Financing Constraints and Access to Credit in Post Crisis Environment: Evidence from New Farmers in Alabama

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Abstract

We use survey data to study the degree to which new farming operations in Alabama were financially constrained in the post crisis period. Next, we control for farmers' self-selection out of the credit market and identify which farmers were able to secure loans during the 2009-2010 period. The results show that new farmers, who started any part of their operation after 2005, were financially constrained, but there was no evidence that their financing constraints were affected by the 2008 financial crisis. As expected, we find that lending was collateral driven, although lenders also considered farmers' profitability and cash flows.

Keywords: financing constraints, access to agricultural credit, new farmers

JEL Classification: G31, Q12, Q14

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Financial market crises translate into limited access to credit with negative consequences for all producers including those in agriculture. We study how the 2008 crisis affected agricultural producers' access to credit. Agricultural banks were less affected because they are small compared to non-agricultural banks. Since previous financial crises have affected agricultural lenders significantly, this time they were in a better position to manage risks (Briggeman et al., 2009; Ellinger, 2009). Nationwide, agricultural sector profitability peaked in 2008 but has decreased since. Consequently, while the share of problem loans of agricultural lenders remains less than 50% of that of non-agricultural banks, delinquencies have been increasing (Briggemann, 2011, Ellinger, 2011). Increased delinquency rates typically lead to elevated collateral requirements with a potential to worsen access to credit for agricultural producers, especially among more vulnerable groups (Briggeman and Zakrzewicz, 2009).

This paper sets out to determine the impact of the financial crisis on access to credit for new farming operations and to determine which farmers got credit in the post crisis environment. The existence and magnitude of credit constraints for agricultural producers are non-negligible. Nationwide, Briggeman et al. (2009) estimate that the value of production is 3% lower in credit-constrained farm sole proprietorships compared to those that are not credit-constrained. Credit constraints have also been found in agricultural cooperatives and shown to affect land values (Chaddad et al, 2005; Mishra et al., 2008)

If the financial crisis has affected farmers' ability to borrow, then new operations should be most affected, since they typically lack capital, experience, or both. Even with the introduction of special support programs, beginning farmers continue to face production and

financing challenges and remain disadvantaged relative to the general farmer populations.[i] Previous studies have found that new operations are financially constrained and that, for younger (and high debt) farmers, the financial constraints are affected by the business cycle (Barry et al, 2000; Bierlen and Featherstone, 1998). This group is most vulnerable because banks elevate collateral requirement when delinquencies are on the rise and new farmers typically have less assets to offer as collateral. Moreover, even when lenders make lending decisions based not on collateral but on projected performance, younger farmers are still at a disadvantage because they have lower return on assets compared to more established operations (Mishra et al., 2009).

Even prior to the financial crisis, farmers in Alabama, especially small sole proprietors, were financially constrained and used off farm spousal income to invest on the farm (Hartarska and Mai, 2008). In this paper, we use survey data collected in the fall of 2010 from new operations in Alabama to study the degree to which new operations were financially constrained during the post crisis period and to identify the factors affecting access to credit in the 2009-2010 period.

The remainder of the paper is organized as follows. Section 2 presents the conceptual framework and empirical specifications. Section 3 briefly describes the data. Section 4 summarizes the results. Conclusions are offered in Section 5.

2. Analytical framework and empirical specifications

The analysis consists of first establishing if new operators have financing (or liquidity) constraints and whether these constraints have become more severe in the post crisis period. Next, we identify the factors affecting farmers' ability to obtain credit, in order to gain insights into possible ways to alleviate existing financing constraints.

The first part of the analysis is based on the literature on asymmetric information in credit markets. According to this literature, in the presence of high transaction costs and asymmetric information, loans are either rationed or available at a premium (Jensen and Meckling, 1976; Stiglitz and Weiss, 1981). In such circumstances, external and internal finance are no longer substitutes and investment in firms facing high information costs, such as most new farming operators, is constrained by the availability of internal funds (Myers and Majluf, 1984). Since financial constraints do not affect all farmers uniformly, the extent of effective financing constraints that different operators face provides information on the ability of the financial system to cater to their financial needs in that time period.

Financial constraints are important in farming because farming is capital intensive and, while farmers do not like debt, many especially newer operations have limited ability to undertake profitable investment with only own funds. The lack of equity markets and seasonality of cash flows makes access to loans crucial and the ability of credit markets to alleviate financing constraints very important. Moreover, limited diversification opportunity and supply shocks lead to large variations in farmers' net worth and profitability further restricting their investment.

The financing constraints approach pioneered by Fazzari et al. (1988) tests for differences in sensitivity of investment to internal funds in firms with different levels of informational opacity by comparing sub-samples defined according to priors that characterize constrained and unconstrained firms (*e.g.*, new and established farms). For each sub-sample, a reduced-form investment equation is estimated where investment is modeled as a function of internal funds and investment opportunities determined from a variety of theoretical perspectives (Hubbard, 1998).[ii] A statistically significant difference in investment sensitivity to internal funds between sub-samples indicates that one group is more credit constrained. Recently, Carreira and Silva (2010)

provided an extensive review of the vast empirical literature on the subject. In particular, they argue that numerous studies find that younger firms are more financially constrained than established firms.

We first estimate a reduced-form (change in) investment equation for the 2008-2010 period for two groups of Alabama operators: *new* (started any part of their operation between 2000 and 2004) and *newest* (since 2005) and test for the difference in sensitivity of investment to cash flows. In this framework, we also test for differences in financing constraints before and after the crisis of 2008 for each group. Following Hartarska and Nadolnyak (2008), investment is modeled as a function of operators' investment opportunity and internally generated funds (typically defined as revenues minus expenses) to which we add change in liquidity since 2008 and controls.[iii] The estimated model is of the form:

$$\Delta\, Investment_i = \beta_0 + \beta_1 Inv\ Opportunity_{\ i} + \beta_2\, Cash\ Flow_i + \beta_3\, Change\ in\ Liquidity\ since\ 2008_i +$$

$$+ \Sigma\beta_K\, Controls_{\ i} + e_i \qquad (1)$$

where Δ *Investment* is the percentage change in the value of Fixed Assets, *Inv Opportunity* is a measure of investment opportunity proxied by the change in the Return-on-assets ratio (ROA), *Cash Flow* is the cash flow measure that proxies for available internal liquidity, *Change in Liquidity since 2008* is a dummy that measures the impact of the 2008 crisis on liquidity and takes the value of one if, after 2008, operators kept larger proportion of cash and liquid assets, compared to before 2008.[iv]

Investment in farms differs from that in firms because, for farmers who own their land, the land is the largest part of fixed investments. Some operators may not be landowners, and landowners may not be working on their farms. The dependent variable measuring change in fixed assets may contain possible measurement error since the survey did not collect data on land

ownership and increase (or decrease) in land value may drive changes in fixed assets. Furthermore, when farmers cannot obtain a loan to invest in fixed assets, they could lease the land, and there will be no change in investment but we argue that even if this is true it will be a dependent variable measurement error which does not lead to biased coefficient estimates.[v]

We also note that the majority of farm operators in Alabama (68 % of all farm sales) are in livestock production (cow and calf) or poultry for which land is a less important capital asset compared to land in row-crop producing regions. In our sample row-crop producers are only four percent. Thus, we include farm operation types as explanatory variables. We also capture variation in land assets size by including farm assets classes at the beginning of the operation. We also control for spatial land value differences by including the average county-level price of land. During the study period, there were no recorded drops in the price of agricultural land values, so possible bias is likely one-sided – increase in the value. Since the possible measurement error is in the left hand side variable, it will be swept away in the error term.

In this class of models, proper measurement of investment opportunities and cash flow (liquidity) is important. Farm operators who do not have investment opportunities would not invest even if they had cash. These two effects must be clearly separated to ensure that the *Cash Flow* variable (liquidity, net worth) is capturing internally generated funds and not investment opportunity to avoid attributing investment's sensitivity to cash flow. To measure available liquidity, we directly ask farmers what percentage of their revenue they keep in liquid assets .

In the literature, investment opportunity is a measure of the expected value of future profits or discounted value of income from 1 extra $ investment. In large firms, this is typically the average *q* which, under certain conditions (Hayashi, 1982), serves as a proxy for marginal *q* or the fundamental q which is measured in various ways (see Bierlen and Featherstone (1998) for

application to agricultural producers). In small firms/farms, investment opportunity is measured by (previous year) employment growth, sales growth, or indicators of current profitability such as return-on-assets or ROA (see Carreira and Silva 2010). We measure investment opportunity with three categories for change in ROA – increase, decrease and no-change as the base. [vi,vii]

Empirical evidence shows that farmers' off-farm investment is affected by entrepreneurial and operation characteristics (Mishra and Morehart, 2001). Since money is fungible within the household, these factors may also affect farm investment. We include controls for entrepreneurial experience and experience in farming prior to starting this operation, whether the operator or the spouse work off farm to capture possible access to external funds, the age of the operation to capture experience, and gender of the entrepreneur to capture differences in preferences for investment. We also include the proportion of income coming from farming to control for hobby farming as well as the proportion of sales coming from various types of farming e.g., livestock (largest group and serving as the base), poultry, specialty crops, government payments, and others.

While panel data would be preferable, such data are too costly to collect, especially given the relatively small population of new operators in Alabama and the difficulty of soliciting financial information, as well as because of large expected attrition due to high percentage of failure of new enterprises. Instead, farmers were asked to provide information for change in the key variables during the period 2008-2010, which compensates partially for the lack of panel data. Nevertheless, we interpret the results cautiously and argue they are valid for the state of Alabama and the study period.

We next determine which farmers were able to overcome their financing constraints and secure loans. To answer this question, we estimate a probit model where the dependent variable

takes the value of one if the farmer received a loan. Since some operators may self-select out of the market if they believed they would not be approved even if they applied, we need to control for farmers' self-selection. Thus, we use a Heckman probit model as described by Van de Ven and Van Pragg (1981). The unobserved relationship is

$$y^*_j = x_j\beta + u_{1j} \quad (2)$$

where y_j^* is the credit received by operators and x includes variables affecting banks' decisions to lend. However, instead of y^*_j, we only observe a binary outcome (received or did not receive loans) which is captured by a probit equation

$$y_j^{probit} = (y^*_j > 0) \quad (3)$$

The dependent variable for operator *j* is observed only if we observe a loan application from that operator. Thus, the selection equation (applied or did not apply for a loan) is

$$y_j^{\ select} = z_j\gamma + u_{2j} > 0 \quad (4)$$

where

$$u_1 \sim N(0; 1)$$

$$u_2 \sim N(0; 1)$$

$$corr(u_1; u_2) = \rho$$

and the Log likelihood for this model is

$$LnL = \sum_{\substack{j\in S \\ y_j\neq 0}} w_j ln\{\Phi_2(x_j\beta, z_j\gamma, \rho)\} + \sum_{\substack{j\in S \\ y_j\neq 0}} w_j ln\{\Phi_2(-x_j\beta, z_j\gamma, -\rho)\} + \sum_{j\neq S} w_j ln\{1 - \Phi(z_j\gamma, -\rho)\} \quad (5)$$

where S is the set of observations for which y_j is observed, $\Phi_2(.)$ is the cumulative bivariate normal distribution function (with mean [0 0]`0), $\Phi(.)$ is the standard cumulative normal, and w_j is an optional weight for observation j.[viii]

The explanatory variables in equation (3) include factors affecting the decision to extend a loan by a lender. This decision is based on evaluation of project profitability, collateral, and borrower credit worthiness. To achieve identification in equation (4), we need at least one instrument in z_j in addition to the explanatory variables in equation (3), otherwise identification would be only by functional form. Such an instrument needs to affect the choice to apply or not to apply for credit (eq. 4) but not lenders' decisions to lend (eq 3). Since farmers who do not believe they can get a credit are less likely to apply, we use self-evaluation for access to credit as an instrument that likely will affect their decision to apply for a loan but should not affect a lender's decision to grant the loan. In particular, we use two instruments: z_1 is a variable measuring farmers' perceived lack of access to credit from banks and financial institutions, and z_2 is a variable measuring farmers' perceived lack of access to credit from the Farm Credit System institutions.

The existence and value of collateral is likely the main determinant for loan approval (Klinefelter and Penson, 2005). Collateral is needed because lenders do not have perfect knowledge of borrower credibility and investment projects. To decrease information asymmetry, in addition to requiring collateral to guard against default, lenders collect information about borrowers and their projects. Boucher et al. (2008) show that asymmetric information can result not only in typical quantity rationing but also in "risk rationing", whereby farmers are able to borrow but only under high-collateral contracts which brings them lower expected well-being. Therefore, farmers' ability to offer collateral will affect their chances to get loans. Since we could not ask farmers what is the value of potential collateral they can offer for a loan, we asked if farmers considered their availability of collateral an *obstacle* to obtaining loans and use this variable in the main probit equation (3).

To control for possible land price effects, we include county-level land values. We also include farm age to control for availability and quality of financial statements and a growth dummy, to proxy for farm profitability since agricultural lenders are increasingly using cash flow rather than collateral based lending (Klinefelter and Penson, 2005). The growth dummy takes the value of one if the enterprise grew (experienced employment growth) and zero otherwise. We also control for operators' income diversification and creditworthiness by including the percentage of income coming from farming and whether the operator works off the farm since banks also use such information in lending decisions (Berger and Udell, 1998).

To properly identify the effect of credit constraints on investment, variables that affect credit but not investment should be included in the credit supply equation (3). In our model, this variable is the growth dummy. The assumption is that change in ROA used in the investment equation (1) captures investment opportunities, while the dummy variable used in equation (4) provides information only on whether growing firms were funded or not.

3. Data

The data come from a survey of new farmers in Alabama, conducted by Alabama National Agricultural Statistical Service (NASS) in October 2010. The survey was designed to collect unique financial, business and demographic information from new operators in the state.

New operators were defined as farmers in Alabama who begun any part of their operation since 2005 based on the 2007 Agricultural Census data.[ix] This classification encompasses farms that started a new operation, e.g.. an existing cow-calf production that started a small feedlot. Questionnaires were sent to all farmers comprising the population of 1639, with one reminder letter sent two weeks after the first questionnaire and follow up phone calls made by NASS

personnel.[x] The result was 393 returned questionnaires, which represents an effective response rate of 25.9 percent.

While only operators who began to operate any part of their operation in 2005 or later were part of the population who received the questionnaires, when the completed questionnaires were returned, over 140 of the respondents indicated a year prior to 2005 as a year they started their operation.[xi] However, over 100 of these indicated year after 2000 and thus fit the definition for new farmers by the Farm Credit Administration for 10 years or less in farming. We use this data feature to our advantage to study if there are financing constraints for the two groups of new farmers. The "newest" operator group includes those who started their operation in 2005 or later which was the original target of the survey, while the "new" operator group includes those operators who, in the survey, indicated that they started any part of their operation between 2000 and 2004. The resulting sample with all variables needed for the analysis consists of 305 observations.[xii]

Since, during the survey, a number of farmers called and indicated they had problems accessing loans, we expected that most credit constrained farmers would return the questionnaire. Comparison of the survey respondents by sales categories described in our survey is presented in Table 1, Panels A and B. The table shows that farmers who responded match surprisingly closely the general population of farmers in Alabama. In particular, roughly half of farmers in Alabama (58%) and in our sample (48%) had sales less than $5,000. The rest of the categories match relatively closely except for the categories with sales between $10,000-25,000 ($100,000-250,000) being underrepresented (overrepresented) in the survey. The overrepresentation could be because these are the farmers with a new operation, or because these were the most credit constrained new operations, or perhaps both. The majority of farms in

Alabama are in livestock and poultry (58%) and in our sample these farmers are a somewhat overrepresented at 68% of the sample while those in row crops are underrepresented (4% vs. 14% in Alabama). We note these differences when describing our variable choice and possible biases.

Investment, measured by the change in the value of fixed assets, has both positive (investment) and negative (disinvestment) values. The question we use to construct this variable first defines fixed assets as land, buildings, machinery vehicles, equipment and breeding livestock, and then asks by what percent has the net value of all fixed capital assets changed from 2008 to 2010 to measure the value of investment as percentage of fixed assets.[xiii]

Since land is part of fixed investment, there is a concern that measured increases in investment may be due to change in land prices even if there was no real investment change. To alleviate measurement errors as discussed in the methods section, we include the county level price of land from the 2007 Census of Agriculture to reflect possible differences in the value of the assets. Second, we add the value of assets at the beginning of operation to control for the size of beginning assets values. This variable also corrects for the overall scale effects. Since the largest group of farmers in Alabama consists of livestock (calf and cow) and poultry producers, ownership of land would cause some measurement error but, for Alabama, the measurement error is likely smaller compared to what it may be for a major crop producing region. Further, since potential measurement errors are in the dependent variable, we expect valid coefficient estimates with likely high standard errors.[xiv] Although the average disinvestment of the *newest* operations is one percent while that of *new* ones is two percent, this difference is not statistically significant as shown in Table 2, which contains summary statistics of all variables.

The cash flow variable is measured by the percentage of revenue minus costs kept in liquid assets.[xv] Table 2 shows only few statistically significant differences between the two groups in the sample. To explore if there is a possible effect on investment of liquidity that farmers kept we asked "Compared to years prior to the 2008 financial crisis, do you now keep larger amount of cash and liquid assets (bank accounts, CDs etc)?". The results do not show statistically significant difference across the two groups with only 22 percent in each group reporting they kept higher levels of liquidity after the crisis.

Opportunity cost of capital is measured by three dummy variables. The first takes the value of one if operations' ROA has increased in the 2008-2010 period and zero otherwise, and the second dummy that takes the value of one if ROA has decreased during the period and zero otherwise. A third dummy takes the value of one if ROA has not changed and is the omitted dummy variable serving as a base for comparison. Table 2 shows that increase in ROA was 10% among the *newest* operators which is double the 5% increase in ROA among the new operations and this difference is statistically significant at the 10 % level.

Among the control variables, we find few statistically significant differences across the groups. The newest farmers have fewer years of previous experience in farming (8.5 versus 13.5 years) and higher proportion of their income coming from farming (17% versus 9%). Statistically significant differences indicate that compared to the group of new operators, more farmers of the newest group have a Masters Degree or higher (16% versus 9%), fewer have sales from livestock production (51% versus 62%) and fewer are black (7% versus 13%). Fewer of the newest operators inherited it (14% versus 24%) and more purchased it (19% versus 12%). Most interestingly, while only 5% of the operators in the new group had beginning assets of $250,000 or more, 29% of the newest operations fall within this group. It is possible that many of the

newest entrants in farming bought land to diversify their assets in unstable financial markets. However, since much higher percentage of this group's income comes from farming, it is possible that the high returns to farming in the past few years had attracted new entrants.

Summary statistics for the variables in the credit offer equation (4) are also presented in Table 2. There is a statistically significant difference between percentage of credit applications by the new and by the newest farmers (25% vs. 38%, respectively).[xvi] To evaluate how collateral requirements affected access to loans, we asked farmers if collateral requirements were an obstacle to obtaining loans.[xvii] The answer choices were "no obstacle" which we use as a base, while the obstacles were classified as *minor*, *moderate,* and *major*. We find statistically significant difference between the two groups only in the *moderate* category: 27% vs. 17% for the *newest* and the *new* farmers, respectively.

The instruments for the loan application equation (4) come from two questions regarding farmers perceived access to credit. We created a dummy variables equal to one if farmers stated that they do not have access to loans from the Farm Credit System (z_1) and from Banks and Financial Institutions (z_2).[xviii] As Table 2 shows, there is no statistically significant difference in access to credit between the new and the newest group.

4. Results and Discussion

4.1. Liquidity constrains

Table 3 presents the results from the regression of investment sensitivity to cash flow and investment opportunity. It contains 3 models with three samples , the first with operators who started any part of their operations after 2005 (the *newest* group), the second with those who

started between 2000 and 2005(*new*), and the last regression uses all observations. The overall fit of these models explains from a quarter to a third of the variation in the data.

The results indicate that, as expected, investment opportunity affects investment by new farming operations in all specifications. Compared to farmers with a no change in their ROA, investment in operations with increasing ROA is higher by 12 percent and that in operations with decreasing ROA is lower by 6 percent. These results are the same for both groups of farmers.

We find that investment in the group of newest operators depends on internal cash flows (liquidity) with 10 percent higher liquidity associated with about one percent higher investment. This relationship is not statistically significant for the subsample of farmers who started their operation before 2005. We observe that the standard error is relatively small, (though not small enough to make it statistically significant) and this may be due a possible measurement error in the dependent variable which would inflate the standard error.[xix] Nevertheless, lack of statistical significance for this group is in line with Bierlen & Featherstone (1998) who found liquidity constraints in only young operators (although their group of young does not necessarily correspond to our "newest" farmers). It is also in line with the empirical literature on liquidity constraints which shows that newest firms are most liquidity constrained (Carreira and Silva, 2010).

The dummy capturing the change in liquidity (*Extra Liquidity*) kept by operators since 2008 is not statistically significant in any of the specifications and the standard errors are relatively large. We interpret this result to indicate that while newest farmers had liquidity constraints, these constraints were not affected by the 2008 crisis. These results would need to be interpreted with caution because they are valid only for our sample of Alabama operations and are the result of a cross-sectional data analysis so the time aspects of the post crisis liquidity

(2009 versus 2010 needs for example) cannot be captured well with such data. Nevertheless, we assume that, if in any of the 2008-2010 years farmers had to keep more cash, they answered yes to the question asking them about change in liquidity since 2008.

Few other variables are statistically significant in the OLS model. We find that farmers who inherited, rather than purchased their operation have 7% lower investment for the newest and 5% for all farmers. In the group of newest operations, female operators had 7 % less investment than male operators. This result, combined with the relatively high age of operators and anecdotal evidence, suggests that the sample contains widows receiving an inheritance and disinvesting from farming. Off farm work by the operator or the spouse and the percentage of income from farming are not associated with higher level of investment. We also do not find that experience in farming or in other business, operator age, education level, or race are associated with differences in on-farm investment, contrary to findings for off-farm investment by farmers (Mishra and Morehart, 2001).

We find that 100 dollars higher land values are associated with about 3.8 percent disinvestment in farming but this variable is statistically significant only in the first specification for the newest operations. These results suggest that relatively expensive land may promote leasing.

4.2. Access to credit

Since financing constraints for new operators exist as our results suggest, we turn to the credit offer equation (4) to determine what factors affected operators' access to credit. The results with the marginal impact coefficients are shown in Table 4. Two specifications are estimated – one with the subsample of operators who started since 2005 and one for all operators who started

since 2000. We first test for self-selection out of the credit market by testing if a credis supply probit with self –selection is appropriate. The Wald test for independence of equations (3) and (4) is rejected at the 1 percent level in both specifications confirming the presence of self-selection.

Table 4 presents the marginal impact from the probit model with self-selection. The first and second columns contain the results for applying and receiving credit for the complete sample and the third and fourth columns present the results from applying for and receiving credit for the group of newest farmers only. The results suggest that, for the full sample, those who thought they had no access to credit were 20% less likely to apply for it than the farmers who thought that they could get credit from banks and other financial institutions. The *newest* operators were even less likely to apply if they stated that they did not have access to loans as shown by the higher marginal impact of 0.266 (versus 0.201).

Results from the application for credit (columns 1 and 3) show that lending to farmers remains collateral driven. Compared to unconstrained farmers for whom collateral was not a problem, farmers for whom collateral was a minor obstacle to obtaining credit were 18% more likely to apply (14% for the *newest* group), and those who thought collateral is a major obstacle for them to get credit were 27% (or 18% for the *newest* group) more likely to apply for loans. That is, these farmers needed more credit but discovered (through applying) or knew that their collateral was a problem so they had to apply more. Clearly, the *newest* farmers were experiencing more significant credit constraints since they were less likely to apply knowing they had no access, and their own insufficient collateral was more of a deterrent to application (14% and 18% for minor and major problems) compared to all farmers (18% and 27% resp.).

Results from the credit supply equations (columns 2 & 4) show that the *newest* farmers were more likely to be denied credit if they had collateral problems compared to all farmers. Compared to farmers without collateral problems, *newest* farmers with moderate collateral problems were 11 percent less likely to be approved for credit compared to 6 percent for the full sample. Similarly, for the farmers for whom collateral was a major problem, these numbers are 21 and 16 percent respectively.

We also find, however, that the youngest farmers who had growing businesses were 15 percent more likely to be approved for loans, while only 10 percent of all farmers with growth were approved. Overall, these results support the idea while collateral remains the major determinant of access to credit, business growth, especially for the newest operators, also factors in the lender's decisions which is consistent with the trend reported in Klinefelter and Penson (2005).

We find that older operations were less likely to apply for loans. One additional year in business is associated with 0.6% and 6% lower probability of applying for credit for the *all* and *newest* operations, respectively. Further, one percent increase in income from farming is associated with 0.5 % increase in probability of applying for a loan. Farmers with off-farm jobs were 13.7 % more likely to apply for loans than farmers who did not work off the farm suggesting that income diversification strengthen farmers' confidence to seek loans. We also find that a 10 point increase in income from livestock production is associated with a one percent higher probability to apply for loans and one percent higher probability of being denied a loan. This is a very small effect but it is consistent with observed problems in the market for protein production (Elinger, 2011).

5. Conclusions

In this paper, we set out to establish how the financial crisis of 2008 affected farmers' credit constraints and which farmers were able to secure loans. We focus on the most vulnerable farmers – those with a new operation or any part of their operation started in the past 10 years. Survey data from over 300 farmers from Alabama are used to estimate an investment equation linking investment to investment opportunity and cash flow (liquidity). In the financing constraints literature, significant cash flow coefficient indicates that internal and external funds are not perfect substitutes and is interpreted as evidence of credit (liquidity) constraints.

In this context, we test for a link between investment and farmers keeping larger liquidity post 2008 as evidence of worsened credit constraints. We find financing constraints for the newest operators (who started any part of their operations since 2005) with 10% higher liquidity associated with about 1% increase in investment. However, we do not find evidence that the financial crisis worsened these financing constraints for new operations in Alabama.

We also identified factors affecting agricultural lenders' decisions to fund producers and found that collateral remains the main obstacle to obtaining loans. We also found that, in Alabama, farmers' profitability also factored in lending decisions and was more important for the newest operations, consistent with the general trend observed by Klinefelter and Penson (2005). Since our main finding is that newest farmers remain financially constrained (although unaffected by the crisis) and since our survey data also show that most new farmers use multiple financial sources to start and expand their operations, programs to encourage entrepreneurship remain relevant.

Table 1. Comparison between farmers in Alabama and in the sample

Panel A. Percentage of farms with sales in a category

	Alabama farms (%)	Sample since 2005 (%)	Full Sample (%)
Row Crop	14	4	4
Livestock	48	52	55
Poultry	10	16	13
Fruit, vegetable and horticulture	8	8	8
Government agricultural payment	3	8	7
Other	18	13	14
Total	128		

Source: 2007 Census of Agriculture, authors' calculations

Panel B Percentage farms by sales categories

	Alabama farms (%)	Sample since 2005	Full sample
less than 5,000	58	45	48
$5,000-$9,999	12	10	13
$10,000-$24,999	13	8	7
$25,000-$49,999	5	5	4
$50,000-$99,999	3	5	4
$100,000-$249,999	2	13	10
$250,000-$499,999	3	2	2
$500,000-$999,999	2	0	0
$1000000 or more	3	0	1
No sales		11*	12*
Total	100	99	101

Source: 2007 Census of Agriculture, authors' calculations

* Farmers report no sales, inline with Ahearn's (2011) finding that 22% of new farmers (FCA definition) do not generate positive production.

Table 2. Summary Statistics.
Panel A. Investment equation (1) variables

	Newest	Newest	New	New
	Mean	Std.	Mean	Std.
Investment				
Investment (% change in net fixed assets)	-1.0	15.3	-2.0	13.9
Cash flow (% liquid net revenue)	10.3	23.9	11.9	26.8
Keep extra liquidity (share 2008)	0.22	0.42	0.21	0.41
ROA increase (share)	0.10*	0.30	0.05	0.22
ROA decrease (share)	0.53	0.50	0.58	0.50
Female (share)	0.14	0.35	0.15	0.35
Experience in farming (in years)	8.5***	12.5	13.5	13.7
Experience in business (years)	13.0	14.4	10.5	14.3
Income from Farming (%)	17**	29	9	21
Work off farm (share)	0.70	0.46	0.61	0.49
Spouse works off farm (share)	0.48	0.50	0.43	0.50
Operator age (years)	52	13	54	12
Operation age (years)	*4**	*1*	*15*	*12*
Education				
Graduated high school (share)	0.23	0.42	0.26	0.44
Some college/(share)	0.30	0.46	0.37	0.48
College graduate (share)	0.19	0.40	0.21	0.41
Some graduate school (share)	0.04	0.21	0.03	0.16
Masters degree or higher (share)	0.16**	0.37	0.09	0.28
Gross Sales in 2009				
Row crop (sales, % of total)	4	19	5	20
Poultry (sales, % of total)	15***	34	4	19
Specialty crops (sales,% of total)	7	24	9	27
Government payments (sales % of total)	8	26	5	20
Have income only from government payment (%)	13	32	15	32
Livestock (sales % of total)	51**	47	62	45
Operators race				
White (share)				
Black (share)	0.07*	0.25	0.13	0.34
Other (share)	0.04	0.19	0.03	0.16
Beginning assets (shares)				
$5,000- $9,999	0.05***	0.23	0.21	0.41
$10,000- $24,999	0.10	0.31	0.12	0.33

$25,000- $49,999	0.11	0.32	0.13	0.34
$50,000- $99,999	0.08	0.27	0.11	0.32
$100,000- $249,999	0.21	0.41	0.19	0.39
$250,000- $499,999	0.13***	0.33	0.02	0.13
$500,000 – 999,999	0.11***	0.32	0.03	0.16
$1,000,000 or more	0.05**	0.23	0.01	0.09
County land value (in 2007$)	2,543	644	2,540	647
Number of Observations (eq 1)	201		104	

Statistically significant difference in means *** p<0.01, ** p<0.05, * p<0.1

Table 2. Summary Statistics
Panel B. Credit supply with selection equations (3&4)

	Newest	Farmers	New	Farmers
	Mean	St. Dev.	Mean	St. Dev.
Credit				
Got loans (share)	0.26	0.44	0.19	0.39
Applied for loans (share)	0.38**	0.49	0.25	0.44
No access to FCS loans (share)	0.21	0.41	0.24	0.43
No access to FI loans (share)	0.06	0.23	0.08	0.27
Dummy if operation grew	0.30	0.46	0.44	0.50
Collateral				
Not an obstacle (share)				
Minor obstacle (share)	0.21	0.41	0.24	0.43
Somewhat obstacle (share)	0.27**	0.45	0.17	0.37
Major obstacle (share)	0.11	0.31	0.15	0.35
Number of Observations [eq.(3)]	208		93	

Statistically significant difference in means *** p<0.01, ** p<0.05, * p<0.1

Table 3. Investment Determinants, OLS

	Newest	New	All
Constant	17.10*	-16.56	11.44
	(10.15)	(18.17)	(7.783)
Cash Flow	0.111**	0.0112	0.0634*
	(0.048)	(0.0615)	(0.035)
Extra liquidity	2.812	1.656	1.563
	(2.665)	(5.333)	(2.097)
ROA Increase	11.46***	12.08*	11.391***
	(3.460)	(6.500)	(2.889)
ROA Decrease	-5.782**	-6.080*	-5.825***
	(2.448)	(3.474)	(1.901)
Female	-7.232**	-5.117	-7.62***
	(3.541)	(5.966)	(2.834)
Exp in Farming	-0.0868	0.185	0.0117
	(0.0797)	(0.147)	(0.0671)
Exp in Business	-0.0545	0.0931	0.00575
	(0.0807)	(0.119)	(0.0621)
Income from Farming	-0.0544	0.0587	-0.0313
	(0.0602)	(0.0879)	(0.0473)
Off farm work	-1.211	4.076	-0.341
	(2.845)	(4.505)	(2.215)
Off farm work by spouse	0.916	-0.273	1.436
	(2.409)	(3.661)	(1.786)
Operator age	-0.088	0.105	-0.0361
	(0.115)	(0.173)	(0.0854)
Farm age	1.654	-0.0807	0.00686
	(1.287)	(0.165)	(0.118)
Row crops	0.089	-0.058	0.0512
	(0.061)	(0.045)	(0.0435)
Land value	-0.004**	0.004	-0.00136
	(0.002)	(0.003)	(0.00133)
Inherited	-7.208**	-5.388	-5.053**
	(3.057)	(3.635)	(2.087)
Purchased	-2.023	-3.418	-2.796
	(2.752)	(6.787)	(2.579)
Controls:			
Operations type (%sales from operation)	Yes	Yes	Yes
Education	Yes	Yes	Yes
Beginning Assets Size	Yes	Yes	Yes
Observations	201	104	305
R-squared	0.357	0.335	0.251

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4 Probit Heckman for receiving a loan, conditional on applying. Marginal effects for new and newest samples

	Applied for loans	Received loans	Applied for loans	Received loans
VARIABLES	Full sample	Full sample	Newest	Newest
No access to loans from Farm Credit Services	0.076		0.059	
	(0.066)		(0.079)	
No access to loans from banks & financial institutions	-0.201*		-0.266*	
	(0.117)		(0.141)	
Collateral is a minor obstacle to obtaining credit [a]	0.175**	-0.024	0.139*	-0.020
	(0.069)	(0.044)	(0.083)	(0.054)
Collateral is a moderate obstacle to obtaining credit [a]	0.098	-0.061*	0.106	-0.112*
	(0.066)	(0.035)	(0.079)	(0.062)
Collateral is a major obstacle to receiving credit [a]	0.267**	-0.163***	0.181*	-0.205***
	(0.091)	(0.073)	(0.115)	(0.060)
Land Values (2007 in $'000)	-0.016	-0.038	-0.059	-0.0.36
	(0.040)	(0.031)	(0.048)	(0.046)
Dummy growth	-0.035	0.101**	-0.005	0.1490**
	(0.054)	(0.042)	(0.007)	(0.058)
Operator Age	-0.006*	0.0049	-0.064**	0.034
	(0.003)	(0.0036)	(0.028)	(0.022)
Income from farming	0.005***	-0.001	0.005***	-0.00066
	(0.001)	(0.001)	(0.001)	(0.0001)
Livestock production (% of farm income)	0.001**	-0.001**	0.002*	-0.0014**
	(0.001)	(0.001)	(0.001)	(0.0004)
Experience in Farming	-0.00001	0.001	0.002	0.0008
	(0.0019)	(0.001)	(0.002)	(0.0015)
Off-farm work	0.136**	0.029	0.137*	0.011
	(0.061)	(0.029)	(0.071)	(0.045)
Observations	301	106	208	82
Wald Chi2 (10)	40.14			
Pseudo log likelihood (Prob>chi2)	-225 (0.000)		-156 (0.000)	
Wald test of eq. independence (Pr>chi2)	10.34 (0.001)		154 (0.000)	

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

References

Barry, P., R. Bierlen, and N. Sotomayor. 2000. "Financial Structure of Farm Business under Imperfect Capital Markets," *American Journal of Agricultural Economics,* 82(4):920-933.

Berger, A. and G. Udell. 1998. "The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle," *Journal of Banking and Finance,* 22:613–673.

Bierlen R. and A. Featherstone. 1998. "Fundamental q, Cash Flow, and Investment: Evidence from Panel Data," *Review of Economics and Statistics,* 80(3):427-435.

Briggeman, B.C. 2011. "The Role of Debt in Farmland Ownership," *Choices,* Second Quarter.

Briggeman, B.C., C.A. Towe, and M.J. Morehart. 2009. "Credit Constraints: Their Existence, Determinants, and Implications for U.S. Farm and Nonfarm Sole Proprietorships," *American Journal of Agricultural Economics,* 91(1): 275–289.

Briggeman, B.C., M.A. Gunderson, and B.A. Gloy. 2009. "*Financial Health of Agricultural Lenders,*" Invited Paper at the 2009 annual meeting of the Agricultural and Applied Economics Association, Milwaukee, WI, July 26-28, 2009.

Briggeman, B. and C. Zakrzewicz. 2009. "Can the Ag Credit Survey Predict National Credit Conditions?" *Federal Reserve Bank of Kansas City Economic Review,* 4th Quarter, 94(4):93-110.

Boucher, S., M. Carter, and C. Guirkinger. 2008. "Risk Rationing and Wealth Effects in Credit Markets: Theory and Implications for Agricultural Development," *American Journal of Agricultural Economics,* 90(2): 409-423.

Carreira C., and F. Silva. 2010. "No Deep Pockets: Some Stylized Empirical Results on Firms Financial Constraints," *Journal of Economic Surveys,* 24(4):731-753.

Cameron, A.C. and P.K. Trivedi. 2005. "*Microeconometrics: Methods and Applications*". Cambridge University Press: New York.

Chaddad, F., M. Cook, and T. Heckelei. 2005. "Testing for the Presence of Financing Constraints in US Agricultural Cooperatives: An Investment Behavior Approach," *Journal of Agricultural Economics,* 56(3):385-397.

McFadden, D.T. and S. Sureshwaran. "Innovations to Support Beginning Farmers and Ranchers," *Choices,* Theme Article, 2nd Quarter 2011, Issue 26(2).

Cleary, S., P. Povel, and M. Raith. 2007. "The U-Shaped Investment Curve: Theory and Evidence," *Journal of Financial and Quantitative Analysis,* 42(1):1-40.

Ellinger, P. “Financial Markets and Agricultural Credit at a Time of Uncertainty,” *Choices*, Volume 24, Number 1, First Quarter 2009.

Ellinger, P. 2011. “Agricultural Banks Improve Profitability,” Farmdoc Daily, October 28.

Fazzari, S., G. Hubbard, and B. Petersen. 1988. “*Finance Constraints and Corporate Investment*.” Brookings Papers on Economic Activity 1:141–195.

Hartarska V. and C. Mai. 2008. “Financing Constraints and the Family Farm: How do Families React?” Paper presented at the Southern Agricultural Economics Association Annual Meeting, Dallas, TX, February 2-6, 2008.

Hartarska V. and D. Nadolnyak. 2008. “An impact Analysis of Microfinance in Bosnia,” *World Development*, 26(12), pp. 2605-2619.

Hayashi, F. 1982. “Tobin’s Marginal q and Average q: A Neoclassical Interpretation,” *Econometrica*, 50, pp.213-224.

Hubbard, G. R. 1998. “Capital Market Imperfections and Investment,” *Journal of Economic Literature* 36(1):192–225.

Jensen, M. and W.H. Meckling. 1976. “Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure,” *The Journal of Financial Economics,* 3:305–360.

Klinefelter, D., and J. Penson. 2005. “Growing Complexity of Agricultural Lending Decisions,” *Choices*, 20(1).

Mishra, A., C. Wilson, and R. Williams. 2009. “Factors Affecting the Financial Performance of New and Beginning Farmers,” *Agricultural Finance Review*, 69(2):160-79.

Mishra, A., C. Moss, and K. Erickson. 2008. “The Role of Credit Constraints and Government Subsidies in Farmland Valuations in the US: An Options Pricing Model Approach,” *Empirical Economics*, 34(2): 285-97.

Mishra, A., and M.J. Morehart. 2001. "Off-farm investment of farm households: A logit analysis," *Agricultural Finance Review*, 61(1):88–101.

Myers, S.C., and N.S. Majluf. 1984. “Corporate Financing and Investment Decision when Firms Have Information that Investors Do not Have,” *Journal of Financial Economics*, 13(2):187–221.

Stiglitz, J.A., and A. Weiss. 1981. “Credit Rationing in Markets with Imperfect Information,” *American Economic Review*, 71: 912–927.

Thijssen, G. 1996. “Farmers Investment Behavior: An Empirical Assessment of Two Specifications,” *American Journal of Agricultural Economics,* 78:166-174.

Van de Ven, W.P.M.M., and B.M.S. Van Pragg. 1981. “The demand for deductibles in private health insurance: A probit model with sample selection,” *Journal of Econometrics* 17:229–252.

Footnotes

[i] An overview of the state of beginning farmers and ranchers is presented in recent special issue of Choices 2009, 26(2).

[ii] This approach has been modified to account for the impact of working capital and other issues. Advantages and disadvantages of the approach are also discussed in Hubbard, 1998.

[iii] Advantages and disadvantages of this approach are discussed in Hubbard, (1998). Empirical findings and specification issues are discussed in Carreira and de Silva, 2010. Theoretical justifications are further offered by Cleary et al 2007.

[iv] Change in capital assets rather than the more typical investment level scaled by capital stock is the dependent variable because it was not possible to ask farmers what was the value of their investment and their capital (or we would not have had sufficient number of returned surveys to conduct this analysis). For Alabama for example, there are 149 observations from farms in the 2009 ARMS data and only 7 have started any part of their operation since 2005.

[v] See Cameron and Trivedi (2009), p. 913.

[vi] *Thijssen* (1996) shows that farmers when investment and financing decisions are independent, capital investment decisions are consistent with static expectations, suggesting that a simple measure for investment opportunity is appropriate.

[vii] While we asked farmers for the precise ROA they generated, only very few farmers answered. Thus, we believe that a set of dummies measuring the change in ROA better reflects farmers' investment opportunity.

[viii] This model is estimated with the heckprobit command in Stata

[ix] To reach the target population of new farmers, it was only possible to use data from the 2007 Agricultural Census since the NASS list sampling frame does not keep any control data that correspond to date of operation inception. There is simply no reasonable way to identify and survey the population of farmers based on their inception day.

[x] The Census question was "In what year did the operator begin to operate any part of this operation?" The population was identified as all farmers who entered 2005 or later; imputed records were excluded and only the first operator from the operation cell (k0930) was used (operators 2 or 3 were ignored); inactive records were removed. Only operators with total value of products sold, who met the minimum threshold of $1,500, were part of the net population which consisted of 1,639.

[xi] NASS identifies 3 reasons why the actual operation start-up date differs from the target after 2005. Specifically, these are: 1) Incorrect information provided to the 2007 Census from which the sample was targeted, 2) A different person (senior operator, other partner, spouse) completed the AU survey vs. the Census, and 3) misinterpretation of the question. Some respondents might have interpreted this question as when anyone in the family began the current farm operation, as opposed to the year the target (intended respondent) began operating the farm.

[xii] Our resulting "new" farmers group likely misses possible operations that were started between 2002 and 2005 since they were not explicitly targeted by the NASS, and thus may mischaracterize actual financing constraints or access to loans for Alabama farms expanding or starting their operations during this period. Thus, we interpret with caution the results relevant to the group of "new" farmers.

[xiii] The specific question was "Capital assets are LAND, BUILDINGS, MACHINERY, VEHICLES, EQUIPMENT and BREEDING LIVESTOCK. From 2008 to 2010, by what percent did the net value of ALL your capital assets change?"

[xiv] It is possible that some Alabama farmers leased rather than bought land, but we were unable to measure the use of leasing by operators.

[xv] Specifically, we ask "From 2008 to 2010, after you paid your operating expense, what percentage of your REVENUE did you keep in cash or liquid assets (bank accounts, CDs etc)?"

[xvi] These results are consistent with the latest evidence on new small businesses presented at Atlanta Fed Reserve Conference on Small Businesses and Entrepreneurship, November 9-10 2011.

[xvii] Specifically we asked, "ACCESS TO FINANCING may be a problem given the current economic situation. In order to identify barriers that limit access to financing, please rate the obstacles listed below as they relate to your current operation. a/ Collateral requirements [with choices] No obstacle, minor obstacle, moderate obstacle, major obstacle.

[xviii] We asked "If you were to need additional financing now, how difficult would it be to use: a/ Loans from Farm Credit System (*First South Farm Credit, Alabama Farm Credit, Alabama AgCredit, AgFirst* etc.), and Loans from banks or financial institutions (CU, loan fund etc.,). The answer choice "no access" was coded as one to create the dummy variables.

[xix] It is also possible that due to our sample characteristics, we are missing constrained operators who started 2000-2004 and this affects the result. We thank an anonymous reviewer for pointing this out.