Do Welfare Policies Matter for Labor Market Aggregates?

Quantifying Safety Net Work Incentives since 2007[*]

by Casey B. Mulligan

University of Chicago

January 2012

Abstract

Inflation-adjusted spending on means-tested subsidies has increased sharply since 2007, and most of the growth was due to changes in eligibility rules, and increases in subsidies per eligible person, rather than increases in the number of people who would have been eligible under pre-recession subsidy rules. In 2007, the non-elderly parts of the safety net paid about $11,000 in benefits per person-year that non-elderly heads of household or spouses were unemployed. By the end of 2009, the annual subsidy rate per person-year unemployed was up to $17,000. As a result, the average private returns to employment are substantially less than they were in 2007. One result of the paper is a monthly time series for the overall safety net's marginal income tax rate from the point of view of the average marginal worker.

[*] I appreciate conversations with Gary Becker, Christian Ferrada, Elizabeth Lower-Basch, Bruce Meyer, and Rob Shimer, and the research assistance of Sophie Wang. I also appreciate the financial support of the George J. Stigler Center for the Study of the Economy and the State.

During the recession, a variety of private and public sector practices moved in a direction that would likely distort the labor market, and thereby reduce labor hours and increase output per hour. Among those are recent changes in regulations, such as the federal minimum wage hikes of 2007, 2008, and 2009. In addition, markets and governments have been allocating an increasing amount of resources on the basis of "means": household income and employment status. This paper documents the surprisingly large changes in means-tested resource allocation since 2007.

One increasingly prevalent instance of means-tests resulted from the large number of homeowners who owed more on their mortgage than their house was worth, and both private and public sector renegotiations of the mortgage contracts served as a massive implicit tax on their earning during the recession because borrowers can expect their earnings to affect the amount that lenders will forgive (Mulligan 2009). Renegotiations of business debts (Jermann and Quadrini 2009), consumer loans (Han and Li 2007), student loans, and tax debts present debtors with similar disincentives. A new home buyers' $8000 tax credit was made available, but phased out as annual family income varied from $80,000 to $120,000. Other parts of the 2009 "stimulus law" increased the generosity of means-tested subsidies like food stamps, and employment-tested subsidies like unemployment insurance. Congress considered various legislation that would raise marginal income tax rates, and would present Americans with new health benefits that would be phased out as a function of income.

All of these safety net expansions help cushion individuals and businesses from reductions in their incomes. A necessary, but presumably unintended, byproduct of means-tested benefits is that they act as a penalty for raising one's market income: the more someone earns, the more of the "cushion" he has to give back. The penalty reduces the rewards to activities that raise market incomes, and thereby causes at least some people to do less toward earning their own market income. The magnitude of these effects depends on the amount and characteristics of safety net expansions (the subject of this paper) and the sensitivity of work hours to those expansions.

Many economists noticed that the allowable duration of unemployment benefit payments was extended during the recession, and have attempted to determine the extensions' impact on employment.[2] However, aside from the duration extensions, much analysis of the labor market since 2007 assumes that marginal tax rates have otherwise been constant.[3] This paper's measures of marginal tax or "replacement" rates since 2007 suggest that other changes to the safety net increased the overall replacement rate significantly more than duration extensions did. Moreover, given that the overall replacement rate change is similar in magnitude to estimates of labor market distortion changes based on productivity, work hours, and consumption behavior, it could potentially explain a large fraction of the reduction in labor hours since 2007.

The quantitative incentive effects of many, if not all, of the safety net events since 2007 are complex and varied, and might therefore seem beyond the reach of aggregate analysis. The purpose of this paper is to select the large subset of these events that can be characterized as changing means-tested transfers to individuals either from the government or from lenders, begin to quantify the combined amount of labor market distortion that they might create, and begin to identify the types of workers that might be most affected.

A Framework for Quantifying the Generosity of the Safety Net as a Whole

This paper examines the social safety net for the purpose of quantifying changes in work incentives. One of the challenges of the exercise is that the benefits received from any one safety net program depend on the participating household's characteristics: its income, assets, employment status, presence of children, knowledge of the program, and other factors. As a result, the degree of safety net generosity varies by demographic groups, some of which are more relevant for aggregate outcomes than others. At the same time, convenient summary measures of program activity, such as program spending, are often a complicated mixture of changes in program rules and changes in the relative size of demographic groups that differ in terms of the

[2] A few of these are Elsby, Hobijn and Sahin (2010), Shimer (2010), and the studies cited in Council of Economic Advisers (December 2010).
[3] Mulligan (2008) and Herkenhoff and Ohanian (2011) consider the safety net created by loan discharges. Research on prior business cycles, such as Braun (1994) and McGrattan (1994) has considered marginal tax rates, especially from income and payroll taxes.

program benefits they are awarded. The former have the potential of affecting labor market behavior, whereas the latter are merely reflective of it.

The task is complicated by interactions among the programs. For one, an increased generosity of safety net program A might reduce labor hours, and the reduced labor income obligates safety net program B to spend more, even though program B's benefit rules were unchanged. From the point of view of program B, it appears that "the recession" caused it to spend more, but in fact at least part of its spending growth derives from an overall safety net that became increasingly generous because that safety net includes program A.

Second, a single program's quantitative impact on the labor market depends on the generosity of the rest of the safety net, because an important determinant of labor market behavior is the effect of working on a person's disposable income. A person earning, say, $30,000 per year might react differently to program A's $5,000 annual benefit for non-workers when the rest of the safety net provided nothing, than he would when the rest of the safety net provided $25,000 in annual benefits for non-workers. In the first case, not working would mean giving up $25,000 of disposable income ($30,000 in lost income from working, minus program A's $5000 benefit) whereas, in the second case, the $5,000 benefit from program A makes it possible to stop working without losing any disposable income. More generally, the benefit paid by a single program to people with low incomes has a larger percentage impact on the reward to earning income the more that the rest of the safety net helps people with low incomes.

My approach begins by forming two time series for each safety net program j: a statutory eligibility index $\{E_{jt}\}$ and a statutory benefit-per-participant index $\{B_{jt}\}$. Each index, and therefore their product, changes only at dates t when new program rules ("statutes") go into effect. A time series for overall statutory safety net generosity $\{b_t\}$ is obtained by aggregating the product of the two indices across programs using a set of time-invariant program weights ω_j.

$$b_t \equiv \sum_j \omega_j E_{jt} B_{jt} \tag{1}$$

where *t* indexes time and *j* indexes safety net programs. Any program's weight depends on the population of interest, and is estimated as the fraction of the population of interest that typically participates in the program, holding eligibility constant. For example, the unemployment insurance program would receive a positive weight if unemployed people were the population of interest, but zero weight if persons out of the labor force were the population of interest. Regardless of the exact values for the program weights, the overall generosity index (1) changes over time only to the extent that one or more of the component programs had a change in eligibility rules, benefit rules, or both.

This paper focuses on the group of household heads and spouses less than age 65, which it divides into those unemployed, out of the labor force, under-employed (defined later), and the remainder. Thus, each safety net program in principle has four weights – a weight used for unemployed population calculations, a weight used for out of the labor force population calculations, etc. – and my framework delivers four time series for overall safety net generosity.[4] At the end of the paper, I combine the four time series into a single aggregate time series by weighting each component according to the share of its population's contribution to the reduction in aggregate hours between 2007 and 2010.

Children and youth qualify for a number of programs on the basis of their parents' or guardians' income or employment, not their own, which is why this paper examines safety net expansions from the perspective of (non-elderly) household heads and spouses.[5] Table 1 displays some of their characteristics in 2007 and 2009.

Weekly employment fell two percent among married women, and about six percent for the other three demographic categories. Overall, employment fell, and non-employment increased, about five million between 2007 and 2009. Among those employed, weekly work hours fell about three percent. Inflation-adjusted weekly earnings, measured at the mean, median, and 1st quartile were pretty stable, reflecting the increase in earnings per hour.

[4] In practice, the remainder group (employed but not underemployed) has a constant generosity index, so that the unemployed, out of the labor force, and underemployed are all examined relative to the remainder group. The result is then three time series for overall safety net generosity relative to generosity to the remainder group.

[5] I omit the elderly because of their small share of the labor market and because of the large amount of government spending on them that, contrary to the program spending examined in this paper, is not means-tested.

Between 2007 and 2009, the number of household heads and spouses not working increased 14 percent, which is one crude estimate of how much aggregate safety net spending would have increased during that time if benefit rules had remained constant. This measure potentially neglects weekly income losses among the employed that might also create more safety net expenditure. For this reason, I also measure employed persons' contribution to underemployment: according to the amount by which their weekly work hours fall short of average weekly work hours among heads and spouses employed in 2007. Thus, total underemployment in 2009 is three percent of the number of people employed, plus the number of persons not employed, which is a total of 41.4 million.[6]

This paper examines two categories of safety net programs: means-tested (or work-tested) government subsidies and means-tested loan forgiveness. Regarding the first category, Table 2 displays the various means-tested or work-tested subsidies that appear in the personal income accounts as government social benefits. For each program, the table displays the 2006-2010 average fractions of program expenditures that go to the non-elderly, and indicates the result in the "inclusion factor" column of the table.[7] The Medicaid inclusion factor also contains a 50 percent reduction for the possibility that Medicaid benefits are a poor substitute for cash benefits. I then add up each program's product of inclusion factor and 2009 expenditures, and show the contribution of each program to the total in the last column of the Table. The three largest programs for persons under age 65 in 2009 were Medicaid, Unemployment Insurance (UI), and Supplemental Nutrition Assistance (SNAP). These are also the three government

[6] Using the 2007 CPS merged outgoing rotation groups, I calculate average hours worked in the reference week among employed heads and spouses less than age 65 (persons employed but not at work are not included in this average), using the CPS weights adjusted so that each month gets equal total weight. For every month 2006-2010, I then measure underemployment as the sum of persons not employed in the reference week plus the product of the number employed and one minus the ratio of average hours among those at work to the 2007 average noted above, using the same adjusted CPS weights. By construction, under-employment is equal to non-employment for 2007 and any other period in which the average hours worked among those at work was the same as in 2007. Otherwise, employed persons also contribute fractionally to under-employment according to hours worked. Given that my purpose is to decompose changes in safety net expenditures based on actual work hours (rather than intended work hours), my underemployment measure is different from Bureau of Labor Statistics measures of labor underutilization.

[7] On average between 2006 and 2010, 3.3 percent of regular state UI beneficiaries were aged 65 and over (United States Department of Labor, various issues). 6.6 percent of SNAP benefits were pro-rated to persons aged 60+ (Eslami, Filion and Strayer 2011) (Leftin, Gothro and Eslami 2010) (Wolkwitz and Trippe 2009) (Wolkwitz and Leftin 2008). 12.4 percent of SSI benefits were paid out under aged provisions (Social Security Administration 2011). 21 percent of Medicaid benefits (fiscal years 2009 and 2010 unavailable) were paid to the aged. I assume that the elderly share of Family Assistance, General Assistance, Energy Assistance, and Other is the same as it is for SNAP.

programs featured in major federal legislation and with the largest spending changes since 2007; the remaining means-tested government programs are lumped into a single "other" category for the purposes of applying the formula (1).[8]

The rest of this paper first derives statutory eligibility and benefit indices for the major government programs. The indices are used to decompose government safety net program spending changes into statutory changes and changes in population characteristics. The paper then measures the amount of resources redistributed to persons underemployed or not employed through mortgage and consumer debt forgiveness, and how the availability of such resources changed over time.

Legislation Made the Safety Net Available to Millions More

The fraction of households receiving benefits from safety net programs increased dramatically since 2007. Figure 1's red series shows the average weekly number of persons aged 25-64 receiving unemployment benefits as a ratio to the average weekly number of persons aged 25-64 who are unemployed.[9] Figure 1's green series displays the average monthly number of households receiving SNAP benefits as a ratio to total households with annual income below 125 percent of the poverty line (as defined by the Census Bureau on the basis of their money income). Many more households have money income below the poverty line than in 2007, and many more household heads and spouses find themselves unemployed, yet the two ratios shown in Figure 1 rise because the number of safety net program participants increased even more. For example, the number of families with income below 125 percent of the federal poverty guideline increased about 16 percent from 2007 to 2010, yet the number of households receiving SNAP benefits increased 58 percent over the same time frame. As a result, the SNAP recipiency ratio shown in Figure 1 increased 37 percent.

[8] Social security, Medicare, education, veterans' benefits, and various medical, retirement and pension transfers are entirely excluded from Table 3.2.

[9] The population of nonelderly heads and spouses has a lot of overlap with the population of persons aged 25-64 (a population that can be isolated for the purpose of measuring unemployment insurance participation): only 5 percent of nonelderly heads and spouses are less than age 25, and 85 percent of persons aged 25-64 are either head or spouse.

Millions of households received safety net benefits in 2010 that would not have been eligible for benefits in 2007 even if their circumstances had been the same in the two years, because the rules for receiving safety net benefits had changed. Table 3 displays some of the major government benefit rule changes that are quantified in this paper. The Table is organized in panels: the top panel lists unemployment insurance and associated initiatives, the middle panel list SNAP changes, and the bottom panel lists Medicaid changes. The left column indicates rule changes related to program eligibility, and the right column (discussed further below) indicates rule changes related to the amounts received by eligible beneficiaries. All together, I quantify the nine major eligibility expansions embodied in eight different pieces of legislation shown in the left column of Table 3. For the most part, those expansions went into effect in 2009 or in the second half of 2008. All but one of the expansions are indefinite in that the initial legislation either specified no termination date or, as with the unemployment insurance eligibility period additions, was repeatedly renewed by subsequent legislation and continued in force as of the time of my writing.

Unemployment Insurance Eligibility: Benefit Duration and Alternative Base Periods

The unemployment insurance (UI) program is jointly administered and financed by federal and state governments, offering weekly cash benefits to people who have lost their jobs and have as yet been unable to find and start a new job. On average they receive about $300 a week until they start working again, they stop looking for work or their benefits are exhausted. Before the recession, an unemployed person in a typical state without high unemployment would often have his benefits limited to a maximum of twenty-six weeks (United States Department of Labor 2007). The federal law in place before the recession included some local labor market "Extended Benefit" (EB) triggers that, based on the statewide unemployment rate, would automatically lengthen the maximum benefit period. These automatic triggers began to extend the duration of benefits around the nation in the middle of 2008 (United States Department of Labor 2011), as indicated in Table 3's first entry. At about the same time, the Supplemental Appropriations Act of 2008 included new "Emergency Unemployment Compensation" (EUC) legislation that extended maximum benefit periods for the entire nation. The Worker, Homeownership, and Business Assistance Act of 2009 further extended the EUC periods, so that

unemployment insurance benefits could be paid up to 99 weeks (United States Department of Labor 2011). The maximum unemployment benefit duration was not changed by the February 2009 American Recovery and Reinvestment Act, but the Act did expand eligibility by encouraging states to "modernize" (and relax) their monetary eligibility requirements by processing earnings histories through an "alternative base period" (National Employment Law Project 2003) and through other provisions (United States Department of Labor 2009).

For each safety net program, I create a monthly statutory eligibility index. Each program's index is normalized so that it averages one in fiscal year 2010, and changes only when eligibility rules change. The amount of the change is calculated according to a time-invariant measure of the fraction of program participants impacted by the eligibility rule change. The index increases when eligibility rules are relaxed, and decreases when eligibility rules are tightened. For example, if a program's only eligibility rule change were January 1, 2009, that rule change was permanent, and on average 80 persons would participate in the program under the pre-2009 rules for every 100 persons participating under the post 2009 rules, then the eligibility index's value would be 0.8 for all months prior to January 2009, and 1.0 for all months thereafter. By construction, the eligibility index does not change when eligibility rules remain fixed, even though population characteristics may be changing (e.g., more people lose their jobs) in a way that changes the fraction of the population that participates in the program.

Figure 2 displays the eligibility indices for unemployment insurance, SNAP (food stamps), and Medicaid. The eligibility index for unemployment insurance (green series) changes four times since January 2007, at the four initiation dates indicated in the first column of Table 3. The largest index change occurs July 2008, when the maximum benefit period went from 26 to 52 weeks, because about half of people who are unemployed more than 26 weeks are still unemployed less than 52 weeks. The smallest jump is for eligibility modernization, although I may have underestimated the number of people affected by those provisions.[10]

Overall, the eligibility index increases almost 50 percent from 2007 to 2010, which suggests that a majority of the increase in the fraction of unemployed receiving benefits (see Figure 1) was the result of the legislation changes shown in Table 3. Indeed, the average weekly

[10] Appendix 3.1 gives the index calculation details.

number of unemployed persons aged 25-64 not receiving unemployment insurance actually fell by 700,000 between 2007 and 2009, even though the number of unemployed people aged 25-64 had increased by more than 6 million.[11]

SNAP Eligibility: State-by-State Elimination of Asset and Work Status Tests

The Department of Agriculture's food stamp program, now known as Supplemental Nutrition Assistance (SNAP), provides funds to low income households for the purpose of buying food (Social Security Administration 2008), often in conjunction with cash assistance programs. SNAP benefits are potentially available to households earning less than 130 percent of the poverty line, which is adjusted each fiscal year according to the rate of inflation. For example, 130 percent of the poverty line was, on a monthly basis, $1430 for a household of two in fiscal year 2007, and $1578 in fiscal year 2010.[12] With an essential exception noted below, a household with sufficiently few assets and satisfying other eligibility criteria has its monthly benefit calculated as the program's maximum benefit for its household size minus 30 percent of its net income, where net income is money income minus deductions for shelter and other items. For this reason, essentially every participating household's benefit is linked to the program's maximum benefit.

An important legislative change since 2007 was the adoption by 28 states, plus the District of Columbia, of "broad based categorical eligibility," which means that states confer automatic SNAP eligibility on all households receiving a specified social service informational brochure.[13] Households that participate in SNAP under this rule still have benefits determined

[11] For the purposes of this calculation, I assume that, consistent with the law, nobody received unemployment benefits for a week that he was employed.

[12] Fiscal years begin October 1 in the prior year (e.g., fiscal year 2009 began October 1, 2008). The average household size is 2.2 among SNAP households (Eslami, Filion and Strayer 2011, Table A.27) and 2.6 for the entire United States (United States Census Bureau 2010).

[13] Technically, the brochure is called a "TANF/MOE-funded noncash benefit." (Eslami, Filion and Strayer 2011, 4) For example, Connecticut distributes a two page "Help for People in Need" brochure with links to SNAP and various state safety net programs (United States Department of Agriculture, Food and Nutrition Service 2011). The categorically eligible households need not receive cash benefits from any other welfare program, and in some states may have income up to double the federal poverty guideline (Leftin, Gothro and Eslami 2010, 56-57). Broad-based categorical eligibility was made possible by a 2002 federal law, but had been adopted by only twelve states as of January 2007.

by the same formula (of household size and net income) as the other SNAP beneficiaries.[14] A practical result of broad based categorical eligibility is therefore that households can receive benefits based solely on their net income, and not based on the value of their assets or their work status.[15] Even SNAP households not participating through broad based categorical eligibility saw the asset test relaxed by the 2008 Farm Bill, as the values of vehicles, retirement accounts, and education savings accounts began to be excluded from the test (Eslami, Filion and Strayer 2011, 6).

Between fiscal years 2007 and 2010, the number of SNAP households increased 37 percent more than did the number of households with incomes at or below 125 percent of the poverty line, and the inflation-adjusted average income of participating households actually increased (Eslami, Filion and Strayer 2011, Table A.27). More than 100 percent of the increase in participating households occurred among those qualifying under broad-based categorical eligibility that, with the exception of the three states noted above, were not subject to asset tests.[16,17]

Figure 2's SNAP eligibility index shows the dynamics of the "broad based categorical eligibility" (BBCE) legislation. The index shows an increase if and only if BBCE went into effect in at least one state on that date, and the size of the increase is proportional to the fraction of the U.S. population (measured in 2010) living in states with the new legislation. For example, the largest jump is in July 2009 when California and Connecticut began conferring broad-based categorical eligibility. The index is normalized to average one in fiscal year 2010, and to have a

[14] As a result, more than 95 percent of participating households have monthly income less than or equal to 125 percent of the federal poverty guideline during the months that they are participating (Eslami, Filion and Strayer 2011, Table A.3).

[15] As of October 2011, 38 states plus the District of Columbia had no asset test for determining broad-based categorical eligibility (United States Department of Agriculture, Food and Nutrition Service 2011). Three states (Michigan, Nebraska, and Texas) had asset tests that were more lax than SNAP's. The remaining states did not yet confer broad-based categorical eligibility.

Broad-based categorical eligibility from the states is not subject to work requirements. Work requirements for other SNAP beneficiaries were dropped between April 2009 and October 2010. Another policy change encouraging participation: potential program participants have increasingly been given the opportunity to apply for benefits on the internet (Eslami, Filion and Strayer 2011, 8).

[16] Even without BBCE expansion, the SNAP participation probably would have grown faster than the number of households in poverty because SNAP relaxed work requirements and asset tests, and allowed for more deductions from income. But my purpose here is to quantify SNAP participation changes attributable to all eligibility rule changes combined, not to isolate the effect of a specific type of legislation such as BBCE.

[17] The Department of Agriculture also found that the food stamp spending increase "…is likely attributable to the deterioration of the economy, expansions in SNAP eligibility, and continued outreach efforts." (Leftin, Gothro and Eslami 2010, xiii).

three year logarithmic change equal to 0.20, based on previous estimates of the effects of asset tests and BBCE on program participation.[18]

Medicaid: A Historic Expansion Planned for 2014

The state-administered Medicaid program pays health care providers on behalf of low-income individuals and families (Centers for Medicare and Medicaid Services 2011). It is the largest single program shown in Table 2, spending about $8,000 per beneficiary per year.[19] Due to the high rates of spending on the elderly and disabled, spending per non-elderly, non-disabled beneficiary is about half the average for the entire program (Henry J. Kaiser Family Foundation 2011). An average family eligible for Medicaid would obtain over $10,000 in benefits per year, even without any elderly or disabled members.[20] As explained below, the sheer size of this program is important for understanding the economic effects of expansions of the other safety net programs.

Unlike the UI and SNAP programs, the Medicaid program has not yet significantly expanded its eligibility or average benefit since 2007.[21] Some states have restricted Medicaid benefits in order to control costs. A number of states have expanded eligibility (Smith, et al. 2011), but those expansions were small enough that nationwide Medicaid enrollment and inflation-adjusted Medicaid spending actually grew slightly less between 2007 and 2010 than did

[18] That is, I assume that adoption of BBCE and other changes in SNAP eligibility rules are responsible for 64 percent of the growth of SNAP participation in excess of poverty growth. Appendix 3.1 and Appendix 3.2 have more details and sensitivity analysis.

[19] To calculate spending per beneficiary, I divide calendar year Medicaid spending (as reported in the government social benefits section of the personal income accounts) by the number of persons enrolled in Medicaid as of June of that year (Henry J. Kaiser Family Foundation 2011). Sometimes annual spending per beneficiary is measured as the ratio of spending to the number of persons enrolled at any time during the year (Henry J. Kaiser Family Foundation 2011), in which case the ratio is about $5,000. With the exception of amounts for premiums and copayments (see below), all of the Medicaid statistics reported in this paper include the Medicaid CHIP program.

[20] For example, at $4,000 per beneficiary per year, families with three beneficiaries would receive benefits with an average value (at program cost) of $12,000 per year. Note that private family health insurance, a substitute for Medicaid enrollment, typically costs about $13,000 per year (Crimmel 2010).

[21] A few states recently began to require participants to pay regular premiums, make co-payments upon visits to healthcare providers, or both (Henry J. Kaiser Family Foundation 2011). The copayments are small: for example, in 2008 the Wisconsin Medicaid program began collecting co-payments ranging from zero to three dollars from participants with incomes below 200 percent of the poverty level (Dague 2011). The premiums, if any, also increase with beneficiary income (Dague 2011).

the number of Americans in poverty.[22] To a first approximation, Medicaid spending and enrollment have expanded since 2007 because of the number of families who have seen their incomes decline (Smith, et al. 2011, 15), rather than relaxation of eligibility rules.

The Patient Protection and Affordable Care Act was passed in March 2010. As a result of this legislation, Medicaid enrollment and spending are expected to increase significantly in 2014, when the program is made "available to able-bodied adults with incomes up to 133 percent of the federal poverty level" (Sack 2010). The Medicaid eligibility index shown in Figure 2 is therefore one prior to 2014, at which time it jumps up an amount reflecting estimates of the number of newly eligible beneficiaries who will participate in the program (see Appendix 1). Thus, while the safety net has already expanded due to recent changes in eligibility rules for the UI and SNAP programs, Medicaid may be the main way that the safety net further expands in the near future.

Legislation Increased the Amount of Benefits Received per Program Participant

For each safety net program, I create a monthly statutory real benefit index. Each index is normalized so that its fiscal year 2010 average is equal to the program's average real monthly benefit per participant in fiscal year 2010. A real benefit index changes only when benefit rules change the amount that a program participant with a given set of characteristics would receive. The results are displayed in Figure 3.

The major benefit rule changes are indicated in the right half of Table 3. The four provisions shown in the top panel were put in place by the ARRA and serve to increase the amounts received by persons laid off from their jobs. The first provision exempts the first $2,400 of unemployment benefits received by an unemployed person from 2009 federal income tax (United States Department of Labor 2011). Because the provision serves to reduce that person's personal income tax, I estimate it to be worth about $56 per month for each of the nine

[22] The poverty rate increased 18 percent between 2007 and 2010, when Medicaid enrollment and inflation-adjusted spending per capita increased 16 percent.

months April 2009 through December 2009 (details in Appendix 1), which is why the green unemployment insurance series in Figure 3 jumps down that amount in January 2010.

For laid off workers who wanted to remain on their former employer's health plan, the ARRA offered to pay 65 percent of the cost. For a $13,027 annual family health insurance premium (Crimmel 2010), that subsidy is worth $711 per month. However, I estimate that the number of people receiving the benefit when it was available was only one fifth of the number of people receiving unemployment benefits, so the effect of the provision on the index is only $142 per month (see Appendices 1 and 2). The third provision is worth a bit more than $100 per month.

SNAP had two major federal legislative changes in benefits since 2007: the 2008 Farm Bill (effective October 2008) and the 2009 American Recovery and Reinvestment Act (effective April 2009). Both laws increased the per-household benefit amount across the board, far in excess of the rate of inflation, which is why the real SNAP benefit index shown in Figure 3 jumps up at the two legislation dates. A smaller nominal benefit increase went into effect in October 2007. The benefit formulas were unchanged in nominal terms in between these three dates, which is why the SNAP real benefit index trends slightly down in between the jumps.[23]

At all three dates, benefit amounts were change by increasing the maximum benefit. The maximum benefit increased about 8.5 percent on October 1, 2008 and another 13.6 percent on April 1, 2009 (Eslami, Filion and Strayer 2011, 22). The dollar amount of the maximum benefit change depends on household size, and averaged $27 on October 1, 2008 and $47 on April 1, 2009.[24] In addition, the 2008 Farm Bill revised the standard deduction and expanded the child care deduction, and would thereby increase benefits by about $2 per household per month, holding fixed the composition of SNAP households. The net effect of legislation and accumulated inflation was to increase the statutory real SNAP benefit index by $60 per month from fiscal year 2007 to fiscal year 2010, or about 26 percent.

[23] I assume that UI and Medicaid benefits are indexed to inflation: unemployment benefits depend on a person's earnings history, and Medicaid provides participants a fixed set of medical goods and services rather than a set dollar amount.

[24] Any SNAP household not receiving the minimum benefit has its benefit change dollar-for-dollar with the maximum benefit for their household size, even if their benefit is less than the maximum benefit. About three percent of SNAP households receive a minimum benefit, which was increased $4 per month by the 2008 Farm Bill and another $2 by the ARRA. The average household monthly benefit increase from the maximum and minimum benefit provisions of the 2008 Farm Bill and ARRA was therefore $26 and $45, respectively.

Safety Net Rule Changes and Assistance for the Unemployed

The levels of each eligibility index shown in Figure 2 cannot be compared across programs because each program's index is set to one in FY 2010, even though the eligible populations vary across programs. For the same reason, the benefit indices shown in Figure 3 cannot be compared across programs. However, they can be compared, and summed together, when adjusted for a time-invariant measure of the likelihood of participation in each program. Recall the formula (1) for overall statutory safety net generosity:

$$b_t \equiv \sum_j \omega_j E_{jt} B_{jt} \tag{1}$$

where t indexes time and j indexes safety net programs. E_j is program j's statutory eligibility index and B_j is its statutory per-participant benefit index, measured in inflation-adjusted dollars per month. The program aggregation weight ω_j is the fraction of the population of interest that typically participates in program j, holding eligibility constant.

Program Aggregation Weights

Ultimately I use the formula (1) to consider both government and private sector safety net programs as they apply to various persons on the margin of working, but for the moment I limit attention to the government safety net programs listed in Table 2 as they apply to household heads or spouses who are unemployed. The first column of Table 5 indicates the program weights for this purpose.

The first column weight on unemployment insurance could be one only if, under the fiscal year 2010 eligibility rules, all unemployed heads and spouses would receive unemployment benefits some time during their unemployment spell. Historically, many unemployed persons have not collected unemployment benefits due to ineligibility, lack of awareness, or simply unwillingness to collect benefits (Anderson and Meyer 1997), so a proper

first entry in Table 5 is likely less than one. One way to estimate that entry is as the ratio of the number of regular UI recipients aged 25-54 to the number of persons aged 25-64 who are unemployed but not yet more than 26 weeks, times the fraction of unemployed with spells no greater than 92 weeks (the 2010 eligibility rule) which is typically 0.63.[25]

In order to measure the SNAP program weight ω_j for the population of heads and spouses who are unemployed, I take the ratio of the number of fiscal year 2010 SNAP household heads who were unemployed to the weekly average total number of unemployed household heads, which is 0.57.[26] In words, it appears that, with fiscal year 2010 eligibility rules in place, a bit more than half of the unemployed would participate in SNAP.

In order to measure the participation fraction ω_j for the Medicaid program, I take the ratio of the change in non-elderly Medicaid enrollment (including children) from June 2007 – June 2010 to the 2007-2010 change in the average weekly number of non-elderly heads and spouses who were not employed or underemployed, which is 0.96,[27] and discount the result by 50 percent to reflect the fact that Medicaid benefits are distributed in-kind, rather than in cash or cash equivalents.[28] I assume that eligibility and benefit indices for "all other safety net programs" are constant over time, and assume that the non-elderly parts of those programs pay equal benefits to all non-elderly heads and spouses who do not receive unemployment insurance in a given week. The average inflation-adjusted monthly benefit is therefore $357, and the program weight for the population of unemployed heads and spouses is the fraction of them not receiving UI, 0.37.

[25] The ratio is 0.61 in 2007 and 0.72 in 2010. Adjust the 2007 ratio for the alternative base period rule yields 0.64, and hence a 2007 and 2010 average of 0.68. Four (10.5) percent of persons age 25-64 were unemployed no more than 92 weeks in 2007 (2010), which is an average of 7.2 percent. Recall from above that the unemployment claims data do not indicate relationship to spouse, so I used age 25-64 as a proxy.

[26] The ratio of the number of people unemployed in SNAP households (regardless of head status) to the average total weekly number of heads and spouses unemployed is 0.64, and would therefore yield similar results to the 0.57 ratio I use.

[27] This 0.96 does not imply that 96 percent of the unemployed are enrolled in Medicaid, but rather than on average each head or spouse added to the unemployed adds 0.96 non-elderly persons (including children) to Medicaid enrollment. For example 24 unemployed out of 100 could add a family of four to Medicaid, while the other 76 unemployed added none. The value of the Medicaid participation weight ω_j does not affect any of my estimates of safety net generosity *changes* prior to 2014, because Medicaid eligibility and benefit rules are assumed to be constant prior to 2014 (see also Appendix 3.2).

[28] Many people are eligible for Medicaid but do not participate (Aizer 2003), which suggests that the average eligible person values the program's benefits less than they cost.

Note that all program weights $\{\omega_j\}$ are based on actual program participation, and not the participation that would theoretically be possible if all eligible persons participated. At the same time, changes over time in the weighted sum (1) do not reflect *changes* in program participation aside from those associated with changes in program eligibility rules because the program weights do not change over time.

Results, and Multi-program Participation Examples

The red series in Figure 4 shows the results of aggregating, according to the formula (1), the product of the statutory eligibility and benefit indices across programs using the weights shown in Table 5. The red series can be interpreted as the combined monthly benefits received from all government safety net programs by the average unemployed household head or spouse as a function of when they were unemployed, holding constant the characteristics of the average unemployed person. The average combined monthly benefit was about $890 in 2007 and the first half of 2008. By the beginning of 2009, it had increased about $210 per month entirely as a result of the eligibility and benefit rule changes cited above. The series peaks another $275 higher at the end of 2009. By 2011, the statutory benefit series was down to about $1,200, but still $310 greater than it was in 2007. Simply put, safety net program rules were the most generous to the unemployed in the 12 months or so after the ARRA went into effect, and remain significantly more generous than they were before the recession began.

As demonstrated below, aggregate quantitative estimates of changes in safety net generosity, such as the series shown in Figure 4, are helpful for quantitative analysis of the major macroeconomic variables. It is therefore helpful to examine a few hypothetical families, and how their safety net benefits would have been different in, say, 2009-Q4 if the eligibility and benefit rules from two years earlier had remained in place.

Consider a family of four, with the primary earner unemployed during 2009-Q4. The primary earner is entitled to a $275 weekly UI benefit, plus the ARRA's federal additional compensation, but only until benefits expire. The household can either purchase health insurance through the former employer (at a cost of $13,027 per year) or participate in Medicaid (if eligible on the basis of assets and income). Its monthly deductions for SNAP purposes are

$410 (the FY 2010 average for all SNAP households without earnings) plus 20 percent of spousal earnings.[29] Its marginal federal income tax rate for the purposes of changes in the amount of unemployment benefits is 21%.[30]

If the primary earner has so far been unemployed four months, as with the hypothetical households A, C, and E shown in Table 6, it would be receiving unemployment benefits under both 2007-Q4 and 2009-Q4 eligibility rules. However, it receives the federal additional compensation ($25 per week, which is $108 per month) only under the 2009-Q4 rules, so Table 6 shows a policy impact on UI of $108 for those three households. Any household receiving UI receives a tax exemption of $2400 of UI income – $267 per month when amortized over the nine months of 2009 when the ARRA was in effect. Assuming that the household will have more than $2400 of UI income for the calendar year, its total monthly tax savings from the 2009-Q4 policies is $33 (21 percent of $267- $108).

If the primary earner has so far been unemployed more than six months, it qualifies for unemployment benefits only under 2009-Q4 rules, and the entire $1300 monthly benefit is the policy impact. It owes tax on this monthly benefit, so 2009-Q4 rules cost such a household $217 more per month in federal income tax: see Table 6's hypothetical households B, D, and F.

If the primary earner has a spouse or other household member who earns much more than $2,000 per month (such as the $2,500 per month shown in Table 6's first two columns), the hypothetical household will not qualify for SNAP benefits, even under broad-based categorical eligibility. In this case, the policy change has no impact on the household's SNAP benefits.

Without any spousal earnings, the household qualifies for $401 SNAP benefits under 2009-Q4 rules.[31] If the household's assets exceeded SNAP limits under 2007 rules, as with hypothetical households E and F, the policy impact is the full $401. If the household would have qualified for SNAP under 2007-Q4 rules, then the policy impact is the $108 difference between

[29] Eslami, Filion and Strayer (2011, Table A.2).
[30] The average marginal federal income tax rate in 2009 was 21 percent for wage income (National Bureau of Economic Research 2010).
[31] Each dollar of UI income can reduce SNAP benefits, but less than dollar-for-dollar (Hanson and Andrews March 2009). The ARRA required that the $25 increase in weekly UI benefits not count against the recipient's Medicaid eligibility (Ross and Parrott 2009).

$401 and its $293 benefit under inflation-adjusted 2007-Q4 rules: see Table 6's hypothetical households C and D.

Hypothetical households C and D have sufficiently little assets and spousal earnings to qualify for Medicaid. For this reason, I assume that households C and D do not obtain health insurance through the former employer and therefore do not benefit from the ARRA's COBRA subsidy. I assume that hypothetical households not qualifying for Medicaid (A and B fail to qualify because of spousal income, E and F fail to qualify because of assets) opt to obtain health insurance from the former employer through the COBRA provision. The 65 percent subsidy for COBRA costs is available only under 2009-Q4 rules, so the policy impact on the COBRA subsidy is $706 per month (706 = 0.65*13027/12).

Added together across all six safety net provisions, the policy impact on the disposable income of the household with an unemployed primary earner and fixed characteristics ranges from $227 and $2,190 per month among the six hypothetical households.[32] These amounts are policy impacts: the amounts that 2009-Q4 rules *add* to safety net benefits relative to the benefits that would be paid under inflation-adjusted 2007-Q4 rules. Five of the six hypothetical households experience a policy impact of $824 per month or more. Half of the households experience a policy impact of more than $1,000 per month even without the COBRA provision.

By comparison with the amounts shown in Table 6, the $450 increase in Figure 4's red series measuring statutory safety net generosity over time is not particularly large. As shown in Appendix 2, the statutory safety net generosity increases shown in Figure 4 and elsewhere in this paper are also congruent with changes over time in aggregate benefit payments per not employed or underemployed household heads and spouses. The safety net actually did become significantly more generous, and the payments actually received by unemployed people and other potential beneficiaries reflect this increased generosity.

[32] Assuming two household members rather than four yields a range of $178 to $1,673, largely because "employee plus one" health insurance costs $9,053 per year rather than $13,027 for an entire family (Crimmel 2010).

Means-tested Loan Forgiveness

Household debt had been increasing during the 1980s and 1990s, but the rate of increase was extraordinary between 2000 and 2007. In 2000, household sector debt was less than 80 percent of annual personal income. By 2007, it had reached 114 percent of the nation's personal income (Dynan and Kohn 2007) – more than $14 trillion. The change was almost entirely due to accumulation of home mortgage debt; non-mortgage debt remained about one quarter of personal income throughout the period (Dynan and Kohn 2007). The mortgage debt had grown more or less in proportion to the growth in residential real estate values (Dynan and Kohn 2007); by 2007 home mortgage debt was 87 percent of annual personal income.

Means-tested Home Mortgage Collection

The combination of housing market events and the profit motive for mortgage lenders turned trillions of dollars of household debt into a kind of safety net, because one of the consequences of unemployment would increasingly be a lender-provided discount on home mortgage expenses. Normally, lenders do not offer discounts on home mortgage expenses because the mortgages are fully secured by a residential property: when a homeowner fails to make the scheduled payments in full and on time, the lender can seize the property and sell it to obtain his principal, interest, and fees.[33] When the lender has this valuable foreclosure option, borrowers overwhelmingly either make their home mortgage payments, or sell their property in an orderly fashion in order to obtain the funds to repay the mortgage lender. As long as a property could be sold for enough to repay its mortgage, even homeowners who had become unemployed could be expected to pay their mortgages in full.[34] The vast majority of mortgages were paid in full and on time, and homes were typically owned by occupants, not by banks.

When residential property values plummeted in 2008 and 2009, a number of residential properties were suddenly "under water": worth less than the mortgages that they secured. In those cases, the lender's foreclosure option was no longer valuable – selling the property would

[33] In exchange for funds to make a home purchase or improvement, a homeowner promises in the mortgage agreement to either make his scheduled payments or, at the lender's discretion, pay late fees or surrender ownership of the home.

[34] Foote et al (2009, footnote 3). Liebowitz (2009) finds that negative equity was a more important factor than unemployment in causing the foreclosures that occurred in the second half of 2008. Geanakopolos and Koniak (2009) find that foreclosures are "stunningly sensitive" to the amount of home equity. See also First American Core Logic (2008, 2).

likely yield too little funds to cover principal, let alone interest and fees. For the same reason, a homeowner who suddenly owed more than his house was worth might minimize his losses by stopping his mortgage payments.

A homeowner always has the option to stop paying his mortgage, even if he can afford the payments. Although state laws are somewhat different, to a good approximation the worst case scenario for a homeowner who stops paying is that he can no longer own or occupy the house, may suffer a reduction in his credit rating that might raise his future borrowing costs, and may personally suffer a loss in pride for his failure to pay as promised.[35] But if the combined value of the house and these costs were less than the present value of his promised mortgage payments, then he could do better than paying in full. That's probably an important reason why, as of early 2009, more than five million homes were already either in foreclosure (lenders were seizing the collateral as a consequence of lack of payment) or their owners were delinquent on their mortgage payments.

In order to minimize lending losses, it helps to encourage at least some of the underwater borrowers to make their scheduled mortgage payments, and thereby pay more than their homes were worth. As explained above, insisting on full payment from everyone probably would not minimize losses because lenders would find themselves owning millions of unoccupied homes. Lenders could essentially eliminate foreclosures by reducing all mortgage amounts enough that homeowners were no longer underwater, but that would eliminate their chances of collecting from the subset of borrowers who would pay in full despite being underwater.

Lenders needed a way to estimate which borrowers would pay in full, and for other borrowers try to work out a mortgage modification that would give them an incentive to pay at least a bit more than their homes were worth. Naturally, a borrower's income is a factor to be considered – borrowers with high income can be expected to repay more than borrowers with low income. Thus, a partial solution to the lenders' collection problem is to insist that high

[35] A number of states prohibit lenders from holding homeowners liable for the difference between the mortgage amount and funds obtained from a foreclosure sale. Other states technically allow such liabilities, but homeowners can often shield their assets from home loan deficiency judgments. In a few states, homeowners may expect to be liable for the deficiency (Ghent and Kudlyak 2011), but in practice collection of such liabilities may, in effect, involve some of the same means-tests noted below.

income borrowers pay more, and allow some low income borrowers to pay less. Lenders have been doing exactly that.

Mulligan (2009) examines the microeconomics of mortgage modification in more detail, and the role of public policy in determining mortgage modification formulas, but a couple of examples begin to put mortgage modification in the context of the overall safety net. Table 7 shows some of the mortgage modification arithmetic based on the federal guidelines for a hypothetical dual-earner household. When working, the both earners earn $727 per week, or $3,148 per month (2010 dollars), which is the median among working heads of households and spouses at work during the average week in 2007. The household has monthly housing expenses, inclusive of mortgage principal and interest payments, that are 31 percent of their income when both earners are working.

If one of the earners were not working and eligible for unemployment insurance (Table 7's first column), then unemployment benefits would replace half his salary, or $1,574 per month. Otherwise unemployment benefits are zero. Either way, unemployment thereby reduces household income and increases the household's debt-to-income ratio, or DTI. According to federal modification guidelines, home mortgage interest payment should be reduced so that the household's DTI returns to 31 percent. For the household shown in Table 7, the required reduction is zero if both earners are working, and either $488 or $976 per month if one of the earners is unemployed, depending on whether the unemployed earner is UI eligible.[36] In this regard, mortgage modification provides a $488 monthly unemployment benefit, in addition to the $1,574 received from the unemployment insurance system (the Table's first column), or a $976 monthly benefit by itself (second column).

The only remaining question is whether the lender could do better by foreclosing rather than agreeing to reduce interest payments by $488 per month, or $976 per month for the UI-ineligible household, for five years.[37] That depends on the value of the collateral: if the home's value is low enough that the loan to value ratio is no greater than 1.13 for the UI-eligible

[36] Unemployment benefits count as income for the purpose of calculating DTI. See also Herkenhoff and Ohanian (2011).
[37] If not, the modification is said to fail the NPV test.

household, or 1.29 for the UI-ineligible household (see the last row of the table), then the modification is more profitable than foreclosure.[38]

In order to put mortgage modification in the context of the overall safety net, I calculate an eligibility index, a benefit index, and a program weight for mortgage modification so that it can be added to the other safety net programs using the formula (1). The modification eligibility index is not based on statutes, however, but rather the propensity of homeowners to have negative equity in their home – because a homeowner with positive equity is not eligible for modification if he is unemployed. Figure 5 displays a time series for the modification eligibility index, which is calculated as the ratio of the fraction of owner-occupied homes with negative equity to the average fraction in fiscal year 2010 (0.189). The eligibility index has more than tripled since 2007 as residential property values collapsed and home equity was more often negative than it was before the recession began. By the end of 2009, the average amount of negative home equity was $70,700, and the aggregate amount was $801 billion (First American Core Logic February 2010). Home mortgage modification thereby had the potential of redistributing as many resources as the expansions in unemployment insurance or food stamps.

I estimate that 36 percent of the 2007-2010 change in hours worked by household heads and spouses is covered by unemployment insurance and the rest is not (often because the person is underemployed, rather than unemployed). With these weights, I set the (time-invariant) modification benefit index to the $764 weighted average of $488 and $976.

Mortgage modification provides no safety net to someone who does not have an underwater home mortgage, which in fiscal year 2010 described about 87 percent of household heads and their spouses because they did not own their home, or had nonnegative home equity. Nor is modification a safety net for a household that has access to, and is satisfied with, a non-means tested resolution such as foreclosure without lender recourse. A number of other homeowners are technically eligible for modifications but do not pursue them, perhaps because they are unaware of the possibility, or prefer to pay their mortgage as promised at origination.

[38] A single-earner household in which that earner went from earning $3,148 to receiving $1,574 in UI would have the same $488 modification amount, but the critical LTV would be 1.29. If an earner were unemployed only part of the year that earnings were examined for the purposes of modification, then the monthly modification amount would, as a ratio to time unemployed, be the same as shown in the table, but the critical LTV would be closer to one. Part year unemployment is an important reason why the average actual modification amount is closer to $400 per month (Office of Thrift Supervision various issues).

Others apply for a modification, but have their application lost or delayed by lenders and their servicers. As for the other safety net programs, the proper program weight ω_j reflects the actual number of modifications rather than the number that would hypothetically occur if all eligible homeowners received a modification, so I multiply the fraction of heads and spouses owning an underwater home by the ratio of the actual number of home mortgage modifications under the Obama administration's Making Home Affordable Program through the end of 2011 (1.1 million) and the number that the program originally targeted (3.5 million).[39] As a result, mortgage modification adds a $29 monthly benefit per month of nonemployment or underemployment of the head or spouse to the income of the average household experiencing that reduced employment. In fiscal year 2007, the monthly benefit was only $8 because negative home equity was less common.

Means-Tested Collection of Unsecured Consumer Loans

Consumers also borrow with credit cards and other forms of consumer debt that is unsecured in the sense that the loans are not collateralized by a specific asset such as a home or automobile. Aside from paying back in full, consumers potentially have three ways to have some of their unsecured consumer debt discharged: negotiating a settlement with creditors, filing Chapter 7 bankruptcy, and filing Chapter 13 bankruptcy. In all three cases, more debt is expected to be discharged the less that the debtor earns: in effect part of the debtor's earnings goes to the lender. Implicit wage taxation is obvious during the three to five year period following Chapter 13 bankruptcy when creditors receive all of the income, beyond amounts set aside for necessary expenses, of debtors who are not scheduled to pay in full (Li and Sarte 2006). Wage taxation is also relevant during the settlement process not only because wage garnishment (that is, having a specific percentage of the debtor's paycheck withheld on behalf of creditors) is one of the debt collection tools, but also because the debtor can eschew a settlement and opt for Chapter 13 instead. The lower the debtor's income, the more creditors are threatened by the Chapter 13 possibility. The debtor's income is not considered when discharging debts under

[39] Trial modifications are given fractional weight 5/60, because a permanent modification reduces payments for 60 months and the average trial modification reduced them about five months (United States Department of Treasury 2012).

Chapter 7 bankruptcy, which is the majority of non-business bankruptcies. However, under current law, Chapter 7 bankruptcy is not permitted for high income debtors.[40]

Ignoring bankruptcy law changes for the moment, means-tested consumer debt discharges are nothing new. Moreover, contrary to the amount of mortgage debt, the amount of unsecured consumer debt was not historically unusual in 2007 (Moore and Palumbo 2010). To a first approximation, unsecured consumer debt discharge is a cushion for a debtor against declines in his income, but the size of the cushion has been constant over time. This suggests treating unsecured consumer debt discharges like Medicaid expenditures: a positive but time-invariant component of safety net benefits. To estimate the size of this cushion, I average the fiscal year 2007 and 2010 ratios of inflation-adjusted consumer loan discharges by commercial banks to the number of non-elderly heads and spouses not employed or under-employed, which is $95 at a monthly rate.

In fact, a new federal bankruptcy law went into effect in October 2005. To the degree that the new legislation achieved its goal of making it more difficult for high income debtors to discharge debts under bankruptcy, the generosity of the consumer debt discharge component of the safety net is not time-invariant, but rather has increased since the new law went into effect. However, the legislation implemented its goal by means-testing eligibility for Chapter 7, yet the ratio of Chapter 7 bankruptcies to Chapter 13 bankruptcies was not substantially different during the 2008-9 recession than it was in the 2001 recession (Administrative Office of the United States Courts 2011). In order to be slightly conservative as to the change in the generosity of the overall safety net, I treat consumer loan discharges as a time-invariant benefit.

Conclusion: Replacement Rates for Aggregate Analysis

The amount of earnings replaced by the aggregate safety net – that is, the increase in benefits from all programs that occurs for each dollar that income falls – varies across households, and varies within household according to how their earnings are reduced (e.g.,

[40] Specifically, anyone with income above his state's median and with monthly income net of necessary expenses more than about $200, is not permitted Chapter 7 (Administrative Office of the United States Courts 2011, 14).

employment versus hours, or primary earner versus secondary earner). A simple average across households and circumstances is one way to simplify this complex reality, although many of those households and circumstances are irrelevant for determining equilibrium employment and hours. For example, a large fraction of elderly persons are not about to return to work, even if there were a significant change in labor market circumstances. Many other persons obtain a large surplus from working, and would not change their work hours in response to safety net rules. For the purposes of understanding equilibrium employment and how it changed since 2007, two particularly important groups are: (a) persons working in 2007 but near the margin of not working, and (b) persons not working in 2007 but near the margin of working. The safety net rules affecting these two groups are the majority, if not all, of the safety net rules that affect equilibrium employment.

Unfortunately, the usual data sets do not indicate exactly who is near the margin of working, let alone their distance from that margin. I therefore take a couple of steps to attempt to isolate marginal workers and the safety net benefits they would receive if not working. First, as noted at the beginning of this paper, I exclude elderly people and safety net programs targeted toward the elderly, at least for the moment. Second, I measure replacement rates separately for unemployed people, people out of the labor force, and employed people with reduced hours. Third, I consider the possible size of these three groups among the larger group of people who would be working more hours if the labor market had remained like it was in 2007. An appropriately weighted average of replacement rates for unemployed people, people out of the labor force, and employed people with reduced hours is then the aggregate replacement rate series that could be used for aggregate analysis. As with its component replacement rate series, the aggregate series changes only when there are changes in the rules for eligibility or benefit amounts of one or more of the safety net programs.

As noted above, the red series in Figure 4 measures overall government safety net generosity for unemployed non-elderly heads and spouses by weighting the indices for the UI, SNAP, Medicaid, and "all other" programs. The blue and green series are weighted sums of the same component-program series, but with weights appropriate for the out of the labor force (OLF) or underemployed group. The UI program weight is zero for both the OLF and underemployed groups (see also Table 5). Based on the approximation that the underemployed

have about the same income (inclusive of unemployment benefits) and assets as the unemployed, I set all other program weights equal for the two groups. The SNAP weight for the OLF group is the ratio of fiscal year 2010 non-elderly OLF SNAP household heads to the average monthly number of non-elderly OLF household heads in the nation, which is 0.42. The Medicaid weight for the OLF group affects only the level of the replacement rate, and not its changes prior to 2014, so I assume it is the same as for the other two groups. The "other program" weight for the OLF group is calculated in the same way as for the unemployed group: one minus the UI program weight.

The main difference between the OLF and under-employed series and the series for the unemployed is that the latter exclude UI and related programs. As a result, the blue and green series are less than the other two, and show no tendency to decline as the ARRA expires. Note that the underemployed series is the average monthly benefit received by the underemployed *per month underemployed*, holding constant the composition of the underemployed. The level of this series is lower than the others because, on average, safety net programs spend less on the underemployed per hour of underemployment: they typically do not qualify for unemployment insurance and sometimes have too much income to qualify for other safety net programs.

Aggregate Replacement Rates

The bottom row of Table 5 shows the relative contribution to the 2007-10 reduction in average hours worked among non-elderly heads and spouses of changes in their propensity to be unemployed, OLF, or underemployed. The contributions in that row sum to one[41] and I use them as weights to average the overall government safety net series in Figure 4. The results are shown in red in Figure 6.

Because the red series is a weighted average of weighted sums, it can itself be interpreted as a weighted sum across programs of the form (1), using the single set of "average marginal worker" program weights shown in the last column of Table 5.[42] I henceforth refer to the series

[41] The interaction term is negligible.
[42] The last column is the weighted average of the previous three, using the last row as weights.

in Figure 6 as measures for the average marginal worker among non-elderly heads and spouses, or simply for non-elderly heads and spouses.

The eligibility indices, benefit indices and program weights, constructed in the previous section for means-tested mortgage modification and consumer debt discharges were themselves calculated for non-elderly heads and spouses, so that their product can be added to the red series in Figure 6. The results of their addition are shown in blue and black in Figure 6. The mortgage modification addition is the smaller of the two because owning a home with negative equity is still relatively rare, but it is the only addition of the two that varies over time because the prevalence of negative equity changed over time.

The final addition is for taxes on earnings. For brevity, and probably without much loss of accuracy, I consider only changes in payroll taxes, and treat personal income taxes as a constant ten percent. With the exception of the former employer liability noted previously, the payroll taxes do not apply to any of the safety net benefits and do not apply to income that a person fails to earn because he is unemployed, out of the labor force, or underemployed. However, they do apply to a person who is employed, which is the baseline to which I have been comparing all of the other groups, so their amount is appropriately added to any and all of the series in Figures 5 and 6. Prior to 2011, I calculate the payroll tax amount as 15.3 percent of the median monthly earnings of heads and spouses, $3,148 (2010 prices), which is $481.68. The amount is constant through December 2010. Beginning January 2011, it is reduced by $62.96 due to the two percentage point FICA payroll tax cut that was part of the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010. The result is shown as the green series in Figure 6.

The overall net monthly safety net benefit series averages $1,597 during fiscal year 2007, and is about $300 per month greater during fiscal year 2010 and much of fiscal year 2009. The net benefit averaged $1,764 during 2011, but is expected to return to $1,822 when the payroll tax cut expires (and assume none of the safety net expansion is reversed in the meantime). Of course, increases in the amount of time that people could receive unemployment benefits contribute to the increase in the overall net monthly safety net benefit series since 2007, but Appendix 2 shows that the contribution of benefit durations is well less than half of the overall change. In this regard, we cannot have an accurate assessment of the role of fiscal policy

changes in the labor market or in the distribution of resources on the basis of means if we limit our attention to the duration of unemployment benefits.

A key indicator of the employment incentive effects of means-tested subsidies is the replacement rate: the fraction of productivity that the average non-employed person receives in the form of means-tested benefits.[43] Another indicator is the self-reliance rate – the fraction of lost productivity not replaced by means-tested benefits – and is merely one minus the replacement rate. The larger is the self-reliance rate, the more that a household has to rely on its own earnings rather than subsidies in order to maintain its living standard. If none of the means-tested subsidies and discharges went to any household whose head (and, if present, spouse) was continuously employed, then Figure 6 can be used to measure the replacement rate by dividing the dollar amounts in the figure by the amount of production lost from the median head or spouse missing work for a month. Under the assumption that productivity is lost at the rate of $3,885 per month, the right scale in Figure 6 shows the replacement rate.[44] Before the recession began Figure 6's measure of the self-reliance rate was about 59 percent, but by the second half of 2009 it had fallen about 8 percentage points. By any standard, that's a large and sudden change in the self-reliance rate and thereby a large and sudden change in the incentives to work.

My findings of high replacement rates and low self-reliance rates during the recession are not surprising when benefit expansions since 2007 are put in the context of some of the previous literature on anti-poverty programs. Holt and Romich (2007) look at self-reliance rates from tax and subsidy programs in the year 2000 and find them to be about 50 percent, and potentially much smaller if program participation rates had been greater, as they were since 2007. It is well-known that a large number of households saw their market-incomes fall below the poverty line since 2007, but Sherman (2011, Figure 2) shows that only 0.6 percent of the population saw their living standards fall below the poverty line between 2007 and 2010, thanks to expansions in means-tested subsidy programs. For every 42 people whose market income declines would have put them in poverty, government assistance pulled 36 back out. Roughly speaking, Sherman's

[43] Sometimes the replacement rate is defined with respect to lost earnings rather than lost productivity, with the difference being the gap between earnings and productivity due to employer taxes and other employer-side labor market distortions. I use productivity in order to be consistent with aggregate productivity calculations.

[44] The median earnings of non-elderly heads and spouses was $727 per week, or $3,148 per month. $3,885 is the result of scaling up monthly earnings by the national accounts ratio of aggregate employee compensation to wages paid, in order to have an estimate of median labor productivity comparable to what would be used for aggregate analysis.

results suggest that the government absorbed six-sevenths of market income declines, at least for households with income in the neighborhood of the poverty line. That is a low self-reliance rate.

Once we recognize the amount of new safety net legislation that relaxed eligibility requirements, increased benefits, or both, it is no surprise that replacement rates increased significantly. The hypothetical households shown in Table 6 illustrate that a larger benefit became available for a variety of household circumstances because of changes in program rules. Just as important, the rule changes are obvious in safety net program spending, which has increased a faster rate than the population that was once considered eligible (see Table 4 for UI and SNAP, and Appendix 2 for all safety net programs).

I have not quantified several other areas of expanding means-tested benefits such as student loan discharges, forgiveness of income tax debts, and tax credits targeted to low income households that presumably reduced self-reliance rates still further during the recession.[45] Moreover, some of the credit market discrimination may have served to reduce replacement rates before the recession began – creditors rewarded high income prior to the recession by extending more credit and rewarded low income during the recession by extending more forgiveness. The fact that I omitted the former effect means I underestimated self-reliance rate declines. This paper does not consider the safety net for businesses, especially financial businesses (Morgenson 2011).

Aggregate Replacement Rates and Aggregate Distortions

The decline in self-reliance rates is, by definition, a decline in the rewards to time and effort that raise market incomes. In theory, at least some people respond by doing less toward earning their own market income. As people work fewer hours, and fewer businesses attempt to expand, output will be lower, and output per hour will be greater. In other words, as safety net rules changed to reduce self-reliance rates, economic theory predicts that the gap between productivity and consumers' marginal rate of substitution (MRS) would widen, as would the gap

[45] On targeted tax credits, see Sherman (2011). Melvin (2009) explains how "IRS agents were given more flexibility in their collection actions, including the ability to reduce or suspend monthly payments on back taxes so those *hit hard by the financial downturn* are not forced to default on their tax payments" (emphasis added).

between hourly employee compensation and the MRS. Moreover, the theory says that, holding constant employer-side distortions, the magnitudes of the two changes (self-reliance rates and gap) are identical. With Figure 4 measuring changes in the self-reliance rate, and Mulligan (2011b) measuring the gap between productivity and MRS (conditional on a particular model of the MRS function), we are now in a position to begin to evaluate the theory.

Figure 7 graphs the productivity-based distortion series from Mulligan (2011b) (red) together with (minus one times) log changes in the self-reliance rate implied by safety net statutes since 2007-Q4 (green). The green series tends to increase over time because safety net benefit rules change in the direction of increasing replacement rates and reducing self-reliance rates. Assuming that Mulligan (2011b) used the correct marginal rate of substitution function, that employer-side distortions were constant, and all of the measurements were exactly correct, the theory says that the red and green series should be identical. Note that the two series are based on very different data sources – the former comes from data on aggregate consumption and productivity while the latter comes largely from changes in government benefit rules – which means the two series are not automatically equal. Nevertheless, the two series follow each other closely. They both increase about 0.07 or 0.08 during the first five quarters of the recession. The total increase through the end of 2009 was 0.15 for the log self-reliance rate and 0.17 for the productivity-based distortion. By the end of 2010, the gap between the red and green is about 0.07.

Most of the taxes and safety net programs included in the green series create employee-side distortions rather than employer-side distortions, and all of the measured program changes change employee-side distortions. If all of the measurements were correct, and employer-side distortions possibly changed over time, then the theory says that the green series would follow a wage-based measure of the distortion at least as well as it follows the productivity-based measure shown in red. A waged based measure is shown as a blue series in Figure 7. It follows the self-reliance rate series closely through early 2010. By the end of 2010, the safety net series is closer to the wage-based series than the productivity-based series.

Reasonable alternative measures of either distortions or safety net self-reliance rates could introduce more gaps between the two types of measures than are shown in Figure 7.[46] But a couple of lessons derive from even a rough agreement between distortions and safety net self-reliance rates. First, the safety net expanded, and then stabilized at a more generous level, at about exactly the times that employment rates dropped, and then stabilized at a lower level. Second, the amount of the safety net expansion was large, and possibly large enough to cause a significant part of the employment drop. Both of these lessons are consistent with the reasonable ideas that the recession motivated at least some of the safety net expansions, and that the entire recession cannot be attributed to expansions in the safety net.

[46] So far I have omitted employer-side labor distortions that, as noted in Mulligan (2011b), probably changed since 2007. Changes in these distortions would tend to change Figure 3.5's red series, without changing the green one.

Table 1. Number and Characteristics of Household Heads, Spouses

	Employed			Not Employed		
	2007	2009	chg	2007	2009	chg
	Millions					
Married male	42.6	40.2	-6%	6.3	8.1	28%
Married female	33.6	32.9	-2%	16.4	16.8	3%
Unmarried male	16.0	15.0	-6%	4.1	5.6	36%
Unmarried female	18.5	17.5	-6%	6.7	7.7	15%
Total	110.8	105.6	-5%	33.5	38.2	14%
	Among the Employed					
Weekly hours, average	40.5	39.2	-3%			
Weekly earnings, average, 2007$	846	853	1%			
Weekly earnings, median, 2007$	692	696	1%			
Weekly earnings, 1st quartile, 2007$	438	435	-1%			
Under-employment rate	0	0.030				

Persons under age 65 only. Employment, hours, and earnings refer to the survey reference week. Hours are measured only for persons at work.
Among the employed, the underemployment rate is one minus the ratio of average hours to average hours in 2007. Because 2009 employment was 105.6 million, the absolute amount of underemployment was 3.2 million among the employed.

Table 2. Means-tested Public Subsidies Found in the Personal Income Accounts, 2009

Program	Inclusion Factor[a]	Percentage of Total[b]
Federal		
Unemployment Insurance	0.97	30%
Supplemental Nutrition Assistance Program	0.93	12%
Supplemental Security Income	0.88	9%
State and Local		
Medicaid	0.40	35%
Family Assistance	0.93	5%
Supplemental Security Income	0.88	1%
General Assistance	0.93	3%
Energy Assistance	0.93	1%
Other[c]	0.93	4%

NOTES:

[a]Inclusion factor is an estimate of the fraction of program spending on non-elderly persons. For Medicaid, it is multiplied by an estimate of the relative value of in-kind versus cash subsidies (0.5).

[b]Percentage of total is proportional to a program's transfer amount times its inclusion factor; percentages sum to 100 across programs.

[c]Other consists of expenditures for food under the supplemental program for women, infants, and children; foster care; adoption assistance; and payments to nonprofit welfare institutions.

Table 3. Major Government Benefit Rule Changes Since 2007

Eligibility	Benefit Amounts
Unemployment Insurance and related	
automatic extended benefit trigger add 13 weeks of eligibility Jul 2008 - indefinite	*American Reinvestment & Recovery Act* exempt $2400 UI from 2009 federal inc. tax Apr 2009 - Dec 2009
Supplemental Appropriations Act of 2008 add 13 weeks of eligibility Jul 2008 - indefinite	*American Reinvestment & Recovery Act* cover 65% of COBRA expense after layoff Apr 2009 - May 2010
Unemp. Comp. Extension Act of 2008 add 20 weeks of eligibility Dec 2008 - indefinite	*American Reinvestment & Recovery Act* $25 weekly bonus Apr 2009 - Jul 2010
American Reinvestment & Recovery Act reward states for modernizing eligibility Apr 2009 - indefinite	*American Reinvestment & Recovery Act* eliminate extended benefit experience rating Apr 2009 - indefinite
Worker, Homeownership, & Business Assistance Act of 2009 add 20 weeks of eligibility Dec 2009 - indefinite	
SNAP	
Farm Bill of 2002 begin diffusion of Broad-Based Categorical Eligibility median implementation in October 2008	*Farm Bill of 2008* increase maximum benefit; exclude more income from benefit formula Oct 2008 - indefinite
Farm Bill of 2008 relax asset test Oct 2008 - indefinite	*American Reinvestment & Recovery Act* increase max. benefit; more inc. excluded Apr 2009 - Nov 2013
American Reinvestment & Recovery Act grant states relief from work requirement Apr 2009 - Oct 2010	
Medicaid	
Patient Protection and Affordable Care Act of 2010 admit able-bodied adults up to 133% FPG Jan 2014 - indefinite	

Table 4. UI and SNAP Spending Growth Attributable to Benefit Rule Changes

	2007 $ per capita			changes from 2007	
	2007	2009	2010	2009	2010
Unemployment Insurance					
actual spending, all programs[a]	109	411	427	279%	293%
regular state programs only	109	251	180	131%	66%
regular state programs, adj. for ARRA eligibility[b]	109	242	172	123%	59%
regular state programs, adj. for ARRA eligibility and $25 weekly benefit increase	109	227	163	109%	50%
Food Stamps/SNAP					
actual spending[a]	102	173	205	68%	100%
under 2007 eligibility rules[c]	102	153	165	50%	61%
under 2007 eligibility rules, and constant real benefits rules[d]	102	123	130	21%	27%
Addendum: per capita persons in poverty[e]	0.173	0.189	0.201	9%	16%
UI and SNAP combined					
actual spending[a]	211	584	632	177%	199%
under 2007 eligibility and benefit rules	211	404	345	92%	64%

NOTES:

[a]Actual spending amounts from the personal income accounts, and thereby exclude program administrative costs.

[b]Adjusts for changes in the "alternative benefit period" component of the statutory UI eligibility index.

[c]Adjusts for changes in the statutory SNAP eligibility index.

[d]Adjusts for changes in the product of the statutory SNAP eligibility index and real benefit index.

[e]Fraction of persons below 125 percent of the poverty level from U.S. Census Bureau's American Community Survey.

Table 5. Government Safety Net Program Weights
for household heads and spouses

	Labor Force Status			
	Unemployed	Out of the Labor Force	Employed with Reduced Hours	Average Marginal Worker
UI sometime during spell	0.63	0	0	0.36
SNAP	0.57	0.42	0.57	0.55
Medicaid	0.47	0.47	0.47	0.47
all other government safety net	0.37	1.00	0.37	0.43
Demographic weights	0.58	0.09	0.33	

Note: Demographic weights are used to define the average marginal worker. Program weights are used to aggregate program-specific statutory generosity measures. Medicaid weight reflects a 50 percent discount factor for in-kind benefits

Table 6. Changes in Safety Net Generosity for Hypothetical Households with Four Members

	monthly amounts, levels					
Household Characteristics	HH A	HH B	HH C	HH D	HH E	HH F
months of unemployment so far	4	9	4	9	4	9
real spousal income	2,500	2,500	0	0	0	0
passes 2007 SNAP asset test?	1	1	1	1	0	0
2009-Q4 Benefit Generosity Relative to inflation-adjusted 2007-Q4 Benefit Rules, when Primary Earner not Earning						
	monthly amounts, policy impact					
Unemployment insurance	108	1,300	108	1,300	108	1,300
SNAP	0	0	108	108	401	401
Medicaid	0	0	0	0	0	0
COBRA subsidy	706	706	0	0	706	706
Payroll Tax savings	0	0	0	0	0	0
Federal Income Tax savings	33	-217	33	-217	33	-217
All provisions combined	824	1,789	227	1,191	1,225	2,190

Assumptions: Each hypothetical household participates in the above programs whenever eligible. Each has a 21% marginal federal income tax rate. The primary earner's weekly UI benefit (before exhaustion) is $275, plus the ARRA's federal additional compensation. Household does not use secondary earner's health insurance. Household lives in a state that began conferring broad-based categorical eligibililty, without an asset test, sometime between 2007-Q4 and 2009-Q4. Health insurance costs $13,027 per year. The Medicaid asset test is the same as the 2007-Q4 SNAP asset test. Monthly deductions for SNAP purposes are $410 plus 20 percent of spousal earnings.

Table 7. Home Mortgage Interest Payment Forgiveness for A Hypothetical Dual-Earner Household

Household Characteristics	UI Eligible	UI Ineligible
monthly earnings when working	3,148	3,148
monthly UI when not working	1,574	0
spousal earnings	3,148	3,148
DTI when working	31%	31%
Modification Characteristics if one earner was unemployed		
DTI when not working, unmodified	41%	62%
Monthly modification that hits DTI = 31%	488	976
LTV needed to pass NPV test	1.13	1.29

Assumptions: Insurance and real estate taxes are 20 percent of overall (unmodified) housing expenses. The annual interest rate is 7 percent. Unemployment occurs, if at all, for the full year that income is examined for the purposes of modification.
DTI = debt-to-income ratio
LTV = loan-to-value ratio
NPV test = modification must be at least as profitable as foreclosure.

Table 8. Self-Reliance Rate Changes: Sensitivity Analysis

	Log Changes from 2007-Q4		
	2008-Q4	2009-Q4	2010-Q4
Benchmark	-0.06	-0.17	-0.11
Replacement rate level			
+ 5 pct points	-0.07	-0.19	-0.12
- 5 pct points	-0.05	-0.15	-0.10
COBRA incidence among the unemployed[a]			
+ 5 pct points	-0.06	-0.18	-0.11
- 5 pct points	-0.06	-0.16	-0.11
Unemployment Insurance layoff tax			
subtract half of the tax from UI benefits	-0.06	-0.16	-0.11
subtract all of the tax from UI benefits	-0.06	-0.15	-0.10
Debt forgiveness components			
set both benefit indices to zero	-0.05	-0.15	-0.10
double mortgage modification	-0.07	-0.18	-0.12
SNAP			
log BBCE factor set to 0.3	-0.06	-0.17	-0.12
log BBCE factor set to 0.1	-0.06	-0.16	-0.11
all rules frozen at FY2007[b]	-0.05	-0.14	-0.08
Labor force weights			
move 10 pct points from UE to OLF	-0.05	-0.14	-0.10
move 10 pct points from UE to under-	-0.05	-0.14	-0.10
Unemployment Insurance duration alone[c]			
actual duration schedule	-0.04	-0.06	-0.06
duration limited to 52 weeks	-0.04	-0.04	-0.04

Notes

[a]Benchmark incidence is 0.2.

[b]The SNAP eligibility and real benefit indices are held constant at their 2007-Q4 values.

[c]All other eligibility indices and real benefit indices, including those for COBRA and federal additional compensation, are held constant at their 2007-Q4 values.

Figure 1. UI and SNAP Recipiency Rates since 2007

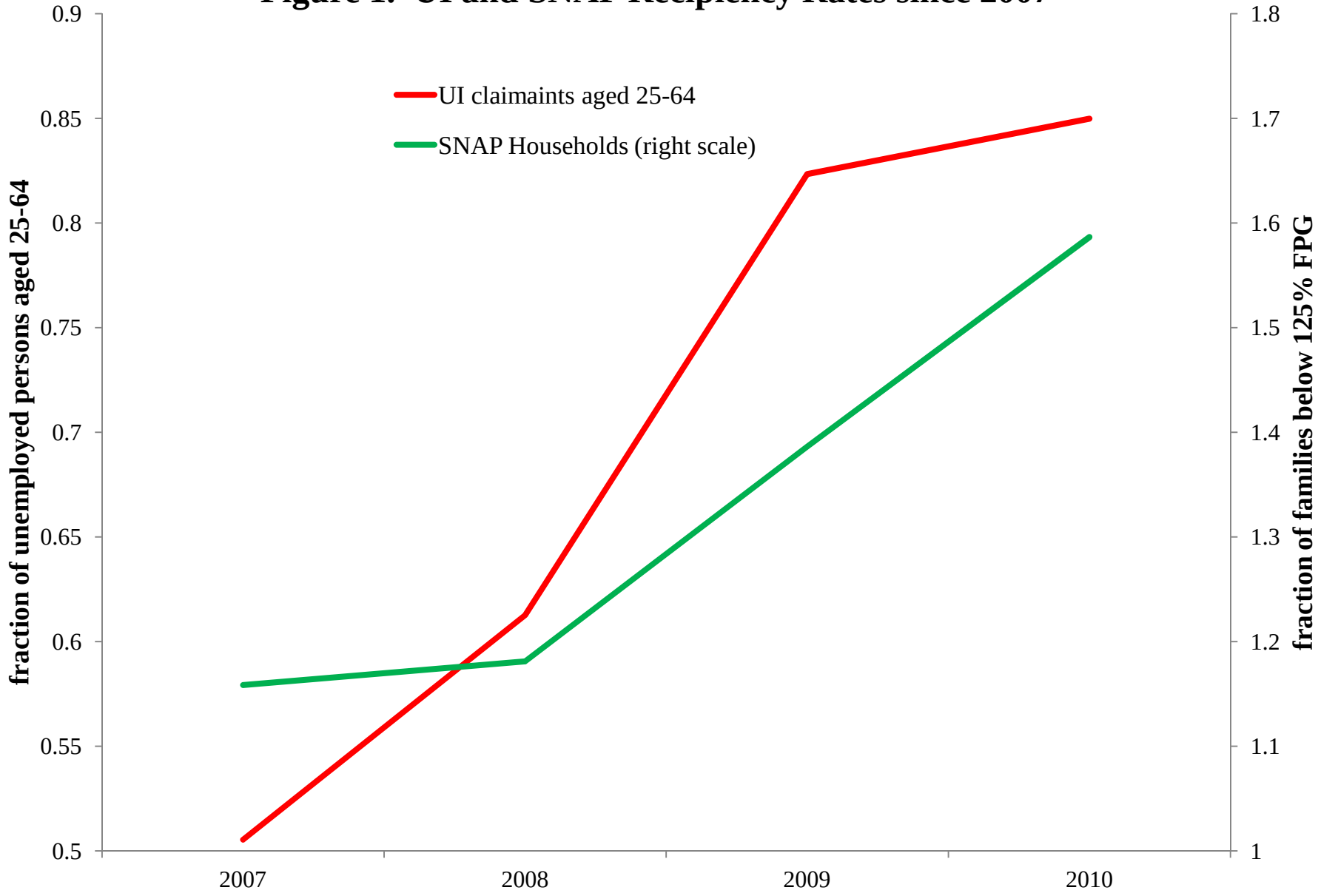


Figure 2. Statutory Changes in Safety Net Eligibility

non-elderly household heads and spouses

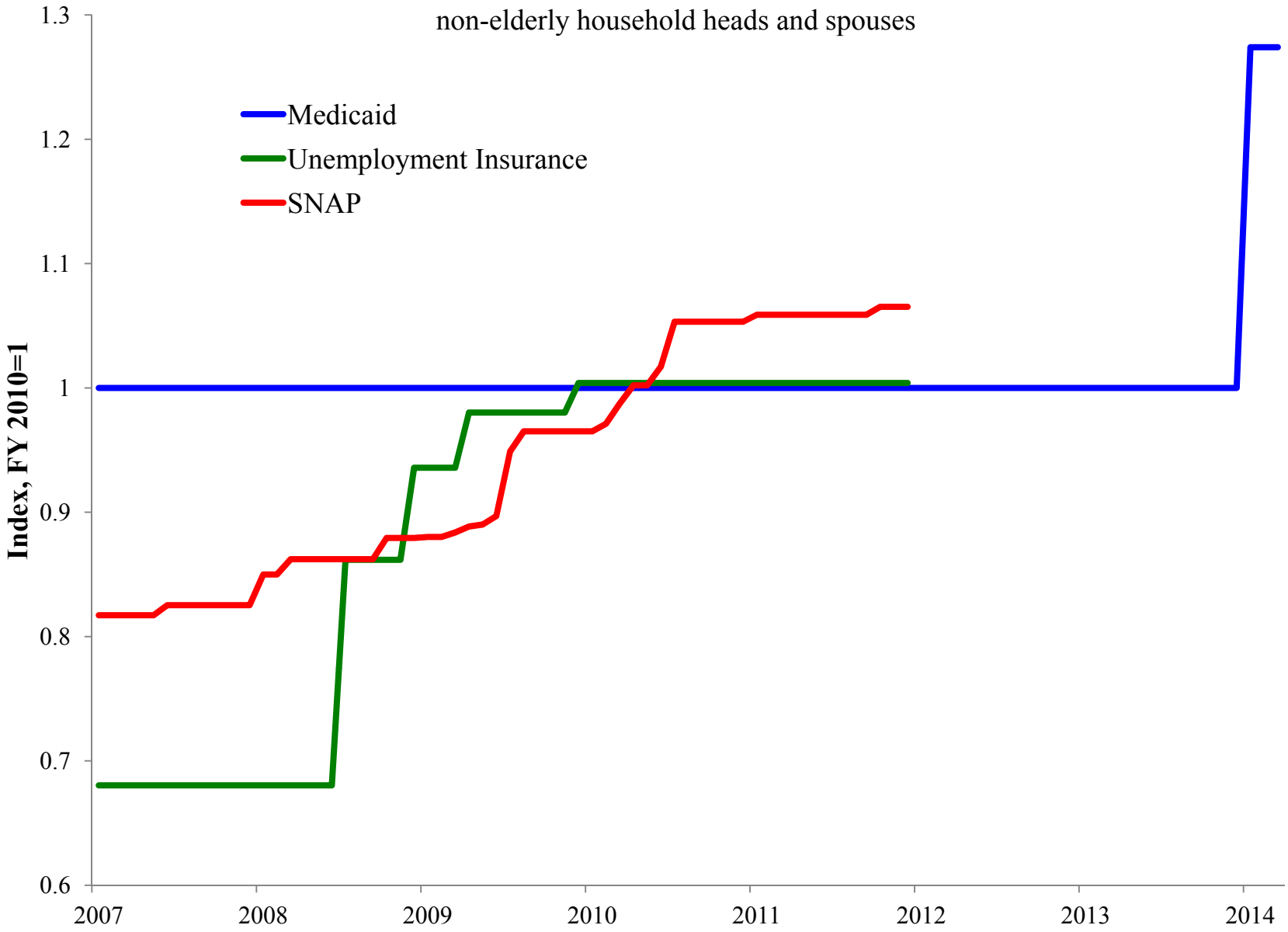


Figure 3. Statutory Safety Net Benefits per Non-elderly Participant

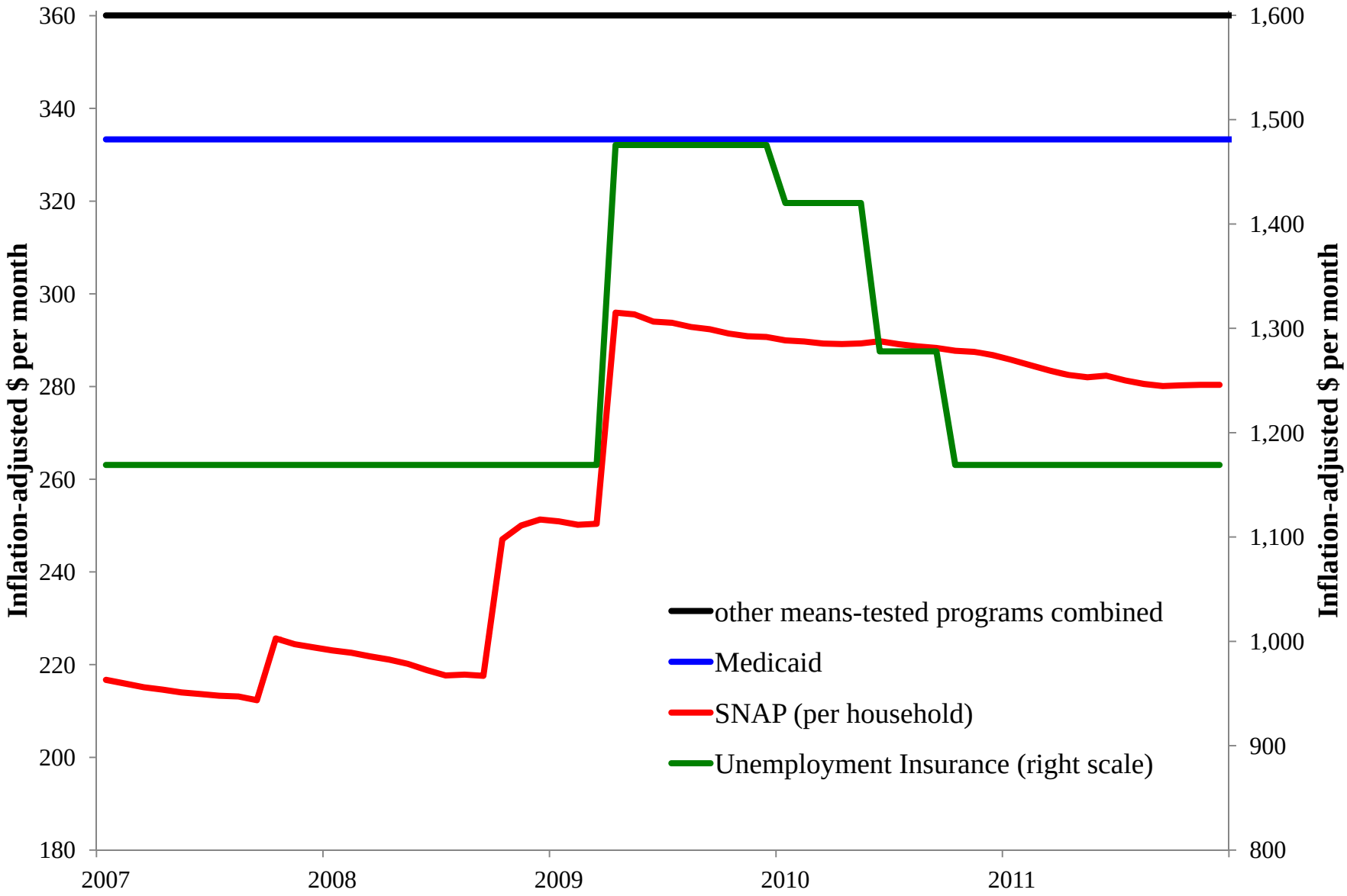


Figure 4. Statutory Government Safety Net Generosity

for non-elderly household heads and spouses, by labor force status

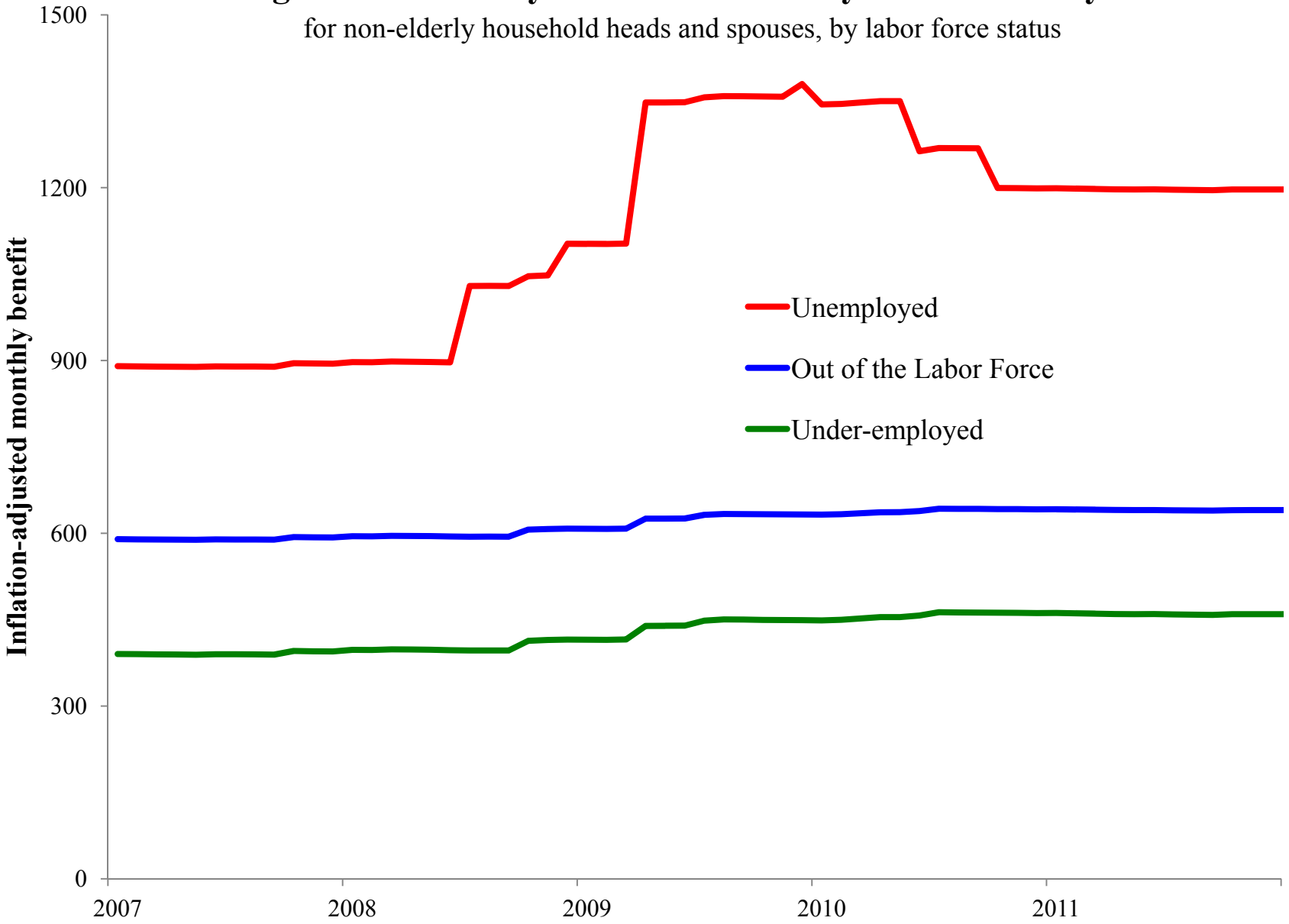


Figure 5. Eligibility Index for Mortgage Modifications

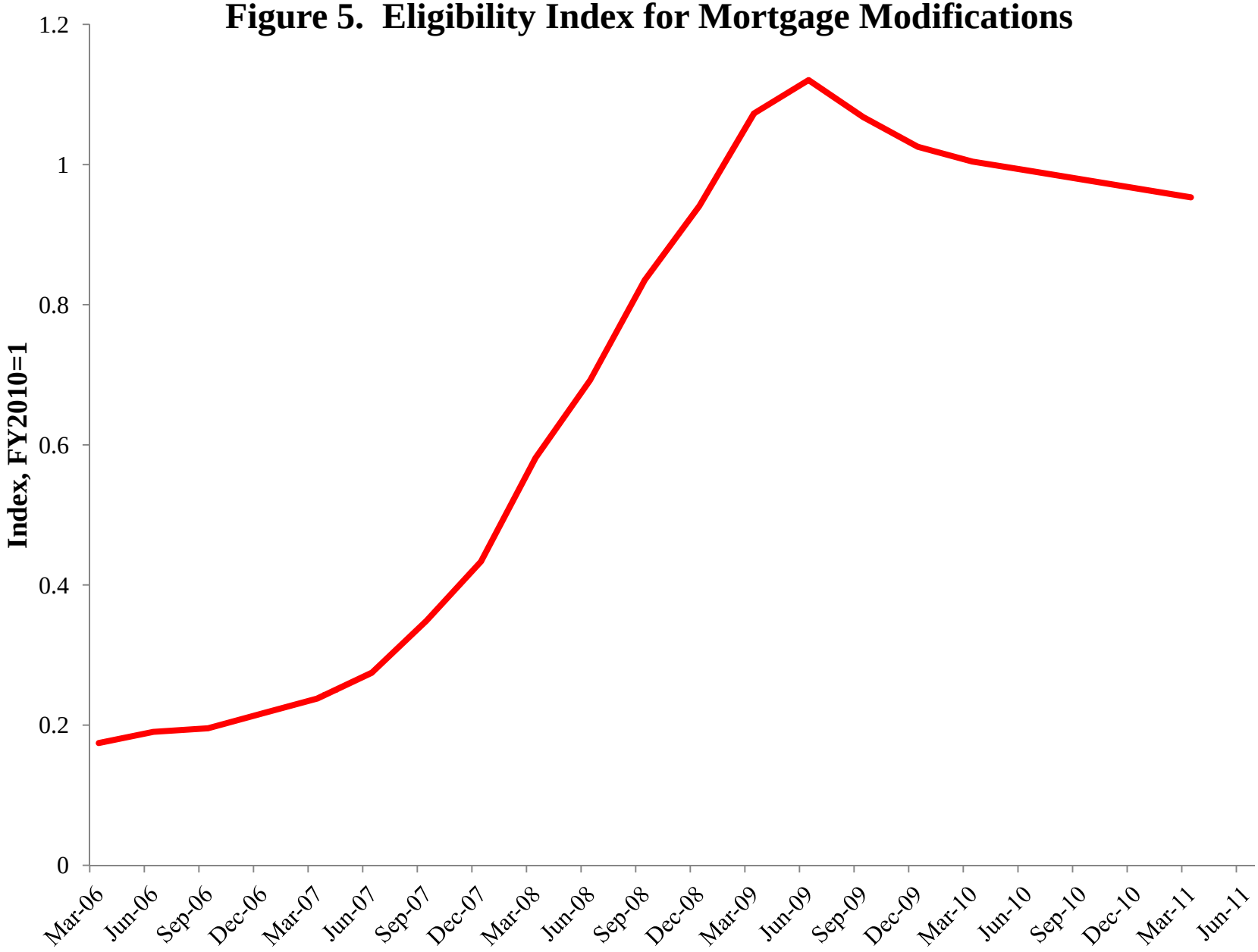


Figure 6. Statutory Safety Net Generosity

for non-elderly heads or spouses

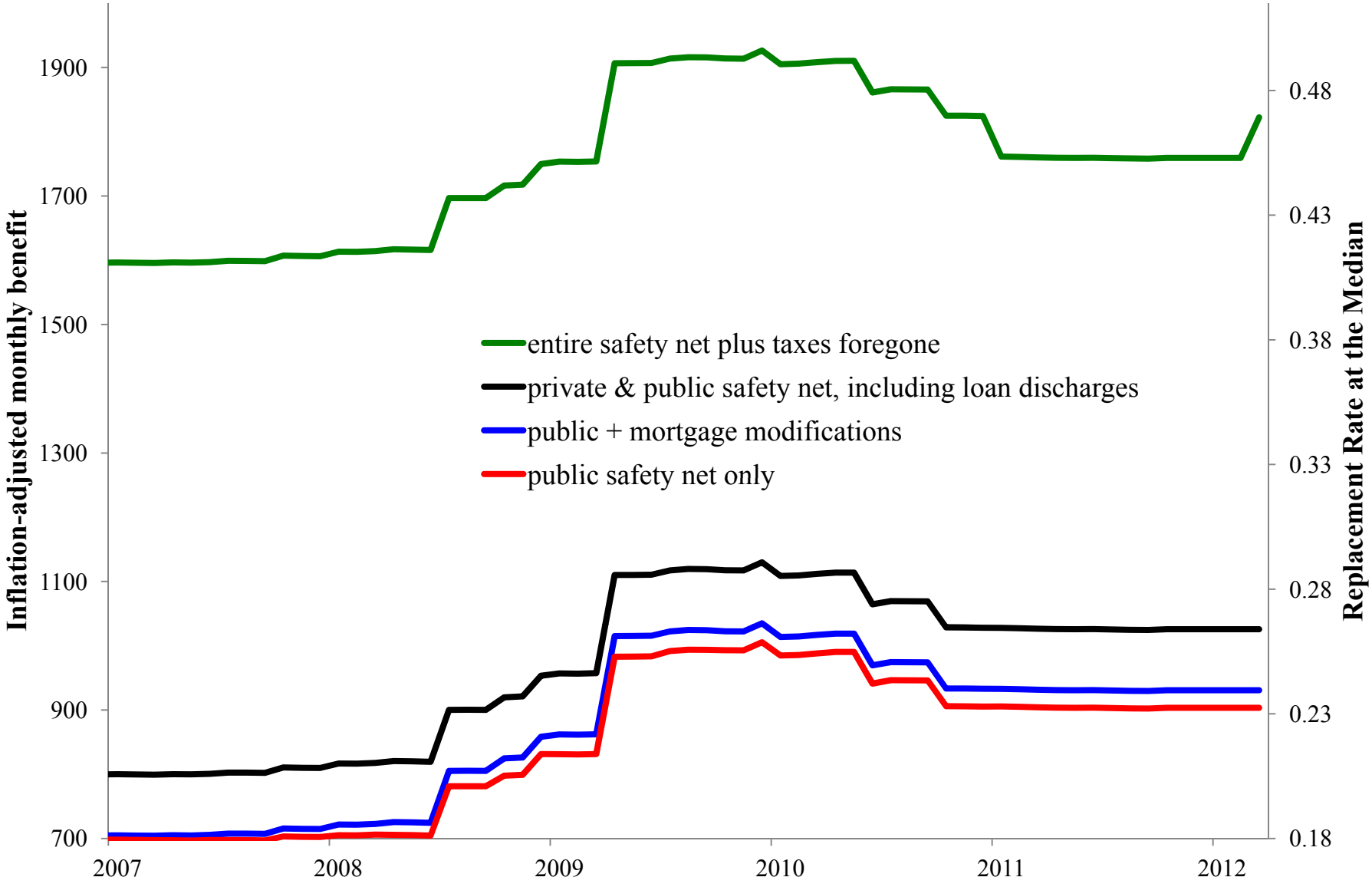


Figure 7. Labor Market Distortions Measured from Productivity, Wages, and Safety Net Statutes

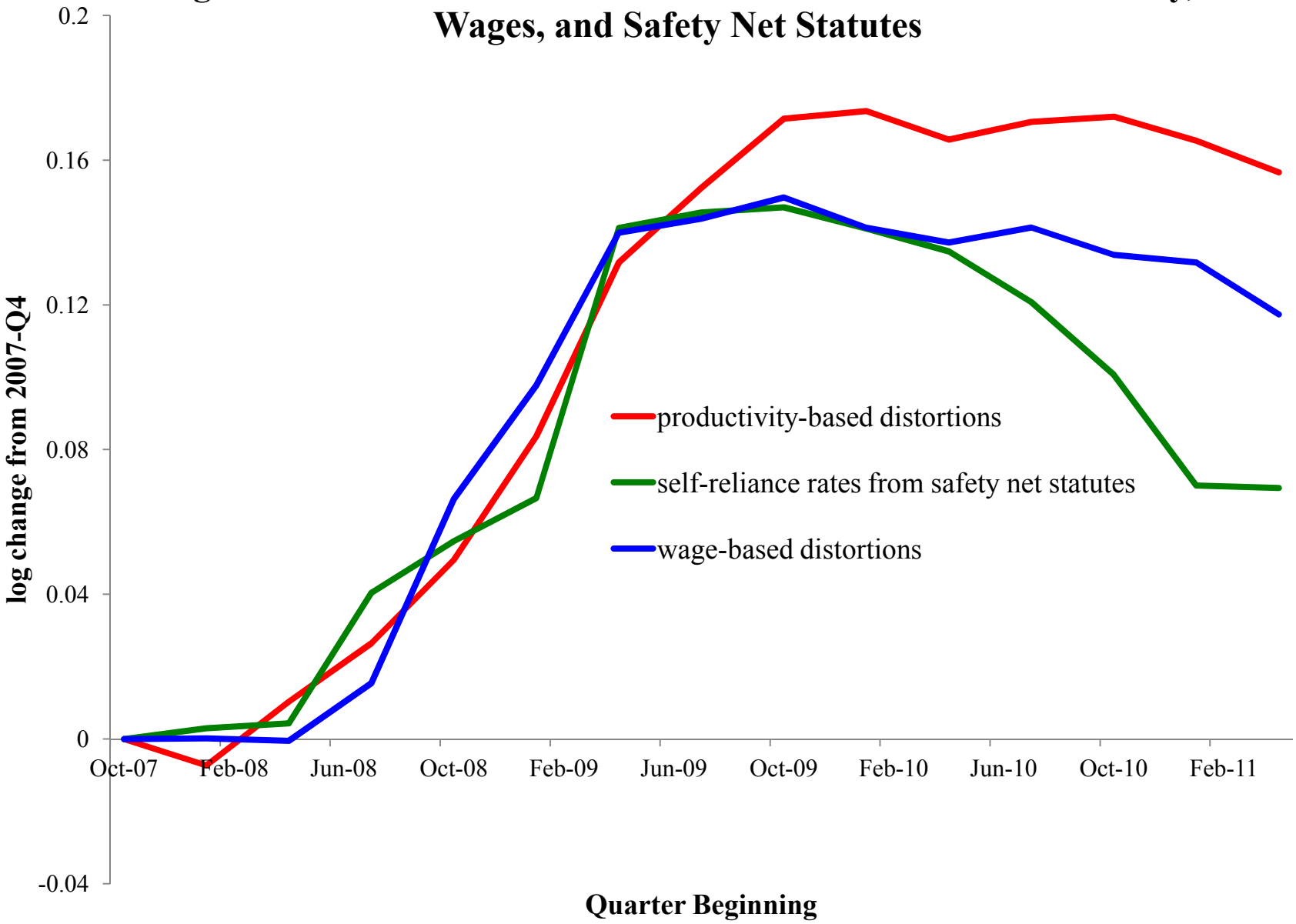
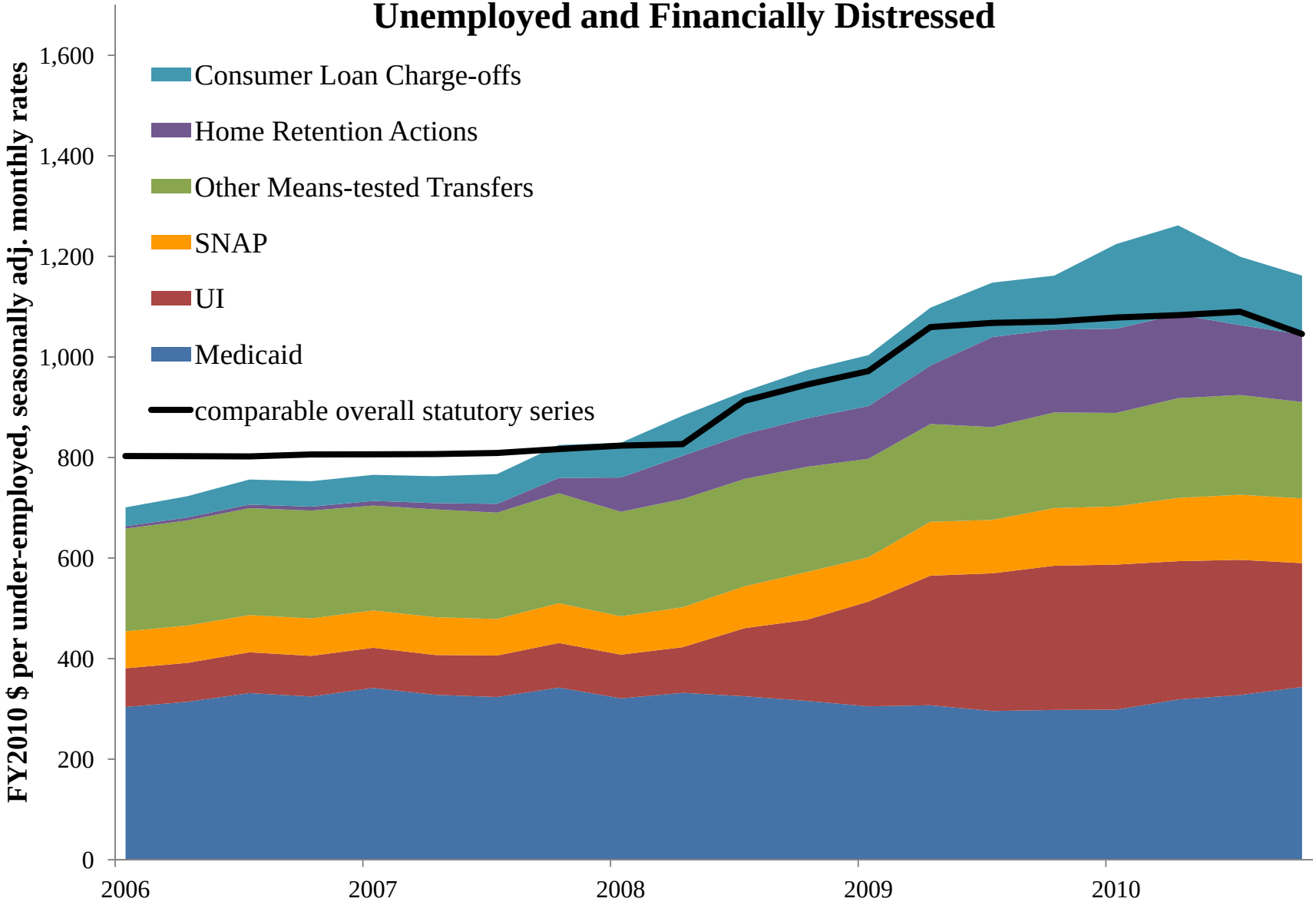


Figure 8. Transfers and Loan Discharges for the Non-elderly Unemployed and Financially Distressed



[Appendices available on request]

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