Farm Loan Concentration and Financial Risk

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1 Motivation

Several studies have recorded considerable diversity in lender types that serve production agriculture (Fiechter and Ifft, 2020; Brewer, Wilson, Featherstone, and Langemeier, 2014). Multiple farms depend on several loan types at the same time (for example, traditional, farm credit, non-traditional, credit cards, among others) and the level of loan concentration – the extent to which farms depend on few loan types (or one loan type) – is different across farms. However, factors driving loan concentration are not fully understood especially in production agriculture despite several theories on debt structures and multiple borrowing (Berglöf and Von Thadden, 1994; Bolton and Scharfstein, 1996; Green and Liu, 2021). In this paper, we explore the determinants of loan concentration and examine how it influences financial risk and investment in some selected farms in Kansas.

Prior studies in the finance literature indicate that a less concentrated debt affects debt renegotiation. As the number of lenders increase, coordination during debt renegotiation is challenging as several demands from multiple lenders protecting their interests is difficult to harmonize (Asquith, Gertner, and Scharfstein, 1994; Li, Lou, Otto, and Wittenberg-Moerman, 2021). Such coordination problems with the possibility of conflicts among multiple lenders increase coordination costs and could arise as a result of great divergence in collateral and cash flow requirements, lender objectives and debt maturity (Li, Lou, Otto, and Wittenberg-Moerman, 2021). According to Gertner and Scharfstein (1991), multiple borrowing relationships could give rise to free-rider problems as some lenders may shirk their role to monitor borrowers by riding on the assumption that other lenders will undertake such a critical task. Having multiple borrowing relationships could impose a default externality on creditors (Green and Liu, 2021), as new debt could lower the repayment probability of existing existing loans as new loan conditionality may be diametrically opposed to fulfilling old loan agreements.

Multiple borrowing relationships can be beneficial to borrowers and could highlight the extent of financial deepening. Such a phenomenon can increase credit access for investment or to repay existing loans, which could perpetuate the debt cycle and render the borrower insolvent. It could reflect the extent of financial development and competition in credit markets as lenders compete

for borrowers by lowering cost of borrowing. Monitoring of borrowers could improve with this phenomenon as lenders observe borrowers' behavior to minimize inefficient projects.

The remainder of this study is as follows. Section 2 presents the literature review whereas a description of the data set and the methodology are presented in Section 3. The empirical results are discussed in Section 4, and Section 5 concludes.

2 Literature Review

Debt concentration is widely explored in the literature. As such several studies have examined its effects on observable characteristics of both lenders and borrowers. According to the financial intermediation theory in the spirit of Diamond (1984) and a review by Gorton and Winton (2003), a more concentrated borrowing promotes screening and monitoring with an attendant effect of reducing ex post default likelihood. Information asymmetry exists in the financial intermediation process as only borrowers know their realized output, which could influence debt repayment. Consequently, lenders monitor borrowers to reduce such information asymmetry that could influence their profitability. With a higher debt concentration coordination costs are low which promotes debt renegotiation in times of financial distress. As rational agents, borrowers realize they can renegotiation their debt and may engage in excessive risk taking (Bolton and Scharfstein, 1996).

Other earlier work on determinants of loan concentration present conflicting results (see, for example, Hubert and Schäfer, 2002; Guiso and Minetti, 2010; Gobbi and Sette, 2014).

Firms engage in multiple borrowing for several reasons. As operations expand over time, firms may require large financial resources to undertake that objective. However, a single lender may not be able to provide such a large loan, as such firms resort to multiple borrowing. Lending institutions provide an array of products and services to firms, however, these products and services may not completely align with the needs of firms, making borrowers engage the services of other lenders to complement the services they receive from existing lenders. Firms also engage in overlapping borrowing relationships to obtain additional resources for paying off initial loans/debt in case of financial distress and adverse shocks. Multiple borrowing is thought to mitigate the risk of having a single lender who could withdraw funds as a project is being undertaken. Put differently, a

firm can rely on other lenders to provide finance for ongoing projects when it engages in multiple borrowing.

Multiple borrowing thus has implications for firms' financial performance. When an application for an additional loan from a new lender is granted, it injects liquidity into the business. However, this additional liquidity may come at a high cost to the receiving firm, especially when a financially distressed firm seeks out a loan from another lender following a credit crunch by its main lender (Degryse and Ongena, 2001).

Closely related to our study is Green and Liu (2021) who explore multiple borrowing in a theoretical framework. Their dynamic model a borrower can obtain credit from multiple lenders to fund a project, and that borrowers usually prefer additional credit from different lenders, which dilutes claims on existing loan facility. However, there is no prior commitment to solely borrow from one lender type. Consequently, after obtain project proceeds, the borrower may opt to repay the existing loan based on her comparison of the loan cost and the default cost. Their multiple borrowing model offers some notable predictions. Investment that promotes the business may decline as entrepreneurs may engage in inefficient allocation of credit when they have access to multiple lender types. In addition to that, the model predicts that multiple borrowing increases debt accumulation and the likelihood of default. We test whether the empirical results from our model affirm the predictions of Green and Liu (2021)'s dynamic model. Considering empirical studies, Giannetti (2019), for instance, finds that firms with less concentrated debt structure are less probable to record high turnover decline

3 Methodology and Data

We explore the determinants of farm loan concentration and its impact on investment and default risk in an empirical model that accounts for some farm heterogeneity.

3.1 Data

We use loan-level data from Kansas Farm Management Association farms from 2013-2020 to observe variations over the business cycle. We construct per farm loan concentration in a year by using Herfindahl-Hirschman Index (HHI) (Guiso and Minetti, 2010). Below is a table of summary statistics of our data, revealing that loan concentration ranges from 0.08 to 1, implying some farms have a single lending relationship whereas others have multiple lending relationships with different loan shares across lenders.

Table 3.1: Summary Statistics, 2013-2020

Description	**Mean**	**Median**
Debt to asset ratio	0.29	0.26
HHI	0.75	0.77
Current ratio	3.64	1.67
Operator's age	57.92	59
Number of workers	1.42	1.2
Total farm size (Acres)	1522.89	1329.9
Number of beef cattle	55.31	25
Machinery Inventory	11.65	11.7

On average, there is a high degree of loan concentration and average farm size is 1,522 acres. Operators' average age is 58 years.

3.2 Methodology

To achieve our objectives, we use a fixed effects model. Farm and operator characteristics may drive loan concentration as such they are included in the model to determine their importance in explaining loan diffusion across different lender types.

$$HHI_{it} = \alpha_0 + \alpha_1 X_{it} + \epsilon_{it} \tag{3.1}$$

where X_{it} is characteristics of farm i in time t including farm size (in acres), number of farm workers; ϵ_{it} is the error term.

We also explore the effect of farm loan concentration on debt-to-asset ratio as a measure of financial risk.

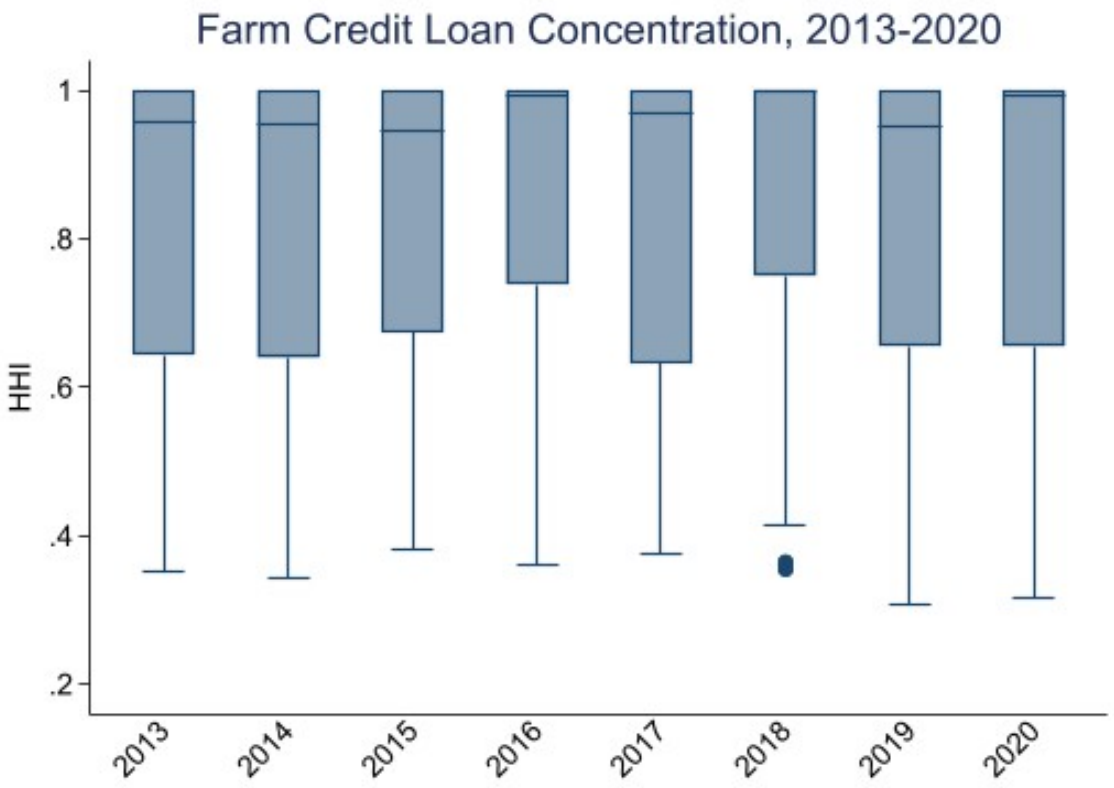
$$y_{it} = \beta_0 + \beta_1 HHI_{it} + \beta_2 X_{it} + \tau_t + \gamma_i + \epsilon_{it} \tag{3.2}$$

where X_{it} is characteristics of farm i in time t including farm size (in acres), number of farm workers; $HHI = s_1^2 + s_2^2 + ... + s_n^2$; τ_t & γ_i are time & farm fixed effects respectively; ϵ_{it} is the error term.

4 Findings

This section discusses the main results of the above-stated model specifications and the dynamic loan concentration.

Figure 1: Farm Credit Loan Concentration in KFMA, 2013-2020

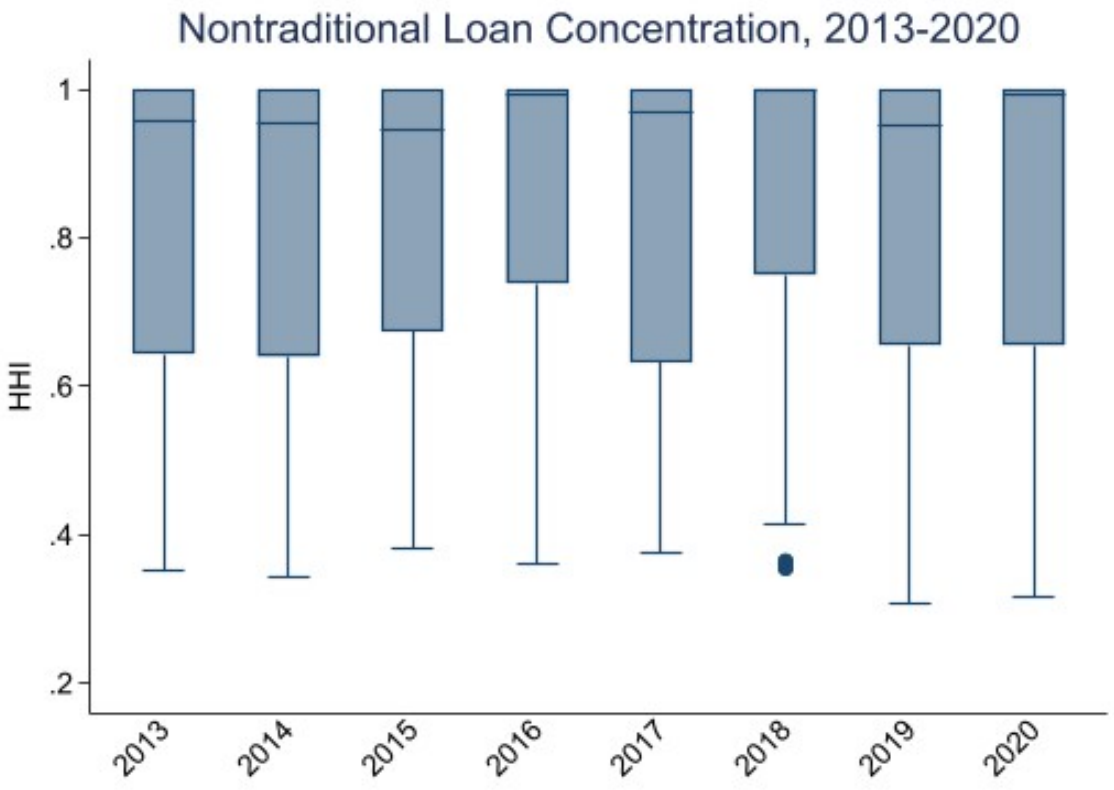


Source: KFMA

As can be seen in Figure 1, there is no consistent pattern of farm credit loan concentration over the period under investigation. Nontraditional loans serve as an important source of external financing for farms, as such we investigate its dynamic concentration.

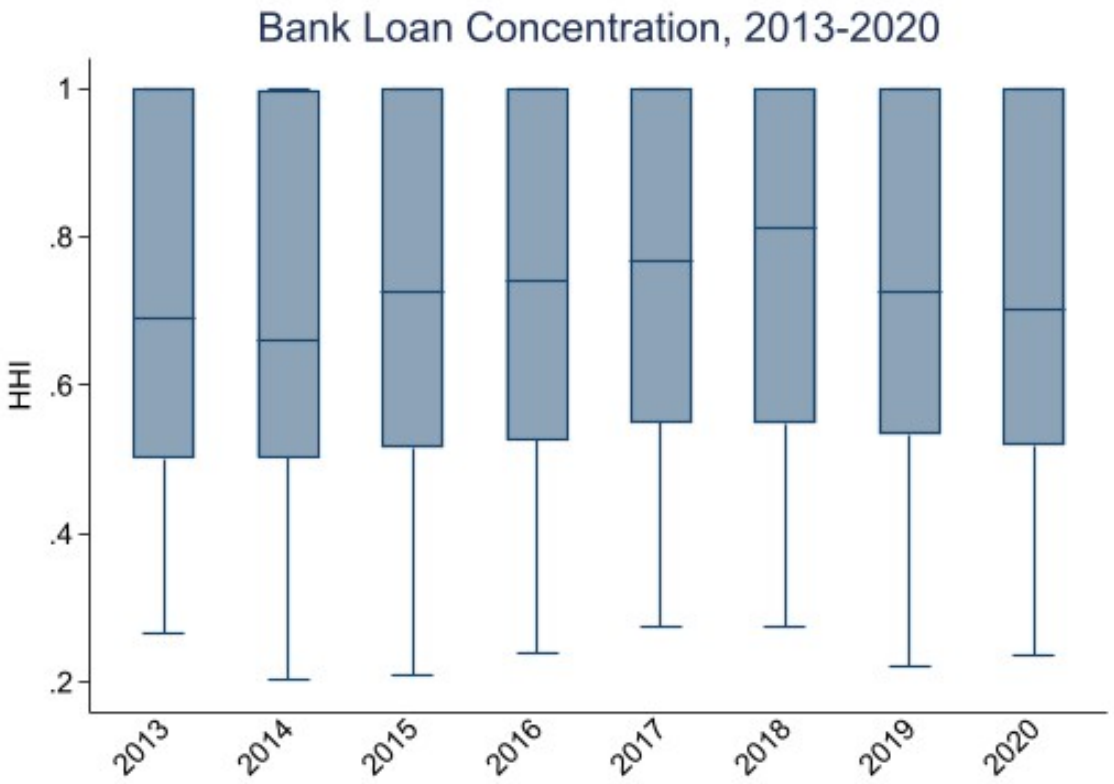
In Figure 2, loan concentration declined prior to 2016, however we do not observe any consistent pattern after that period. Multiple farms receive bank loan, thus raising interests in examining its dynamic loan concentration. We observe that loan concentration begins to decline from 2016.

Figure 2: Nontraditional Loan Concentration in KFMA, 2013-2020



Source: KFMA

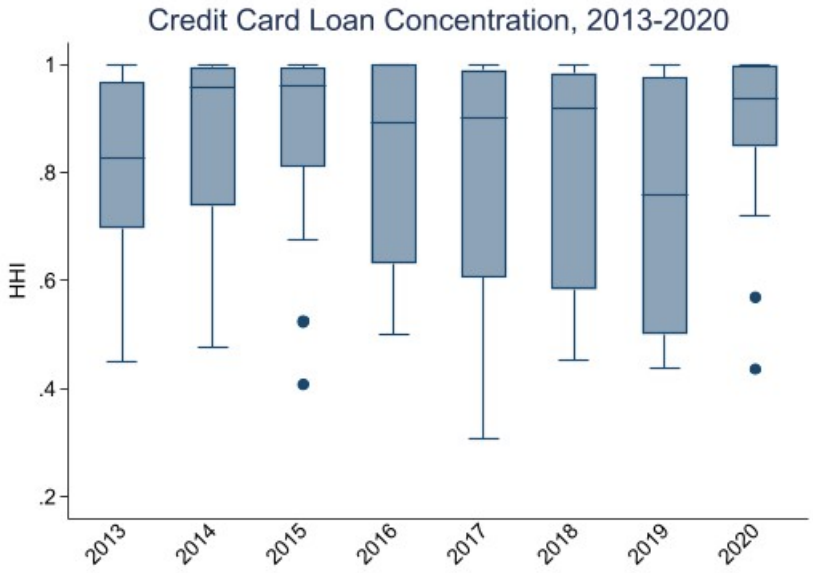
Figure 3: Bank Loan Concentration in KFMA, 2013-2020



Source: KFMA

Credit card use for loan continues to grow over time, as such we also examine its loan concentration. Its concentration increases up until 2016, and further increased from 2016 to 2018.

Figure 4: Credit Card Loan Concentration in KFMA, 2013-2020



Source: KFMA

Our fixed effects model obtains the following results. A number of factors including operator's age, farm size and number of workers drive farm loan concentration.

Table 4.1: Factors Driving Loan concentration , 2013-2020

Description	Model 1	Model 2	Model 3	Model 4
log operator's age	0.144*	0.148*	0.160*	-0.138
	(0.0634)	(0.0634)	(0.0636)	(0.125)
log number of workers		-0.0456**	-0.0381*	-0.0356*
		(0.0148)	(0.0153)	(0.0152)
log total farm size			-0.0300*	-0.0274
			(0.0152)	(0.0152)
Year Fixed Effects	N	N	N	Y
N	4453	4453	4453	4453
R-sq	0.002	0.004	0.006	0.02
AIC	-5191.8	-5202.6	-5205.8	-5259.1

Standard errors are in parenthesis; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; N=Not included; Y= Included

Higher concentration of loan is associated with lower debt-to-asset ratio, consistent with the prediction of the dynamic model by Green and Liu (2021).

Table 4.2: Loan concentration & debt to asset ratio

Description	Model 1	Model 2	Model 3
HHI (the extent farms use diversified debt structure)	-0.0231**	-0.0185*	-0.0189*
	(0.0083)	(0.0081)	(0.0082)
Other covariates	N	Y	Y
Year Fixed effects	N	N	Y
N	4453	4453	4453
R-sq	0.002	0.047	0.065
AIC	-11812.6	-12008.5	-12076.2

Standard errors are in parenthesis; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; N=Not included; Y= Included

As predicted by Green and Liu (2021), loan concentration may influence investment. We thus examine the relationship between loan concentration and machinery investment and obtain the following results. Inconsistent with Green and Liu (2021), higher loan concentration is associated with lower machinery inventory.

Table 4.3: Loan concentration & Machinery inventory

Description	Model 1	Model 2	Model 3
HHI (the extent farms use diversified debt structure)	-0.144***	-0.126***	-0.113***
	(0.026)	(0.026)	(0.026)
Other covariates	N	Y	Y
Year Fixed effects	N	N	Y
N	4453	4453	4453
R-sq	0.009	0.035	0.054
AIC	-1540.6	-1650	-1724.4

Standard errors are in parenthesis; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; N=Not included; Y= Included

5 Future Work

This paper intends to undertake further works in understanding the determinants of loan concentration in production agriculture especially the effect of weather shocks on farm loan concentration. Weather shocks may adversely impact producers' output and liquidity, as such it is important to examine this relationship to deepen our understanding.

In line with Giannetti (2019), this study also explores the possibility of using Hirano and

Imbens (2004)'s propensity score estimation to examine the effects of loan concentration. We also intend to use a longer time span from 2002-2020.

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