

EXAMINING MORTGAGE DEFAULT RATES IN OHIO

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EXECUTIVE SUMMARY

Ohio has experienced a major increase in mortgage defaults in recent years. The default rate increased from a low of .67% at the end of 1995 to over 3.5% in 2004. The US rate, by contrast, increased from .87% to around 1.5%. The large increase in default rates seems largely related to Ohio's poor economic performance in recent years. The Ohio unemployment rate was below the national average for most of the 90s but increased dramatically to above the US figure by 2005. Further, Ohio state product grew at a considerably lower rate than the US during the period that the state's relative default rate increased. In addition, home prices in Ohio have much slower than in the US as a whole. This relatively poor growth in equity certainly could be expected to contribute to rising problem mortgages.

The relative default rate for Ohio was statistically related via OLS against the relative unemployment rate, relative real GDP amounts, and the relative home price values for the state. The estimates explained around 64% of default rates for Ohio. Further, the independent variables correctly relate to defaults, with relative unemployment being positively related and relative GDP and home values being negatively related. All variables were highly significant.

To examine additional influences on defaults, a survey of over 1,000 defaulted properties was undertaken. These were combined with an additional survey of over 1,000 properties in the same neighborhoods around Ohio to examine both economic and noneconomic influences on defaults. These included whether the mortgage was a variable rate, unemployment, significant income declines, divorce, non-prime lending, medical illness, minority status, age and having little equity (for whatever reason).

With the exception of age, all variables were positively related to defaults. Further, all regressors were statistically significant with the exception of non-prime lending and minority status. The lack of explanatory power of those two variables, however, may be due to being statistically correlated with age and low equity in the property. Suggestions that the default problem in Ohio was caused by non-prime lending are therefore problematical.

EXAMINING MORTGAGE DEFAULT RATES IN OHIO

I. INTRODUCTION

Ohio has a serious problem with home mortgage defaults and foreclosures. The rate of mortgage delinquencies is over 6% as opposed to approximately 4% nationwide. The percentage of mortgages in foreclosure was over 3.5% vs. around 1.5% nationwide. While the existence of this problem is not in dispute the causes of it may involve both expected and unexpected factors. Clearly the usual suspects in any upsurge in problem home mortgages, namely the state of the general economy, needs to be examined.

In addition to a lack of economic prosperity there are other generally accepted factors at play in mortgage defaults. Small down payments are clearly an issue in many defaults. A lack of credit history should also be expected to produce more defaults as will a lack of sweat equity. A period of rising interests may also be a factor given the existence of variable rate mortgages.

Other variables need to be considered as well. The media suggests that “sub prime” lending is a contributor to increasing mortgage defaults. While this is certainly a possibility a detailed statistical analysis to determine if these assertions are indeed true. More subtle factors may be at play as well. Does borrower age influence default rates? Does race play a role? The sex and or family status of the borrower who defaults? Or a significant change in family status such as divorce, illness or death?

This paper examines these issues in depth. The research is two part in nature. First, an econometric model will be estimated that relates mortgage default rates to a host of anticipated variables, some of which were discussed above. Various statistical tests and methods will be used to identify the factors that actually influence default rates. Second, the micro reasons for default will be researched via the results of surveys of borrowers whose properties were placed for Sheriff’s sales around Ohio as well as neighboring homes whose mortgages are not in default. A host of personal variables from this group will be examined to determine the specific causes for the failed mortgage.

II. MORTGAGE DEFAULT LITERATURE

There is considerable academic research on the determinants of mortgage defaults. Von Furstenberg and Green (1974), Campbell and Dietrich (1983), Foster and Van Order (1984, 1985), Evans, Maris and Weinstein (1985), Vandell and Thibodeau (1985), Cunningham and Capone (1990), Quercia and Stegman (1992), Vandell (1993), and Johnson (1994) have all researched this area. Virtually all have concluded that the loan to value ratio is an important determinant of the likelihood of a mortgage default. In addition, changes in family status play a significant role as well. These include job loss, divorce, illness and death.

For example, research by Johnson (1994) finds that the current loan to value ratio was the most important determinant of mortgage defaults. The unemployment rate was also positively related to failure to pay as was changes in borrower income while employed. Vandell finds significant impact on defaults from the life events mentioned above (1995). Ambrose and Capone (1998) examine the default and foreclosure process using a two stage analysis. This work was extended by Ambrose and Buttimer (2000) and Elmer and Seelig (1999) by modeling the impact of life events along with the amount of equity in the household and by examining home price changes for borrowers.

The issue of LTV ratios has also been examined by researchers. Current loan to value ratios (CLTV) have been estimated on a book and market basis. On a book basis the unpaid loan balance is used while on a market basis the unpaid balance is determined by discounting remaining payments at the current market rate. This requires an accurate mortgage prepayment period which is exceedingly difficult to calculate for a single loan. Another issue is obviously the determination of the market value of the property. For research purposes appraisals are usually unavailable so investigators have proxies these values using market indices.

Cappoza, Kazarian and Thomson (1997, 1998) examine this issue in detail. They create a CLTV ratio for a large set of Freddie Mac loans. The market value of the properties was estimated using median prices from both the National Association of Realtors and Freddie Mac repeat indices. They estimate market value of mortgages assuming prepayment after 40% of the initial loan period. They proxy for trigger events using divorce and unemployment rates. Their later paper contrast market value of the

unpaid balance against book value and concludes that an adjusted book value unpaid balance is acceptable in calculating CLTV.

Ambrose and Capone (1998) examine the issue of defaults not necessarily leading to foreclosure. They used data from the Federal Housing Administration to study the outcome of mortgage defaults. Using the Office of Federal Housing Enterprise Oversight home price index they estimate CLTV. The sample was then broken down into mortgages in default with negative and positive equity. They found that negative equity understated the total defaults though the anomaly was partially explained by trigger events and chronic defaulters. A later study by Ambrose, Capone and Deng (2001) they examine the timing of defaults given home price and interest rate changes. They found that the cost of life events such as divorce influenced the default option but also found that the existence of second mortgages played a role. Clapp (2001), on the other hand, finds that CLTV and borrower credit scores solely explain mortgage defaults.

The impact of home equity loans on default has only recently been examined. Lacour-Little (2004) studies the impact of junior lien mortgages on defaults. He develops a model to predict the use of second mortgages and other junior lien financing, given the unavailability of such data. The model predicted junior liens as a function of borrower age, income, marital status and appreciation of the home in question. In a surprising finding the existence of high CLTV ratios did not appear to significantly reduce the ability to add junior financing. The author presumes this was related to declining lending standards and the rapid development of the home equity market. When the probability of a second mortgage or other junior financing is introduced the likelihood of default increases significantly.

Another issue with little examination in the literature is the impact of sub prime lending on mortgage defaults. Danes and Cross (2005) examine the behavior of investments in sub prime mortgages. Using a sample of over 22,000 sub prime loans they find that FICO credit scores, past delinquency rates, current CLTV ratios, low documentation status were all significant variables in problem sub prime loans. As expected low FICO scores and past delinquency rates significantly affect the likelihood of default by sub prime borrowers. While low documentation loans were more likely to be delinquent they were somewhat less likely to wind up in default. It is uncertain why

but given the belief that a portion of low doc borrowers are self employed individuals perhaps the potential variability of their income explains the higher delinquency rates.

The issue of the impact of race on borrower default and foreclosure has been examined. Munnell, et al (1996), found mortgage loan approval rates were lower for minority borrowers and concluded that this indicated the existence of racial discrimination. Horne (1997) examined the same data set and, grouping by subset of characteristics, found no statistical difference in approval rates by race. Berkovec, et al (1994), analyzed default probabilities by characteristics of the property in question as well as its neighborhood and borrower traits. They concluded that minority borrower default rates are higher and their loans less profitable, a conclusion which does not support the existence of discrimination.

Brueckner (1995) and Ferguson and Peters (1995) conclude that lower minority mortgage approval rates may be indicative of discrimination. Anderson and VanderHoff (1999) found that black households have lower initial equity and higher mortgage default rates. Further, they found that loans to black borrowers were no more profitable than those to white borrowers. They conclude that this is not consistent with discrimination. They do, however, concede that trigger events are more likely to occur for blacks. Related to the issue of low equity for minorities is whether low initial equity (high LTV) ratios are useful in predicting defaults. Harrison, Noordewier and Yavas (2004) examine this issue by controlling for the cost of default to the borrower. Using FICO scores as a proxy for default cost (borrowers with good credit ratings have much more to lose than borrowers with bad credit ratings) they conclude that high credit score borrowers with a high likelihood of payment select higher LTV mortgages and that low credit score borrowers with a high likelihood of payment select low LTV mortgages.

Finally, the issue of whether defaults led to foreclosure has been researched. For example, Lauria, et al (2004) examines the variables that determine the time that elapses between default and foreclosure. Lower LTV values (using the relevant neighborhood property values) have significantly longer periods before foreclosure proceedings are initiated than high LTV's. Surprisingly, low mortgage rate loans received more forbearance than high rate loans. This indicates that lenders were not anxious to foreclose for the ability to replace a low interest rate loan with a high one. Borrowers who

defaulted because of life events such as loss of job were foreclosed on at a significantly faster rate than those gainfully employed and simply unable to afford the payments.

In summary, the literature on explaining mortgage defaults and foreclosure seems to largely follow what common sense would suggest. Little equity seems to be a major culprit as are life events such as job loss and/or divorce. This is true of both prime and sub prime loans. The use of junior mortgages also appears to influence default rates. As might be expected, sub prime borrowers with low FICO scores were more likely to default. Race remains a contentious issue in explaining defaults but a significant part of the literature does not find evidence of discrimination. Time between default and foreclosure may be explained by anticipated changes in property values and the employment status of the borrower in default.

III. EXPLAINING MORTGAGE DEFAULTS IN OHIO

Why is Ohio's mortgage default rate higher than the national average? Figure I shows the percentage of mortgages in foreclosure in Ohio while Figure II shows the total for the US. These are taken quarterly between 1979 and 2005. Figure III represents the difference. Over the 26 year period in question the national foreclosure rate averaged .94% while Ohio's rate averaged 1.48%. For the US the highest quarterly foreclosure rate was 1.51% in the first quarter of 2002 (henceforth 2002) the maximum rate for Ohio was an astonishing 3.53% in the 2004:1.

The difference between the state and national figures averaged +.54% (plus indicating a higher figure for Ohio). It was actually negative for part of the 1990's with Ohio recording a problem rate .28% less than the aggregate total in the first quarter of 1997. The state default rate surpassed the US at the end of 1998 and has soared since then with an excess foreclosure rate of more than 2% of the national average for the last 9 quarters of available data. At first glance economic factors appear to have played a roll in the increase in defaulted mortgages. At the beginning of 1997 Ohio's unemployment rate was a half percent below the national average (see Figure 4). At the peak of unemployment in the middle of 2003 the national rate had increased by 1% while Ohio's

rate had increased by 50% more. Total employment shows the same relatively poor performance in Ohio. From 1997 through 2005 national payroll

FIGURE 1 OHIO MORTGAGE DEFAULT RATE 1979-2005. QUARTERLY AVERAGES

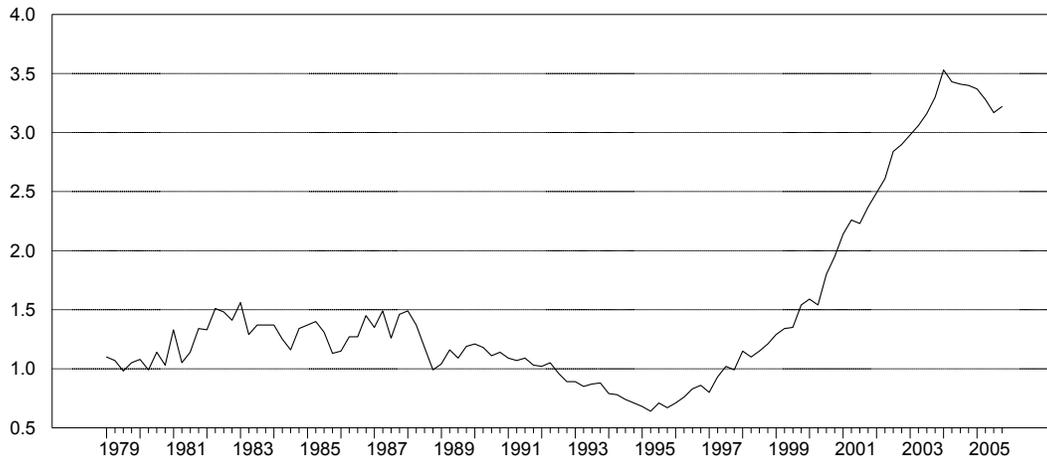


FIGURE 2 US MORTGAGE DEFAULT RATE 1979-2005. QUARTERLY AVERAGES

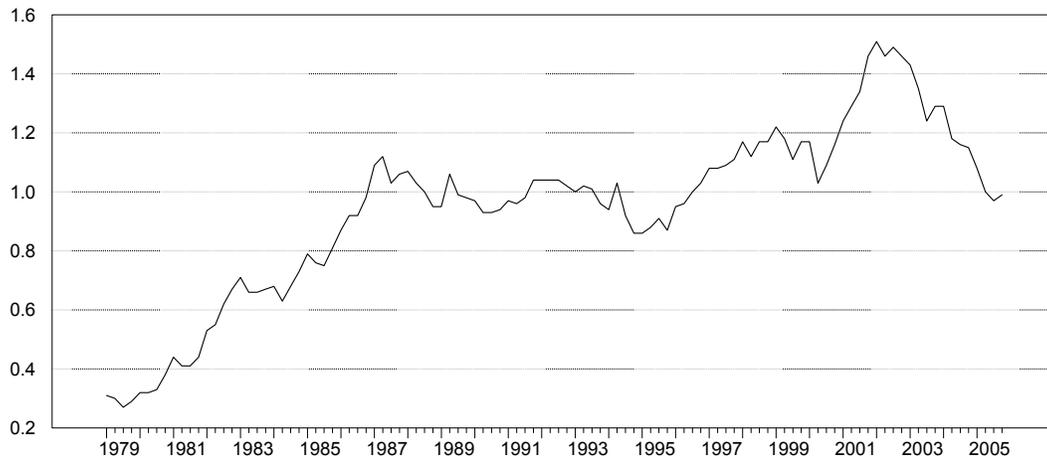


FIGURE 3 OHIO MORTGAGE DEFAULT RATE LESS US RATE, 1979-2005. QUARTERLY AVERAGES

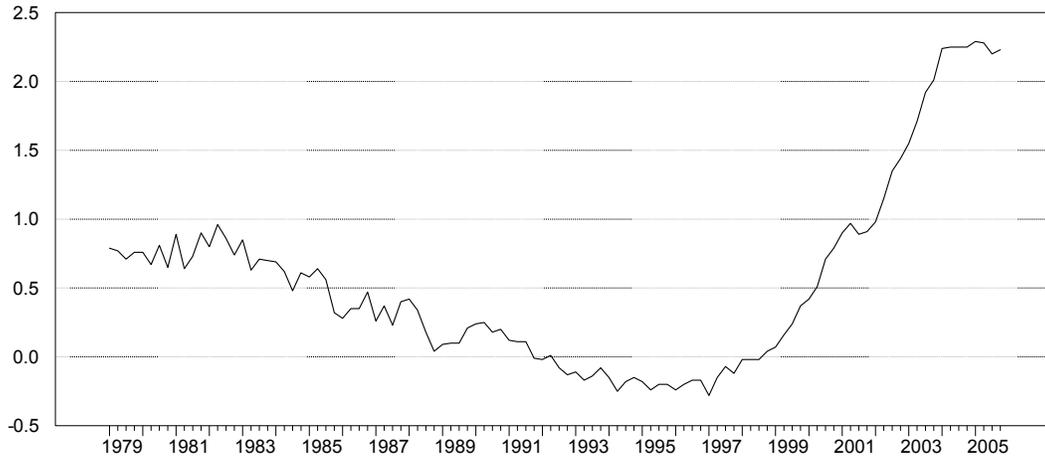
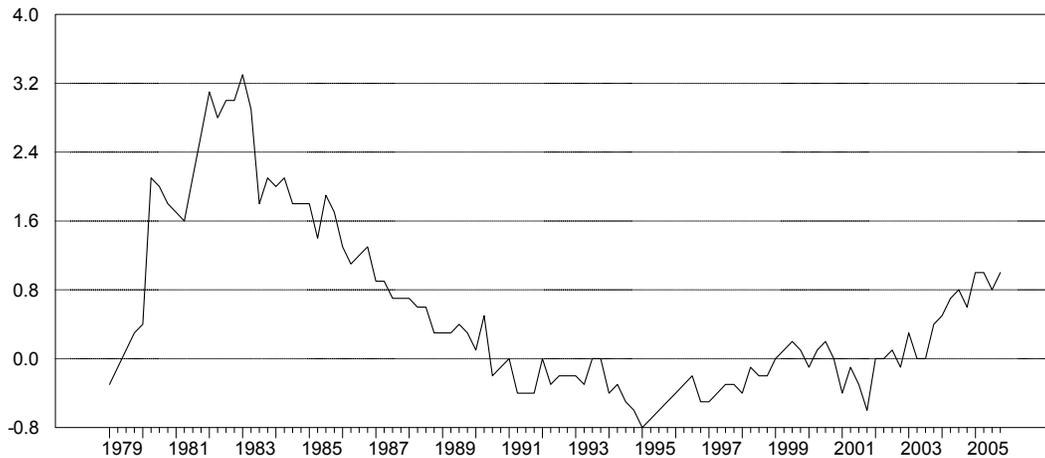


FIGURE 4 OHIO UNEMPLOYMENT RATE LESS US RATE, 1979-2005. END OF QUARTER RATES



employment grew at an annualized rate of 1.15%. During the same time frame Ohio's employment growth was just .23% at an annual rate (Figures 7 through 9).

What is occurring in Ohio to explain such poor employment performance? As with any economy, Ohio's destroys and creates jobs at the same time. The state's job creation rate in the 1989 through 2001 period was below par. The US job creation rate per existing employment was 17% in this period while Ohio's was 15%. If the state had created jobs at the national average Ohio would have added around 85,000 jobs per year. Further, new job growth was sub par in both manufacturing and nonmanufacturing.

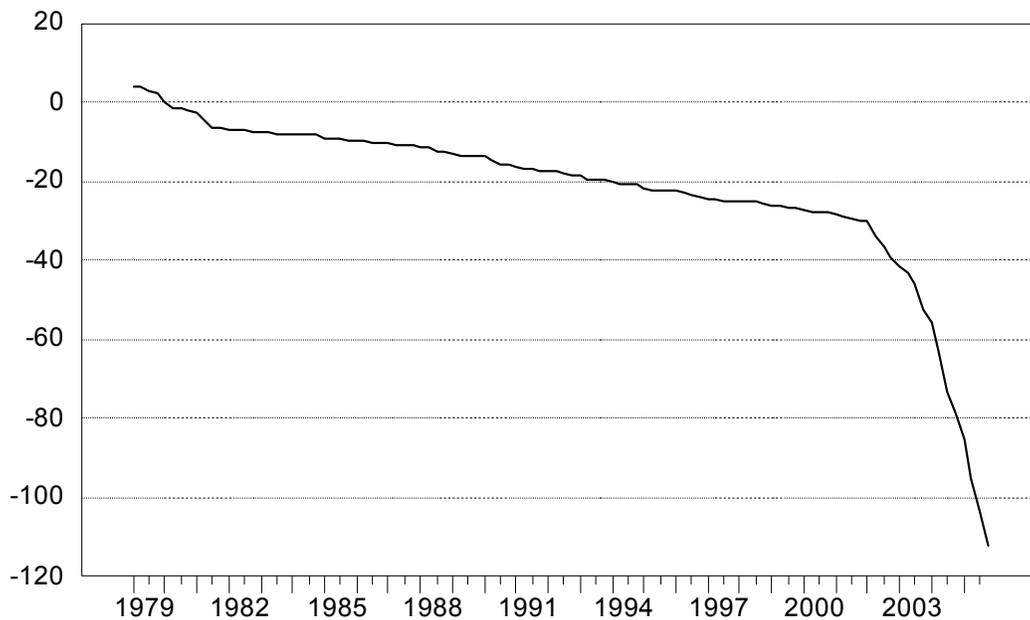
Unfortunately, this slow new job growth has occurred along with an increase in the number of jobs being destroyed. Up until the mid 1990's Ohio, as well as many other Midwestern states, had a job destruction rate less than the national average. After that, the lost job rate began to increase both absolutely as well as relative to the nation and now has risen to roughly the US average. As with new jobs, the increase in lost jobs has been seen in both manufacturing and nonmanufacturing.

The nature of the job losses is revealing. Lost employment may occur because a firm goes out of business or because it uses fewer employees. In Ohio a small portion of the job loss is related to companies shutting down. About two thirds of lost jobs are related to firms that continue to remain in business. Job destruction was 8.5% in 1989 vs. 12.9% in 2001. Ohio's rate increased faster than the US rate over this period and now exceeds the national average. Difficult times in the labor market bode for problems with meeting mortgage obligations (source: Federal Reserve Bank of Cleveland)

Another measure of the states relative economic health is the difference in the growth of real state product vs. the US real GDP growth. From 1997 through 2004 the US economy grew at a real annualized rate of 3.1 %. Ohio's real gross state product, by contrast, grew at only 1.4% during this period. Ohio accounted for 4.7% of US real output in 1979 vs. just 3.5% in 2005. It is obvious that Ohio was hit far harder by the most recent recession than the nation as a whole. The combination of slow growth in incomes and rising unemployment should certainly be expected to wreak havoc in the mortgage market.

Of course, loss of jobs and/or income should be expected to generate home loss. Why, however, has the foreclosure rate risen so high in Ohio? If an individual or family loses their job why not simply sell the home collateral and move on? Part of the answer is seen in the performance of collateral in question. Between 1979 and 2005 the rate of increase in home prices nationwide averaged 5.5%. For Ohio the rate of growth was 4.1%. This masks the deterioration in the relative value of home properties in Ohio. From 1997 through 2005 home values gained an average of 7.8% in the US, a clear acceleration. Unfortunately, the rate remained at just 4.1% for Ohio. Figure 5 shows the relative change in housing values in Ohio.

FIGURE 5 OHIO HOME PRICE INDEX LESS US INDEX, 1979-2005, QUARTERLY (1980 = 0)



Specific parts of the state fared even worse. For example, over the last five years (through 2005) US home prices rose over 57%. During this same period Akron's growth 20.4%, Canton-Massillon was 20.7%, Cleveland's totaled 21.1%, Columbus was 23.8%, Dayton 18.5%, Lima 24.6%, Mansfield 23.0%, Springfield 20.9%, Toledo 20.7%, and Youngstown 20 %. Of course, these are averages for the regions in question. It is entirely possible that within those areas some homes/neighborhoods actually saw declining property values.

From above, it is obvious that Ohio's economy has not been performing well in recent years. This, combined with slow growth in average home values, may explain at least part of the increase in the mortgage default rate in the state. In the next section statistical analysis is undertaken to test this hypothesis. Further, if the economy and lagging home price growth are factors it should be possible to determine how much they contributed to the rapid rise in mortgage defaults.

IV. STATISTICAL ANALYSIS OF ECONOMIC FACTORS AND MORTGAGE DEFAULTS

In this section a basic model of Ohio's mortgage default rate is developed and analyzed. From above, it is anticipated that Ohio's relatively weak economy and lagging home value increases will explain a significant portion of the rapid increase in the state's mortgage default rate. The basic model is shown in (1):

$$(1) \quad MD = a - RA + OU + GDP + e$$

where

MD = Ohio's mortgage default rate less the US rate

RA = Ohio's home price index divided into US home price index

DUE = Ohio's unemployment rate less US unemployment rate

GDP = Ohio's real state product divided by US real GDP

Mortgage default rates are quarterly averages from 1979 through 2005. Data is from the Mortgage Bankers Association. The dependent variable is the Ohio default rate less the US rate. From above, this figure ranged from a low of minus .28% in the first quarter of 1997 to a high of 2.29% in the first quarter of 2005. Home price data is from the The Office of Federal Housing Enterprise Oversight (OFHEO). OFHEO's House Price Index (HPI) is a measure designed to capture changes in the value of single-family homes in the U.S. as a whole, in various regions of the country, and in the individual states and the District of Columbia. The HPI is published by OFHEO using data provided by Fannie Mae and Freddie Mac.

The HPI is a broad measure of the movement of single-family house prices. Because of the breadth of the sample, it provides more information than is available in other house price indexes. The HPI serves as a timely, accurate indicator of house price trends at various geographic levels. It also provides housing economists with an improved analytical tool that is useful for estimating changes in the rates of mortgage defaults, prepayments and housing affordability in specific geographic areas.

The HPI includes house price figures for the nine census bureau divisions. In addition, the Index contains separate house price indexes for the 50 states and the District of Columbia. A weighted average index figure for the United States as a whole is also included. Each quarter, Fannie Mae and Freddie Mac provide information on their most recent mortgage transactions. These data are combined with the data of the previous 29 years to establish price differentials on properties where more than one mortgage transaction has occurred. The data are merged, creating an updated historical database that is then used to estimate the HPI (description from OFHE website). The independent variable in this study is the Ohio index divided into the national index. It is anticipated that the relative value of Ohio homes will be negatively related to default rates.

Unemployment data is taken from the Bureau of Labor Statistics monthly household survey. Since it is impractical to actually count every unemployed person each month, the Government conducts a monthly sample survey called the Current Population Survey (CPS) to measure the extent of unemployment in the country. The CPS has been conducted in the United States every month since 1940 when it began as a Work Projects Administration project. It has been expanded and modified several times since then. As

explained later, the CPS estimates, beginning in 1994, reflect the results of a major redesign of the survey.

There are about 60,000 households in the sample for this survey. The sample is selected so as to be representative of the entire population of the United States. In order to select the sample, first, the 3,141 counties and county-equivalent cities in the country are grouped into 1,973 geographic areas. The Bureau of the Census then designs and selects a sample consisting of 754 of these geographic areas to represent each State and the District of Columbia. The sample is a State-based design and reflects urban and rural areas, different types of industrial and farming areas, and the major geographic divisions of each State (description from BLS website). The independent variable is the Ohio rate for end of quarter less the US unemployment rate end of quarter. Presumably the relative rate of Ohio unemployment will positively impact mortgage default rates.

Ohio real state product is taken from the Bureau of Economic Analysis as is US GDP. Since the state numbers are available annually they are interpolated to create a quarterly series. The relative growth rate of the Ohio economy is expressed as the Ohio product divided by US real GDP. Presumably mortgage default rates will be negatively related to this variable.

OLS estimates for quarterly data 1979 through 2005 are presented in Table 1. As anticipated, the relative home value variable RA is negatively related to relative default rates as is the relative real product variable GDP. In addition, the excess level of Ohio unemployment (DUE) has a positive influence on problem mortgages. All of the variables are statistically significant with t-scores of -3.86, -9.29 and 11.41, respectively. The model is fairly robust, with the two independent variables explaining around 64% of the relative default rate.

Interpreting the coefficients is straightforward. For example, the US and national housing price index is set at 1 in 1980. If Ohio's home values had grown at the same rate as the US the relative mortgage default rate in the state would be 1.47% less than actual value of 2.23% in the fourth quarter of 2005. If Ohio's unemployment rate was the same as the US the relative default rate would be .52% lower in the fourth quarter of 2005.

While the above results are logical, 36% of mortgage defaults in the state are not explained by the model. Certainly common sense along with a review of literature

suggests that other factors play a role in mortgage defaults. The next part of the research attempts to examine those factors by direct survey.

V. STATEWIDE MORTGAGE DEFAULT SURVEY

In order to exam a broader spectrum of possible causes of defaults in the state a survey of individuals who have experienced mortgage defaults was undertaken. Specifically, a survey of 1,000 plus individuals/families who had defaulted on their mortgages in Cleveland, Toledo, Columbus, Dayton, and Cincinnati was undertaken. They were identified (with great effort) via Sheriff's auction information. The names identified were then matched with phone numbers via web search. They were contacted for a current address for mailing the survey.

Of the approximately 1,200 final surveys mailed a total of 225 were returned in usable form. An additional 1,200 plus individuals were surveyed in the same regions using county records. As much as possible they were drawn from the neighborhoods where the mortgages had been defaulted on. The purpose of this was to build a survey data set of problem mortgages and those not in default to examine specific characteristics that could explain the successful and problem loans. Of those surveyed 271 were returned in usable form.

The survey asked the following questions:

- 1.) Is/was this residence your primary place of residence? YES NO
- 2.) Have you defaulted on your mortgage? YES NO
- 2.) Was/is your mortgage a variable rate? YES NO
- 3.) Had you lost your job since you obtained the mortgage? YES NO
- 4.) Assuming no job loss was their a significant decrease in your income? YES NO
- 5.) Was there a divorce or significant change in family status? YES NO
- 6.) Was your mortgage a low down payment or non-prime loan? YES NO
- 7.) Was their a significant illness in the family prior that did not result in job loss? YES NO
- 8.) Are you or other family members a member of a minority group? YES NO
- 9.) What is the current age of the head of household?

10.) Did/does your property appear to be worth less than what you owed on your mortgage? YES NO

In order to isolate specific factors in mortgage defaults the survey attempted to eliminate redundant causes. For example, loss of employment would likely cause a drop in family income so a positive response there would necessitate a negative entry for income loss. A significant illness in the family was dealt with in the same way, that is, if it caused loss of employment it was entered as a negative. It also possible, of course, that other survey variables are correlated. Earlier research indicates, for example, that minority borrowers are significantly younger than nonminorities.

To maximize response size and accuracy, all variables except age are binary with zero indicating negative response and one for a positive answer. For example, a mortgage in default carries a value of one. A minority borrower carries a value of one where as a Caucasian has a zero value. Since the dependent variable is whether the mortgage was defaulted on and has a zero or one value, statistical estimation is done by probity analysis. This is done by estimating non-linear maximum likelihood models. The resulting coefficients, standard errors, t-statistics and significance levels have interpretations similar to linear regression.

It is anticipated the variable rate mortgages, job loss, reduced income and divorce/significant change in family status will increased mortgage default rates. In addition it seems reasonable that borrowers with significant illness and those who obtained nonprime loans would also have higher default rates. Defaulted mortgages should also be related to low equity amounts. Finally, age and race are surveyed as potential factors in mortgage defaults. It seems likely, for example, that younger borrowers would be more likely to default on mortgages given lower incomes, fewer assets and so forth.

The results of the probit estimation are shown in Table 2. The pseudo R squared value indicates that over 84% of mortgage defaults are explained by the above survey variables. All regressors were anticipated to be positively related to defaults except age. Examination of these coefficients shows this to be the case. In addition, all of the suspect

influences are statistically significant with the exception of the non-prime variable and the race variable.

Attempting to explain the rapid rise in mortgage defaults in Ohio from this corresponds with the time series estimates on the state's relative default rates. Both job loss and (assuming continued employment) significant change in family incomes are positively related with failed mortgages. From the above time series data we know that job loss and state product growth in Ohio fared much worse than the nation in the period that the relative mortgage default rate soared. It is also possible that the major illness response also picks up hard economic times in that significant medical bills for those without insurance are much more difficult to deal with when a.) firms are dropping health coverage and b.) employment opportunities to deal with those bills are limited. The strong relationship between perceived negative equity and default also corresponds with the aggregate findings of lagging property value growth in Ohio. Divorce was also related to defaults. Given that economic factors play a role in failed marriages the weak economy may have influenced marriage breakdowns.

This leaves three regressors, non-prime mortgages, race and age. Age is strongly, negatively correlated with mortgage defaults which seems logical. Both non-prime borrowing and race are positively related to defaults but are statistically insignificant from zero. These need to be carefully interpreted lest these factors be removed as culprits in mortgage defaults. There may two reasons these variables are not significant. One is statistical. For example, younger borrowers may be more likely to be minorities and to obtain sub-prime loans (correlation coefficients of -.41 and -.18, respectively). Reestimating the probit model without the age variable, as shown in Table 3, causes the race variable to be highly significant in the estimation. Only non-prime lending remains insignificant but its t-statistic does increase.

It also seems that obtaining non-prime mortgages may be correlated with low/negative equity in the immediate years after the loan has occurred. Reestimation of the model with the exclusion of the low equity response causes the non-prime variable to become statistically significant as shown in Table 4. Another possible explanation of the initial lack of significance of non-prime lending on defaults is that some borrowers were

unaware that they had obtained this type of financing (as sub-prime critics contend) and simply responded incorrectly.

Given mixed race marriages and/or mixed heritages this number overstates minority borrowing yet the sample certainly has a higher percentage of these respondents than the does the total population of the state. The minorities have a default rate of of 67% in the sample while non-minorities have a rate of around 30%. These borrowers, however, have an average age of 36.4 years while the minority average age is 29.5 or almost seven years younger. Given the strong negative relationship between age and defaults makes the argument that race is a culprit questionable. For example, employed respondents in the survey were around 35 years old on average while unemployed were about 28.5 years old.

The model has a great deal of explanatory power both in terms of how much of defaults are explained by the survey variables as well as how all of the factors in question have the anticipated relationship to troubled mortgages. Since the survey is cross sectional as opposed to panel in nature it is not possible to show how changing independent variables have caused mortgage defaults to soar. The results clearly show that bad economic factors such as unemployment and reduced income clearly increase the likelihood of distressed mortgages as does having a variable rate mortgage. Given earlier evidence that Ohio's economy deteriorated much more than the nation during the last recession the findings are as expected. In addition, Ohio's lagging property values show up as a major influence on defaults given the responses to the low equity query.

While illness and divorce should increase troubled mortgages it seems unlikely that they would have accelerated dramatically in the period when Ohio's mortgage rates were soaring. As stated above, though, the poor Ohio economy may have increased family stress and worsened the financial impact of illness via lost employment and/or income. Age is clearly a culprit with younger borrowers being much more likely to default on mortgages. How much of this is related to the fact that younger individuals earn less, have less savings and are potentially less able to deal with significant financial obligations is uncertain. Minority borrowers are also much more likely to default. They are also much more likely to be young and to have experienced job and/or income loss.

Finally, the development and marketing of “sub prime” loan products may have played some role in rising default rates. Over 50% of default respondents report having this type of financing vs. around 25% for ongoing mortgages. The accuracy of this figure may be a concern. For, example over 70% of mortgage default respondents report a positive response regarding low equity. Perhaps some of these individuals actually had sub prime loans and were not aware of it. On the other hand 70% of those claiming to have sub prime lending have variable rate mortgages. They may be confusing the two. Further, sub prime lending should certainly be expected to lead to foreclosures when (again) the economy is in poor condition.

VI. Summary and Conclusions

Ohio has experienced a significant and disturbing increase in mortgage defaults in recent years. The default rate increased from a low of .67% at the end of 1995 to over 3.5% in 2004. The US rate, by contrast, increased from .87% to around 1.5%. The large increase in default rates seems to be related to Ohio’s poor economic performance in recent years. The Ohio unemployment rate was below the national average for most of the 90s but increased dramatically to one full percent above the US by 2005. Further, Ohio state product grew at a rate less than half of the US during the period that the relative default rate soared. In addition, home prices in Ohio have grown at a far slower rate than in the US. This lack of equity build up certainly could be expected to contribute to rising problem mortgages.

The relative default rate for Ohio was statistically related via OLS against the relative unemployment rate, relative real GDP amounts, and the relative home price values for the state. The estimates explained around 64% of default rates for Ohio. Further, the independent variables correctly relate to defaults, with relative unemployment being positively related and relative GDP and home values being negatively related. All regressors were highly significant.

To examine additional influences on defaults, a survey of over 1,000 defaulted properties was undertaken. These were combined with an additional survey of over 1,000 properties in the same neighborhoods around Ohio to examine both economic and

noneconomic influences on defaults. These included whether the mortgage was a variable rate, unemployment, significant income declines, divorce, non-prime lending, medical illness, minority status, age and having little equity (for whatever reason). The surveys were analyzed using probit analysis with robust results. With the exception of age, all variables were positively related to defaults. Further, all regressors were statistically significant with the exception of non-prime lending and minority status. The lack of explanatory power of those two variables, however, may be due to being statistically correlated with age and low equity in the property. As such, blaming sub-prime lending for high mortgage defaults is problematical.

TABLE 1 RESULTS OF OLS ESTIMATE OF RELATIVE OHIO MORTGAGE DEFAULT RATES, RELATIVE HOME PRICES, RELATIVE UNEMPLOYMENT AND RELATIVE GDP

Linear Regression - Estimation by Least Squares

Dependent Variable DIFF

Quarterly Data From 1979:01 To 2005:04

Usable Observations 108 Degrees of Freedom 104

Centered R2 0.649668 R Bar **2 0.639562**

Uncentered R2 0.785938 T x R**2 84.881**

Mean of Dependent Variable 0.5423148148

Std Error of Dependent Variable 0.6828740890

Standard Error of Estimate 0.4099735136

Sum of Squared Residuals 17.480141315

Regression F(3,104) 64.2871

Significance Level of F 0.00000000

Variable	Coeff	Std Error	T-Stat	Signif

1. Constant	5.5754423	2.2757287	6.84416	0.00000000
2. DUE	0.5275725	0.0462329	11.41119	0.00000000
3. RA	-4.1878955	1.0823197	-3.86937	0.00019062
4. GDP	-252.4883336	27.1856541	-9.28756	0.00000000

TABLE 2 RESULTS OF PROBIT ESTIMATE OF MORTGAGE DEFAULT SURVEY VARIABLES

Probit - Estimation by Newton-Raphson

Convergence in 8 Iterations. Final criterion was 0.0000000 < 0.0000100

Dependent Variable DEF

Usable Observations 496 Degrees of Freedom 486

Cases Correct 462

Log Likelihood -87.939833

Average Likelihood 0.8375301

Pseudo-R2 0.8455602**

Variable	Coeff	Std Error	T-Stat	Signif

1. Constant	2.028215632	0.708282296	2.86357	0.00418897
2. FR	0.527933341	0.228898479	2.30641	0.02108783
3. UE	2.186659154	0.322539607	6.77951	0.00000000
4. SI	2.747631675	0.379757596	7.23523	0.00000000
5. DV	0.583822985	0.220418305	2.64870	0.00808009
6. NP	0.063768053	0.228200202	0.27944	0.77990789
7. SM	1.742784616	0.420803893	4.14156	0.00003450
8. MI	0.183491011	0.244408994	0.75075	0.45280076
9. AGE	-0.161327000	0.020623088	-7.82264	0.00000000
10. LOW	2.084192284	0.272193246	7.65703	0.00000000

**TABLE 3 RESULTS OF PROBIT ESTIMATE OF
MORTGAGE DEFAULT SURVEY VARIABLES
EXCLUDING AGE**

Probit - Estimation by Newton-Raphson

Convergence in 7 Iterations. Final criterion was 0.0000000 < 0.0000100

Dependent Variable DEF

Usable Observations 496 Degrees of Freedom 487

Cases Correct 425

Log Likelihood -135.955290

Average Likelihood 0.7602535

Pseudo-R2 0.7186248**

Variable	Coeff	Std Error	T-Stat	Signif

1. Constant	-3.350708068	0.302642590	-11.07150	0.00000000
2. FR	0.543196065	0.186930921	2.90587	0.00366239
3. UE	2.012655310	0.229905047	8.75429	0.00000000
4. SI	2.158847276	0.266841946	8.09036	0.00000000
5. DV	0.634202159	0.177486252	3.57325	0.00035258
6. NP	0.229852458	0.180270387	1.27504	0.20229410
7. SM	1.355831194	0.331361734	4.09170	0.00004282
8. MI	0.834691941	0.182668641	4.56943	0.00000489
9. LOW	1.840334365	0.197844568	9.30192	0.00000000

**TABLE 4 RESULTS OF PROBIT ESTIMATE OF
MORTGAGE DEFAULT SURVEY VARIABLES
EXCLUDING AGE AND LOW EQUITY**

Probit - Estimation by Newton-Raphson

Convergence in 6 Iterations. Final criterion was 0.0000000 < 0.0000100

Dependent Variable DEF

Usable Observations 496 Degrees of Freedom 488

Cases Correct 413

Log Likelihood -194.043238

Average Likelihood 0.6762339

Pseudo-R2 0.5407783**

Variable	Coeff	Std Error	T-Stat	Signif

1. Constant	-2.413820965	0.209396494	-11.52751	0.00000000
2. FR	0.505115694	0.154648102	3.26623	0.00108991
3. UE	1.695286656	0.173217615	9.78703	0.00000000
4. SI	1.950548158	0.212368376	9.18474	0.00000000
5. DV	0.650914301	0.146641861	4.43880	0.00000905
6. NP	0.366957645	0.150006301	2.44628	0.01443382
7. SM	1.033729368	0.278318608	3.71419	0.00020385
8. MI	0.835696334	0.150193884	5.56412	0.00000003

**TABLE V CORRELATION MATRIX OF SURVEY
VARIABLES**

	<i>DEF</i>	<i>FR</i>	<i>UE</i>	<i>SI</i>	<i>DV</i>	<i>NP</i>	<i>SM</i>	<i>MI</i>	<i>AGE</i>	<i>Column 10</i>
DEF	1									
FR	0.168544	1								
UE	0.360517	0.063505	1							
SI	0.316483	0.05788	-0.37594	1						
DV	0.327963	0.084399	0.09521	0.167981	1					
NP	0.276624	0.055666	0.162198	0.083678	0.114975	1				
SM	0.05843	-0.17124	-0.14869	0.075305	0.021173	-0.07657	1			
MI	0.364956	0.030303	0.165716	0.083621	0.134914	0.236568	-0.04098	1		
AGE	-0.62134	-0.09561	-0.28062	-0.12439	-0.20813	-0.18238	0.024217	-0.41932	1	
LOW	0.591669	0.096717	0.156777	0.181453	0.200726	0.202733	0.000763	0.229346	0.34515	1

REFERENCES

Ambrose, Brent W.; *Capone*, Charles A.. [Modeling the Conditional Probability of Foreclosure in the Context of Single-Family Mortgage Default Resolutions.](#) Real Estate Economics, Fall98, Vol. 26 Issue 3, p391-429, 39p; (AN 1116228)

Ambrose, Brent W.; *Buttimer Jr.*, Richard J.. [Embedded Options in the Mortgage Contract.](#) By: Journal of Real Estate Finance & Economics, Sep2000, Vol. 21 Issue 2, p95, 17p, 3 charts, 1 graph; (AN 3952345)

Ambrose, Brent W.; *Capone Jr.*, Charles A.; Yongheng Deng. [Optimal Put Exercise: An Empirical Examination of Conditions for Mortgage Foreclosure.](#) Journal of Real Estate Finance & Economics, Sep2001, Vol. 23 Issue 2, p213, 11p, 7 charts, 2 graphs; (AN 5163511)

Anderson, Richard; *VanderHoff*, James. [Mortgage Default Rates and Borrower Race.](#) By: Journal of Real Estate Research, Sep/Oct99, Vol. 18 Issue 2, p279, 11p, 2 charts; (AN 2557731)

Berkovec, Jim; Zorn, Peter. [How Complete is HMDA? HMDA Coverage of Freddie Mac Purchases.](#) Journal of Real Estate Research, 1996, Vol. 11 Issue 1, p39, 17p, 9 charts; (AN 4474943)

Brueckner, Jan K., [Why Do We Have ARMs?](#) Journal of the American Real Estate & Urban Economics Association, Fall93, Vol. 21 Issue 3, p333-345, 13p; (AN 5917553)

Campbell, Tim S.; *Dietrich*, J. Kimball. [The Determinants of Default on Insured Conventional Residential Mortgage Loans.](#) Journal of Finance, Dec83, Vol. 38 Issue 5, p1569, 13p, 3 charts; (AN 4655195)

Capozza, Dennis R.; Kazarian, Dick; Thomson, Thomas A.. [Mortgage default in local markets](#). Real Estate Economics, Winter97, Vol. 25 Issue 4, p631, 25p, 5 charts, 2 graphs; (AN 88360)

Capozza, Dennis R.; Kazarian, Dick. [The Conditional Probability of Mortgage Default](#). Real Estate Economics, Fall98, Vol. 26 Issue 3, p359-389, 31p; (AN 1116227)

Clapp, John M.; Goldberg, Gerson M.; Harding, John P.; LaCour-Little, Michael. [Movers and Shuckers: Interdependent Prepayment Decisions](#). Real Estate Economics, Fall2001, Vol. 29 Issue 3, p411, 40p, 3 graphs; (AN 5487161)

Cunningham, Donald F.; **Capone** Jr., Charles A.. [The Relative Termination Experience of Adjustable to Fixed-Rate Mortgages](#). Journal of Finance, Dec90, Vol. 45 Issue 5, p1687, 17p; (AN 4652393)
Quercia and Stegman (1992)

Danis, Michelle A.; Pennington-**Cross**, Anthony. [A Dynamic Look at Subprime Loan Performance](#). Journal of Fixed Income, Jun2005, Vol. 15 Issue 1, p28-39, 12p, 8 charts, 2 diagrams, 6 graphs; (AN 17542267)

Evans, Richard D.; **Maris**, Brian A.; Weinstein, Robert L.. [Expected Loss and Mortgage Default Risk](#). Quarterly Journal of Business & Economics, Winter85, Vol. 24 Issue 1, p75, 18p, 6 charts, 2 graphs; (AN 7024644)

Ferguson, Michael F.; **Peters**, Stephen R.. [What Constitutes Evidence of Discrimination in Lending?](#) Journal of Finance, Jun95, Vol. 50 Issue 2, p739-748, 10p, 1 diagram, 1 graph; (AN 9508160614)

Foster, Chester; **Van Order**, Robert. [FHA Terminations: A Prelude to Rational Mortgage Pricing](#). AREUEA Journal: Journal of the American Real Estate & Urban Economics Association, Fall85, Vol. 13 Issue 3, p273-291, 19p; (AN 5860489)

Harrison, David M.; **Noordewier**, Thomas G.; Yavas, Abdullah Harrison (2004) [Do Riskier Borrowers Borrow More?](#) By: Real Estate Economics, Fall2004, Vol. 32 Issue 3, p385-411, 27p, 3 charts, 3 graphs; DOI: 10.1111/j.1080-8620.2004.00096.x; (AN 14118220)

Horne, David K.. [Mortgage Lending, Race, and Model Specification](#). Journal of Financial Services Research, Feb-Apr97, Vol. 11 Issue 1/2, p43-68, 26p, 7 charts; (AN 9710280655)

LaCour-Little, Michael. [Equity Dilution: An Alternative Perspective on Mortgage Default](#). Real Estate Economics, Fall2004, Vol. 32 Issue 3, p359-384, 26p, 5 charts, 3 graphs; DOI: 10.1111/j.1080-8620.2004.00095.x; (AN 14118221)

Lauria, Mickey; Baxter, Vern; Bordelon, Bridget.Lauria, et al (2004) [An investigation of the time between mortgage default and foreclosure](#). Housing Studies, Jul 2004, Vol. 19 Issue 4, p581-600, 20p; DOI: 10.1080/0267303042000221972; (AN 13867875)

Munnell, Alicia H.; Tootell, Geoffrey M. B.; Browne, Lynn E.; McEneaney, James. [Mortgage Lending in Boston: Interpreting HMDA Data](#). By: American Economic Review, Mar1996, Vol. 86 Issue 1, p25-53, 29p, 8 charts; (AN 9604090384)

Vandell, Kerry D.; **Thibodeau**, Thomas. [Estimation of Mortgage Defaults Using Disaggregate Loan History Data](#). AREUEA Journal: Journal of the American Real Estate & Urban Economics Association, Fall85, Vol. 13 Issue 3, p292-316, 25p; (AN 5860500)

By: **Vandell**, Kerry D.; Barnes, Walter; Hartzell, David; Kraft, Dennis; Wendt, William. [Commercial Mortgage Defaults: Proportional Hazards Estimation Using Individual Loan Histories](#). Journal of the American Real Estate & Urban Economics Association, Winter93, Vol. 21 Issue 4, p451-480, 30p; (AN 5918821)

Von Furstenberg, George M.; Green, R. Jeffery [Home Mortgage Delinquencies: A Cohort Analysis](#), *Journal of Finance*, Dec74, Vol. 29 Issue 5, p1545, 4p; (AN 4655371)