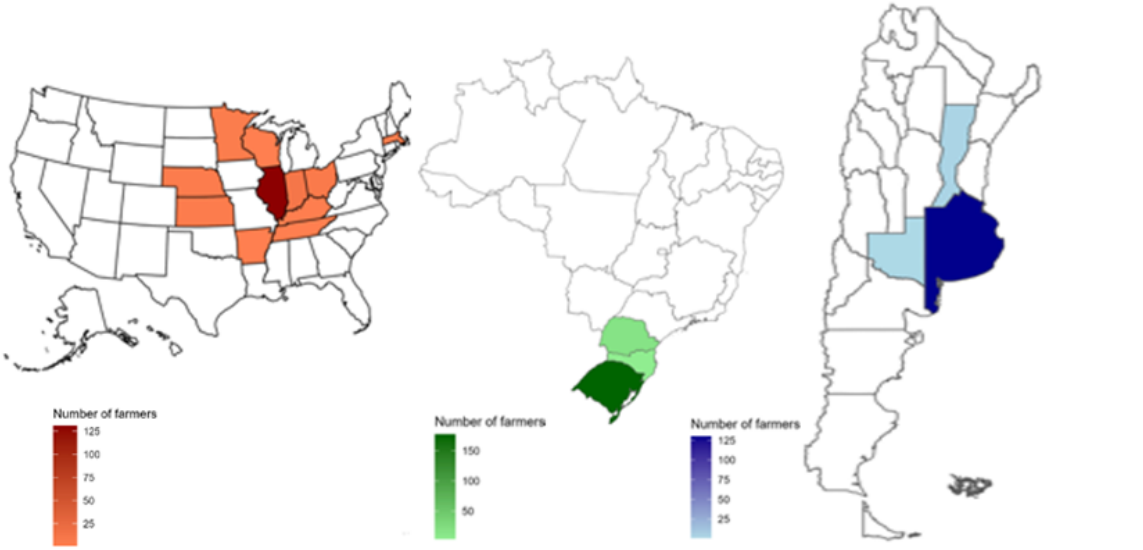
Risk Perception for Crop Farming in the United States, Brazil and Argentina

A survey was conducted with 475 farmers from the U.S. Midwest (n=137), the Argentine Pampas (n=158), and southern Brazil (n=180) in 2022 and 2023 (see Figure 2). These regions are among the most important in the world for rainfed grain production, with specific characteristics unique to each area. The characterization of the surveyed crop producers in the three regions is detailed in Cabrini et al. (2023a).

Figure 2. Maps of the Study Areas in the United States, Brazil, and Argentina



The survey is part of a study on access to climate information and the influence of seasonal climate forecasts on agricultural decision-making. The questionnaire survey employed was based on a review of literature and previous research focused on the use of climate and weather information in agribusiness decisions. One section of the survey examined perceptions of the main sources of risk in agriculture. The specific question analyzed in this study was: *What are the main sources of risk in agricultural production? (Please list between 3 and 10 sources of risk)*. This question was open-ended, and the responses were categorized as shown in Table 1.

Climate-related production risk was identified as the primary source of risk for most producers surveyed across the three regions. In Argentina, the three most frequently identified types of risks were: climate, government interventions, and product price. In the United States and Brazil, the three most mentioned risks were: climate, production price, and input price.

Climate was identified as the primary source of risk for most farmers surveyed in the U.S. Midwest, southern Brazil, and the Argentine Pampas. This result reinforces the relevance of climate in crop production, as documented in previous research (Cohn et al., 2016; D'Agostino et al., 2016; Lesk et al., 2016; Ray et al., 2015; Thomasz et al., 2019; Cabrini et al., 2023b).

Table 1. Classification of Farmers' Responses to Types of Risk in Agriculture

Category	Sub-category	Farmers' answers
Production risks	Climate	climate, climate variability, climate warming, cold spring weather, drought, early frost event fall, flooding, frost events spring, hail, heat waves, summer storms, wet fall, strong wind
	Yield - other than climate	disease and insects, resistant weeds/insects, product efficacy, compaction, erosion, harvest timeliness, inadequate insurance coverage, uniform plant stand establishment, low diversification level, animal health, misuse of genetic traits, equipment breakdowns, timely planting, # days suitable for field work, application timing,
Market risk	Price of outputs	commodity price risk, market price risk, market volatility, wild price swings, lack of control over sale prices, market speculation, funds involvement in markets, profitability—input/output price levels, USDA forecasting errors, foreign disruptive events, export trade issues, embargo, tariffs, geo-political conflict, world events, world weather, demand from China, export capability, local competition, local ethanol production, other countries competition, supplier/buyer consolidation, corporate bankruptcy
	Price/ availability of inputs	inputs - price/availability, cost of production, input shortages - fuel, fertilizer, pesticide, consolidation of suppliers and buyers, loss of rented farmland, cash rent, health care cost, property tax, affording modern equipment, equipment repair access, metrics and support for soil health, transportation costs, beginning farmer start up costs
	Labor cost/availability	labor costs/availability, human resources, qualified labor, labor legislation
	Inflation	inflation, cost of inputs - inflation
Institutional	Government interventions	public policy uncertainties, excessive government regulation, domestic policies, policy - renewable fuels, farm programs, government manipulation of markets, trade policies, political turmoil, current administration, lessening political influence, taxes, export taxes, property taxes, destruction of private property rights, communism, left-wing government, eminent domain, geo-politics, government decisions - embargos -wars etc., corruption
	Environmental regulations	environmental regulations, environmental risk, environmental activism, consumer sentiment, climate change activists, animal rights groups, radical vegans, EPA WOTUS FSA, people against GMOs, regulation-chemicals, very flexible environmental laws
	exchange rate and regulations	high value of the dollar, exchange rate volatility, decoupling of internal prices versus external prices and versus inputs
Personal		generational transition, non farming family, personal heath, unexpected death or injury, loss of key partner/employee, divorce, individual producer behavior, safety, business leadership
Financial		credit, financial, increasing interest rates, adequate financing, capital, financial markets, lack of liquidity in assets, difficulty accessing credit
Other		black swan event, economic uncertainty, insufficient and untimely data that is useful, poor management, public misinformation, rural development, contract force majeure, bee mortality, livestock theft, insecurity

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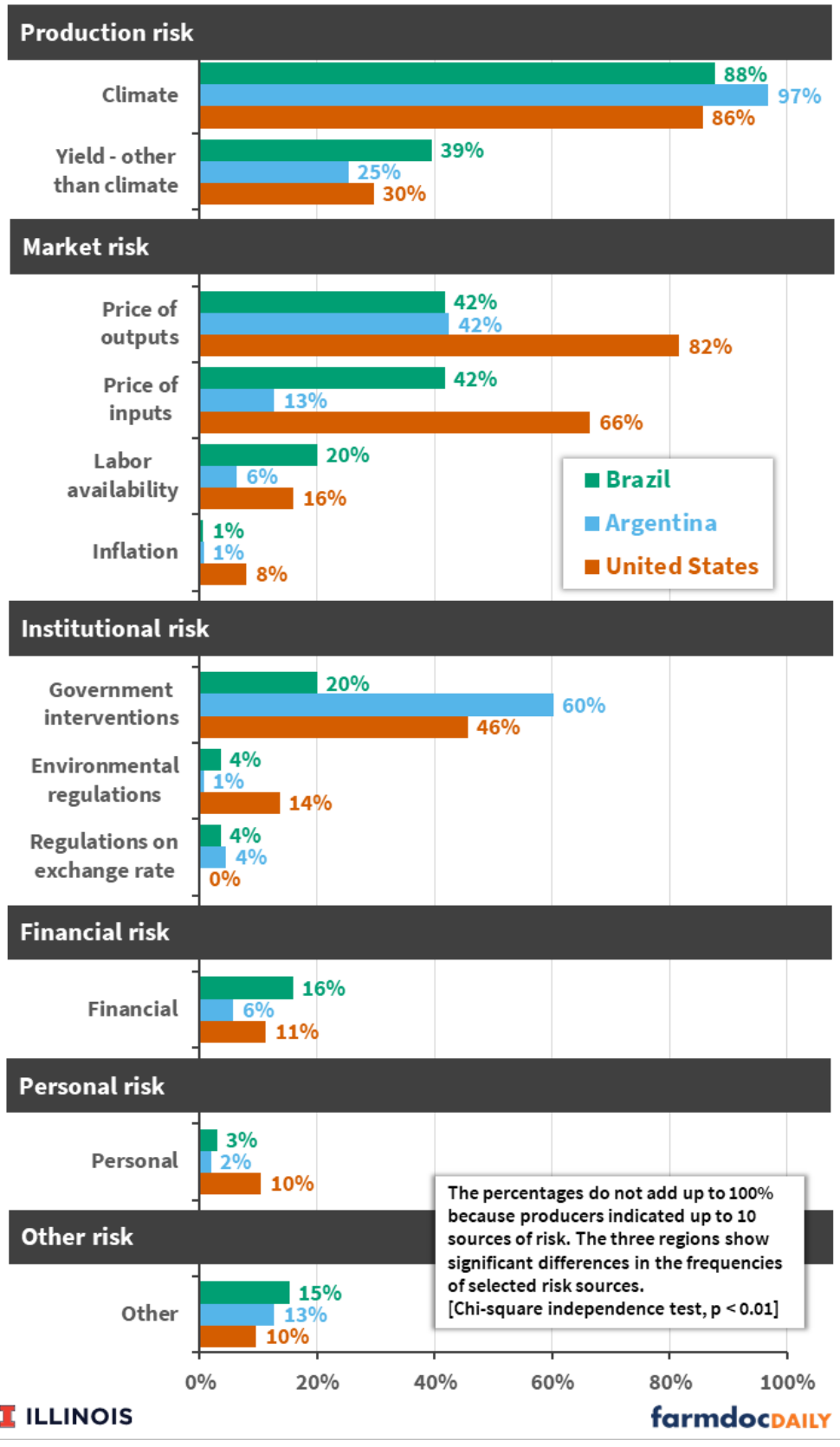
Figure 3. Main Sources of Risk Identified by Crop Producers in the U.S. Midwest, Southern Brazil, and Argentina's Pampas



Other sources of risk frequently mentioned by farmers in the three regions include price of outputs and the prices/availability of inputs. Grains, fertilizers, pesticides, and fuel are globally traded, and prices fluctuate based on changing conditions in global supply and demand. A recent global event brought these market risks into focus: the Russian invasion of Ukraine caused disruptions in the global fertilizer trade and had significant impacts on grain and fertilizer prices (Colussi et al., 2022). It is likely that respondents were influenced by this event when assigning importance to this type of risk. A significantly higher proportion of US farmers indicated output price as an important source of risk.

Another source of risk frequently identified by farmers was government intervention. This source of risk was mentioned by most Argentine farmers. In Argentina, export taxes impose a high tax burden on the agricultural sector. Since 2020, export taxes have been set at a rate of 12% for corn and wheat, 33% for soybean grain, and 31% for soybean oil and soybean meal. Over the last 10 years, these rates have undergone significant changes, ranging from a minimum of 0% for wheat and corn and 27% for soybeans, to a maximum of 20%, 23%, and 35% for corn, wheat, and soybeans, respectively.

Additionally, in Argentina, there have been periods of varying levels of regulation on export quotas for agricultural products. In the U.S. and Brazil, as in most countries, there is significant support for the agricultural sector (BID, Agrimonitor).

It is interesting to note that inflation was mentioned as a source of risk by 8% of U.S. farmers and only 1% of Argentine farmers. This could be explained by the fact that, despite Argentina's higher inflation rate (at the time of the survey, the 2022 inflation rate in Argentina was around 100%), U.S. inflation was more variable in relative terms over the five years prior to the survey (higher coefficient of variation).

Another noteworthy difference lies in the perception of risk due to changes in environmental regulations across the regions. Among U.S. producers, concerns about these changes are much more frequent and are largely attributed to shifts in public attitudes in the country.

Final Remarks

The main sources of risk identified by crop producers in the U.S. Midwest, Southern Brazil, and Argentina's Pampas varies across regions. Understanding the different sources of risk affecting agricultural activities is valuable for improving policy design, facilitating the adoption of innovations, and evaluating the sustainability of production systems. Governments, non-governmental organizations (NGOs), and other stakeholders can allocate resources more efficiently when they understand which risks are of greatest concern to farmers.

Farmers identify multiple sources of risk for their businesses. Therefore, it is essential to consider multiple risks simultaneously when evaluating the risk levels of production systems. This can be achieved by integrating risk assessment tools, such as stochastic simulation models and scenario analyses.

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