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Increased Costs of Phosphate Fertilizers in the United States due to Countervailing Duty (CVD) on Imports from Morocco

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Research Report 26-01

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Executive Summary

- U.S. Representative Pat Fallon (TX-4) requested that the Agricultural and Food Policy Center (AFPC) at Texas A&M University prepare an analysis of the effects of the U.S. Countervailing Duty (CVD) on Moroccan phosphate fertilizer imports on U.S. phosphate fertilizer prices and costs incurred by U.S. agricultural producers.
- The U.S. Countervailing Duty (CVD) on Moroccan phosphate fertilizer imports was imposed in March of 2021. Farm groups and lawmakers have alleged that the CVD has reduced supply options for critical crop nutrients, tightening the market and fueling concerns about higher input costs for growers.
- Previous academic research carried out using data observed immediately following the imposition of the CVD found it resulted in statistically significant increases in the prices of phosphate fertilizers paid by U.S. farmers.
- This report extends and improves on the existing body of evidence. We find that the CVD increased the price of diammonium phosphate (DAP), a common phosphorus fertilizer, by 28.6% during the period when the CVD was imposed at its full initial level of 19.97%, confirming both the allegations of farm groups and lawmakers and the findings of previous academic research.
- The CVD has increased the cost of phosphorus fertilizers for U.S. producers of a subset of major crops by an estimated $6.9 billion for the 2021 through 2025 growing seasons.

1 Introduction

The countervailing duty (CVD) proceedings on Moroccan phosphate fertilizers (primarily those of OCP Group, S.A.) began in mid-2020, when The Mosaic Company filed CVD petitions against imports from Morocco and Russia. The U.S. International Trade Commission (USITC) instituted the related import-injury investigations soon after, and noted that phosphate fertilizers had not previously been the subject of U.S. CVD or anti-dumping investigations (U.S. International Trade Commission, 2020; Hill, Clark, 2020).

The U.S. Department of Commerce (Commerce) and the USITC issued affirmative final determinations, resulting in a 19.97% CVD on Moroccan phosphate fertilizers beginning in March 2021. Commerce's fact sheet documented the final determination that countervailable subsidies existed, and the USITC's final publication accompanied the issuance of the order (U.S. Department of Commerce, 2021).

An administrative review of the determination concluded in 2023. Commerce issued preliminary results in May 2023 and later finalized the review; industry coverage reported that the final results decreased the CVD rate to 2.12% as of Novermber 2023 (U.S. Department of Commerce, 2023). A second administrative review ended in late 2024. Commerce determined that OCP received countervailable subsidies during the period of review and finalized results that raised OCP's rate to 16.81% as of November 2024 (U.S. Department of Commerce, 2024). The history of the level of the CVD on Moroccan phosphate fertilizers over time is depicted in Figure 1.

The import barrier created by the CVD was imposed in a precarious market environment for phosphate fertilizers in the United States. U.S. extraction of phosphate rock has been declining for decades, from approximately 45 million metric tons in 1995, to approximately 20 million in 2023, even as use of phosphate fertilizers in the U.S. increased. This has resulted in a growing reliance on imports. In the 2019 to 2020 time frame, Moroccan phosphate fertilizers accounted for approximately 72% of U.S. imports, based on USITC importer questionnaire data (United States International Trade Commission, 2021). The CVD not only reflects a barrier to imports from a major supplier, but also has been imposed in the context of a highly concentrated market. Mosaic company accounts for approximately 75% of U.S. phosphate fertilizer production (Mosaic Company, 2025). Given these circumstances, the CVD would reasonably be expected to have a significant impact on the prices of phosphate fertilizers in the U.S. market.

Indeed, U.S. farm groups and lawmakers have alleged that the CVDs on Mo-

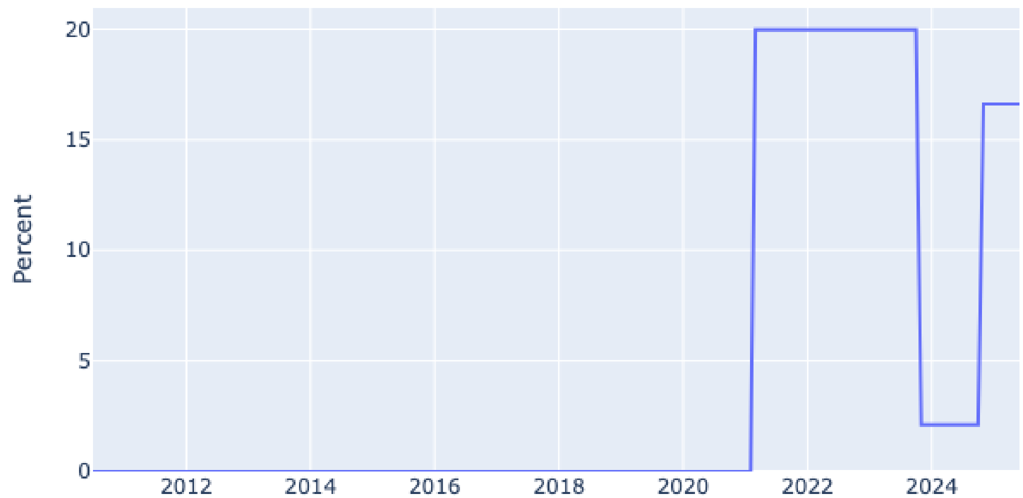

Figure 1: U.S. Countervailing Duty on Moroccan phosphate fertilizer imports

roccan phosphate fertilizer imports have reduced supply options for critical crop nutrients, tightening the market and fueling concerns about higher input costs for growers (Young, 2022). A Senate letter asserted that supply options “significantly decreased” after the 2020 imposition of duties, while farm advocates warned that additional trade barriers would further strain farmers already facing elevated costs (Grassley et al., 2023). Market prices of diammonium phosphate (DAP), a common phosphate fertilizer, before and after the imposition of the CVD on Moroccan imports are presented in Figure 2.

Farmers’ concerns have been validated by academic research. A 2024 study by Beeler et al. (2024) found that the CVD on Moroccan phosphate fertilizers increased the price of DAP paid by U.S. farmers by 34%. That study was published in the *American Journal of Agricultural Economics*, the flagship journal in the field of agricultural economics, with a rigorous peer review process and very high standards for publication. This provides empirical evidence that the CVD on Moroccan phosphate fertilizers has indeed increased costs for U.S. farmers, as alleged by farm groups and lawmakers. That study relied on observed market prices through only February 2022, just 12 months after the CVD was imposed. The longer run effects of the CVD on phosphate fertilizer prices have not been investigated to date.

The objective of this report is to extend and improve on the analysis of Beeler et al. (2024), quantifying both the impact of the CVD on U.S. phosphorus fertil-

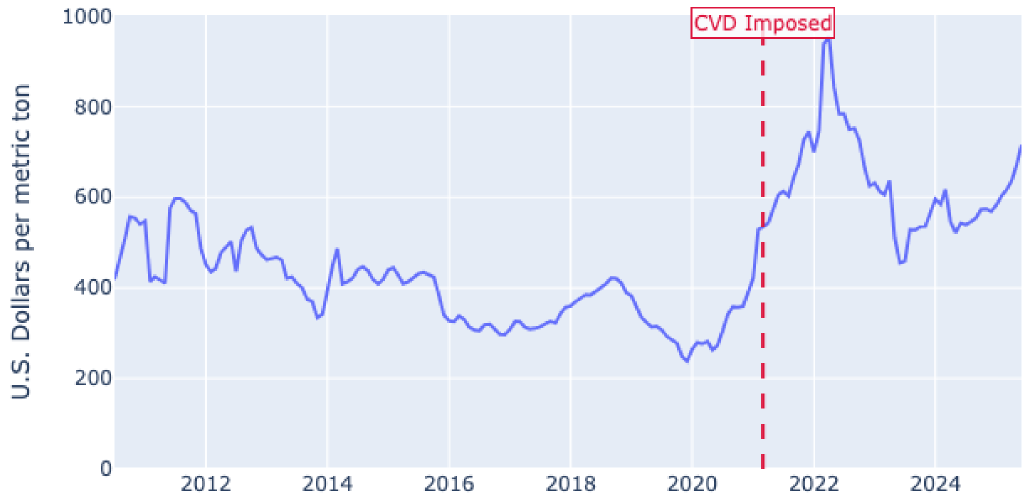

Figure 2: Diammonium phosphate price, U.S. Gulf f.o.b. (Source: USDA Agricultural Marketing Service)

izer costs experienced to date, and expected near-term future effects. We use the same methodology as Beeler et al. (2024), but extend the analysis to include additional data through late 2023, capturing more variation in the CVD level and longer run effects of the CVD on U.S. phosphorus fertilizer prices (allowing time for equilibration of the market). We additionally improve on their analysis by using more appropriate natural gas price data, and by including sulfur prices in the analysis. Sulfur is used to produce sulfuric acid, which is then used to extract phosphorus from phosphate rock, and is therefore a crucial input in the production of phosphate fertilizers. These changes allow an up-to-date and more accurate estimate of the CVD's effects on the phosphate fertilizer costs experienced by U.S. farmers in recent years, as requested by U.S. Representative Pat Fallon (TX-4).

2 Background

Before presenting the methodology, data, and results of the main analysis of the effects of the CVD on prices paid by U.S. agricultural producers, we provide some background on U.S. production, use, and trade in phosphates.[1]

2.1 Phosphate Usage across U.S. Commodities

Phosphorous is a plant-essential nutrient critical to commercial agricultural production throughout the world. Examining USDA Agricultural Chemical Use Survey data reveals corn is the largest user of phosphate fertilizer among all crops in the U.S. with the nutrient applied on 75 percent of planted acres at an average rate of 64 lbs./acre for a total usage of 4.1 billion pounds (2021 crop year). Soybeans rank second with 44 percent of acres receiving an average of 57 lbs./acre of the nutrient for a total usage of approximately 2.0 billion pounds (2023 crop year). Corn, soybeans, wheat, and cotton account for over 90 percent of domestically applied phosphate fertilizer. Although some specialty crops receive a higher total lbs. of phosphates applied per acre, the sheer volume of area planted to traditional row-crop commodities leads to those crops accounting for the majority of usage of phosphates in domestic agricultural production. A compilation of USDA survey data for application rates and total usage of phosphate for selected commodities and specialty crops is available in Table 1.

2.2 U.S. phosphate production

According to the most recently available U.S. Geological Survey (USGS) report, phosphate rock ore was mined domestically by five companies operating in four states (Florida, Idaho, North Carolina, and Utah) and processed into approximately 20 million tons of product in 2024. Florida's Bone Valley region is the largest single source of U.S. phosphate, accounting for approximately 80% of domestic capacity. Most (95%) of the domestically mined phosphate rock is used to produce intermediate feedstocks ultimately becoming granular and liquid am-

[1] The material in this section draws on many sources: Li and Elser (2023), National Agricultural Statistics Service (2021a), National Agricultural Statistics Service (2021b), National Agricultural Statistics Service (2021c), National Agricultural Statistics Service (2022a), National Agricultural Statistics Service (2022b), National Agricultural Statistics Service (2023a), National Agricultural Statistics Service (2023b), National Agricultural Statistics Service (2023c), National Agricultural Statistics Service (2023d), National Agricultural Statistics Service (2024), Observatory of Economic Complexity, U.S. Environmental Protection Agency (2023), U.S. Geological Survey (2020), U.S. Geological Survey (2021), U.S. Geological Survey (2022), U.S. Geological Survey (2023), U.S. Geological Survey (2024), U.S. Geological Survey (2025), U.S. International Trade Commission (2024),

monium phosphate fertilizers. Table 2, referenced throughout this background section, is a compilation of figures from USGS reports from 2020 to present.

2.3 Volume of U.S. phosphate imports subject to the CVD

The U.S. was expected to import 3.5 million tons of product in 2024, putting domestic net reliance on imports as a percentage of consumption at 13 percent, the second highest annual reliance figure over the last decade. This reliance figure has ranged from a low of 2 percent in 2018 to a high of 16 percent in 2023.

Morocco is the largest producer of phosphate in the world and currently holds approximately 50 billion metric tons in reserves, accounting for about 70 percent of the world's phosphate Although the trend over the last 10 years has been toward an increased reliance on imports, the share of imports sourced from Morocco, one of the countries targeted by the CVD order, has declined over the same period. USGS data does not report annual figures for sources of imports; however, it does provide a 4-year moving average of percentage of product sourced by country (Table 3). By examining USGS data from publications back to 2020, we see the 4-year average reliance on Moroccan imports fall annually from a high of 20 percent for the 2015-2019 period to 2 percent for the most recently reported period (2020-2023). A sharp drop in the percentage of imports from Morocco was realized during the first 4-year period that included 2021, which corresponds to the first year of CVD orders. Imports from Peru have essentially completely offset this decline in Moroccan imports, climbing from an average of 79 percent for the 2015-2019 period to 98 percent for the 2020-2023 period. Although Peru is not currently affected by the CVD, reliance on a single trade partner for essentially all imported phosphates does pose inherent risks, potentially leading to disruptions in supply.

2.4 U.S. phosphate exports and destinations

Major destinations for U.S. phosphate exports include Brazil, Canada, and Germany. Brazil was the top destination for U.S. phosphorous for fiscal year 2025 (October 2024 to September 2025) and continues to be the fastest growing market according to the Observatory of Economic Complexity (OEC).[2] Over 50 percent of U.S. phosphoric acid production is exported as finished fertilizers or commercial acid. Although the U.S. has historically thrived as a major global exporter

[2]Source: https://oec.world/en/profile/bilateral-product/phosphorus/reporter/usa

of phosphates, global competition (primarily from Morocco and China) has increased in recent years. The U.S. has experienced a decline in exports to India, but rising exports to Latin American countries have at least partially offset this drop. Increased competition and the threat of tariffs will continue to complicate the landscape.

2.5 U.S. potential for self-sufficiency in phosphate production

Estimated domestic consumption in 2024 was 23 million tons of marketable product, exceeding current marketable production of 20 million tons; at current production and consumption levels, the U.S. falls short of self-sufficiency in phosphate production. Despite holding only a fraction of Morocco's reserves, the U.S. does have approximately 1 billion tons of phosphate rock in reserves, thus raw product is not the limiting factor. Two firms, The Mosaic Company and Nutrien Ltd. are numbers one and two in domestic phosphate fertilizer production, accounting for over 90% of domestic capacity. Assuming continued availability of raw materials in the U.S., potential does exist for expansion; however, challenges and barriers also exist. Examples of these obstacles include but are not limited to increased production costs in the manufacturing process, environmental and regulatory concerns, and distribution/logistical inefficiencies. Additionally, as two companies essentially control domestic production, expansion will certainly be under heightened scrutiny due to the high level of concentration in the industry.

3 Methodology

In this report, we estimate the effect of the CVD on Moroccan phosphate fertilizers on the price of diammonium phosphate (DAP) paid by U.S. farmers. We closely follow the methodology of Beeler et al. (2024), which is based on the law-of-one-price (LOP). The LOP asserts that the price of a good should be the same across markets if there are no barriers to arbitrage. Expanding on this somewhat, after accounting for any transformation costs, transportation costs, and normal returns on capital, the price of a good should reflect the prices of the inputs used to produce it in the absence of market power. Given this assumption, Beeler, et al. estimate a cointegrating vector (in this context, a stable long-run relationship between prices) for the U.S. DAP price and the prices of some inputs into its production, viz., the price of Moroccan phosphate rock and a U.S. price for natural gas. We use a European natural gas price instead, as this is more closely associated with the price of natural gas used in Morocco. We additionally include the price of sulfur, which is used to produce sulfuric acid, which is then used to extract phosphorus from phosphate rock. Data sources are described in the next section. This approach is attractive because it allows us to estimate the effect of the CVD on DAP prices, while filtering out common factors that may affect the prices of DAP and related prices, such as the Chinese phosphate export ban, the Russian invasion of Ukraine, and the COVID-19 pandemic (Carter and Smith, 2007).

We initially apply the augmented Dickey-Fuller (ADF) test to determine the stationarity of the price series used in the analysis (Said and Dickey, 1984). Upon confirming that the prices are integrated of order one (I(1)), we estimate a cointegrating vector for the U.S. DAP price (D) using the Engle-Granger approach (Engle and Granger, 1987). The cointegrating vector is estimated by OLS regression of the (natural logarithm of the) DAP price on the (log) prices of the inputs used to produce DAP:

$$\ln(D_t) = \beta_0 + \beta_1 \ln(P_t) + \beta_2 \ln(G_t) + \beta_3 \ln(S_t) + \beta_4 CVD_t + \epsilon_t \qquad (1)$$

where P_t is the price of Moroccan phosphate rock observed in month t, G_t is the European natural gas price, S_t is the Middle Eastern sulfur price, CVD_t is the CVD level for Moroccan phosphate fertilizers, and ϵ_t is the regression residual. Note that CVD is measured in percent, so that the fitted coefficient for β_4 reflects the percentage change in the DAP price associated with a one percentage point increase in the CVD level.[3]

We consider other potential variables for inclusion in the cointegrating vector, including a dummy variable to reflect the Russian invasion of Ukraine, and the Baltic Index to reflect freight rates. However, these variables did not improve the model as measured by both the Aikake information criterion (AIC; Akaike, 1974) and Schwarz Bayesian information criterion (BIC; Schwarz, 1978), and were therefore not included in the final model.

We test null hypotheses that the residuals of the main regression are not stationary using a standard ADF t-statistic. We calculate critical values for this test using response surface regressions from MacKinnon (2010). Rejection of the null hypothesis indicates that the regression residuals are integrated of order

[3]By contrast, Beeler et al. (2024) incorporated the CVD as a binary dummy variable, which was appropriate for their data sample, wherein only a single non-zero value for the CVD level had been observed.

zero (I(0)) and there exists a cointegrating relationship between the I(1) prices. We apply the Chow (1960) test for the presence of a structural break at the time of the imposition of the CVD.

4 Data

Mean annual per-acre application rates for phosphorus in the United States are collected in the USDA's Agricultural Resource Management Survey (ARMS) for each crop every few years. These are collected from the USDA's National Agricultural Statistical Service (NASS) for the years 2000 through 2024, and an average rate is calculated for each crop across available years. This may slightly overstate the application rates since the CVD was imposed, as producers may have reduced their application rates in response to the increased cost of phosphorus fertilizers. However, the period since the CVD was imposed also featured increased costs for non-phosphate fertilizers, which may have attenuated the effect of the CVD or even increased application rates for phosphate fertilizers. That is, it is not clear that producers would have significantly substituted away from phosphate fertilizers. Additionally, the application rate data appears to include an overall upward trend over time, which we do not attempt to impose, so the application rates used in the calculations below may understate the actual cost increases realized by producers.

These ARMS data are "pounds of a fertilizer *primary nutrient* . . . applied, counting all applications per crop year" (National Agricultural Statistics Service, 2025). This facilitates the calculation of realized cost increases on a nutrient-equivalent basis using only DAP prices, given a lack of data on the application rates of specific phosphate fertilizers. To this end, note that one ton of DAP contains 920 pounds of phosphorus, and applying one pound of phosphorus (as measured in the ARMS data) therefore requires purchasing and applying 2.1739 pounds of DAP.

Planted acres for each year for corn, soybeans, wheat, rice, sorghum, and cotton in the United States are collected for 2021 through 2024 from USDA's Agricultural Marketing Service (AMS). Data for 2025 are from USDA's World Agricultural Supply and Demand Estimates (WASDE) report for May of 2025. Projected planted acres for 2026 are from the Food and Agricultural Policy Research Institute (FAPRI) projections for the 2026/27 marketing year.

Using the primary data sources described above, typical annual use for the five crops is approximately 5,985 thousand metric tons of DAP-equivalent. As a check on those primary sources for phosphate fertilizer use, we compare those data to secondary sources. Based on Jasinski (2024), typical consumption of phosphate rock in the U.S. in recent years is 24,000 thousand metric tons, of which 95% is used to produce fertilizers and animal feed supplements, 25% of which is exported. Using average elemental phosphorus extraction (from rock) rates and typical DAP phosphorus content, this implies typical domestic use supplied by domestic production of about 4,554 thousand metric toms of DAP-equivalent. Typical annual imports in recent years of phosphorus in fertilizers are 1,580 thousand metric tons on a DAP-equivalent basis (Nigh, 2025). This gives a total typical annual U.S. DAP-equivalent phosphate use of 6,134 thousand metric tons. Since the use from domestic production includes all uses, including animal feed supplements, horticultural use, and use for crops other than those considered in our calculations, this value of 6,134 comports well with the 5,985 thousand metric tons of DAP-equivalent use for six crops calculated using our primary data sources. These secondary sources are for validation only; however, changes in phosphate fertilizer costs incurred by producers reported below are based only on those primary data sources: typical annual application rates and year-specific planted acres for the six major row crops.

Monthly Moroccan phosphate rock f.o.b. prices are from World Bank Commodity pink sheet data. Difficulties with the collection methodology for these data have been documented, resulting in an apparently sham price for Moroccan phosphate rock being reported for all months starting in late 2023, as shown in Figure 3. We therefore use data (from all sources) only before this period for estimation.

Monthly Middle Eastern f.o.b. sulfur prices from the Saudi Arabian company Adnoc are from CRU Group. Monthly U.S. DAP prices, U.S. Gulf f.o.b., are from USDA's Agricultural Marketing Service (AMS). Bulk freight rates are represented by the Baltic Index, collected from the Baltic Exchange. European natural gas prices are from the World Bank and World Gas Intelligence[4].

[4]Natural gas is difficult and expensive to transport across oceans, and prices can differ substantially across markets that are far apart. While natural gas prices in Morocco, where it is used to produce DAP and MAP, are not available, we believe that the the European natural gas price reflects production costs in Morocco better than the Henry Hub, Louisiana, price that was used in Beeler et al. (2024).

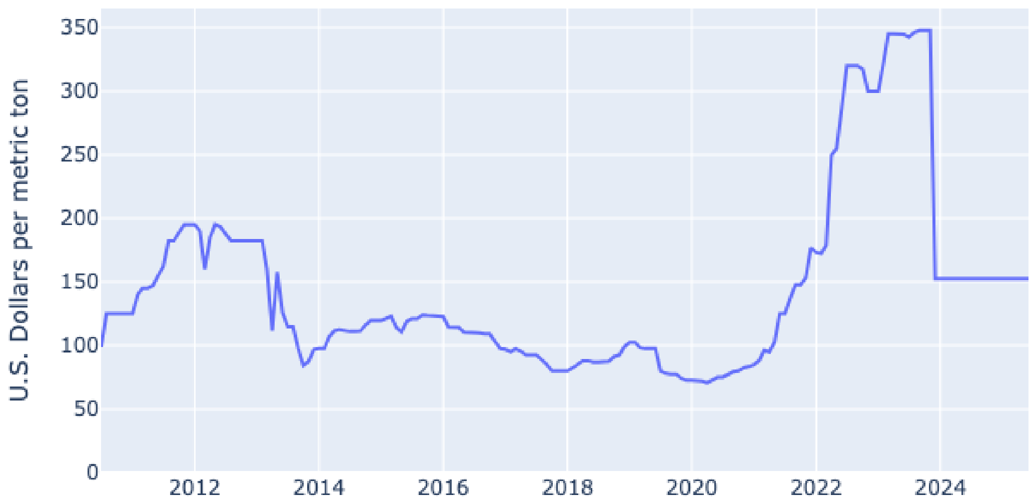

Figure 3: Morrocan phosphate rock price (Source: World Bank)

5 Results

5.1 DAP market cointegration

The null hypothesis of non-stationarity is not rejected using ADF tests for for all data series, with p-values ranging from 0.546 to 0.943. We therefore conclude that all series are integrated of order one (I(1)). Preliminary cointegration models including one or both of a Ukraine invasion dummy and the Baltic freight index were rejected due to their worsening both the Akaike Information Criterion and the Schwarz Bayesian Information criterion relative to the model in Equation 1.

The fitted model reflecting Equation 1 is presented in Table 4. All coefficients have the expected sign. Because the dependent variable is the natural logarithm of the DAP price, and the CVD is measured in percent, the fitted coefficient for β_4 of 0.0143 indicates that a one percentage point increase in the CVD level is associated with a 1.43% increase in the DAP price. The CVD was initially imposed at 19.97%, indicating an associated increase in the DAP price of 28.6%. This is slightly lower than the 34% increase estimated by Beeler et al. (2024), which is reasonable given that our analysis includes a longer time period, allowing the global market to adapt to the new constraint on one trade route. Our analysis also uses different relevant variables in the cointegrating vector (sulfur prices and a more appropriate natural gas price), so some differences in the estimated effect of the CVD are to be expected for that reason as well.

The null hypothesis that the residuals of the main regression are not stationary is rejected using the Engle-Granger approach (test statistic of -4.81, with a 1% critical value of -3.48). We therefore conclude that there exists a cointegrating relationship between the DAP price and the input prices. We reject the null hypothesis of no structural break in the relationship upon the imposition of the CVD using the Chow test (F-statistic of 6.0614, with a p-value of 0.00005). This is all consistent with the results of Beeler et al. (2024).

5.2 Counterfactual DAP prices and cost increases for U.S. farmers

Counterfactual DAP prices that would have been observed in the absence of the CVD are calculated by adjusting the observed DAP prices using the fitted coefficient for the CVD level from the cointegrating vector and month-specific CVD levels. These observed and counterfactual prices are presented in Figure 4. The window or time when the CVD was reduced to 2.12% in late 2023 is clearly visible, as is the subsequent increase to 16.81% in late 2024.

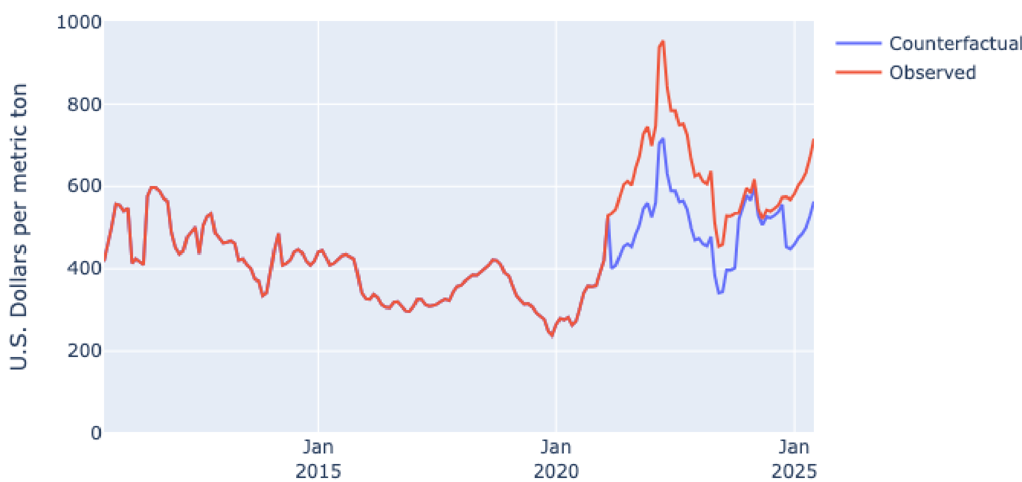

Figure 4: U.S. observed and counterfactual diammonium phosphate prices

To calculate the increased costs of phosphorus fertilizers incurred by U.S. farmers due to the CVD, we multiply month-specific DAP price differences by assumed purchases for that month for each crop. Quantities purchased are assumed to be annual application rates multiplied by year-specific planted acres for each crop, and are assumed to be spread evenly across a fertilizer purchasing window associated with the corresponding growing season. These evenly spread monthly purchases are intended to reflect both anticipatory purchases before each growing season and purchases during the growing season. Aggregate cost increases for each crop are then summed across the months in the purchasing window to give an annual cost increase for each crop. These cost increases are presented in Table 5.

In the table, the 2021/22 marketing year is associated with the 2021 growing season, with an assumed fertilizer purchasing window of September 2020 through August 2021, and the cost increases for that marketing year reflect the month-specific differences between observed and counterfactual DAP prices during that window and planted acres for 2021. These 2021/22 marketing year cost increases reflect a purchasing window during which the CVD was imposed only partially, starting in April 2021. By that time many producers would have already purchased their fertilizer for the 2021 growing season. Similarly, the costs for the 2024/25 and 2025/26 marketing years are lower due to the reduction of the CVD to 2.12% during portions of the purchasing windows for those years.

The 2022/23 marketing year in our calculations is the earliest to reflect a full purchasing window with the 19.97% CVD, resulting in an aggregate increased cost to corn producers of $996 million. This agrees well with a corresponding estimate of $1,070 million in Beeler et al. (2024).[5]

6 Conclusion

In this report, we estimated the effect of the U.S. Countervailing Duty (CVD) on Moroccan phosphate fertilizers, at various levels, on the price of diammonium phosphate (DAP) paid by U.S. farmers. We used a cointegration approach based on the law-of-one-price, following the methodology of Beeler et al. (2024), but extending the analysis to include additional data through late 2023, capturing more variation in the CVD level and longer run effects of the CVD on U.S. phosphorus fertilizer prices. We additionally improved on their analysis by using more appropriate natural gas price data, and by including sulfur prices in the analysis.

[5]In their Table 3, they assume an annual aggregate 5,920 thousand metric tons of DAP-equivalent used for corn, multiplied by their estimate of an approximately $180.50 per metric ton increase in DAP prices.

We found that the CVD increased the price of DAP by 28.6% during the period when the CVD was imposed at its full initial level of 19.97%, confirming the both the allegations of farm groups and lawmakers and the findings of previous academic research. We estimated that the CVD has increased the cost of phosphorus fertilizers for U.S. producers of a subset of major crops by an estimated $6.9 billion for the 2021 through 2025 growing seasons.

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Table 1: U.S. phosphate usage for major crops

	Survey Year	Acres w/ Phosphate Applied (%)	Average Rate (lbs/acre)	Total Applied (million lbs)
Row crops				
Corn	2021	75	64	4,100.0
Soybeans	2023	44	57	2,041.6
Wheat (all)	2024	-	-	947.6
Winter	2024	55	34	578.4
Spring	2024	80	38	322.7
Durum	2024	83	27	46.5
Cotton	2021	46	51	240.0
Rice	2021	74	84	157.9
Potatoes	2022	97	132	107.6
Barley	2023	74	36	78.6
Sorghum	2024	49	25	78.4
Oats	2023	38	35	30.6
Peanuts	2023	43	41	27.2
Row crops total				**50.1**
Fruits				
Blueberries	2023	79	63	4.12
Apples	2023	47	9	1.12
Apricots	2023	40	22	0.04
Avocados	2023	36	33	0.52
Cherries, sweet	2023	49	15	0.57
Cheries, tart	2023	22	14	0.09
Dates	2023	9	47	0.04
Grapefruit	2023	82	110	2.75
Grapes, table	2023	43	32	1.18
Grapes, wine	2023	55	21	5.77
Lemons	2023	44	32	0.43
Nectarines	2023	12	54	0.09
Olives	2023	44	27	0.38
Oranges	2023	79	110	30.73
Peaches	2023	45	28	0.87
Pears	2023	57	9	0.19
Plums	2023	6	38	0.02
Raspberries	2023	72	82	0.63
Strawberries	2023	51	63	0.27
Tangerines	2023	42	16	0.26
Fruits total				**50.08**

Source: USDA National Agricultural Statistics Service Chemical Use Highlights

Table 2: Key U.S. phosphate statistics and industry information compiled from 2020 to 2025 USGS reports (1,000 metric tons unless noted otherwise).

	Production, marketable	Sold or used by producers	Imports for consumption	Consumption, apparent	Price f.o.b. mine ($/metric ton)	Stocks, producer, yearend	Employment, mine and benefication plant (count)	Net import reliance (% of apparent consumption)
2015	27,400	26,200	1,960	28,100	72	6,730	2,000	4
2016	27,100	26,700	1,590	28,200	77	7,450	2,000	4
2017	27,900	26,300†	2,470	28,800	74	8,440	1,800	5
2018	25,800	23,300	2,770	26,000	71	10,600	1,900	2
2019	23,300	23,400	2,140	25,500	68	9,940	1,900	11
2020	23,500	22,600	2,520	25,100	76	11,000	1,800	6
2021	21,600	21,900	2,460	24,400	83	10,700	2,000	11
2022	19,800†	19,800†	2,500	22,300†	99†	10,600†	1,900	12
2023	19,600†	20,000†	2,590	22,600†	101†	9,550†	1,900	16
2024†	20,000	19,000	3,500	23,000	100	10,000	1,900	13

†Estimated value

Table 3: Four-year moving average of percent of phosphate imported by country, 2015-2018 to 2020-2023

	Peru	Morocco	Other
2015-2018	79	20	1
2016-2019	85	15	0
2017-2020	87	13	0
2018-2021	95	5	0
2019-2022	98	2	0
2020-2023	98	2	0

Source: U.S. Geological Survey Mineral Commodity Summaries

Table 4: Engle-Granger estimate of the cointegrating vector for the U.S. DAP price

	Coefficient	Std Error†
Constant	4.4861	0.164
Phosphorus rock price	0.0340	0.030
Natural gas price	0.1447	0.019
Sulfur price	0.2101	0.021
CVD level (percent)	0.0143	0.002

†While we report OLS standard errors here, note that it is not valid to conduct standard t-tests of hypotheses that the coefficients are different than zero.

Table 5: Aggregate phosphate fertilizer cost increases (millions of dollars)

Marketing year	Corn	Soybeans	Wheat	Rice	Sorghum	Cotton	Total
2021/22	388	319	124	11	13	39	$893
2022/23	996	865	325	25	30	105	$2,345
2023/24	830	642	281	25	26	81	$1,885
2024/25	191	161	63	6	6	20	$446
2025/26	616	470	174	17	18	59	$1,353
Total	$3,021	$2,456	$996	$85	$92	$303	$6,923