

Appendix to:

Did Technology Contribute to the Housing Boom? Evidence from MERS

Stefan Lewellen and Emily Williams

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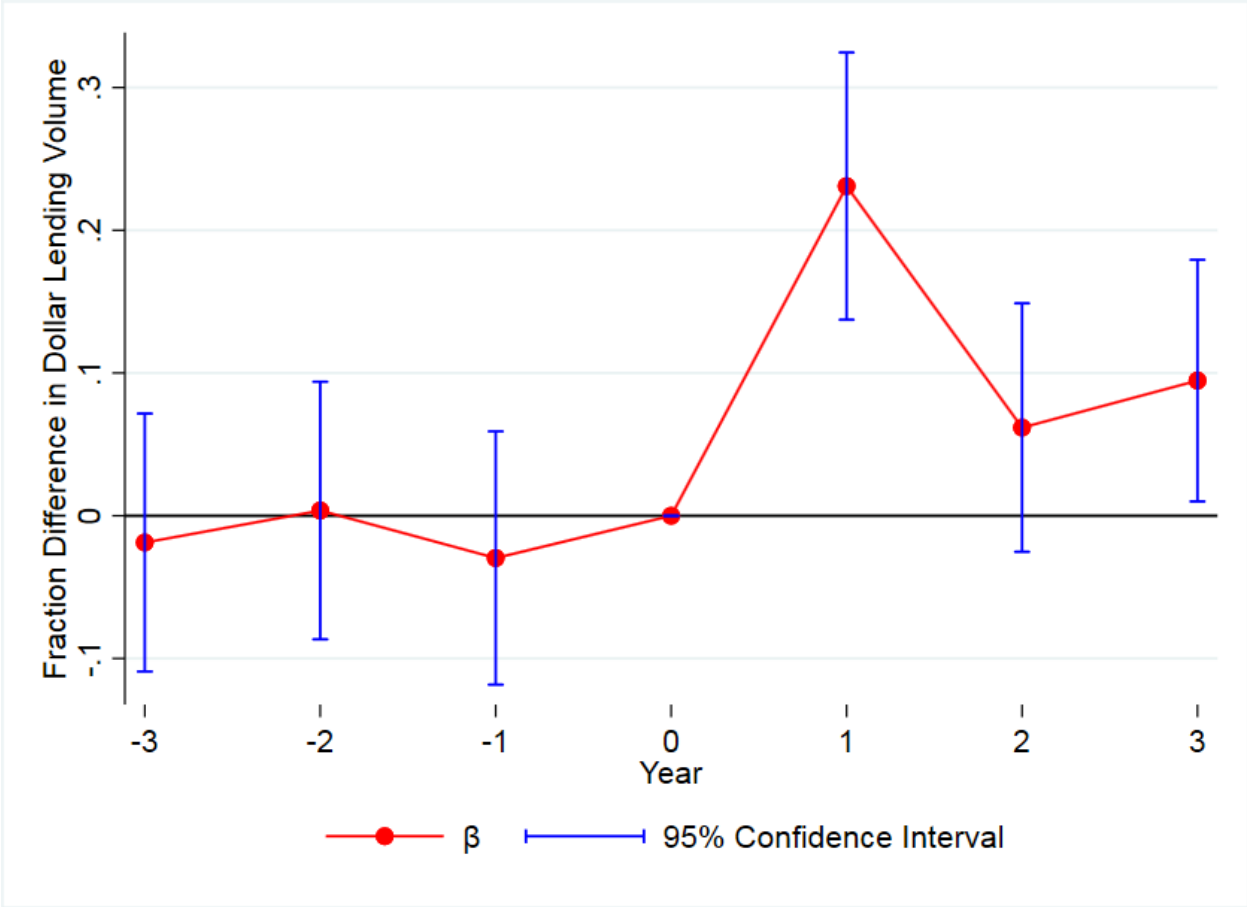


Fig. A.1. This figure plots the annual coefficients of differences in differences regression, of the log of total lending in MERS active census tracts, relative to non MERS active census tracts, coefficients are relative to treatment year=0.

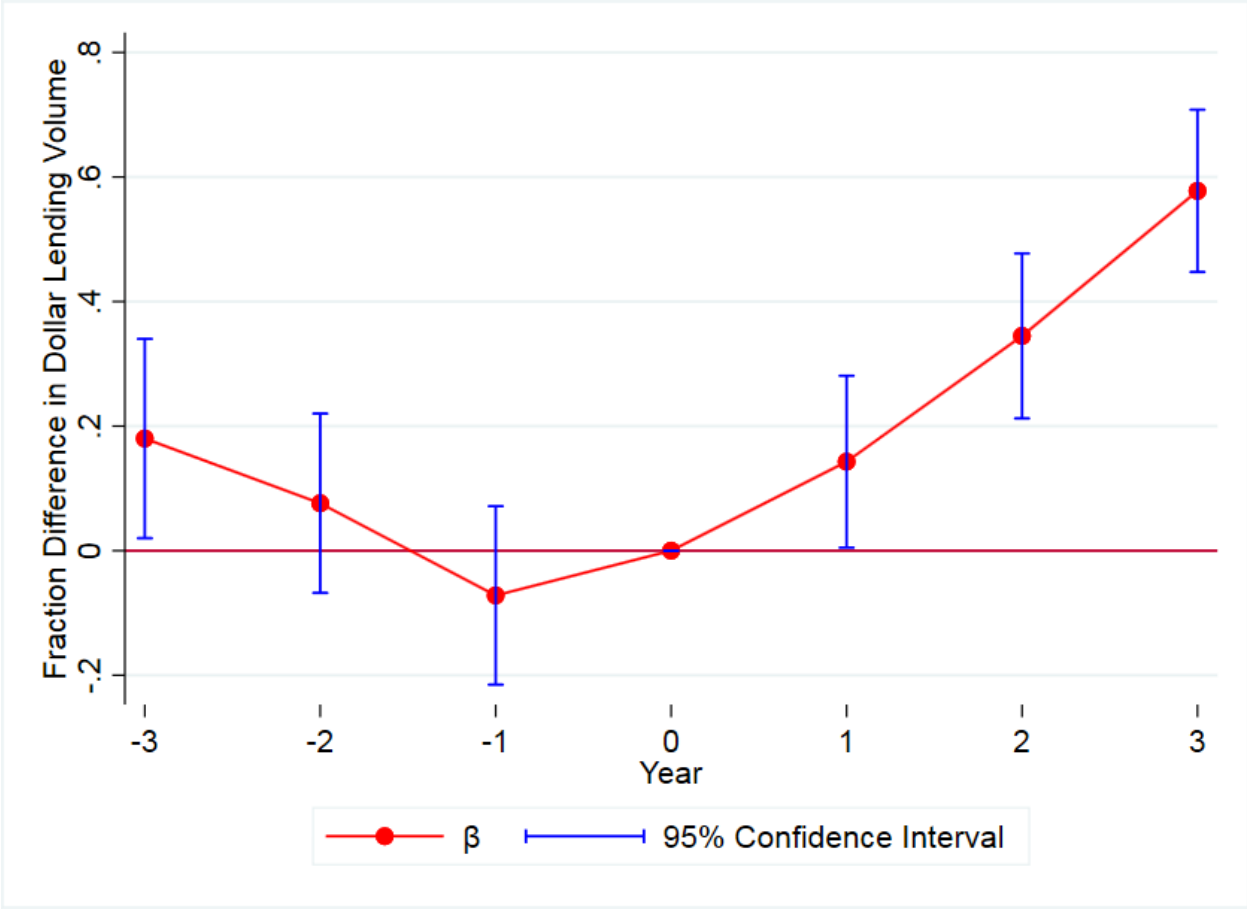


Fig. A.2. This figure plots the annual coefficients of differences in differences regression, of the log of total lending of MERS lenders relative to non-MERS lenders in MERS active census tracts, coefficients are relative to treatment year=0.

Table A.1
Credit Supply Effects of MERS - Tract-level Evidence

This table contains results of census tract/year regressions. The first two regressions capture the effects of a census tract becoming “MERS Active” on lending outcomes. We define a census tract as “MERS Active” if at least one lender that makes a loan in that tract has a relationship with a purchaser who has just joined MERS. To avoid the issue of overlapping treatment events, we drop all census tracts that simultaneously appear in the pre-event and post-event groups (where events are defined as in Table 4). As in our other tests, the sample is limited to the three years surrounding purchasers’ decisions to join MERS. The control group for these tests are census tracts in the same zip code for which no purchasers joined MERS. Standard errors are clustered by zip code.

Dependent Variable	All Tracts		Treated Tracts	
	Log(Loan Volume)	Log(Num. Loans)	Log(Loan Volume)	Log(Num. Loans)
Post × MERS Active	0.0910* (0.0460)	0.0546** (0.0250)	0.607*** (0.0598)	0.626*** (0.0535)
Zip x Year Fixed Effects	Y	Y	Y	Y
Census Tract Fixed Effects	Y	Y	Y	Y
Observations	5,296	5,301	3,367	3,419
R-squared	0.816	0.960	0.797	0.835

*** p<0.01, ** p<0.05, * p<0.1

Table A.2
Purchases of non bank-originated loans by commercial banks

This table contains results of purchaser/lender/year/census tract/mortgage sale type regressions using nationwide mortgage origination data from HMDA. The dependent variable is either the log of the total dollar amount of mortgages – volume – or the log of the total number of mortgages – Num Loans – originated per lender/year/census tract/sale type. We append a purchaser in the pre-event and post-event periods if the lender had a relationship with that purchaser in the pre-event period in each census tract/year. Post is a dummy variable that takes a value of 1 for the year of and year after the purchaser that a lender has a relationship with becomes a MERS member, and 0 for the year prior. MERS is a dummy variable that takes a value of 1 if the lender is a MERS member and 0 otherwise. Bank is a dummy variable that equals 1 if a mortgage was sold to a commercial bank, and equals 0 otherwise. The sample is limited to loans originated by non-bank lenders. Non-bank lenders are institutions with a HMDA lender code of 3. Zip code \times year, purchaser \times year and relationship fixed effects are included. Relationship refers to the purchaser/lender relationship. All purchaser and lender variables are based solely on data from the Massachusetts land records. Standard errors are clustered by zip code.

	(1)	(2)
Dependent Variable	Log(Volume)	Log(Num. Loans)
Post \times MERS	-0.0388*** (0.0086)	-0.0013 (0.0080)
Post \times MERS \times Bank	0.2664*** (0.0331)	0.2774*** (0.0309)
Zip \times Year Fixed Effects	Y	Y
Purchaser \times Year Fixed Effects	Y	Y
Relationship Fixed Effects	Y	Y
Observations	10,100,006	10,100,006
R-squared	0.334	0.223

*** p<0.01, ** p<0.05, * p<0.1

Table A.3
Credit Supply Effects of MERS - Capturing the Extensive Margin

This table contains results of lender/year/census tract conditional logit regressions, at the census tract level. We augment the baseline data by adding zeros in the year prior to the first year a lender makes a loan in a given census tract, and in the years following the last year a lender lends in a census tract and we then restrict the sample to instances with entry. The dependent variable - Entry - is a dummy variable, taking a value of 1 for the first year that a lender enters a census tract and lends a greater than 0 amount and a 0 otherwise. MERS is a dummy variable taking a value of 1 if the lender is a MERS member, and a value of 0 if the lender is not a MERS member in the pre and post period. Post is a dummy variable taking a value of 1 for the year of and year after the year the purchaser the lender has a relationship with becomes a MERS member, and a value of 0 for the year prior to the year the purchaser the lender has a relationship with becomes a MERS member. Non-Bank is a dummy variable that takes a value of 1 if the institution has a HMDA lender code 3 (i.e. is a non-bank or a manually verified institution of this type), and a value of 0 if the institution has a HMDA lender code 0,1,2, or 5 (i.e. is a bank, or a subsidiary or affiliate of a bank or a manually verified institution of this type). Standard errors are clustered by census tract.

Dependent Variable	Entry	
Post × MERS	0.861*** (0.237)	-0.226 (0.607)
Post × MERS × Non-Bank		1.256* (0.688)
Observations	11,218	11,218

*** p<0.01, ** p<0.05, * p<0.1

Table A.4
MERS and House Price Appreciation

This table presents the results of census tract/year regressions of the Bogin, Doerner, and Larson (2019) house price index on the variable $Post \times MERS \text{ Active}$, which is defined in Table A.1. Column (1) uses data from the Massachusetts land records, while column (2) uses the full nationwide HMDA dataset. In both columns, the unit of observation is a census tract-year. Standard errors are clustered by zip code.

Dependent Variable	House Price Index	
	Land records	HMDA
Post \times MERS Active	5.717** (2.293)	10.963** (4.717)
Zip \times Year Fixed Effects	Y	Y
Census Tract Fixed Effects	Y	Y
Observations	4,489	84,256
R-squared	0.984	0.886

*** p<0.01, ** p<0.05, * p<0.1

Table A.5
Relationship Dynamics

This table shows the average number of relationships for non-MERS lenders in the years prior to, during, and after a purchaser the lender has a relationship with joins MERS. A relationship is defined as a lender selling at least one loan to a purchaser in a given year. The data source is the Massachusetts land records and the sample period is 1990-2018. Note that once a lender joins MERS, we cannot observe the lender's loan sales (and hence, relationships) in the Massachusetts land records; therefore, the table focuses on the number of relationships that *non*-MERS lenders have with purchasers during the period when a purchaser joins MERS.

	Year		
	$t - 1$	t	$t + 1$
Mean	6.55	6.11	6.67
10th percentile	1	1	1
50th percentile	5	4	5
90th percentile	14	13	14
t -statistic for difference in means relative to year $t - 1$		-0.36	0.12
Observations	283	283	283

Table A.6
Relationship Persistence

This table reports the results of a logit regression that examines the factors associated with whether a relationship in one year between a lender and a purchaser persists to the following year. We restrict the tests to observe only relationships with purchasers who are not MERS members in year $t+1$. A relationship is defined as a lender selling at least one loan to a purchaser in a given year. The dependent variable takes the value of one if a relationship that exists in year t also exists in year $t + 1$ and takes the value of zero otherwise. The variable *MERS* takes the value of one if a lender is a MERS member in year t and zero otherwise. The variables $\ln(\text{Volume})$ and $\ln(\text{Num. Loans})$ represent the natural logs of the lender's dollar origination volume and the number of mortgages the lender originated in that year. The variable *Non – bank* takes the value of one if a lender has a HMDA lender code 3 (i.e. is a non-bank or a manually verified institution of this type) and a value of zero if the institution has a HMDA lender code 0,1,2, or 5 (i.e. is a bank, or a subsidiary or affiliate of a bank or a manually verified institution of this type). The data source is the Massachusetts land records and the sample period is 1990-2018.

	Relationship persists in year $t + 1$
MERS	-0.0102 (0.0903)
$\ln(\text{Volume})$	-0.175*** (0.0523)
$\ln(\text{Num. Loans})$	-0.0350*** (0.0514)
Non-bank	0.160*** (0.0542)
Constant	0.557 (0.660)
Observations	18,978

Table A.7
Predicting Relationships: Lenders

This table reports the results of a logit regression that examines whether lenders' MERS status predicts the existence of a relationship with purchasers who subsequently join MERS. We first restrict the sample to only include purchasers who eventually join MERS and further restrict the sample to the year prior to the year in which the purchaser becomes a MERS member. For each lender-purchaser pair, we then code a variable – Relationship– that equals one if a relationship exists between the two parties and 0 otherwise. We then determine whether various lender characteristics are correlated with the existence of a relationship. The variable *MERS* takes the value of one if a lender is a MERS member in year $t - 1$ and zero otherwise. The variables $\ln(\text{Volume})$ and $\ln(\text{Num. Loans})$ represent the natural logs of the lender's dollar origination volume and the number of mortgages the lender originated in that year. The variable *Non - bank* takes the value of one if a lender has a HMDA lender code 3 (i.e. is a non-bank or a manually verified institution of this type) and a value of zero if the institution has a HMDA lender code 0,1,2, or 5 (i.e. is a bank, or a subsidiary or affiliate of a bank or a manually verified institution of this type). The data source is the Massachusetts land records and the sample period is 1990-2018.

	Relationship
MERS	-0.212 (0.239)
$\ln(\text{Volume})$	-0.0472 (0.0717)
$\ln(\text{Num. Loans})$	0.385*** (0.066)
Non-bank	1.151*** (0.124)
Constant	-5.435*** (1.034)
Observations	116,291

Table A.8
Predicting Relationships: Purchasers

This table reports the results of a logit regression that examines purchaser characteristics that determine whether a lender/purchaser relationship exists in the years prior to the lender joining MERS. We first restrict the sample to only include lenders who eventually join MERS, and then further restrict the sample to the year prior to the year the lender becomes a MERS member. For each lender-purchaser pair, we then code a variable – Relationship– that equals one if a relationship exists between the two parties in that year and 0 otherwise. We then determine whether the purchaser’s MERS status is correlated with the existence of a relationship. The variable *MERS* takes the value of one if a purchaser is a MERS member in year $t - 1$ and zero otherwise. The data source is the Massachusetts land records and the sample period is 1990-2018.

	Relationship
MERS	-0.128 (0.224)
Constant	-4.303*** (0.105)
Observations	144,095

Table A.9
Credit Supply Effects of MERS: Extended Event Window

This table contains results of purchaser/lender/year/census tract regressions. We rerun the tests reported in the first two columns of Table 4 after extending the pre-event and post-event windows to be three years each instead of one year each. All other variables are defined as in Table 4. Standard errors are clustered by zip code.

	Log(Volume)	Log(Num. Loans)
Post \times MERS	0.114** (0.0426)	0.0749* (0.0392)
Zip \times Year Fixed Effects	Y	Y
Purchaser \times Year Fixed Effects	Y	Y
Relationship Fixed Effects	Y	Y
Observations	112,556	112,890
R-squared	0.416	0.429

*** p<0.01, ** p<0.05, * p<0.1

Table A.10
Credit Supply Effects of MERS: First Treatment Event per Lender

This table contains results of purchaser/lender/year/census tract regressions. We rerun the tests reported in the first two columns of Table 4 after restricting the sample to only include the first time a lender is treated (via a purchaser joining MERS). All subsequent treatments for the lender (via other purchasers joining MERS) are excluded from the sample. All other variables are defined as in Table 4. Standard errors are clustered by year.

	Log(Volume)	Log(Num. Loans)
Post \times MERS	0.0911** (0.0387)	0.0593** (0.0298)
Zip \times Year Fixed Effects	Y	Y
Purchaser \times Year Fixed Effects	Y	Y
Relationship Fixed Effects	Y	Y
Observations	18,459	18,541
R-squared	0.517	0.528

*** p<0.01, ** p<0.05, * p<0.1

References

Bogin, A. N., Doerner, W. M., Larson, W. D., 2019. Local house price dynamics: New indices and stylized facts. *Real Estate Economics* 47, 365–398.