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Research Note

Food or Fuel?
The Case for a US Strategic Corn Reserve and Food-Fuel Throttle to Reduce Global Hunger During Food Price Spikes

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Abstract: Corn, at 47 billion bushels annually, is the second most produced crop globally, serving as a key staple food for billions. The U.S. is the world's largest producer and consumer, producing 13.7 billion bushels in 2023. Out of this, the US uses roughly 40% to produce fuel for cars and trucks, because of the Renewable Fuel Standard (RFS), with 40% used for animal feed and the remaining 20% going to food and other uses. In recent years, world events such as Covid and the Ukraine war have caused food price spikes, resulting in severe hunger for the global poor, especially the millions at the margins of food affordability in Sub-Saharan Africa. It could be strategically beneficial for the US to adjust its corn storage and allocation policy. This paper sets forth two policy proposals: (1) Strategic Corn Reserve (SCR) to store corn for periods of soaring prices modeled on the Strategic Petroleum Reserve (SPR); (2) Fuel-Food Throttle (FFT) for flexible usage of corn as fuel or food depending on the situation. The benefits of these policies would significantly outweigh the costs, by reducing hunger in critical moments and countering foreign influence in poverty-stricken regions such as Sub-Saharan Africa. To execute these bold policies will require either an executive order and/or congressional legislation, as well as developing pathways for storage and flexible use, which are outlined within.

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1. Agriculture
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1. The Problem – Food Price Volatility and Severe Hunger

Motivating this paper is a report by the FAO and other global agencies (2023) stating that severe food insecurity has been steadily rising since 2014, and since 2010 in Africa. In 2022, 30% of humanity, 2.4 billion people, could not afford a healthy diet costing the equivalent of $4 per day. And as we have seen in recent years, food prices can spike suddenly, like in early 2022 when wheat prices spiked by 50%. Events such as this cause much more hunger for individuals and

families at the global margin of food affordability, many of whom are in lower-income countries. While food prices have come down since then, long term volatility factors like increased extreme weather, crop yields, and political tensions could very well cause future spikes.

Food price spikes are a problem for US consumers also – food inflation causes stress, and forces hard sacrifices for everyday Americans. 2022's inflation rightfully gained substantial media coverage. The volatility of food prices puts the health and survival of the world's poor and US national security at stake.

Grains are the world's staple food – rice, wheat, and corn provide over half of the world's food energy. Of the grains, corn is the most produced, at 47 billion bushels annually, 50% more than wheat. The US is the world's leading producer of corn at 13.7 billion bushels in 2023. Of this 13.7 billion, a staggering 38% or 5.2 billion bushels, was processed into 15 billion gallons of ethanol for fuel in motor vehicles (US Department of Energy, 2024). This is because the law requires every American to use E10 gasoline, a fuel that is made of 10% ethanol from corn, in their car. The high usage of corn for ethanol raises some serious questions.

From the food perspective, it seems to be highly inefficient when millions around the world are going hungry. Based on typical calorie needs and the corn required for ethanol, the amount of corn required to fill up a large SUV once if using 100% corn ethanol would be enough to feed a human being for an entire year.[1]

From the energy perspective, corn ethanol doesn't make much sense either since it's less efficient than gasoline. A recent study funded by the US Department of Energy (DOE) found that ethanol is likely at least 24% more carbon-intensive than conventional gasoline, largely due to energy needs to grow and process the corn (Lark et al., 2022).

2. Historical Context and US Policy on Grain Reserves

Over the years, the United States has implemented and rolled back or otherwise adjusted several strategic grain subsidies and reserves to boost grain production, stabilize grain prices, and ensure food security. Since 2008, the US has not held a nationwide grain reserve.

One of the earliest reserves was the Farmer-Owned Grain Reserve (1977-1996), which allowed farmers to store grain with the aid of government loans, helping to stabilize prices and maintain a steady food supply. This was followed by the Food Security Wheat Reserve (1980-1996), which specifically focused on wheat and aimed to meet international food aid commitments while also addressing domestic emergencies. In 1996, this reserve was expanded into the Food Security Commodity Reserve (1996-1998), which included other grains to support more comprehensive food security goals.

In 1998, the focus shifted with the establishment of the Bill Emerson Humanitarian Trust. Named after Congressman Bill Emerson, this trust initially held both grain and cash, but since 2008, it has maintained only a cash reserve. This cash is used to purchase food during unexpected food crises, allowing the U.S. to respond quickly to international food aid needs

[1] From Cornell University, an acre of U.S. corn yields about 7,110 pounds of corn for processing into 328 gallons of ethanol, which for a typical SUV twenty-gallon tank comes out to 433 pounds of corn (Pimental, 2001). Given a pound of corn yields about 1,566 calories according to an article by the Washington Post's Tamar Haspel (2015), multiplying 433 by 1,566 and dividing by 365 days in a year gives us 1,860 calories, or enough to feed a sedentary forty-year-old woman (WebMD).

without the logistical challenges of storing physical commodities. This evolution reflects a broader shift from market stabilization to more flexible, direct humanitarian assistance.

But being a cash reserve, the Bill Emerson Humanitarian Trust comes with drawbacks like being subject to higher food prices when it needs to purchase food for aid. It is also only for foreign aid and cannot support the US in the case of a global food crisis. As of 2024 the trust only has $280 million in funds remaining, with its most recent disbursement ($200 million) happening in 2022 to support Sub-Saharan Africa, leaving the future of the fund an open question (US Agency for International Development, 2024).

Meanwhile in recent years China, the US's largest strategic rival, has been building its grain production capacity and reserves to ensure national food security amid growing global uncertainties. The Chinese government has taken the lead on this initiative, and it seems to be working. According to a recent article in the *Global Times*, these programs have resulted in record grain harvests, with 2023 seeing a total output of 695 million tons (Lin, 2024). These efforts include expanding cultivation areas, particularly in regions like Xinjiang, which saw a 16% increase in planting area and output (Zuo, 2023). Strategic reserves have been bolstered to maintain a grain reserve-to-consumption ratio well above the safety threshold recommended by the UN Food and Agriculture Organization.

To improve the efficiency and management of its vast grain reserves, China established the China Enterprise United Grain Reserve Company Ltd. in 2022, a joint venture between major state-owned enterprises Sinograin and COFCO. This move, according to an article in *The Diplomat*, aims to streamline reserve management and address issues of corruption and mismanagement that have previously plagued the system (Donnellon-May, 2024). Additionally, China continues to diversify its agricultural imports and strengthen international cooperation, particularly with countries involved in the Belt and Road Initiative, to mitigate the risks posed by geopolitical tensions and climate change. As stated by the Sino-German Agricultural Centre (DCZ), these comprehensive strategies highlight China's commitment to securing its food supply and stabilizing domestic grain markets (Behme, 2022).

Considering the US history, current policy, and what players like China are already doing, we should strongly consider reviving a US corn stockpiling policy.

3. Historical Context and US Policy on Corn Ethanol Fuel

The US is the world's leading producer of corn ethanol, a type of biofuel, or fuel made from direct biomass rather than fuel like oil. Countries like Brazil, Indonesia and some European nations round out the other top producers of biofuels. This production capacity was spurred in the US by the Renewable Fuel Standard (RFS), administered by the Environmental Protection Agency (EPA).

Almost all gasoline in the US today is "E10", or a blend of 10% corn ethanol/90% gasoline. The main policy that drives corn ethanol production is called the RFS, which mandates that refiners produce certain amounts of biofuels and provides credits for overproducers.

The Clean Air Act established the RFS in 2005, and the Energy Independence and Security Act in 2007 further expanded it. The RFS's goal is to promote alternative domestic energy production via biofuels, and the EPA has jurisdiction over the program in consultation with U.S. Department of Agriculture (USDA) and the DOE.

The original law set continually increasing volume targets through 2022, starting with 4 billion gallons in 2006 solely from corn ethanol and planning for 32 billion in 2024, with the contribution of other, so-called "advanced" biofuels. The law capped corn ethanol at 15 billion gallons, to avoid diverting too much corn from food and feed uses, which took effect in 2017.

The EPA has consistently reduced advanced biofuels requirements due to lack of available supply, meaning corn ethanol makes up almost all the US biofuel production.

4. Mechanics of the Renewable Fuel Standard (RFS)

To meet the RFS, refiners usually blend corn ethanol and other biofuels into gasoline. The EPA has the authority to set the RFS requirement each year. It can then use targets based on refiners' fuel sales to calculate their Renewable Volume Obligation (RVO). To comply with the program, refiners need to show a certain number of Renewable Identification Numbers (RINs), or tradable credits, which are generated when producing the fuel and can be bought and sold. RINs are created when making a specific kind of biofuel, and RIN prices reflect the marginal cost of producing and consuming renewable fuel.

Low RIN prices mean that the market thinks that the RVO will be easy to achieve, while high prices mean the opposite. If a refiner makes a gallon of ethanol, they get one D6-level RIN – as of April 22, 2024, a D6 RIN costs $0.66 (US Environmental Protection Agency, 2024). Refiners who don't make enough ethanol have to buy more RINs to reach the target percentage. The RIN prices act as an effective tax on gasoline and an effective subsidy on renewable fuels, and the ethanol fuel target (currently 10% of total US gasoline) becomes the "breakeven" blend showing how the RIN has its impact.

The EPA can annually set biofuel targets, and in recent years it has fallen below the original goal of 36 billion gallons set by the EISA in 2007. The total amount of biofuels has consistently risen in the past 3 years, reaching 20.8 billion gallons in 2023, mainly driven by ethanol increases (United States Environmental Protection Agency, 2023). The EPA can set new requirements in 2024 and 2025 based on factors such as future production expectations, environmental impact, and others – food prices among them.

5. Price Impacts of the RFS and Corn Supply-Demand Dynamics

According to most economic research, biofuel production affects crop prices. The EPA cites research that shows that the RFS program raised corn prices by 20-40% globally depending on how impacts are measured (Condon et al., 2015). Also, a comprehensive review of 157 studies on the effect of corn ethanol on prices found that corn prices increase proportionally with ethanol production (Timmer, 2008). And a summary of studies on the impacts of biofuels finds a price impact of between 3-5% per billion-gallon increase in corn ethanol, with decreases similar in proportional scale (International Council on Clean Transportation, 2021).

There is sparse data about the elasticities of crop supply and demand. But in the short run, an increase in ethanol usage of corn and RFS requirements elevates the global price of corn, which according to Rosegrant et al. (2008) may lead to higher rates of malnutrition in the developing world. Another study found an extremely strong relationship between the FAO Food Price Index and corn ethanol production, with the latter being the only factor found to support the former's upward trend from the early 2000s to today.

On the other hand, government subsidies and support for corn ethanol like RFS can stimulate increased corn production over several years which leads to increased supply over time. So increased RFS ethanol standards may reduce corn prices over the longer term.

But in the short-term (<1 year), demand is variable, and supply is fixed for corn, meaning that increases in ethanol use directly take away from corn that could be used for food purposes. A Congressional Budget Office study (2014) found that increased corn demand for ethanol

contributed to 20-40% of the corn price increase seen from 2008-2009, since supply did not increase sufficiently to compensate.

Additionally, corn's prices affect the prices of other key, staple crops due to substitutability for consumption and land use competition for production. A recent analysis using econometric models as well as land use techniques found that the RFS increased corn prices by 30% as well as soybean and wheat prices by 20% (Stein et al., 1977).

Biofuels also increase the price of meat by increasing animal feed prices – one study found that biofuel production increased the retail price of broiler meat in 2007-2009 by 6-12% percent (Pollen, 2006). All this is to say that there may be a short-term opportunity to reduce those prices by bringing on extra food supply in times of dire global hunger.

6. Proposed Two-Part Solution

There is a way to better leverage the US corn supply to meet the needs of the global poor and to protect domestic consumers in times of food price spikes. This paper proposes a two-prong solution:

- Create a "Strategic Corn Reserve" (SCR) modeled off the Strategic Petroleum Reserve (SPR) to store this important grain for times of dire need, foreign and domestic.
- Introduce a corn "Fuel-Food Throttle" (FFT) to function as a release valve during food price spikes.

6.1. A "Strategic Corn Reserve" Provides Important Benefits

An SCR in the U.S. would provide multiple benefits, including market stabilization, food security, and emergency preparedness. By holding a reserve of an essential grain such as corn, the government can mitigate the effects of supply disruptions caused by natural disasters, geopolitical events, or market volatility. This reserve would help stabilize prices, ensuring that sudden shortages do not lead to spikes that could harm consumers and the agricultural economy.

Implementation of a strategic grain reserve would involve creating infrastructure for storage, like the existing SPR for oil. The SPR is an emergency stockpile of oil held underground in Texas and Louisiana and managed by the DOE. It is the largest known supply in the world with a capacity of 714 million barrels, developed to address the 1973 energy crisis. The U.S. Strategic Petroleum Reserve (SPR) is the world's largest emergency crude oil stockpile, established in 1975 to mitigate supply disruptions and stabilize oil markets. It consists of underground storage caverns located in Texas and Louisiana, capable of holding up to 727 million barrels of oil. According to the DOE, Section 161 of the Energy Policy and Conservation Act (EPCA) gives authority to the President to tell the Secretary of Energy to conduct sales and purchases from the SPR. In situations of severe and even some lesser energy supply disruptions, the DOE can sell SPR oil in a competitive auction to the highest bidder (U.S. Department of Energy, 2015).

Like the SPR, a possible U.S. corn reserve would work by keeping extra corn that could be used during times of low supply or high prices. This would help balance the U.S. corn markets and guarantee food security. Like the SPR, a corn reserve would involve presidential oversight to manage stockpile levels and release schedules, selling the corn in the open market to cushion against price shocks. Managed by the USDA with facilities located in key agricultural regions across the US, these facilities would need to be equipped with modern technology to manage and preserve copious quantities of grain efficiently. The government would oversee the acquisition of surplus grains during periods of high production, ensuring that farmers receive a

fair price for their produce. This would also provide a safety net for farmers, helping to buffer against market fluctuations.

Management of the SCR would include regular monitoring and quality control to prevent spoilage and ensure the grains remain viable for use during emergencies. The reserve could be rotated periodically to keep the stock fresh, with older stock released to the market in a controlled manner to avoid disrupting current production and pricing. Coordination with private sector storage and distribution networks would be crucial to ensure seamless integration and efficient handling of the reserves.

There should be an established pathway for delivery of corn to poor countries in times of specific need. This could entail special Navy or shipping routes coordinated by USAID from New York or Baltimore to provide aid to key African ports like Lagos, Nigeria during food price spikes.

In addition to market and emergency stabilization, the SCR would support national security by reducing dependence on international grain supplies. This is particularly important in the context of global supply chain vulnerabilities highlighted by recent geopolitical events. By creating an SCR, the U.S. would be better positioned to respond to international crises that affect food supply chains, ensuring that the nation remains resilient and self-sufficient in critical food commodities.

6.2. A Corn "Fuel-Food Throttle" Would Establish Flexibility in US Corn Usage as Food or Fuel in Times of Crisis

The corn "Fuel-Food Throttle" (FFT) is a proposal – complementary to the SCR – that will enable the flexible usage of corn as food or ethanol fuel based on the global food price situation. The policy would be an overlay to the RFS and be triggered by food price increases according to presidential discretion. It would establish a pathway for the diversion of ethanol corn to food purposes, which would require coordination between government departments and with the private sector. This policy would need to balance food and fuel production, consider environmental and economic sustainability, and ensure trade and market stability.

As explained before, in the immediate term, when corn becomes fuel, there is less food for people. And in the short-term, food corn costs more because of ethanol mandates. The FFT will make more food available in the short term by moving corn from ethanol to food uses like cornmeal and polenta, which would help with domestic stability and foreign aid when food prices are high.

The US can decide whether to use corn for food vs fuel, and how much would be used a given year, using the adjustable RFS and special Presidential-led measures to intervene. The FFT would be overseen by the USDA with additional presidential involvement and discretion, allowing for additional flexibility in times of crisis. An example of a trigger for the throttle could be a certain grain price increase over the previous 2-year average, e.g. >40%, at which point the FFT would activate, and farmers would be given a special incentive along with a temporary RFS reduction to immediately divert corn from fuel to food. The exact mechanism would need to be determined via a thorough engagement of all relevant stakeholders. And the diversion could either be a direct diversion of corn as food to those in need, or the price effects of increased corn supply would indirectly help reduce global hunger through lower prices.

For a rough price impact estimation, if the US reduced biofuels usage by 27% from 15 billion gallons to 11 billion gallons, best estimates suggest that corn prices would likely drop by at least 10% (2.5% * 4 billion), and other prices of competing grains such as wheat and soybeans may also drop by around 7%. These lower global grain prices would directly help feed the world's poorest, who are often starving in periods of food price spikes. The impacts of more affordable

corn will also benefit Americans who eat meat, through an increase in the supply of animal feed which will reduce meat prices.

This policy will need leadership from the executive branch of government and the President, as well as coordination between public and private sectors and across government agencies. The government and farm industry groups and trade unions should work together to make sure that the policy changes are fair and compensated. The EPA, the USDA, and the DOE will also be involved in these initiatives, with the president's input if needed.

A comprehensive U.S. corn fuel-food policy like the FFT must address the delicate balance between allocating corn for food production and biofuel production. Corn is a staple in the American diet and a crucial feedstock for livestock, but it is also a primary source for ethanol production. The policy should ensure that food security is not compromised by the diversion of excessive corn to biofuels. One way to do this is to limit the quantity of corn that can be used for ethanol through the RFS guidance and encourage the use of other sources of biofuel, such as switchgrass or crop residues.

Environmental sustainability is another critical component of the policy. Corn cultivation is resource-intensive, requiring significant amounts of water, fertilizers, and pesticides, which can lead to environmental degradation. The FFT should incentivize sustainable farming practices, such as crop rotation, conservation tillage, and precision agriculture, to minimize the environmental footprint of corn production. Economically, the policy should support farmers through subsidies or incentives that promote the adoption of sustainable practices and ensure that they are not financially disadvantaged by shifts in policy priorities.

Lastly the FFT must consider the implications of corn production on trade and market stability. The U.S. is a major exporter of corn, and changes in domestic policy can have significant global repercussions. The policy should maintain stable corn prices and ensure reliable supply chains. This requires working together with other countries to avoid trade conflicts and reduce the effects of global market changes. Also, helping research and development in corn production technologies can improve efficiency and adaptability against market and environmental difficulties.

7. Conclusion and Next Steps

In view of the highly volatile global food situation of the past couple of years, with Africa gravely affected, US ethanol production should be flexible. The “field corn” used to make ethanol can be milled and prepared – e.g. as polenta – for human consumption. In this paper, I advocate two specific policies: 1) a Strategic Corn Reserve (SCR), modeled off the SPR for oil, and 2) a corn Fuel-Food Throttle (FFT).

Research outlined above indicates that these policies could, in conjunction, reduce short-term global corn prices by ten percent and prices of other staples by about seven percent. In the case of a food price spike, a hypothetical re-allocation of one-third of U.S. ethanol production from fuel to food would free up 1.9 billion bushels of corn per year, enough to add five hundred kcal/day to the diets of nine hundred million people.

Clearly, the policy would be a lifesaver for the vast majority of the world’s poor, especially those in African countries who often import maize from the open market, and even those in America who cannot afford healthy foods when prices rise sharply.

Presidential support would be necessary to push this policy forward. Acts of Congress could facilitate, and bipartisan support should be possible given the importance of such an initiative to national security and global diplomacy, not to mention the genuine benefits of feeding the world’s poor. This is an opportunity for the US to take ambitious action – reducing hunger with

these policies is an opportunity for the US to lead the world in policy innovation and global altruism.

I encourage the USDA Economic Research Service and other research groups to further investigate these topics. I urge the EPA, Department of Energy, and USDA to conduct diligence on the SCR and corn ethanol food throttle with an eye to fast-tracked implementation.

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