THE IMPACT OF SINO-USA TRADE WAR ON USA FARM BANKRUPTCIES

A Thesis

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ABSTRACT

The Sino-USA trade war has raised concerns on the USA agricultural economy as farm bankruptcies rose up. While media reports tend to attribute the increase in farm bankruptcy to the trade war, there are many other factors affecting the farm sector. Therefore, the objective of this paper is to determine whether the trade war has a net effect on farm bankruptcy. This study utilized monthly estimate of variables on state level from 2007 to 2019. Chapter 12 bankruptcy number and rate are applied as dependent variables. We divided our factors into agricultural variables, economic variables, and government variables apart from the trade war. Our result confirmed that the trade war has a positive effect on farm bankruptcy. Economic factors (net charge-offs of farm loans, U.S. real GDP, the average effective interest rate), agricultural factors (soybean export volume, PPI of farm products, U.S. anomaly wet areas percentage) also produced significant results.

BIOGRAPHICAL SKETCH

Yu Wu is a master student from Beijing, China. She finished her undergraduate study majoring in agricultural economics at China Agricultural University. After completing her master's degree in Applied Economics and Management, she will pursue a career in financial institution.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

The Sino-USA trade war, an unprecedented trade conflict between two of the world's largest economies, has posed huge challenges to both the USA and China's agricultural economies. The trade war was ignited in March 2018 when the USA imposed an additional tariff on steel and aluminum imports for most countries, including China. In reaction to the tariff, China imposed tariffs on 128 products in April 2018. In July 2018, the US imposed the first tariff targeted at China, including a 25% tariff on imports from China valued at US$34 billion and China retaliated subsequently (Wong and Koty, 2020). This officially opened up the first round of the Sino-USA trade war. A consequence of the trade war was a significant decline in the USA exports of agricultural products. Soybeans exports to China plummeted to zero during September and November 2018 and remained at a low level in 2018 and 2019 compared to previous years.

The trade war raised intense concerns about the health of America's agricultural economy. As reported by Bloomberg, farmers' personal income in the USA declined by an annualized $11.8 billion between January and March 2019, which was the largest first-quarter drop in the past 3 years (Dorning et al., 2019). The bankruptcy level of USA farmers in the Midwest is higher than that observed in almost a decade (Vavra, 2019). Dairy farmers were also undergoing hard times, and the trade war

"pushed many of Wisconsin's already struggling dairy farmers to the edge" (Rappeport, 2019, para. 2). According to the U.S. Dairy Export Council, China's tariffs have put American dairy farmers at an unfavorable circumstance compared to farmers from other countries. USDEC also pointed out that it is estimated that dairy export and farmer's income would decrease by $2.7 billion and $16.6 billion, respectively, in a few years due to the tariff of China and Mexico if situations remain unchanged[1]. Forbes noted that the USA spent decades to expand the Chinese market, but President Trump's tariff may bring significant loss in a short time, and with China's retaliation, it will be difficult for farmers to make up losses from the Chinese market (Jones, 2019). For it's part, MSNBC reported that the White House insisted that "farmers were doing great", and even though they were suffering, they would not mind as they were fighting for the country (Benen, 2019, para. 1). In reality, however, farmers were not doing great with rising farm bankruptcies and farm debt (USDA)[2]. A soybean farmer complained that the tariff "created a crisis for his business" (Benen, 2019, para. 12). Overall, farm bankruptcies rose 24.6% in 2019 to an eight-year high.

While media reports tend to attribute increases in farm bankruptcies to the Sino-USA trade war, there are many other factors affecting stability in the farm sector. Farm incomes and commodity prices have been in decline for several years, and some sectors were not directly impacted by the trade war. The dairy sector experienced decline since the elimination of European milk quota system which caused milk

[1] Available at: https://www.usdec.org/newsroom/news-releases/news-releases/news-release-08/27/2018
[2] Data further referred to Farm Income and Wealth Statistics, ERS, USDA. Available at: https://www.ers.usda.gov/data-products/farm-income-and-wealth-statistics/data-files-us-and-state-level-farm-income-and-wealth-statistics/

expansion from Europe. Unrelated events such as ethanol demand, drought, and 2019 floods have added considerable uncertainty to the agricultural sector. As a result, the direct causality implied by media and news reports may overstate the real impacts since the trade war might have just aggravated an already evolving bankruptcy problem. On the other hand, the government started a program of subsidies to farmers with the intent of stabilizing incomes and reducing the negative impacts of trade. Thus, to isolate the real impacts of the Sino-USA trade war, the economics requires considering multiple factors including national economic growth, the deteriorating conditions in the USA agriculture prior to the trade war which would have resulted in farm bankruptcies, and the influences of the Market Facilitation Program which was designed to reduce farm bankruptcies.

The overall objective of this paper is therefore to investigate the net effect of the Sino-USA trade war on farm bankruptcies. The specific objectives are to determine whether the trade war has increased Chapter 12 farm bankruptcy numbers even with the considerable government funding or whether the rising number of farm bankruptcy is only a result of the general downward trend in USA agriculture. We utilized a panel fixed effect model to examine factors affecting farm bankruptcy filings with the main focus on the impact of the Sino-USA trade war. Our study utilized monthly estimate of variables on state level (contiguous United States) from 2007 to 2019. Monthly Chapter 12 bankruptcy filings rate and numbers are applied as our dependent variable to indicate the financial stress of farmers. We divided our factors into agricultural variables, economic variables, and government variables apart from the trade war.

Our paper contributes to the literature on farm bankruptcies and exposes the challenges to isolating significant causal factors. Related literature, including Dixon et al. (2004) and Dinterman et al. (2018) examined factors affecting farm bankruptcies on an annual basis, but because of the time specificity of events between 2018 and 2019, a more granular, monthly, approach is required. Our research model is based on monthly level data to better capture the two-year effect of the Sino-USA trade war. Evaluating the impact of the Sino-USA trade war is important because farmers under these particular circumstances need more focus and assistance from the government, even with the emergency federal government bailout. Moreover, the impact of the trade war will be far-reaching on farmers because of the shift of international trade partnership between the USA and China. Although it is hard to verify whether the trade war will be an eventual boon for farmers as President Trump declared, our focus is on the more immediate impacts on farm bankruptcies.

To this end, the next section provides an overview of farm bankruptcy in the United States. This is followed by a discussion of current conditions of the farm economy prior to the trade war. Following this background, we review related literature on USA bankruptcy and the special circumstances of Chapter 12 bankruptcy. Our empirical model based on statewide monthly panel data is the presented and the paper concludes.

CHAPTER 2

BACKGROUND

2.1 History of USA bankruptcy law

The history of US bankruptcy law dates back to periods when 1787 Constitution authorize the National Government to enact bankruptcy laws (Stam and Dixon, 2004). However, Congress did not exercise the bankruptcy power frequently in the 19th century until the enactment of the National Bankruptcy Act of 1898, which "marked the beginning of the era of permanent Federal bankruptcy legislation" (Stam and Dixon, 2004, p. 2). The Bankruptcy Act of 1898 was followed by the Bankruptcy Reform Act of 1978. Over the years, the main function of bankruptcy legislation and law was to help debtors who cannot afford their debt to restart by liquidating assets or by creating a repayment plan[3].

Currently, there are four types of bankruptcies for filing personal or business bankruptcy petitions and each of them are classified under different chapters in the U.S. Bankruptcy Code. Chapter 7 and Chapter 13 are designed for individual filings. Under Chapter 7, the bankruptcy trustee manages the assets from the debtors and allocate the proceeds of such assets among creditors. While Chapter 7 focused on liquidation of the property held by the debtors, creditors under Chapter 11, 12, and 13 look into future earnings. Chapter 13 bankruptcy allows filers with regular income to

[3] Definition from U.S. court, https://www.uscourts.gov/services-forms/bankruptcy

pay back their debt in 3 to 5 years under the plans approved by the court, while saving the valuable asset, such as their homes from foreclosure. Chapter 11 bankruptcy is used for business reorganization, including corporation, sole proprietorship, or partnership[4].

Chapter 12 works solely for family farmers and fishermen and filers can propose and carry out a similar plan under Chapter 13. The most significant difference in Chapter 12 is that it tailored bankruptcy law to the realities of farmers and fishermen. Under Chapter 12, many obstacles are removed, which debtors would face if seeking reorganization under other Chapter, considering risks in farm operation including the seasonality in income, fluctuation in commodity price, as well as the adverse weather conditions (Stam and Dixon, 2004). Another benefit is that, similar to Chapter 13, Chapter 12 provides a special automatic stay that protects co-debtors on consumer debt. The relaxation of absolute priority rules and the definition of adequate protection also help for preserving farms (Stam and Dixon, 2004).

Chapter 12 bankruptcy was first enacted under the 1986 amendments to the bankruptcy act of 1978 in reaction the 1980s farm crisis. Until then, farm operators could either liquidate the property or reorganize but not under the appealing condition that Chapter 12 provides, even though since 1898 they could not be forced into bankruptcy[5]. Chapter 12 bankruptcy was expected to expire in 1993 as an emergency

[4] Bankruptcy Basics. (2011), Revised Third Edition., Administrative Office of the United States Courts, available at: https://www.uscourts.gov/services-forms/bankruptcy/bankruptcy-basics.
[5] Bankruptcy Act of 1898 § 4(b), 30 Stat 544, 547 (repealed 1978).

statute but ended up being extended 11 times and was made to be a permanent law in 2005 (Harl, 2006). Farmers filing for bankruptcy under Chapter 12 have enjoyed "favored status", and the 2005 bankruptcy reform strengthened this status despite the fact that most of the rest of the 2005 law switched from favoring debtors to favoring creditors (Harl, 2006, p. 7).

The Bankruptcy Abuse Prevention and Consumer Protection Act of 2005 made the most influential revision of bankruptcy law since 1978[6]. In general, the 2005 act made several revisions that are not favorable to debtors, including the establishment of small business Chapter 11 case, including limitations on automatic stay, homestead exemptions, and lien avoidance. On the contrary, the revision of Chapter 12 under the 2005 act is friendly to debtors. Chapter 12 was made to be a permanent law and extended to include "family fisherman". The 2005 Act also relaxed the requirement for eligibility to be a family farmer. In addition, the manners of modifying plans are more favorable to debtors after confirmation. Chapter 12 debtors are eligible for a new tax entity to avoid income tax liability for assets liquidated by the bankruptcy code, which relieved debtors from tax burdens in business reorganization (Demetri and James, 2019).

In our study, we focus exclusively on Chapter 12 bankruptcy, even though farmers are eligible for Chapter 7 and Chapter 13 bankruptcy. However, unlike Chapter 12, Chapters 7 and 13 are open to individuals and firms unrelated to agriculture, and the

[6] Major Developments In Chapter 12 Bankruptcy. Available at: https://www.extension.iastate.edu/agdm/articles/harl/harOct05.html

data available does not separate different types. Consequently, our numbers likely underestimate total farm bankruptcies, although we expect that the patterns would be similar on margin.

2.2 USA farm bankruptcy

Farmers generally are faced with five types of risk as defined by USDA, including production risk, price or market risk, financial risk, institutional risk, and human or personal risk, with the former three affecting most on farms' operation. While production risk and price or market risk are more referred to business risk, which represents changes from markets, including the uncertainty of the weather, disease, pests, the price received or price paid for inputs, financial risk occurs when farmers borrow money from bank or other institutions[7]. Under these risks, farms may be forced into financial stress or even file for bankruptcies.

"If we define a 'golden era' in agriculture as a period when the inflation-adjusted value of farmland significantly exceeds the 1910 level, we can argue that there have been three major golden eras in modern U.S. agriculture over the last 100 years: 1910 to 1920, 1973 to 1981, and most recently 2003 to 2013" (Zhang and Tidgren, 2018, p. 396). The three eras were all followed by economic downturns, and the former two eventually evolved into farm crises.

[7] "Risk in Agriculture". (2019), United States Department of Agriculture, Economic Research Service, 20 August, available at: https://www.ers.usda.gov/topics/farm-practices-management/risk-management/risk-in-agriculture/

The first crisis began in 1920 and went through the Great Depression of the 1930s. Despite the prosperity in the agricultural sector during the first two decades in the 20th century, the collapse of commodity price and farm value made farmers unable to repay their loans before 1920. 51863 farm bankruptcies filed between 1920 and 1929 (Stam and Dixon, 2004). Conditions worsened with the shock of the Great Depression and adverse weather conditions in the 1930s, which ultimately led to the formation of the Farm Credit System in 1933 (Turvey, 2017).

The second farm crisis started from around 1980. The expansion in agriculture production and the abundant investment in farmland during the 1970s left farmers with heavy debt. When the economic conditions reversed in the 1980s, especially as farmland values began to fall, it was difficult for these farmers to repay the high level of debt with the rising interest rate. 4812 Chapter 12 bankruptcies, the highest number since 1933, were filed in 1987[8], although this annual number could be overestimated because farmers may postpone their filings till the enactment of Chapter 12 (Stam and Dixon, 2004).

[8] The fiscal year of 1987 ended in June 30.

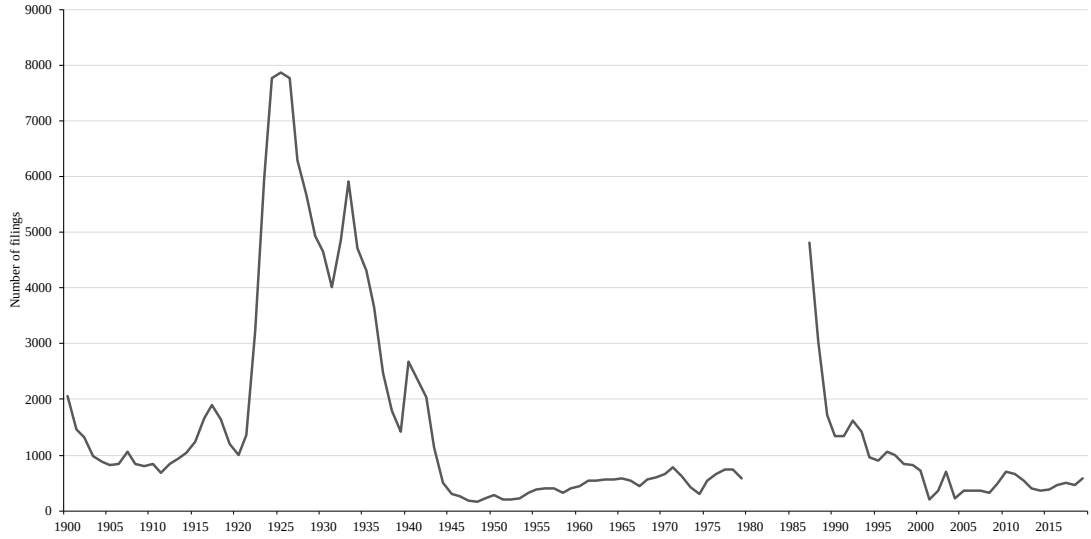

Figure 1: Total Chapter 12 bankruptcy filings, by year, 1900-2019

(Source: US court, Stam and Dixon (2004))[9]

Chapter 12 bankruptcy number dropped significantly after the 1980s crisis with the increased farm income and land values as well as the decreased debt level. Government assistance and institutional changes also played essential roles in stabilizing the agricultural economy. Three institutional changes, including the emergence of farm loan mediation, the enhancement in the contractual rights of famer borrowers of the Farmers Home Administration and Farm Credit System, and the increasing use in risk management tools, significantly reduced total farm losses (Stam and Dixon, 2004).

[9] The bankruptcy numbers and total farm numbers (excluding sharecroppers) from 1900 to 2002 are from Stam and Dixon (2004), from 2003 data are from judicial publications Table F-2 of US court and NASS of USDA. Prior to 1980, the bankruptcy numbers are calculated as the sum of filings of Chapter 7, 11, 13 in which the filer's occupation are classified as farmers, but the occupational data are no longer reported after October 1979, until Chapter 12 is enacted in 1986. Therefore, farm bankruptcy numbers are solely from Chapter 12 after 1986.

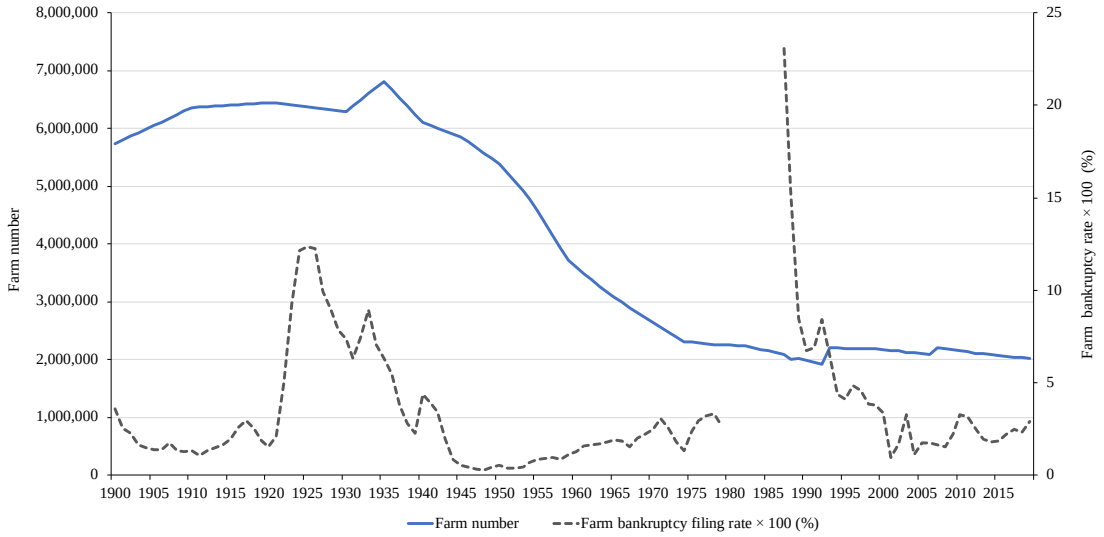

Figure 2: Total farms and farm bankruptcy filing rate, by year, 1900-2019

(Source: US court, Stam and Dixon (2004))[10]

The most recent prosperous period from 2003 to 2012 can be attributed to three main factors, including the increase in China's import from USA, low level 10-year U.S. Treasury Constant Maturity rate, and the increase of corn used for ethanol production (Zhang, Tidgren, 2018). Inflation-adjusted farm cash income peaked in 2012 and then started to decline since 2013.

In recent years, concerns have been elevated on the health of the USA farm economy, with a 2018 special issue in Agricultural Finance Review dedicated to the issue (Hadrich et al., guest editors, 2018). Zhang and Tidgren(2018) discussed the current agricultural economic downturn with the crisis in the 1920s and 1980s; Prager and

[10] The bankruptcy numbers and total farm numbers (excluding sharecroppers) are from 1900 to 2002 are from Stam and Dixon (2004), from 2003 data are from judicial publications Table F-II of US court and NASS of USDA. Prior to 1980, the bankruptcy numbers are calculated as the sum of filings of Chapter 7, 11, 13 in which the filer's occupation are classified as farmers, but the occupational data are no longer reported after October 1979, until Chapter 12 is enacted in 1986. Therefore, farm bankruptcy numbers are solely from Chapter 12 after 1986.

Burns(2018) discussed farm debt issues in recent years; Dinterman et al. (2018) studied the effect of 2005 Bankruptcy Abuse Prevention and Consumer Protection Act on farm bankruptcies. USDA also examined financial measures including farm income, interest expenses, the debt-to-asset ratio and etc. to evaluate the financial health of farm business (Key et al.,2019). They found that farmer's real net cash income dropped by 34% between 2012 and 2017; Farm debt, on the other hand, rose by 81% in real term from 1994 to 2017 with upward interest expense; Farm real estate, the major farm-sector asset and source of collateral, had reach a plateau in price after the significant increase from 2003 to 2014 along with a upward debt to asset ratio; Delinquency rates for agricultural real estate loans and agricultural production loans from the Farm Credit System (FCS) and commercial bank increased beginning in 2015.

Although there are rising concerns on the recent agricultural downturn, Zhang and Tidgren (2018) suggested that this downturn was unlikely to fall into the crisis as recorded in the 1930s and 1980s due to three reasons including 1) the accumulation of more income compared to the past crises, 2) the tightened of underwriting and capitalization requirements in farm loans, and 3) the low interest rate. Besides, despite several measures including net cash income, farm debt, farmland value, and loan delinquency rate suggest a downturn in agriculture sector, most of them remain close or lower than the long run (1970-2017) average (Key et al.,2019).

2.3 Recent conditions of USA agriculture and Sino-USA trade war

American farmers are going through one of the worst periods in almost 30 years because of the low commodity prices, the Sino-USA trade war, and the serious floods (Brown, 2019). Farmers were experiencing declines in commodity prices and farm income for years. Extreme floods along Mississippi, Missouri, and Arkansas rivers in March 2019 continued to add pressure on farmers. According to the annual National Climate Report of the National Oceanic and Atmospheric Administration, the contiguous US average annual precipitation went up to the second wettest year in history. Flooding on the Missouri, Arkansas, and Mississippi river caused an estimated $20 billion in damage in 2019[11]. Atop these multiple factors, the trade war has only added economic stress for farmers even with the government bailout. Under these severe circumstances, farm bankruptcies rose 24.6% in 2019 to an eight-year high. Farmers also retired or sold the farms because of these stresses as farm numbers continued to decline (Huffstutter, 2020). Figure 3 shows the farm number and bankruptcy rate changes from 2007 to 2019.

[11] "National Climate Report for Annual 2019" from NOAA National Centers for Environmental Information, available at: https://www.ncdc.noaa.gov/sotc/national/201913.

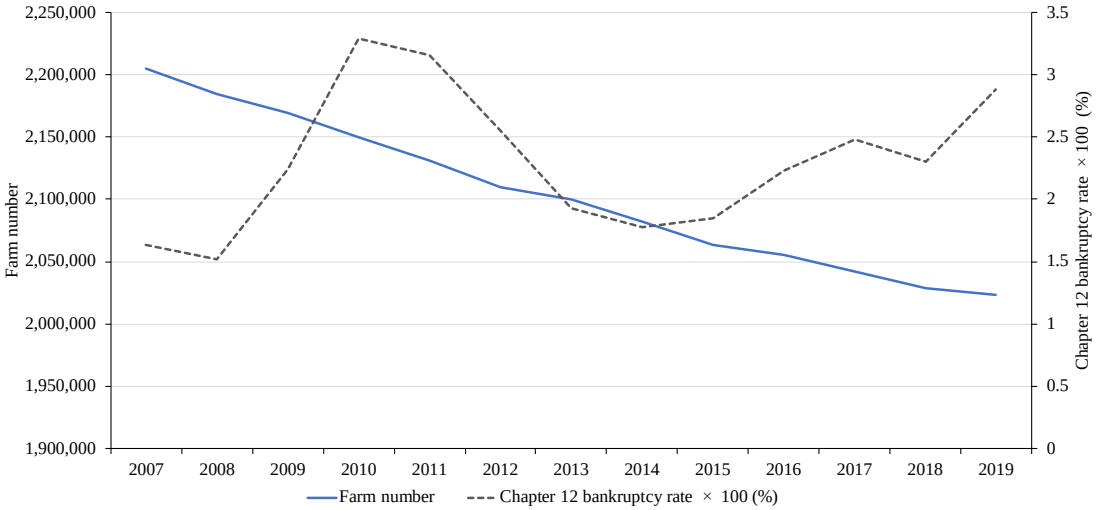

Figure 3: Total farms and Chapter 12 bankruptcy filing rate, by year, 2007-2019

(Source: US court)

Over the years, international trade has contributed a lot to the overall economy in the United States. It is estimated that American real incomes are 9% higher than they would otherwise have been due to trade liberalizing efforts[12]. The agricultural sector is one of the biggest beneficiaries of trade in terms of the significant expansion of agricultural production. According to Financial Times, "with a relatively stagnant domestic market, US farmers have depended heavily on exports to sustain profits and prices" (Demetri and James, 2019, para. 14). Among all the trade partners, China is currently the third-largest partner in total goods traded (export and import) and was the USA's largest supplier of goods imports and the third largest in the USA's good export market in 2019. In terms of agricultural trade, the USA exported $13.8 billions of products in 2019, which ranks third in the USA agricultural export market. The top five export products include soybeans ($8.0 billion), pork & pork products ($1.3

[12] Estimated by the Office of the United States Trade Representatives.

billion), cotton ($708 million), tree nuts ($606 million), and hides & skins ($412 million). The USA imported $3.6 billions of agricultural products from China in 2019, which ranks sixth in the USA agricultural import market (third in 2018). The top five import products include processed fruit & vegetables ($786 million), spices ($170 million), snack foods ($170 million), fresh vegetables ($136 million), and Tree Nuts ($102 million)[13].

US President Donald J. Trump has long criticized China of unfair trading practices as well as intellectual property theft. Concerns also arose about China's trade depressing job creation in the USA and weakening the USA national security (Liu and Woo, 2018). Beginning in March 2018, the USA imposed an additional tariff on steel and aluminum imports for most of the countries, including China. In retaliation for the tariff imposed, China imposed tariffs on 128 products in April 2018. In the following three months, the USA released a list of products subjected to additional tariffs and introduced restrictions on Chinese telecom companies. China, in reaction, proposed tariffs to be applied to more products. In July 2018, US implemented the first tariff targeted at China, including 25% tariff on imports from China valued at US$34 billion while China imposed a 25% tariff on 545 goods imported from the USA (worth US$34 billion) (Wong and Koty, 2020).

With escalating trade tensions between April 2018 and January 2020, the US imposed tariffs on US$550 billion worth of Chinese products (US Section 301, List 1 to List 4).

[13] Extracted from standard query of Foreign Agriculture Service, United States Department of Agriculture.

China, in turn, imposed tariffs on US$185 billion worth of US goods (Wong and Koty, 2020). In Jan 15, 2020, the USA and China finally signed the historic Phase One trade deal involving the areas of intellectual property, technology transfer, agriculture, financial services, and currency and foreign exchange. The two sides will address the structural barriers and expand the USA agriculture export, as mentioned in the Agriculture chapter of the trade deal.

Although the USA and China have reached the trade deal, tariffs on both sides are still significantly higher than those before the trade war began in 2018[14]. During the whole process, farmers faced significant financial difficulties in farm operations with many requiring extended credit lines from their lenders. Figures 4 5 show the total agricultural export and import value to China, and the percentage change from year to year. The export value of agricultural products dropped by 53% in 2018, while the import value dropped by 26% in 2019.

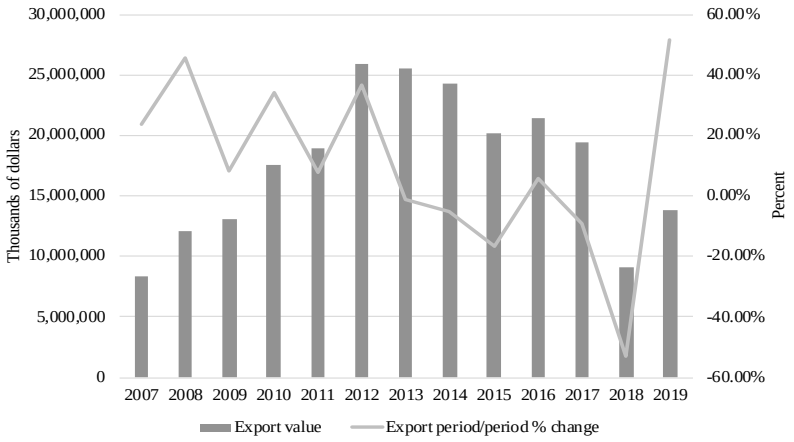

Figure 4: USA-China total agricultural products export, by year, 2007-2019

(Source: USDA)[9]

[14] See "US-China Trade War Tariffs: An Up-to-Date Chart", which calculates the average tariff on both sides. Available at: https://www.piie.com/research/piie-charts/us-china-trade-war-tariffs-date-chart.

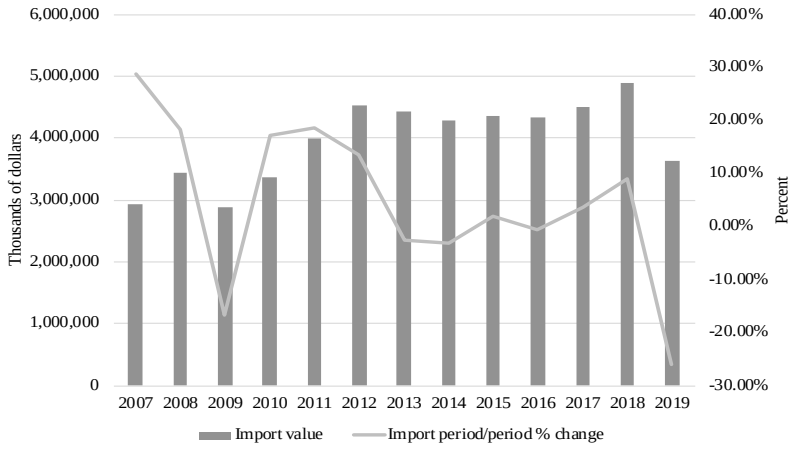

Figure 5: USA-China total agricultural products import, by year, 2007-2019

(Source: USDA)[15]

Among all the products, soybean was the most negatively affected product. The export value of soybeans to China plummeted to zero during September and November 2018, and the total value in 2018 plunged by 75% to $3 billion from $12 billion. Soybean spot price and breakeven price also declined after the trade war, as shown below.

[15] Extracted from standard query of Foreign Agriculture Service, United States Department of Agriculture.

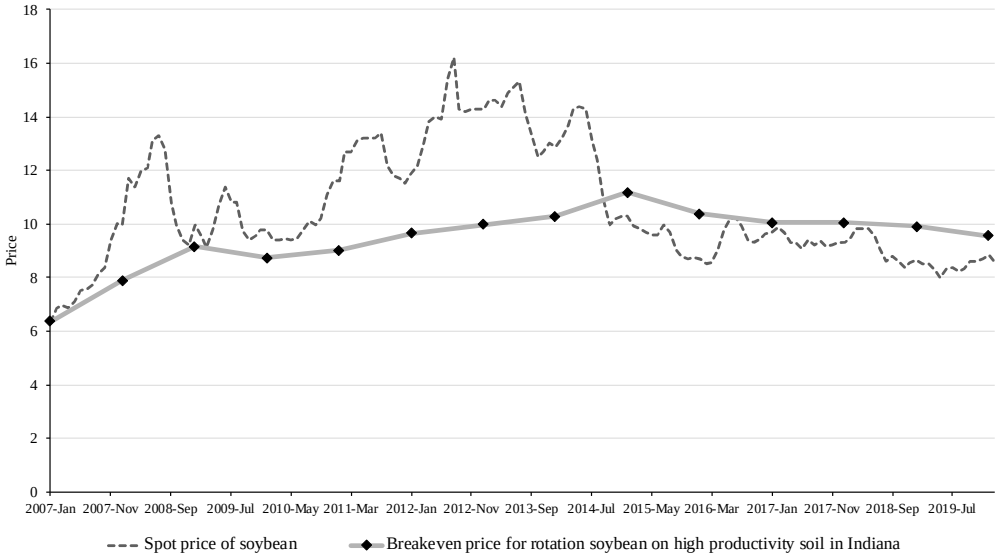

Figure 6: Price received and breakeven price of soybean, 2007-2020

Breakeven prices: for rotation soybean on high productivity soil in Indiana

(Source: USDA[16], Purdue University, Center for Commercial Agriculture[17])

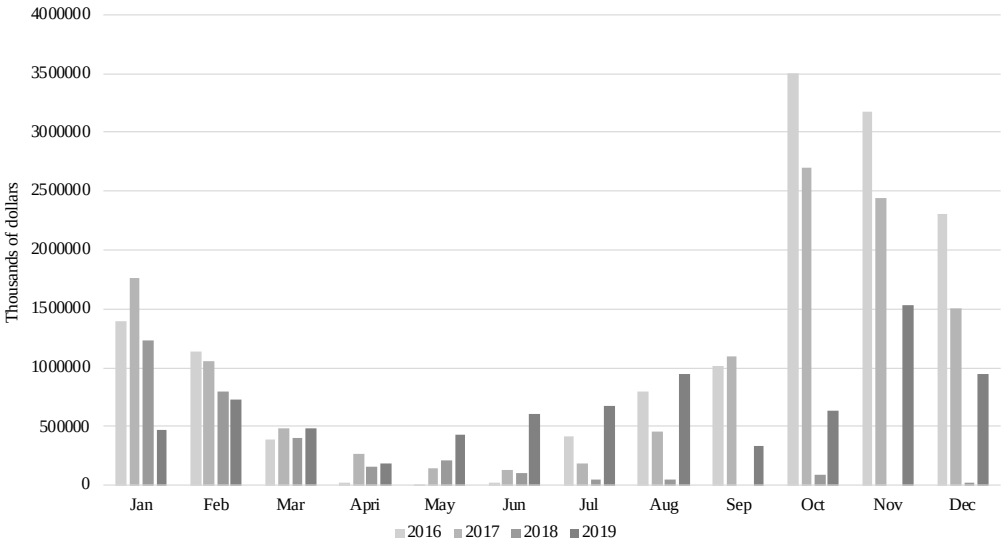

Figure 7: Soybeans export to China, by month, 2016-2019

(Source: USDA)[18]

[16] Data of priced received is obtained from National Agricultural Statistics Service of USDA

[17] We followed the method in "Projected Corn and Soybean Breakeven Prices" by Michael Langemeier to calculate the breakeven price. Available at: https://farmdocdaily.illinois.edu/2018/04/projected-corn-and-soybean-breakeven-prices.html. Data is further obtained at CROP COST & RETURN GUIDE at center for commercial agriculture of Purdue University. Available at: https://ag.purdue.edu/commercialag/home/resource/keyword/crop-cost-return-guide-archive/

In order to support American farmers from the trade impact, President Trump authorized the USDA to provide subsidies in programs beginning in August 2018. Up to 12 billion and 16 billion are authorized in 2018 and 2019, respectively. Three programs were enacted to assist farmers including Market Facilitation Program (MFP) which provides around $10.6 billion and $14.5 billion payments to farmers in 2018 and 2019, Food Purchase and Distribution Program (FPDP) under which $1.2 billion and $1.4 billion would be used by the Agricultural Marketing Service (AMS) to purchase surplus commodities under the trade war, and Agriculture Trade Promotion Program (ATP) under which $200 and $100 million were issued to assist in developing new export markets.

The Market Facilitation Program (MFP) is administered by the Farm Services Administration under the authority of Commodity Credit Corporation[19]. The primary purpose was to provide payments to farmers who had been affected considerably by the trade disruptions and experienced loss in exports. There were two tranches for MFP 2018 beginning in September and December 2018 with the specific date based on the time when farmers harvest 100% of the crop and certify the amount of production. The 2018 payment rate of different commodities is determined by "the severity of the trade disruption and the period of adjustment to new trade patterns"

[18] Extracted from standard query of Foreign Agriculture Service, United States Department of Agriculture.
[19] Further information available at: https://www.usda.gov/media/press-releases/2019/07/25/usda-announces-details-support-package-farmers

(USDA)[20]. Commodities including Almonds(shelled), cotton, corn, dairy(milk), pork(hogs), soybeans, sorghum, sweet cherries(fresh), and wheat were covered under the 2018 program. The first and second tranche payments were 50% of the producer's actual production in 2018 multiplied by the MFP rate, respectively.

The 2019 MFP covered a broader range of crops than the previous year, and the payment rate no longer depended upon crops planted but rather upon the county. In this way, farmers were encouraged to plant crops that worked best for them instead of seeking crops with the highest payment rate. The FSA considered the severity of trade impacts in each county and set different county payment rates vary from $15 to $150 per acre. Farmers who planted the FSA-certified cover crop due to the adverse weather condition still have the chance to apply for a minimal amount of payment under MFP 2019. MFP payments for 2019 consisted of three tranches, with the first round beginning in August 2019, the second round came in November 2019 and the final round in February 2020. The first tranche contained the higher of either 50% of a producer's calculated payment or $15 per acre. The second tranche was 25% of the total payment, and the third tranche covered the remaining 25% payment[21].

Although farm income was trending downward from 2014, farm net income increased by 3.0% in 2018 and was projected to increase by 15.6% in 2019 under massive government bailout funding. USDA reported that the government payment and

[20] Further information available at: https://www.usda.gov/media/press-releases/2018/08/27/usda-announces-details-assistance-farmers-impacted-unjustified
[21] Further detail available at Farmer.gov, https://www.farmers.gov/manage/mfp

commodity insurance payment represents almost one-third of the projected net farm income in 2019. Nevertheless, the temporary subsidy only helps bridge the gap instead of making up the whole loss of farms, and farm income would have plunged without the bailout, according to Bloomberg (Dorning and Dmitrieva, 2019).

2.4 Previous economic research

Most of the research before focused on the analysis of the development of Bankruptcy law and the comparison of Chapter 12 bankruptcy rates during different periods. Stam and Dixon (2004) presented a comprehensive analysis of farm bankruptcies and farm exit from 1899 to 2022. They summarized the development of major bankruptcy law reform, including the 1898 Act and 1978 Act and compared the difference among Chapter 11, 12, and 13. The 1930s and 1980s farm crisis were analyzed in detail with relative farm bankruptcy numbers. When comparing farm bankruptcy with farm exit, they found that bankruptcy only plays a small role in the decline of farm numbers. Harl (2006) summarized the major changes in Bankruptcy Abuse Prevention and Consumer Protection of 2005. In general, the 2005 Act made the law more favorable to creditors except for Chapter 12, which could be explained by the support of farm state members of Congress and the general understanding of the adverse condition farmers faced.

Zhang and Tidgren (2018) examined the most recent agricultural downturn with the 1920s and 1980s crisis from economic and regulatory perspectives. They concluded that the current downturn was unlikely to fall into the crisis like previous periods

based on the strong income, low interest rate, and strengthened regulatory requirements. Nigel Key et al. (2019) reached similar conclusions as indicators (net cash income, farm debt, farmland value, and loan delinquency rate) they applied remained close to the long run average level as of 2017. Although they were not worried about the agriculture sector as a whole, they did find that larger farms, poultry and hog farms, dairy farms, and farms with beginning or young farmers were more likely to be in financial stress compared to their counterparts.

Before research from Dixon et al. (2004), there was no empirical study on the determinant of Chapter 12 bankruptcy rate or number. Previous studies focused on the prediction of Chapter 7 and Chapter 13 filing rate (Buckley and Brinig, 1998). Shepard and Collins (1982) used OLS regression with the annual national agriculture bankruptcy rate from 1910 to 1978 as the dependent variable. They separated the period into pre-World War II and post-World War II and found that farm size, leverage, and government payment were significant before World War II, with only farm size significant in the later model.

The paper from Dixon et al. (2004) was the first one to apply the fixed effect model at the state level to examine the effect of economic, legal, and social factors as well as the role of government on farm bankruptcies. All the variables were in log form, and the independent variables were lagged one year since filing a bankruptcy is not a quick process. They found that economic indicators (unemployment rate), income and debt variables (debt to asset ratio, real net farm income, percent of off-farm work, debt

servicing ratio), farm structure factor (farm size), and government factor (government payment) were significant. There was no evidence that social norms (moral hazard) influenced farm bankruptcy.

The most recent research on Chapter 12 bankruptcies is from Dinterman et al. (2018) who investigated the effects of agriculture and macroeconomic factors on financial stress of farms using panel fixed effect model and specifically, they looked into the influence of the 2005 Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA). They used annual data Chapter 12 bankruptcy numbers from the US Courts website, the F-2 Table at the district and state level and applied the bankruptcy rate as the dependent variable. The results show that interest and unemployment rates are positively related with bankruptcy rate. The relationship of agricultural land value with farm bankruptcy was dynamic, with the coefficient of lagged agricultural land values having a positive sign, while the current agricultural land value was negative. Further, they evaluated the transitory effect and permanent effect of the 2005 Act by interacting the BAPCPA variable with other variables. There appeared to exist a regime shift of the 2005 Act in the relationship between farm bankruptcies and explanatory variables. Of the three significant variables in the first model, only the post-BAPCPA effects (calculated as the sum of the coefficient of the non-interacted variable and the interaction term) of current agricultural land value remained significant.

Several papers evaluated the possible effect of the Sino-USA trade war before the trade war officially began or in the middle of the trade war. Guo et al. (2017) explored four scenarios in which China and other countries were hypothesized to retaliate or not. All cases showed that the trade war would hurt international trade, and the USA would become one of the biggest losers considering social welfare. Amiti et al. (2019) suggested that tariffs would almost entirely pass through into the USA domestic price based on data of 2018. This conclusion is further verified by their paper in 2020, which included data for most of 2019. By contrast, Paper from Li et al. (2018) suggests that under the trade war, China will lose more than the USA.

Few papers examined the effect of the Sino-USA trade war on the agricultural sector. Turvey et al. (2020) investigated the trade war effect on price diffusion, and information transfer relationship between prices of soybean futures contracts trade on the Chicago Mercantile Exchange in Chicago and Dalian Futures Exchange in Liaoning China. They applied the Vector Autoregression model and found that there are strong relationships between several groups, including US futures settlement price and the Chinese spot price, US spot price and China spot price, and US spot price and Chinese futures price before the trade war. However, these relationships lost economic significance after the trade war. They concluded that the efficiency of the soybean futures market is negatively affected by the Sino-USA trade war.

Compared to previous work, our paper contributes in three aspects. First, our main contribution is that we examine the effect of the current Sino-USA trade war on USA

farm bankruptcies. Second, our panel model is based on monthly data, while previous models are yearly based, which allow us to investigate the short-run trade war effect. Third, our result suggests the limited effect of the trade war targeted government subsidy on farmers and encouraged more government assistance to help farmers get through the hard time.

CHAPTER 3

DATA

3.1 Data description

It is notable that family farmers and fishermen can still file for bankruptcies under Chapter 7, 11 and 13. Although the 2005 Act has relaxed the requirement imposed on farmers and fishermen, they still have to meet debt and income requirements to be eligible to file for Chapter 12. As a result, some farmers may turn to Chapter7 or Chapter 13. Porter (2005) also argued that small farmers might not be able to afford the substantial legal fees under Chapter 12, and farmers who were pushed into financial stress because of reasons common in consumer bankruptcies (e.g., overdue income taxes, unpaid medical bills) may also file for other Chapters which can solve their problems more effectively. Therefore, Chapter 12 only provides a lower bound of the total farm bankruptcies. For farmers who fulfilled the requirement, however, Chapter 12 bankruptcy is still preferable from other chapters due to the special considerations for farmers. Besides, the patterns between Chapter 12 bankruptcy and overall farm bankruptcy would be similar; therefore, we assume Chapter 12 can be a reasonable estimate of the farm financial conditions.

We use the monthly bankruptcy data on the state level from the repository from Robert Dinterman[22] at The Ohio State University, which is extracted from the US Courts, F-2 one-month table of bankruptcy from March 2013 and PACER for the

[22] See Robert Dinterman's website or project at GitHub. Available at: http://robertdinterman.com/historical-bankruptcies/

earlier period from 2007. Data on the monthly level are available from 2007; therefore, our data covers the period of 2007 to 2019. Figure 8 shows the monthly Chapter 12 bankruptcy filings from 2007 to 2019, and we can see an onward trend of bankruptcy numbers from May 2018.

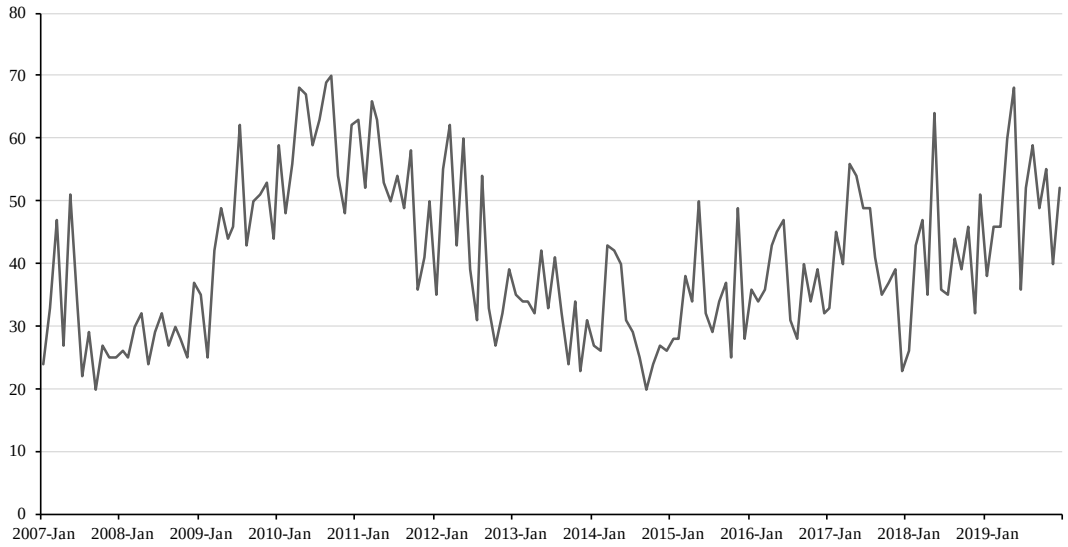

Figure 8: Chapter 12 bankruptcy filings, by month, 2007-2019

(Source: US court, PACER)

Because we are looking at the specific trade war effects which began in June 2018, it is necessary to use monthly data. In order to match the frequency of our data, we make two assumptions to convert low-frequency data (annual/quarter) to high-frequency data (monthly). For data accumulating continuously through our observing period, we applied the cubic spline function to get data that we cannot observe under a low frequency. In this way, we are using the trend of lower frequency data to estimate higher frequency data. The cubic spline is used to fit a smooth curve to a series of points with a piecewise series of cubic polynomial curves. It is defined as the curve that for any two adjacent internal points which satisfy a) The curve passes exactly

through both points, b) the slope of the curve at the end points is equal to the slope of the adjacent segments, and c) the curvature of the curve at the end points is equal to the curvature of the adjacent segments[23]. Specifically, the spline used in our model is that of Forsythe, Malcolm and Moler (1977)[24], in which an exact cubic is fitted through the four points at each end of the data. Figure 9 shows how we convert annual soybean yield index to monthly data.

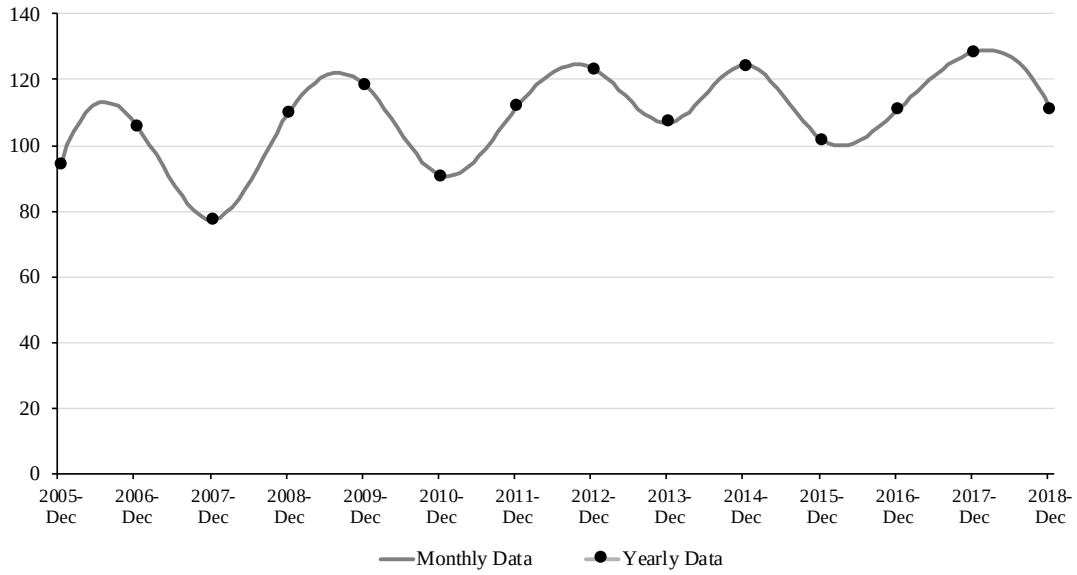

Figure 9: Convert yearly data to monthly data (Soybean yield index)

(Source: USDA)[25]

For data which had not continuously accumulated over our observing period, we evenly distributed the total amount throughout the period. For example, we divided the total cost of soybeans production of 2018 by 12 to get the monthly cost. The total cost

[23] Definition available at: https://newtonexcelbach.com/2009/07/02/cubic-splines/
[24] See R documentation. Available at: https://www.rdocumentation.org/packages/stats/versions/3.6.2/topics/splinefun
[25] This graph shows how cubic spline connects the yearly data and generates the overall trend. Black points represent the annual data. We use soybean yield data as an example. Data is obtained from Commodity Costs and Returns, USDA-ERS.

of 2018 accumulated from zero at the beginning of the year, therefore it is inappropriate to estimate the monthly data though cubic spline.

Our dependent variables are the monthly Chapter 12 bankruptcy numbers at the state level as well as monthly Chapter 12 bankruptcy rate calculated by the number divided by total farms. Following Dinterman et al. (2018), the bankruptcy rate is multiplied by 10000 for ease of interpretation. The annual number of farm operations is from the National Agricultural Statistics Service (NASS) of USDA[26] and converted into a monthly number using cubic splines.

We divided our factors affecting farm bankruptcy into agricultural factors, economic factors, and government factors. The trade war is a dummy variable which takes 1 after May 2018, which we defined as the very beginning of trade war going into effect. Table 1 contains the summary statistics of the variables used in the analysis. Variables of trade volume, U.S. real GDP, government direct payment, and farm numbers are divided by 1,000,000 for ease of interpretation. Only contiguous states are included in our dataset, which excludes Alaska, District of Columbia, Hawaii, Northern Mariana Islands, Puerto Rico, Guam, and Virgin Islands.

Table 1: Descriptive statistics

[26] National Agricultural Statistics Service, USDA. Available at: https://quickstats.nass.usda.gov

Statistic	Mean	St. Dev.	Min	Max
Chapter 12 bankruptcy rate (per 10,000 farms)	0.24	0.56	0	10
Chapter 12 bankruptcy number	0.80	1.30	0	14
Trade war	0.12	0.33	0	1
Farm number (Millions)	0.04	0.04	0.001	0.25
Basis of Soybean (Future price of nearby contrast - Spot price)	0.38	0.67	-2.08	4.52
Export value of soybean (Billions of dollars)	0.02	0.05	0.00	0.52
Yield of soybean (Index, bushels per planted acre)	127.55	16.79	76.53	171.48
Total cost of soybean (Index)	155.46	25.78	95.15	207.57
Producer price index of farm products	165.96	22.45	115.50	211.00
U.S. anomaly wet areas percentage	0.13	0.09	0.00	0.46
Average effective interest rate on non-real estate farm loans	4.90	1.30	3.54	8.61
Farm loan outstanding at commercial banks (Billions of dollars)	136.27	23.69	95.57	181.22
Net charge-offs of farm loans held by insured commercial banks (Millions of dollars)	21.50	18.53	1.33	78.67
U.S. Real GDP (Trillions of chained 2012 dollars)	0.03	0.03	0.002	0.23
Government direct farm program payments (Billions of dollars, Exclude MFP)	0.02	0.02	0.0001	0.13
MFP 2018 first tranche	0.01	0.08	0	1
MFP 2018 second tranche	0.01	0.08	0	1
MFP 2019 first tranche	0.01	0.08	0	1
MFP 2019 second tranche	0.01	0.08	0	1

3.2 Agricultural factors

We apply soybean as the indicator of the agriculture condition under the trade war since soybean is the most affected crops in the agricultural products that are exported to China and also plays the largest proportion of total export to China. We use the basis of soybeans, which is the difference of nearby futures price and the spot price to approximate the market condition of the soybeans at the local level. In our case, we use futures price minus spot price to calculate the basis since a positive number would be easier to interpret. If the basis in our case is positive, or in contango, the market could be interpreted as normal without supply shortage. If the basis is widening, the spot price is falling relative to the nearby futures contract because of local conditions that could include excess supply due to falling exports. Therefore, the basis could be a good proxy of the soybeans stock conditions at the local state level and capture the

shock from the trade war as the decline in exports led to the excess supply of soybeans, at least in the short run when farmers had no way to find new buyers to substitute for the Chinese market. Furthermore, our use of basis and related basis risk will also capture additional economic effects and farm conditions at the state level that are unrelated to trade war effects. The spot price of soybeans, or the price received of soybeans[27], is obtained from the National Agricultural Statistics Service of USDA. For states that do not report the price or simply do not grow soybean, we use the national level, the average of available soybean prices, to approximate the price level. The future price of soybean is acquired from the Season-Average Price Forecasts dataset from USDA's Economic Research Service (ERS), which provided the average monthly settlement price for the nearby soybean futures contract[28]. The future price provided by the ERS was in turn obtained from the Chicago Mercantile Exchange (CME group).

The soybean export volume captures the extremes of the US-China agriculture trade condition. We try to estimate it by multiplying the total trade volume with the export percentage of each state because the state level agricultural export data is not available. Economic Research Service estimates annual soybeans exports on state level using U.S. farm-cash-receipts data[29]. Based on this dataset, the state soybean export percentage is calculated by the annual estimated state export value divided by the total export value. Export percentage rates were not yet available for 2019, so we use a

[27] National Agricultural Statistics Service, USDA. Available at: https://quickstats.nass.usda.gov
[28] Season-Average Price Forecasts, USDA-ERS. Available at: https://www.ers.usda.gov/data-products/season-average-price-forecasts/
[29] State Export Data, USDA-ERS. Available at: https://www.ers.usda.gov/data-products/state-export-data/

moving average of 2018, 2017, 2016 and 2014 with weights of 0.4, 0.3, 0.2 and 0.1 respectively to calculate the rate of 2019 since the percentage is relatively stable in recent years. Monthly exports from the USA to China were acquired from the USDA Foreign Agricultural Service's Global Agricultural Trade System[30]. Finally, monthly export value by state is calculated as the product of monthly export and the state export percentage.

While previous variables captured mainly the change of soybean, we used the monthly producer price index (PPI) for farm products as a proxy of the general farm economic conditions. The PPI of farm products captured the changes of price received by farmers. The PPI data is acquired from the U.S. Bureau of Labor Statistics[31] and lagged for half a year in the dataset.

ERS has estimated annual production costs and returns per planted acre (excluding government payments) for major production regions for major field crops, which is recorded in the dataset of Commodity Costs and Returns[32]. Data are estimated at regional levels constructed by ERS. Due to the reason that counties in one state may not be classified in the same region, we calculate the average cost and return of one state using the percentage of counties that are classified in each region. For yield (bushels per planted acre), we applied the cubic spline to convert the annual data into

[30] USDA Foreign Agricultural Service's Global Agricultural Trade System, USDA. Available at: https://apps.fas.usda.gov/gats/default.aspx
[31] U.S. Bureau of Labor Statistics. Available at: https://beta.bls.gov/dataViewer/view/timeseries/WPU01;jsessionid=BDB9311C669497F1AEF71F16DF16D797
[32] Commodity Costs and Returns, USDA-ERS. Available at: https://www.ers.usda.gov/data-products/commodity-costs-and-returns/

monthly values. Instead of interpreting the estimated monthly yield data as the actual yield, we interpret them as yield expectations of farmers. For the total cost, we divided the annual number by 12 to get the proxy of monthly value. We lagged the yield of soybean productions and total cost for one year in our model and converted them into an index with 2006 Alabama as 100. For states in which data are not available, we applied the national average level.

The extensive flooding that began in spring 2019 resulted in a record-slow planting pace for the Nation's corn, soybeans, and rice, also created pressures on farm income and financial condition[33]. We utilized U.S. percentage areas (very wet) from the National Centers for Environmental Information website of NOAA as an approximation of the flooding condition of contiguous United States[34]. Climate division would be classified as "very wet" if the standardized anomaly of that division is within the top 10% of the historical distribution. This dataset shows the percentage of the contiguous United States that experienced extreme precipitation conditions for each month.

[33] Released June 28, 2019, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, United States Department of Agriculture (USDA). https://www.nass.usda.gov/Publications/Todays_Reports/reports/acrg0619.pdf
[34] U.S. Percentage Areas (Very Warm/Cold, Very Wet/Dry). Available at: https://www.ncdc.noaa.gov/temp-and-precip/uspa/wet-dry/10

3.3 Economic factors

The Agricultural Finance Databook[35] from the Federal Reserve Bank of Kansas City provides quarterly reports of national and regional farm loan data. The interest rate of farm loans represents the cost of borrowing of farmers. We obtained the average effective interest rate on non-real estate farm loans made by commercial banks from this dataset, which is lagged for a quarter in the model. Farm loans and net charge-offs indicate the financial risk farmers faced. We acquired the farm loan outstanding at commercial banks and net charge-offs of farm loans held by insured commercial banks, which are lagged for one year. The quarterly interest rate and total farm loans is converted into monthly data using cubic spline function as the farm loan here is a debt balance. The quarterly net charge off is divided by three to get the monthly value. GDP is obtained from the Bureau of Economic Analysis[36] to approximate the overall economic condition of the United States. Quarterly data are evenly divided to get the monthly GDP and lagged for one year.

3.4 Government factors

Government payment plays a significant role in stabilizing farm financial conditions. Projected by ERS, government direct farm program payment contributes roughly 25% of total net farm income. Without significant government payment, farm income would have plummeted in 2019. We acquired the annual government direct farm

[35] Agricultural Finance Databook. Available at: https://www.kansascityfed.org/research/indicatorsdata/agfinancedatabook
[36] GDP, from BEA. Available at: https://apps.bea.gov/iTable/index_regional.cfm

program payments by state from Farm Income and Wealth Statistics of ERS[37]. The annual data was then divided by 12 to get the monthly subsidy and lagged one year in the model.

The Market Facilitation Program represents the largest portion of the total trade war specific subsidy, and we utilize it to approximate the impact of government measures in supporting farmers during the Sino-USA trade war. There were two tranches for MFP 2018 beginning in September 2018 and December 2018 with the specific date based on the time when farmers report their production. MFP payments for 2019 consist of three tranches, with the first round beginning in August 2019, the second round came in November 2019 and the final round in February 2020.

We applied dummy variables for each MFP tranches for 2018 and 2019 except for the final tranche of 2019, which was not covered in our data period. For example, variable first tranche18 takes 1 if the date is within September 2018. Although not all the farmers received the payment on the exact month we mentioned above, we assume most farmers received the payment in the month when the government began issuing the payment. The value of the subsidy from the market facilitation program is already subtracted from the total government payment.

[37] Government payments by program, USDA-ERS. Available at: https://data.ers.usda.gov/reports.aspx?ID=17833

CHAPTER 4

EMPIRICAL MODEL

We focused on evaluating factors affecting farm bankruptcy between 2007 to 2019, especially on the link between the 2018-2019 Sino-USA trade war and farm bankruptcy. Following Dinterman et al. (2018) and Dixon et al. (2004), we applied the panel fixed effect model in our study. The fixed effect model explores the relationship between the predictor and dependent variables within an entity (in our case, state). Each state has its own characteristic, like the geographical features of one state, which do not change over time but may impact the dependent variable. By applying the fixed effect model, the state unique characteristics are controlled, which allows us to examine the net effect of other independent variables.

We also consider using the random effects of time (in our case, month). However, since our data was already granular with multiple instruments covering key events, time (dummy) variables added no additional information to the model, and so we exclude these random effects.

The conceptual form of the fixed effect estimating equation is:

$$(1)\ Y_{it} = \alpha + \alpha_i + \beta_1 TradeWar + \beta_2 A_{it} + \beta_3 E_{it} + \beta_2 G_{it}$$

Where i represents the region (state), t represents the time (month). Unlike previous models, both Chapter 12 bankruptcy filing rate and Chapter 12 filing numbers by month were used as our dependent variables. Farm numbers were included in both models to account for the state differences in farming populations across time and space (Dinterman et al., 2018). The difference is that farm number is used for calculating the bankruptcy filing rate in the first model while included as one of the explanatory variables in the second model. The A_{it}, E_{it}, G_{it} vectors are three groups of independent variables representing agricultural variables, economic variables, and government variables that could influence the Chapter 12 bankruptcy rates. The α parameter is the model's error term; α_i is a regional fixed effect indicating those time-invariant state characteristics.

The subscript of i and t do not match exactly with each variable, and we use them for simplification. Variables of soybean future-price basis, interest rate of non-real estate bank loans, PPI for farm products, farm loan outstanding at commercial banks, and net charge-offs of farm loans are on the national level. In terms of the time period, the variable of short-term interest rate is lagged for a quarter, PPI is lagged for half a year while variables of soybean yield, soybean total cost, farm loan outstanding at commercial banks, net charge-offs of farm loans, US real GDP and government direct payment are lagged for one year.

As a robustness test, we also estimated and reported the regression in the log-linear form (base 10). Because of zero or negative values, log transformation was not used

on the dependent variable (bankruptcy rate and bankruptcy number), soybean export volume, trade war dummy variable, U.S. anomaly wet areas percentage, and MFP tranches dummy variables.

CHAPTER 5

REGRESSION RESULT

Tables 2 and 3 show the regression results of ordinary least square (OLS) regression and panel fixed effect model with the dependent variable of bankruptcy rate in the first and second columns, and bankruptcy numbers in the third and fourth column. Regressions are based on levels data, and the log-linear models are provided side-by-side. Coefficient p-values are provided in parenthesis below each coefficient. The OLS estimate ignores the panel structure of the dataset. Results of four panel fixed effect models are consistent.

Table 2: Ordinary least square regression

	Bankruptcy Rate		Bankruptcy Number	
	Non-Log	Log-Linear	Non-Log	Log-Linear
Trade war	0.0303***	0.0319***	0.1288***	0.1766***
	(0.0028)	(0.0033)	(0.0047)	(0.0005)
Farm number (Thousands)			2.2299***	0.2025***
			(0.0000)	(0.0001)
Basis of Soybean (Future price of nearby contrast - Spot price)	0.0091**	0.0157***	0.0398**	0.0734***
	(0.0119)	(0.00002)	(0.0151)	(0.00002)
Export volume of soybean (Billions of dollars)	-0.0711	-0.2996***	-0.9067***	-1.4684***
	(0.1494)	(0.0000)	(0.00005)	(0.0000)
Yield of soybean (Index, bushels per planted acre)	-0.0004***	-0.0170	-0.0010	0.6007***
	(0.0072)	(0.7191)	(0.1672)	(0.0065)
Total cost of soybean (Index)	0.0005***	-0.0072	0.0017*	-0.1501
	(0.0089)	(0.9254)	(0.0593)	(0.6762)
Producer price index of farm products	-0.0012***	-0.4049***	-0.0053***	-2.0142***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
U.S. anomaly wet areas percentage	0.0462**	0.0456**	0.2488**	0.2648**
	(0.0433)	(0.0481)	(0.0154)	(0.0142)
Average effective interest rate on non-real estate farm loans	-0.0150***	-0.3158***	-0.0857***	-1.7209***
	(0.00003)	(0.000000)	(0.000001)	(0.0000)
Farm loan outstanding at commercial banks (Billions of dollars)	-0.0005**	-0.0773	-0.0026***	-0.8475***
	(0.0128)	(0.2007)	(0.0020)	(0.0027)
Net charge-offs of farm loans held by insured commercial banks (Millions of dollars)	0.0007***	0.0276***	0.0032***	0.1196***
	(0.000000)	(0.000001)	(0.000000)	(0.000003)
U.S. Real GDP (Trillions of chained 2012 dollars)	1.1846***	0.0741***	8.5418***	0.4375***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Government direct farm program payments (Billions of dollars, Exclude MFP)	0.3042***	0.0469***	5.1082***	0.2113***
	(0.0031)	(0.0000)	(0.0000)	(0.0000)
MFP 2018 first tranche	-0.0074	-0.0072	-0.0065	0.0042
	(0.7749)	(0.7847)	(0.9556)	(0.9726)
MFP 2018 second tranche	-0.0229	-0.0260	-0.0926	-0.1456
	(0.3766)	(0.3209)	(0.4266)	(0.2340)
MFP 2019 first tranche	0.0343	0.0449*	0.1614	0.2402**
	(0.1855)	(0.0862)	(0.1662)	(0.0498)
MFP 2019 second tranche	-0.0091	-0.0035	0.0140	0.0693
	(0.7249	(0.8952)	(0.9044)	(0.5716)
Constant	0.3468***	1.6253***	1.5435***	8.4013***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Observations	7,332	7,332	7,332	7,332

Note: *p**p***p<0.01, P-value shown in parenthesis

Table 3: Panel fixed effect model

	Panel Fixed Effect Model			
	Bankruptcy Rate		Bankruptcy Number	
	Non-Log	Log-Linear	Non-Log	Log-Linear
Trade war	0.0655***	0.0768***	0.2054***	0.2216***
	(0.0012)	(0.0003)	(0.0010)	(0.0003)
Farm number (Thousands)			-36.7317**	-1.8368
			(0.0489)	(0.1587)
Basis of Soybean (Future price of nearby contrast - Spot price)	-0.0019	0.0056	0.0343	0.0665***
	(0.8522)	(0.5438)	(0.1455)	(0.0082)
Export volume of soybean (Billions of dollars)	-0.2035**	-0.2199***	-1.2093***	-1.2621***
	(0.0114)	(0.0071)	(0.0005)	(0.0003)
Yield of soybean (Index, bushels per planted acre)	-0.00003	-0.0231	-0.0007	-0.1794
	(0.9555)	(0.8979)	(0.6721)	(0.6995)
Total cost of soybean (Index)	-0.0007	-0.3080	-0.0011	0.2215
	(0.3150)	(0.2710)	(0.6243)	(0.7741)
Producer price index of farm products	-0.0016***	-0.6299***	-0.0074***	-2.9598***
	(0.0002	(0.0002)	(0.000000)	(0.000000)
U.S. anomaly wet areas percentage	0.0958***	0.0893**	0.4053***	0.3688***
	(0.0065)	(0.0116)	(0.00003)	(0.0001)
Average effective interest rate on non-real estate farm loans	-0.0361***	-0.5732***	-0.1238***	-1.7597***
	(0.00005)	(0.00002)	(0.00005)	(0.0004)
Farm loan outstanding at commercial banks (Billions of dollars)	-0.0002	-0.0727	0.0001	-0.2568
	(0.7421)	(0.7333)	(0.9530)	(0.7548)
Net charge-offs of farm loans held by insured commercial banks (Millions of dollars)	0.0011**	0.0440***	0.0044***	0.2144***
	(0.0223)	(0.0026)	(0.0002)	(0.00002)
U.S. Real GDP (Trillions of chained 2012 dollars)	-3.3260**	-0.2663	-39.6679***	-2.5880*
	(0.0373)	(0.2866)	(0.0003)	(0.0594)
Government direct farm program payments (Billions of dollars, Exclude MFP)	0.1281	-0.0094	-0.4834	0.0193
	(0.7921)	(0.8487)	(0.8137)	(0.8691)
MFP 2018 first tranche	-0.0781	-0.0738	-0.0772	-0.0452
	(0.1102)	(0.1254)	(0.6454)	(0.783)9
MFP 2018 second tranche	-0.0767*	-0.0806*	-0.0550	-0.0607
	(0.0646)	(0.0523)	(0.7705)	(0.7496)
MFP 2019 first tranche	0.1507	0.1553	0.3428*	0.3454*
	(0.1302)	(0.1281)	(0.0964)	(0.0988)
MFP 2019 second tranche	-0.0390	-0.0391	-0.0284	-0.0369
	(0.4148)	(0.4135)	(0.8693)	(0.8307)
Observations	7269	7268	7269	7268

Note: *p**p***p<0.01, P-value shown in parenthesis

The trade war dummy variable appears to have a significant effect on farm bankruptcy rate and numbers, which increase the monthly Chapter 12 bankruptcy rate by 0.0655 per 10,000 farms (Coef = 0.0655, p = 0.0012) or 0.2054 bankruptcy numbers (Coef = 0.2054, p = 0.001) in non-log form models. The result confirms that the Sino-USA trade war had a negative impact on farms' financial conditions, although the effect is rather small. However, this effect is to be taken ceteris paribus with all other factors held unchanged. It was not the trade war as an event that leads to increased farm bankruptcies, but the consequences of that event, which are captured by other variables in our model. Nonetheless, if we divide 0.2054 (the monthly increase of bankruptcy numbers due to trade war) in Column 3 of Table 1, by 0.80 (the average monthly bankruptcy numbers), we find that the trade war increased monthly bankruptcy numbers by 25.7%.

In terms of agricultural factors, export volume, PPI of farm products, and U.S. anomaly wet areas percentage produced significant coefficients across all regressions. Farm numbers are significant in the non-log form regression. Export volume of soybeans is negatively associated with farm bankruptcy, suggesting states with higher volumes of soybean trade generally have lower Chapter 12 bankruptcy rates. All else being equal, a 1% increase in export volume of soybeans is associated with 0.02% decrease in Chapter 12 bankruptcy filing rates per 10000 farms (Coef = -0.2199, p = 0.0071), and 0.03% decrease in bankruptcy number (Coef = -1.2621, p = 0.0003)[38].

[38] We interpret most of the relationship in elasticity form and interpret the result of log-linear regressions. Since the dependent variable and several explanatory variables are not in log form due to the zero or negative values in the log-linear regression, we convert the coefficients into elasticity by dividing the mean of dependent variables or multiplying the mean of independent variables (or both).

The negative relationship indicates the roles trade plays in the agricultural sector, which helps stabilize the agricultural economy even when the Sino-USA trade war significantly impacts trade volume. The producer price index of farm products (lag for half a year) also has a negative and significant relationship with farm bankruptcy, which is in line with the expected signs as increases in prices received by domestic producers for output could lessen the financial stress of farms, and subsequently lead to the decline in filings for bankruptcy. All else being equal, as PPI increase by 1%, the monthly bankruptcy rate per 10000 farms (Coef = -0.6299, p = 0.0002) and number (Coef = -2.9598, p = 0.0000) will decrease by 2.62% and 3.70% respectively. The general decline in farm prices in recent years and the exacerbated price declines due to the trade war has contributed significantly to farm bankruptcy rates. For example, the 2.7% decline in PPI between 2018 and 2019 implies an increase in monthly farm bankruptcy numbers of nearly 10%.

U.S. anomaly wet areas percentage has a positive coefficient, which further confirms that farmers were hurt from the flooding. A 1% increase in U.S. anomaly wet areas percentage would lead to 0.05% (Coef = 0.0893, p = 0.0116) or 0.06% (Coef = 0.3688, p = 0.0001) increase in monthly bankruptcy rates per 10000 farms or bankruptcy number. Farm numbers have a negative relationship with farm bankruptcy. The result is reasonable since filing for bankruptcies is one way for farm exits. Although the result is not completely consistent with Stam and Dixon (2004), who found no clear relationship between these two variables, their conclusions were based on a period in

the 20th century which experienced several complex changes and events that differed considerably in form than the more recent events of 2018-2020.

Three variables among economic factors have consistent significant impacts on farm bankruptcies across at least three regressions. U.S. real GDP (lag for one year) is negatively related to farm bankruptcies with 1% increase of GDP associated with 3.24% (Coef = -2.588, p = 0.0594) decrease in monthly bankruptcy numbers. This is intuitive as the improvement of the overall economy helps reduce farmer's risk and stabilize their income. Net charge-offs of farm loans (lag for one year) held by insured commercial banks, which can be a good sign of farm financial stress, are also shown to be statistically significant at predicting farm bankruptcy. The coefficient is positive, indicating 1% increase in net charge-off of farm loans is associated with 0.18% increase in monthly bankruptcy rates per 10000 farms (Coef = 0.0440, p = 0.0026) or 0.27% increase in monthly Chapter 12 bankruptcy numbers (Coef = 0.2144, p = 0.00002).

Average effective interest rate (lag for a quarter) on non-real estate farm loans turned in a significantly negative coefficient that suggests higher interest rate will decrease the farm bankruptcy rate per 10000 farms (Coef = -0.5732, p = 0.00002) and numbers (Coef = -1.7597, p = 0.0004). While we anticipated that this relationship would in fact be positive, an alternative explanation is that rising interest rates have an induced leverage effect that reduces debt to asset or debt to equity (Collins 1985; Featherstone et al. 1988). This would require that the credit demand curve is quite elastic, and some

evidence of this is provided in Weersink et al. (1994) Turvey and Weersink (1997), and Carduner and Turvey (2016). In other words, rising interest rates reduce credit demand, which in turn lowers the financial and solvency risk of farms and reduces filings for bankruptcy. On the other hand, a rising interest rate also means higher borrowing costs and leads to an increase in credit supply. Therefore, one possible explanation of the relationship is that interest rates decreased during this period, and bankruptcies concurrently increased.

The government factors have mixed significance through regressions. The trade war targeted subsidy, Market Facilitation Program, does not show a significant relationship with bankruptcy for the first tranche in 2018 and second tranche in 2019. Nevertheless, the second tranche in 2018 has positive and significant coefficient in regressions with bankruptcy rate as dependent variable (Coef = -0.0806, p = 0.0523) and the first tranche in 2019 has negative and significant coefficient in regressions with bankruptcy number as dependent variable (Coef = 0.3454, p = 0.0988). The contradictory correlations may be due to several reasons. Market Facilitation Program may take time to take effect as we do not apply a lag form for these indicators, and it could be too late for farmers who received the payment to make up their loss and save the farms. Also, the trade war came with several negotiations and amendments on the tariff list between the two countries, which made the demand for agricultural products in the international market full of uncertainty. The several changes could have a combining effect with the subsidy on farmers. Another explanation is that the flooding added

more complexity of the relationship, as farmers who received the first tranche of 2019 in August were still under the adverse impact of flooding and heavy rainfall.

CHAPTER 6

CONCLUSION

In this article, we utilized a fixed effect model to determine factors that influence the farm bankruptcy rate and numbers for the period of 2007-2019. In particular, we set out to establish if the Sino-USA trade war in 2018-2019 had a net impact on farm bankruptcy when farm income had been on a general decline since 2014. We applied Chapter 12 bankruptcy filings rate and numbers as our dependent variables respectively and divided our regressors into agricultural variables, economic variables, and government variables in the model.

The results show that among the agricultural group, higher soybean export volume, and PPI of farm products could reduce farm bankruptcy. As a result, although the heavily dependent on trade could leave the agricultural market with more uncertainty, the increase in agricultural trade significantly improved the demand of farm products, expanded the agricultural market, and further led to better financial conditions of farmers. Another agricultural factor, U.S. anomaly wet areas percentage, significantly improved the farm bankruptcy. We could confirm that the unusual flooding in 2019 did contribute to the rising farm bankruptcies in recent periods.

Our result also indicates that economic factors (net charge-offs of farm loans held by insured commercial banks, U.S. real GDP, the average effective interest rate on non-real estate farm loans) affect farm bankruptcy. Net charge-off of farm loans produces a

positive relationship with bankruptcy, which is intuitive as the net charge-off is an indicator of farmer's financial stress. The negative relationship between GDP and farm bankruptcy suggests the farm bankruptcy tends to decline when general economic conditions improve. Although interest rate produces a positive coefficient, we infer that it is possible that interest rate decreased, and bankruptcies concurrently increased during this period as both credit supply and demand are functions of the interest rate.

Finally, the result confirms that the trade war does have a positive impact on farm bankruptcy. The Market Facilitation Program, the government bailout targeted at trade war, has mixed effects on farm bankruptcy. Among the four tranches of the Market Facilitation Program, the second tranche in 2018 and the first tranche in 2019 produce opposite effects on bankruptcy while remaining tranches are not significant. This might be a combining result of several international trade negotiations and amendments during the trade war, the adverse weather condition as well as the delayed effect of government funding.

Although President Trump insists that the pain of trade war is only short term and eventually will be a boon for farmers through the improved access to foreign markets, there is no doubt that the trade war has pushed many farms to the edge along with the low commodity price and flooding in 2019. The federal aid to farmers did release pressure on farmers and mitigate the painful effect but may not be helpful in saving all the farms in time. Although we could wait for one or two years to test the effect of the

Market Facilitation Program, we believe there is a more immediate need to discuss about the policy and encourage more assistance for farmers to get through this hard time. It takes time to examine the remaining effect of this trade war on USA farmers as it has changed the global commercial landscape and the past partnership between the USA and China.

REFERENCES

1. Amiti, M., Redding, S.J. and Weinstein, D. (2019), "The impact of the 2018 trade war on U.S. prices and welfare", presented at the CEP Discussion Papers (1603), LSE, London, UK, Centre for Economic Performance.
2. Amiti, M., Redding, S.J. and Weinstein, D.E. (2020), "Who's Paying for the US Tariffs? A Longer-Term Perspective", *NBER Working Paper,* Vol. 26610.
3. *Bankruptcy Basics*. (2011), Revised Third Edition., Administrative Office of the United States Courts, available at: https://www.uscourts.gov/services-forms/bankruptcy/bankruptcy-basics.
4. Benen, S. (2019), "Farmers' reality disproves rosy rhetoric from Team Trump", *MSNBC*, 27 December, available at: http://www.msnbc.com/rachel-maddow-show/farmers-reality-disproves-rosy-rhetoric-team-trump.
5. Brown, C. (2019), "America's farmers are facing the worst economic crisis in almost 30 years", *Axios*, 22 May, available at: https://www.axios.com/tough-times-in-farm-country-economy-a0d7a810-e55e-4d0c-aaea-2cb2de97b9de.html.
6. Buckley, F.H. and Brinig, M.F. (1998), "The Bankruptcy Puzzle", *The Journal of Legal Studies*, Vol. 27 No. 1, pp. 187–207.
7. Carduner, A.L. and Turvey, C.G. (2016), *Farm Loan Demand Elasticities and the Relationship Between the Farm Credit System and Commerical Bank Lending*, Cornell University, February.
8. "Chinese and Mexican Tariffs Will Cost Dairy Industry Billions If Left Unchecked | U.S. Dairy Export Council". (2018), , 27 August, available at: https://www.usdec.org/newsroom/news-releases/news-releases/news-release-08/27/2018.

9. Collins, R.A. (1985), “Expected Utility, Debt-Equity Structure, and Risk Balancing”, *American Journal of Agricultural Economics*, Vol. 67 No. 3, pp. 627–629.
10. Dinterman, R., Katchova, A.L. and Harris, J.M. (2018), “Financial stress and farm bankruptcies in US agriculture”, *Agricultural Finance Review*, Vol. 78 No. 4, pp. 441–456.
11. Dixon, B.L., Ma, N., Ahrendsen, B.L., Settlage, L. and Stam, J.M. (2004), “Factors affecting chapter 12 bankruptcy filings in the United States: a panel data model”, *Emory Bankruptcy Developments Journal*, Vol. 20 No. 2, pp. 401–426.
12. Dorning, M. and Dmitrieva, K. (2019), “U.S. Farmer Income Drops Most Since 2016 as Trade War Losses Mount”, *Bloomberg*, 29 April, available at: https://www.bloomberg.com/news/articles/2019-04-29/farmer-income-drops-most-since-2016-amid-trump-trade-war-pain.
13. Featherstone, A.M., Moss, C.B., Baker, T.G. and Preckel, P.V. (1988), “The Theoretical Effects of Farm Policies on Optimal Leverage and the Probability of Equity Losses”, *American Journal of Agricultural Economics*, Vol. 70 No. 3, pp. 572–579.
14. Forsythe, G.E., Malcolm, M.A. and Moler, C.B. (1977), *Computer Methods for Mathematical Computations*, Prentice-Hall, Englewood Cliffs, N.J.
15. Guo, M., Luz, L., Sheng, L. and Yu, M. (2018), “The Day After Tomorrow: Evaluating the Burden of Trump’s Trade War”, *Asian Economic Papers*, Vol. 17 No. 1, pp. 101–120.
16. Hadrich, J.C., Janzen, J., Etienne, X.L. and Yeager, E. (2018), “Agricultural credit and the changing landscape of American agriculture”, *Agricultural Finance Review*, Vol. 78 No. 4, pp. 394–395.

17. Harl, N.E. (2006), “Bankruptcy reform and the effects on chapter 12 bankruptcy for farmers (and fishermen)”, *Agricultural Finance Review,* Vol. 66 No. 1, pp. 7–16.
18. Huffstutter, P.J. (2020), “U.S. farm bankruptcies hit an eight-year high: court data”, *Reuters,* 31 January, available at: https://www.reuters.com/article/us-usa-farms-bankruptcy-idUSKBN1ZT2YE.
19. Jones, C. (2019), “Amid Trump Tariffs, Farm Bankruptcies And Suicides Rise”, *Forbes*, 30 August, available at: https://www.forbes.com/sites/chuckjones/2019/08/30/amid-trump-tariffs-farm-bankruptcies-and-suicides-rise/.
20. Katchova, A.L. and Dinterman, R. (2018), “Evaluating financial stress and performance of beginning farmers during the agricultural downturn”, *Agricultural Finance Review*, Vol. 78 No. 4, pp. 457–469.
21. Key, N., Burns, C. and Lyons, G. (2019), *Financial Conditions in the U.S. Agricultural Sector: Historical Comparisons*, Economic Research Service, United States Department of Agriculture, Economic Information Bulletin No. 211.
22. Langemeier, M. (2018), *Projected Corn and Soybean Breakeven Prices*, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, available at: https://farmdocdaily.illinois.edu/2018/04/projected-corn-and-soybean-breakeven-prices.html.
23. Li, C., He, C. and Lin, C. (2018), “Economic Impacts of the Possible China–US Trade War”, *Emerging Markets Finance and Trade*, Vol. 54 No. 7, pp. 1557–1577.
24. Liu , T. and Woo , W.T. (2018), “Understanding the U.S.-China Trade War”, *China Economic Journal*, pp. 319–340.

25. “National Climate Report for Annual 2019”. (2020), , NOAA National Centers for Environmental Information, State of the Climate, 14 January, available at: https://www.ncdc.noaa.gov/sotc/national/201913.
26. Porter, K.M. (2005), “Phantom Farmers: Chapter 12 of the Bankruptcy Code”, *American Bankruptcy Law Journal*, Vol. 79 No. 3, pp. 729–748.
27. Prager, D.L., Burns, C.B. and Miller, N.J. (2018), “How do financially vulnerable farms finance debt in periods of falling prices?”, *Agricultural Finance Review*, Vol. 78 No. 4, pp. 412–424.
28. Rappeport, A. (2019), “Stung by Trump’s Trade Wars, Wisconsin’s Milk Farmers Face Extinction”, *The New York Times*, 26 April, available at: https://www.nytimes.com/2019/04/26/us/politics/trump-trade-war-wisconsin-dairy.html.
29. Sevastopulo, Demetri and Politi, James . (2019), “Why Democrats don’t want to mention Trump’s (trade) war”, *Financial Times*, 6 May, available at: https://www.ft.com/content/8a1c9f7c-6cc2-11e9-a9a5-351eeaef6d84.
30. Shepard, L.E. and Collins, R.A. (1982), “Why Do Farmers Fail? Farm Bankruptcies 1910–78”, *American Journal of Agricultural Economics*, Vol. 64 No. 4, pp. 609–615.
31. Stam, J.M. and Dixon, B.L. (2004), *Farmer Bankruptcies and Farm Exits in the United States, 1899-2002.*, Economic Research Service, United States Department of Agriculture, Agricultural Information Bulletin No. (AIB-788) , p. 42.
32. Stam, J.M., Dixon, B.L. and Rule, W. (2003), “Sixteen years of chapter 12 bankruptcy: evolution of filing and disposition rates”, *Agricultural Finance Review*, Vol. 63 No. 1, pp. 93–108.
33. Turvey, C.G. (2017), *Inclusive Finance and Inclusive Rural Transformation*, IFAD, available at: https://ssrn.com/abstract=3284470.

34. Turvey, C.G. and Weersink, A. (1997), “Credit Risk and the Demand for Agricultural Loans”, *Canadian Journal of Agricultural Economics/Revue Canadienne D'Agroeconomie*, Vol. 45 No. 3, pp. 201–217.
35. Turvey, C.G., Zhang, X. and Gomez, M. (2020), *The Effects of the 2018-2019 Sino-America Trade War on the Relationship between Chicago and Dalian Soybean Future Price*, Cornell University, 30 January.
36. “USDA Announces Details of Assistance for Farmers Impacted by Unjustified Retaliation”. (2018), *U.S. Department of Agriculture*, 27 August, available at: https://www.usda.gov/media/press-releases/2018/08/27/usda-announces-details-assistance-farmers-impacted-unjustified.
37. Vavra, S. (2019), “Farmer bankruptcies swell to decade high in the Midwest”, *Axios*, 6 February, available at: https://www.axios.com/farmer-bankruptcies-decade-high-midwest-f85721f6-4478-4e5b-b49d-7df88010d7cc.html.
38. Weersink, A., Vanden-Dungen, M.J. and Turvey, C.G. (1994), “Estimating the Demand for Farm Operating and Term Credit”, *Cahiers d’économie et Sociologie Rurales*, Vol. 33, pp. 97–116.
39. Wong, D. and Koty, A.C. (2020), “The us-china trade war: a timeline”, *China Briefing News*, 26 February, available at: https://www.china-briefing.com/news/the-us-china-trade-war-a-timeline/.
40. Yoders, J. (2020), “NOAA Says 2019 Floods Caused $6.2B in Damage, Expects More”, *ENR Midwest*, 29 January, available at: https://www.enr.com/articles/48586-noaa-says-2019-floods-caused-62b-in-damage-expects-more?v=preview.
41. Zhang, W. (2017), “Four Reasons Why We Aren’t Likely to See a Replay of the 1980’s Farm Crisis”, *Agricultural Policy Review*, Vol. 2017 No. 2.

42. Zhang, W. and Tidgren, K.A. (2018), “The current farm downturn vs the 1920s and 1980s farm crises: An economic and regulatory comparison”, *Agricultural Finance Review,* Vol. 78 No. 4, pp. 396–411.