

SECTION 5

ECONOMETRIC ANALYSIS OF CRA IMPACTS

The simple descriptive analyses presented in the previous section demonstrate that the assessment area lending of CRA-regulated depository institutions is more focused on lower-income people and communities than is lending by non-regulated entities. The analysis revealed, however, that changes in industry structure, the emergence of new types of affordable loan products, and the strong economy also had significant impacts on lending to lower-income people and communities. Disentangling these overlapping influences on mortgage lending levels is a challenging task. This section addresses this task through a series of multivariate models that seek to isolate the independent role of each of these factors, including CRA, on the behavior of CRA-regulated institutions and the residential mortgage market.

The Community Reinvestment Act of 1977 encourages banks, thrifts and their affiliates¹ to expand home purchase lending to borrowers in lower-income neighborhoods and to lower-income borrowers throughout metropolitan areas.² To accomplish this expansion in lending, CRA-regulated institutions must alter the supply of mortgage credit in ways that favor lower-income borrowers. This could occur in any of the following ways. CRA could induce lenders to directly lower the out-of-pocket costs faced by CRA-eligible borrowers by lowering interest rates (or other costs) on mortgage loans. CRA could also increase the supply of mortgage credit by prompting lenders to ease approval standards, effectively deepening the pool of qualified mortgage loan applicants. Finally, CRA could spur lenders to do additional marketing, outreach and counseling, thereby lowering the pre-qualification costs borne by prospective mortgage borrowers. Importantly, all three of these factors could be the source of observed independent CRA effects discussed in this section.

If CRA-regulated lenders are behaving in any or all of these ways, it should be possible to observe the effects of these actions either directly or indirectly. The section reports on three classes of tests, each of which use linear regression models to search for CRA's potential independent influence. The section begins with a non-technical overview of the findings, then describes the analytical framework behind each class of test, and finally discusses the results for each group of tests in detail.

OVERVIEW OF FINDINGS

This section presents and describes statistical models based on 1993-2000 residential mortgage lending data. The models are designed to identify CRA's impact on the volume of home purchase lending flowing to lower-income borrowers and neighborhoods. The section presents the results of complex econometric models, and the discussion is therefore somewhat technical in nature. It is useful, therefore to begin with a non-technical overview of the findings, to help introduce the material presented in the rest of the section.

The econometric models divide logically into three broad groups. The first set of models look at how CRA may have directly influenced CRA lender behavior. The second and third types of models look for *consequences* of changed CRA lender behavior, in terms of their overall share of the CRA-eligible lending market, and in terms of changes in housing markets in CRA-eligible neighborhoods.

¹ Banks, thrifts and their affiliates are sometimes referred to as CRA lenders in this section. Similarly, credit unions and independent mortgage banks are sometimes referred to as non-CRA lenders.

² Loans to lower-income borrowers and borrowers in lower-income areas are sometimes referred to as CRA-eligible loans in this section. Loans that are not classified as CRA-eligible loans are considered to be higher-income loans.

The analysis reports the following three key findings, which are consistent with the notion that CRA has had a positive impact on CRA-eligible lending:

- CRA lenders have changed their behavior. CRA lenders originate a higher proportion of CRA-eligible loans than they would if CRA did not exist, and they seem to reject fewer CRA-eligible loan applications than they would if CRA did not exist.
- CRA lenders appear to have captured a higher share of the CRA-eligible lending market than they would have if CRA were not in place.
- CRA-eligible neighborhoods seem to have more rapid house price increases and higher turnover rates than other neighborhoods, which is consistent with an expansion of credit in those areas.

The findings are reasonably robust, in that changing the structure and design of the statistical models does not affect the basic findings, except where explicitly identified in the text. And, while there is always a range of options in structuring statistical models, the results presented here do not depend, in large measure, on using the particular specification presented.

The statistical testing presented in this section goes beyond qualitative effects to quantify to what extent CRA lender behavior has changed, to estimate how much their CRA-eligible market share has expanded, and to measure the size of the house price increase and turnover rate differentials between CRA-eligible neighborhoods and other neighborhoods. These magnitudes are much more difficult to interpret, however. Differences in how the models are structured can have important impacts on the estimates of the magnitude of the effects presented in this section. Thus, while different model specifications do not produce qualitatively different answers, they do produce different quantitative ones. It would be inappropriate to conclude that the models have revealed with precision the exact magnitude of the impact of CRA on mortgage lending or housing market prices and turnover rates.

With these very important caveats in mind, Exhibit 21 presents the quantitative results of the statistical models. The technical discussion in the remainder of this section reveals specifically how these estimates were developed. The findings in Exhibit 21 suggest that CRA has had a number of small but measurable effects. For perspective in reading the table, in 2000 there were 1.3 million CRA-eligible home purchase loans (those made to lower-income borrowers or in lower-income communities) originated in the metropolitan areas included in this analysis.

The statistical analysis shows that CRA may have increased the CRA-eligible loan origination share by 7 percent, from 30.3 percent to 32.4 percent over the 1993 to 2000 time period. This change, in absolute terms, is consistent with a shift to CRA-eligible lending from non-CRA eligible lending of 42,000 originations. Compared to the 864,000 CRA-eligible loans that CRA lenders originated in 2000, the shift represents a small but significant effect. Different specifications of the statistical tests are almost certain to produce alternative estimates of this quantitative impact. The key conclusion that should be drawn is only that CRA can be reasonably demonstrated to have a small but measurable impact.

Exhibit 21: CRA Has Had a Small but Significant Effect on CRA-Eligible Lending

Impact Area	Expectation	Results over the 1993-2000 Time Period, Expressed in Three Equivalent but Different Ways		
Behavior of CRA Lenders	CRA should increase the proportion of originated home purchase loans that are CRA-eligible	Proportion found to be 7% higher than it would have been without CRA	Average CRA-eligible loan origination share would have been 30.3% instead of 32.4%	In an average year, CRA lenders originated 42,000 more CRA-eligible loans than would have been originated without CRA
	CRA should increase the proportion of CRA-eligible home purchase loans originated in higher income areas, and this effect should be stronger after 1995 than before 1995	Proportion found to be 13% higher than it would have been without CRA No differential effect identified before and after 1995	CRA-eligible loan origination share would have been 21.0% instead of 23.7%	In an average year, CRA lenders originated 29,000 more CRA-eligible loans in higher-income areas than would have been originated without CRA
	CRA should reduce the proportion of all CRA-eligible home purchase loans applications that are rejected	Rejection rate found to be 24% lower than it would have been without CRA	Rejection rate would have been 25.3% instead of 20.8%	In an average year, CRA lenders accepted 39,000 more CRA-eligible loan applications than they would have without CRA
CRA-Eligible Market Share of CRA Lenders	The ratio of higher- to lower-income lending for non-CRA prime lenders should be declining over time, and should be higher in areas where CRA has stronger impact	Ratio found to be 4% higher than it would have been without CRA No significant effect over time identified	Ratio would have been 3.70 instead of 3.87 (for selected set of prime non-CRA lenders)	On average, about 53,000 prime loans per year shifted to CRA lenders from non-CRA lenders
	The share of all CRA-eligible lending accounted for by CRA lenders should be higher in areas where CRA has stronger impacts	Share found to be 2% higher than it would have been without CRA	CRA market share would have been 61.3% instead of 62.3% over the time period	On average, about 13,000 net lower-income loans were originated by CRA lenders instead of non-CRA lenders
Price Changes and Turnover Rate Changes in LMI Neighborhoods	CRA should increase price change in lower-income neighborhoods	Price changes found to be 1% higher than they would have been without CRA	On average price inflation would have been 4.6% per year instead of 4.7% per year	Prices for properties in lower-income neighborhoods were perhaps \$500 higher with CRA than they would have been without CRA
	CRA should increase turnover rates in lower-income neighborhoods	Turnover rates were 1% higher than they would have been	On average turnover rates would have been 6.21% per year	For an average tract, there would have been .5 less sales per tract in

The statistical modeling discussion that follows controls for significant changes in the economy over time and for economic and demographic differences across the 301 MSAs studied. For further perspective in interpreting the model results, it appears generally true that economic changes had more impact on CRA-eligible lending than did the CRA itself. For example, a 1.3 percentage point decrease in the unemployment rate (which is less than half of the total reduction in unemployment over the 1993 to 2000 time period) had the same impact in increasing the share of CRA-eligible originations as did a loan application being for a property located inside, rather than outside, a CRA lender's assessment area.

The remainder of this section is more technical in nature, describing the analytical framework, the data, and the specific tests in more detail.

ANALYSIS FRAMEWORK

For CRA to have expanded the level of credit available to lower-income people and communities the Act must have, in economic terms, shifted the mortgage credit supply curve. In order for the amount of mortgage credit available to increase as a result of CRA, the price of mortgage credit faced by these borrowers and areas must decrease.

It is important to understand that this price decrease may come through a variety of methods, and not just through lower loan interest costs. For any given borrower, the cost of securing a mortgage includes time spent searching for a lender. As a result, CRA-induced outreach and marketing efforts directed toward CRA-eligible clientele may raise costs for lenders while at the same time lowering search costs for potential borrowers. Similarly, products that allow lower downpayments, higher debt-to-income ratios, or broader scope for demonstrating creditworthiness also lower the cost to borrowers of getting a mortgage. The same is true anytime lenders relax underwriting criteria in order to expand the pool of acceptable borrowers. Thus, new borrowers may pay the same interest rate as others, but still be facing lower costs than they would in a world without CRA. This additional cost is absorbed by lenders through expenses associated with non-standard underwriting, additional loss mitigation efforts or more directly through higher default and delinquency rates. To the extent that lenders require credit enhancements such as mortgage insurance, however, they are able to shift a portion of these costs back to borrowers.

It is important to understand, however, that the costs to lenders of achieving this downward shift in the supply curve may be temporary. In cases where the supply of mortgage credit to lower-income borrowers and communities had been constrained due to market failures (as was hypothesized to be the case by many of CRA's original proponents), after an initial demonstration period, the costs of supplying credit decline so that the additional, or marginal credit provided by CRA lenders may be no more costly to provide than that which they were already providing. The fact that many large independent mortgage companies (*i.e.*, mortgage lenders not subject to CRA) have been stunningly successful at serving the lower-income market is highly suggestive that this dynamic has indeed played out and that a reasonable portion of the CRA-eligible market is now being served economically.

Behavior by CRA lenders is consistent with the notion that they have taken steps to adjust to a world in which CRA exists and to minimize or eliminate the additional costs of compliance. Homebuyer counseling is one prominent way lenders have attempted to improve the loan worthiness of the CRA-eligible pool by partnering with non-profits that they hope will develop 'loan-ready' borrowers and screen out lower-income households not yet ready for homeownership.

CRA's impact should be observable from three different perspectives. CRA's effects should translate into a more concentrated focus on CRA-eligible lending by CRA lenders. This greater concentration should result most directly in more CRA-eligible loans being originated by CRA lenders. This higher level of CRA-eligible loan originations on the part of CRA lenders should generate two other kinds of impacts. First the CRA-eligible market share for independent mortgage banks and credit unions (non-CRA lenders) should fall as CRA lenders capture customers that would otherwise turn to independent mortgage banks for service. Second, insofar as higher levels of CRA-eligible loan originations represent an expansion of the overall CRA-eligible segment of the housing market, there should be relatively more demand for housing in CRA-eligible lower-income neighborhoods, and these neighborhoods should exhibit more housing turnover and greater price increases than would otherwise occur.

The models presented in this section utilize four distinct variable categories: MSA characteristics, census tract characteristics, loan characteristics, and borrower characteristics. Exhibit 22 lists the specific variables within each of these groupings, and the dataset from which each is drawn. The strength of the

analysis here derives in large part from combining data from different sources to control in an effective way for determinants of lending behavior besides CRA.

At the heart of the statistical analysis that follows are two variables constructed to represent the impact of CRA: a lending-agreement-in-place indicator variable, and a variable that indicates whether or not a CRA-eligible loan is originated by a CRA-regulated lender operating inside its CRA assessment area. These indicator variables are discussed in more detail below.

A. Assessment Area Indicator for CRA Lender Loan Originations

Exhibit 22: Statistical Modeling Uses Data On MSA, Census Tract, Loan, and Borrower Characteristics

Variable Category	Statistical Analysis Variable	Source of Data Underlying Variable
Metro	Indicator Of Existence Of Metro Area Lending Agreement	Developed by Joint Center for Housing Studies from NCRC report
Metro	Index Of Housing Affordability (% Of Households Than Can Afford Median Priced Home)	NAHB
Metro	Metro Median Household Income	HUD Income Database
Metro	Metro Unemployment Rate	Bureau of Labor Statistics
Metro	Metro Home Ownership Rate In 1990	1990 Census
Tract	% Of Tract Housing Built Before 1960	1990 Census
Tract	% Change In Tract Housing Prices	Proprietary Data from CSW
Tract	1990 Tract Minority Population As % Of Total Tract Population	HMDA
Tract	Tract Income As % MSA Income	HMDA
Tract	1990-2000 Tract Population Growth Rate	1990 and 2000 Censuses, and Proprietary Joint Center Estimation
Loan	Loan Amount	HMDA
Loan	Conventional Or Government (FHA, VA, Fmha) Loan Indicator	HMDA
Loan	Indicator Of Whether Or Not Loan Is Resold To Fannie Mae Or Freddie Mac In Year Of Origination	HMDA
Loan	For All CRA Lenders, Code Indicating Assessment Area Or Non-Assessment Area Loan	FRB Proprietary Lender Database
Loan	Lender Type (Prime, Subprime, Or Manufactured Home)	HUD Lender Specialization Database
Loan	Lender Parent Organization's Overall Level Of Home Purchase Lending	FRB Proprietary Lender Database
Loan	Lender Assets	FRB Proprietary Lender Database
Loan	Lender Regulatory Status (CRA Lender Or Non-CRA Lender)	FRB Proprietary Lender Database
Loan	County Location Of Loan Property	HMDA
Loan	Tract Location Of Loan Property	HMDA
Borrower	Borrower Income	HMDA
Borrower	Borrower Race	HMDA

The most important CRA variable employed in the models is a dummy variable indicating whether or not each loan was made by a CRA-regulated lender or one of its affiliates operating in its assessment area. The variable takes a value of 1 if the loan is an assessment area loan, and 0 otherwise. 'CRA-regulated lenders' are defined at the holding company or bank organization level so that all activities of the organization that take place in a county in which the organization maintains a deposit-taking branch are considered 'in assessment area' lending. To reiterate an important point made earlier in the report, all lending by an organization in a county where the organization has a branch is considered to be in assessment area lending even if it is made by the organization's mortgage company affiliate, whether or not the organization chose to include the affiliate's activity in its CRA exam.

Affiliate activity is included for several reasons. First, lenders effectively have discretion to shift and book activity between their depository and mortgage company affiliates. Second, in many, though by no means all cases, affiliate activity is actually included in the exam at the lenders' behest. Therefore, looking only at the depository's activity will miss some activities upon which lenders intend to be examined. In fact, due to the ability of lenders to book different types of mortgage business in different parts of the organization, the alternative approach could give an unrealistically positive picture of the impact of CRA. Our approach is intentionally conservative in this regard.

Lending inside and outside assessment areas represents a 'natural experiment' testing for the effect of CRA. After controlling for economic and demographic differences, CRA's additional impact can be quantified by examining the differential levels of CRA-eligible lending inside and outside assessment areas. As a result, the assessment area indicator is a robust measure of CRA's impact on the supply of mortgage capital by CRA-regulated entities.

B. Lending Agreement Indicator for MSAs

The lending agreement variable is also a dummy variable defined at the MSA level. An MSA is considered to have an agreement in place for every year or not at all. Insofar as CRA has led to the establishment of these agreements, and insofar as the agreements led to more CRA lending, the variable can be used to quantify the impact of CRA. In simplest terms, after controlling for as many factors that impact CRA-eligible lending as possible, the lending agreement variable is used to set up a 'natural experiment' which looks to see if CRA-eligible lending is higher in areas with agreements than areas without agreements.

The determination of which MSAs have agreements in place is based on the National Community Reinvestment Coalition's list of CRA commitments (National Community Reinvestment Coalition, 2001). Because these agreements generally last for five to ten years, any metropolitan area that had any agreement made in 1988 or later was assumed to have had an agreement in place for the duration of the study period. In addition, where lenders signed state-level agreements all MSAs that were assessment areas for the signatories were also assumed to have had agreements in place. In all, 123 of the 301 MSAs included in the analysis are flagged as having lending agreements in place.

Meeting the goals of the agreements, whose existence is due in part to the CRA, pushes lenders to target and reach the CRA-eligible market to a greater extent than they would otherwise. Therefore, if areas with lending agreements exhibit increased CRA-eligible lending relative to areas without agreements, this is taken as evidence that the existence of CRA agreements results in higher levels of mortgage credit being supplied to CRA-eligible borrowers and areas.

It is important to point out, however, that the presence of agreements might also be linked to elevated CRA-eligible lending levels in more subtle ways. For instance, interaction between banks and community-based organizations that begins around a CRA agreement may lead to collaboration in development of products that serve the needs of the CRA-eligible market. These products, by allowing more substantial penetration of lower-income markets in these MSAs, may then boost CRA-eligible loan volume. Alternatively, since community reinvestment oriented non-profits often conduct homebuyer counseling, agreements may signal more extensive counseling efforts that result in a larger pool of loan-ready borrowers over time.

Finally, it is necessary to note that lenders may be particularly willing to enter into agreements in MSAs where the opportunities for success in the CRA-eligible market are highest. In such a case the correlation between agreements and CRA-eligible lending levels would also be positive, but largely not as a result of

CRA. As a result, care must be exercised in interpreting the coefficients on this variable as solely representing the impact of CRA on mortgage lending patterns.

TESTS OF CRA IMPACT ON CRA LENDER BEHAVIOR

This set of three tests examines the extent to which CRA might be affecting the lending patterns of regulated lenders in observable ways. All of the models examine changes in home purchase lending (as opposed to refinance or home equity lending) that are originated (as opposed to purchased) by CRA-regulated lenders. The tests all work through the two CRA variables discussed above, which reveal the extent to which CRA had an independent effect on lending patterns. In each case, the effects of other factors that would be expected to influence lending patterns with or without CRA are controlled for by including independent variables that capture the effect of demography, economics, housing market characteristics, and industry structure.

A. CRA Lenders' CRA-Eligible Portfolio Share

The first test examines whether the CRA variables appear to influence the proportion of CRA-regulated lenders' loans that are CRA-eligible (*i.e.*, CRA lenders' 'CRA-eligible origination share'³). As throughout the report, CRA-eligible loans are defined here as those going to lower-income people and/or lower-income areas. The hypotheses for these tests can be stated as follows: 1) CRA-regulated lenders are expected to have portfolios that consist of larger shares of CRA-eligible loans when they are operating in their assessment area than when they are not, and, similarly, 2) CRA-regulated lenders are expected to have portfolios that consist of larger shares of CRA-eligible loans when they are operating in markets that have CRA agreements in place than when they are operating outside such markets.

Exhibit 23 presents the results for a linear regression model that uses individual loans originated by CRA lenders as the underlying observations. Over the 1993 to 2000 time period there were approximately 13,000,000 such loans to consider. The dependent variable in the model summarized in Exhibit 23 takes a value of 1 if the loan is a CRA-eligible loan, and a value of 0 if the loan is not a CRA-eligible loan.

The linear regression specification is only one possible approach: non-linear logit and probit specifications are also possible. Linear models are used here for several reasons. First, linear specifications facilitate interpretation of the effects of the independent variables. In addition, since the average of the dependent variable is not located near the extreme 0 or 1 values, the linear specification doesn't inappropriately misrepresent the underlying functional form.

³ CRA-eligible origination share is a more concise way of saying 'the share of all lending that is CRA-eligible lending.'

Exhibit 23: Loan-Level Model of CRA-Eligible Origination Share Identifies a CRA Effect

Coefficient Category	Coefficient Description	Coefficient Value	t-value	Mean Value
	Intercept	(0.376)	(203.7)	1.0
CRA	Lending Agreement Dummy	0.022	76.3	.730
CRA	Loan Inside Assessment Area	0.027	101.9	.499
Metro	MSA Housing Affordability Index	0.003	284.9	66.32
Metro	MSA Med Household Income	0.002	103.1	50.49
Metro	MSA Unemployment Rate	(2.04)	(239.2)	.045
Metro	Metro Home Ownership Rate in 1990	0.594	287.4	.625
Tract	90-00 growth -8-0%	(0.025)	(49.6)	.198
Tract	90-00 growth 0-10%	(0.040)	(81.2)	.274
Tract	90-00 growth 10-20%	(0.039)	(73.4)	.156
Tract	90-00 growth >20%	(0.063)	(128.8)	.292
Tract	1990 Tract Minority Percentage	0.644	878.9	.166
Loan	Loan resold to FNMA/GNMA	(0.011)	(38.3)	.269
Loan	FHA Loan	0.194	523.4	.145
Loan	Large Lender Dummy	(0.012)	(41.9)	.602
Borrower	Black Applicant	0.059	109.6	.064
Borrower	Hispanic Applicant	0.117	213.6	.061
Year	1994 Year Dummy	0.003	5.5	.103
Year	1995 Year Dummy	0.003	4.8	.106
Year	1996 Year Dummy	(0.009)	(16.7)	.124
Year	1997 Year Dummy	(0.022)	(40.4)	.130
Year	1998 Year Dummy	(0.032)	(57.3)	.140
Year	1999 Year Dummy	(0.021)	(38.0)	.151
Year	2000 Year Dummy	(0.010)	(17.1)	.150
	Observations	13,000,000		
	Adjusted R-Sq	0.13		
	Model	LMI_L2		

The coefficient for the lending agreement dummy variable indicates that CRA-eligible loans are 2.2 percent more likely in MSAs with lending agreements than in MSAs without such agreements. Similarly, the coefficient on the assessment area variable indicates that CRA-eligible lending is 2.7 percent more likely if the loan property is located inside rather than outside the lender’s assessment area. Since the likelihood in the overall sample of a loan being a CRA-eligible loan is 32.4 percent, the results indicate that CRA has had a small but statistically significant positive impact in raising the proportion of loans originated that are CRA-eligible.

The other independent variables in the statistical regression model presented in Exhibit 23 work as expected to control for economic, housing market, industry structure, and demographic differences that also impact lending inside and outside assessment areas or inside and outside MSAs with lending agreements in place. For example, every increase of 1 percentage point in the unemployment rate reduces the likelihood of a loan being a CRA-eligible loan by 2 percent. Thus, the overall positive effect CRA appears to have had in increasing the likelihood of a loan made inside the lender’s assessment area being CRA-eligible is roughly equivalent to the impact of a 1.3 percentage point reduction in unemployment.

Similarly, other independent variables are significant indicating that, in addition to CRA and employment conditions; demographics, economics, housing market characteristics, and industry structure all play an important role in determining the CRA-eligible shares of CRA-regulated lenders' mortgage lending portfolios. Because both CRA impact variables are statistically significant the model indicates that CRA also matters in determining CRA lenders' CRA-eligible origination shares.

Exhibit 24 presents models of CRA lender origination share that are estimated at the metro and tract level, and presents again the loan-level model in Exhibit 23 for comparison purposes. Repeating the analysis at higher levels of geographic aggregation is useful, because it can produce different outcomes as a result of using a restricted set of control variables, or because doing so implicitly weights individual loans differently.

Using aggregated data involves some transformation of the independent variables. For example, in the loan-level equation, the assessment area variable is a dummy variable taking on the value of 1 if the loan is an assessment area loan, and taking on the value of 0 otherwise. In a tract or metro area level model, however, the dummy variable must be modified to represent the proportion of all loans in the tract or MSA that are originated by CRA lenders operating in their assessment area. Similarly, while the loan-level model uses an indicator for the race/ethnicity of the applicant, the aggregate models employ the proportion of all borrowers in the tract or metro area that are black or Hispanic. Additionally, since the black and Hispanic share is a fraction between zero and one, the models can include this share directly, and also as higher-order terms (*e.g.*, the share squared or cubed) to reflect differential effects as the share becomes higher or lower.

Exhibit 24 demonstrates that statistical tests based at MSA or tract level also indicate a positive effect for CRA that generally falls in the range of being statistically significant (as a useful rule of thumb, most analysts accept a coefficient as statistically significant if the t-value exceeds 2.0). The different levels of aggregation produce a range of coefficient estimates and levels of statistical significance, but the collective modeling results are generally consistent. For example, the coefficient on the MSA lending agreement variable ranges from .004 to .04, with the loan-level estimate from Exhibit 23 squarely in the middle of the range. The coefficient on the assessment area variable ranges from .027 to .082, with the loan-level estimate at the lower end of this range.

Some analysts argue that HMDA data, which are the foundation data for the statistical analyses reported here, vary in their coverage consistency over the 1993 to 2000 time period. In addition, it is possible that CRA-regulated entities' tendency to originate higher shares of loans to CRA-eligible borrowers simply reflects the fact that over time CRA-regulated entities have acquired affiliates that specialize in lower-income lending. To explore these issues, and to understand how the statistical effects identified may vary from year to year, we developed separate loan-level models for each year of the 1993 to 2000 time period. Exhibit 25 presents the coefficients for each of the CRA variables included in the models. For comparison, it also includes the coefficients from the model estimated over all years of data first presented in Exhibit 23. Exhibit 25 shows that the CRA variables are statistically significant in each year of the time period, with the impact declining over time. For example, the assessment area dummy variable indicates that in 1993, loans located inside the lenders' assessment areas were 3.9 percent more likely to be CRA-eligible loans, while in 2000 loans located inside assessment areas were 2.1 percent more likely to be CRA-eligible loans. This finding is consistent with the observation that CRA's regulatory reach has declined over time.

Exhibit 24: CRA-Eligible Origination Share Models Are Broadly Consistent Across Different Units of Analysis

Coefficient Category	Coefficient Description	Loan-Level Model		Metro Level Model		Tract Level Model	
		Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
	Intercept	(0.376)	(203.7)	(0.110)	(6.0)	(0.160)	(20.6)
CRA	Lending Agreement Dummy	0.022	76.3	0.004	1.5	0.040	31.1
CRA	Share of Loans inside Assessment Area	0.027	101.9	0.027	3.0	0.082	32.3
Metro	MSA Housing Affordability Index	0.003	284.9	0.002	17.4	0.004	68.7
Metro	MSA Med Household Income	0.002	103.1	0.003	16.7	0.000	1.4
Metro	MSA Unemployment Rate	(0.020)	(239.2)	(0.003)	(5.1)	(0.025)	(73.3)
Metro	Home Ownership Rate in 1990	0.594	287.4	0.135	6.4	0.511	67.0
Tract	90-00 growth -8-0%	(0.025)	(49.6)			(0.036)	(19.0)
Tract	90-00 growth 0-10%	(0.040)	(81.2)			(0.055)	(29.9)
Tract	90-00 growth 10-20%	(0.039)	(73.4)			(0.048)	(23.0)
Tract	90-00 growth >20%	(0.063)	(128.8)			(0.057)	(29.3)
Tract	1990 Tract Minority Percentage	0.644	878.9			0.672	227.0
Loan	FNMA & GNMA Resell Rate	(0.011)	(38.3)	0.106	6.6	(0.183)	(52.3)
Loan	Share of Loans which are FHA	0.194	523.4	0.225	13.8	0.369	108.4
Loan	Share of Loans Orig by Big Lenders	(0.012)	(41.9)	0.008	1.0	(0.090)	(34.6)
Borrower	% Loan Orig to Blacks			(0.257)	(3.7)	0.099	11.9
Borrower	% Loan Orig to Hispanics			(0.147)	(4.6)	0.387	43.7
Borrower	% Loan Orig to Blacks Squared			1.512	4.2	(0.210)	(23.6)
Borrower	% Loan Orig to Hispanics Squared			0.382	8.8	(0.309)	(29.6)
Borrower	Black Applicant	0.059	109.6				
Borrower	Hispanic Applicant	0.117	213.6				
Year	1994 Year Dummy	0.003	5.5	0.024	5.3	(0.011)	(5.0)
Year	1995 Year Dummy	0.003	4.8	0.026	5.6	(0.002)	(1.1)
Year	1996 Year Dummy	(0.009)	(16.7)	0.013	2.7	(0.007)	(3.2)
Year	1997 Year Dummy	(0.022)	(40.4)	(0.000)	(0.1)	(0.016)	(7.0)
Year	1998 Year Dummy	(0.032)	(57.3)	(0.006)	(1.4)	(0.016)	(7.1)
Year	1999 Year Dummy	(0.021)	(38.0)	0.015	3.0	(0.015)	(6.2)
Year	2000 Year Dummy	(0.010)	(17.1)	0.028	5.2	0.014	5.6
	Observations	13,000,000		1,437		293,119	
	Adjusted R-Sq	0.13		0.57		0.43	

The measure of CRA impact is computed taking into account both the effect of MSA agreements and the effects of location inside or outside assessment areas. Without CRA, the assessment area dummy would always be 0, and the associated coefficient multiplied by 0 would equal 0. With CRA, the assessment area dummy takes on the value of 1 in some observations, so the effect with CRA is the mean value of this dummy variable multiplied by the coefficient associated with the variable. The difference with and without CRA is thus the average value of the assessment area dummy variable multiplied by the associated model coefficient. The computation of the impact of MSA agreements is similar, except there may be multiple drivers behind putting lending agreements in place, of which CRA is only one. For example, many agreements focus on lending to minority communities, and are as likely to represent concerns about Fair Lending issues as concerns about lending to lower-income borrowers and neighborhoods. To be conservative, the impact calculation takes 50 percent of the total MSA agreement

effect, to recognize these other drivers behind lending agreements. Thus, the total CRA effect is the sum of the assessment area effect and 50 percent of the lending agreement effect.

Exhibit 25: CRA-Origination Share Models Developed for Individual Years Demonstrate Declining CRA Impact

Year	MSA Agreement Dummy		Assessment Area Dummy		CRA Impact
	Coefficient	t-value	Coefficient	t-value	
1993	.041	43.2	.039	45.8	0.037
1994	.027	29.1	.044	53.5	0.036
1995	.019	22.6	.028	34.6	0.022
1996	.016	19.7	.020	27.0	0.015
1997	.021	27.1	.023	31.6	0.019
1998	.021	27.9	.025	36.2	0.020
1999	.018	23.6	.024	36.2	0.018
2000	.019	24.1	.021	31.1	0.016
93-00	.022	76.3	.027	101.9	0.021

Note: CRA impact is the sum of the product of the assessment area coefficient times the mean value of the assessment area variable, and one-half the product of the MSA agreement coefficient times the mean value of the MSA agreement variable.

The analysis of CRA-eligible origination share also tested alternative specifications of the loan-level model, to better understand how the inclusion or omission of control variables impacts the results. For example, the 1990 percentage of minority residents in the census tract performs as an important control variable in the loan-level model in Exhibit 23. Leaving this variable out of the model presented in Exhibit 23 slightly reduces the coefficients on the CRA variables but they remain positive and statistically significant. Similarly, omitting the indicator for whether or not the loan originator is a large lender with more than 5,000 home purchase loans overall in the year of origination does not change the signs or the statistical significance of the coefficients.

The indicator of whether or not the loan is an assessment area loan is obviously the key variable in driving the ‘natural experiment’ of comparing lending inside and outside assessment areas. To test whether or not some other unspecified loan characteristic might be correlated with assessment area lending, and driving the results, an alternative specification of the model presented in Exhibit 23 was constructed that included both a binary indicator of each loan’s assessment area status, and also a measure of the aggregate proportion of loans within each loan’s geographic census tract which were assessment area loans. Including the aggregate tract assessment share variable did reduce the magnitude of the coefficient on the assessment area binary indicator, but the coefficient remained positive and statistically significant.

To test whether changes in the mix of lenders over time might be driving the result that the coefficients on the CRA variables are positive and significant, an alternative specification of the model presented in Exhibit 23 was constructed that included dummy variables for each of the largest 100 lenders. This alternative specification did not change the result that the coefficients on the CRA variables are positive and statistically significant.

Finally, a logit specification of the model in Exhibit 23 was tested, to see if a non-linear structure would change the result.⁴ The CRA effects identified in the linear specification also were present in the logit

⁴ The (non-linear) logit specification recognizes that as the values of the independent variables drive the predicted dependent variable close to the extreme values of 0 or 1, unit changes in the dependent variables have a diminished effect on changes in the

specification tested as a variant of the model presented in Exhibit 23. The coefficients on the MSA agreement indicator and the assessment area indicator were positive and statistically significant and the CRA effect computed from the logit model was very similar to the CRA effect computed from the regression model.

B. CRA Lenders' CRA-Eligible Portfolio Share Outside CRA-Eligible Neighborhoods

Tests in Part B are similar to those in Part A, except for the fact that they concentrate exclusively on higher-income areas – those where only lending to lower-income borrowers counts for CRA credit. The first test considers whether the CRA effect that appears significant overall is also operating for lending outside CRA-eligible neighborhoods. The second test explores whether or not CRA had a greater impact after than before 1995, in response to the belief that the refocusing of CRA in the 1995 regulations changes placed more emphasis on CRA-eligible lending outside CRA-eligible neighborhoods.

Exhibit 26 presents the outcome of the testing, presenting the results of two models explaining CRA-eligible loan origination share outside CRA-eligible neighborhoods. The first model is parallel in structure to the overall origination share model presented in Exhibit 23. It demonstrates smaller, but still significant, impacts of CRA on lending outside CRA-eligible neighborhoods. The coefficient on the lending agreement variable is .016 rather than .022, and the coefficient on the assessment area variable is .022 rather than .027. The smaller coefficient on the lending agreement variable is consistent with the fact that CRA agreements have historically focused on lower-income, and hence CRA-eligible, neighborhoods. The smaller coefficient on assessment area is consistent with less focus by CRA-regulated lenders on loans outside CRA-eligible neighborhoods earlier in the 1993 to 2000 time period.

To explore the timing issue more explicitly, the second model in Exhibit 26 includes interactions of each CRA impact variable with the specific year dummy variables. If CRA had more of an impact on lending outside CRA-eligible neighborhoods in the early years, this should be reflected by larger (positive) coefficients on the interaction term variables in the later years than in the earlier years. The results indicate no such pattern, however. The analysis, therefore, does not support the proposition that CRA-eligible lending outside CRA-eligible neighborhoods became more important in the later years of the time period.

C. CRA Lenders' Rejection Rates on CRA-Eligible Loan Applications

Tests in this section are based on the notion that, insofar as CRA pushes CRA-regulated lenders to expand their CRA-eligible lending, rejection rates on CRA-eligible home purchase loan applications should decline. Many analysts accept this general proposition but avoid studying rejection rates because credit score information is unavailable. In addition, HMDA-measured rejection rates may be a poor measure of true rejection rates because HMDA does not capture applications that are never filed when loan officers discourage applicants most likely to be rejected. To the extent that this activity takes place, the observed rejection rate will be different than the measured rejection rate. Alternatively, lenders actively reach out and otherwise market their loans to prospective applicants that can meet their eligibility criteria, and these further increase the probability that an applicant will be accepted.

dependent variable. A linear specification assumes, in contrast, that unit changes in the independent variables have the same effect on the dependent variable irrespective of whether the predicted dependent variable is close to 0 or 1 or centered somewhere between those two values.

Exhibit 26: Loan-Level Model of CRA-Eligible Origination Share Outside CRA-Eligible Neighborhoods Identifies CRA Effect

Coefficient Category	Coefficient Description	Coefficient Value	t-value	Coefficient Value	t-value	Mean Value
	Intercept	(0.312)	(168.2)	(0.328)	(165.6)	1.0
CRA	Lending Agreement Dummy	0.016	54.3	0.037	41.5	.729
CRA	Loan Inside Assessment Area	0.022	83.0	0.027	33.4	.494
Metro	MSA Housing Affordability Index	0.003	277.1	0.003	275.5	66.45
Metro	MSA Med Household Income	0.002	149.1	0.002	148.2	50.43
Metro	MSA Unemployment Rate	(1.074)	(124.6)	(1.087)	(125.9)	.045
Metro	Home Ownership Rate in 1990	0.306	147.9	0.305	147.4	.625
Tract	90-00 growth -8-0%	(0.008)	(15.2)	(0.008)	(15.2)	.196
Tract	90-00 growth 0-10%	(0.018)	(34.5)	(0.018)	(34.5)	.276
Tract	90-00 growth 10-20%	(0.019)	(35.5)	(0.019)	(35.5)	.155
Tract	90-00 growth >20%	(0.028)	(54.8)	(0.028)	(54.8)	.301
Tract	1990 Tract Minority Percentage	0.154	165.0	0.154	165.2	.135
Loan	Loan Resold to FNMA/GNMA	0.001	3.2	0.001	3.2	.279
Loan	FHA Loan	0.210	553.4	0.211	553.8	.135
Loan	Large Lender Dummy	(0.000)	(1.0)	(0.000)	(1.1)	.604
Borrower	Black Applicant	0.115	196.6	0.114	196.3	.051
Borrower	Hispanic Applicant	0.131	221.4	0.131	221.3	.049
Year	1994 Year Dummy	0.010	17.9	0.015	12.6	.102
Year	1995 Year Dummy	0.009	16.5	0.030	25.9	.106
Year	1996 Year Dummy	0.001	1.2	0.025	22.4	.125
Year	1997 Year Dummy	(0.010)	(18.1)	0.009	7.8	.130
Year	1998 Year Dummy	(0.015)	(27.2)	0.003	3.0	.141
Year	1999 Year Dummy	(0.006)	(10.0)	0.016	14.5	.150
Year	2000 Year Dummy	0.001	1.9	0.023	20.6	.148
CRA*Year	Inside Assmnt Area * Year 1994			0.006	5.8	.060
CRA*Year	Inside Assmnt Area * Year 1995			(0.008)	(7.8)	.055
CRA*Year	Inside Assmnt Area * Year 1996			(0.011)	(10.1)	.058
CRA*Year	Inside Assmnt Area * Year 1997			(0.008)	(7.4)	.061
CRA*Year	Inside Assmnt Area * Year 1998			(0.003)	(3.2)	.067
CRA*Year	Inside Assmnt Area * Year 1999			(0.006)	(6.0)	.070
CRA*Year	Inside Assmnt Area * Year 2000			(0.008)	(7.7)	.065
CRA*Year	MSA Lending Agmnt * Year 1994			(0.013)	(10.8)	.076
CRA*Year	MSA Lending Agmnt * Year 1995			(0.023)	(19.3)	.075
CRA*Year	MSA Lending Agmnt * Year 1996			(0.027)	(23.2)	.088
CRA*Year	MSA Lending Agmnt * Year 1997			(0.021)	(18.1)	.094
CRA*Year	MSA Lending Agmnt * Year 1998			(0.023)	(20.5)	.102
CRA*Year	MSA Lending Agmnt * Year 1999			(0.026)	(23.0)	.112
CRA*Year	MSA Lending Agmnt * Year 2000			(0.025)	(22.3)	.112
	Observations	11,500,000		11,500,000		
	Adjusted R-Sq	0.07		0.07		
	Model	LMIBMHHN_L4		LMIBMHHN_L4A		

For the purposes of capturing CRA's impact, the difference between observed and true rejection rates may not be critical, however. As long as the behavior that leads to the discrepancy between true and observed rejection rates is not different inside and outside assessment areas or inside and outside of MSAs where lending agreements are in place, then the CRA impact can still, in principle, be identified.

The loan-level model presented in Exhibit 27 suggests that CRA has a very important effect on rejection rates. It indicates that rejection rates on CRA-eligible applications are lower in MSAs where lending agreements exist, and lower inside CRA lender assessment areas. The coefficients on these variables are negative and statistically significant in Exhibit 27. All other things being equal, the model suggests that rejection rates are 8 percentage points lower inside assessment areas than outside assessment areas, and the rejection rates are 3 percentage points lower in MSAs where lending agreements exist than in others.

Exhibit 27: Loan-Level Model of CRA-Eligible Loan Application Rejection Rates Demonstrates CRA Effect

Coefficient Category	Coefficient Description	Coefficient Value	t-value	Mean Value
	Intercept	0.725	302.9	1.0
CRA	Lending Agreement Dummy	(0.029)	(71.5)	.710
CRA	Loan Inside Assessment Area	(0.081)	(221.6)	.479
Metro	Housing Affordability Index	(0.002)	(108.5)	67.7
Metro	Med Household Income	(0.004)	(185.8)	50.7
Metro	Unemployment Rate	0.173	13.7	.043
Tract	90-00 growth -8-0%	(0.005)	(8.3)	.206
Tract	90-00 growth 0-10%	0.001	0.9	.264
Tract	90-00 growth 10-20%	0.002	2.4	.155
Tract	90-00 growth >20%	0.005	8.1	.268
Tract	% Tract Housing Built pre1960	(0.074)	(112.2)	.395
Tract	1990 Tract Minority Percentage	0.017	19.0	.248
Tract	Ratio of Tract to MSA Household Income	(0.056)	(74.5)	.931
Loan	Large Lender Dummy	(0.053)	(138.6)	.594
Loan	Loan Amount / Applicant Income	(0.042)	(212.5)	2.19
Borrower	Black Applicant	0.097	167.0	.127
Borrower	Hispanic Applicant	0.046	75.9	.109
Year	1994 Year Dummy	(0.010)	(12.7)	.096
Year	1995 Year Dummy	(0.009)	(11.1)	.100
Year	1996 Year Dummy	0.023	28.6	.119
Year	1997 Year Dummy	0.041	50.9	.126
Year	1998 Year Dummy	0.037	45.4	.135
Year	1999 Year Dummy	0.078	96.5	.163
Year	2000 Year Dummy	0.096	114.4	.169
	Observations	5,320,000		
	Adjusted R-Sq	0.050		
	Model	RR_L2		

The control variables in Exhibit 27 generally behave as expected, with the notable exception of the loan-to-income ratio. The expectation would be that, all other things equal, a higher loan-to-income ratio would lead to higher rejection rates. However, the model coefficient indicates that the reverse is true. This may be a result of the inability to observe actual rejection rates. Alternatively, it may be that metropolitan differences in loan-to-income ratios are significant and there is a correlation across MSAs that is obscuring the true positive relationship between loan-to-income ratios and rejection rates that might be expected.

The three groups of tests in this section collectively indicate a role for CRA in influencing the level and pattern of mortgage credit access. The first group indicated that location in the lender's assessment area or in an MSA with a CRA lending agreement in place has a positive effect on the proportion of CRA-regulated lenders' loans that are CRA-eligible. The second group indicated that CRA's effect persists in higher-income neighborhoods, though it is weaker, and suggested that CRA impact in these areas has not measurably increased since 1995. The third set of tests showed that CRA-regulated lenders' rejection rates are also responsive to the provisions of the Act, being lower in MSAs with lending agreements in place and for applications for loans inside lenders' assessment areas.

TESTS OF CRA IMPACT ON CRA LENDER SHARE OF THE CRA-ELIGIBLE LOAN MARKET

Since the mortgage market is served both by organizations subject to CRA and those that are not, it is possible to examine the factors that influence the share of the market that is served by different types of lenders. The tests in this section examine the shares of the CRA-eligible market captured by CRA-regulated and non-regulated lenders. The tests are built on the premise that because of CRA, covered lenders have an extra incentive to seek out and originate CRA-eligible loans, and should consequently claim a larger share of the lower-income borrower and area markets.

A. CRA Lenders' Share of the CRA-Eligible Market

The first test in this section examines whether CRA lenders tend to capture a larger share of the lower-income borrower and/or area market for mortgage loans when they are operating in MSAs with CRA agreements in place. The assessment area dummy variable is not included here because it has no meaning in a model that includes non-CRA lenders. If the variable was included, it would always be zero for non-CRA lenders, and by definition, an assessment area loan would be a CRA lender loan. Because of this identity, the variable would perform well in indicating which loans were CRA loans, but that performance would be based on a truism built into the model rather than on changes in behavior caused by CRA.

The hypothesis investigated here is that CRA lenders' market share will be higher in MSAs with an agreement in effect. At the loan-level, we expect that a loan is more likely to be made by a CRA lender than a non-CRA lender if it is made in an MSA with a CRA agreement in place. Exhibit 28 presents the model developed to test the hypothesis. It shows that CRA lenders have a market share that is 3.5 percentage points higher in MSAs with lending agreements in place than in other MSAs.

As in the previous section, the influence of the control variables was generally significant and as expected. Interestingly, dummy variables for the year loans were made that were included in this model indicate that, holding all other influences constant, CRA lenders' share of lower-income lending slipped as the decade wore on through 1999. This effect is at least partially based on the big expansion in subprime lending that took place, for the most part, among non-CRA lenders. The effect is seen in many of the other variables as well, with CRA lenders having bigger market shares in areas with a stronger

economy, and in neighborhoods with fewer minority residents – that is, in places where subprime lenders are less prominent.

The model presented in Exhibit 28 shows a noticeable positive effect on CRA lender market share in 2000. That is, the coefficient on the year 2000 dummy variable is positive and statistically significant.

Exhibit 28: Loan-Level Model of the CRA Lender Share of the CRA-Eligible Market Demonstrates CRA Effect

Coefficient Category	Coefficient Description	Coefficient Value	t-value	Mean Value
	Intercept	0.413	170.4	1
CRA	Lending Agreement Dummy	0.035	82.7	.714
MSA	MSA Housing Affordability Index	0.002	91.6	67.5
MSA	MSA Unemployment Rate	(0.014)	(116.6)	4.46
MSA	Home Ownership Rate in 1990	0.097	28.4	.630
Tract	90-00 growth –8-0%	(0.001)	(1.3)	.202
Tract	90-00 growth 0-10%	(0.002)	(2.4)	.262
Tract	90-00 growth 10-20%	(0.011)	(13.9)	.157
Tract	90-00 growth >20%	(0.026)	(36.6)	.277
Loan	Loan resold to FNMA/GNMA	0.044	94.2	.206
Loan	Large Lender Dummy	0.094	244.4	.564
Borrower	Borrower:MSA Income	0.005	35.4	.769
Borrower	Black Applicant	(0.057)	(98.6)	.122
Borrower	Hispanic Applicant	(0.064)	(106.3)	.117
Year	1994 Year Dummy	0.012	14.2	.100
Year	1995 Year Dummy	0.015	17.7	.101
Year	1996 Year Dummy	(0.005)	(6.3)	.120
Year	1997 Year Dummy	(0.018)	(21.1)	.127
Year	1998 Year Dummy	(0.054)	(65.3)	.145
Year	1999 Year Dummy	(0.022)	(26.0)	.160
Year	2000 Year Dummy	0.024	27.6	.151
Tract	% Tract Housing Built pre-1960	0.101	156.1	.387
	Observations	6,700,000		
	Adjusted R-Sq	0.030		
	Model	LMIC_L		

The year 2000 effect is so different from the effects measured in other years that it is possibly the result of one or more acquisitions of major independent mortgage companies by CRA lenders, shifting the activity done by this or these formerly unregulated lenders into the CRA-regulated category.

B. Non-CRA Prime Lenders' Ratio of Non-CRA Eligible Loans to CRA-Eligible Loans

If, as the previous models suggest, CRA-regulated lenders are making extra efforts to originate loans that count for CRA credit, they should be squeezing non-CRA lenders out of this portion of the market. By originating fewer lower-income loans, non-CRA lenders should therefore have higher proportions of

higher-income loans. Thus, examining non-CRA lenders' ratio of loans in higher-income areas to loans in lower-income areas highlights a potential indirect effect of CRA. One specific hypothesis is tested: that non-CRA lenders' ratio of higher-income area loans to lower-income area loans should be higher in counties where CRA agreements are in effect.⁵

Exhibit 29 summarizes a model designed to test this hypothesis. The observations used in the model are ratios of non-CRA-eligible lending to CRA-eligible lending for particular lenders in particular counties in particular years. The model includes observations for all lenders who originated at least 50 loans each in a county for each year of the time period. The minimum loan requirement is used to stabilize the ratio computation, and the requirement that each lender have at least 50 loans in the county for each year of the time period is intended to generate consistent lending histories so the confounding effects of lenders coming into and leaving counties is avoided.

Exhibit 29: Model of Non-CRA Lender Ratios of Non-CRA-Eligible Loans to CRA-Eligible Loans Demonstrates CRA Effect

Coefficient Description	Coefficient Value	t-Value	Mean Value
Intercept	562.517	11.7	1.0
Year	(.280)	(11.6)	1996.8
MSA Lending Agreement Dummy	.511	2.2	.669
County Dummies			
Observations	12,081		
Adjusted R-Sq	.17		
Model	NH3_2		

The coefficient on the MSA lending agreement dummy is positive, indicating that non-CRA prime lenders systematically have lower ratios of non-CRA eligible lending to CRA-eligible lending in those places. The effect is not large, however, and when lender dummies as well as county dummies were included in the equation, the effect disappears.

Tests in this section presented results on the market share impacts of CRA, both directly and indirectly. The first set of results indicates that CRA lenders have larger shares of the CRA-eligible lending market in MSAs where lending agreements are in place. The second test showed that CRA-regulated lenders' competitors do proportionately more higher-income lending (*i.e.*, lending that is not CRA-eligible) in places where CRA agreements are in place – suggesting that they are crowded out of the CRA-eligible market by their regulated competitors.

TESTS OF CRA IMPACT ON HOUSING PRICE AND TURNOVER

This section is built around another set of indirect tests for CRA's influence in the marketplace. In this case, the relationship between CRA's geographic focus on lower-income areas and housing market characteristics in these areas is examined. Specifically, the tests consider whether rates of house price change and housing stock turnover in lower-income areas are measurably different than they are in higher-income places. Both tests are conducted at the tract level. The first group of tests employs data on house price appreciation and housing transaction frequency in Boston, Los Angeles, and Chicago.⁶ The

⁵ All counties in MSAs with agreements in place are assumed to be 'counties where CRA agreements are in effect.'

⁶ Transaction data are those that underlie the Case Schiller Weiss house price index.

second uses tract-level data from all 301 MSAs in the database used for most of the analyses in this report.

A. House Price Changes in CRA-Eligible Neighborhoods

It seems reasonable to expect that if CRA stimulates credit flows to lower-income neighborhoods in particular, then house prices in those neighborhoods should be increasing faster (or declining more slowly) than prices in other neighborhoods. This should occur because the extra focus of CRA lenders on lower-income areas ought to result in higher levels of effective demand in these areas as relatively larger numbers of lower-income borrowers are eligible to purchase homes there. Based on this line of reasoning, the following hypothesis is tested: house prices will rise more rapidly (or decline more slowly) in census tracts that are CRA-eligible than in other neighborhoods, even holding other relevant influences on house price changes constant.

The test for a CRA effect in this model is conducted through a dummy variable that determines whether or not loans in each tract are CRA-eligible in each year or not. The model results in Exhibit 30 indicate that house prices in CRA-eligible areas increase more rapidly and resist declines better than in higher-income neighborhoods, as indicated by the positive coefficients on the dummy variable for lower-income neighborhood. This result is consistent with the hypothesis.⁷

Exhibit 30: Models of House Price Changes Demonstrate CRA Effects

Description	Specification 1		Specification 2		Specification 3		Specification 4		Mean Value
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	
Intercept	(28.718)	(43.9)	(28.718)	(43.9)	(19.188)	(7.5)	(19.187)	(7.5)	1.00
Los Angeles Dummy	(0.032)	(13.8)	(0.032)	(13.8)	(0.032)	(14.0)	(0.032)	(14.0)	.316
Chicago Dummy	(0.010)	(4.9)	(0.010)	(4.9)	(0.010)	(4.9)	(0.010)	(4.9)	.181
LMI Neighborhood Dummy	0.006	2.3	0.006	2.3	(1.730)	(0.7)	(1.730)	(0.7)	.104
Year	0.014	43.9	0.014	43.9	0.010	7.5	0.010	7.5	1996
% Minority in Tract	(0.008)	(1.8)	(0.008)	(1.8)	(23.948)	(8.8)	(23.947)	(8.8)	.218
Tract:MSA Income	0.008	3.7	0.008	3.7	(3.563)	(1.8)	(3.564)	(1.8)	1.15
90-00 tract growth			0.001	0.3			0.001	0.3	.092
Year * LMI Tract					0.001	0.7	0.001	0.7	209.2
Year * % Minority Population					0.012	8.8	0.012	8.8	435.3
Year * Tract:MSA Income					0.002	1.8	0.002	1.8	2,308.5
Observations	3,243		3,243		3,243		3,243		
Adjusted R-SQ	.43		.43		.45		.45		
Model	PE_6		PE_6a		PE_6c		Pe_6b		

⁷ A number of different specifications of the housing price change model were tested, producing consistent results whether or not indicators of tract growth over the 1990 to 2000 time period were included and whether or not interaction effects between different years and the explanatory variables were included or excluded.

B. Turnover Rates in CRA-Eligible Neighborhoods

If CRA induces regulated lenders to expand their CRA-eligible lending, it is reasonable to expect that turnover rates in lower-income neighborhoods will be higher, all other things being equal, than turnover rates in higher-income neighborhoods. CRA-eligible neighborhoods should be more attractive to both lower- and higher-income borrowers because the costs of home purchase loans there are less than they would be without CRA, so prospective buyers will have heightened interest in owning properties there. To test this proposition, a model that looks at the turnover rate in lower- and higher-income tracts is used, where 'turnover' is defined as the total number of home purchase loans in the tract in a particular year divided by the number of owner-occupied housing units in the tract in 1990. The hypothesis here is that, holding other relevant factors constant, turnover will be more rapid in CRA-eligible tracts than in non-eligible tracts.

The model results confirm the existence of higher turnover rates in CRA-eligible neighborhoods, as indicated by the positive coefficients on the dummy variable for lower-income neighborhood in Exhibit 31, or the combined positive effect of the lower-income dummy variable and interaction effects. The models of turnover rate are structured to be parallel to the housing price change models. The other

Exhibit 31: Models of Turnover Rates Demonstrate CRA Effects

Description	Specification 1		Specification 2		Specification 3		Specification 4		Mean Value
	Coefficient	t-value	Coefficient t	t-value	Coefficient	t-value	Coefficient	t-value	
Intercept	(7.353)	(131.4)	(7.35400)	(131.4)	(7.7830)	(33.0)	(7.78000)	(33.0)	1.0
LMI Neighborhood Dummy	0.001	6.0	0.00121	6.0	(0.4020)	(2.3)	(0.40241)	(2.3)	.284
Year	0.004	132.7	0.00372	132.7	0.0039	33.2	0.00393	33.2	1996.5
% Minority in Tract	(0.025)	(78.7)	(0.02529)	(78.7)	(0.6728)	(3.0)	(0.67316)	(3.0)	.271
Tract:MSA Income	0.010	44.4	0.00992	44.3	0.7238	3.9	0.72077	3.9	1.00
90-00 tract growth			0.00004	8.7			0.00004	8.7	.305
Year * LMI Tract					0.0002	2.3	0.00020	2.3	568.6
Year * % Minority Population					0.0003	2.9	0.00032	2.9	541.6
Year * Tract:MSA Income					(0.0004)	(3.9)	(0.00036)	(3.9)	2013.5
Observations	334,671		334,671		334,671		334,671		
Adjusted R-SQ	0.21		0.21		0.21		0.21		

variables in the model behave in identical fashion, as would be expected.

Overall then, the results from this section offer additional support for a CRA effect in housing markets. Results presented here are consistent with the notion that in areas where lenders receive CRA credit for their activities, house prices are more robust and homes are sold more frequently. Both of these results suggest that CRA's mandate to increase accessibility to mortgage capital works by increasing effective demand in specific types of areas

SUMMARY

Statistical analysis of 30 million home purchase loan originations and loan applications over the 1993 to 2000 time period produces evidence consistent with the following propositions about CRA:

- CRA lenders originated a higher proportion of CRA-eligible home purchase loans than they would have if CRA were not in place.
- CRA lenders rejected a smaller proportion of CRA-eligible home purchase loan applications than they would have if CRA were not in place.
- CRA lenders captured a larger share of the CRA-eligible home purchase market than they would have if CRA were not in place.
- Housing price increases and turnover rates were higher in CRA-eligible neighborhoods than they would have been if CRA were not in place.

These conclusions are based on finding positive and statistically significant correlations between variables that capture CRA's differential influence on the volume of specific types of lending across market segments and geography.

To the extent that these findings have weight, it is the result of these correlations, and not on the precise magnitude of the changes that CRA may appear in the analysis to have generated. Because there are many credible alternative specifications of the statistical tests used, each of which would produce different estimates of the magnitude of CRA's impact, it is inappropriate to rely on the specific quantitative estimates of the effects of CRA presented in this report. Rather, the specific quantitative effects of CRA that are summarized in Exhibit 21 are meant to provide order of magnitude indications of CRA's likely impacts over the 1993 to 2000 time period.

In the statistical testing presented in this section, a serious and diligent effort was undertaken to build control variables based on metro area, local neighborhood, lender, loan, and borrower characteristics. Based on the specific approach reported here, CRA's quantitative impact has been small but significant. Other specifications and research efforts could produce different specific results, but it is unlikely that such efforts would indicate either that CRA has had no effect or that CRA has had a very major impact on the levels of CRA-eligible lending that took place over the time period.