# Literature Review

# Data

# Empirical Strategy

## Measure main variables of interest

The carcinogen exposure level is measured by aggregating facility-level release indicators, reported in the Toxic Release Inventory. These indicators encompass three broad categories*: On-site Release Total*, representing the quantity of toxic chemicals released at the facility itself*; Off-site Release Total*, indicating the quantity of toxic chemicals transferred to off-site locations for release or disposal; and *Total Release*, which combines both *On-site* and *Off-site* totals. By combining this data with the Carcinogen classification from the TRI, I can calculate the amount of carcinogenic and non-carcinogenic waste generated by each facility. Subsequently, I utilize the geographical identifiers of these facilities to consolidate annual county-level data on toxic chemical waste releases.

For the main analysis, *Total Carcinogen Release* is used to measure the carcinogen exposure in a county and use the *Total Carcinogen Air Release* for robustness check. Additionally, I createdthe *Carcinogen* *Exposure Dummy* variable by splitting the main *Total Carcinogen Release* into “High” release and “Low” release based on the median value.

The dependent variable is the mortgage rate spread obtained from the Home Mortgage Disclosure Act dataset. The spread is the difference between the interest rate that mortgage lenders charge to borrowers and the low-risk interest rate. A mortgage with a wider rate spread indicates that the lender perceives the mortgage as having relatively higher risk, and reversely.

I also delve into a second target variable, the mortgage interest rate. While the rate spread signifies the marginal cost, the interest rate represents the direct expense of borrowing and the potential return on lending or investing funds. Consequently, employing the interest rate allows me to examine how carcinogen exposure influences the fundamental pricing mechanisms of lenders.

## Lender classification

The US mortgage market is serviced by two distinct categories of lenders: banks and nonbanks, which have considerable differences in both long-term and short-term risk appetite. Following Buchak, Matvos, Piskorski and Seru (2018) classification, I designate traditional depository institutions as banks, and non-depository institutions as nonbanks.

Specifically, banks are all entities regulated by the Federal Reserve System (FRB), Federal Deposit Insurance Corporation (FDIC), and the Office of the Comptroller of the Currency (OCC), as they offer credit intermediary services and accept deposits. This classification encompasses federally-chartered banks, state-chartered banks, and credit unions. In contrast, nonbanks provide credit intermediation services but do not accept deposits, thus operating under sight of different regulators. Nonbanks primarily include Fintech lenders, and it's noteworthy that banks generally face more regulatory scrutiny compared to nonbanks. The difference in regulatory might lead to different lender characteristics and regulatory expenses, which need to be considered and investigated further. Therefore, I include lender fixed effects in my subsequent regression analysis as well as make an additional analysis on the impact of bank and non-bank lenders on the relationship between carcinogen exposure and cost of mortgage credit.

## Empirical model

This study aims to measure the relationship between properties’ exposure to carcinogenic waste (at the county level), and cost of mortgage credit. However, the key empirical problem is that variation in the mortgage rate spreads might be explained by factors other than carcinogen exposures. For instance, properties near manufacturing facilities usually have lower prices (Mastromonaco, 2015), which attracts low-income and less creditworthy home buyers. *Figure 1* gives a conceptual illustration of factors involved in the relationship between carcinogenic waste and mortgage interest rate spread.

**Exposure to Carcinogenic Waste**

**Mortgage Rate Spread & Loan Cost**

**Decision to buy the Property** *(proximity to industrial facilities)*

**Borrower’s & Property’s Characteristics**

**Unobserved time-invariant & unit-invariant factors**

Figure 1: A conceptual representation of the involved factors in the relationship between carcinogenic waste and mortgage interest rate spread. Dashed boxes indicate unobserved factors.

I use the fixed effects models to address the confounding problem related to unobserved county-specific, time-specific, and lender-specific variables. The aim of the model is to compare mortgages that have observable similarities in loan details, properties’ characteristics, and borrowers’ characteristics. This means including in the regression a set of covariates that can control for the main traits of loans, properties, and borrowers. The regression estimation is of the following form:

Whereas the dependent variable {Rate Spread} is the difference between the covered loan’s annual percentage rate of mortgage originated in year in county , and the average prime offer rate for a similar transaction, determined on the date when the interest rate is established. The {Loan Cost} is measured using the interest rate for the covered loan. The {Carcinogen Exposure} is calculated using the log-transformed total carcinogenic release of county in year .

include a set of variables controlling for different characteristics of mortgage, property, and borrower. The mortgage-level variables include *Loan Purpose* (a dichotomous variable equals 1 if the loan is for refinancing and 0 if the loan is for buying a new house), *Bank (*a dichotomous variable equals if the loan’s originated lender is a bank, and 0 if the loan it is a non-bank lender) and *Loan-to-Value ratio* (the mortgage’s loan-to-value ratio). The variables controlling for property characteristics are *Property Value* and *Metro Dummy* (which specify whether the property is in an urban or rural census tract). Finally, the borrower-level variables include applicants’ *Income,* *Gender, Age,* and *Race* in combination with the aforementioned *Loan-to-Value* ratio, which can jointly account for the borrower’s creditworthiness. Variable *Gender* specifies whether the applicants are only female, only male, or both. *Age* is a factor variable that divides the age range from below 25 to above 74 years old into 7 levels. *Race* is also a factor variable that specifies whether the main applicant is White, Asian, African American, or other ethnicities. In addition, I also include several county-level variables including *Land Area*, *Housing Density* and *Unemployment Rate* to control for the county’s socio-demographic conditions.

I use the county year fixed effect […]

Notably, while the main independent variable {Carcinogen Exposure} is aggregated at the county level, the target variables {Rate Spread} and {Interest Rate}, and most of the set of covariates X are at the individual level. This means that, though I try to exploit the variation of carcinogen exposure between different counties (i.e., the different amounts of carcinogenic waste released in counties), the individual-level data can provide additional variation to analyse the heterogenous effect of carcinogen exposure on different groups of borrowers and properties.

## Summary statistics

Table 1: Summary statistics

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | **Mean** | **SD** | **p25** | **p50** | **p75** | **Min** | **Max** |
| **County-level variables** | | | | | | | |
| Ln(Total Carcinogen Releases) | 9.76 | 3.29 | 8.29 | 10.62 | 11.78 | -8.52 | 17.48 |
| Ln(Total On-site Carcinogen Releases) | 11.92 | 2.71 | 10.68 | 12.12 | 13.46 | 0.00 | 19.44 |
| Ln(Total Carcinogen Air Releases) | 8.73 | 3.46 | 6.64 | 9.91 | 11.10 | 0.00 | 14.64 |
| Land Area (km2) | 2,380 | 3,140 | 1,070 | 1,560 | 2,360 | 5 | 47,100 |
| Housing Density | 950.10 | 2638.59 | 168.36 | 458.22 | 820.15 | 0.23 | 40339 |
| Unemployment Rate | 4.90 | 2.19 | 3.40 | 4.20 | 5.90 | 1.30 | 17.80 |
| **Loan-level variables (from HMDA)** | | | | | | | |
| Rate Spread (%) | 0.36 | 0.53 | 0.02 | 0.27 | 0.59 | -2.94 | 4.37 |
| Interest Rate (%) | 3.82 | 0.86 | 3.12 | 3.75 | 4.50 | 1.79 | 8.37 |
| Loan-to-Value ratio | 0.78 | 0.16 | 0.70 | 0.80 | 0.91 | 0.00 | 6.20 |
| Ln(Income) | 11.45 | 0.62 | 11.03 | 11.44 | 11.85 | 6.91 | 13.47 |
| Ln(Property value) | 12.72 | 0.59 | 12.32 | 12.72 | 13.09 | 10.92 | 14.65 |
| Age (7 categories) | 3.44 | 1.36 | 2 | 3 | 4 | 1 | 7 |
| Gender (Male, Female and Join) | 2.10 | 0.79 | 1 | 2 | 3 | 1 | 3 |
| Bank/Non-banks | 0.15 | 0.36 | 0 | 0 | 0 | 0 | 1 |
| Loan Purpose (New purchase/Refinancing) | 1.77 | 0.97 | 1 | 1 | 3 | 1 | 3 |

# Main results

## Baseline results

**Table 2**: The effects of carcinogen exposure on mortgage pricing

This table shows the estimates from regressions of the mortgage spread or mortgage interest rate on the Carcinogen Exposure, with a set of covariates controlling for the characteristics of loan, borrower, and property. Columns (1), (2), and (3) show the effect of carcinogen exposure on mortgage rate spread, while columns (4), (5), and (6) show the effect on mortgage interest rates. The main independent variable Carcinogen Exposure is measured by the Total Carcinogen Release. Total Carcinogenic Releases, Income, and Property Value are log-transformed.

Standard errors clustered at the county level are reported in parentheses under the coefficients. \*\*\*, \*\*, and \* indicate the statical significance at the 1%, 5%, and 10% levels, respectively.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Dependent Variable** | **Rate Spread** | **Rate Spread** | **Rate Spread** | **Interest Rate** | **Interest Rate** | **Interest Rate** |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| Carcinogen Exposure | 0.003\*\* | 0.003\*\*\* | 0.001\* | 0.003\*\* | 0.003\*\* | 0.001\*\* |
|  | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Loan Purpose | 0.019\*\*\* | 0.020\*\*\* | 0.034\*\*\* | 0.016\*\*\* | 0.016\*\*\* | 0.027\*\*\* |
|  | (0.004) | (0.004) | (0.004) | (0.004) | (0.004) | (0.004) |
| Bank | 0.011 | 0.011 | -0.022 | 0.006 | 0.006 | -0.152\*\*\* |
|  | (0.011) | (0.011) | (0.019) | (0.008) | (0.008) | (0.019) |
| Loan-to-Value Ratio | 0.436\*\*\* | 0.437\*\*\* | 0.425\*\*\* | 0.109\*\*\* | 0.111\*\*\* | 0.085\*\*\* |
|  | (0.016) | (0.015) | (0.011) | (0.014) | (0.014) | (0.010) |
| Age | 0.045\*\*\* | 0.045\*\*\* | 0.023\*\*\* | 0.057\*\*\* | 0.057\*\*\* | 0.039\*\*\* |
|  | (0.004) | (0.004) | (0.003) | (0.003) | (0.003) | (0.002) |
| Age2 | -0.004\*\*\* | -0.004\*\*\* | -0.001\*\*\* | -0.005\*\*\* | -0.005\*\*\* | -0.003\*\*\* |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Income | -0.305\*\*\* | -0.302\*\*\* | -0.273\*\*\* | -0.308\*\*\* | -0.301\*\*\* | -0.125\*\*\* |
|  | (0.054) | (0.053) | (0.033) | (0.055) | (0.056) | (0.040) |
| Income2 | 0.015\*\*\* | 0.015\*\*\* | 0.015\*\*\* | 0.016\*\*\* | 0.015\*\*\* | 0.008\*\*\* |
|  | (0.002) | (0.002) | (0.001) | (0.003) | (0.003) | (0.002) |
| Male | -0.002 | -0.002 | 0.002 | -0.005\* | -0.005\* | -0.002 |
|  | (0.003) | (0.003) | (0.002) | (0.003) | (0.003) | (0.002) |
| Race: Asian vs. White | -0.061\*\*\* | -0.061\*\*\* | -0.052\*\*\* | -0.065\*\*\* | -0.065\*\*\* | -0.056\*\*\* |
|  | (0.006) | (0.006) | (0.003) | (0.006) | (0.006) | (0.003) |
| Race: Black vs. White | 0.127\*\*\* | 0.127\*\*\* | 0.122\*\*\* | 0.089\*\*\* | 0.089\*\*\* | 0.078\*\*\* |
|  | (0.004) | (0.004) | (0.003) | (0.004) | (0.004) | (0.003) |
| Race: Natives vs. White | 0.054\*\*\* | 0.054\*\*\* | 0.051\*\*\* | 0.037\*\*\* | 0.037\*\*\* | 0.031\*\*\* |
|  | (0.004) | (0.004) | (0.003) | (0.004) | (0.004) | (0.004) |
| Property Value | -0.327\*\*\* | -0.326\*\*\* | -0.330\*\*\* | -0.265\*\*\* | -0.265\*\*\* | -0.265\*\*\* |
|  | (0.011) | (0.011) | (0.008) | (0.009) | (0.009) | (0.006) |
| Non-Metropolitan | 0.017\*\*\* | 0.016\*\*\* | 0.015\*\*\* | 0.012\*\* | 0.011\*\* | 0.004 |
|  | (0.006) | (0.006) | (0.004) | (0.005) | (0.005) | (0.004) |
| County Land Area | -0.000 | -0.000 | -0.000 | -0.000 | -0.000\* | -0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| County Hou. Density | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| County Unemp. Rate | 0.013\*\*\* | 0.016\*\*\* | 0.010\*\*\* | 0.011\*\*\* | 0.014\*\*\* | 0.009\*\*\* |
|  | (0.004) | (0.003) | (0.002) | (0.004) | (0.003) | (0.002) |
| Year Fixed Effect | Yes | No | No | Yes | No | No |
| State Fixed Effect | Yes | No | No | Yes | No | No |
| Year×State Fixed Effect | No | Yes | Yes | No | Yes | Yes |
| Lender Fixed Effect | No | No | Yes | No | No | Yes |
| Number of Obs. | 977,490 | 977,490 | 977,286 | 977,490 | 977,490 | 977,286 |
| Adjusted R­­2 | 0.230 | 0.233 | 0.375 | 0.666 | 0.668 | 0.712 |

## Robustness tests for the baseline results

### Measure mortgage rate spread with U.S. 30-Year Treasury Yield

**Table 3**: The effects of carcinogen exposure on mortgage pricing

This table shows the estimates from regressions of the alternative mortgage spread or mortgage interest rate on the alternative Carcinogen Exposure with a set of covariates controlling for the characteristics of loan, borrower, and property. Columns (1) (2) show the effect of carcinogen exposure on the mortgage rate spread, while columns (4) (5) show the effect on mortgage interest rates. The alternative mortgage rate spread is measured by the difference between the mortgage rate and the U.S. 30-year Treasury Yield. The alternative Carcinogen Exposure is measured by the Total Carcinogen Air Release. Total Carcinogen Air Releases, Income, and Property Value are log-transformed.

Standard errors clustered at the county level are reported in parentheses under the coefficients. \*\*\*, \*\*, and \* indicate the statical significance at the 1%, 5%, and 10% levels, respectively.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Dependent Variable** | **US30Y Spread** | **US30Y Spread** | **US30Y**  **Spread** | **Interest Rate** | **Interest Rate** | **Interest Rate** |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| Carcinogen Air Exposure | 0.002\* | 0.002\* | 0.001\* | 0.002\* | 0.002\* | 0.001\* |
|  | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Loan Purpose | 0.015\*\*\* | 0.016\*\*\* | 0.027\*\*\* | 0.015\*\*\* | 0.016\*\*\* | 0.027\*\*\* |
|  | (0.004) | (0.004) | (0.004) | (0.004) | (0.004) | (0.004) |
| Bank | 0.006 | 0.006 | -0.154\*\*\* | 0.006 | 0.006 | -0.154\*\*\* |
|  | (0.008) | (0.008) | (0.019) | (0.008) | (0.008) | (0.019) |
| Loan-to-Value Ratio | 0.109\*\*\* | 0.111\*\*\* | 0.086\*\*\* | 0.109\*\*\* | 0.111\*\*\* | 0.086\*\*\* |
|  | (0.014) | (0.014) | (0.010) | (0.014) | (0.014) | (0.010) |
| Age | 0.057\*\*\* | 0.057\*\*\* | 0.039\*\*\* | 0.057\*\*\* | 0.057\*\*\* | 0.039\*\*\* |
|  | (0.003) | (0.003) | (0.002) | (0.003) | (0.003) | (0.002) |
| Age2 | -0.005\*\*\* | -0.005\*\*\* | -0.003\*\*\* | -0.005\*\*\* | -0.005\*\*\* | -0.003\*\*\* |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Income | -0.311\*\*\* | -0.304\*\*\* | -0.127\*\*\* | -0.311\*\*\* | -0.304\*\*\* | -0.127\*\*\* |
|  | (0.055) | (0.056) | (0.040) | (0.055) | (0.056) | (0.040) |
| Income2 | -0.005\* | -0.005\* | -0.002 | -0.005\* | -0.005\* | -0.002 |
|  | (0.003) | (0.003) | (0.002) | (0.003) | (0.003) | (0.002) |
| Male | 0.009\*\*\* | 0.008\*\*\* | 0.016\*\*\* | 0.009\*\*\* | 0.008\*\*\* | 0.016\*\*\* |
|  | (0.003) | (0.003) | (0.002) | (0.003) | (0.003) | (0.002) |
| Race: Asian vs. White | -0.065\*\*\* | -0.064\*\*\* | -0.056\*\*\* | -0.065\*\*\* | -0.064\*\*\* | -0.056\*\*\* |
|  | (0.006) | (0.006) | (0.003) | (0.006) | (0.006) | (0.003) |
| Race: Black vs. White | 0.090\*\*\* | 0.089\*\*\* | 0.078\*\*\* | 0.090\*\*\* | 0.089\*\*\* | 0.078\*\*\* |
|  | (0.004) | (0.004) | (0.003) | (0.004) | (0.004) | (0.003) |
| Race: Natives vs. White | 0.037\*\*\* | 0.037\*\*\* | 0.031\*\*\* | 0.037\*\*\* | 0.037\*\*\* | 0.031\*\*\* |
|  | (0.004) | (0.004) | (0.004) | (0.004) | (0.004) | (0.004) |
| Property Value | -0.265\*\*\* | -0.264\*\*\* | -0.265\*\*\* | -0.265\*\*\* | -0.264\*\*\* | -0.265\*\*\* |
|  | (0.009) | (0.009) | (0.006) | (0.009) | (0.009) | (0.006) |
| Non-Metropolitan | 0.011\*\* | 0.011\*\* | 0.005 | 0.011\*\* | 0.011\*\* | 0.005 |
|  | (0.005) | (0.005) | (0.003) | (0.005) | (0.005) | (0.003) |
| County Land Area | -0.000 | -0.000\* | -0.000 | -0.000 | -0.000\* | -0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| County Hou. Density | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| County Unemp. Rate | 0.012\*\*\* | 0.015\*\*\* | 0.009\*\*\* | 0.012\*\*\* | 0.015\*\*\* | 0.009\*\*\* |
|  | (0.004) | (0.003) | (0.002) | (0.004) | (0.003) | (0.002) |
| Year Fixed Effect | Yes | No | No | Yes | No | No |
| State Fixed Effect | Yes | No | No | Yes | No | No |
| Year×State Fixed Effect | No | Yes | Yes | No | Yes | Yes |
| Lender Fixed Effect | No | No | Yes | No | No | Yes |
| Number of Obs. | 982,895 | 982,895 | 982,691 | 982,895 | 982,895 | 982,691 |
| Adjusted R­­2 | 0.299 | 0.302 | 0.395 | 0.666 | 0.667 | 0.711 |

### Covariates balance

Using propensity score matching to match loans in counties with zero carcinogenic exposure and counties with positive carcinogenic exposure based on loan characteristics.

# Additional Analyses

## Heterogeneity across bank and non-bank lenders

**Table 6**: The heterogeneous effects of carcinogen exposure on mortgage pricing between bank and non-bank lenders

This table shows the estimates from regressions of the mortgage spread or mortgage interest rate on Carcinogen Exposure, the interaction term of Carcinogen Exposure and Loan Purpose, and a set of covariates controlling for the characteristics of loan, borrower, and property. Columns (1) (2) show the effect of carcinogen exposure on mortgage rate spread, while columns (4) (5) show the effect on mortgage interest rates. The variable Carcinogen Exposure is a dummy variable, with “high” and “low” values based on the median of Total Carcinogenic Releases. Income and Property Value are log-transformed.

Standard errors clustered at the county level are reported in parentheses under the coefficients. \*\*\*, \*\*, and \* indicate the statical significance at the 1%, 5%, and 10% levels, respectively.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Dependent Variable** | **Rate Spread** | **Rate Spread** | **Interest Rate** | **Interest Rate** |
|  | (1) | (2) | (3) | (4) |
| Carcinogen Exposure | 0.016\*\* | 0.006 | 0.014\*\* | 0.007 |
|  | (0.007) | (0.004) | (0.007) | (0.004) |
| Carc. Exposure×Bank | 0.017 | 0.007 | 0.011 | 0.002 |
|  | (0.018) | (0.005) | (0.012) | (0.005) |
| Bank | 0.002 | -0.026 | 0.001 | -0.154\*\*\* |
|  | (0.011) | (0.019) | (0.009) | (0.019) |
| Loan Purpose | 0.020\*\*\* | 0.034\*\*\* | 0.016\*\*\* | 0.027\*\*\* |
|  | (0.004) | (0.004) | (0.004) | (0.004) |
| Loan-to-Value Ratio | 0.437\*\*\* | 0.425\*\*\* | 0.111\*\*\* | 0.086\*\*\* |
|  | (0.015) | (0.011) | (0.014) | (0.010) |
| Age | 0.044\*\*\* | 0.023\*\*\* | 0.056\*\*\* | 0.039\*\*\* |
|  | (0.004) | (0.003) | (0.003) | (0.002) |
| Age2 | -0.004\*\*\* | -0.001\*\*\* | -0.005\*\*\* | -0.003\*\*\* |
|  | (0.000) | (0.000) | (0.000) | (0.000) |
| Income | -0.307\*\*\* | -0.278\*\*\* | -0.304\*\*\* | -0.133\*\*\* |
|  | (0.053) | (0.033) | (0.056) | (0.039) |
| Income2 | 0.015\*\*\* | 0.015\*\*\* | 0.015\*\*\* | 0.009\*\*\* |
|  | (0.002) | (0.001) | (0.003) | (0.002) |
| Male | -0.002 | 0.002 | -0.005\* | -0.002 |
|  | (0.003) | (0.002) | (0.003) | (0.002) |
| Race: Asian vs. White | -0.061\*\*\* | -0.052\*\*\* | -0.065\*\*\* | -0.056\*\*\* |
|  | (0.006) | (0.003) | (0.006) | (0.003) |
| Race: Black vs. White | 0.127\*\*\* | 0.122\*\*\* | 0.089\*\*\* | 0.079\*\*\* |
|  | (0.004) | (0.003) | (0.004) | (0.003) |
| Race: Natives vs. White | 0.054\*\*\* | 0.051\*\*\* | 0.037\*\*\* | 0.031\*\*\* |
|  | (0.004) | (0.003) | (0.004) | (0.004) |
| Property Value | -0.326\*\*\* | -0.330\*\*\* | -0.264\*\*\* | -0.265\*\*\* |
|  | (0.011) | (0.008) | (0.009) | (0.006) |
| Non-Metropolitan | 0.017\*\*\* | 0.015\*\*\* | 0.011\*\* | 0.004 |
|  | (0.005) | (0.003) | (0.005) | (0.003) |
| County Land Area | -0.000 | -0.000 | -0.000\* | -0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) |
| County Housing Density | 0.000 | 0.000 | 0.000 | 0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) |
| County Unemp. Rate | 0.017\*\*\* | 0.011\*\*\* | 0.015\*\*\* | 0.009\*\*\* |
|  | (0.003) | (0.002) | (0.003) | (0.002) |
| Year×State Fixed Effects | Yes | Yes | Yes | Yes |
| Lender Fixed Effects | No | Yes | No | Yes |
| Number of Observations | 991,656 | 991,458 | 991,656 | 991,458 |
| Adjusted R­­2 | 0.233 | 0.375 | 0.667 | 0.711 |

## Heterogeneity across loan purposes

**Table 5**: The heterogeneous effects of carcinogen exposure on mortgage pricing between different loan purpose

This table shows the estimates from regressions of the mortgage spread or mortgage interest rate on the Carcinogen Exposure, the interaction term of Carcinogen Exposure and Loan Purpose, and a set of covariates controlling for the characteristics of loan, borrower, and property. Columns (1) (2) show the effect of carcinogen exposure on mortgage rate spread, while columns (4) (5) show the effect on mortgage interest rates. The variable Carcinogen Exposure is a dummy variable, with “high” and “low” values based on the median of Total Carcinogenic Releases. Income and Property Value are log-transformed.

Standard errors clustered at the county level are reported in parentheses under the coefficients. \*\*\*, \*\*, and \* indicate the statical significance at the 1%, 5%, and 10% levels, respectively.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Dependent Variable** | **Rate Spread** | **Rate Spread** | **Interest Rate** | **Interest Rate** |
|  | (1) | (2) | (3) | (4) |
| Carcinogen Exposure | 0.022\*\* | 0.009\* | 0.013 | 0.003 |
|  | (0.009) | (0.005) | (0.008) | (0.005) |
| Carc. Exposure×Purpose | -0.008 | -0.005 | 0.007 | 0.009 |
|  | (0.010) | (0.009) | (0.008) | (0.008) |
| Loan Purpose | 0.024\*\*\* | 0.036\*\*\* | 0.013\*\* | 0.022\*\*\* |
|  | (0.006) | (0.005) | (0.005) | (0.004) |
| Bank | 0.010 | -0.022 | 0.006 | -0.154\*\*\* |
|  | (0.011) | (0.018) | (0.008) | (0.019) |
| Loan-to-Value Ratio | 0.436\*\*\* | 0.425\*\*\* | 0.111\*\*\* | 0.086\*\*\* |
|  | (0.015) | (0.011) | (0.014) | (0.010) |
| Age | 0.044\*\*\* | 0.023\*\*\* | 0.056\*\*\* | 0.039\*\*\* |
|  | (0.004) | (0.003) | (0.003) | (0.002) |
| Age2 | -0.004\*\*\* | -0.001\*\*\* | -0.005\*\*\* | -0.003\*\*\* |
|  | (0.000) | (0.000) | (0.000) | (0.000) |
| Income | -0.308\*\*\* | -0.278\*\*\* | -0.305\*\*\* | -0.128\*\*\* |
|  | (0.053) | (0.033) | (0.056) | (0.040) |
| Income2 | 0.015\*\*\* | 0.015\*\*\* | 0.015\*\*\* | 0.009\*\*\* |
|  | (0.002) | (0.001) | (0.003) | (0.002) |
| Male | -0.002 | 0.002 | -0.005\* | -0.002 |
|  | (0.003) | (0.002) | (0.003) | (0.002) |
| Race: Asian vs. White | -0.061\*\*\* | -0.052\*\*\* | -0.065\*\*\* | -0.056\*\*\* |
|  | (0.006) | (0.003) | (0.006) | (0.003) |
| Race: Black vs. White | 0.127\*\*\* | 0.122\*\*\* | 0.089\*\*\* | 0.078\*\*\* |
|  | (0.004) | (0.003) | (0.004) | (0.003) |
| Race: Natives vs. White | 0.054\*\*\* | 0.051\*\*\* | 0.037\*\*\* | 0.031\*\*\* |
|  | (0.004) | (0.003) | (0.004) | (0.004) |
| Property Value | -0.326\*\*\* | -0.330\*\*\* | -0.264\*\*\* | -0.265\*\*\* |
|  | (0.011) | (0.008) | (0.009) | (0.006) |
| Non-Metropolitan | 0.016\*\*\* | 0.015\*\*\* | 0.011\*\* | 0.004 |
|  | (0.005) | (0.003) | (0.005) | (0.003) |
| County Land Area | -0.000 | -0.000 | -0.000\* | -0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) |
| County Housing Density | 0.000 | 0.000 | 0.000 | 0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) |
| County Unemp. Rate | 0.017\*\*\* | 0.011\*\*\* | 0.015\*\*\* | 0.009\*\*\* |
|  | (0.003) | (0.002) | (0.003) | (0.002) |
| Year×State Fixed Effects | Yes | Yes | Yes | Yes |
| Lender Fixed Effects | No | Yes | No | Yes |
| Number of Observations | 982,895 | 982,691 | 982,895 | 982,691 |
| Adjusted R­­2 | 0.233 | 0.375 | 0.667 | 0.711 |

## Heterogeneity across races