

## **Online Appendix for “Unemployment Insurance as a Housing Market Stabilizer”**

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### **Appendix A. Using LPS to calculate extended benefits' effect on the probability that delinquent loans transition to foreclosure**

To understand whether UI merely prevents delinquency or also prevents default, we examine loan servicing data from Lender Processing Services (LPS). Across all loans that became 90-days delinquent in the year 2009 in a given state, we measure the proportion entering foreclosure within 24 months. To test whether this transition rate varies with the generosity of extended benefits, we regress the transition rate on *Max Benefit EB EUC* and control for the state's economic and fiscal conditions: log of real GDP per capita, home price growth, average wages, union coverage, the UI trust fund reserve ratio, an indicator for a negative UI trust fund balance, and a cubic function of the state's unemployment rate.

We find no detectable impact of extended UI benefits on the transition rate. Appendix Table A14 reports estimates from regression analysis with various combinations of control variables. The most demanding specification, reported in column (4), finds that an additional \$1,000 in maximum benefits is associated with 0.9-basis-point lower transition rates (SE = 13.5 basis points). The negative point estimate suggests that expanding UI might have reduced the foreclosure rate even more than it reduced the delinquency rate, but regardless, the point estimate is small. A one-standard-deviation (\$8,400) increase in maximum extended benefits is associated with a 7-basis-point lower foreclosure transition rate (SE = 1.13 percentage points), which is multiple orders of magnitude smaller than the national average foreclosure transition rate of 38.9 percent. The stable transition rate suggests that UI prevents foreclosures as well as delinquencies.

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**Appendix B.** *Using the SIPP to develop an alternative partial equilibrium estimate of foreclosures avoided by UI expansions*

As a supplement to the analysis in Section IV.B, we use our delinquency estimates from the Survey of Income and Program Participation (SIPP) to provide an additional estimate of foreclosures avoided by unemployment insurance extensions during the Great Recession. We apply a framework similar to the one used in Section IV.B for the NLSY. For each year  $t$ , we calculate the proportional change in the mortgage delinquency rate implied by our estimates using the following equation, where  $UI$  denotes the additional benefits authorized (in thousands of dollars) under the EB, EUC, and FAC programs:

$$\% \Delta D_t = \frac{(\Delta \Pr(\text{Delinquency}) \text{ per } UI | \text{Layoff}) * \overline{UI}_t * \Pr(\text{Layoff})_t}{\Pr(\text{Delinquency})}$$

The numerator gives the change in the probability of delinquency across all households, assuming zero effect of UI payments on households that do not experience a layoff. More specifically, we multiply the differential change in delinquency for each \$1,000 in maximum expanded benefits among those who are laid off (-0.30, from column 2 of Table 6) by the amount of maximum expanded benefits, averaged across states, and by the probability of a layoff in that year. After dividing by the average delinquency rate, we are left with an estimate of the proportional change in delinquencies attributable to the UI expansions.

In Appendix Table A16, we report the inputs to this calculation in each year. For the year 2009, we find that expanded benefits reduced the delinquency rate by 1.04 percentage points (i.e.,  $0.3 \times 18.752 \times 0.184$ ), or 13.4%, relative to the average delinquency rate of 7.74%. To convert this proportional change into the number of delinquencies avoided, we multiply by 4.1 million, the average number of delinquent mortgages (30+ days late) in the year 2009, according to the Mortgage Bankers Association's National Delinquency Survey (NDS). By this calculation, UI expansions helped avoid 547,701 delinquencies in 2009 and 2.8 million delinquencies in total between 2008 and 2013.

To convert our estimate of delinquencies avoided into foreclosures avoided, we rely on our finding, discussed in Appendix A, that expanded benefits have no effect on the probability that delinquent loans transition to foreclosure. This finding implies that additional UI benefits cause the same proportional change in foreclosures as in delinquencies. In the year 2009, for

which we found a 13.4% reduction in delinquencies, we estimate that UI avoided 310,304 foreclosures (13.4% of the 2,320,309 foreclosure starts in 2009 as per the NDS). Summing the estimated foreclosures avoided between July 2008 and December 2013, we find that expanding UI helped prevent about 1.4 million foreclosures. This estimate is slightly higher than our NLSY-based estimate of 1.3 million foreclosures avoided, which is based on the cohort of individuals aged 45 to 55 during the Great Recession.

### **Appendix C. *Estimated savings from avoiding foreclosures***

By preventing foreclosures, the federal expansions of unemployment insurance during the Great Recession provided benefits to the government-sponsored enterprises (GSEs) and other financial institutions that owned mortgages. We measure these savings using estimates of the typical unpaid balance and loss rate on foreclosed loans. Appendix Table A17 shows the details of this calculation.

We calculate losses on both first-lien mortgages using data from the Census Bureau, Department of Housing and Urban Development (HUD), and Fannie Mae. Based on the median property value in 2007 (U.S. Census Bureau 2012), an original loan-to-value ratio of 80%, and an unpaid loan balance of 104%, we estimate a typical unpaid balance of \$181,000. Although this estimate is based on the national median home value, we confirm that laid-off mortgagors' median home value is similar to that of the national median.<sup>1</sup> This estimate is also close to the \$193,000 average unpaid balance on defaulted Fannie Mae loans in the 2007 vintage (Fannie Mae 2017). We apply a loss rate of 42.3% (HUD 2010). This is similar to other available estimates. For example, Fannie Mae reports average loss severity of 38.3% on loans defaulting between 2008 and 2013 (Fannie Mae 2017), which underestimates loss severity on foreclosures because it also includes losses on short sales and other foreclosure alternatives (Goodman and Zhu 2015). Multiplying the typical unpaid balance by the average loss severity, we estimate that first-lien mortgage lenders lost roughly \$77,000 per foreclosure during the Great Recession.

Many properties were also financed by second-lien loans, for which the outstanding balance was about one-eighth of the balance on first-lien loans (Lee, Mayer, and Tracy 2012), or,

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<sup>1</sup> In SIPP data from 2010, the median home value among laid-off mortgagors (\$175,000) is very close to the median home value among all homeowners (\$170,000). While laid-off homeowners own lower value homes than do non-laid-off homeowners, mortgagors own higher value homes than do individuals who own their homes outright. A similar pattern holds for average home values.

on average, about 10% of the original property value. Applying the same calculation as for first-lien loans and recognizing that the typical second-lien holder recovered nothing in foreclosure, we estimate an average loss of \$18,000 per foreclosed property for second-lien holders.

Aggregating over the 1.3 million avoided foreclosures and accounting for the proportion of federally owned or insured loans (Lucas and Torregrosa 2010), we estimate that UI expansions during the Great Recession provided a \$45 billion subsidy to the GSEs and an \$81 billion subsidy to private mortgage investors. Given the federal government’s implicit guarantee of the GSEs, this estimate implies that the net cost of the UI expansions to the federal government was nearly one-sixth less than the \$273 billion paid out. These saving are particularly notable because the fiscal cost of extending UI was a key consideration in the public policy debate. The subsidy to private investors, many of which were struggling financial institutions, also represented a sizable capital injection into the financial system at a critical time. At \$81 billion, this subsidy equates to almost 40% of the \$205 billion of capital invested in banks under the Troubled Asset Relief Program (SIGTARP 2015), which Veronesi and Zingales (2010) estimate created substantial social value by reducing the risk of bank runs, relieving debt overhang to facilitate productive lending, and preventing potentially value-destroying liquidation.

#### **Appendix D. *Supplementary figures and tables***

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Figure A1. Trends of Key Variables in High and Low Benefit States, Classified Based on the Median Increase in UI Generosity between 1991 and 2010

Figure A2. Distributions of Key Variables in Full Sample, Presented as Histograms with Fitted Normal Distribution Curves, across States

Figure A3. Change in the Mortgage Delinquency Rate and Extended Benefits Available to Eligible Unemployment Insurance Recipients under the Extended Benefits and Emergency Unemployment Compensation Programs (in Thousands of Dollars) between 2005 and 2008, by State

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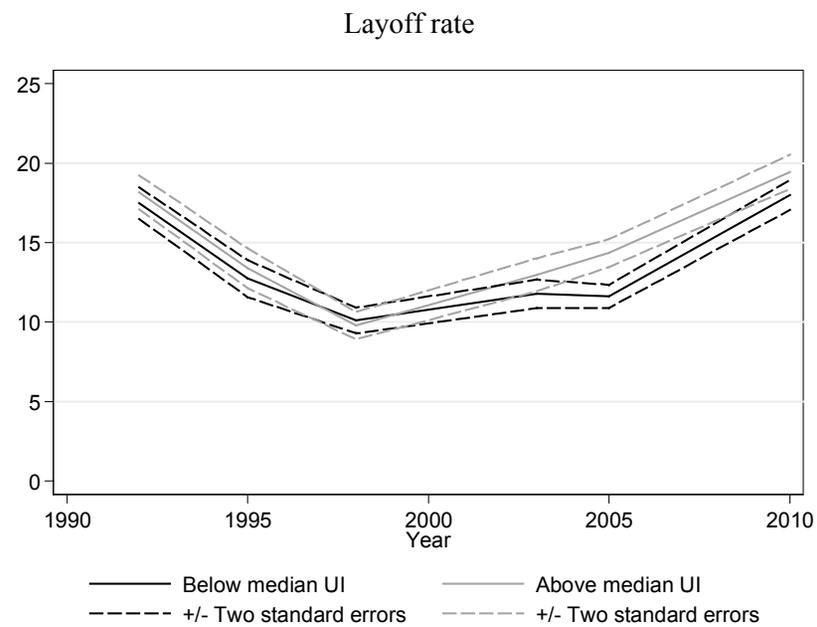
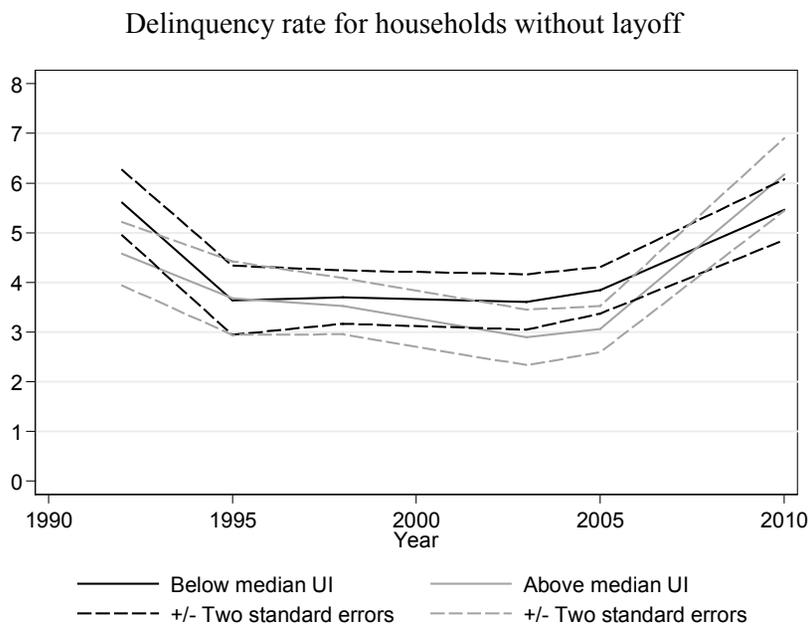
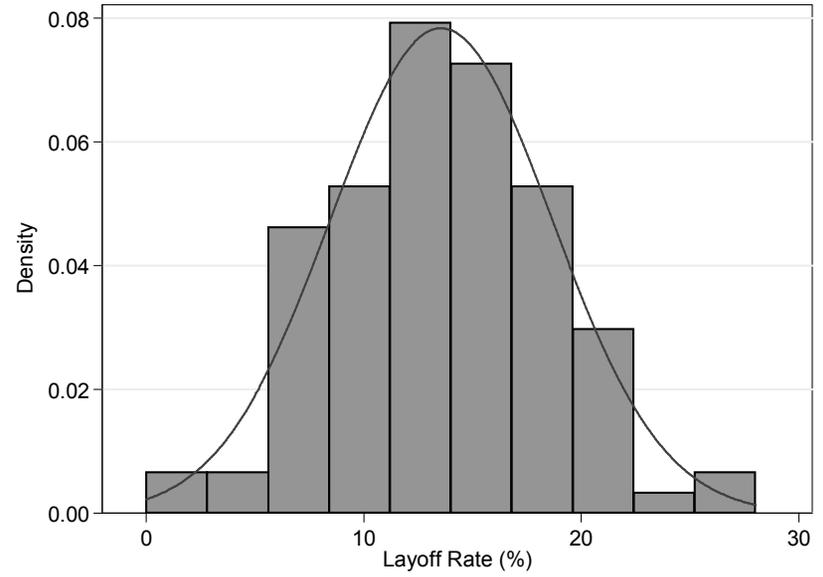
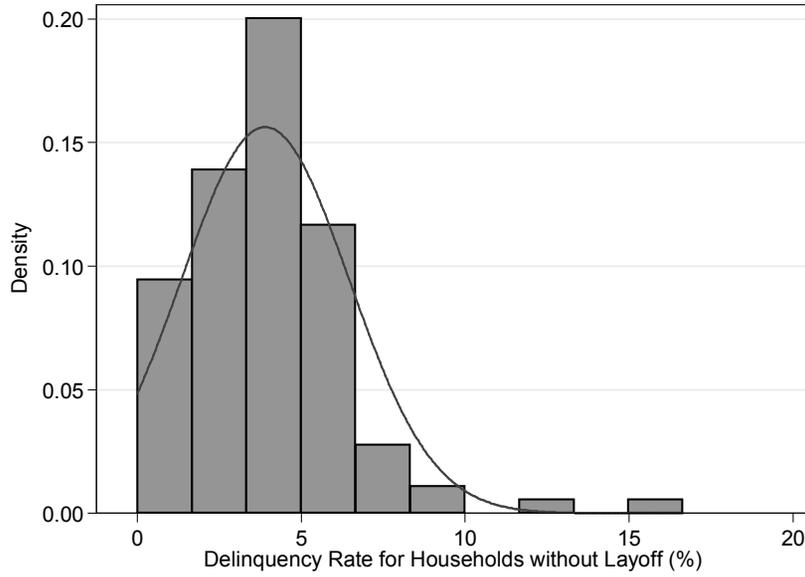


Figure A1. Trends of Key Variables in High and Low Benefit States, Classified Based on the Median Increase in UI Generosity between 1991 and 2010

Panel A. States with an above median increase in UI generosity between 1991 and 2010



Panel B. States with a below median increase in UI generosity between 1991 and 2010

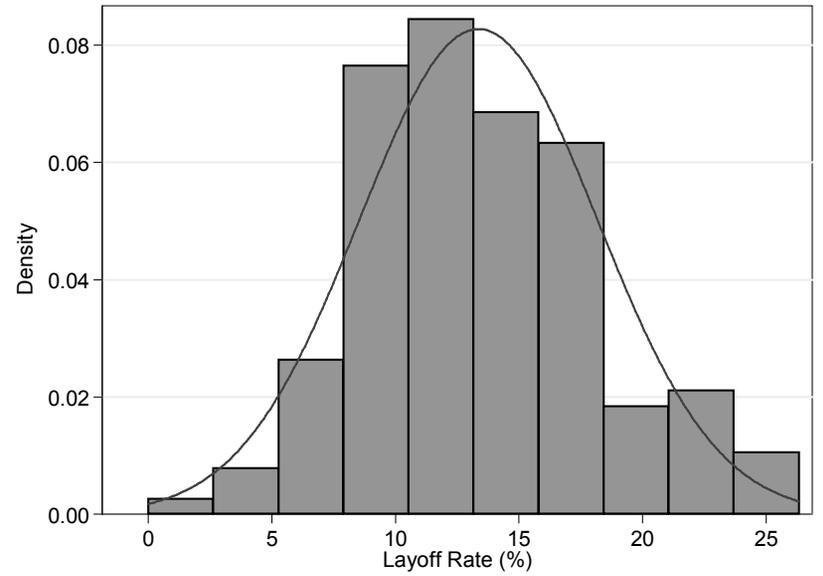
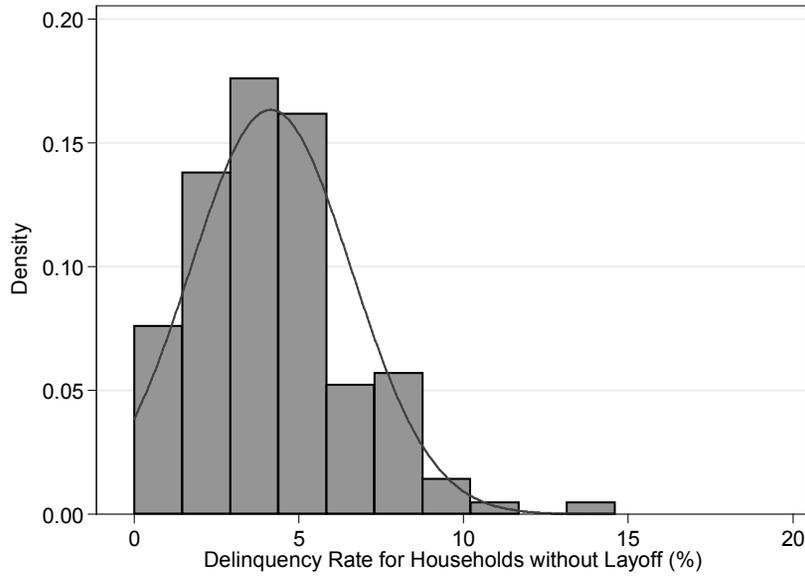


Figure A2. Distributions of Key Variables in Full Sample, Presented as Histograms with Fitted Normal Distribution Curves, across

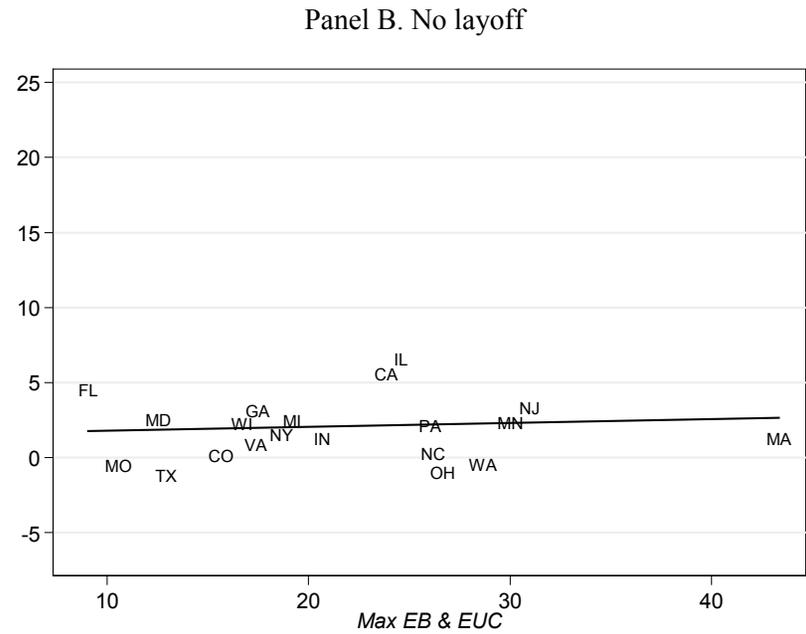
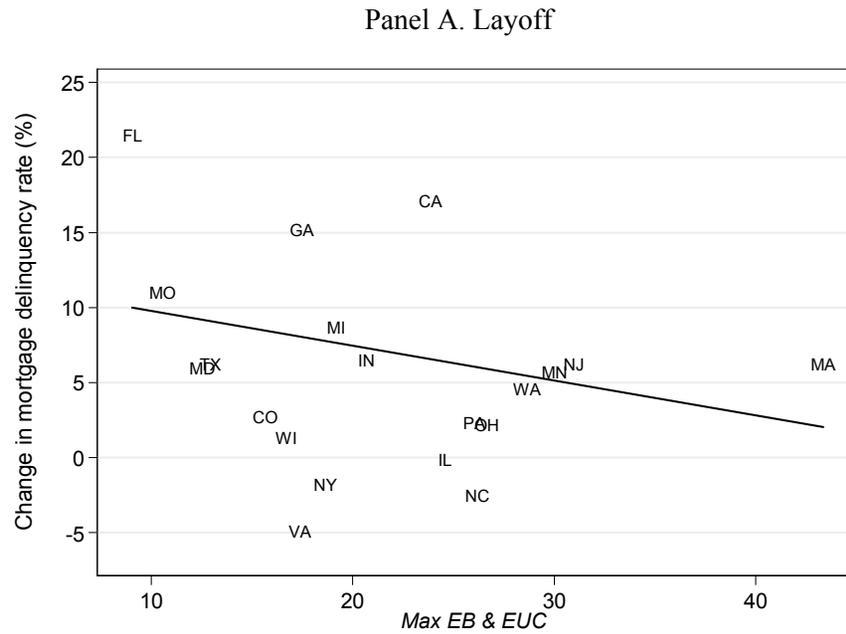


Figure A3. Change in the Mortgage Delinquency Rate and Extended Benefits Available to Eligible Unemployment Insurance Recipients under the Extended Benefits and Emergency Unemployment Compensation Programs (in Thousands of Dollars) between 2005 and 2008, by State

Notes: Delinquency rates, for households experiencing a layoff in panel A and other households in panel B, are calculated from the

Appendix Table A1—Long-Difference Changes in Unemployment Insurance Generosity and Initial Economic Conditions (1991-2010)

|                              | Dependent variable: Change in Max Benefit (1991-2010) |                   |                   |                  |                   |                  |          |                   |
|------------------------------|---|-------------------|-------------------|------------------|-------------------|------------------|----------|-------------------|
|                              | (1)   | (2)               | (3)               | (4)              | (5)               | (6)              | (7)      | (8)               |
| Economic conditions in 1991: |   |                   |                   |                  |                   |                  |          |                   |
| Unemployment rate (%)        | 0.014<br>(0.228)                                      |                   |                   |                  |                   |                  |          | -0.222<br>(0.308) |
| Ln(Real GDP per capita)      |   | -0.031<br>(1.347) |                   |                  |                   |                  |          | -3.54<br>(3.756)  |
| House price growth (%)       |   |                   | -0.098<br>(0.097) |                  |                   |                  |          | -0.149<br>(0.117) |
| Average wage                 |   |                   |                   | 0.033<br>(0.081) |                   |                  |          | 0.103<br>(0.254)  |
| Union coverage (%)           |   |                   |                   |                  | 0.096*<br>(0.055) |                  |          | 0.113<br>(0.068)  |
| UI trust fund reserves       |   |                   |                   |                  |                   | 0.015<br>(0.279) |          | 0.023<br>(0.307)  |
| UI trust fund reserve < 0?   |   |                   |                   |                  |                   |                  | —<br>(—) | —<br>(—)          |
| Observations                 | 51  | 51                | 51                | 51               | 51                | 51               | 51       | 51                |
| $R^2$                        | 0.00  | 0.00              | 0.02              | 0.00             | 0.06              | 0.00             | 0.00     | 0.11              |

*Notes:* This table summarizes the results from regressions of changes in *Max Benefit* (the maximum total benefit available under the state's unemployment insurance system) between 1991 and 2010 on measures of the state's economic conditions in 1991. No state had a negative UI trust fund balance in 1991. Standard errors are reported in parentheses.

\* Significant at the 10 percent level.

Appendix Table A2—Long-Difference Changes in Unemployment Insurance Generosity  
and Economic Conditions (1991-2010)

|   | Dependent variable: Change in Max Benefit (1991-2010) |         |         |         |         |         |         |         |
|---|---|---------|---------|---------|---------|---------|---------|---------|
|   | (1)   | (2)     | (3)     | (4)     | (5)     | (6)     | (7)     | (8)     |
| Change in economic conditions (1991-2010) : |   |         |         |         |         |         |         |         |
| Unemployment rate (%)                       | -0.245  |         |         |         |         |         |         | -0.289  |
|   | (0.185)   |         |         |         |         |         |         | (0.270) |
| Ln(Real GDP per capita)                     |   | 2.885   |         |         |         |         |         | 1.867   |
|   |   | (3.447) |         |         |         |         |         | (4.104) |
| House price index                           |   |         | 0.016   |         |         |         |         | -0.001  |
|   |   |         | (0.014) |         |         |         |         | (0.024) |
| Average wage                                |   |         |         | 0.043   |         |         |         | 0.067   |
|   |   |         |         | (0.062) |         |         |         | (0.096) |
| Union coverage (%)                          |   |         |         |         | 0.072   |         |         | 0.030   |
|   |   |         |         |         | (0.148) |         |         | (0.162) |
| UI trust fund reserves                      |   |         |         |         |         | 0.034   |         | -0.28   |
|   |   |         |         |         |         | (0.258) |         | (0.360) |
| UI trust fund reserve < 0?                  |   |         |         |         |         |         | -0.378  | -0.164  |
|   |   |         |         |         |         |         | (0.684) | (0.917) |
| Observations                                | 51  | 51      | 51      | 51      | 51      | 51      | 51      | 51      |
| $R^2$                                       | 0.03  | 0.01    | 0.03    | 0.01    | 0.00    | 0.00    | 0.01    | 0.07    |

*Notes:* This table summarizes the results from regressions of changes in *Max Benefit* (the maximum total potential benefit available under the state's unemployment insurance system) between 1991 and 2010 on changes in the state's economic conditions during the same period. Standard errors are reported in parentheses.

Appendix Table A3—Alternate Estimates for Standard Errors—Regular Benefits

|                            | Dependent variable: Mortgage Delinquency |           |           |
|----------------------------|--|-----------|-----------|
|                            | (1)                                      | (2)       | (3)       |
| Max Benefit                | -0.05                                    | -0.01     |           |
| Huber-White                | (0.11)                                   | (0.12)    |           |
| Cluster by year            | (0.09)                                   | (0.09)    |           |
| Cluster by state           | (0.11)                                   | (0.11)    |           |
| Cluster by census division | (0.10)                                   | (0.10)    |           |
| Max Benefit × Layoff       |  | -0.22     | -0.23     |
| Huber-White                |  | (0.10)**  | (0.10)**  |
| Cluster by year            |  | (0.09)*   | (0.08)**  |
| Cluster by state           |  | (0.08)*** | (0.08)*** |
| Cluster by census division |  | (0.08)**  | (0.08)**  |
| Layoff                     | 6.49                                     | 6.44      | 6.43      |
| Huber-White                | (0.37)***                                | (0.37)*** | (0.37)*** |
| Cluster by year            | (0.56)***                                | (0.53)*** | (0.52)*** |
| Cluster by state           | (0.35)***                                | (0.32)*** | (0.33)*** |
| Cluster by census division | (0.38)***                                | (0.30)*** | (0.31)*** |
| Observations               | 64,919                                   | 64,919    | 64,919    |
| $R^2$                      | 0.04                                     | 0.04      | 0.05      |
| Household controls?        | Y  | Y         | Y         |
| State-year controls?       | Y  | Y         | —         |
| State and year FEs?        | Y  | Y         | —         |
| State-year FEs?            | N  | N         | Y         |

*Notes:* This table displays alternate standard error estimates for the three specifications reported in Table 4. The table reports standard errors calculated under four different clustering assumptions. We first allow for heteroskedasticity but no correlation across observations (Huber-White). We then cluster, or allow for arbitrary correlation between, observations by year, state, or census division. The standard errors for each coefficient estimate are reported in parentheses beside a label indicating the underlying assumption.

\*\*\* Significant at the 1 percent level.

\*\* Significant at the 5 percent level.

\* Significant at the 10 percent level.

Appendix Table A4—Alternate Estimates for Standard Errors—Extended Benefits

|                                     | Dependent variable: Mortgage Delinquency |           |           |
|-------------------------------------|--|-----------|-----------|
|                                     | (1)                                      | (2)       | (3)       |
| Max EB EUC × Layoff                 | -0.24                                    | -0.30     |           |
| Huber-White                         | (0.10)**                                 | (0.11)*** |           |
| Cluster by state                    | (0.09)**                                 | (0.09)*** |           |
| Cluster by census division          | (0.08)**                                 | (0.08)*** |           |
| Max EB EUC Duration × Layoff        |  |           | -0.31     |
| Huber-White                         |  |           | (0.12)**  |
| Cluster by state                    |  |           | (0.10)*** |
| Cluster by census division          |  |           | (0.11)**  |
| Layoff                              | 8.13                                     | 8.89      | 8.81      |
| Huber-White                         | (0.80)***                                | (1.06)*** | (1.05)*** |
| Cluster by state                    | (0.74)***                                | (0.88)*** | (0.87)*** |
| Cluster by census division          | (0.55)***                                | (0.65)*** | (0.65)*** |
| Observations                        | 12,602                                   | 12,602    | 12,602    |
| $R^2$                               | 0.07                                     | 0.07      | 0.07      |
| Household controls?                 | Y  | Y         | Y         |
| State-year FEs?                     | Y  | Y         | Y         |
| Layoff × Cubic in unemployment rate | N  | Y         | Y         |

*Notes:* This table displays alternate standard error estimates for the three specifications reported in Table 6. The table reports standard errors calculated under three different clustering assumptions. We first allow for heteroskedasticity but no correlation across observations (Huber-White). We then cluster, or allow for arbitrary correlation between, observations by state or Census division. The standard errors for each coefficient estimate are reported in parentheses beside a label indicating the underlying assumption.

\*\*\* Significant at the 1 percent level.

\*\* Significant at the 5 percent level.

Appendix Table A5—Binary Regression Models

| Estimation method:       | Dependent variable: Mortgage Delinquency |                              |                               |                               |
|--------------------------|--|------------------------------|-------------------------------|-------------------------------|
|                          | Probit<br>(1)                            | Logit<br>(2)                 | Probit<br>(3)                 | Logit<br>(4)                  |
| Max Benefit              |  |                              |                               |                               |
| Structural coefficient   | 0.00                                     | 0.00                         |                               |                               |
| Standard error           | (0.01)                                   | (0.03)                       |                               |                               |
| Average marginal effect  | [0.00]                                   | [0.01]                       |                               |                               |
| Max Benefit × Layoff     | -0.01*<br>(0.01)<br>[-0.18]              | -0.02**<br>(0.01)<br>[-0.19] |                               |                               |
| Max EB EUC               |  |                              | 0.00<br>(0.00)<br>[0.03]      | 0.00<br>(0.01)<br>[0.03]      |
| Max EB EUC × Layoff      |  |                              | -0.01***<br>(0.01)<br>[-0.28] | -0.03***<br>(0.01)<br>[-0.28] |
| Layoff                   | 0.52***<br>(0.06)<br>[5.48]              | 1.13***<br>(0.12)<br>[5.30]  | 3.09*<br>(1.85)<br>[7.49]     | 6.27*<br>(3.67)<br>[7.38]     |
| Loan-to-value            | 0.40***<br>(0.05)<br>[3.35]              | 0.75***<br>(0.10)<br>[2.96]  | 0.41***<br>(0.09)<br>[4.31]   | 0.78***<br>(0.20)<br>[4.03]   |
| Loan-to-value × Layoff   | 0.02<br>(0.06)<br>[4.56]                 | -0.09<br>(0.12)<br>[3.59]    | -0.02<br>(0.13)<br>[4.35]     | -0.14<br>(0.26)<br>[3.80]     |
| Negative equity          | 0.05<br>(0.04)<br>[0.41]                 | 0.05<br>(0.08)<br>[0.19]     | 0.08<br>(0.08)<br>[0.90]      | 0.14<br>(0.17)<br>[0.71]      |
| Negative equity × Layoff | 0.01<br>(0.07)<br>[0.76]                 | 0.05<br>(0.14)<br>[0.76]     | 0.11<br>(0.13)<br>[3.46]      | 0.18<br>(0.24)<br>[3.16]      |

|  |                                |                                |                               |                               |
|--|--------------------------------|--------------------------------|-------------------------------|-------------------------------|
| Earnings (\$ 1,000s)                       | -0.01***<br>(0.000)<br>[-0.05] | -0.01***<br>(0.001)<br>[-0.06] | -0.00***<br>0.000<br>[-0.04]  | -0.01***<br>0.000<br>[-0.04]  |
| Net worth (\$ 1,000,000s)                  | -0.67***<br>(0.15)<br>[-0.01]  | -1.99***<br>(0.34)<br>[-0.01]  | -0.42***<br>(0.11)<br>[-0.01] | -1.07***<br>(0.28)<br>[-0.01] |
| High school diploma only                   | -0.05<br>(0.05)<br>[-0.46]     | -0.05<br>(0.10)<br>[-0.26]     | 0.11<br>(0.09)<br>[1.35]      | 0.21<br>(0.17)<br>[1.40]      |
| Some college                               | 0.00<br>(0.05)<br>[-0.01]      | 0.06<br>(0.09)<br>[0.27]       | 0.15**<br>(0.07)<br>[1.98]    | 0.32**<br>(0.14)<br>[2.10]    |
| College degree                             | -0.29***<br>(0.06)<br>[-2.89]  | -0.55***<br>(0.12)<br>[-2.64]  | -0.09<br>(0.08)<br>[-1.14]    | -0.16<br>(0.15)<br>[-1.03]    |
| Some graduate studies                      | -0.47***<br>(0.06)<br>[-4.61]  | -0.95***<br>(0.13)<br>[-4.57]  | -0.36***<br>(0.08)<br>[-4.67] | -0.75***<br>(0.18)<br>[-4.89] |
| Observations                               | 64,821                         | 64,821                         | 12,602                        | 12,602                        |
| $R^2$                                      | 0.11                           | 0.11                           | 0.11                          | 0.11                          |
| State-year controls?                       | Y                              | Y                              | Y                             | Y                             |
| State and year FEs?                        | Y                              | Y                              | N                             | N                             |
| Layoff $\times$ Cubic in unemployment rate | N                              | N                              | Y                             | Y                             |

*Notes:* This table summarizes the results from probit and logit regressions of mortgage delinquency on the generosity of state unemployment insurance benefits, a layoff indicator, their interaction, and a set of controls. For each covariate, we report the structural coefficient, its standard error (in parentheses), and its average marginal effect (in brackets). The marginal effect is the difference in the predicted probability of delinquency for a one unit change in the covariate of interest, holding fixed the remaining covariates at their actual values. For interactions, such as *Max Benefit*  $\times$  *Layoff*, we compute the marginal effect by taking the difference between the marginal effect of *Max Benefit* for laid off households and the marginal effect of *Max Benefit* for non-laid-off households. Standard errors are adjusted for clustering at the state level.

\*\*\* Significant at the 1 percent level.

\*\* Significant at the 5 percent level.

\* Significant at the 10 percent level.

Appendix Table A6—Estimates of Control Variables and Variation over Time

|                                     | Dependent variable: Mortgage Delinquency |                    |                    |
|-------------------------------------|--|--------------------|--------------------|
|                                     | All Years                                | Pre-2008           | Post-2008          |
|                                     | (1)                                      | (2)                | (3)                |
| Max Benefit × Layoff                | -0.23***<br>(0.08)                       | -0.35**<br>(0.14)  | -0.22*<br>(0.13)   |
| Max EB EUC Duration × Layoff        |  |                    | -0.25**<br>(0.10)  |
| Layoff                              | 6.43***<br>(0.33)                        | 5.88***<br>(0.39)  | 8.87***<br>(0.83)  |
| Loan-to-value                       | 4.06***<br>(0.34)                        | 3.82***<br>(0.40)  | 5.69***<br>(1.12)  |
| Loan-to-value × Layoff              | 6.76***<br>(1.27)                        | 6.02***<br>(1.44)  | 8.51***<br>(2.33)  |
| Negative Equity                     | 2.38***<br>(0.73)                        | 1.95**<br>(0.84)   | 2.42*<br>(1.28)    |
| Negative Equity × Layoff            | 2.95*<br>(1.65)                          | (3.14)<br>(2.89)   | 4.48<br>(2.93)     |
| Earnings (\$ 1,000s)                | -0.03***<br>0.000                        | -0.03***<br>0.000  | -0.02***<br>0.000  |
| Net worth (\$ 1,000,000s)           | -0.16**<br>(0.07)                        | -0.13*<br>(0.07)   | -0.35<br>(0.24)    |
| High school diploma only            | -1.70*<br>(0.97)                         | -1.99*<br>(1.03)   | 0.49<br>(1.66)     |
| Some college                        | -1.68*<br>(0.93)                         | -2.08*<br>(1.05)   | 0.71<br>(1.33)     |
| College degree                      | -4.81***<br>(0.98)                       | -5.02***<br>(1.09) | -3.17**<br>(1.28)  |
| Some graduate studies               | -5.42***<br>(0.95)                       | -5.46***<br>(1.06) | -4.63***<br>(1.22) |
| Observations                        | 64,919                                   | 52,317             | 12,602             |
| $R^2$                               | 0.05                                     | 0.04               | 0.07               |
| State-year FEs?                     | Y  | Y                  | Y                  |
| Layoff × Cubic in unemployment rate | N  | N                  | Y                  |

*Notes:* This table summarizes the results from linear probability regressions of mortgage delinquency on the generosity of state unemployment insurance benefits, a layoff indicator, their interaction, and a set of controls. Column (1) reports additional coefficients from the model reported in Table 4, column (3). Column (2) reports coefficient estimates from the same specification but in a sample that excludes data from 2008 or later. Column (3) includes an interaction of the layoff indicator with both regular and extended benefit generosity, and is estimated using data from 2008 or later. Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\*\* Significant at the 1 percent level.

\*\* Significant at the 5 percent level.

\* Significant at the 10 percent level.

Appendix Table A7—Placebo Test—Only Households without a Layoff

|  | Dependent variable: Mortgage Delinquency |                    |
|--|--|--------------------|
|  | All Years<br>(1)                         | 2010<br>(2)        |
| Max Benefit                                | -0.02<br>(0.10)                          |                    |
| Max EB EUC                                 |  | 0.01<br>(0.03)     |
| Loan-to-value                              | 4.18***<br>(0.33)                        | 5.65***<br>(1.09)  |
| Negative equity                            | 2.63***<br>(0.71)                        | 2.53**<br>(1.26)   |
| Earnings (\$ 1,000s)                       | -0.02***<br>0.00                         | -0.02***<br>0.000  |
| Net worth (\$ 1,000,000s)                  | -0.12**<br>(0.05)                        | -0.16<br>(0.10)    |
| High school diploma only                   | -2.39***<br>(0.79)                       | -1.51<br>(1.55)    |
| Some college                               | -2.43***<br>(0.78)                       | -1.63<br>(1.38)    |
| College degree                             | -5.03***<br>(0.79)                       | -4.24***<br>(1.50) |
| Some graduate studies                      | -5.69***<br>(0.79)                       | -5.90***<br>(1.42) |
| Observations                               | 55,365                                   | 10,200             |
| $R^2$                                      | 0.03                                     | 0.03               |
| State-year controls?                       | Y  | Y                  |
| State and year FEs?                        | Y  | N                  |
| Layoff $\times$ Cubic in unemployment rate | N  | Y                  |

*Notes:* This table summarizes the results from linear probability regressions of mortgage delinquency on the generosity of state unemployment insurance benefits and a set of controls. The regression sample is restricted to households that do not experience a layoff. Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\*\* Significant at the 1 percent level.

\*\* Significant at the 5 percent level.

Appendix Table A8—Robustness to Alternative Control Variables

|                                     | Baseline specification<br>(1) | Excluding controls for state economic conditions or fixed effects<br>(2) | Including cubic polynomials in earnings, net worth, and loan-to-value ratio<br>(3) | Including quartile indicators for earnings, net worth, and loan-to-value ratio<br>(4) | Including Layoff interacted with household controls and year effects<br>(5) | Including Layoff interacted with indicators for union membership and industry (16 categories) of household's highest earner<br>(6) |
|-------------------------------------|-------------------------------|--|--|---|---|--|
| Panel A: Regular UI benefits        |                               |  |  |   |   |  |
| Max Benefit × Layoff                | -0.22***<br>(0.08)            | -0.22***<br>(0.08)   | -0.23***<br>(0.08)   | -0.20**<br>(0.09)   | -0.21*<br>(0.12)  | -0.25***<br>(0.08)   |
| Observations                        | 64,919                        | 64,919   | 64,919   | 64,919  | 64,919  | 64,919   |
| R <sup>2</sup>                      | 0.04                          | 0.04   | 0.05   | 0.06  | 0.05  | 0.05   |
| Household controls?                 | Y                             | Y  | Y  | Y   | Y   | Y  |
| State-year controls?                | Y                             | N  | Y  | Y   | Y   | Y  |
| State-year FEs?                     | N                             | N  | Y  | Y   | Y   | Y  |
| Panel B: Extended UI benefits       |                               |  |  |   |   |  |
| Max EB EUC × Layoff                 | -0.30***<br>(0.09)            | -0.29***<br>(0.09)   | -0.30***<br>(0.09)   | -0.30***<br>(0.09)  | -0.25***<br>(0.09)  | -0.28***<br>(0.09)   |
| Observations                        | 12,602                        | 12,602   | 12,602   | 12,602  | 12,602  | 12,602   |
| R <sup>2</sup>                      | 0.07                          | 0.07   | 0.08   | 0.08  | 0.08  | 0.08   |
| Household controls?                 | Y                             | Y  | Y  | Y   | Y   | Y  |
| State-year FEs?                     | Y                             | N  | Y  | Y   | Y   | Y  |
| Layoff × Cubic in unemployment rate | Y                             | Y  | Y  | Y   | Y   | Y  |

*Notes:* This table summarizes the results from linear probability regressions of mortgage delinquency on the generosity of state unemployment insurance benefits, a layoff indicator, their interaction, and a set of controls. Column (1) reports the baseline specifications from Table 4, column (2), in panel A and from Table 6, column (2), in panel B. The headings of the remaining columns describe how the estimation reported varies from the baseline specifications. Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\*\* Significant at the 1 percent level.

\*\* Significant at the 5 percent level.

\* Significant at the 10 percent level.

Appendix Table A9—Controlling for Regular UI Generosity in Neighboring States

|  | Dependent variable: Mortgage Delinquency |                   |                   |
|--|--|-------------------|-------------------|
|  | (1)                                      | (2)               | (3)               |
| Max Benefit                              | -0.06<br>(0.12)                          | -0.01<br>(0.11)   |                   |
| Max Benefit Bordering States             | 0.14<br>(0.20)                           | 0.12<br>(0.20)    |                   |
| Max Benefit × Layoff                     |  | -0.24**<br>(0.12) | -0.26**<br>(0.13) |
| Max Benefit Bordering States<br>× Layoff |  | 0.05<br>(0.21)    | 0.06<br>(0.21)    |
| Layoff                                   | 6.47***<br>(0.35)                        | 6.43***<br>(0.34) | 6.42***<br>(0.34) |
| Observations                             | 64,674                                   | 64,674            | 64,674            |
| $R^2$                                    | 0.04                                     | 0.04              | 0.05              |
| Household controls?                      | Y  | Y                 | Y                 |
| State-year controls?                     | Y  | Y                 | —                 |
| State and year FEs?                      | Y  | Y                 | —                 |
| State-year FEs?                          | N  | N                 | Y                 |

*Notes:* This table summarizes the results from linear probability regressions of mortgage delinquency on the generosity of state unemployment insurance benefits, a layoff indicator, their interactions, and a set of controls. The specifications are the same as in Table 4 but also include controls for the median *Max Benefit* of bordering states. Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\*\* Significant at the 1 percent level.

\*\* Significant at the 5 percent level.

Appendix Table A10—Extended Benefits Analysis, Including Data before the Great Recession (SIPP 2005, 2010)

|   | Dependent variable: Mortgage Delinquency |                    |
|---|--|--------------------|
|   | (1)                                      | (2)                |
| Max EB EUC × Layoff                           | -0.30***<br>(0.09)                       |                    |
| Max EB EUC Duration × Layoff                  |  | -0.31***<br>(0.10) |
| Observations                                  | 27,389                                   | 27,389             |
| $R^2$   | 0.06                                     | 0.06               |
| Household controls?                           | Y  | Y                  |
| State-year FEs?                               | Y  | Y                  |
| Layoff × Cubic in unemployment rate × Year FE | Y  | Y                  |

*Notes:* This table summarizes the results from linear probability regressions of mortgage delinquency on measures of extended benefit generosity, a layoff indicator, their interaction, and a set of controls. These models are the same as in columns (2) and (3) of Table 6, but the regression sample includes an additional wave of data from the 2005 SIPP delinquency interview. Extending the sample introduces time-series variation as extended benefits increase from zero in 2005 to their levels as of the 2010 interview window. Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\*\* Significant at the 1 percent level.

Appendix Table A11—Controlling for Extended UI Generosity in Neighboring States

|  | Dependent variable: Mortgage Delinquency |                    |                    |
|--|--|--------------------|--------------------|
|  | (1)                                      | (2)                | (3)                |
| Max EB EUC × Layoff                              | -0.26**<br>(0.10)                        | -0.30***<br>(0.09) |                    |
| Max EB EUC Bordering States × Layoff             | 0.10<br>(0.13)                           | 0.01<br>(0.14)     |                    |
| Max EB EUC Duration × Layoff                     |  |                    | -0.31***<br>(0.10) |
| Max EB EUC Duration Bordering States<br>× Layoff |  |                    | 0.02<br>(0.08)     |
| Layoff   | 8.12***<br>(0.73)                        | 8.89***<br>(0.89)  | 8.82***<br>(0.87)  |
| Observations                                     | 12,539                                   | 12,539             | 12,539             |
| $R^2$  | 0.07                                     | 0.07               | 0.07               |
| Household controls?                              | Y  | Y                  | Y                  |
| State-year FEs?                                  | Y  | Y                  | Y                  |
| Layoff × Cubic in unemployment rate              | N  | Y                  | Y                  |

*Notes:* This table summarizes the results from linear probability regressions of mortgage delinquency on the generosity of state unemployment insurance benefits, a layoff indicator, their interactions, and a set of controls. The specifications are the same as in Table 6 but also include controls for the median *Max EB EUC* or median *Max EB EUC Duration* of bordering states. Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\*\* Significant at the 1 percent level.

\*\* Significant at the 5 percent level.

Appendix Table A12—Regression Discontinuity Design (SIPP, 2010)

|   | Dependent variable:<br>Mortgage Delinquency |
|---|---|
| May 2009 State Total Unemp. Rate (TUR): | <u>5.5 &lt; TUR &lt; 6.5</u>                |
|   | <u>(1)</u>                                  |
| I(TUR ≥ 6.0) × Layoff                   | -10.79**<br>(2.82)                          |
| Observations                            | 587   |
| $R^2$                                   | 0.09  |
| Household controls?                     | Y   |
| State-year FEs?                         | Y   |
| Layoff × Cubic in unemployment rate     | Y   |

*Notes:* This table summarizes the results from linear probability regressions of mortgage delinquency on an indicator for whether the state total unemployment rate (TUR) is 6% or higher, a layoff indicator, their interaction, and a set of controls. The sample includes households in states with a TUR between 5.5% and 6.5% in May 2009. At that time, the Emergency Unemployment Compensation (EUC) program provided an additional 13 weeks of extended UI benefits to claimants in states at or above the 6% TUR threshold. Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\* Significant at the 5 percent level.

Appendix Table A13—Foreclosure Transition Rates (LPS, 2009)

|                            | Dependent variable: Foreclosure Transition Rate (in basis points) |                  |                   |                  |
|----------------------------|---|------------------|-------------------|------------------|
|                            | (1)   | (2)              | (3)               | (4)              |
| Max EB EUC                 | 7.77<br>(12.80)   | -0.79<br>(13.00) | -11.01<br>(15.94) | -0.87<br>(13.52) |
| Observations               | 51  | 51               | 51                | 51               |
| $R^2$                      | 0.01  | 0.57             | 0.16              | 0.58             |
| State-year controls?       | N   | Y                | N                 | Y                |
| Cubic in unemployment rate | N   | N                | Y                 | Y                |

*Notes:* This table summarizes the results from state-level regressions of the foreclosure transition rate on the generosity of extended unemployment insurance (UI) benefits and a set of controls. The foreclosure transition rate is the proportion of loans that became 90-days delinquent in 2009 that enter foreclosure within 24 months, based on loan servicing data from Lender Processing Services (LPS). *Max EB EUC* is the maximum total potential dollars paid under the Extended Benefits (EB) and Emergency Unemployment Compensation (EUC) programs. Controls in columns (2) and (4) include the state's unemployment rate, log of real GDP per capita, home price growth rate, average wage, union coverage, UI Trust Fund reserve ratio, and an indicator for a negative UI Trust Fund reserve ratio. Controls in columns (3) and (4) also include a cubic function of the state's unemployment rate. Robust standard errors are reported in parentheses.

Appendix Table A14—Foreclosure Transition Rates (NLSY, 2010 and 2012)

| Sample:<br>Dependent variable:<br>Mean of dependent variable: | Delinquent mortgagors           |                   |                   |                                 |                  |                  |
|---|---------------------------------|-------------------|-------------------|---------------------------------|------------------|------------------|
|   | Foreclosure Initiation<br>41.1% |                   |                   | Foreclosure Completion<br>19.9% |                  |                  |
|   | (1)                             | (2)               | (3)               | (4)                             | (5)              | (6)              |
| Max EB EUC × Layoff   | -0.12<br>(0.60)                 | 0.30<br>(0.90)    |                   | -0.50<br>(0.52)                 | -0.62<br>(0.97)  |                  |
| Max EB EUC Duration × Layoff                                  |                                 |                   | -0.21<br>(0.49)   |                                 |                  | -0.61<br>(0.60)  |
| Layoff  | 18.00***<br>(5.60)              | 15.84**<br>(6.95) | 15.21**<br>(7.42) | 18.05***<br>(5.81)              | 11.67*<br>(6.00) | 10.43*<br>(6.20) |
| Observations  | 759                             | 759               | 759               | 758                             | 758              | 758              |
| $R^2$   | 0.19                            | 0.20              | 0.20              | 0.23                            | 0.24             | 0.24             |
| Household controls?   | Y                               | Y                 | Y                 | Y                               | Y                | Y                |
| State-year FEs?   | Y                               | Y                 | Y                 | Y                               | Y                | Y                |
| Layoff × Cubic in unemployment rate                           | N                               | Y                 | Y                 | N                               | Y                | Y                |

*Notes:* This table summarizes the results from linear probability regressions of home foreclosure on the generosity of extended benefits, a layoff indicator, their interaction, and a set of controls. The analysis is the same as in Table 9, but the sample is restricted to delinquent mortgagors, so the coefficients measure effects on the probability of transitioning to foreclosure conditional on delinquency. Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\*\* Significant at the 1 percent level.

\*\* Significant at the 5 percent level.

\* Significant at the 10 percent level.

Appendix Table A15—Unemployment Insurance Generosity and Eviction

|  | Dependent variable: Eviction |                   |
|--|------------------------------|-------------------|
|  | (1)                          | (2)               |
| Max Benefit $\times$ Layoff                | -0.025*<br>(0.014)           |                   |
| Max EB EUC $\times$ Layoff                 |                              | -0.022<br>(0.021) |
| Layoff                                     | 0.181**<br>(0.071)           | 0.237<br>(0.286)  |
| Observations                               | 64,885                       | 12,600            |
| $R^2$                                      | 0.01                         | 0.01              |
| Household controls?                        | Y                            | Y                 |
| State-year FEs?                            | Y                            | Y                 |
| Layoff $\times$ Cubic in unemployment rate | N                            | Y                 |

*Notes:* This table summarizes the results from linear probability regressions of eviction on the generosity of state unemployment insurance benefits, a layoff indicator, their interaction, and a set of controls. Except for the dependent variable, the specification reported column (1) is the same as in Table 4, column (3), and the specification reported column (2) is the same as in Table 6, column (2). Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\* Significant at the 5 percent level.

\* Significant at the 10 percent level.

Appendix Table A16—Alternative Estimate of Delinquencies and Foreclosures Prevented by Unemployment Insurance Expansions (July 2008 to December 2013)

| Year  | UI-Layoff coefficient, % per \$1,000 (SIPP) | EB, EUC, and FAC, \$ | Layoff rate, % (SIPP) | Delinquency rate, % (SIPP) | Delinquent loans (NDS) | Foreclosure starts (NDS) | Avoided delinquencies | Avoided foreclosures |
|-------|---|----------------------|-----------------------|----------------------------|------------------------|--------------------------|-----------------------|----------------------|
| (1)   | (2)   | (3)                  | (4)                   | (5)                        | (6)                    | (7)                      | (8)                   | (9)                  |
| 2008  | -0.30                                       | 5,376                | 17.1                  | 7.74                       | 3,518,162              | 951,090                  | -125,353              | -33,888              |
| 2009  | -0.30                                       | 18,752               | 18.4                  | 7.74                       | 4,095,454              | 2,320,309                | -547,701              | -310,304             |
| 2010  | -0.30                                       | 29,955               | 17.4                  | 7.74                       | 4,010,227              | 2,132,809                | -810,162              | -430,878             |
| 2011  | -0.30                                       | 28,421               | 16.2                  | 7.74                       | 3,480,138              | 1,780,283                | -621,052              | -317,702             |
| 2012  | -0.30                                       | 22,879               | 16.2                  | 7.74                       | 3,076,501              | 1,475,142                | -441,964              | -211,916             |
| 2013  | -0.30                                       | 15,142               | 16.2                  | 7.74                       | 2,713,056              | 1,001,012                | -257,949              | -95,173              |
| TOTAL |   |                      |                       |                            |                        |                          | -2,804,182            | -1,399,862           |

*Notes:* The estimates of avoided foreclosures are based on the following inputs: our regression estimate for the impact of additional UI benefits on mortgage delinquency (from Table 6, column 2), estimated from the Survey of Income and Program Participation (SIPP); the proportion of households with a layoff and the delinquency rate (from the SIPP); the maximum incremental benefit available due to federal expansions of UI, including benefits paid under the Extended Benefits (EB), Emergency Unemployment Compensation (EUC), and Federal Additional Compensation (FAC) programs; and the numbers of delinquent mortgages (30+ days late) and foreclosure starts from the Mortgage Banker's Association's National Delinquency Survey (NDS). See Appendix B for more detail on the calculation of these estimates.

Appendix Table A17—Unemployment Insurance Extensions and Home Values—Robustness Tests  
(Zillow and BLS, 2008–2013)

| Dependent variable: $\Delta$ Log Median Home Value  |                    |                                     |   |                    |
|---|--------------------|-------------------------------------|---|--------------------|
| Sample:   | All states         | Most generous states (top quartile) | Least generous states (bottom quartile) | All states         |
|   | (1)                | (2)                                 | (3)                                     | (4)                |
| Panel A. Generosity measure: Max EB EUC             |                    |                                     |   |                    |
| $\Delta$ Unemployment rate                          | -0.65***<br>(0.19) | -0.05<br>(0.23)                     | -1.35***<br>(0.31)                      | -0.57***<br>(0.20) |
| $\Delta$ Unemployment rate<br>× Max EB EUC          |                    |                                     |   | 0.05***<br>(0.01)  |
| Observations  | 6,381              | 1,625                               | 1,540                                   | 6,381              |
| $R^2$   | 0.51               | 0.32                                | 0.59                                    | 0.51               |
| State-Year FEs?                                     | Y                  | Y                                   | Y                                       | Y                  |
| Panel B. Generosity measure: Max EB EUC Duration    |                    |                                     |   |                    |
| $\Delta$ Unemployment rate                          | -0.65***<br>(0.19) | 0.10<br>(0.17)                      | -1.32***<br>(0.30)                      | -0.62***<br>(0.20) |
| $\Delta$ Unemployment rate<br>× Max EB EUC Duration |                    |                                     |   | 0.02***<br>(0.00)  |
| Observations  | 6,381              | 1,644                               | 1,534                                   | 1,021              |
| $R^2$   | 0.51               | 0.33                                | 0.60                                    | 0.54               |
| State-Year FEs?                                     | Y                  | Y                                   | Y                                       | Y                  |

*Notes:* This table summarizes the results from regressions of changes in home values on changes in unemployment at the county-year level. Panel A repeats the specifications reported in Table 11 but with controls for state-year fixed effects. Panel B repeats the specifications in reported in panel A but measures the generosity of unemployment insurance extensions in weeks instead of dollars. Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\*\* Significant at the 1 percent level.

Appendix Table A18—Regular Unemployment Insurance and Home Values  
(Zillow and BLS, 1996–2007)

|   | Dependent variable: $\Delta$ Log Median Home Value |                   |
|---|--|-------------------|
|   | (1)  | (2)               |
| $\Delta$ Unemployment rate                  | -0.69**<br>(0.29)                                  | -0.87**<br>(0.41) |
| $\Delta$ Unemployment rate<br>× Max Benefit |  | -0.15<br>(0.15)   |
| Observations                                | 10,802   | 10,802            |
| $R^2$                                       | 0.01   | 0.01              |

Notes: This table summarizes the results from regressions of changes in home values on changes in unemployment at the county-year level. These specifications differ in two ways from those reported in Table 11, columns (1) and (4). First, the sample period is 1996–2007 rather than 2008–2013. Second, the measure of UI generosity is the maximum dollars of regular UI benefits available in the state rather than the maximum dollars of extended UI benefits available in the state. Standard errors, adjusted for clustering at the state level, are reported in parentheses.

\*\* Significant at the 5 percent level.

Appendix Table A19—Estimated Savings from Foreclosures Prevented by Unemployment Insurance Expansions (2008–2013)

|  |                 | Data source   |
|--|-----------------|---|
| A. First lien lender loss per foreclosure                      |                 |   |
| 1. Original property valuation (median sale price in 2007)     | 217,900         | U.S. Census Bureau (2012, Table 977)                    |
| 2. Original mortgage amount (80% of #1)                        | 174,320         |   |
| 3. Unpaid balance (104% of #2)                                 | 181,293         | U.S. Department of Housing and Urban Development (2010) |
| 4. Loss in foreclosure (42.3% of #3)                           | 76,687          | Fannie Mae (2017)                                       |
| B. Second lien lender loss per foreclosure                     |                 |   |
| 5. Original mortgage amount (10% of #2)                        | 17,432          | Lee, Mayer, and Tracy (2012)                            |
| 6. Unpaid balance (104% of #5)                                 | 18,129          | U.S. Department of Housing and Urban Development (2010) |
| 7. Current property value (median sale price in 2010)          | 173,100         | U.S. Census Bureau (2012, Table 977)                    |
| 8. Distressed sale value (15% less than #7)                    | 147,135         | U.S. Department of Housing and Urban Development (2010) |
| 9. Loss in foreclosure (#6 minus any residual value from sale) | 18,129          |   |
| C. Aggregate savings from avoiding foreclosures                |                 |   |
| 10. Avoided foreclosures (2008–2013)                           | 1,332,567       | Table 10  |
| 11. Total savings to mortgage investors (#10 × (#4 + #9))      | 126,348,863,163 |   |
| 11. Savings to GSEs (#10 × 44% of # 4)                         | 44,963,767,518  | Congressional Budget Office (2010, p.10)                |
| 12. Savings to private investors (#10 × (56% × #4 + #9))       | 81,385,095,645  | Congressional Budget Office (2010, p.10)                |

*Notes:* This table presents estimates of the estimated savings to Government-Sponsored Enterprises (GSEs), private investors, and local governments from foreclosures prevented by federal unemployment insurance expansions between 2008 and 2013. See Appendix C for more details on the calculation of these estimates.