

Impact of the tariff between the U.S. and China on Soybean Prices and
the U.S. Soybean Farmers

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Impact of low world soybean prices on Mid-West soybean farmers

Introduction

On July 7, 2018, China implemented a retaliatory tariff on U.S. soybeans. The soybean price has significantly decreased and quantities that China imported from the U.S. has also declined. China has to cope with the insufficient amount of soybean imports due to the tariff in order to meet increasing soybean demand. On the other hand, the U.S. has to deal with soybean surplus and protect domestic farmers from the negative impacts on U.S. soybean price.

Soybeans in the world

The soybean is one of the most valuable sources for oilseed, animal feed, and human dietary protein, which contributes to 25% of the production of the world's comestible oil. The US is one of the largest soybean producers in the world. US farmers produced 4.39 billion bushels of soybeans in 2017; it accounts for 34 % of the global soybean production. In the US, soybeans are the dominant oilseed and account for 90 % of the nation's oilseed production (USDA, 2018). The US exported about \$21.5 billion worth or 55.3 million metric tons of soybeans to the global market in 2017, accounting for 37.1% share in world exports. Brazil exported about \$25.7 billion worth or 68.2 million metric tons of soybeans to the global market in 2017, accounting for 44.3% share in world exports (ITC, 2018). The global production of soybeans is projected to increase 2.1% annually to 359.7 million tons by 2030 as the demand for oil products and feed for animals has increased because of the growth of per capita income in Asia (Masuda et al., 2008).

The U.S, the biggest soybean exporter to China

China is the world's biggest importer of soybeans and has heavily relied on imports to meet the growing demand for soybeans because its national production is insufficient. The annual demand for soybeans in China has rapidly increased to over 100 million metric tons in 2017. China imported about 32.9 million metric tons from the United States and 50.9 million metric tons from Brazil in 2017. China's soybean imports over 80 million metric tons in 2016 have accounted for two-thirds of global soybean trade. China's imports comprise of 62.8% world soybean imports (ITC, 2018). These data represent the importance of China in the U.S. and Brazil soybean markets as the biggest soybean buyer in the world.

The U.S. is the largest soybean producer in the world. Soybeans produced in the U.S. account for 34 percent of the world's soybean production. In the U.S., soybeans are primary oilseed, and about 90 percent of oilseed production is produced using soybeans. Soybeans have been at the center of agricultural commodity trades between China, and the U.S. Soybeans are the top U.S. agricultural export to China. The oilseed accounts for 60 percent of U.S. agricultural exports to China. China has accounted for at least 50 percent of all U.S. soybean exports since 2008. In 2017, U.S. soybean exports had a value of \$22 billion and China accounted for 57.3 percent of the exports. China imported about 32.9 million metric tons from the United States in 2017.

China's Retaliatory Tariffs on U.S. Soybeans

On March 8, 2018, President Donald Trump signed proclamations to impose tariffs on steel and aluminum imports. The proclamations were based on President's authority under Section 232 of the Trade Expansion Act of 1962, establishing a 25 percent tariff on steel imports and a 10 percent tariff on aluminum imports, to protect the national security. On March 22,

2018, President Donald Trump also signed a memorandum to impose tariffs on Chinese goods of \$50 billion. The proposal is based on Section 301 of the Trade Act of 1974 that authorizes the U.S. International Trade Commission to deal with unfair trade practices (Ross, 2018).

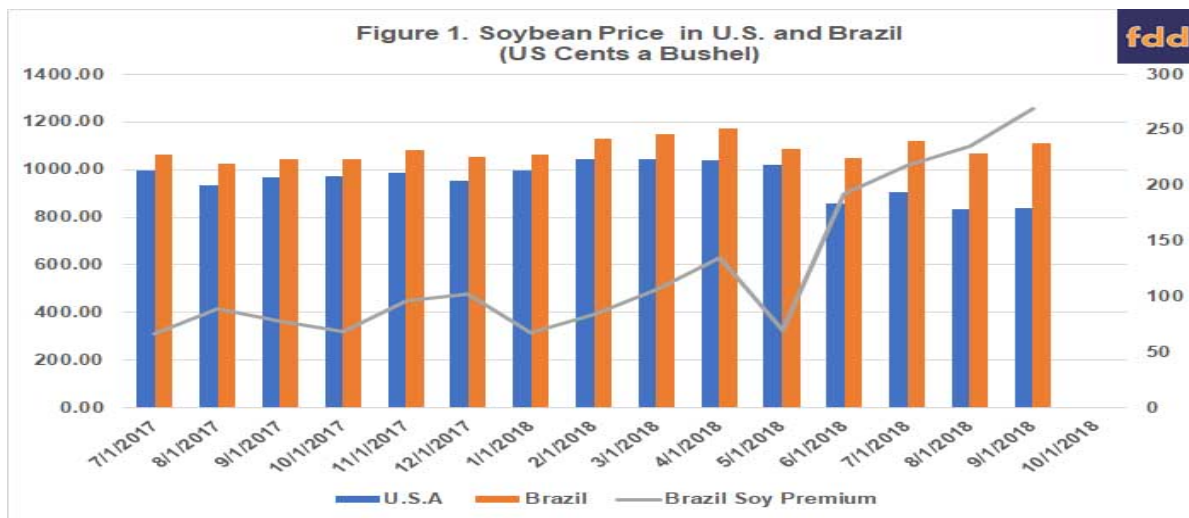
Chinese government retaliated against the 232 and 301 tariffs by imposing tariffs on U.S. goods, including soybeans. In early July 2018, China imposed 25% tariff on soybeans to retaliate against the U.S tariffs on \$34 billion worth of imports from China. China imported 62% of total U.S. soybean exports. The U.S. obtained \$12.4 billion in exports of soybeans to China in 2017. The announcement of retaliation made the U.S. soybean industry have concerns about the potential negative impact on soybean prices and quantities exported to China. As Brazil has rapidly increased its soybean production, would the tariff benefit Brazil? What are the negative effects that the tariff would bring if the trade dispute continues? How will the tariff hurt the domestic soybean farmers in the U.S.? Those questions are ongoing and critical because the U.S. soybean market is very reliant on the exports to China.

Expected Profit of Brazil from the Trade War

Brazil could profit from the U.S. loss in soybeans exports as China seeks other overseas soybean suppliers. Cash values for Brazilian soybeans have increased beyond the CBOT price (Patterson, 2018). China will not be capable of importing more soybeans from Brazil to cope with the decrease in imports from the U.S. because Brazil seldom has any soybeans left at the end of its marketing cycles (Braun, 2018). If China wants to reduce their reliance on soybeans imported from the U.S., Chinese investors will be able to find other foreign lands to develop and harvest soybeans, which have appropriate conditions for the cultivation of soybeans.

Price Changes

The initial tariff announcement by China caused pressure for the U.S. soybean industry, reaching an icy finger into CBOT soybean prices since Mid-April. The CBOT soybean price has fallen about 21 percent since mid-April. The price significantly decreased below \$8.50 per bushel that was the lowest price in the last decade. In contrast, Brazil's soybean price increased to over \$10.50 per bushel. These opponent price movements made a significant gap between the U.S. and Brazil soybean prices up to \$1.90 per bushel. That indicates the impact of the tariff includes the switches in China soybean imports. Soybean prices were around \$8.38 per bushel in the U.S. and over \$10.50 per bushel in Brazil. A perspective shift in international agricultural trade is forecasted based on the disparity of prices between the two largest soybean producers, the US, and Brazil (Zhou et al., 2018).



Quantity Changes

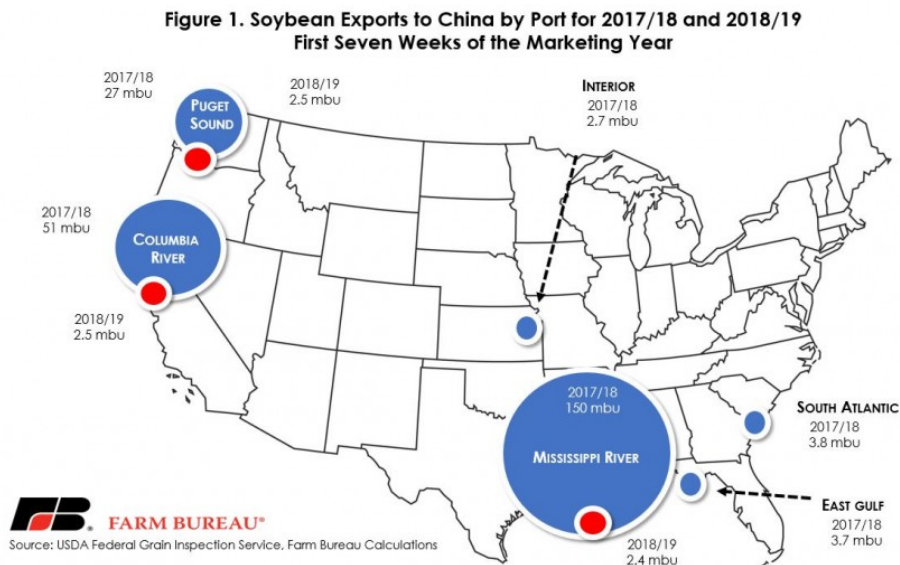
Total soybean exports of the U.S. have sharply fallen because of a significant decrease in imports from China. Through the first seven weeks of the 2016/2017 marketing year, the U.S. shipment recorded 211 million bushels of soybeans China. During the same period in

2017/2018 marketing year, the U.S. shipped 239 million bushels of soybeans to China. However, as a result of the tariff, the number of soybeans shipped to China during the first weeks of the 2018/2019 marketing year significantly declined to 7.4 million bushels, which is down 97 percent from the previous year.

China imported no U.S. soybeans in November. China's soybean imports of U.S. soybeans fell 40.1 percent from the prior-year import to 5.72 million tons in December.

Shipment

Shipments of soybeans to China have fallen by 98 percent along the Mississippi River, 95 percent out of the Columbia River and by 91 percent from the Puget Sound. Shippers in the Interior, South Atlantic, and Eastern Gulf regions have yet to make a soybean shipment to China, Figure 1.



The Description of the Base Farm

Indiana's Agricultural Industry

Indiana has 56,800 farming operations, with an average farm size of 259 acres. Indiana is also the tenth largest farming state in the states. Agriculture contributes about \$31.2 billion to Indiana's economy. Notably, Indiana's corn (for grain) and soybean production ranked in the top five in the nation. By the value of sales, corn and soybeans contribute \$3.28 billion and \$3.08 billion separately to Indiana's agricultural industry. In terms of the exports, soybeans ranked first worth \$1.6 billion, and corn ranked second worth \$636 million. That indicates that the agricultural commodities exports in Indiana have heavily reliant on corn and soybeans production.

A Base Farm Model

In order to see how this affects an Indiana farm, the PCLP program of Purdue University is used to construct the base farm model. The cropland acres used for farming is 2,500 acres. The farm uses one-half of the acres for corn and the other for rotation soybeans. The farm has two permanent workers, and they work up to 12 hours per day. The farm also hires six temporary workers, and they work up to 8 hours per day. The hourly wage rate is \$12. The farm has two big tractors and two small tractors. They operate up to 15 hours per day. It has a chisel, anhydrous, field cultivator, sprayer, and cultivator machinery. I refer to the 2019 Purdue Crop Cost & Return Guide December 2018 Estimates to estimate expected yield per acre, harvest price, market revenue, and variable costs for rotation corn. The expected yield is 174 bushels per acre for corn and 54 bushels per acre for soybeans. Total variable cost for rotation corn is \$440 in the model which is increased by \$5 from the cost of fertilizer of \$126 from the Guide. Prices that yield the profit from half corn and half soybeans in the model are \$4.10 for corn and \$8.50 for soybeans. The profit from the operation using 2,500 total acres is \$149,109. The marginal return for land is

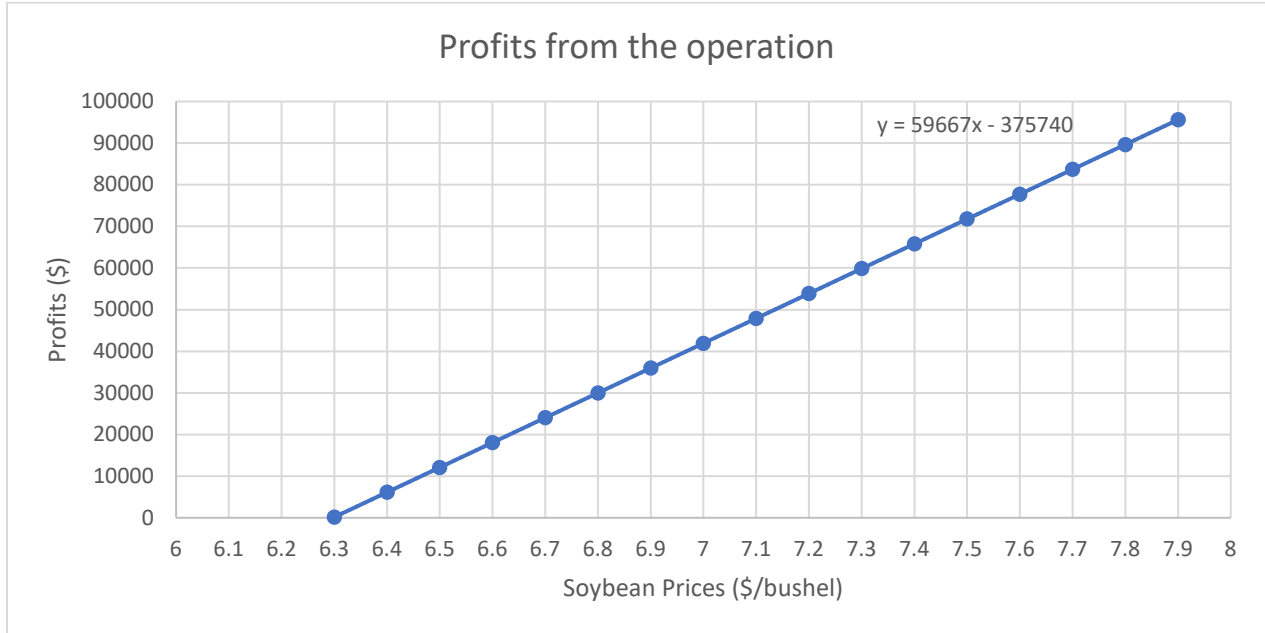
\$198.64 per acre. According to the income statement of the program, the sales revenues for crop products are \$892,136 for 217,594 bushels of corn and \$582,362 for 66,938 bushels of soybeans. The farm yields 174.08 bushels of corn and 53.55 bushels of soybeans per acre. Those yields per acre are almost the same with the expected yield per acre of the data table below (Langemeier et al., 2018).

Table 1. Estimated per Acre Crop Budgets for Low, Average, and High Productivity Indiana Soils

	Crop Budgets for Three Yield Levels ¹														
	Low Productivity Soil					Average Productivity Soil					High Productivity Soil				
	Cont. Corn	Rot. Corn	Rot. Beans	Wheat	DC Beans	Cont. Corn	Rot. Corn	Rot. Beans	Wheat	DC Beans	Cont. Corn	Rot. Corn	Rot. Beans	Wheat	DC Beans
Expected yield per acre ²	131	139	43	61	30	164	174	54	77	38	196	209	65	92	46
Harvest price ³	\$3.80	\$3.80	\$9.20	\$5.00	\$9.20	\$3.80	\$3.80	\$9.20	\$5.00	\$9.20	\$3.80	\$3.80	\$9.20	\$5.00	\$9.20
Market revenue	\$498	\$528	\$396	\$305	\$276	\$623	\$661	\$497	\$385	\$350	\$745	\$794	\$598	\$460	\$423
Less variable costs ⁴															
Fertilizer ⁵	\$128	\$116	\$42	\$61	\$31	\$137	\$126	\$51	\$81	\$38	\$146	\$135	\$60	\$100	\$45
Seed ⁶	91	91	67	44	78	111	111	67	44	78	111	111	67	44	78
Pesticides ⁷	58	58	50	30	45	58	58	50	30	45	58	58	50	30	45
Dryer fuel ⁸	31	25	N/A	N/A	4	39	31	N/A	N/A	5	46	37	N/A	N/A	6
Machinery fuel @ \$2.72	20	20	12	12	9	20	20	12	12	9	20	20	12	12	9
Machinery repairs ⁹	22	22	18	18	15	22	22	18	18	15	22	22	18	18	15
Hauling ¹⁰	13	14	4	6	3	16	17	5	8	4	20	21	7	9	5
Interest ¹¹	11	11	7	6	6	12	12	7	6	7	13	12	7	7	7
Insurance/misc. ¹²	36	36	31	9	9	38	38	34	9	9	40	40	34	9	9
Total variable cost	\$410	\$393	\$231	\$186	\$200	\$453	\$435	\$244	\$208	\$210	\$476	\$456	\$255	\$229	\$219
Contribution margin ¹³ (Revenue - variable costs) per acre	\$88	\$135	\$165	\$119	\$76	\$170	\$226	\$253	\$177	\$140	\$269	\$338	\$343	\$231	\$204

If we reflect the tariff and lower the soybean price to \$7.9 per bushel, the farm has switched 280.7 acres of land to corn after corn production from the rotation of soybeans and corn. The acres used for rotation soybeans are 1109.6, and for rotation corn are 1109.6. The profit decreased by \$53,484 from \$149,109 to \$95,625 as the soybean price has declined from \$8.7 to \$7.9 per bushel. The Figure 2. shows the change in profits with the shift of the soybean prices at which the farm has shifted its production.

Figure 2.



New Prices with New Constraint Settings

I discovered that two constraints kept farmers from switching to more corn. In the previous setting dryer capacity and storage capacity were not enough to expand corn acreage if farmers cannot sell out of the field at harvest. So, I increased the limits of both constraints.

With constraints removed, new prices that yield the best profit at 50 percent corn acreage and 50 percent soybeans acreage cultivation are \$4.10 for corn and \$8.10 for soybeans per bushel. The profit from the operation using 2,500 total acres is \$70,743. The total contribution margin is \$508,343. The marginal return for land is \$173.08 per acre. The income statement of the program indicates that the sales revenues for crop products are \$827,619 for 214555 bushels of corn and \$545,971 for 67404 bushels of soybeans. The yields per acre are 171.644 bushels for corn and 53.92 bushels for soybeans. Those yields per acre are slightly different with the

expected yield per acre of the data, 2019 Purdue Crop Cost & Return Guide December 2018 Estimates (Langemeier et al., 2018).

The shift of the land

The farm had switched no acres of the land to corn after corn production before the price of soybeans dropped to \$7.40 per bushel. At the soybean price of \$7.40 per bushel, the farm began to switch some of its lands to corn after corn production from the rotation of soybeans and corn. The total contribution margin decreased by \$47,180 as the soybean price has declined from \$8.10 to \$7.40 per bushel.

The shift of the land to new corn is not significant until the soybean price drops to \$7.20 per bushel. The farm has expanded corn after corn acreage up to 812.1 acres at the soybean price of \$7.00 per bushel. Table 1. shows the change in total contribution margin, corn after corn (CCorn) acreage, beans after corn (BCorn), and corn after beans (CBeans) as the soybean prices change.

Table 1.

Soybean Price	Total Contribution Margin	CCorn (nd)	BCorn (nd)	CBeans (nr)
\$7.40	\$461,163	11.8	1244.1	1244.1
\$7.30	\$454,465	23.2	1238.4	1238.4
\$7.20	\$448,603	640	930	930
\$7.10	\$443,532	640	930	930
\$7.00	\$438,892	812.1	843.9	843.9

Conclusions

As the trade war between the U.S. and China continues, the U.S. government has to consider the long-term consequences for the domestic soybean growers with the likelihood of a continuous decline in soybean prices. The effects of the tariff associated with lower soybean prices would require Indiana farmers to switch their cropland from soybean to corn production. However, there are many things to consider before the farmers shift their land like the cost of fertilizer, machinery, and productivity. For instance, in the PCLP base farm model that I used to simulate an individual farm, only 280.7 acres of land has switched from soybeans to corn because of two constraints: storage capacity and dryer capacity. I had to remove those constraints to make the farm able to shift more acres to new corn. However, farms, in reality, might not be able to remove those constraints since it would require a lot of either indirect or direct costs. So, the readjustment to more corn might not happen. That would lead farmers to produce more soybeans instead of switching their land to more corn while soybean prices decline. As the effects of the tariff became prevalent on the market, it is significant for the U.S. government to arrange practical proposals to protect domestic soybean growers.

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