Spatial Patterns of Subprime Mortgages by Local Banks, Non-Local Banks, and Independents in the Continental U.S.

by

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Abstract:

Mortgage innovations and New Deal agencies facilitated lower priced loans for prime borrowers and minimum price disparities across U.S. regions. In the 1980s, deregulation removed price restrictions on banks' mortgages and also removed geographic distance restrictions on lending, opening the subprime industry. Global and Local Moran identified interregional price disparities based upon proportions of subprime mortgage originations. A cluster of high-priced mortgage originations was found along the Gulf States both before and after the subprime collapse of 2007. Local banks, perceived to have special underwriting knowledge about their markets, and who were more likely to offer preferred prices, were compared with non-local banks and independent mortgage companies on their spatial distributions of mortgage pricing. During the boom and bust years from 2005 to 2008, the regional patterns of proportions of subprime mortgages for each mortgage institution type were similar, adversely impacting borrowers in the Southern Gulf region. These spatial patterns suggest that non-local banks and independents made the same underwriting conclusions about borrowers in regional markets as the local bank specialists.

Introduction:

Historically, in many countries and especially in the U.S., borrowers relied on their local depository banks for housing credit. Local banks were special because they had superior access to local information (Collender and Shaffer, 2003). U.S. savings and loans, chartered to finance residential mortgages under regulations limiting their geographic reach, had a special stake in the economic well-being of the areas they served.

Mortgage industry innovations such as automated underwriting, credit scoring, New Deal agencies, securitization, and legislation such as the Deregulation and Monetary Control Act of 1980 helped break down distance barriers between mortgage lenders of all types and borrowers. A national mortgage market evolved that served borrowers having excellent credit with low mortgage prices which were generally consistent across all U.S. regions. This national market helped achieve two public policy goals: maximizing home ownership and low-cost homeowner credit with minimum price disparities across regions (Bernanke, 2007). Deregulation of bank mortgage loans permitted credit risk-based pricing resulting in high-priced ('subprime') mortgages for credit-constrained borrowers. The varying proportions of subprime mortgages across the U.S. resulted in new pricing disparities across geographic regions.

This research identified regional areas where borrowers were most likely to obtain subprime mortgage pricing and also identified locations where borrowers were more likely to obtain subprime mortgage pricing based upon the borrowers' choice of mortgage institution type. Borrowers may have selected a bank for a mortgage loan which had a retail branch office in the homeowners' market. These institutions' mortgages were classified as 'local bank'. Borrowers may have obtained their mortgage from a bank which did not have any retail branch offices in their market. These mortgages were classified as 'non-local bank'. Or borrowers may have selected independent mortgage companies or credit unions for their mortgage loans.

Local banks have special advantages when competing in their markets for new mortgage originations. Local banks have relationship experience with local customers (Degryse and Oregena, 2005; Ergungor, 2010) who are potential candidates for new mortgage loans, knowledge about local market competitors, and knowledge about the communities' economic conditions (Snowden, 1997). In the early 21st century, homeowners who obtained mortgage loans from local bank branches were more likely to obtain favorable pricing as compared to homeowners who chose mortgage loans from non-local banks or independent mortgage companies (Avery et al, 2006; Betts et al, 2006; 2007; 2008). If local banks had special knowledge of their markets and used this special knowledge to underwrite mortgages at preferred prices, then it is reasonable to ask if the areas where local banks were more likely to provide favorable pricing mapped to the same areas where the non-local lenders were more likely to provide favorable pricing. Twenty-five years after geographic distance lending was deregulated, were the regional spatial patterns of subprime mortgage pricing similar for borrowers selecting local banks, non-local banks, and independents? Did any of the mortgage institution types provide their borrowers consistent prices across regions?

Spatial autocorrelation using Global Moran's I and Local Moran was calculated on the proportion of borrowers who obtained subprime mortgage pricing. The geographic units were metropolitan areas in the continental U.S. The spatial disparities of mortgage pricing were shown by mapping Local Moran for all mortgage institution types combined, and also separately for local banks, non-local banks, and independents. This research identified regional areas where mortgage credit was rationed. The results reveal that the New Deal mortgage finance agencies, new mortgage technologies, and lending distance deregulations did not close the mortgage pricing disparities between regions. The results show that the non-local banks and independents generally followed the same spatial patterns of mortgage pricing as the local banks which were expected to have specialized knowledge of their markets and customers. The bubble–bust period of 2005 through 2008 was studied in order to observe changes before and after the 2007 collapse of the subprime industry (Wyly et al, 2008).

Background:

U.S. depository institutions originating home mortgage loans were localized from their beginnings in the mid-1800s through the 1980s. Nationally chartered commercial banks were prohibited from originating mortgages on residential properties until the 1930s (Crossney, 2010). New Deal legislation required nationally chartered savings and loan institutions to invest a majority of their insured deposits in residential mortgages; however, their mortgage loans were restricted to homeowners located within a 50-mile radius from the savings and loans' home offices. This geographic lending restriction was to insure that lenders had 'local expertise' in underwriting and servicing (Green and Wachter, 2007) and to preserve the soundness and safety of residential finance (Snowden, 1997).

Savings banks' mortgages were fixed rate loans and were generally amortized over 30 years. Savings banks funded these mortgages with short-term deposits. Prior to the 1980s, interest rate ceilings on savings banks' deposits and interest payment restrictions on commercial banks' demand deposits provided saving banks—chartered to originate home mortgages—special advantages to obtain a steady supply of low-cost capital to lend to homeowners in their local markets. During the 1970s, market interest rates exceeded ceilings on savings deposit rates. The result was the outflow of deposits from banks to higher yielding securities such as U.S. Treasuries.

The Depository Institution Deregulation and Monetary Control Act (DIDMCA) of 1980 and the Garn-St. Germain Depositories Institution Act (GSGDIA) of 1982 addressed the liquidity squeeze on banks and broadened their ability to raise capital and earn profits on new mortgages. DIDMCA removed interest ceilings on insured deposits and permitted national savings banks and commercial banks to charge any interest rate they chose on mortgage loans, superseding state usury laws. GSGDIA allowed federal savings banks to originate adjustable rate mortgages, interest only mortgages, balloon payment mortgages, and to charge borrowers prepayment penalties. Furthermore, DIDMCA removed all geographic distance restrictions on mortgage loans between federally chartered savings banks and borrowers. "These laws opened the door for the development of the subprime market" (Chomsisengphet and Pennington-Cross, 2006).

Home mortgage interest rates in the U.S. varied by geographic region over the past 150 years (Lea, 1996; Longbrake and Peterson, 1979; Snowden, 1987). Census data which captured 1880s home mortgage pricing across the country showed the mortgage price gradient was lowest in the Northeast and increased with distance from the Northeast. Borrowers in the South and West had mortgages 200 to 400 basis points, or 2 to 4%, higher. Transfer costs combined with credit risk factors were significant contributors to these interregional price disparities. New Deal reforms in the 1930s established agencies such as Fannie Mae, a common name for the Federal National Mortgage Association, to increase the supply of home mortgage credit, lower its costs, and minimize regional mortgage interest rate disparities (Bernanke, 2007). Fannie Mae was first chartered in 1938 to purchase government-insured mortgages and sell mortgage securities to investors. In 1968 Fannie Mae was re-chartered to provide a secondary market through purchasing conventional mortgages from banks and mortgage companies to sell to investors. In 1980 the Federal Home Loan Mortgage Corporation (commonly known as Freddie Mac) was chartered by Congress to compete with Fannie Mae. Fannie Mae's and Freddie Mac's charters granted these government-sponsored enterprises (GSEs) special privileges. Capital to finance the GSEs' mortgage purchases is obtained from Federal Reserve loans or by issuing debt securities without Securities and Exchange Commission approval. The implicit government guarantee of the GSEs' debt enables them to raise capital on bond market exchanges at preferential rates. Government-insured savings deposits, government-insured mortgages, guarantees protecting mortgage investors from defaults, and government-sponsored secondary markets to purchase mortgage securities resulted in narrowing interregional mortgage interest rate differentials from 200 basis points in the 1930s to roughly 50 basis points by the mid-1980s (Bernanke, 2007).

New technologies such as credit scoring, automated underwriting, securitization, and outsourcing loan servicing allow today's lenders to market and service mortgage loan products to borrowers throughout the country without local branch offices. In 2009, Freddie Mac's weekly Primary Mortgage Market Surveys indicated that interest rate spreads between their regions narrowed to 13 basis points (Freddie Mac, 2009). While institutions and new technologies expanded mortgage credit availability and distribution at lower costs with minimum regional disparities for low-risk 'prime' mortgage borrowers, new mortgage products, namely 'subprime' mortgages, served credit-constrained borrowers; however, subprime mortgages carried much higher interest rates. Wide regional variations in the proportion of subprime mortgage originations diluted the accomplishments of prime mortgages' spatial homogeneity. Large proportions of high-priced mortgage originations in one region over other regions are unequal geographic allocations of mortgage credit, and their existence illustrates that national goals of low-cost home credit for all regions were not fulfilled.

Paraphrasing Wyly and Holloway (2002), the Home Mortgage Disclosure Act (HMDA) data, which contains the numbers and geographic locations of mortgage institutions' mortgages, enables researchers to monitor mortgage credit's geographic allocation. Mortgage price data has been included in the HMDA data since reporting year 2004. Subprime mortgages are reported in the HMDA data as having a rate spread between the annual percentage rate (APR) of the mortgage and the U.S. Treasury bond yield with a similar term to maturity. A mortgage's APR includes the loan's interest rate and the fees required to obtain the mortgage expressed as an annualized interest rate over the loan term. Example fees used in the APR calculation include loan origination, discount points, appraisal, and underwriting. When a mortgage APR exceeded the U.S. Treasury bond yield by three or more percentage points for first lien mortgages, the interest spread was included in the HMDA data record; otherwise, the rate spread field in the HMDA data record was empty. Most rate spread mortgages in the HMDA data for the periods studied were 'subprime' (Avery et al, 2006). The presence of a rate spread value in the HMDA data is generally considered to be a proxy for subprime mortgages (Betts et al, 2006; 2007; 2008; Ergungor, 2010; Mayer and Pence, 2008; Wyly et al, 2008).

Using HMDA data (Federal Financial Institutions Examination Council (FFIEC), annual), the proportions of high-priced subprime mortgages in metropolitan areas of the continental U.S. were calculated. Table 1 provides the numbers and proportions of conventional first lien mortgages on owner-occupied, site-built homes within the conforming loan limits which had subprime prices between years 2004 and 2008. Conforming loan limits were the maximum loan amounts of mortgages eligible for sale and guaranteed by the GSEs (Fannie Mae and Freddie Mac). The percentage of high-priced mortgages relative to all conventional conforming mortgages for each mortgage institution type is also included in Table 1. The HMDA data confirms that borrowers were more likely to obtain better pricing when they selected local banks as compared to non-local banks or independent mortgage companies. Across the nation, subprime mortgage lending surged in the mid-2000s. The irrational exuberance in housing, buttressed by easy home finance credit at any price, peaked in 2006 when subprime's share of all mortgages exceeded 28%. A consequence of the housing bust was that conventional mortgage originations 'fell off a cliff' by 2008 and subprime mortgage lending also fell below 8% of all mortgages.

Table 1. Proportion of high-priced (subprime) mortgages in U.S. metropolitan areas by mortgage institution type (source: FFIEC, 2005-2009).

	All lender types			Percentage of mortgages high-priced (subprime) by mortgage institution type			
Year	Number of mortgages	Number high-priced	Percentage high-priced	Local banks	Non-Local banks	Independent mortgage companies	Credit unions
2004	8 018 381	1 122 621	14.00	5.11	11.94	25.04	3.29
2005	7 642 464	1 995 623	26.11	9.14	25.73	41.87	2.49
2006	6 487 225	1 847 039	28.47	14.13	31.89	39.77	2.45
2007	5 015 771	881 318	17.57	12.44	23.89	19.40	2.46
2008	3 144 606	247 178	7.86	8.52	9.73	5.28	2.91

Table 2 provides the number of mortgages and the market shares of the different mortgage institution types that originated those mortgages reported in Table 1. Market share was evenly distributed between local banks, non-local banks, and independent mortgage companies from 2004 through 2006, the peak years of subprime lending. Independent mortgage companies that had the largest market shares, and were the most likely to originate high-priced subprime mortgages from 2004 through 2006, surrendered their market share leadership by 2007 and were competing in the lower price segment of the mortgage market in 2008. Conventional mortgage lending fell 37% in 2008 from the previous year's already weak numbers. Hard-hit mortgage institutions specializing in subprime mortgage products closed by choice, bankruptcy, or through the force of regulators. Surviving mortgage institutions closed down subprime lending divisions and, as shown by the increased local bank share in Table 2, operated closer to their branch office footprint.

Table 2. Market share by institution type for mortgage loans in U.S. metropolitan areas (source: FFIEC, 2005-2009).

		Mortgage institution type							
		Local bank		Non-Local bank		Independent mortgage company mortgages		Credit union mortgages	
Year	Total number of mortgages	Number of mortgages	Market share	Number of mortgages	Market share	Number of mortgages	Market share	Number of mortgages	Market share
2004	8 018 381	2 502 587	31.21%	2 540 876	31.69%	2 729 010	34.03%	245 908	3.07%
2005	7 642 464	2 191 839	28.68%	2 458 981	32.18%	2 763 091	36.15%	228 553	2.99%
2006	6 487 225	1 947 989	30.03%	2 038 148	31.42%	2 306 408	35.55%	194 680	3.00%
2007	5 019 524	1 920 526	38.26%	1 725 137	34.37%	1 161 952	23.15%	208 156	4.15%
2008	3 144 606	1 361 720	43.30%	963 544	30.64%	579 759	18.44%	239 583	7.62%

The bubble–bust period from 2004 through 2008 had remarkable shifts in mortgage lender types participating in U.S. markets and changes in mortgage products offered. Using Global and Local Moran statistics (Anselin, 2003; Anselin et al, 2006), this research explored the geographic distribution of the proportion of subprime mortgage originations, including breaking down the geographic distribution by mortgage institution types.

Previous Research:

Two studies document the loan price impact of distance between lenders and borrowers. Degryse and Onegena (2005) reported evidence that loan rates increased with the distance between a Belgian bank lender with a national branch office network and small business borrowers. Loan prices decreased with distance between the borrowing firm and the bank branch when competing banks were nearby. A shortage of local lenders competing in a market resulted in substantially higher loan rates or spatial price discrimination for business firms in markets served by few local lenders. Ergungor (2010) reported that residential mortgage loan prices decreased in low- to moderate-income census tracts in Ohio based upon the number of bank branch offices located within a 10-mile radius of the census tract. Loan pricing in high-income census tracts was not impacted by the number of nearby bank branch offices. Ergungor suggested that borrowers in high-income neighborhoods relied more on their credit history and scores for low-cost mortgage loans, while local banks in low- to moderate-income neighborhoods used relationships or soft information in addition to credit history to approve lower priced residential mortgage loans for their customers. Relationships between banks and borrowers were established over time when customers interacted with the local bank branch for multiple products and services. Relationship lending requires a physical presence in the market. Ergungor used 2004 and 2005 HMDA data for approximately 2,900 census tracts in Ohio. Bank branch location data was obtained from the FDIC's Summary of Deposit data sets.

Avery et al (2006) built thematic maps of metropolitan area units that were classified by quintiles of the proportions of high-priced mortgages and documented the associated geographic patterns. Their study used conventional first lien home purchase mortgages on owner-occupied site-built homes from 2005 HMDA data. The presence of a rate spread value was used to identify high-priced mortgages. Avery et al, reporting the extreme disparities of proportions of high-priced mortgages in metropolitan areas, found that in Ithaca, NY, 4% were high-priced, while in McAllen, TX, 53% were high-priced. The reasons given for these wide variations across metropolitan areas were differences in credit scores, percentage of adults with less than high school education, unemployment rates, and racial composition of the metropolitan areas. Avery et al also discussed the pattern of a low proportion of high-priced mortgages along the Pacific Coast. The Pacific Coast had lower proportions of high-priced mortgages for refinancing as compared with home purchases, while the rest of the country had higher proportions of high-priced mortgages for refinancing. Avery et al attributed this anomaly to the rapid home appreciation in this region which gave refinance borrowers reduced loan-to-value ratios, which lowers credit risk, while purchasers had to stretch financially to purchase homes at higher prices.

As a proxy variable for credit risk, Wyly et al (2008) used proportions of HMDA data records describing mortgage applications denied based on credit history. The mortgage application denial rate proportion explained more than one-third of the variance in the proportion of subprime mortgages in their logit model. The metropolitan areas with the highest credit history denial rates matched many of the metropolitan areas having the highest proportion of high-priced mortgages found in this present study, namely the Texas border and Southern metropolitan areas. While Wyly et al (2008) argued that race mattered, their results showed that subprime geography mapped to credit risk geography.

Fellows (2006) of the Brookings Institution analyzed the geography of credit scores using TransUnion's trend database. The sample data included 25 million credit reports extracted quarterly from 1999 to 2004. From the database, Fellows provided national estimates as well as county-level data on credit scores and credit delinquencies. Counties in the Southern states, including Texas, had the highest concentrations of weak credit scores in 2004. Counties along the Pacific Coast, including those California and in the Northeast, had the highest concentrations of high credit scores. Avery et al (2006) reported the close association of the spatial patterns of high-priced lending with Fellows' geographic patterns of credit scores.

Betts et al (2006; 2007; 2008) utilized HMDA data to thematically map subprime lending by zip code area within Shelby County (including Memphis), TN. They extended their research by examining subprime lending based upon the types of lenders that originated mortgages in their local markets. Lender types included local banks (depository bank and credit union institutions having a branch in Shelby County) and non-local lenders (depository institutions without any branches in Shelby County and all independent mortgage companies). While finding the highest concentrations of subprime loans in zip code areas with lower incomes and higher minority populations, their analysis showed the highest market share penetration in Shelby County zip code areas by non-local lenders. The proportions of non-local lenders' subprime loans in Shelby County, TN, were more than twice the proportions of local banks'. Non-local banks and independent mortgage companies accounted for 91% of all the subprime loans originated in Shelby County in 2006. Local lenders had not penetrated the neighborhoods having high concentrations of low- and moderate-income borrowers or African American borrowers as compared with non-local lenders' success in these neighborhoods. Newman and Wyly (2004), who studied the spatial patterns of subprime mortgages and foreclosures in Essex County, NJ, and Betts et al (2008), have both argued that subprime loans replaced 'redlining' of low-income and minority neighborhoods with 'greenlining' to facilitate a 'foreclosure-driven' housing market.

The present research includes a spatial dimension. Allen and Gale (2000) suggested that banking liquidity shocks are subject to contagion processes. While Allen and Gale's work relates specifically to liquidity crises, their arguments may be extended to other banking practices. Thus some form of a contagion process would be expected if subprime mortgages were first promoted by banks or mortgage companies competing with each other within a specific region. These contagion processes would be reinforced by bottom-up pressure from borrowers interacting with their neighbors. Evidence for this appeared in Schintler et al (2009) and Schintler (2008). Schintler et al (2009) showed the growing spatial association of residential unit foreclosures in neighboring census tracts of New England states over quarterly time periods. The increasing value of Global Moran's I over time showed stronger foreclosure relationships impacting neighboring census tracts, suggesting that, over time, foreclosures spread as a contagion to neighboring communities. Using Local Moran, Schintler et al identified the geographic hot and cold spots of foreclosure activity and compared mean values of demographic data between hot and cold foreclosure neighborhoods to describe attributes of communities where foreclosures were concentrated. In addition, Schintler (2008) calculated Global Moran's I on metropolitan area changes in home prices and showed the contagious spread of home price changes over time to neighboring metropolitan areas. Local Moran was used to show clusters of neighboring metropolitan areas having the highest and lowest rates of change in home prices.

The present research makes several contributions to the literature. The spatial dimension demonstrating regional mortgage pricing disparities is reported through spatial autocorrelation statistics. The existing literature relies heavily on thematic mapping on raw mortgage statistics followed by qualitative descriptions of the spatial variation in mortgage pricing. The spatial autocorrelation approach using Global Moran's I and Local Moran provides concrete evidence of statistically significant regional price disparities. Existing literature that compares mortgage pricing between local banks and distant lenders was presented at a local level. The present research fills that gap by reporting the mortgage pricing at a national scale. For each of the lender types, the spatial distribution of mortgage pricing is presented using spatial autocorrelation including Local Moran.

Data and Methods:

Proportions of subprime mortgages were calculated for each metropolitan area in the continental U.S. using conventional, first lien, owner-occupied, dollar conforming mortgages on site-built, single family homes defined in the HMDA data. Jumbo mortgages with loan amounts exceeding the maximum loan that can be purchased by

Fannie Mae or Freddie Mac were excluded. Mortgages secured by two-, three-, and four-family residences which had higher conforming loan amount limits than single-family residences were not captured if the loan amount exceeded the limits for single-family mortgages because HMDA data records did not identify the number of family units. The presence of the rate spread in the HMDA data record identified the subprime mortgages. Calculations were performed separately for each year from 2005 through 2008.

The FDIC's Summary of Deposit (SOD) data provided the addresses of all U.S. FDIC insured bank branches. The HMDA data identified institution types (banks, independent mortgage companies, credit unions) through the regulatory agency code. Banks' mortgages needed to be reclassified as either 'local' or 'non-local'. HMDA data for depository institutions (except credit unions) were linked to SOD data using the mortgage's bank identifier and metropolitan area code. HMDA data mortgage loans of depository institutions were classified as either 'local' or 'non-local' based upon the bank depository having a branch office in the same metropolitan area where its mortgage was originated (Betts et al, 2007). Proportions of high-priced subprime mortgages in each metropolitan area were calculated separately for each mortgage institution type: local banks, non-local banks, independent mortgage companies, and credit unions. Credit union data was captured only to account for the complete set of conventional mortgages in each metropolitan area.

Geographic lending patterns between local banks, non-local banks, independent mortgage companies, and these three institution types combined were compared using spatial autocorrelation, which measures a variable's dependency to its geographic space. The spatial autocorrelation measurements in the present research indicate whether or not borrowers in one metropolitan area had a similar or dissimilar likelihood of obtaining subprime mortgage pricing based upon the likelihood in neighboring metropolitan areas. When neighboring metropolitan areas have similar likelihoods of subprime mortgages, the spatial autocorrelation is stronger. Spatial autocorrelation measures increasing over time suggest that the subprime mortgage phenomena spread like an infection from a core area, impacting increasing numbers of neighboring metropolitan areas. The GeoDa software package (Anselin, 2003; 2005; Anselin et al, 2006) was used to calculate Global Moran's I statistics on metropolitan areas' proportions of subprime lending to measure the level of spatial autocorrelation in the data (Ebdon, 1985; Rogerson, 2006; Wong and Lee, 2005). Positive values of Global Moran's I suggest that values of proportions of subprime are similar in neighboring metropolitan areas. Global Moran's I values approaching +1 suggest the strongest relationship while values approaching 0 (from the negative side) suggest that the proportions of subprime mortgage originations are randomly distributed across metropolitan areas. Global Moran's I was calculated using the attribute of proportions of high-priced mortgages for each study year, for all mortgage lender types combined, and repeated for each of the three types of mortgage institutions across continental U.S. metropolitan areas.

Since metropolitan areas are not continuous within the continental U.S., Thiessen polygons were generated from metropolitan area units to ensure that all metropolitan area units were connected. Using Thiessen polygons and the first order queen's contiguity rule (Anselin, 2005), neighbors of metropolitan areas were identified to build the spatial weights matrix used by GeoDa to calculate Global and Local Moran statistics. Anselin recommended that the distribution of spatial unit neighbors be verified to avoid strange features such as bimodal distributions or some spatial units having very few neighbors and some spatial units having a high number of neighbors. The observed connectivity weights matrix for these Thiessen polygons representing metropolitan areas resulted in a normal distribution of neighbors ranging between 2 and 10 metropolitan areas.

Global Moran's I provided a single metric of spatial dependence over the entire continental U.S. Because global measures are inadequate to describe specific locations of spatial variability, local measures must be relied upon (Wong and Lee, 2005). Local Moran on thematic maps was used to detect clusters' size and location (Rogerson, 2006), defining geographic regions having high proportions of subprime mortgages and geographic regions having concentrations of low proportions of subprime mortgages. For each statistically significant value of a metropolitan area's Local Moran index (using *p*-value < .05 computed by GeoDa), the Local Moran cluster classification was set for a metropolitan area using one of the following classification values (Anselin, 2005):

- High-High when the proportion of high-priced mortgages of the metropolitan area and its neighbors was high relative to the mean value of all metropolitan areas,
- Low-Low when the proportion of high-priced mortgages of the metropolitan area and its neighbors was low relative to the mean value of all metropolitan areas,
- High-Low when the proportion of high-priced mortgages in the metropolitan area was low and its neighboring metropolitan areas had high proportions of high-priced mortgages, and

- Low-High when the proportion of high-priced mortgages in the metropolitan area was high and its neighboring metropolitan areas had low proportions of high-priced mortgages.

Thematic maps of the Local Moran's classifications were presented in groups of four to qualitatively compare the size and locations of regional clusters of high-priced subprime mortgage lending. Local Moran cluster maps for years 2006 and 2008 were used to show changes between the peak year of subprime lending and the year following the subprime mortgage industry's collapse. Metropolitan areas were rank ordered by proportions of subprime loans on charts to show the ten highest and ten lowest metropolitan areas based upon the proportion of high-priced mortgages for all lenders combined for the years 2006 and 2008.

Results:

The Global Moran's I values (Figure 1) reflect spatial autocorrelation coefficients using proportions of high-priced mortgages in metropolitan areas for all mortgage institutions combined, and separately for each mortgage institution type. The Global Moran's I values, ranging from +0.3 to +0.53, suggest a low to moderate spatial autocorrelation of proportions of subprime mortgages across U.S. metropolitan areas. All mortgage institution types combined and non-local banks' mortgages had an increasing value of spatial autocorrelation over the four years from 2005 to 2008, suggesting that the phenomena of high and/or low proportions of subprime mortgages extended outward from core areas, impacting neighboring metropolitan areas to an increasing degree over time. Local banks had the highest spatial autocorrelation coefficients of the three mortgage institution types. The irregular annual increases and decreases in Global

Moran's I by local banks and independent mortgage companies suggest no contagious impact of loan pricing into neighboring metropolitan areas by these mortgage institution types during the study period.

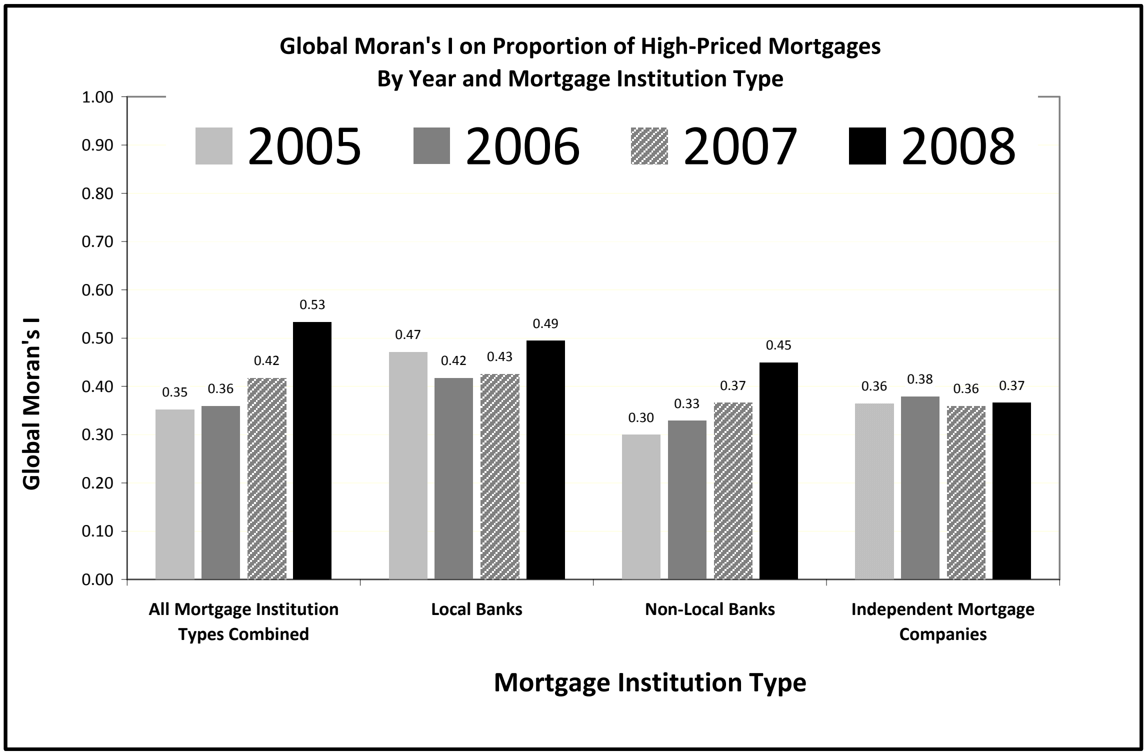

Figure 1. Moran's I Spatial autocorrelation coefficients on proportions of high-priced mortgages (source: FFIEC, 2006-2009; graph by authors).

The Local Moran cluster map (Figure 2) reveals the sizes and locations of hot and cold spots for proportions of high-priced mortgage originations. During the peak years of subprime lending (2005 and 2006) through the collapse of subprime lending (2007 and 2008), high-proportion areas were concentrated in metropolitan areas along the Southern Gulf Coast states. This region of high proportions of subprime mortgage originations was relatively static in location, although this cluster's density grew slightly during the four-year time period. Regions having low proportions of subprime mortgages were found along the Pacific Coast. Over time the clusters having low proportions of subprime mortgagees extended from the Pacific Coast eastward over the Rocky Mountain states. Other clusters of low proportions of subprime mortgages emerged and grew from the Maine coast to New Jersey. The clusters of metropolitan areas having low proportions of subprime loans spread to more neighboring metropolitan areas over time, explaining the increased values of Global Moran's I during the time period studied and providing evidence of a contagion process.

The Local Moran cluster maps occasionally reveal isolated 'High-High' or 'Low-Low' values appearing as a cluster of a single metropolitan area unit. For example, in Figure 2, the 2008 Local Moran cluster map displays the Pittsburgh, PA, metropolitan area as an isolated 'High-High' cluster surrounded by metropolitan areas classified as 'not significant'. The visualized 'High-High' cluster on the Local Moran map represents the core of a cluster, and the neighboring metropolitan areas share statistically significant similar high values with the core but do not share statistically significant similar 'High-High' values with their separate sets of neighboring metropolitan areas (Anselin, 2005).

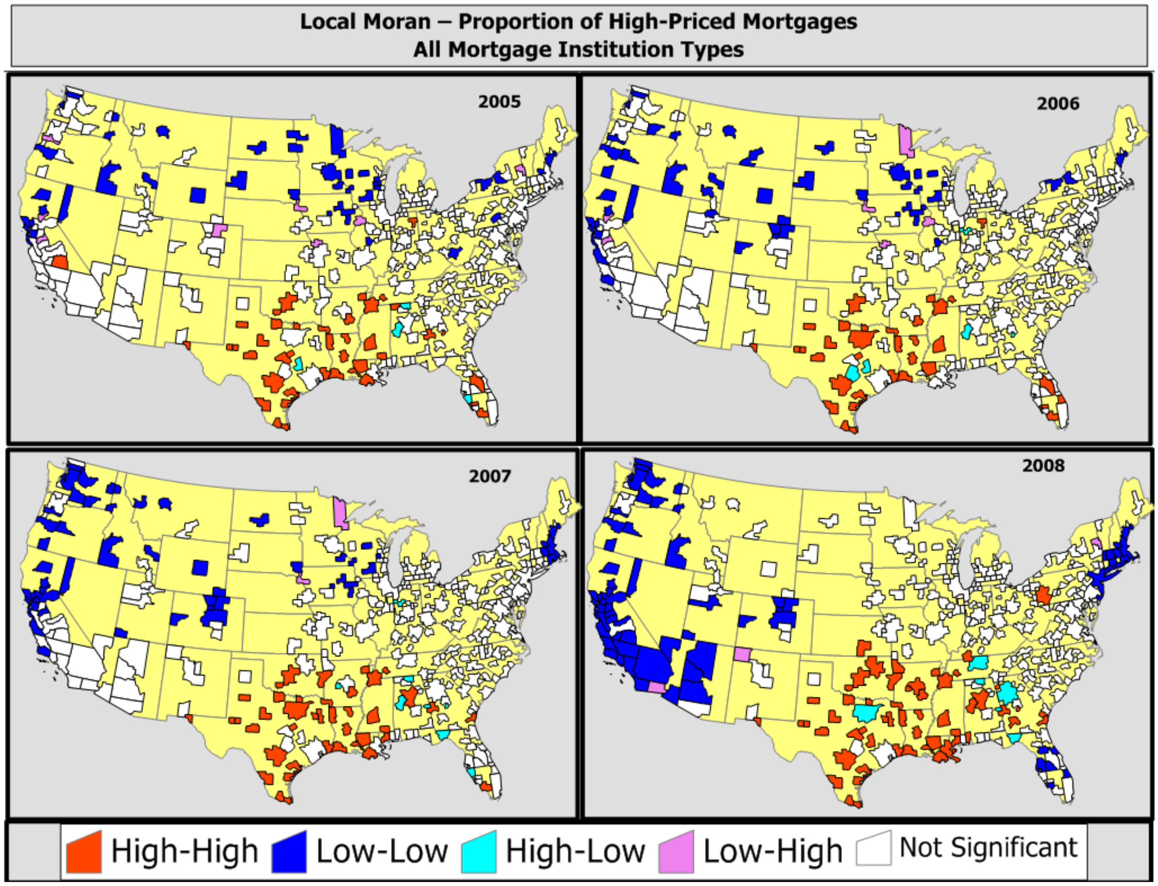

Figure 2. Local Moran cluster map on proportion of high-priced mortgages 2005-2008 (source: FFIEC, 2006-2009; maps by authors).

Using a rank ordered list, the magnitude of the differences in proportions of subprime mortgages across regions is evident. Figure 3 provides the top ten metropolitan areas having the highest and lowest proportions of subprime mortgage originations during the peak subprime year of 2006. There is a wide disparity of subprime originations between metropolitan areas of Texas and the Southern Gulf states as compared with metropolitan areas in the rest of the county. Five of these top ten metropolitan areas were in Texas and all ten were more than 2 standard deviations higher than the mean for all metropolitan areas. On the top ten list of metropolitan areas having the lowest proportions of subprime mortgages, six were on or near the central California coast. The mean proportion of subprime mortgages in 2006 was roughly 27% and the standard deviation was approximately 7.

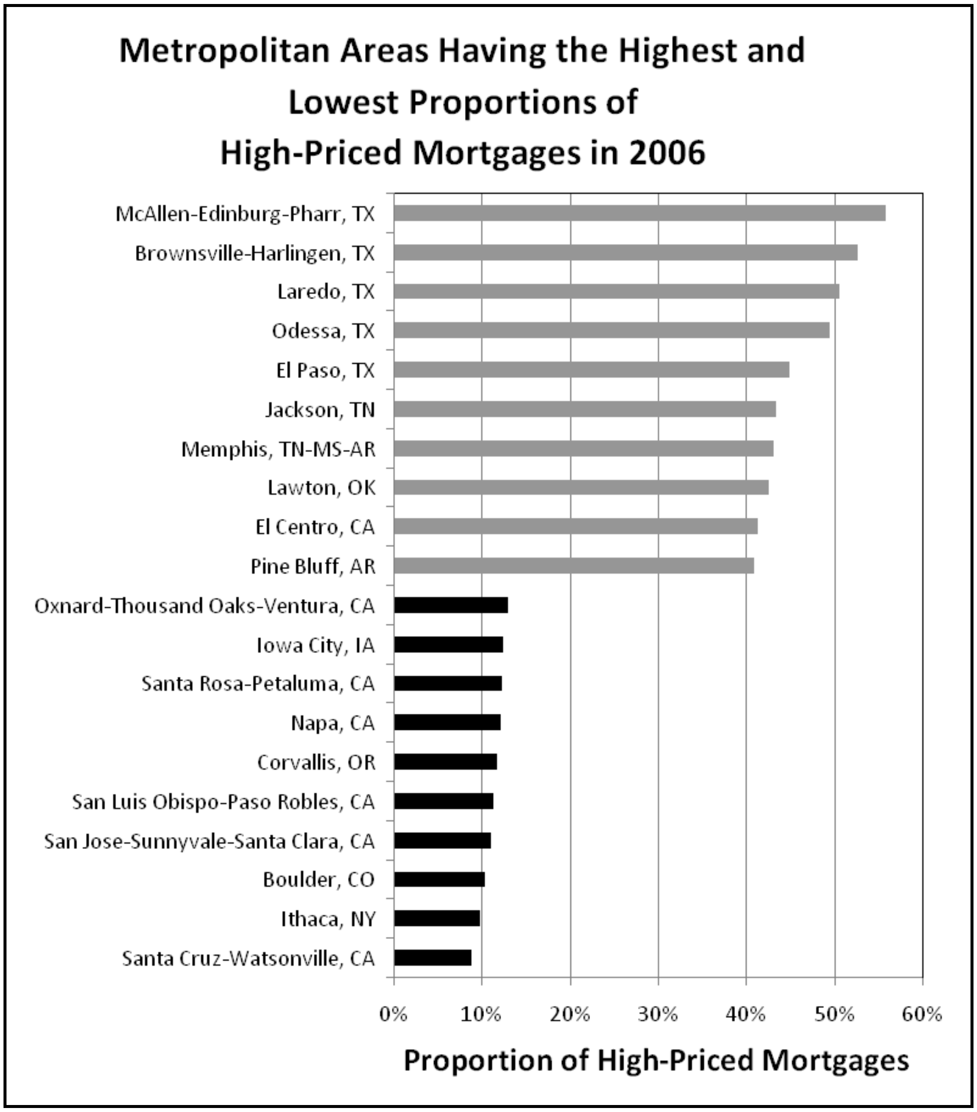

Figure 3. Leading 10 metropolitan areas having the highest and lowest proportion of high-priced mortgages in 2006 (source: FFIEC, 2007; graph by authors).

By 2008 the mean proportion of subprime mortgage originations in metropolitan areas fell to 11%. Figure 4 displays the top ten metropolitan areas having the highest and lowest proportions of subprime mortgages for 2008. Four of these metropolitan areas were within Texas, as they were in 2006, and nine were in the Southern states. These geographically clustered metropolitan areas were more than two standard deviations above the mean. With proportions of subprime exceeding 30% in 2008, these ten metropolitan areas were above the 2006 national mean of 28.47%, the peak year of subprime. On the low proportion side, eight of the top ten metropolitan areas are clustered on or near the California coast, having proportions of subprime mortgages four standard deviations below the mean.

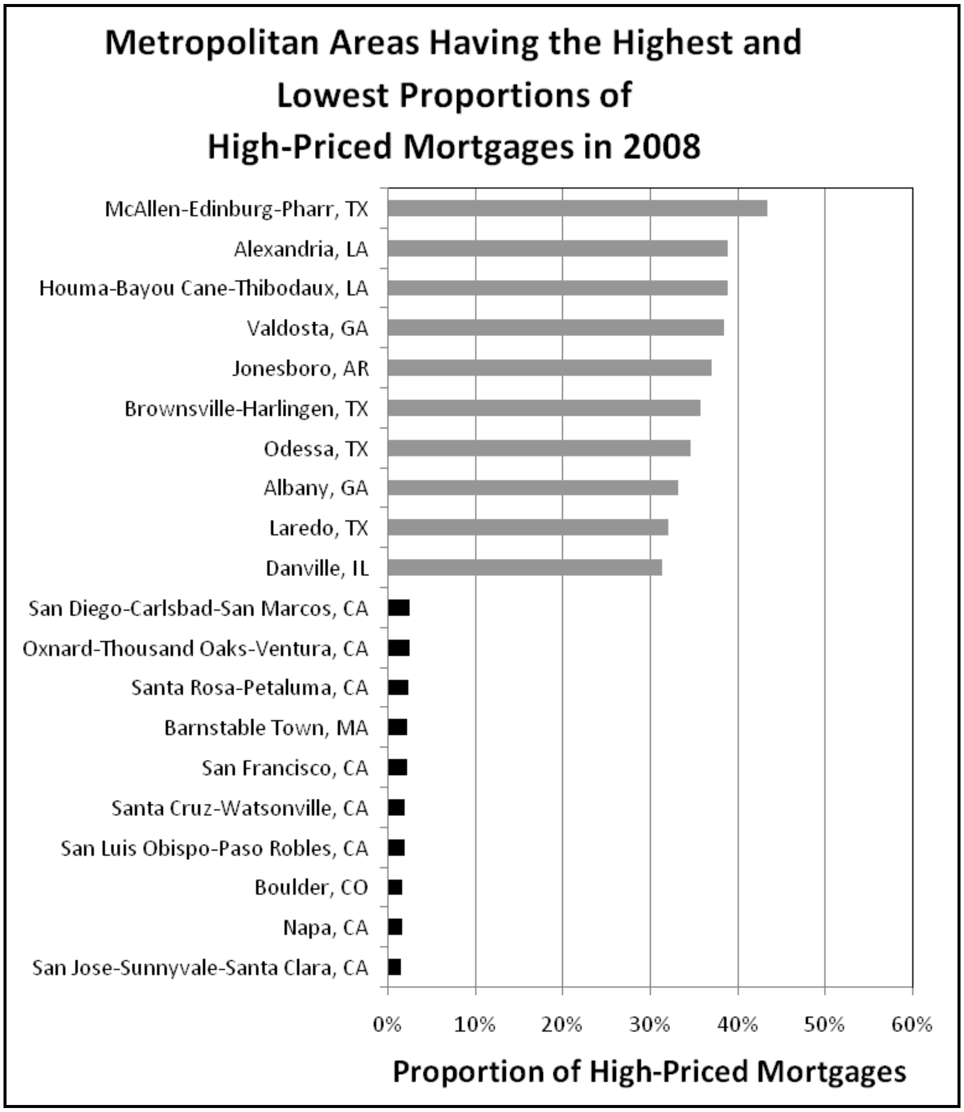

Figure 4. Leading 10 metropolitan areas having the highest and lowest proportion of high-priced mortgages in 2008 (source: FFIEC, 2009; graph by authors).

Figure 5 shows the subprime lending patterns of each mortgage institution type for 2006 displayed as a cluster map. During 2006 all three institution types each had market shares exceeding 30%. Local banks and independent mortgage companies had high proportions of subprime sales concentrated in metropolitan areas in the Southern Gulf states. This was partly the case for the non-local banks as well. The local bank clusters of low proportions of subprime mortgages along the Atlantic Coast differ from the patterns for the other lender types who had more heterogeneous outcomes in the Atlantic Coast region.

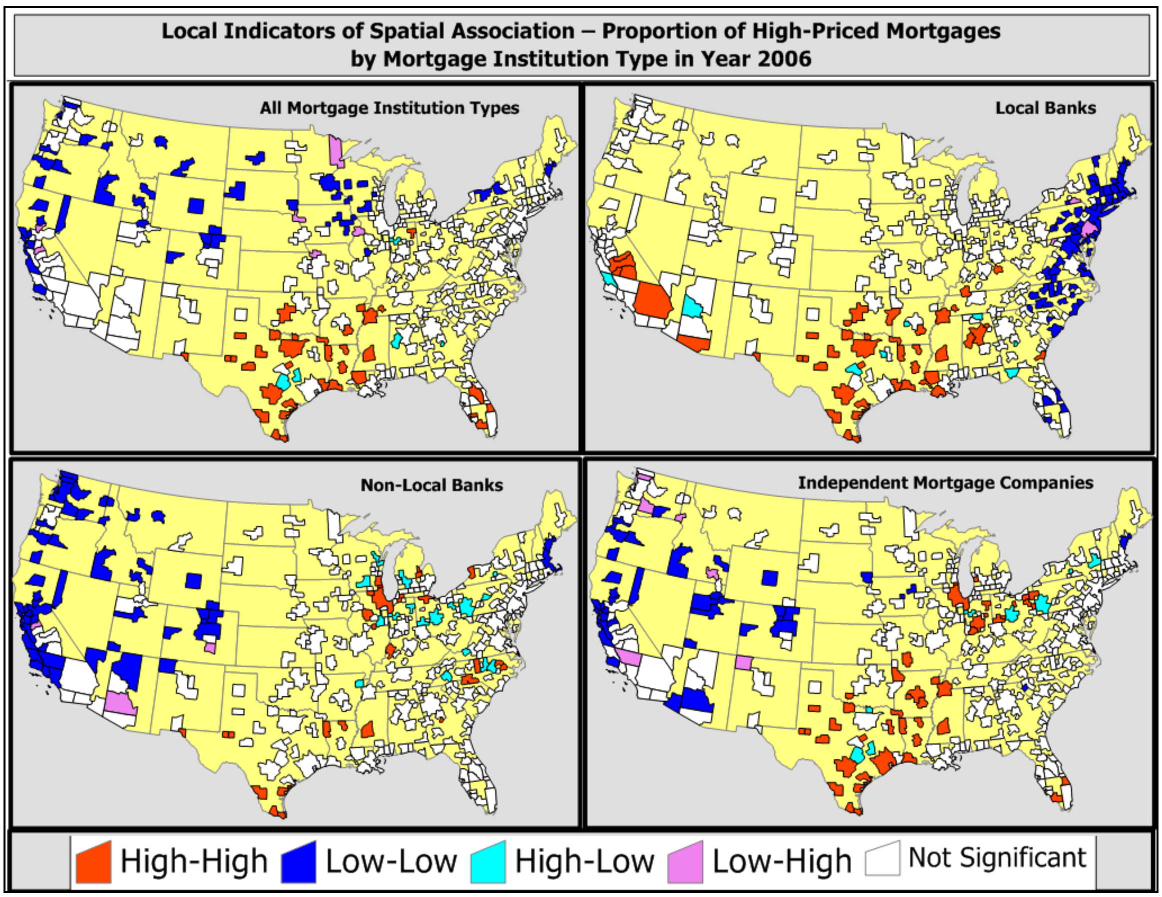

Figure 5. Local Moran cluster map on proportion of high-priced mortgages by mortgage institution type in 2006 (source: FFIEC, 2007; maps by authors).

Figure 6 displays the Local Moran cluster maps by institution type for 2008. Contrasting with the patterns of subprime lending between 2006 and 2008, the year following the collapse of the subprime industry, high-priced lending remained concentrated in the Southern Gulf area. This Southern region of subprime lending expanded for mortgage loans originated by local and non-local banks between 2006 and 2008. Independent mortgage companies, who by 2008 had lost roughly half of their market share, competed in the lower price segment. While small differences between the three types of mortgage institutions' spatial patterns exist, they generally show a higher propensity of subprime prices for borrowers in metropolitan areas of the South and a lower propensity of subprime prices for borrowers in metropolitan areas along the West Coast extending east through the Rocky Mountain states and also for borrowers in the Northeast.

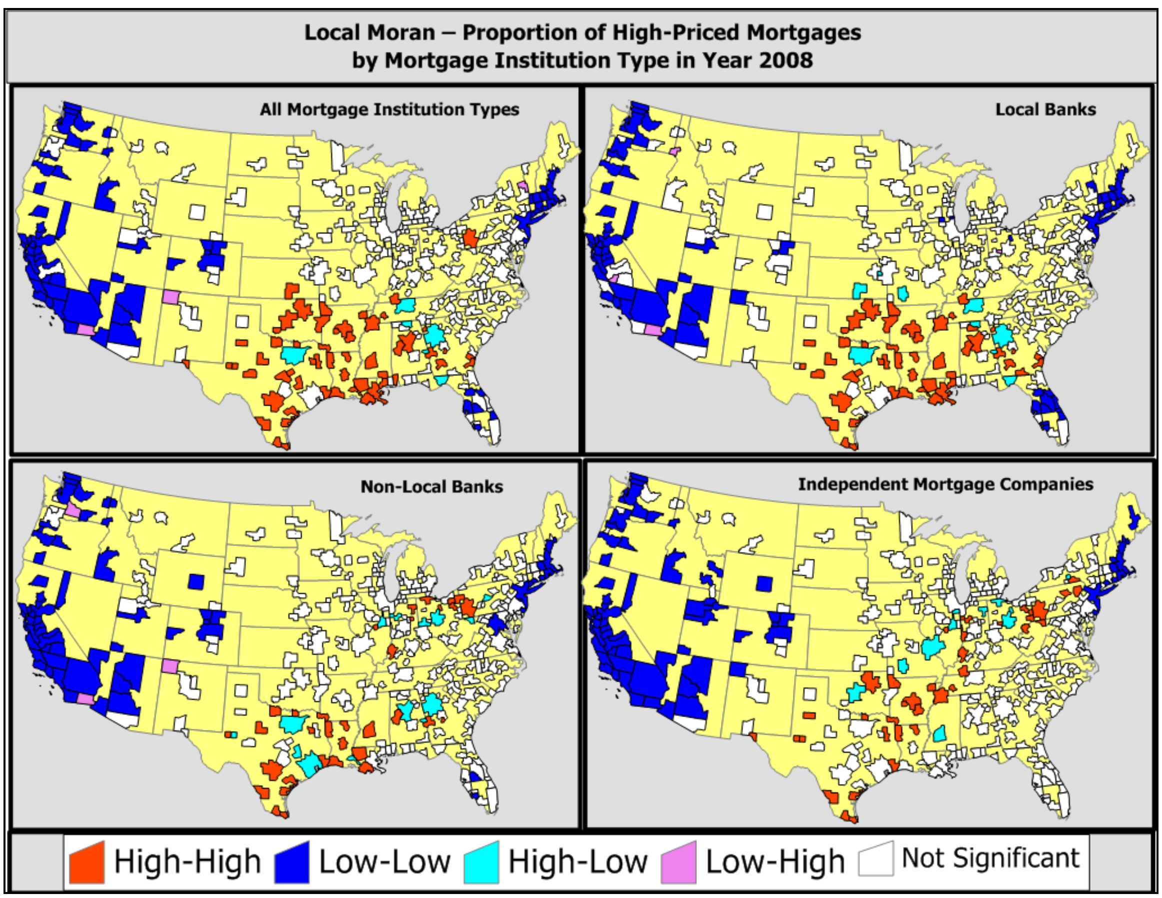

Figure 6. Local Moran cluster map on proportion of high-priced mortgages by mortgage institution type in 2008 (source: FFIEC, 2009; maps by authors).

Discussion:

Subprime mortgage pricing diminished by 2008, yet geographic disparities remained. Diminished proportions of subprime helped to extend the low subprime pricing clusters found along the Pacific Coast eastward over the Rocky Mountain States. Other low proportion clusters formed as subprime lending dropped precipitously in 2008. By 2008, one year after the collapse of the subprime market, many metropolitan areas still had high proportions of high-priced mortgages exceeding the peak proportions of subprime originations for the nation in 2006. The largest regional area was the Southern Gulf States combined with Oklahoma and Arkansas. Subprime mortgage pricing remained following the 2007 collapse of the subprime mortgage industry. Spatial autocorrelation measures support this finding's statistical significance. The persistence of genuinely spatial effects in subprime market penetration forces us to consider the potential depth of historical, spatial inequalities in demography, education attainment, health, housing, and economic fortunes—inequalities that seem to be responsible for what might be described as a 'subprime region'. Old landscapes of affordable mortgage exclusion in inner-city areas were replaced during the long boom by districts of subprime exploitation inside most large cities (Betts et al, 2008; Newman and Wyly, 2004; Wyly et al, 2008), but this study suggests that it is also possible to distinguish these inequalities at the regional scale.

Explanations for the higher mortgage prices in the Southern Gulf States region must take into account credit-related factors. Fellows (2006) showed the Southern Gulf region to have the lowest mean credit scores. Wyly et al (2008) identified metropolitan areas in this region that exhibited these low credit scores. Lower education attainment, higher unemployment (Avery et al, 2006), and higher proportions of minorities (Wyly et al, 2008) in the same region are additional explanatory variables that cannot be ignored. The Southern Gulf region's local banks had special knowledge of their housing markets, and relationship expertise with borrowers who had a history of using their banks' products and services. These local banks had a stake in the economic well-being of their communities and their own economic well-being. Using their special expertise and their commitment to their communities and themselves, the Southern Gulf States region's local banks were more likely than the region's non-local banks and independents to offer their borrowers better pricing. However, borrowers in this region were more likely to obtain subprime pricing no matter which institution type they chose for their mortgage. The local banks' higher likelihoods of subprime pricing in the Southern Gulf region versus other regions is additional evidence that credit factors including collateral, financial capacity, and credit history are risk factors plaguing higher proportions of borrowers in the region. The innovations, government agency support for homeowner credit, and bank deregulation that introduced greater competition to these markets did not cure all problems of high-priced mortgages.

Calculations of Herfindahl-Hirschman indices, which measure market concentration (Forgey et al, 1997; U.S. Department of Justice, no date), provided results that characterize the mortgage markets in the Southern Gulf region and virtually all other metropolitan areas as highly competitive. Home borrowers had access to their local banks as well as banks across the country through brokers or the internet. The HMDA data identified out-of-market banks such as ING Bank, and independent mortgage companies such as Provident Funding Associates, which originated a large number of mortgages in almost all states, including the Gulf Coast states and Southern region. Both ING Bank and Provident Funding Associates used subprime pricing for less than 2% of their mortgages in 2006—which suggests that competitive opportunities were available for homeowners to shop for mortgages by price.

Removing geographic distance restrictions on savings and loans in the 1980s and removing lending restrictions by national banks on home loans made it possible for depository institutions with few branch offices to invest their insured deposits in mortgage loans securing residential properties wherever they chose. Several banks that had few branch offices achieved large market shares in 2006, including Countrywide Bank, IndyMac Bank, and Fremont Investment and Loan. These institutions were among the leading subprime lenders in the nation based on HMDA reportable rate spread data. According to Summary of Deposit (SOD) data, which identified bank branch locations, these institutions had branch offices in fewer than eight metropolitan areas, yet they marketed and originated mortgages in virtually all metropolitan areas. These and similar banks accounted for a large share of non-local bank lending reported in 2006. DIDMCA's geographic lending deregulation can be blamed for these institutions' actions. On the other hand, banks such as ING Bank which specialized in prime rate mortgages marketed nationally with a small branch office footprint would have been denied access to qualified borrowers in all metropolitan areas.

Twenty-eight banks were closed in 2008 (Federal Deposit Insurance Corporation, 2010). These closures exacerbated non-local bank lenders' declining mortgage sales, and surviving local bank lenders captured the market share from non-local banks and cash-starved independent mortgage companies. The results were that mortgage loans were more often originated closer to the banks' branch office footprints. Credit-constrained borrowers were denied home mortgages. The mortgage market turmoil associated with the collapse of subprime lending reversed the trend of market share growth from non-local lenders back to local bank lenders.

In the post-subprime era, regional mortgage price disparities continue to challenge public policy. The affected areas having high likelihoods of subprime mortgage pricing provide policy analysts laboratories to study the causes for the areas' higher mortgage finance costs and to advocate potential remedies. To a limited extent, outreach efforts such as home ownership and credit counseling provide some benefits. In particular, the regional disparities in the Southern Gulf are complex. Long-range investments resulting in higher education attainment, fuller employment, community development, and an increased supply of housing credit targeted to these areas may be warranted to remedy home ownership affordability inequalities that have existed in the past and continue to exist despite policy and regulation changes instituted up to the present time.

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