Credit Risk Migration Analysis Focused on Farm Business Characteristics and Business Cycles

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We applied the migration approach to credit scoring measurement to determine how ratings, focused on farm characteristics such as farm size, age, and farm business type, change across business cycles. The empirical results from analyzing migration matrices using data from FBFM suggest that old, large and grain farms are more likely to upgrade their classes, while young, small, livestock farms are likely to downgrade. The migration matrices for each characteristic across the business cycles show that all farm businesses (except small, livestock farms) have a tendency to deteriorate during the recession cycles regardless of their characteristics.

Key words: migration matrix, business cycle, path independence

Credit Risk Migration Analysis Focused on Farm Business Characteristics and Business Cycles

Migration analysis, which shows changes among the classes of a lender's risk-rating or credit scoring system, is a probability-based measurement concept for credit risk. The concept considers upgrades and downgrades in the credit quality of an entire loan portfolio as well as the potential for significant financial stress and loan default (Barry, Escalante, Ellinger, 2002).

Migration analysis has been used to analyze the effects that business cycles and rating drift have on bond rating (Bangia et al., 2002; Nickell, Perraudin, Varotto, 2000). Phillips and Katchova (2004), Deng et al. (2004), Barry, Escalante, Ellinger (2002), Katchova and Barry (2005) applied migration analysis to farm business credit rating. These credit migration analysis studies showed that the transition probabilities for retaining the current classification are highest. Also, the transition probabilities decline as they move to more distant classes and show pattern of higher downgrading than upgrading.

Bangia et al. (2002) and Nickell, Perraudin, Varotto (2000) found that transition probabilities are different based on the type of industry, geographical location of the company, and macroeconomic business cycles. Unlike finance studies in general, the agricultural finance studies by Barry, Escalante, and Ellinger (2002), Escalante et al. (2004), and Katchova and Barry (2005), which applied credit migration analysis to farm business, estimated a single unconditional transition matrix. Phillips and Katchova (2004)

conducted a migration analysis by conditioning migration rates of farm businesses on businesses cycles and path dependence of upgrades and downgrades[1].

In this study, we extended the analysis of the trends of the farm business credit ratings in Illinois. The contribution of our study is that we considered various characteristics for each farm business (i.e. farm size, farm business type, and age) and we analyze whether the migration trends are different based on these characteristics. The objectives of this study are to analyze transition matrices based on different characteristics of the farm businesses, that is, farm size, farm business type and operator's age and to test the tendencies to upgrade and downgrade in expansion and recession periods for each of these farm types.

We used farm-level data to examine the difference in migration probabilities for each farm business and each characteristic and to develop the unconditional and conditional migration matrices. This study employed annual farm-level data from the Illinois Farm Business and Farm Management (FBFM) data set for 1985 to 2003.

The term loan credit scoring model, like the one used in Phillips and Katchova (2004), was used to classify farm businesses credit rating. We used macroeconomic business cycles to assign expansion cycles and recession cycles. For the analysis, we made conditional transition matrices for farm businesses conditioned on each farm characteristic. Using the conditional transition probability matrix for each farm characteristic, we tested whether the unconditional matrix is different from the conditional matrix.

[1] Path independence means that there is no relationship between previous rating change and future change.

Migration matrices[2]

Migration analysis, a probability-based measurement concept, is the change in credit rating of a bond, firm or farm business over time. By focusing on farm businesses, the migration approach shows how historical risk rating classes of an individual farm as a borrower are changed within a specific time period. Lenders can derive estimates of the probability of loan default or stress rates from migration rates, which show trends in class upgrades or downgrades, or retention (Barry, Escalante, Ellinger, 2002; Barry, Ellinger, Sherrick, 2004).

Each cell of the migration matrix shows the probability of a farm business retaining the same credit rating class or upgrading or downgrading during two consecutive years. In this study, we followed the formula of transition probabilities as Lando and Skodeberg (2002) and Phillips and Katchova (2004). That is,

$$p_{ij} = \frac{n_{ij}}{n_i}, \qquad (1)$$

where n_i is the number of farm businesses in a given rating class *i* at the beginning of the year and n_{ij} is the number of farm businesses, out of this group, that have migrated from class *i* to class *j* at the beginning of next year.

Unlike previous studies in which migration probabilities are analyzed without considering the characteristics of the farm business, we will focus on the migration matrices conditioned on the characteristics (age, farm size, farm business type) and on the

[2] In order to compute the credit risk rate for each farm, we follow the model developed by Splett et al. (1994)

business cycles for each characteristic. We can expect that transition probabilities differ for each characteristic and across the business cycles.

We will use p_{ij} from (1) and p_{ij}^{c}, which is the conditional transition probability, to calculate separately for each characteristic and business cycle. To test these expectations, we formulated the following hypotheses:

1. The hypothesis for testing the effect of the characteristics of the farm businesses on transition probability is

H_0 : $p_{ij} = p_{ij}^{c}$ (characteristic k) = p_{ij}^{c} (characteristic l)

H_a : $p_{ij} \neq p_{ij}^{c}$ (characteristic k) or $p_{ij} \neq p_{ij}^{c}$ (characteristic l)

There are 7 conditional matrices (old, young, large, middle, small, grain, and livestock farms) based on each characteristic.

2. The hypothesis for testing the effect of the business cycles for each characteristic on transition probability is

H_0 : p_{ij} (characteristic k) = p_{ij}^{c} (characteristic k| recession)

= p_{ij}^{c} (characteristic k| expansion)

H_a : p_{ij} (characteristic k) $\neq$ p_{ij}^{c} (characteristic k| recession) or

$\neq$ p_{ij}^{c} (characteristic k| expansion)

For this test, the migration matrices for each characteristic are considered as unconditional matrices.

To test the hypothesis, that is, that the unconditional matrix is different from the conditional matrix, the standard deviation of conditional probabilities and the t-statistics should be calculated[3] as follows.

$$se(p_{ij}^c) = \sqrt{\frac{p_{ij}^c(1-p_{ij}^c)}{n_i^c}} \tag{2}$$

and

$$t = \frac{p_{ij} - p_{ij}^c}{se(p_{ij}^c)}. \tag{3}$$

By comparing t-statistics to critical values for each cell in the transition matrices, we conclude whether or not the unconditional matrix is significantly different from the conditional matrix. To analyze the effect of the characteristics on transition probabilities, we classify the farm business into two or three groups by the characteristics. For age, there are two groups - old farmers classified as age 50 or older and young farmers classified as 49 years old or younger. For farm size, we could define it by several measurements such as total assets, total acres, total production and so on, but in this study we used total assets as our measurement. When a farm's total assets are more than $1 million, they are classified as large farms. From $250,000 to $1 million, they are classified as middle farms. If the total assets are less than $250,000, then they are small farms (Speltt et al. 1994). We grouped the farm business type into grain farms, which produce all kinds of crops, and livestock farms which are not included in grain farms. We ignored the part-time farms.

[3]Nickell, Perraudin, Varotto (2000); Phillips and Katchova (2004)

Data

The data for this study is annual farm-level data from the 1985 to 2003 obtained from the Illinois Farm Business Farm Management (FBFM) data set. The Illinois FBFM Association maintains certified valuable financial records for more than 6,500 farms in Illinois. The FBFM data provides sufficient information about measures of their financial performance and for classifying demographic and structural characteristics of these farms.

In order to obtain risk scores for farm businesses, we should have to utilize farm default data from lenders. However, it is hard to get these data. Thus, in this study, we use information from farm-level financial data as a proxy for actual performance of farm borrowers.

For the unconditional migration matrix, 24,840 farm-year observations are used and, in order to test the transition matrix for three characteristics of farm businesses, this unconditional matrix is compared to conditional migration matrices on characteristics and busyness cycles. Three characteristics, age, farm size and farm business type, are considered as conditions. These conditional migration matrices on each characteristic are used as unconditional matrices to compare them to matrices conditioned on the business cycle for each characteristic.

Two migration matrices, conditioned on age, are developed based on 10,758 farms (43.3%), in which operators are over 50 years old, and on 14,082 farms (56.7%) in which operators are young farmers. Three migration matrices, conditioned on farm size based on farm's assets, are calculated using data from 8,665 large farms (34.9%), 14,535

middle farms (58.5%) and 1,640 small farms (6.6%). For migration matrices, conditioned on farm business type, 21,591 grain farms (86.9%) and 3,249 (13.1%) livestock farms are utilized.[4]

Business cycle

Based on the findings in Bangia et al. (2002) and Nickell, Perraudin, Varotto (2000) looking at which national business cycle affect year-to-year migration rate of bonds, we can predict that agricultural asset performance and valuation should account for macroeconomic conditions and business cycles. If there is a good definition of an agricultural business cycle, it can serve as a proxy for the measurement of the systematic risk of a farm business and will suggest reasons for the migration matrix.

In this study, following the example of Bangia et al. (2002) and Phillips and Katchova (2004), we used the definition[5] of business cycles for expansions and recessions based on the published reports by the National Bureau of Economic Research (NBER). According to the NBER, from 1985 to 2003 the peaks in the US economy were July 1990 and March 2001. The troughs were March 1991 and November 2001. Therefore the recessions in the US were in 1990 and 2001 and the expansions were all the other periods in our data.

[4] In this study, using structural characteristic categories in Splett at al.(1994), when farm assets are over $1,000,000, that farm is thought to be a large farm. A farm with assets between $250,000 and $1,000,000 is classified as a middle farm. If the assets are less than $250,000, it is a small farm. We classify the farm type into two types - grain farms and livestock farms.

[5] The period from a peak to a trough is a recession and the period from a trough to a peak is an expansion (NBER). A recession is a significant decline in economic activities in real GDP, real income, employment, industrial production and wholesale-retail sales, and an expansion is vice versa.

Although there is no exact report on business cycles after November 2001, we can say that, since this data, we have had expansion periods due to the fact that the last trough were November 2001, real GDP was still increasing until the 2nd quarter of 2003, and personal income reached its low point in October 2001, and then generally rose throughout 2003 reaching it's highest level in July 2003 (NBER).

Empirical Results

The unconditional migration matrix and related matrices conditioned not only on age, farm size and farm business type, but also conditioned on business cycles are reported in Table 1 to 11. These results are similar to findings from previous migration studies (Barry, Escalante, and Ellinger, 2002; Escalante et al., 2004; Phillips and Katchova, 2004; Katchova and Barry, 2005).

The average one-period transition matrix across the full sample (24,840 observations) is shown in Table 1. The number in the table is calculated as a ratio of the number of farms that migrate to a class *j* (column class) in period *t* to the total number of farms originally classified under a particular class *i* (row class) in period *t-1*. That is, the migration matrix measures the probability that the credit rating classes of a farm business will change from the row classes to the column classes at the end of each period.

The probabilities along the diagonal represent the retention rate, that is, the probability that a farm will remain in the same credit class. The off-diagonal elements show there are changes in credit rating classes; that is, the upper triangle elements

represent the percentage of downgrade and the lower ones show the percentage of upgrade in credit classification.

In Table 1, retention rates are the highest transition probability for class 1, 2, and 3 and the second highest for class 4 and 5, which is similar to previous studies (Phillips and Katchova, 2004; Katchova and Barry, 2005). The retention rates in this study range from 26.01% to 74.17% with the retention rate for class 1 being the highest one. As can be seen, the probability of a farm business migration to a close class is higher than it is to a far class, which is the same as in the study by Phillips and Katchova (2004).

The conditional matrices on characteristics of the farm business are reported in Table 2, 3, and 4. Each matrix shows the migration probabilities, the differences from unconditional matrix in Table 1, and the results of *t*-test based on two-tailed test with 90% and 95% confidence intervals. In Table 2, 14 out of 25 (upper matrix) and 8 out of 25 lower matrix are significantly different from unconditional matrix in Table 1. From these results, the age of a farmer affects a credit migration and may be a determinant of credit risk migration models[6].

Comparing the upper migration matrix for old farmers and the lower migration matrix for young farmers to the unconditional matrix in Table 1, old farmers are more likely to upgrade their classes and less likely to downgrade since the lower triangle elements in the matrix for old farmers is higher, while, young farms are more likely to downgrade since the upper triangle elements in the matrix for young farmers is higher. For example, the probability of old farmers in class 2 moving up to class 1 in the next period is 4.02% higher than the unconditional probability. The retention rate of class 1 in

[6] Barry et al.(2000) showed that old farmers should be less financially constrained than young farmers, and more financially constrained farms are more likely to adhere to the leasing or long term debt pecking order than less constrained farm.

the upper matrix for old farmers (79.08), is the highest rate among other retention rates in the migration matrices for each characteristic.

The migration matrices conditioned on farm size is reported in Table 3. Eleven out of 25, 4 out of 25, 9 out of 25 in large, middle and small farm matrices, respectively, are significantly different from the unconditional matrix in Table 1. Since the lower triangle elements are higher than those in the unconditional matrix, large farms have a slight tendency to upgrade their classes while middle and small farms have a slight tendency to downgrade than in the unconditional matrix. We have an interesting result which is that in the small farm matrix, 44.6% in class 5 moved to class 3 in the next period.

Table 4 shows the conditional migration matrices on farm business type. For grain farms, only 5 out of 25 are significantly different from the unconditional matrix because 86.9% of farms (21,591 observations) are in grain farms due to regional idiosyncrasies in Illinois. From Table 4, we know that, for the same reason as before, grain farms are less likely to downgrade their classes while livestock farms are more likely to downgrade in a given period.

Each migration matrix conditioned on age, farm size and farm business type in Table 2, 3, and 4, will now be considered as unconditional matrices in order to analyze the influence of the business cycles on the credit rating transitions for each characteristic[7].

Table 5 shows that the migration matrices for old farmers were conditioned on business cycles. Like the previous matrices, each matrix shows the migration

[7] We will call these unconditional matrices age-conditioned, size-conditioned, type-conditioned matrix not to be confused with the unconditional matrix in Table 1.

probabilities and the differences from the unconditional matrix in Table 2 (upper matrix) and the results of the *t*-test based on a two-tailed test with 90% and 95% confidence intervals. During the recession cycles, 10 out of 25 are significantly different from the age-conditioned matrix. Since the upper (lower) triangle elements are higher (smaller) than those in the age-conditioned matrix in recession cycles, old farmers are more likely to migrate down to a lower class and less likely to migrate up to a higher class than age-conditioned matrix. As can be seen, however, during the expansion cycles, the results of the *t*-test show that there is no significance because, in this study, only 2 years (1990 and 2001) are considered as the recession periods and all other periods as the expansion ones.[8]

In Table 6, 12 out of 25 are significantly different from the age-conditioned matrix in Table 2 (lower matrix). The young farmers have a tendency to downgrade and are less likely to upgrade during the recession cycles. Interestingly, the retention rates of class 5 for young farmers and old farmers are higher than the age-conditioned matrix during recession periods, unlike our expectation.

The migration matrices for large, middle, and small farms conditioned on the business cycles are represented in Table 7, 8, and 9 respectively. The upper matrices in each table imply that the large and middle farms are more likely to downgrade their classes during the recession cycles (Table 7 and 8). In Table 9, however, the migration matrix for the small farms, conditioned on the business cycles, is not significantly different from the size-conditioned matrix. Insignificance in this matrix results from the non-farm income. Since the small farms have more non-farm income than the large and middle farms, they are seldom affected by the business cycles, if they are hired in stable

[8] The observations in the expansion cycle are almost 88.37%.

firms. Therefore, their migration matrix is similar to the size-conditioned matrix, regardless of business cycle considerations.

Table 10 and 11 show the migration matrices for grain and livestock farms, conditioned on the business cycles. Grain farms are more likely to migrate down to lower classes and less likely to upgrade during the recession cycles. However, the matrices for livestock farms are not significant, because livestock farms do not follow the general business cycle like small farms.

These results suggest that there exists a tendency to downgrade their classes during a recession, regardless of the characteristics of farm businesses, which are equivalent to the findings reached by Phillips and Katchova (2004) in their agricultural finance study and by Bangia et al. (2002) and Nickell, Perraudin, Varotto (2000) in their finance studies.

Summary and Conclusions

This study introduced the characteristics of the farm businesses and the business cycles to the migration analysis. The results show that conditional transition probabilities for each farm characteristic were significantly different from those of the unconditional matrix. We found that large farms, grain farms and farms with older operators are more likely to upgrade their classes while the opposite pattern is shown for small farms, livestock farms and farms with younger operators. From thses results, since the results of the *t*-test is significant for some of the classes in the migration matrices for three characteristics, these characteristics could be considered by agricultural lenders for credit risk migration

analysis as a significant determinant to evaluate a farm's risk in their loan portfolio. Our results are consistent with previous finance and agricultural finance studies considering the business cycles (Bangia et al., 2002; Nickell, Perraudin, Varotto, 2000; Phillips and Katchova, 2004).

The results for the migration analysis considering business cycles show that all farm businesses, except small farms and livestock farms, have a tendency to downgrade during recession periods. Small farms and livestock farms do not follow this trend, that is, they are less affected by business cycles. During the recession cycles, however, the migration matrices for each characteristic are significantly different from the each unconditional characteristic matrix while, during the expansion periods, those are not significant because the definition of recession in this study is only 2 years (1990 and 2001) out of 19 sample years. However, the results are different from the findings in Escalante et al. (2004), which suggested that specific factors, including age and farm size, do not adequately affect the migration matrix using econometric methods.[9]

In conclusion, our study shows that migration trends differ depending on the farm characteristics. These results provide further insights about the factors affecting farm credit risk migration trends and the different impacts that business cycles have on different types of farms. In the future, the agricultural business cycles could be considered for testing significance between conditional and unconditional migration matrices because the business cycles are based on the whole economy, not based specifically on the agricultural economy. For the migration analysis of farm type, a study could be expanded to use the whole US agricultural data since a study using FBFM data

[9] They considered the farm specific factors as farm size, age, soil, location and so on. They found that age has a positive effect on transition and size has a negative effect, but it is not significant.

to analyze the effect of farm business characteristics on migration matrices is narrow in scope.

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Table 1. Unconditional Migration matrix

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
Class 1	74.17	16.91	7.08	1.63	0.21	8,289
Class 2	23.10	43.14	21.77	9.01	2.98	6,407
Class 3	9.56	23.67	42.15	15.44	9.17	5,919
Class 4	4.84	20.91	34.03	26.01	14.22	2,645
Class 5	0.89	11.90	35.00	23.35	28.86	1,580

Notes: The number in the table shows the ratio of the number of farms that migrate to a class *j* (column class) in period 2 to the total number of farms originally classified under a particular class *i* (row class) in period 1, expressed as a percentage. This matrix is compared to the conditioned migration matrices on the characteristics in table 2, 3, and 4.

Table 2. Migration matrix conditioned on the characteristic age

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
Age≥50						
Class 1	79.08*	13.41*	6.42**	1.07*	0.02*	4,192
	(4.91)	(-3.51)	(-0.66)	(-0.56)	(-0.18)	
Class 2	27.12*	42.90	18.61*	8.95	2.41**	2,692
	(4.02)	(-0.24)	(-3.16)	(-0.05)	(-0.57)	
Class 3	13.35*	24.59	37.38*	16.62	8.06**	2,172
	(3.79)	(0.92)	(-4.77)	(1.18)	(-1.12)	
Class 4	5.57	22.47	31.51**	28.31**	12.15*	1,095
	(0.73)	(1.56)	(-2.52)	(2.30)	(-2.07)	
Class 5	0.99	11.20	33.44	23.72	30.64	607
	(0.10)	(-0.70)	(-1.56)	(0.37)	(1.78)	
Age<50						
Class 1	69.15*	20.50*	7.76	2.20*	0.39**	4,097
	(-5.02)	(3.59)	(0.68)	(0.57)	(0.19)	
Class 2	20.19*	43.31	24.06*	9.04	3.39	3,715
	(-2.91)	(0.17)	(2.29)	(0.04)	(0.41)	
Class 3	7.37*	23.14	44.92*	14.76	9.82	3,747
	(-2.20)	(-0.53)	(2.76)	(-0.68)	(0.65)	
Class 4	4.32	19.81	35.81	24.39	15.68	1,550
	(-0.52)	(-1.10)	(1.78)	(-1.62)	(1.46)	
Class 5	0.82	12.33	35.97	23.12	27.75	973
	(-0.06)	(0.43)	(0.97)	(-0.23)	(-1.11)	

Note: Asterisks, * and **, denote significance at a 95% and 90%confidence level in the test that the conditional probabilities in Table 2 are significantly different from the unconditional probabilities in Table 1 (based on a two-tailed *t*-test). The numbers in parentheses indicate differences from the unconditional matrix in Table 1.

These matrices are compared to the conditioned migration matrices on business cycles in table 5, 6, and respectively.

Table 3. Migration matrix conditioned on the characteristic farm size

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
Assets≥$1,000,000						
Class 1	76.32*	15.01*	6.98	1.57	0.12	3,311
	(2.15)	(-1.90)	(-0.10)	(-0.06)	(-0.08)	
Class 2	25.79*	41.64	22.03	8.41	2.14*	2,152
	(2.69)	(-1.50)	(0.25)	(-0.59)	(-0.84)	
Class 3	11.95*	25.94*	37.39*	16.57	8.15	1,816
	(2.39)	(2.27)	(-4.76)	(1.13)	(-1.02)	
Class 4	4.69	21.99	31.25**	28.68**	13.39	896
	(-0.15)	(1.08)	(-2.78)	(2.67)	(-0.82)	
Class 5	0.61	11.43	30.41*	24.08	33.47*	490
	(-0.27)	(-0.47)	(-4.59)	(0.73)	(4.61)	
$250,000≤Assets<$1,000,000						
Class 1	73.18	18.11*	6.84	1.63	0.25	4,489
	(-0.99)	(1.20)	(-0.24)	(0.00)	(0.04)	
Class 2	21.99**	44.21	21.37	9.29	3.14	3,852
	(-1.11)	(1.07)	(-0.41)	(0.29)	(0.16)	
Class 3	8.47*	23.07	43.54**	15.35	9.57	3,636
	(-1.09)	(-0.59)	(1.38)	(-0.10)	(0.40)	
Class 4	4.56	20.51	35.25	24.94	14.75	1,580
	(-0.28)	(-0.40)	(1.23)	(-1.07)	(0.53)	
Class 5	0.82	11.66	36.20	24.13	27.20	978
	(-0.07)	(-0.24)	(1.20)	(0.78)	(-1.66)	
Assets<$250,000						
Class 1	68.71*	18.81	10.02*	2.04	0.41	489
	(-5.46)	(1.90)	(2.94)	(0.42)	(0.20)	
Class 2	19.35**	40.94	24.32	9.43	5.96*	403
	(-3.74)	(-2.20)	(2.54)	(0.42)	(2.97)	
Class 3	8.78	19.49*	49.89*	11.78*	10.06	467
	(-0.78)	(-4.18)	(7.74)	(-3.66)	(0.89)	
Class 4	8.28	18.93	37.28	21.89	13.61	169
	(3.44)	(-1.97)	(3.25)	(-4.12)	(-0.61)	
Class 5	2.68	16.07	44.64*	13.39*	23.21	112
	(1.79)	(4.17)	(9.64)	(-9.96)	(-5.65)	

Note: Asterisks, * and **, denote significance at a 95% and 90%confidence level in the test that the conditional probabilities in Table 3 are significantly different from the unconditional probabilities in Table 1 (based on a two-tailed *t*-test). The numbers in parentheses indicate differences from the unconditional matrix in Table 1. These matrices are compared to the conditioned migration matrices on business cycle in table 7, 8, and 9, respectively.

Table 4. Migration matrix conditioned on the characteristic farm business type

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
Grain Farm						
Class 1	75.11**	16.61	6.68	1.46	0.14	7,243
	(0.94)	(-0.30)	(-0.40)	(-0.17)	(-0.07)	
Class 2	23.21	44.53*	21.48	8.29**	2.49*	5,587
	(0.11)	(1.39)	(-0.29)	(-0.72)	(-0.49)	
Class 3	9.44	23.87	42.96	15.27	8.47**	5,161
	(-0.13)	(0.20)	(0.80)	(-0.17)	(-0.71)	
Class 4	4.40	20.68	34.74	26.60	13.58	2,297
	(-0.44)	(-0.23)	(0.71)	(0.59)	(-0.63)	
Class 5	0.92	11.59	36.30	23.41	27.78	1,303
	(0.03)	(-0.31)	(1.30)	(0.05)	(-1.08)	
Livestock Farm						
Class 1	67.69	19.02**	9.85*	2.77*	0.67**	1,046
	(-6.48)	(2.11)	(2.77)	(1.14)	(0.46)	
Class 2	22.32	33.66*	23.78	13.90*	6.34*	820
	(-0.78)	(-9.48)	(2.01)	(4.90)	(3.36)	
Class 3	10.42	22.30	36.68*	16.62	13.98*	758
	(0.86)	(-1.37)	(-5.48)	(1.18)	(4.81)	
Class 4	7.76*	22.41	29.31**	22.13**	18.39*	348
	(2.92)	(1.51)	(-4.72)	(-3.88)	(4.18)	
Class 5	0.72	13.36	28.88*	23.10	33.94**	277
	(-0.16)	(1.46)	(-6.12)	(-0.25)	(5.07)	

Note: Asterisks, * and **, denote significance at a 95% and 90%confidence level in the test that the conditional probabilities in Table 4 are significantly different from the unconditional probabilities in Table 1 (based on a two-tailed *t*-test). The numbers in parentheses indicate differences from the unconditional matrix in Table 1.
These matrices are compared to the conditioned migration matrices on business cycles in table 10 and 11, respectively.

Table 5. Migration matrix conditioned on the characteristic *age ≥ 50* and business cycle

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
Age≥50						
Recession						
Class 1	77.10	15.03	6.98	0.89	0.00	559
	(-1.98)	(1.62)	(0.56)	(-0.18)	(-0.02)	
Class 2	18.60*	44.19	25.29*	9.30	2.62	344
	(-8.51)	(1.28)	(6.68)	(0.35)	(0.20)	
Class 3	7.22*	20.53	40.30	22.43*	9.51	263
	(-6.13)	(-4.05)	(2.92)	(5.81)	(1.45)	
Class 4	2.50*	9.17*	27.50	41.67*	19.17**	120
	(-3.07)	(-13.30)	(-4.01)	(13.36)	(7.02)	
Class 5	0.00	9.09	21.82*	20.00	49.09*	55
	(-0.99)	(-2.11)	(-11.62)	(-3.72)	(18.45)	
Expansion						
Class 1	79.38	13.16	6.33	1.10	0.03	3,633
	(0.30)	(-0.25)	(-0.09)	(0.03)	(0.00)	
Class 2	28.36	42.72	17.63	8.90	2.39	2,348
	(1.25)	(-0.19)	(-0.98)	(-0.05)	(-0.03)	
Class 3	14.20	25.14	36.98	15.82	7.86	1,909
	(0.84)	(0.56)	(-0.40)	(-0.80)	(-0.20)	
Class 4	5.95	24.10	32.00	26.67	11.28	975
	(0.38)	(1.64)	(0.49)	(-1.64)	(-0.86)	
Class 5	1.09	11.41	34.60	24.09	28.80	552
	(0.10)	(0.21)	(1.16)	(0.37)	(-1.84)	

Note: Asterisks, * and **, denote significance at a 95% and 90%confidence level in the test that the conditional probabilities in Table 5 are significantly different from probabilities in the upper part of Table 2 (based on a two-tailed *t*-test). The numbers in parentheses indicate differences from the upper matrix in Table 2.
Expansion cycles : 1985-1989, 1991-2000, 2002-2003
Recession cycles : 1990, 2001

Table 6. Migration matrix conditioned on the characteristic *age<50* and business cycle

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
Age<50						
Recession						
Class 1	65.81	23.93**	8.12	1.92	0.21	468
	(-3.34)	(3.43)	(0.36)	(-0.27)	(-0.18)	
Class 2	15.98*	44.28	28.51*	8.42	2.81	463
	(-4.21)	(0.97)	(4.45)	(-0.62)	(-0.58)	
Class 3	3.97*	16.34*	51.21*	18.98*	9.49	453
	(-3.39)	(-6.80)	(6.30)	(4.23)	(-0.33)	
Class 4	1.96*	10.46*	35.29	35.29*	16.99	153
	(-2.36)	(-9.35)	(-0.51)	(10.91)	(1.32)	
Class 5	2.25	6.74*	23.60*	20.22	47.19*	89
	(1.42)	(-5.59)	(-12.38)	(-2.90)	(19.44)	
Expansion						
Class 1	69.58	20.06	7.72	2.23	0.41	3,629
	(0.43)	(-0.44)	(-0.05)	(0.04)	(0.02)	
Class 2	20.79	43.17	23.43	9.13	3.47	3,252
	(0.60)	(-0.14)	(-0.63)	(0.09)	(0.08)	
Class 3	7.83	24.07	44.05	14.18	9.87	3,294
	(0.47)	(0.94)	(-0.87)	(-0.58)	(0.05)	
Class 4	4.58	20.83	35.86	23.19	15.53	1,397
	(0.26)	(1.02)	(0.06)	(-1.19)	(-0.14)	
Class 5	0.68	12.90	37.22	23.42	25.79	884
	(-0.14)	(0.56)	(1.25)	(0.29)	(-1.96)	

Note: Asterisks, * and **, denote significance at a 95% and 90%confidence level in the test that the conditional probabilities in Table 6 are significantly different from probabilities in the lower part of Table 2 (based on a two-tailed *t*-test). The numbers in parentheses indicate differences from the lower matrix in Table 2.
Expansion cycles : 1985-1989, 1991-2000, 2002-2003
Recession cycles : 1990, 2001

Table 7. Migration matrix conditioned on the characteristic *Assets≥$1,000,000* and business cycle

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
Assets≥$1,000,000						
Recession						
Class 1	71.88*	18.83*	8.07	1.22	0.00	409
	(-4.44)	(3.82)	(1.09)	(-0.35)	(-0.12)	
Class 2	14.56*	42.72	29.11*	10.76	2.85	316
	(-11.23)	(1.09)	(7.09)	(2.35)	(0.71)	
Class 3	5.24*	14.85*	45.85*	25.76*	8.30	229
	(-6.71)	(-11.09)	(8.46)	(9.19)	(0.15)	
Class 4	3.92	6.86*	29.41	39.22*	20.59**	102
	(-0.77)	(-15.12)	(-1.84)	(10.53)	(7.20)	
Class 5	0.00	2.04*	18.37*	22.45	57.14*	49
	(-0.61)	(-9.39)	(-12.04)	(-1.63)	(23.67)	
Expansion						
Class 1	76.95	14.47	6.82	1.62	0.14	2,902
	(0.63)	(-0.54)	(-0.15)	(0.05)	(0.02)	
Class 2	27.72**	41.45	20.81	8.01	2.02	1,836
	(1.93)	(-0.19)	(-1.22)	(-0.40)	(-0.12)	
Class 3	12.92	27.54	36.17	15.25	8.13	1,587
	(0.97)	(1.60)	(-1.22)	(-1.33)	(-0.02)	
Class 4	4.79	23.93	31.49	27.33	12.47	794
	(0.10)	(1.94)	(0.24)	(-1.35)	(-0.92)	
Class 5	0.68	12.47	31.75	24.26	30.84	441
	(0.07)	(1.04)	(1.34)	(0.18)	(-2.63)	

Note: Asterisks, * and **, denote significance at a 95% and 90%confidence level in the test that the conditional probabilities in Table 7 are significantly different from probabilities in the upper part of Table 3 (based on a two-tailed *t*-test). The numbers in parentheses indicate differences from the upper matrix in Table 3.
Expansion cycles : 1985-1989, 1991-2000, 2002-2003
Recession cycles : 1990, 2001

Table 8. Migration matrix conditioned on the characteristic *$250,000≤Assets<$1,000,000* and business cycle

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
$250,000≤Assets<$1,000,000						
Recession						
Class 1	71.35	20.18	6.85	1.44	0.18	555
	(-1.83)	(2.07)	(0.01)	(-0.18)	(-0.06)	
Class 2	18.88**	44.94	26.52*	7.87	1.80*	445
	(-3.11)	(0.73)	(5.15)	(-1.43)	(-1.34)	
Class 3	4.86*	19.44**	47.22	18.29	10.19	432
	(-3.61)	(-3.63)	(3.69)	(2.94)	(0.61)	
Class 4	1.27*	11.46*	33.12	36.31*	17.83	157
	(-3.28)	(-9.04)	(-2.13)	(11.37)	(3.09)	
Class 5	1.22	10.98	19.51*	21.95	46.34*	82
	(0.40)	(-0.68)	(-16.68)	(-2.18)	(19.14)	
Expansion						
Class 1	73.44	17.82	6.84	1.65	0.25	3,934
	(0.26)	(-0.29)	(0.00)	(0.03)	(0.01)	
Class 2	22.40	44.12	20.69	9.48	3.32	3,407
	(0.41)	(-0.10)	(-0.67)	(0.19)	(0.18)	
Class 3	8.96	23.56	43.04	14.95	9.49	3,204
	(0.49)	(0.49)	(-0.50)	(-0.40)	(-0.08)	
Class 4	4.92	21.50	35.49	23.68	14.41	1,423
	(0.36)	(1.00)	(0.24)	(-1.25)	(-0.34)	
Class 5	0.78	11.72	37.72	24.33	25.45	896
	(-0.04)	(0.06)	(1.53)	(0.20)	(-1.75)	

Note: Asterisks, * and **, denote significance at a 95% and 90%confidence level in the test that the conditional probabilities in Table 8 are significantly different from probabilities in the middle part of Table 3 (based on a two-tailed *t*-test). The numbers in parentheses indicate differences from the middle matrix in Table 3.
Expansion cycles : 1985-1989, 1991-2000, 2002-2003
Recession cycles : 1990, 2001

Table 9. Migration matrix conditioned on characteristic *Assets<$250,000* and business cycle

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
Assets<$250,000						
Recession						
Class 1	77.78**	11.11**	9.52	1.59	0.00	63
	(9.07)	(-7.70)	(-0.50)	(-0.46)	(-0.41)	
Class 2	17.39	47.83	19.57	4.35**	10.87	46
	(-1.96)	(6.88)	(-4.75)	(-5.08)	(4.91)	
Class 3	7.27	18.18	52.73	12.73	9.09	55
	(-1.51)	(-1.30)	(2.83)	(0.95)	(-0.97)	
Class 4	0.00	14.29	35.71	50.00*	0.00	14
	(-8.28)	(-4.65)	(-1.56)	(28.11)	(-13.61)	
Class 5	7.69	7.69	61.54	0.00	23.08	13
	(5.01)	(-8.38)	(16.90)	(-13.39)	(-0.14)	
Expansion						
Class 1	67.37	19.95	10.09	2.11	0.47	426
	(-1.34)	(1.14)	(0.07)	(0.07)	(0.06)	
Class 2	19.61	40.06	24.93	10.08	5.32	357
	(0.25)	(-0.89)	(0.61)	(0.65)	(-0.63)	
Class 3	8.98	19.66	49.51	11.65	10.19	412
	(0.20)	(0.17)	(-0.38)	(-0.13)	(0.13)	
Class 4	9.03	19.35	37.42	19.35	14.84	155
	(0.75)	(0.42)	(0.14)	(-2.54)	(1.23)	
Class 5	2.02	17.17	42.42	15.15	23.23	99
	(-0.66)	(1.10)	(-2.22)	(1.76)	(0.02)	

Note: Asterisks, * and **, denote significance at a 95% and 90%confidence level in the test that the conditional probabilities in Table 9 are significantly different from probabilities in the lower part of Table 3 (based on a two-tailed *t*-test). The numbers in parentheses indicate differences from the lower matrix in Table 3.
Expansion cycles : 1985-1989, 1991-2000, 2002-2003
Recession cycles : 1990, 2001

Table 10. Migration matrix conditioned on the characteristic *Grain Farm* and business cycle

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
Grain Farm						
Recession						
Class 1	71.27*	19.26*	7.94	1.41	0.11	919
	(-3.83)	(2.65)	(1.26)	(-0.05)	(-0.03)	
Class 2	16.13*	44.51	27.82*	8.90	2.64	719
	(-7.08)	(-0.03)	(6.34)	(0.61)	(0.15)	
Class 3	5.02*	17.08*	48.28*	20.38*	9.25	638
	(-4.42)	(-6.79)	(5.32)	(5.11)	(0.78)	
Class 4	2.08*	8.33*	31.25	39.58*	18.75*	240
	(-2.31)	(-12.35)	(-3.49)	(12.98)	(5.17)	
Class 5	1.80	7.21**	22.52*	19.82	48.65*	111
	(0.88)	(-4.38)	(-13.78)	(-3.59)	(20.87)	
Expansion						
Class 1	75.66	16.22	6.50	1.47	0.14	6,324
	(0.56)	(-0.39)	(-0.18)	(0.01)	(0.00)	
Class 2	24.26**	44.54	20.54	8.20	2.47	4,868
	(1.05)	(0.00)	(-0.94)	(-0.09)	(-0.02)	
Class 3	10.06	24.83	42.21	14.55	8.36	4,523
	(0.62)	(0.96)	(-0.75)	(-0.72)	(-0.11)	
Class 4	4.67	22.12	35.15	25.09	12.98	2,057
	(0.27)	(1.44)	(0.41)	(-1.51)	(-0.60)	
Class 5	0.84	12.00	37.58	23.74	25.84	1,192
	(-0.08)	(0.41)	(1.28)	(0.33)	(-1.94)	

Note: Asterisks, * and **, denote significance at a 95% and 90%confidence level in the test that the conditional probabilities in Table 10 are significantly different from probabilities in the upper part of Table 4 (based on a two-tailed *t*-test). The numbers in parentheses indicate differences from the upper matrix in Table 4.
Expansion cycles : 1985-1989, 1991-2000, 2002-2003
Recession cycles : 1990, 2001

Table 11. Migration matrix conditioned on the characteristic Livestock Farm and business cycle

Current Year	Next Year					Farm Obs.
	Class 1	Class 2	Class 3	Class 4	Class 5	
Livestock Farm						
Recession						
Class 1	77.78*	17.59	3.70*	0.93*	0.00	108
	(10.09)	(-1.43)	(-6.14)	(-1.85)	(-0.67)	
Class 2	25.00	42.05	21.59	7.95*	3.41	88
	(2.68)	(8.39)	(-2.19)	(-5.95)	(-2.93)	
Class 3	6.41	24.36	38.46	19.23	11.54	78
	(-4.01)	(2.06)	(1.79)	(2.61)	(-2.45)	
Class 4	3.03	21.21	36.36	27.27	12.12	33
	(-4.73)	(-1.20)	(7.05)	(5.15)	(-6.27)	
Class 5	0.00	9.09	24.24	21.21	45.45	33
	(-0.72)	(-4.27)	(-4.64)	(-1.89)	(11.52)	
Expansion						
Class 1	66.52	19.19	10.55	2.99	0.75	938
	(-1.16)	(0.16)	(0.71)	(0.21)	(0.08)	
Class 2	21.99	32.65	24.04	14.62	6.69	732
	(-0.32)	(-1.01)	(0.26)	(0.72)	(0.35)	
Class 3	10.88	22.06	36.47	16.32	14.26	680
	(0.46)	(-0.24)	(-0.20)	(-0.30)	(0.28)	
Class 4	8.25	22.54	28.57	21.59	19.05	315
	(0.50)	(0.13)	(-0.74)	(-0.54)	(0.66)	
Class 5	0.82	13.93	29.51	23.36	32.38	244
	(0.10)	(0.58)	(0.63)	(0.26)	(-1.56)	

Note: Asterisks, * and **, denote significance at a 95% and 90%confidence level in the test that the conditional probabilities in Table 11 are significantly different from probabilities in the lower part of Table 4 (based on a two-tailed *t*-test). The numbers in parentheses indicate differences from the lower matrix in Table 4.
Expansion cycles : 1985-1989, 1991-2000, 2002-2003
Recession cycles : 1990, 2001