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Abstract

Purpose – The purpose of this paper is to evaluate farm financial stress within the USA over the past 20 years and the agricultural and economic factors which have impacted farm businesses. The effect of the 2005 Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA) on farm financial stress is further evaluated. In particular, Chapter 12 bankruptcies – which can only be filed by farmers – were only a temporary measure until BAPCPA made Chapter 12 a permanent fixture in bankruptcy law.

Design/methodology/approach – Chapter 12 bankruptcy filings from 1997 until 2016 are used as a proxy for farm financial stress. Panel fixed effects models are used to determine relevant factors affecting financial stress for farmers from agricultural and macroeconomic perspectives. Further, models incorporating pre- and post-BAPCPA regimes are utilized.

Findings – The results show that macroeconomic factors (interest and unemployment rates) are strong predictors of farm bankruptcies for farms while agricultural land values are the only consistent strong predictor among the agricultural factors. When evaluating the post-BAPCPA regime, only agricultural land values continue to be a significant predictor of farm bankruptcies. The findings also indicate a dynamic relationship with agricultural land values, where current year values are negatively related but previous year land values are positively related to bankruptcies.

Originality/value – The authors provide an analysis of the post-BAPCPA regime on farm bankruptcies that has not been evaluated within the literature yet. Further, the findings illuminate discussion on a potentially dynamic relationship with financial stress and agricultural land values.

Keywords Financial stress, Farm bankruptcies

Paper type Research paper

Introduction

The increased widespread financial stress from the farm crisis of the 1980s required policy intervention from Congress, which enacted legislation to mitigate the damages to the agricultural sector. This crisis was partially due to a rapid rise in farmland values – largely purchased on credit – followed by a sudden drop in values coupled with high interest rates, easy access to credit, and plummeting net farm incomes. Many farmers experienced financial stress, i.e. they struggled to generate enough cash flow to meet their debt service payments. Prior options of bankruptcy for farms generally required the liquidation of their farmland, a depressed asset at the time, which would result in cessation of operation. With the passage of the Family Farmer Bankruptcy Act of 1986, Chapter 12 bankruptcy became the preferable option for family farms as it helped ease financial stress and allowed for continued operation of their farm following a debt restructuring plan. Chapter 12 was originally set to expire in October 1993 but Congress extended the expiration date 11 times (Harl, 2006). In 2005, the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA) amended Chapter 12 bankruptcy to be a permanent option, allowed for higher debt limits, and implemented less strict income requirements than before.

Trends in declining net farm income, increasing debt use, and stagnating land values are projected to continue beyond 2017 and pose a problem to the agricultural sector

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(Patrick *et al.*, 2016). These factors place financial stress on farms, which may or may not be able to sustain these levels of stress (Briggeman, 2010). The current trends follow a period of rapid appreciation of land values and net farm incomes, which parallels the 1980s farm crisis. While the farm sector debt-to-asset ratio peaked above 20 percent in 1985, debt-to-asset ratios have not been above 15 percent since 1995 which helps illustrate that the magnitude of financial stress today is not as severe as the 1980s farm crisis (Ellinger *et al.*, 2016). One critical difference between the 1980s farm crisis and the current economic climate of the agricultural sector is a farm's ability to seek financial relief through Chapter 12 bankruptcy. The option to file for Chapter 12 bankruptcy changes the farmer-lender relationship with the legal consensus being that the relationship favors the farmer and that this relationship strengthened with passage of BAPCPA (Bromley, 1987; Flaccus and Dixon, 1988; Harl, 2006). While the existence of Chapter 12 bankruptcy affects this farmer-lender relationship, the bankruptcy filing rate for farms has been used as a proxy for financial stress over periods in which bankruptcy laws have not substantially changed (Dixon *et al.*, 2004; Stam *et al.*, 1991).

We provide a quantitative approach to examining factors that affect the financial stress of the agricultural economy with particular interest in the post-BAPCPA climate. Using Chapter 12 bankruptcy filing rates from 1997 to 2016 as our proxy for financial stress, we use panel fixed effects models to evaluate how macroeconomic factors and farm financial sector performance affects farm bankruptcy rates across the USA and the extent to which, if any, BAPCPA has impacted the agricultural sector. Our study utilizes the Agricultural Resource Management Survey (ARMS) to provide regional level estimates of variables which are hypothesized to affect the agricultural sector of the economy. We contribute to the literature by providing a recent analysis of Chapter 12 bankruptcies and the first evaluation of how BAPCPA affects a farm's financial standing. To our knowledge, the most recent econometric analysis utilizing Chapter 12 bankruptcies is Dixon *et al.* (2004) which uses state-level filing rates from 1986 to 2002.

Our findings indicate that macroeconomic factors (interest rates and unemployment rates) have strong, positive influence over farm bankruptcy filing rates while measures of the regional agricultural economy do not appear to have a significant effect except for agricultural land values. The agricultural land values indicate a potentially dynamic relationship as current year values are negatively related to farm bankruptcies but lagged values are positively related to farm bankruptcies. Further, we evaluate the effects of BAPCPA – which made Chapter 12 a permanent fixture in bankruptcy law and increased debt limits and coverage for farmers. Our findings indicate that there is not a significant rise (or fall) in farm bankruptcies post-BAPCPA when controlling for agricultural and macroeconomic factors. However, there does appear to be a regime shift in the relationship between farm bankruptcies post-BAPCPA with respect to the interest and unemployment rates that would suggest these rates are no longer predictive indicators of farm bankruptcies post-BAPCPA. The result for agricultural land values remains post-BAPCPA, although their magnitudes are lessened.

Bankruptcy overview

Modern day bankruptcy began with the Bankruptcy Reform Act of 1978. The Act consolidated the previous Chapters X and XI to form the modern day Chapter 11 bankruptcy, commonly referred to as the reorganization plan. This Act further encouraged Chapter 13 bankruptcy (the wage earner's plan) over the Chapter 7 (liquidation) under the assumption that a Chapter 13 plan would pay more toward creditors and debtors would emerge with better credit afterwards. Previously all states recorded the primary occupation of the filer, but this practice abruptly ended for most states with the 1978 Act thus limiting the ability to effectively track bankruptcies for farmers after 1978.

These particular Chapters (7, 11, and 13) have largely remained the same in terms of their intended targets, although specifics associated with these Chapters have varied over time. Chapter 7 is the liquidation of a filer's nonexempt assets where the proceeds of such assets are used to pay holders of claims (creditors) in accordance with the provisions of the Bankruptcy Code. Chapter 7 is the most common form of bankruptcy across both business and personal filings with 64.3 and 70.0 percent of total filed, respectively, since 1996. Chapter 11 is a reorganization plan for a debtor that allows the filer to continue operations subject to its major creditors' approval of said plan. The filing fees are highest for this option and the most complex of all options since it requires approval of multiple creditors. Chapter 11 is generally used by large corporations and the majority of its filings are by businesses (with businesses representing 88.9 percent of all Chapter 11 filings since 1996), although individuals are permitted to file for Chapter 11. Chapter 13 allows for the restructuring of debts of the filer to be paid out to creditors over a period of time – generally three to five years although this has varied – subject to the filer having a regular stream of income, their level of income, and a limit on their amount of debt. Chapter 13 is predominantly filed by individuals, although there are also businesses which file for Chapter 13.

The Family Farmer Bankruptcy Act of 1986 marked the largest change in bankruptcy law for farmers as a new Chapter in the bankruptcy code was created – Chapter 12 which was modeled after Chapter 13 – and gave farmers four options for filing for bankruptcy. The Act was meant as a temporary measure for Congress to provide financial relief for farmers during the 1980s farm crisis[1] and represented a shift from the previous farm-lender friendly toward farm-debtor friendly (White, 1987). While after the 1978 Act the recording of primary occupation for a filer was generally ended by most states, North Dakota maintained records of primary occupation of filers for all Chapters. Smith (1987) notes that from 1974 to 1980, farm related bankruptcies accounted for only 3.1 percent of all bankruptcies in North Dakota but increased to 11.0 percent between 1981 and 1987. The peak of farming bankruptcies in North Dakota reached 46.6 bankruptcies filed per 10,000 farms in 1987. The rise indicated financial stress within the farming economy and was symptomatic of the need for a new form of bankruptcy designed for farmers.

To qualify for a Chapter 12 filing, a family farmer must pass the debt and income tests. The initial debt test stated that aggregate debts could not exceed $1,500,000 and at least 80 percent of debt arises from a farming operation. The income test required that the farmer receive more than 50 percent of their gross income from farming operations in the preceding tax year. If the tests are passed, a farmer can submit a Chapter 12 plan which could reduce the amount of secured claims to the value of the underlying collateral and pay those claims over three to five years (Dull, 1986). Filing for bankruptcy may reduce the amount owed, extend the payment period, and/or lower the interest rate on existing loans due to the write down of secured debt if the current fair market value is less than the original loan value. O'Neill (2006) lays out the procedures for filing a Chapter 12 bankruptcy.

A farm in financial stress might not file for Chapter 12 bankruptcy if they cannot pass the debt or income tests, or if they are unaware that Chapter 12 is an option for their family business. Under these scenarios, a farm then has Chapters 7, 11, and 13 available to them. Matthews *et al.* (1992) studied all farm bankruptcies in Missouri from 1987 to 1989 and found that the majority of filings were Chapter 7, although Chapter 12 did make up 44 percent of the filings. While farms may file for other Chapters of bankruptcy – and thus we do not have a completely measured value for farm bankruptcies – only farms can file for Chapter 12 which serves as a lower bound estimate for the total number of farm bankruptcies.

Chapter 12 was originally set to expire in October of 1993, but it was subsequently extended by Congress 11 times (Harl, 2006). Chapter 12 became a permanent fixture in bankruptcy law and its coverage expanded with the passage of the BAPCPA of 2005. The 2005 Act increased coverage of Chapter 12 to include family fisherman, who were subject to the same debt and

income tests from the 1986 Act. For family farmers, the percentage of debt arising from farming operations requirement decreased from at least 80 percent to at least 50 percent and the debt limit increased from $1,500,000 to $3,237,000. The debt limit is adjusted for inflation every three years with the limit at $4,031,575 in 2016. The income test, which previously required at least 50 percent of gross income via farming operation in the preceding tax year, was relaxed so that this test could be satisfied if the 2nd and 3rd prior tax years had at least 50 percent of gross income through the farming operation (O'Neill, 2006).

While there are clearly different regimes in bankruptcy law, Figure 1 shows the historical trends for farmer bankruptcies as well as the farming population. Prior to 1979, all farm bankruptcies are tracked as all chapters of bankruptcy filing required the debtor list their primary occupation. Changes in reporting make it infeasible to track every debtor's occupation since 1979 and thus there is a gap in historical bankruptcy rates until 1986 when Chapter 12 serves as a proxy for farm bankruptcies. Because farmers have multiple options to file for bankruptcy, the Chapter 12 bankruptcy rate is a lower bound estimate of financial stress. Research from Dixon *et al.* (2004) indicates the 1987 bankruptcy filings are a result of pent-up demand that likely resulted from farmers anticipating government policy action from the 1980s farm crisis.

Previous economic research

Research on farm bankruptcies is sparse within agricultural economics. Legal scholars have indicated that the immediate effects of Chapter 12, and its subsequent broadening of scope with BAPCPA, transfers wealth from creditors to debtors. The initial effect is that more debtors now have the ability to write down a larger portion of their debt to repay over a longer period of time and at a lower interest rate (Bromley, 1987; Dull, 1986; White, 1987). The short-term benefit to the debtors may not translate to a positive long-term outlook as creditors may leave the market or adapt their loan policies to reduce the risk associated with the creditor (Barry and Lee, 1983; Rucker and Alston, 1987; Jensen, 1989). While legal analyses point out a tilted relationship toward debtors in the short run, a long-run analysis is needed to determine the welfare implications of BAPCPA on the farm economy.

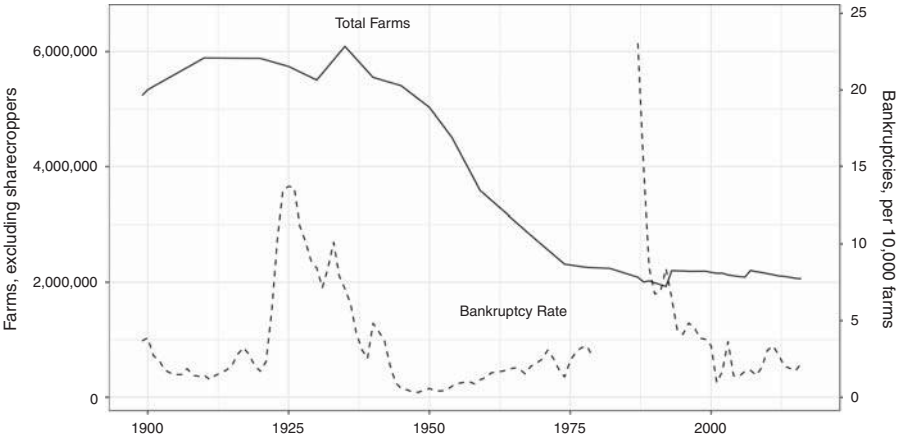

Figure 1.
Historical farm bankruptcies

Source: Data prior to 2003 from Stam and Dixon (2004); from 2003 onward from judicial publications Table F-II and USDA-NASS

One of the first studies to directly evaluate farm bankruptcies is Shepard and Collins (1982), which uses national US farm bankruptcy data from 1910 until 1978 (omitting 1940-1946 due to the Second World War). Their results indicate that non-agricultural bankruptcy rates, real net farm income, farm debt-to-asset ratio, and average farm acreage affect farm bankruptcy rates while they fail to find evidence that government support payments affect farm bankruptcy rates. Their results cannot be extrapolated to a regional conclusion due to limitations of time-series data, which leaves the possibility that variations in government payments across the USA may have an aggregate null effect but is a significant predictor in farm bankruptcies.

The most similar analysis on Chapter 12 filing rates to this paper is from Dixon *et al.* (2004) which uses a state-panel model from 1987 to 2000 with USDA-ARMS data to determine factors affecting Chapter 12 filing rates. They find unemployment rate to be a positive predictor of farm bankruptcies, that several measures of the ability to pay current liabilities (debt-to-asset, debt-servicing ratio, and net farm income), farm characteristics (proportion of revenues from crops, off-farm work, and real value of farmland and buildings), and that government payments are significant predictors in filing rates for a given state over this time period. This analysis was largely confirmed through Stam *et al.* (2003) and Stam and Dixon (2004) at differing levels of analysis although throughout this time period, Chapter 12 was a temporary policy which is an important change which calls for an extension of their panel model to after the 2005 BAPCPA.

Data description

We use data on aggregate bankruptcy filings which are publicly available from the US Courts website the Judicial Business publication F-2 Table of bankruptcy filings for every district starting in 1996 at the annual level for each government fiscal year[2]. In addition, their Bankruptcy Filings publication provides quarterly level filings of all bankruptcy Chapters for each district starting with the quarter ending on March 31, 2001. Figure 2 shows the quarterly number of business bankruptcy filings from 2001 to 2016 where the

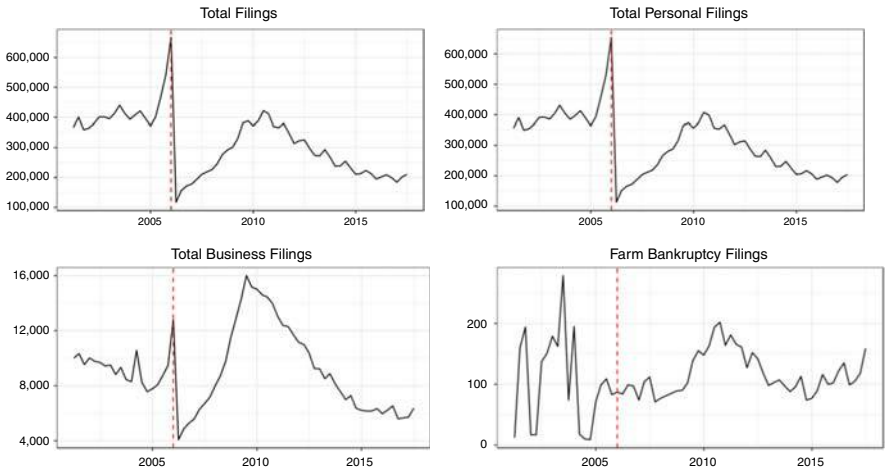

Figure 2.
Bankruptcy filings: total, total personal, total business, and farm bankruptcies

Note: Red vertically dashed line indicates the enactment of BAPCPA, which was the quarter ending on December 30, 2005

Source: Judicial business publications Table F-2

vertical striped line indicates the quarter when BAPCPA began applying to bankruptcy filings, which is the quarter ending on December 30, 2005.

Figure 2 shows the effects of the passage of BAPCPA across all types of bankruptcies: personal (non-business), business, and farm bankruptcies (Chapter 12). It is clear that BAPCPA reduced the number of bankruptcy filings for businesses and non-businesses across the USA. It is not as clear that farms had a similarly pronounced decline in filing rates after the passage of BAPCPA because the pre-BAPCPA regime does not exhibit a clear trend in farm bankruptcies.

Although there is substantial temporal variation of farm bankruptcy rates, a regional inspection of farm bankruptcy rates highlights another important aspect of the farm economy (Figure 3). Business and personal bankruptcy filings are public records and every bankruptcy is filed to a district court based on either the business location or primary filer's residence. There are 94 district courts across the USA, of which none of these district courts cross state boundaries. Each state has at least one district and at most four districts. There is variation of law, policies, and judge tendencies across circuits, states, and districts although none of the lower courts can overstep their jurisdiction affords them from the higher courts (Chang and Schoar, 2006).

Factors affecting bankruptcy

While a bankruptcy filing is an individual occurrence which represents a series of events that led to a poor financial position for a farm, our data on bankruptcies are aggregated and not at the farm level. Instead, we utilize regional variables which act as proxies for

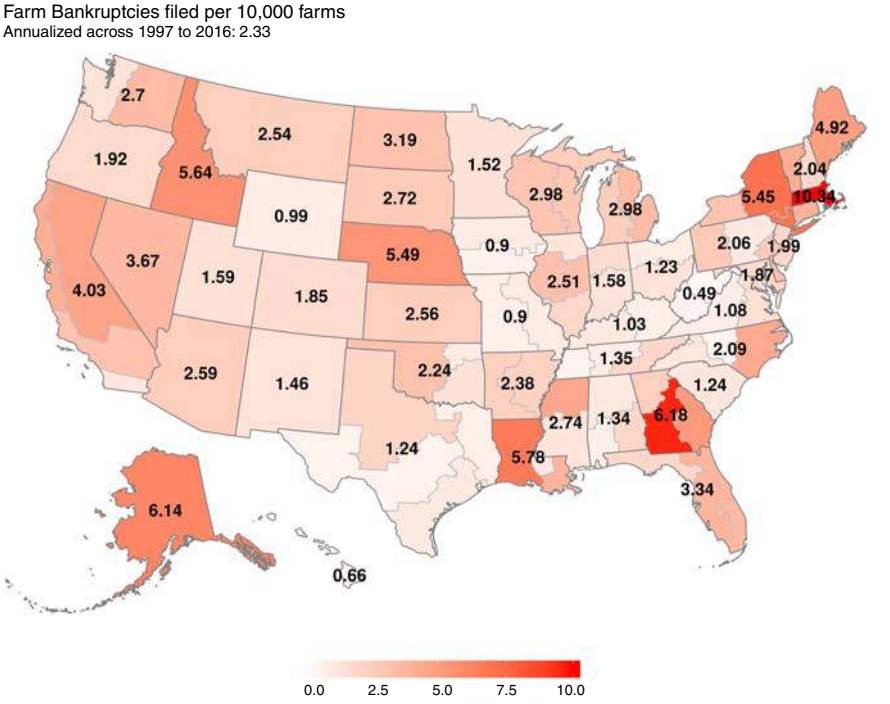

Figure 3.
Farm bankruptcy rates by state and district

Note: Bankruptcy rates are shown as a number for each state while shading indicates bankruptcy rate at the district level

the financial conditions that the average farm faces. Our two regional aggregations are state and district level. We group these variables into agricultural factors and macroeconomic factors in order to distinguish the degree to which policy makers could affect farm bankruptcy rates. Our dependent variable is the Chapter 12 filings for a region divided by the number of farms within the region for that year multiplied by 10,000 for ease of interpretation. We use the USDA ARMS to estimate the number of farms in a region. Table I shows summary statistics for all variables in the analysis and all financial values are converted to real 2015 dollars using the GDP deflator to account for inflationary issues.

Agricultural factors

ARMS is a comprehensive survey on financial characteristics on farms across the USA that is conducted by the Economic Research Service and National Agricultural Statistics Service (NASS) beginning in 1996. ARMS is a non-random annual survey sent to approximately 30,000 farms in the USA, although this varies across years. The survey utilizes a multi-phase, multi-frame, stratified, probability-weighted sampling design. The USDA selects farms into ARMS with the goal of constructing a nationally representative population of farms. Part of the survey design of ARMS is that certain variables are calibrated to match official state level estimates (e.g. acreage, number of farms, total harvest, etc.).

We utilize ARMS to calculate regional values for average acreage per farm, average farm assets, average net farm income, average government payments received, average debt-to-asset ratio, average working capital to expense ratio, average debt-servicing ratio, and average share of household off-farm income to total income. Each of these statistics are evaluated at the region's weighted median value where the weights are provided by NASS and account for the

	State		District		
	Mean	SD	Mean	SD	Source
Farm bankruptcy rate (per 10,000 farms)	2.904	3.868	3.609	15.283	Table F-2
Non-Ag bankruptcy rate (per 10,000 establishments)	54.55	61.65	53.233	51.321	Table F-2 and CBP
Consumer delinquency rate	2.50%	1.79%	–	–	FDIC Call Reports
Agricultural delinquency rate	2.49%	2.59%	–	–	FDIC Call Reports
Unemployment rate	5.60%	1.95%	5.82%	1.99%	Bureau of Labor Statistics
Value of agricultural land (per acre)	$3,638	$3,302	–	–	USDA June Area Survey
Acreage of operation (per farm)	124	138	112	117	ARMS
Total assets (per farm)	$517,012	$247,971	$546,003	$956,450	ARMS
Net farm income (per farm)	$5,320	$7,132	$8,923	$105,316	ARMS
Share of government payments to gross cash farm income (per farm)	1.23%	3.51%	1.30%	4.07%	ARMS
Debt-to-asset ratio (in percent)	1.257	3.117	1.325	3.42	ARMS
Working capital to expense (in percent)	38.46	45.86	43.52	79.37	ARMS
Debt service ratio (in percent)	0.559	4.716	1.118	16.364	ARMS
Ratio of household off-farm income to total income (in percent)	0.986	0.139	1.02	1.8	ARMS
Share of farmers with bachelor's degree	25.20%	11.00%	25.00%	13.40%	ARMS
1-year interest rate	2.46%	2.20%	–	–	FRED
10-year interest rate	3.97%	1.47%	–	–	FRED

Notes: Farm values are the mean of the region of interest where each region's value is based on a median estimate of the variable from ARMS. Further, interest rates do not vary by region and represent the mean and standard deviation from 1997 to 2015

Table I.
Descriptive statistics for 1997-2015

farm's probability of selection into the survey and are calibrated to match other official USDA estimates. We choose median values to minimize the impact of outlier farms since we are interested in the financial standing of what an average farm faces[3]. We supplement our ARMS data with the June Area survey, conducted by USDA-NASS, to obtain estimates of the value of an acre of agricultural land since this is not found in ARMS.

The ARMS weights are not designed to represent a smaller geographical scale than the state level. If within-state sampling for ARMS approximates a random sample conditioned on the use of survey weights, then creating district-level estimates of agricultural conditions is a justified method with the added note that there is an inherent loss of precision for these measurements[4]. However, if there is within-state correlation in ARMS observations that is not accounted for with the survey weights, then it is not clear what district-level estimates of the calculated statistics represent. If this is the case, then it is appropriate to use state level estimates of the statistics from ARMS in an analysis. We do not have enough information on the sampling procedures of ARMS from 1996 to 2015 to determine if there is within-state bias with the ARMS observations. We therefore utilize state-level ARMS estimates as a robustness check on the assumption that within-state sampling for ARMS approximates a random sample.

In addition to utilizing state-level values, we also leverage the sampling design of ARMS for more precise district-level values. ARMS consistently over-samples 15 core states[5]. Because ARMS over-samples these states, it is more likely that the sampling scheme within districts of these states more closely resembles a random sampling and should reflect more precise estimates of our agricultural variables of interest. This subset of the USA reflects the majority of agricultural production, which can alleviate issues involved with the modifiable areal unit problem that may arise due to the arbitrary distinction of the political boundaries for states.

Macroeconomic factors

The Federal Deposit Insurance Corporation (FDIC) provides Reports of Condition and Income (Call Reports) and Uniform Bank Performance Reports for FDIC-insured institutions. These data provide total loan amounts for an institution and further break this down by agricultural production loans and include the value of delinquent loans. We calculate annual state-level values of agricultural and non-agricultural loan delinquency rates by aggregating bank level data for each state and for each year. The resulting value indicates a yearly measure of both agricultural and non-agricultural delinquency rates of all FDIC financial institutions within a state[6]. We utilize both the current and lagged values of these variables as Briggeman *et al.* (2009) indicates that financial stress has a build-up effect and may be leading indicators of bankruptcies.

Annual data on one-year and ten-year treasury constant maturity rates are acquired from the Federal Reserve Economic Data that is maintained by the Federal Reserve Bank of St Louis. The one-year rates proxy the cost of financing short-term projects for a farm while the ten-year rates approximate the cost for long-term projects (Schnitkey, 2016).

The Bureau of Labor Statistics provides annual level values of employment and unemployment for each county through their Local Area Unemployment Statistics program. We aggregate these county-level values to the regional level and calculate each region's unemployment rate to create a macroeconomic variable that also has regional variation. We consider this a macroeconomic variable because it is mainly affected by factors outside of the agricultural sector.

And finally, we utilize the bankruptcy filings data and the Census Bureau's County Business Patterns (CBP) data to calculate the bankruptcy filing rate for non-agricultural businesses at the district level. CBP provides data on the number of establishments at the county level and further breaks this down by industry classification. We use

the total business filings of Chapters 7, 11, and 13 for each region and divide this by the non-agricultural establishments in the region as another way to proxy for financial health of the region unrelated to agriculture.

Panel models

Previous econometric models for analyzing Chapter 12 (Shepard and Collins, 1982; Dixon *et al.*, 2004; Stam and Dixon, 2004) generally use the filing rates for a particular region to correct for differences in farming population across time and space. We follow this convention and adopt a linear panel model as our baseline for understanding farm bankruptcies:

$$y_{it} = \alpha + \alpha_i + \beta_1 BAPCPA_t + \beta_2 X_t + \beta_3 X_{it} + \beta_4 AG_{it-1} + \varepsilon_{it}$$

where i denotes the region (district or state) and t denotes the time period. The dependent variable, y_{it}, is the number of bankruptcies divided by the number of farms (as measured through ARMS) which is meant to proxy financial stress for farms. There is substantial regional and temporal variation in the variable, which helps motivate the choice of explanatory variables we use to better examine the factors affecting financial stress. Further, because of the sampling design of ARMS we subset our data for each of these regressions to only the core states (with the highest values of agricultural production) to reduce potential sampling design errors.

The α parameter is an overall constant for the model; α_i is a regional fixed effect used to control for unobservable fixed effects which are time invariant; $BAPCPA_t$ is a dummy variable taking the value of 1 for the post-BAPCPA period aiming to test if BAPCPA has a significant effect on farm bankruptcy rates as well as its transitory and permanent effects; X_t is a set of macroeconomic controls which affect farm bankruptcy rates; X_{it} are non-agricultural control variables related to the macro-economy which vary across time and regions; and AG_{it-1} are agricultural-related variables which proxy a region's farm financial climate. See the preceding section on data for details on the covariates in each set.

The agricultural variables are lagged one year, meaning that the bankruptcy filings across October 1996 to September 1997 are explained by ARMS observation for 1996, which explain farm financial characteristics from January 1996 to December 1996. Lagging the agricultural variables by one year is done for three reasons: income for a particular year is anticipated toward the end of the year when a farmer may decide to file for bankruptcy, lumpiness in farm incomes imply that the previous year's income is a better proxy of the capital stock of a farm, and it produces a better fit. And finally, because Davies (1996) indicates the dynamic relationship of agricultural land values over time we include current year and previous year values for agricultural land to further examine these effects.

Of additional focus is BAPCPA and its potential impact on the agricultural sector's financial performance as well as its transitory and permanent effects. In the above specification, the coefficient β_1 will show any mean difference in the filing rates for farms after the passage of BAPCPA in 2005, controlling for agricultural and macroeconomic factors. This is one way to evaluate how BAPCPA affected farms and can be interpreted as the overall long-run effect of BAPCPA's effect on bankruptcies since pre-2005 Chapter 12 was only a temporary policy. However, there may be a myriad of effects that BAPCPA had on farms affecting the bankruptcy filing rate both positively and negatively, which may result in an aggregate null effect. To check for this possibility, we interact the $BAPCPA_t$ variable with each of the other control variables to further evaluate how BAPCPA may have had other effects on farms as follows:

$$\begin{aligned} y_{it} = {} & \tilde{\alpha} + \tilde{\alpha}_i + \tilde{\beta}_1 BAPCPA_t + \tilde{\beta}_2 X_t + \tilde{\beta}_3 X_{it} + \tilde{\beta}_4 AG_{it-1} + \gamma_2 BAPCPA_t \times X_t \\ & + \gamma_3 BAPCPA_t \times X_{it} + \gamma_4 BAPCPA_t \times AG_{it-1} + \tilde{\varepsilon}_{it} \end{aligned}$$

The interaction coefficients, we denote as γ, reflect the change in a marginal effect due to Chapter 12 becoming a permanent bankruptcy option due to BAPCPA. If the transitory and permanent effects of a particular variable are identical – and assuming pre-BAPCPA represents only the transitory effects and post-BAPCPA the permanent effects – this would lead to a null finding in the interaction coefficient. Or in other words, there would be no change in the marginal effect of X on Y across regimes and so there would be no change due to BAPCPA occurring (i.e. $\beta_2 = \tilde{\beta}_2$). This change from temporary to permanent coincides with increases of debt limits and relaxing of income requirements for Chapter 12 filings, which confounds the interpretation of the BAPCPA coefficient. While we largely interpret the effects of BAPCPA to the change to a permanent option, it may be that the filing requirement changes contribute to this effect.

Results

Table II shows regression results for the first panel model with districts in the first column, districts from only the core states in the second column, state-level variables in the third column and state-level variables for only the core states in the fourth column. Across all

	District level		State level	
Farm bankruptcy rates per 10,000 farms	All states	Core states	All states	Core states
Post-BAPCPA dummy	−1.059 (1.198)	−0.834* (0.440)	−0.388 (0.437)	−0.408 (0.312)
1-year interest rate	0.274 (0.259)	0.780*** (0.236)	0.483*** (0.117)	0.541*** (0.104)
10-year interest rate	−0.612 (0.514)	−0.849*** (0.322)	−0.313 (0.239)	−0.512** (0.205)
Non-Ag bankruptcy rate (per 10,000 establishments)	0.001 (0.004)	0.004 (0.006)	0.0002 (0.002)	−0.006 (0.007)
Consumer delinquency rate	−0.923*** (0.307)	−0.179 (0.169)	−0.499*** (0.141)	−0.282 (0.198)
Lagged consumer delinquency rate	0.896** (0.443)	0.277 (0.233)	0.294*** (0.095)	0.165 (0.208)
Agricultural delinquency rate	0.389 (0.341)	−0.094 (0.375)	0.142** (0.067)	0.367*** (0.117)
Lagged agricultural delinquency rate	−0.576 (0.424)	0.113 (0.377)	−0.107 (0.081)	−0.189 (0.254)
Unemployment rate	0.303 (0.193)	0.366** (0.155)	0.580*** (0.140)	0.460** (0.204)
Value of agricultural land (per acre) ($1,000s)	−2.331*** (0.848)	−2.157*** (0.588)	−1.721 (1.058)	−1.400** (0.633)
Lagged agricultural land value ($1,000s)	2.151*** (0.831)	2.076*** (0.473)	1.868* (0.999)	1.744*** (0.469)
Acreage of operation	0.009 (0.006)	0.007** (0.003)	0.005 (0.001)	0.010*** (0.002)
Total assets ($100,000s)	0.468*** (0.081)	0.314 (0.311)	−0.165 (0.139)	−0.493*** (0.109)
Net farm income ($100,000s)	−2.494*** (0.563)	−3.933 (3.234)	−2.584 (2.836)	−1.270 (5.349)
Share of government payments to gross cash farm income from	0.017 (0.048)	−0.033 (0.065)	−0.077 (0.051)	−0.055 (0.057)
Debt-to-asset ratio	−0.006 (0.233)	0.358 (0.271)	0.176** (0.084)	−0.003 (0.062)
Working capital	−0.015 (0.010)	0.004 (0.005)	0.003 (0.005)	0.004 (0.003)
Debt service ratio	−0.024 (0.030)	−0.002 (0.007)	−0.003 (0.038)	−0.073** (0.029)
Ratio of household off-farm income to total income	−0.291*** (0.106)	3.064 (2.547)	−1.314 (1.744)	3.820* (2.205)
Share of farmers with bachelor's degree	−0.070 (0.059)	0.081** (0.034)	0.008 (0.015)	−0.033 (0.025)
Number of observations	1,740	700	960	300
Adjusted R^2	−0.015528	0.12822	0.11169	0.28585

Table II.
Panel data models for farm bankruptcy rates

Notes: All standard errors are clustered at the state level. District-level models aggregate data at the district level, while state level models aggregate data at the state level; either all states were used in the estimation or only the 15 core states with highest value of agricultural production. *,**,***Significant at 0.1, 0.05 and 0.01 percent levels, respectively

models, restricting the analysis to only the core states from ARMS improves the fit of the models per the adjusted R^2. The sharp increase from a negative adjusted R^2 from the model using all districts to adjusted R^2 above 0.12 using only the districts within the core states suggests that the ARMS sampling design has a poor fit for proper inference at regional levels below the state. However, this assertion is tempered by the increase in model fit from the state-level regressions which restricts the sample to only the core states.

The only significant predictor of farm bankruptcies across all four specifications is the lagged value of agricultural land which has a negative relationship with bankruptcy rates. The current value of agricultural land is negatively associated with bankruptcy rates across all regressions and statistically significant for all but the state-level regression. This relationship of near term negative association but lagged positive association is a similar result to Davies (1996) which posits that the relationship between agricultural land value and financial stress may evolve dynamically due to differing managerial strategies under times of rising or falling land values. Since our data are not at the farm level, we are unable to comment on managerial strategies that farmers use but can acknowledge that these results appear to highlight a potentially dynamic relationship between agricultural land values and farm bankruptcies.

If one ignores the district-level model using data from all states on the basis that ARMS may not accurately define the farm conditions at the district level, then the one-year constant maturity interest rate and regional unemployment rate are positive and significantly related to farm bankruptcies. The one-year interest rate is positively associated with bankruptcy rates, which is an intuitive result that increasing the cost of near-term borrowing will have adverse effects on farms' ability to repay current debts. However, the ten-year constant maturity interest rate is negatively associated with bankruptcy rates and statistically significant with the core states subset, which indicates that farms become less likely to file for bankruptcy as long-term debt costs rise[7]. The one-year interest rate approached a zero bound during 2009-2014 while the ten-year interest rates continued a gradual decline, which may further explain these results.

We view the positive association between regional unemployment rates and bankruptcy rates as reflecting the local labor market conditions which proxy for regional economic performance and find this result intuitive and clear. As local economies fare worse, the likelihood of a farm experiencing these effects increases which would then result in higher levels of economic stress. A one percentage point increase in the unemployment rate leads to 0.366 more farm bankruptcies per 10,000 farms at the district level and 0.46 at the state level for the core states subset, which is almost a 13 percent increase in bankruptcies. In our sample, the unemployment rate ranges from 2.06 to 14.9 percent with a standard deviation of 1.9 percent.

The delinquency rates, which are for consumer loans and agricultural loans for the current and lagged period, have mixed results across the specifications. The agricultural delinquency rates do not appear to have a significant relationship with the agricultural bankruptcy rate with the exception of the current value at the state level showing a positive relationship. The consumer delinquency rate has consistent signs across both the current (negative) and lagged (positive) values, although the statistical significance is mixed.

Among the null findings consistent across the district and state-level regressions of Table II are for the non-agricultural bankruptcies, government payments, and working capital to expense ratio. Our finding that the non-agricultural bankruptcy rates do not affect farm bankruptcy rates is in conflict with the results of Shepard and Collins (1982). However, their analysis is based on time-series data at the national level while we are able to exploit cross-sectional variation in our panel setting. This result appears to indicate independence of the financial stress in the agricultural sector to that in the rest of the economy, controlling for interest rates and unemployment rates, which is of policy importance for those concerned with farm bankruptcies.

While only two variables have consistent insignificant effects across all specifications, the majority of the agricultural variables are null findings within these regressions with the exception of agricultural land variables. We emphasize that our agricultural measures are at the regional level and not at the farm level, therefore these results may be due to data limitations. While it may be the case that government payments, for example, are a strong predictor that a particular farm will file for bankruptcy, it is not the case that these regional indicators have predictive power for bankruptcy rates. While this result may seem unexpected, we find this to be helpful for policymakers in terms of targeting particular areas of the farm economy to alleviate financial stress. Targeting regional agricultural factors may not result in improvements in the financial stress levels of farms insofar as financial stress is measured through bankruptcies. Our findings show that fewer agricultural variables have significant impacts on bankruptcy rates than agricultural factors such as debt-to-asset ratio, net farm income per farm, and proportion of government payments to total net farm income found to have significant impacts in Dixon *et al.* (2004).

An additional emphasis with Table II is that Chapter 12 has been both a temporary and a permanent measure across the years of interest. This is problematic for disentangling transitory and permanent effects from having a chapter of bankruptcy available to farmers. To the extent that the passage of BAPCPA signals the change from transitory effects to permanent, we turn to interacting all covariates with the post-BAPCPA dummy to evaluate which variables may have disproportionate transitory and permanent effects. The results are only presented for the core states subset due to the better fit of models.

BAPCPA results

Table III shows the results of the models which also interact the passage of BAPCPA with the main variables of interest. The first and third columns represent the non-interacted effects of each variable, which would be the transitory effects of Chapter 12. The second and fourth columns are the interaction terms of the main variables with the post-BAPCPA dummy, which represent the permanent effects of farmer bankruptcy post-BAPCPA. A Wald test that the interaction terms are not jointly different from zero is strongly rejected across both the district and state-level regressions, which would indicate that there are both transitory and permanent effects due to Chapter 12 legislation that can be identified.

In the previous results for the models without interaction terms, the variables which have consistently significant impacts on bankruptcy rates are the one-year interest rate, unemployment rate, and agricultural land values. Evaluating these variables from the pre- and post-BAPCPA context illustrates that the one-year interest rate and unemployment rate have had inverse impacts as both are positively related to bankruptcy rates prior to BAPCPA yet negatively related post-BAPCPA. Their aggregate effects are both positive in model 1, which captures a mixture of the transitory and permanent effects. The post-BAPCPA effects (which can be calculated as $\tilde{\beta}+\gamma$) across the interest rates and unemployment rates do not significantly differ from 0 for either the districts or state regressions (we use an F-test for the $\tilde{\beta}+\gamma=0$ restriction for each of the independent variables and all F-statistics are less than 1.6). Of interest, the post-2005 period experienced elevated unemployment rates and the Federal Funds Rate pushed interest rates toward the zero bound while much of the farming economy fared well with high net farm incomes. However, the mechanism for interest and unemployment rates no longer having a statistically significant effect on farm bankruptcies post-BAPCPA cannot be identified within our model and is beyond the scope of this paper.

Across both specifications in Table III, the agricultural land value coefficients have the same sign for both district and state-level regressions based on the BAPCPA interaction. The pre-BAPCPA regime coefficients are not significantly different from zero – with the exception of current value based on the district level – while the post-BAPCPA $(\tilde{\beta}+\gamma)$ effects are all statistically significant (all F-statistics are greater than 5.2). Further, a

	District level, core states		State level, core states	
	Main variables	Interaction terms with post-BAPCPA dummy	Main variables	Interaction terms with post-BAPCPA dummy
Post-BAPCPA dummy	9.142 (9.993)	–	2.570 (5.262)	–
1-year interest rate	0.455* (0.237)	−0.477 (0.461)	0.609*** (0.222)	−0.418 (0.355)
10-year interest rate	−0.206 (0.653)	−0.122 (0.861)	−0.661*** (0.248)	0.376 (0.511)
Non-Ag bankruptcy rate (per 10,000 establishments)	−0.006 (0.009)	0.043** (0.020)	−0.008 (0.008)	0.007 (0.013)
Consumer delinquency rate	0.149 (0.703)	−0.495 (0.783)	−0.657 (0.549)	0.479 (0.510)
Lagged consumer delinquency rate	−0.753 (0.619)	0.957 (0.669)	−0.453 (0.433)	0.661* (0.351)
Agricultural delinquency rate	−1.301 (1.297)	1.516 (1.357)	0.082 (0.333)	0.381 (0.352)
Lagged agricultural delinquency rate	0.452 (0.663)	−0.531 (0.809)	0.027 (0.323)	−0.297 (0.344)
Unemployment rate	0.667* (0.369)	−0.759** (0.375)	1.062*** (0.403)	−0.967** (0.457)
Value of agricultural land (per acre) ($1,000s)	−2.119*** (0.760)	0.386 (1.110)	−1.468 (0.738)	−0.121 (1.004)
Lagged agricultural land value ($1,000s)	1.307 (0.905)	0.074 (1.206)	1.443 (0.970)	0.145 (1.323)
Acreage of operation	0.005 (0.004)	−0.010** (0.005)	0.011*** (0.003)	−0.010 (0.007)
Total assets ($100,000s)	0.307 (0.360)	−0.034 (0.294)	−0.642*** (0.111)	0.430*** (0.161)
Net farm income ($100,000s)	−4.065 (4.458)	1.268 (5.549)	1.332 (6.531)	−4.055 (7.840)
Share of government payments to gross cash farm income	−0.014 (0.086)	0.114 (0.126)	−0.034 (0.074)	0.115 (0.109)
Debt-to-asset ratio	0.362 (0.271)	−0.290** (0.147)	0.033 (0.058)	−0.573*** (0.186)
Working capital	−0.001 (0.009)	0.005 (0.008)	−0.004 (0.006)	0.006 (0.008)
Debt service ratio	−0.005 (0.009)	0.022 (0.078)	−0.060*** (0.022)	0.204 (0.131)
Ratio of household off-farm income to total income	3.302 (2.760)	−5.192 (5.979)	5.597* (3.324)	−1.173 (5.453)
Share of farmers with bachelor's degree	0.124** (0.051)	−0.110* (0.061)	−0.021 (0.026)	−0.002 (0.027)
Number of observations	700	–	300	–
Adjusted R^2	0.15638	–	0.32811	–

Notes: All standard errors are clustered at the state level. *,**,***Significant at 0.1, 0.05 and 0.01 levels, respectively

Table III. Panel data models for farm bankruptcy rates with interaction terms

potentially dynamic relationship between the current land values (negative association) and the lagged land values (positive association) is exhibited on bankruptcy rates as seen in Table II across pre- and post-BAPCPA periods. The coefficients are of similar magnitudes yet in opposite directions, which would suggest that stagnant land values from year-to-year would have a null effect on the bankruptcy rate. A further implication that a rise in lagged land values along with a fall in current land values would put upward pressure on bankruptcy rates. This dynamic relationship merits more research into modeling how land values changes over time affect the farm bankruptcy rate.

Conclusion

This paper examines the factors which affect the financial stress of a farm as well as addressing a new question: how does BAPCPA affect farm's financial stress? Using Chapter 12 bankruptcy filings from 1997 to 2016, we find that it is largely macroeconomic factors (interest rates and unemployment rate) which affect the financial position of farms although land values appear to also affect farm bankruptcy rates among the agricultural factors. From a policy perspective, our findings show that policy makers which aim to improve

agricultural indicators (debt-to-asset ratio, working capital to expense ratio, government payments, etc.) as a way to alleviate financial stress should not expect to see a corresponding drop in farm bankruptcies. However, our results are only at the state and district level and do not extend to the farm level, whereby there may be specific farms which may have financial stress lessened due to a change in one of the agricultural indicators that we could not find evidence for an association with bankruptcy filing rates.

Our results also indicate that agricultural land values are highly related to bankruptcy filing rates and that this relationship is dynamic. Our models only use a current and lagged value, but it may be the case that there is a more complex relationship with the two than we posit. Further research is merited in evaluating how the land values, which make up over 80 percent of a farm's equity, can affect a farm's likelihood of filing for bankruptcy. It appears the relationship is dynamic in that a rise and fall of land values in consecutive periods indicates increased bankruptcies due to the positive and negative coefficients, respectively.

Our model fits appear to indicate that regional ARMS analysis may not be appropriate below the state level unless the core states are utilized. The sampling design of ARMS is complex and does not necessarily conform to the political boundaries of counties. Therefore, there should be caution for analysts when attempting to utilize ARMS for sub-state regional issues.

There does appear to be a regime shift in the relationship between farm bankruptcies post-BAPCPA with respect to the interest and unemployment rates that suggests these rates are no longer predictive indicators of farm bankruptcies post-BAPCPA. The result for agricultural land value remains post-BAPCPA, although its magnitudes are lessened. However, many of the predictors have in both periods indicating that farmers are likely taking advantage of Chapter 12 regardless of its status as temporary or permanent. Making farmers aware of Chapter 12 helps them to increase their options in reducing financial stress for their farms.

As the farm sector has recently experienced downturn with declining farm incomes and land values, it is important to note a concern that financial distress and bankruptcy rates will be on the rise. A prolonged period of low commodity prices and falling land values may increase the distress of very indebted farmers who may have taken on more debt to expand their operations. Bankruptcies seem to be a lagging indicator of financial stress and indeed there has been a small uptick in bankruptcy rates in the last quarter of 2016. However, the farm sector seems to still have strong equity positions which mitigate the effects of the current downturn so farm bankruptcy rates are still near historic lows.

Notes

1. Farm real estate values were high, farm products brought relatively good prices, interest rates were high, and farms tended to be highly leveraged. Shortly thereafter, the bubble burst on the farm economy, with farm product prices dropping sharply and real estate values tumbling but with interest rates remaining high and credit becoming increasingly hard to obtain. Many farms faced significant financial difficulty.
2. The US Government's fiscal year begins the fourth quarter of the calendar year that starts on October 1. By example, the Judicial Business F-2 data begin with the 12-month period prior to September 30, 1997 and represents the 1997 fiscal year.
3. As a referee suggested, the tails of the distribution for farmers may be of interest for an analysis on financial stress since that may better represent a farmer at the margin of filing for bankruptcy. We leave this for further research.
4. This loss of precision can also be thought of as measurement error for some of the independent variables. This would lead to attenuation bias where the estimated coefficients in a regression would be biased toward 0. The implication here is that one would find fewer significant coefficient estimates than a sample with no-measurement error.

5. Core states in ARMS are chosen due to their high values of agricultural production, they are: Arkansas, California, Florida, Georgia, Illinois, Iowa, Indiana, Kansas, Minnesota, Missouri, Nebraska, North Carolina, Texas, Washington, and Wisconsin.
6. Financial institutions in FDIC call reports only report at the headquarter level for an institution. This may be problematic for large national banks which make loans across many states. As sensitivity analysis, we remove the top 100 banks as measured through total value of assets to compute state-level agricultural delinquency rates. Results are unaffected as the two measures are highly correlated (0.999).
7. Models with only the one-year or ten-year interest rates did not impact coefficient estimates for other variables, however, the included interest rate coefficient is a positive and statistically significant value for either one-year or ten-year. This result is likely due to omitted variable bias and highlights their dynamic relationship.

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