

Evaluating Climate Risk Responses in Agribusiness: Insights from Bunge Limited and Archer Daniels Midland

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Abstract: In recent years, climate change has emerged as a critical issue exerting significant negative impacts on the agricultural industry, with globalized companies like Bunge Limited and Archer Daniels Midland (ADM) facing unique challenges. The increasing frequency and intensity of extreme weather events, rising temperatures, and altered precipitation patterns are affecting these companies' international operations, particularly their supply chains and crop production capacities. These disruptions have created substantial risks, threatening the consistency and reliability of their global agricultural supply chains. This paper investigates how climate change has impacted the operations and financial performance of Bunge Limited and ADM. Evaluations will focus on how each company responds to climate-induced risks, considering their risk management practices and adaptation strategies. Both quantitative metrics, such as revenue and profit changes, and qualitative aspects, like operational flexibility and risk mitigation efforts, will be analyzed. Additionally, the effectiveness of their strategic responses in sustaining profitability while minimizing climate-related risks will be assessed, providing a comprehensive overview of their climate resilience approaches.

Keywords: Agribusiness Resilience, Supply Chain Disruptions, Climate Change Impact.

1. Introduction

Climate change, stated by the United Nations, refers to the “long-term shifts in temperatures and weather patterns” [1]. In recent years, climate change patterns have increased as pollution level is boosted. According to statistics, wheat yields are projected to decrease by 6% and maize by 7% per degree Celsius of warming [2]. In 2022, annual economic losses due to climate-related disasters reached \$650 billion [3]. As one of the principal industries that potentially suffered the most influence among all globalized companies, agricultural businesses tended to be very vulnerable facing environmental variations. Agriculture is extremely sensitive to the quality of weather and climate. The worse conditions for growing crops, for instance, heavy rainfall, floods and greenhouse effect would all cause damage on the agriculture productivity, which strongly affected the companies' profitability and financial statement [4].

As an apparent example, the two internationally operated companies, Archer Daniels Midland (ADM) and Bunge Limited, has been influenced strongly. Businesses for ADM were in the regions of North America, South America, Europe and Aisa, and operated significantly in agricultural production areas such as the U.S., Brazil, and Argentina. With the 2023 sales revenue of \$101 billion, ADM relies heavily on crops like corn, soybeans, and wheat. The company has faced challenges from

droughts in the U.S., wildfires in Brazil, and erratic rainfall in Argentina, all of which have negatively affected crop yields. In response, ADM has adopted strategies to mitigate climate risks, including investment in climate-smart agriculture, water-efficient technologies, and diversified sourcing to protect its global supply chain. Similarly, Bunge Limited, which generated \$67 billion in 2023 revenue, faces significant climate challenges. With core operations in South America and the U.S., Bunge's reliance on soybean and corn production has been jeopardized by droughts and unpredictable weather, particularly in Brazil and Argentina. To manage these risks, Bunge has diversified its sourcing, invested in resilient crop varieties, and incorporated sustainable farming practices to reduce water and fertilizer use.

Both ADM and Bunge are also increasingly focusing on digital farming solutions to better manage climate risks, as well as integrating sustainability initiatives to meet regulatory and consumer expectations. As climate change accelerates with time, these companies are being forced to continually adapt their production strategies to maintain profitability and ensure long-term food security, which would be evaluate in the later analysis.

2. Quantitative Analysis

According to numerical results concluded from the sets of data, the general performance of Bunge Limited and ADM could be observed transparently. Significant metrics presented within financial statements have been collected into Table 1 shown below, effectively illustrated the companies' respective earnings power, valuation trends and risks.

Table 1: Financial indicators of Bunge Limited and ADM.

METRIC	Bunge Limited	ADM
Market Value Of Equity	\$13.9B	\$28.4B
Earnings Per Share	\$8.80	\$5.02
P/E Ratio	11.19	11.85
Beta	0.637	0.714
SMB Beta	-0.258	-0.140
HML Beta	0.074	-0.029
Cost of Equity (CAPM)	5.78%	6.03%
Dividend Yield	2.84%	3.39%
Dividend Payout Ratio	29.62%	37.91%
ROE	12.3%	10.75%

2.1. Capital Asset Pricing Model (CAPM)

- Bunge Limited

Cost of Equity: 5.78%

Market value of equity: \$13.9 billion

- ADM

Cost of Equity: 6.03%

Market value of equity: \$18.4 billion

Investors' contributions tend to act crucially in the companies' finance. In this case, the cost of equity is significant to present the rate of return the business pays out to their equity investors [5]. Climate risks can be access in the investors' expectations, which Capital Asset Pricing Model (CAPM) is efficient to apply to.

ADM has a slightly higher cost of equity, meaning investors expect a marginally higher return for the risk they take by investing in ADM compared to Bunge, because of its reliance on U.S. agriculture. In comparison, the broader international footprint and strategic sourcing The difference is small but could reflect the market's perception of ADM's risk profile was slightly higher than Bunge's. Cost of equity is crucial for determining the minimum return investors expect.

Investors view ADM as a larger and more established participant in agricultural industries and food processing sector, this can be demonstrated by the more than double of the market value of equity compared to Bunge. ADM's apparent higher market value provide suggestions on a greater level of investor confidence or more established market presence.

2.2. Dividend Payout Ratio

- Bunge Limited: 29.62%
- ADM: 37.91%

ADM's higher dividend payout ratio suggests it is distributing a larger portion of its earnings as dividends compared to Bunge. A higher payout ratio can indicate a more mature company that has fewer reinvestment opportunities, while a lower payout ratio like Bunge's could suggest that the company is reinvesting more earnings into growth opportunities.

On the other hand, lower payout ratio can provide Bunge with greater financial flexibility, which allows it to navigate uncertainties of economy in the tends to be vital facing the climate-related disruptions, giving the ability to adapt the strategies as needed for Bunge.

2.3. Minimum Variance Portfolio

The minimum Variance Portfolio (MVP) is an investment strategy that aimed at minimizing the overall risk, which is volatility while achieving an expected return. In this case, this was done by optimizing the allocation between Bunge and ADM. Weights for the MVP were:

- Weight in Bunge: 65.9%
- Weight in ADM: 34.1%

This allocation indicates that Bunge experienced extreme climate change events with more severity in the previous years. The high volatility demonstrated their vulnerability to such events. Moreover, the scarcity of essential resources, such as water and arable land, would negatively affect the initial production for those agricultural businesses, whereas the more optimistic performance result for ADM showed the possibly greater management on these resources.

2.4. Tangency Portfolio

The maximum Sharpe ratio portfolio, which was stated as the tangency portfolio, was directed to maximize the portfolio's risk-adjusted return. This is designed to achieve the optimal balance between risk and return.

- Weight in Bunge: 24.7%
- Weight in ADM: 75.3%

The tangency portfolio allocated more heavily toward ADM, suggesting that, based on the calculations, it offers a more favorable risk-return profile compared to Bunge under the prevailing market conditions.

The tangency portfolio not only highlights the investment strategy that offers the highest excess return per unit of risk, but also illustrates how significantly climate risk factors impacted in shaping

these returns. The much higher allocation to ADM may reflect the relatively stable and potential resilient features to climate-related disruptions, which effectively enhances ADM's attractiveness and status in the market, involved as part of a sustainable investment strategy.

3. Qualitative Analysis

3.1. Extreme Weather Events

Climate change enhances the negative environmental impact on both ADM and Bunge Limited, particularly in agricultural sector where these companies fully rely on weather conditions for ensuring high-quality crop production. Throughout these years, extreme climate disasters occurred within operating regions of ADM and Bunge, such as droughts, floods and hurricanes strongly affected the ability to maintain profitability and the operational efficiency.

For instance, in 2021, Hurricane Ida struck the U.S. Gulf Coast, where ADM operates several grain export terminals and processing plants. The hurricane caused significant disruption to shipping routes and damaged infrastructure in the region. The impact was particularly severe for ADM's operations related to the export of corn and soybeans from the U.S. to global markets, as the storm temporarily shut down key ports in New Orleans. ADM was forced to close its Destrehan grain terminal, which delays the export shipments. This caused a backlog in grain supply, meanwhile, it affected global grain prices due to the scale of ADM's operations at these facilities [6].

Similarly, facing climate change issues is also one of the biggest challenges for Bunge Limited. In 2019, widespread damage led by flooding in the Midwest caused destructions on farmland, killing livestock and paralyzing infrastructures [7]. Partial Bunge facilities located within this region had also suffered from the disastrous influence, which extra amount of the capital budget have applied to the season [8].

3.2. Supply Chain Vulnerabilities

Climate change imposes great effects on the global supply chain, particularly for countries that depend heavily on imports of raw materials, such as agricultural products [9]. In this case, climate risks might result in adjustments in key productions of specific geographical regions. For instance, severe droughts in Brazil during 2020–2021 significantly impacted soybean production, affecting both local supply and Bunge's ability to export products efficiently. Prolonged dry spells reduced the availability of raw materials, and increased operational costs simultaneously, as Bunge needed to secure alternative sources [10]. On the other hand, ADM faced the problem as well to maintain the sustainability of supply chain. s adverse weather conditions reduce supply, prices for key inputs can rise sharply, affecting ADM's financial performance [11].

3.3. Cashflow Channel: Influences on Earnings and Dividends

Although climate risks are impactful for many segments, both ADM and Bunge Limited showed strong financial results, which highlighted their positions in the agriculture industry and food processing sectors.

ADM's overall performance is robust in the nearest previous year, which is 2023. According to reported information, the company achieved a segment operating profit of \$5.9 billion, with significant contributions from its Carbohydrate Solutions and Ag Services & Oilseeds (AS&O) divisions. However, the nutrition segment posted a 36% drop in its quarterly operating profit, due in part to higher manufacturing costs and continued downtime at its Decatur East soy processing plant [12]. Moving forward into 2024, ADM is projecting a decline in soybean crush margins, expecting them to stabilize between \$35 and \$60 per metric ton. Despite this, ADM remains optimistic about

growth in renewable diesel and vegetable oil demand. ADM also announced a \$2 billion share repurchase program, indicating confidence in its financial health.

In the same year, Bunge also performed at a high standard, driven by the strong execution and a favorable market environment. For the full year, Bunge reported an impressive earnings per share of \$14.87, up from \$10.51 in the previous year. Large quantity of international demand within this period brought inevitable benefits to Bunge on refining the oil businesses. Bunge is expected to continue leveraging its diversified operations as it navigates the volatility of global commodity markets.

4. Strategies in Response to Climate Risks

While climate change problems become increasingly severe on disrupting both ADM and Bunge Limited's performance, resilient strategies have been designed for the management towards these risks, reflecting on their different geographical locations and operational scales.

4.1. ADM's Projects Implementation and Reduction in Gas Emissions

Associating with the atmospheric problems, investigations on a broad range of technologies and solutions to develop a previewed plan for guiding the efforts was carried out [13]. ADM set the goal to achieve a 25% reduction in absolute greenhouse gas (GHG) emissions by 2035, committing to reduce emissions through energy efficiency improvements, renewable energy usage, plus other carbon-reducing initiatives [14].

According to 2023 ADM Carbon Reduction Program report, ADM's strategies for reducing its environmental footprint, such as achieving an enhance in operational efficiency, sourcing sustainable materials and utilizing innovative technologies. Furthermore, they have implemented renewable energy projects across several facilities, concentrating on wind and solar energy, and are investing in carbon capture and sequestration technologies to limited industrial emissions. ADM is also working closely with suppliers for supporting sustainable farming practices, aiming to reduce the carbon intensity of crop production and transportation in their global supply chains [14].

4.2. Bunge's Sustainability Strategies and Carbon Reduction

One of the company's key commitments is achieving deforestation-free supply chains by 2025, which is central to its plan for reducing greenhouse gas emissions. Bunge's objectives tend to be ambitious, which involved aspects of an absolute reduction of Scope 1 and 2 greenhouse gas emissions of 25% by 2030, reduction of Scope 3 greenhouse gas emissions of 12%, both from a 2020 baseline year [15].

To achieve these goals, Bunge is investing in regenerative agriculture practices, renewable energy, and improving its logistics and shipping operations to lower emissions. These strategies also enable Bunge to tap into growth opportunities in new markets focused on low-carbon products and renewable fuels [16].

5. Conclusion

Throughout the entire amelioration of ADM and Bunge, both companies managed their increasing risks posed by climate change efficiently. The consistency in shielding supply chain resilience, sustainability, and technological innovation from climate change issues laid a solid foundation for the stability of future operation.

For ADM, the wide-spread geographic footprint and technological advances set it at an efficient status for the management in future. As a prior component in ADM's preview toward upcoming operations, the needs of integration in sustainability efforts across its entire network of suppliers and operations was planned carefully, ensuring to improve its abilities on mitigating effect from climate

disruptions. ADM is committed to transparency, continually reporting its progress and ensuring that its climate-related actions align with global targets such as the Paris Agreement.

Bunge, on the other hand, concentrates on broadening its sourcing regions and optimizing supply chain efficiency. Its strong market position and consistent revenue generation demonstrate resilience in the face of climate risks. Bunge's swift adaptability to past environmental challenges highlights its capacity to mitigate the impacts of climate disruptions. Looking ahead, Bunge's long-term strategy of promoting sustainable farming practices and reducing its environmental footprint will be increasingly critical. These ongoing efforts reflect Bunge's proactive approach to sustainability, positioning it as a leader in addressing climate risks within the agribusiness sector.

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