Does Labor Supply Matter During a Recession? Evidence from the Seasonal Cycle*

by Casey B. Mulligan

University of Chicago

October 2010

Abstract

Every year has large demand and supply shifts associated with the seasons, regardless of the phase of the business cycle. The seasonal shifts since the 1940s are inconsistent with the hypotheses that demand shifts affect employment outcomes significantly more in recession years than in non-recession years, and that supply shifts matter significantly less (if at all) in the recession years. The results are consistent with the hypothesis that recessions are characterized by labor market distortions that are neither alleviated by additional labor demand nor exacerbated by additional labor supply.

* I appreciate comments by Gary Becker, Gauti Eggertsson, Jeff Miron, Kevin Murphy, and a number of University of Chicago students. I will provide updates on this work on my blog www.panic2008.net.

During the recession of 2008-9, the federal government took a number of steps to help citizens and the economy, including expansion of food stamps and unemployment insurance, helping financially distressed homeowners refinance their mortgages, and offering tax credits to poor and middle class persons buying homes. The stimulus potential from these and other programs is said to derive from their redistribution of resources to persons with a high propensity to spend, but the same programs also implicitly raise marginal income tax rates because eligibility for them falls with the potential recipient's income.[2]

High marginal income tax rates by themselves "normally" reduce economic activity to some degree, rather than increase it, although there is plenty of room to debate the magnitude of incentive effects. For the same reason, social safety net programs are not expected to increase employment in the long run. But a number of economists believe that recessions are those rare instances when labor supply does not matter, and might even affect the aggregates in the opposite direction as usual (Eggertsson, 2010a). Thus, it is possible that government spending programs like unemployment insurance could stimulate economic activity during a recession, even while they eroded labor supply incentives, and even while those programs had very different effects in non-recession years.

The hypothesis that, as compared to non-recession years, demand matters more and supply matters less for determining aggregate employment and output at the margin in a recession is also the intellectual basis for Keynesian models of the business cycle (Eggertsson, 2010b, p. 2). Yet this hypothesis has not been the subject of much empirical

[2] Topel and Welch (1980), Mulligan (2009).

testing,[3] even though it is logically possible that supply matters at the margin just as much during times of severe labor market distortions as it does "normally." The purpose of this paper is to examine the seasonals in the monthly U.S. data dating back to the 1940s to attempt to measure the degree to which labor supply and demand differentially affect employment and unemployment during recession periods than during non-recession periods.

The seasonal cycle has several analytical advantages. As Jeffrey Miron (1996, p. 17) explains, "The seasonal fluctuations are so large and regular that the timing of the peak or trough for any year is rarely affected by the phase of the business cycle in which that year happens to fall." For example, Barksy and Miron (1989, Table 2) found that GNP falls 8 percent more than normal from Q4 to Q1. In a $14 trillion/year ($3.5 trillion/quarter) economy: that's a sudden reduction of $280 billion, which is a larger change than even the largest *year*-to-*year* change in government spending created by the American Recovery and Reinvestment Act of 2009 (Congressional Budget Office, 2009, Table 2), and larger than other peacetime government spending shocks (Alesina and Ardagna, 2009; Auerbach and Gorodnichenko, 2010; Barro and Redlick, 2009).

Many economic fluctuations are not easily partitioned into "demand" or "supply," but the seasonal cycle features an obvious demand change – Christmas – and an obvious supply change – the availability of teenagers for work during the summer.[4] Moreover, these two seasonal impulses (measured as percentage changes from the previous and subsequent seasons – more on this below) react little to the business cycle, and thus provide the opportunity to measure different effects between recessions and non-recessions of a similar impulse. Finally, the seasonal cycles have occurred many times: there have been 12 summers and 12 Christmas' during U.S. recessions since 1948. Even during the present recession – arguably different from many of the previous ones –

[3] Jurajda and Tannery (2003) find that unemployment insurance affects individual behavior to about the same degree in depressed localities as in less depressed ones, but it is possible that individuals who remain unemployed as the result of unemployed insurance are replaced by other workers differently in recessions than in non-recession years (i.e., labor supply may shift the same in recessions and nonrecessions, but the aggregate employment impact is different). A couple of papers (Auerbach and Gorodnichenko, 2010; Barro and Redlick, 2009) have examined whether fiscal policy multipliers are greater during recessions, which are indirectly tests of whether labor demand matters more during recessions (Mulligan, 2010).

[4] See also (Miron 1996, p. 9) and the labor market indicators shown in my Appendix II.

Christmas and summer each occurred at least twice (depending on when the recession is deemed to have ended).

Previous work on the seasonal cycle has featured quarterly data, which had the advantage that the Bureau of Economic Analysis used to report seasonally unadjusted quarterly national accounts. However, unlike the labor market series used in this paper for which the raw data are seasonally unadjusted, much of the national accounts are built from seasonally adjusted inputs, and seasonally "unadjusted" national account series were obtained by attempting to remove the seasonally adjustments that had been implicitly introduced via the ingredients.[5] More important, the supply and demand shifts of interest here do not coincide exactly with calendar quarters. The seasonal labor supply surge is seen already in June, which is part of the second quarter, and concludes in September, which is at the end of the third quarter. Obviously, Christmas is in December, and some of its activity spills into November, both of which are part of the fourth quarter, but the monthly data permit me to use October as a benchmark for Christmas, rather than the third quarter which would differ from the fourth not only in terms of Christmas demand but also in terms of summer labor supply.

Section I takes for granted that recessions are appropriately characterized as times of severe labor market malfunctions, and briefly shows that a couple of familiar theories predict that labor demand matters significantly more at the margin, and labor supply matters significantly less, during recessions than during non-recession years. However, other theories of labor market distortions predict that the incidence of supply and demand shifts would be no different during recessions than they would be during non-recessions, and predict that income redistribution causes greater deadweight loss in recessions, so it is important to answer these incidence questions with empirical evidence.

Section II presents the evidence on summer seasonals. I find that the summer seasonals for teen employment, teen unemployment and total employment are large and in the direction to be expected if labor supply had shifted significantly more than labor demand. However, the seasonal cycles for recessions and non-recessions are not significantly different from each other.

---

[5] In other words, seasonally unadjusted national accounts series are more accurately described as "twice adjusted," rather than unadjusted.

Section III presents the evidence on Christmas seasonals, which seem to be essentially the same in recession years as in non-recession years. Section IV concludes. Two appendices examine seasonality in the matching framework, and present further evidence that the summer seasonal is dominated by supply.

I. Economic Theories of Unemployment Differ in Terms of the Incidence of Supply and Demand Shocks

The hypothesis that recession employment is less than optimal, and that people cannot find work at the going wage, is quite different from the hypothesis that supply has little marginal effect on aggregate employment during a recession. A couple of brief examples show that, as a matter of economic theory, employment during a recession could be either be more, less, or equally sensitive to supply and demand shocks than it would be at times when employment is better characterized as efficient.

I.A. Job Shortages and Non-wage Allocation Mechanisms

One partial equilibrium "job shortage" perspective on the labor market is that real wages rates have a floor – perhaps due to minimum wage laws, unions, or nominal rigidities – that is typically below the market clearing wage during non-recession periods, but above it during a recession. Moreover, employment is supposed to be determined only by demand during a recession, but by the combination of supply and demand during non-recession periods.[6] For example, a cut in marginal income tax rates during a recession would increase labor supply, but that would only add to the excess labor rather than adding to actual employment. On the other hand, a labor demand shift during a recession would affect labor usage one-for-one without being even partially crowded out by higher factor rental rates.

Admittedly, the "job shortage" view is over-simplified because wage rates are not the only mechanism to help clear the labor market. Suppose, for example, that labor unions set a floor on wages with the objective of maximizing labor's surplus. There would be unemployment in the sense that workers would have an individual incentive, but no opportunity, to work more at the wage floor, but nevertheless the wage floor

[6] See also Barro and Grossman (1971).

would adjust according to supply and demand conditions. In fact, if the wage elasticity of labor demand were constant, the union wage markup would be a constant proportion of the marginal worker's reservation wage and the sensitivity of employment to supply and demand parameters would be the same as it would be in a competitive labor market, even while the total amount of employment was less than the competitive level. With alternative limits on union power, workers' reservation wages could even be "over-shifted," so that the employment in the distorted market would be more sensitive to supply than it would be in a competitive market (Sumner, 1981).

The contrast between the job shortage view and non-wage labor allocation models can also be illustrated in a simple representative consumer model of labor supply and working conditions. Let C denote the amount of consumption and N the number of persons employed. The representative consumer has utility $U(C,\eta N/X^{\lambda})$ where X denotes working conditions, N/X^{λ} denotes effective units of leisure foregone, and the constants $\eta > 0$ and $\lambda \in (0,1)$ are preference parameters.[7] X is in units of foregone output, and represents employer actions that reduce the disutility of work. Examples include flexible scheduling, effort requirements, workplace climate control, child care, etc., but it is important for the theory that employers have a comparative advantage in providing these items so that their adjustment might help to allocate labor.

The efficient working conditions are proportional to the marginal product of labor Y, with proportionality factor $\lambda/(1+\lambda)$. Now consider a fixed floor on the cash wage W received by employees that is binding in the sense that $W > Y/(1+\lambda)$ and employees are prohibited from bribing employers for better working conditions. Then both $X = Y - W$ and employment are less than efficient. The wage floor equilibrium has unemployment in the sense that there exist persons having all three of the following characteristics: (a) are not working, (b) would, as compared to not working, rather have the type of job ($X = \lambda Y/(1+\lambda)$) that would exist absent the wage floor, and (c) would both be working and better off without the wage floor. Nevertheless, the marginal effects of a shift in labor supply – a marginal reduction in the parameter η – on equilibrium employment and

[7] The utility function U is assumed to have the usual curvature and normal-goods properties so that the second order conditions are satisfied and the marginal rate of substitution function U_C/U_N is increasing in consumption and decreasing in employment.

working conditions is efficient, as it would be in the absence of a wage floor, because in either case η has no effect on working conditions.[8]

These examples show that the marginal effects of labor supply on equilibrium employment may not depend on the presence or intensity of labor market distortions and therefore might not vary over the business cycle even while a recession might be well characterized as a time when employment is less than efficient.

I.B. A Matching Framework, and a General Equilibrium Effect

Search frictions can help explain why the supply of labor exceeds demand during a recession, but those frictions are still consistent with a positive effect of supply on actual employment, and with a partial crowding out of demand shifts via higher factor rental rates. Consider, for example, the Mortensen-Pissarides matching framework in which the flow of new hires in the labor market is a homogeneous function $M(U,V)$ of the number U of persons looking for a job and V the number of available positions.[9] Economists usually find that the number of new hires increases with the number of persons looking, holding available positions constant. Thus, it would not be surprising if, say, a marginal income tax rate cut increased employment by increasing the number of persons looking for a job. By the same logic, an increase in the number of available positions would increase employment less than one-for-one, even during a recession.

Nevertheless, the matching-model supply effects are smaller during a recession. First, the ratio of searchers to available positions is high during a recession, and $\partial^2 M/(\partial U \partial V)$ is expected to be positive. Second, during a recession wages may be especially unable to fall to motivate the creation of new positions. Thus, the search equilibrium view admits the possibility that a labor supply shift during a recession affects employment, but significantly less than it would outside a recession. By the same logic, an increase in the number of available positions is expected to have a greater effect on number of new hires during a recession than outside a recession, even if both effects are less than one-for-one. Appendix I derives these results, and finds that (a) the percentage

[8] Employment in this example would be more sensitive to labor demand as a consequence of the wage floor because greater demand would be associated with working conditions that are closer to efficient.

[9] To highlight the idea that wage rates might not clear the market, I follow the literature and assume that the number of available positions is given, rather than reacting to employment costs.

employment effect of a given supply shock *dU* during a recession should (in theory) be about 2/3 of what it would be in a nonrecession and (b) the percentage employment effect of a given demand shock *dV* during a recession should (in theory) be about twice of what it would be in a nonrecession. If real, these effects are large enough to be detected even with data on a few recessions.

Macroeconomists sometimes suggest that an increase in labor supply during a recession might actually *reduce* employment, even when real wages are flexible (Woodford, 2010). In that view an increase in labor supply lowers employer costs, but the lower employment costs do not motivate new hiring because employers do not have customers to purchase the additional output (and will not attract such customers by cutting their output price). At the same time, the lower wage rate affects the composition of demand, potentially reducing it. In this general equilibrium view, labor demand not only looks less elastic during a recession, but might appear to slope the "wrong way."

I.C. An Econometric Model to Nest the Supply and Demand Hypotheses

These economic hypotheses can be formally represented as a single econometric hypothesis. To see this, suppose for the moment that wages adjust to clear the labor market, with labor demand and labor supply of the forms (1) and (2), respectively:

$$\ln N_t = \alpha^D(a_t) + \gamma^D(X_t) - \beta^D(X_t)\ln w_t + \varepsilon_t^D \tag{1}$$

$$\ln N_t = \alpha^S(a_t) + \gamma^S(X_t) + \beta^S(X_t)\ln w_t + \varepsilon_t^S \tag{2}$$

where N_t is employees per person (hereafter, "labor usage") and w_t is the real wage rate in month *t*. X_t indicates the state of the business cycle (normalized so that is at its highest during recessions) at month *t* and a_t the state of the seasonal cycle (e.g., a dummy variable indicating the academic year). Seasonals, the business cycles, and month-specific shocks shift both labor supply and labor demand. The model allows for the possibility that the labor supply and demand elasticities also vary over the business cycle. The hypotheses that labor demand is less (labor supply is more) wage elastic during a recession – even if they may still have the usual sign – are represented as $\beta^{D\prime}(X) < 0$ ($\beta^{S\prime}(X) > 0$), respectively.

The reduced form for the labor market system is:

$$\ln N_t = \left\{\theta(X_t)\alpha^S(a_t) + \left[1-\theta(X_t)\right]\alpha^D(a_t)\right\} + \\ \left\{\theta(X_t)\gamma^S(X_t) + \left[1-\theta(X_t)\right]\gamma^D(X_t)\right\} + \left\{\theta(X_t)\varepsilon_t^S + \left[1-\theta(X_t)\right]\varepsilon_t^D\right\} \\ \theta(X_t) \equiv \frac{\beta^D(X_t)}{\beta^D(X_t)+\beta^S(X_t)} \tag{3}$$

$$\ln w_t = \frac{1-\theta(X_t)}{\beta^S(X_t)}\left[\alpha^D(a_t) - \alpha^S(a_t) + \gamma^D(X_t) - \gamma^S(X_t) + \varepsilon_t^D - \varepsilon_t^S\right] \tag{4}$$

θ is the familiar incidence index:[10] it depends on the relative supply and demand elasticities and shows the degree to which the amount of labor usage is affected by supply or demand at the margin. For the purposes of long run analysis, economists generally agree that labor demand is fairly elastic, but they ultimately disagree about the magnitude of the incidence parameter because estimates of the wage elasticity of aggregate labor supply vary from close to zero to greater than one. If the labor supply elasticity were zero, the incidence index would be one – the amount of labor used would depend *only* on the position of the supply curve.

The hypothesis of interest in this paper is not necessary whether the incidence index θ is close to zero or one, but whether it varies with the business cycle. The hypotheses that the labor usage effect of a labor supply shift is smaller, and the labor usage effect of a labor demand shift is greater, during a recession than outside a recession are both formally represented as $\theta'(X) < 0$.[11] It's as if workers were more elastically supplied, or less elastically demanded, during a recession.[12]

---

[10] Fullerton and Metcalf (2002).

[11] The reduced form for labor usage (3) is broken into three terms: a seasonal term, a business cycle term, and an idiosyncratic term. Note that a common practice in time series analysis is to remove a year-invariant proportional seasonal factor from labor usage series in order to arrive at a "seasonally adjusted" series for business cycle analysis. However, under the joint hypothesis that $\theta'(X) \neq 0$ and that the seasonal differentially affects supply and demand, the seasonal adjustment factor would vary over the business cycle. A previous literature Krane and Wascher (1999), Christiano and Todd (2002), and Matas-Mir and

The effects of the seasonal factor on labor usage and real wages are:

$$\frac{d\ln N_t}{da_t} = \theta(X_t)\left[\alpha^{S\prime}(a_t) - \alpha^{D\prime}(a_t)\right] \tag{5}$$

$$\frac{d\ln w_t}{da_t} = -\frac{1-\theta(X_t)}{\beta^S(X_t)}\left[\alpha^{S\prime}(a_t) - \alpha^{D\prime}(a_t)\right] \tag{6}$$

These effects vary over the business cycle only to the degree that the season differentially affects supply and demand. A seasonal that was either dominated by supply or demand – that is, had $\alpha^{S\prime}$ - $\alpha^{D\prime}$ significantly different from zero – would have log employment effects that varied over the business cycle to the degree that the incidence index $\theta(X)$ varied over the business cycle. Recession-nonrecession comparisons of such a seasonal for log employment reveal whether $\theta'(X)$ is positive, negative, or zero.

II. The Summer Seasonal for Employment and Unemployment

I use two basic ideas to identify seasonals dominated by either labor supply or labor demand shifts: that the academic season significantly affects the willingness and availability of teenagers to work more than it affects the demand for their services, and that the Christmas season abruptly affects the aggregate demand for labor more than it affects the supply. Summertime probably includes some extra labor demand – the weather changes significantly in much of the country, young school children need childcare that they cannot obtain from school during the summer, and some businesses may want temporary replacements for their vacationing employees. However, with well over 20 million students age 16+ exiting school, the supply shift is quite large and

---

Osborn (2004) look at the cyclical sensitivity of seasonality, but two of the studies do not focus on the labor market and none of them attempt to isolate series and seasonals that are dominated by supply or demand.

[12] In the "job shortage" view, employers collectively face a more elastic supply of labor during a recession because employees are supplied not only from out of the labor force, but from the pool of unemployed. Other models (e.g., Barro and Grossman, 1971; Eggertson, 2010a) predict that aggregate labor demand is less elastic (in fact, completely inelastic) during a recession because employers are unable to adjust the price of their output. Either way, the incidence parameter θ is expected to be closer to zero during a recession.

multiple labor market indicators indicate that the supply shift substantially exceeds the demand shift, if any (see Appendix II).

I use BLS measures (based on the Census Bureau's household survey) of monthly national employment and unemployment by age group, dating back to January 1948, and calculate the summer seasonal as the deviation of log per capita employment or unemployment from the average of its May and September values,[13] none of which are seasonally adjusted.[14] The business cycle is measured as a dichotomous variable indicating whether July of the year in question was part of a recession as defined by the NBER. The recession-nonrecession comparisons of the seasonal for a labor market outcome such as employment for a specific age group are made by regressing the time series for the seasonals on the time series for the recession indicator variables and a smooth function of calendar time.

Table 1's first two rows display constant terms from such regressions: that is, the average summer seasonal for employment and unemployment by age group for the non-recession years (from the perspective of the benchmark year in the calendar time polynomial, 1980). For the younger age groups, the gap between academic-year and summer is positive and economically significant for *both* employment and unemployment, which is to be expected given that so many of the younger people become available for work when the academic year ends.[15] For example, July log employment per capita for teenagers ages 16-19 exceeds the average for May and September by an average of 0.296 for the non-recession years and July log unemployment per capita exceeds the average for May and September by an average of 0.285.

The top row of the Table also suggests that the size of the summer seasonal shift likely exceeds the shifts associated with the largest postwar business cycles. Log July

[13] The Census Bureau measures labor market activities during a single reference week that includes the 12th of the month. Usually the reference week in July is exactly nine weeks after the reference week in May and exactly nine weeks prior to the reference week in September. When it is not, the May-September average is weighted. Seasonals are shown for all twelve months in Appendix II.
[14] Appendix I shows how the matching frameworks suggests a log specification, but results are quite similar if the regressions are specified in levels instead of logs.
[15] The unemployment seasonal also confirms our expectation that the summer seasonal in labor supply exceeds the summer seasonal in labor demand (see also Miron, p. 9).

employment per capita for persons aged 16-19 fell “only” 0.114 from 1979 to 1983, and “only” 0.299 from 2007 to 2010, whereas it falls 0.296 at the end of a typical summer.

Even without regard for recessions, the summer seasonal varies over time. For example, minimum wages, activities at school, and other factors can change the propensity of teens to work during the school year, and therefore the fraction of teens whose labor supply would shift when summer begins. These factors are considered in my analysis by its inclusion of a smooth function of calendar time among the independent variables.[16]

Table 1’s middle rows display the estimated coefficients on the recession indicator variable: that is, the gaps between a summer seasonal during recession years and the corresponding seasonal for non-recession years. The gaps for employment are typically in the direction predicted by the various theories – that is, that employment would expand less during recession summers – but are not economically significant. For example, the average recession seasonal for log employment per 16-19-year-old is only 0.0182 smaller than the average of 0.296 for non-recession years, or about 94 percent of the non-recession seasonal (see the second-to-last row of the table). Recall that the simple job-shortage view predicts that the recession employment seasonal would be zero, and the matching function approach predicts that it would be about two-thirds of the non-recession seasonal. The gaps for unemployment are not always in the direction predicted by the theory, and are statistically indistinguishable from zero.

Figures 1 and 2 display the annual time series for the July log employment (unemployment, respectively) seasonal for the 16-19 age group together with fitted values from the regression used for the employment (unemployment) rows of Table 1’s third column. Each of the figures indicates recession year observations with squares and non-recession year observations with circles. The fitted values follow a smooth curve for the nonrecession years, and small spikes down in the recession years.[17] The employment

[16] In separate results (not shown in the Table), I have also replaced the time polynomial with the prior academic year average employment per capita, or just dropped the time polynomial and limited the sample to 1980-2009 – in both cases results were quite similar.

[17] The recession years appear as spikes because most recessions do not include more than one consecutive July months, and the spikes are small because the recession coefficient of -1.82 shown in Table 1 is small compared to the non-recession seasonal of 29.6 (both in 100ths of log points).

data also display small down spikes in many (but not all) of the recession years, which is why the recession coefficient of -1.82 is statistically significant.

However, -1.82 is small enough that the matching theory (shown in Figure 1 as triangles calculated as 2/3 of the predicted value for a non-recession year) and shortage theory (shown as diamonds in the figure) fail to fit even one of the recession observations better than the hypothesis that the recession and non-recession seasonals are the same. Every single recession economy absorbed large numbers of new teen arrivals into the labor market without a statistically abnormal rise in unemployment: all of the recession employment seasonal observations are far from zero, and all of the recession unemployment seasonal observations are within two standard errors of the regression function for non-recession years.

III. Christmas Demand in Recessions and Booms

I use Census Bureau measures of retail sales (from January 1967), employment (from January 1948), and unemployment (from January 1948). Employment is measured both from the establishment survey and the household survey. The regression specification is the same as above, except the dependent variable is the Christmas seasonal – calculated as the deviation of log per capita (retails sales, employment, unemployment, or labor force) in Nov and December (or December only) from the value that is linearly interpolated from October and January[18] – and the business cycle indicator is from the perspective of December (rather than July).

Under the assumption that the Christmas season shifts labor demand more than it shifts labor supply, the simple job-shortage theory predicts that a given sized labor demand increase will increase employment more during a recession. As a result, the labor demand increase will reduce unemployment more during a recession, and increase the labor force less (if at all).

The top part of Table 2 displays the regressions' constant terms: the average Christmas seasonal for retail sales, employment, unemployment, and the labor force

[18] The quantitative results are quite similar if the Christmas seasonal cited above is replaced with the deviation of the average of January and February from the value for those months that is linearly interpolated from the December and May values.

(from the perspective of the benchmark year in the calendar time polynomial, 1980). Not surprisingly, each of them has an economically and statistically significant seasonal. In non-recession years, log aggregate December employment is 0.010 or 0.016 above its Oct-Jan trend on average, depending on the data source, which is a deviation only slightly smaller than measured in the summer. Unlike the summer seasonal, and consistent with our expectation that Christmas is primarily a demand shift, Christmas unemployment is below trend.

The middle part of the table displays regressions' coefficients on the business cycle term: the estimated gap between the recession seasonal and the non-recession seasonal. December log retail sales are slightly less above trend during recessions, although this tendency is of marginal economic and statistical significance.[19] When combined with the fact that the rest of the economy is less seasonal than retail sales (Barksy and Miron, 1989), this suggests that the demand shift associated with Christmas is only slightly smaller, if not the same (as a proportion of economic activity before the season began) in recessions.

The point estimates for employment's seasonal recession-nonrecession gap are not always of the expected sign, and in all cases are statistically and economically insignificant. The point estimates for unemployment's seasonal gap have the expected sign for an unexpected reason. In the first column, the point estimate for the unemployment seasonal is economically (although not statistically) significant: the recession seasonal reduces log unemployment about 29 percent more during a recession year than it does in other years. With no effect of the recession on the employment seasonal, this apparently occurs because the labor force seasonal is less during a recession. In other words, relative to non-recession years' Christmas seasonal, a recession Christmas seasonal moves people at about the same rate from non-employment to employment, but moves more people from unemployment to out of the labor force.

Figures 3-6 display the time series used in Table 2 together with fitted values from the regressions reported in the Table's first column. As noted above, the recession coefficient has the "wrong" sign (negative) in the regression for payroll employment.

---

[19] Judging from the Nov-Dec average, November retail sales may be somewhat more above trend in recessions.

The matching theory says that the Christmas seasonal would be about twice as large during a recession: about 0.015 log points larger for payroll employment. Figure 3 shows how only two of the twelve NBER recession year payroll employment observations lie above the regression function, and the largest deviation of those is less than .002 log points. As shown in Figure 4, CPS employment (otherwise known as employment from the "household survey") has a smaller Christmas seasonal. A couple of the recession seasonals for CPS employment are above the regression function, but none of them is even close to twice the regression function for non-recession years.

According to the simple job-shortage theory, Christmas labor demand would be satisfied from the pool of unemployed, without raising factor prices and thereby without expanding the labor force. Figures 5 and 6 display the Christmas recession seasonals for unemployment and the labor force, showing how few recessions fit this pattern. Roughly consistent with the theory, the 1953-54 recession and the 1973-75 recession had essentially no labor force seasonal and an unemployment seasonal that was larger than normal. However, the other ten recession observations do not fit this pattern either because the labor force seasonal is significant, or the unemployment seasonal is not larger than those from non-recession years, or both.[20]

IV. Conclusions

I find that the summer and Christmas seasonals for employment and unemployment are essentially the same number of log points in recession years and non-recession years. When school lets out and teens storm into the labor force, even a recession economy creates summer jobs. When Christmas increases labor demand, many of the positions are filled by expanding the labor force, even during a recession when there would seem to be ample unemployed to do the work. Even the 2008 and 2009 summers and Christmas' looked a lot like summers and Christmas' in nonrecession years.

[20] One explanation of my results is that a recession can be model as α labor markets that fit the simple shortage model, and 1-α labor markets with no shortage, with $\alpha << 1$. In this case, labor market aggregates might have responses to the seasonal shifts that look like α times the shortage model and 1-α times the no-recession-nonrecession gap model. However, in this case it would be incorrect to claim that, from an aggregate point of view, supply doesn't matter during a recession – it does in 1-α of the markets – and incorrect to claim that demand is dramatically more potent in recessions – it is in only α of the markets.

These findings contradict the view – which is the basis for much fiscal policy and business cycle analysis – that labor supply shifts have little (or even perverse) effects on aggregate employment during a recession, and contradict the view that demand shifts encounter significantly fewer supply constraints during a recession than they normally would. Admittedly, recessions are times when the labor market does not function well, but nonetheless labor supply and demand seem to operate on the margin during recessions in much the same way that they do during non-recession years.

The Christmas cycle is at least as large as the high frequency peacetime government spending changes that have been observed in U.S. history, so my results might imply that fiscal demand shocks would have much the same employment effects in a recession as they would in non-recession years. Of course, the seasonal results by themselves do not rule out the possibility that a fiscal demand increase significantly increases employment regardless of whether or not it were a recession (although see Alesina and Ardagna, 2009 and Barro and Redlick, 2009, on this point).

It is possible that the labor market has different mechanisms to adapt to various supply and demand shifts, and that certain types of fiscal policy might be different from Christmas in this regard. The seasonal cycle is also easily anticipated.[21] Either case raises the question of how, exactly, fiscal policy might be different from Christmas, why government spending might encounter fewer supply constraints than Christmas does, and how that information can be used to better design fiscal policy during recessions.

[21] Presumably supply can better adjust to an anticipated demand shock than to an unanticipated one, and demand can better adjust to an anticipated supply shock than to an unanticipated one. It's not clear how this possibility relates to the *interaction* between the business and seasonal cycles, though.

V. Appendix I: The Constant Elasticity Matching Function and the Interaction between Recessions and Seasonals

The simple job-shortage perspective is perhaps too extreme in predicting that labor supply is essentially irrelevant for determining the quantity of labor used. The Mortensen-Pissarides matching framework acknowledges that supply shifts would matter even in a recession, just to a lesser extent (than it would in a non-recession) because unemployment is greater in recessions and unemployment is assumed to have a positive but diminishing effect on new hires. This prediction and related predictions can be quantified by assuming constancy for either the matching function's unemployment elasticity or its vacancy elasticity.[22]

As in the main text, let *N* denote employment. Employment evolves according to:

$$\dot{N}_t = M(U_t, V_t) - \delta_t N_t \tag{7}$$

where δ denotes the rate of job separations and *t* indexes calendar time. *M* is the job match rate, which depends on the number of job vacancies *V* and the number of job searchers *U*. As in the main text, let *X* denote the state of the business cycle, and *a* denote seasonals. Define the steady state $N_{ss}(X)$ to be the level of employment that is consistent with constant employment, holding constant the season and the state of the business cycle:

$$N_{ss}(X) \equiv M\left(U_{ss}(X), V_{ss}(X)\right) \tag{8}$$

Now consider a system that is in the steady state at time *t*-1, and has unemployment and vacancies at levels $U_{ss}(X) + dU$ and $V_{ss}(X) + dV$, respectively, over the time interval [*t*-1,*t*]. Then time *t* employment will be:

$$\frac{N_t}{N_{t-1}} - 1 = \left[\left(\frac{\partial M}{\partial U} \frac{U_{t-1}}{M_{t-1}} \right) \frac{dU}{U_{t-1}} + \left(\frac{\partial M}{\partial V} \frac{V_{t-1}}{M_{t-1}} \right) \frac{dV}{V_{t-1}} \right] \left[1 - e^{-\delta(X)} \right] \tag{9}$$

[22] The constant elasticity matching function is common in the literature. Anderson and Burgess (2000) use it when considering seasonal and other variation in unemployment and vacancies.

Define a (short-duration) supply shock to be $dU > 0$ and $dV = 0$, and a demand shock to be $dU = 0$ and $dV > 0$. Then the relative employment effects of demand and supply shocks are:

$$\frac{\left.\frac{N_t}{N_{t-1}}\right|_{dU=0} - 1}{\left.\frac{N_t}{N_{t-1}}\right|_{dV=0} - 1} = \frac{\left(\frac{\partial M}{\partial V}\frac{V_{t-1}}{M_{t-1}}\right)}{\left(\frac{\partial M}{\partial U}\frac{U_{t-1}}{M_{t-1}}\right)} \frac{U_{t-1}}{V_{t-1}} \frac{dV}{dU} \tag{10}$$

The separation terms canceled and the terms in parentheses are elasticities of the matching function. If those elasticities, the openings created by Christmas (*dV*), and the job-searchers created by the conclusion of the academic year (*dU*) are independent of the business cycle, then the relative employment effects of supply (summer) and demand (Christmas) vary with the business cycle only because the ratio of unemployment to vacancies varies. That ratio is said to be a factor of 2-4 larger in recession years than in non-recession years (Rampell, 2010).[23]

Equation (9) also shows how a supply shock *dU* has effects that depend on the business cycle:

$$\frac{\left.\frac{N_t}{N_{t-1}}\right|_{dV=0,X=1} - 1}{\left.\frac{N_t}{N_{t-1}}\right|_{dV=0,X=0} - 1} = \frac{\left(\frac{\partial M}{\partial U}\frac{U_{t-1}}{M_{t-1}}\right)_{X=1}}{\left(\frac{\partial M}{\partial U}\frac{U_{t-1}}{M_{t-1}}\right)_{X=0}} \frac{U_{t-1}(0)}{U_{t-1}(1)} \frac{1-e^{-\delta(1)}}{1-e^{-\delta(0)}} \tag{11}$$

Assuming that (a) the elasticities in parentheses do not vary over the business cycle and (b) the separation rates are no greater in a recession ($\delta(1) \leq \delta(1)$),[24] this ratio is less than the ratio of unemployment per capita between non-recession years and recession years, which is about 0.6 – 0.8. A similar calculation applies for examining the interaction between demand shock *dV* and the business cycle: the recession effect exceeds the non-

[23] Alternatively, one might model Christmas demand as *dV*/*V* that is constant over the business cycle, rather than constant *dV*. In this case, the relative effects of demand and supply would vary by a factor of 1.5-2 over the business cycle, because the number unemployed per capita varies by about that factor.

[24] JOLTS data suggest that job separation rates are somewhat less during recessions.

recession effect according to the ratio of non-recession vacancies to recession vacancies, or about 1.7.

The matching function is known to shift during recessions – that is, the number of hires during a recession is even lower than one would expect based on measured vacancies and unemployed. One explanation is that the matching function really is stable, but that the vacancy and unemployment measures are flawed (i.e., either recession vacancies are over-estimated relative to non-recessions, or unemployment is over-estimated, or both). In this case the calculations above are in the right direction, but conservative in magnitude. Another explanation is that the matching function really is different in a recession, but this does not necessarily affect equations (9), (10) and (11) because the form of the matching function matters only through its elasticity.

VI. Appendix II: The Role of Supply in the Summer Seasonal

Figures 7-10 display the seasonals for retail sales, employment and unemployment by age and source, as well as payroll employment for the retail and non-retail sectors. Each series' seasonals are calculated by normalizing October to zero, and then adding the sample average excess log November change from the previous month (that is, the sample average log change between October and November minus the average log change from the previous month for all months), and then accumulating sample average excess log changes for the months December-September.[25]

Several labor market observations for the months May through September suggest that teen labor supply shifts more than labor demand during the summer. A summer demand surge that exceeded the supply surge would pull students into the labor market and result in low teen summer unemployment and high summer real wages because more positions would be available than teens seeking work. Those excess jobs would also create job-finding opportunities for persons who were not enrolled in school, so their summer unemployment rates would be low. But the summer seasonals show the opposite: Figure 11 (taken from Mulligan 2010) shows that, in fact, teen unemployment spikes in June as the labor market absorbs more than one million teens. Unemployment of persons aged 25 and older is high throughout the summer (notice the 25-34 seasonal shown in Figures 8 and 13), peaking in July at almost 700,000 persons above trend. Median nominal and real weekly wages for teens are often at their lowest of the year in the third quarter (July – September – see Mulligan 2010), and presumably hourly wages are even lower due to longer teen summer work weeks. These patterns reverse when the academic year ends.

The summer job surge is larger for groups with higher school employment rates. Figure 12 is based on enrollment data from 1980-2007 and shows how the summer employment spike (measured in the same way it is for Table 1) is a greater percentage for the younger teens, and those are exactly the age groups for whom school enrollment is highest. In fact, there is essentially no employment spike for the 25-to-34 age group, and that group has hardly anyone in school. If summer labor demand were shifting more than

[25] By construction, the sample average excess log change from September to October is the difference between the seasonal shown for October and the seasonal shown for September.

supply (that is, shifting out more than a million employees), then summer ought to bring some extra employment for the 25-to-34 group too.

Figure 13 displays the unemployment spikes for the same age groups. Unemployment per capita is greater during the summer than during the academic year, especially for the groups with more school enrollment. Summer unemployment is higher than normal even for nonstudents, perhaps because many young people out of school compete in the labor market with students who exit school each summer.

Table 1. Summer Seasonals For Employment and Unemployment, by Age Group

Each column of the Table reports results from an employment regression and an unemployment regression. The dependent variable is 100 times the July deviation of log per capita employment (unemployment) from the average of May and September.

		Age Group					
Statistic		16-17	18-19	16-19	20-24	25-34	16+
Non-recession Seasonal, 100ths of log points	Emp.	38.2	23.6	29.6	6.0	-1.3	2.0
		(0.6)	(0.5)	(0.5)	(0.2)	(0.1)	(0.1)
	Unemp.	38.9	19.0	28.5	6.7	4.4	10.2
		(2.3)	(1.9)	(1.8)	(1.1)	(1.2)	(0.8)
Recession Coefficient, 100ths of log points	Emp.	-1.92	-1.67	-1.82	-0.02	-0.05	0.02
		(1.05)	(0.78)	(0.75)	(0.34)	(0.15)	(0.16)
	Unemp.	-3.47	1.44	-1.28	-2.05	1.08	-0.71
		(3.81)	(3.09)	(2.89)	(1.82)	(1.94)	(1.34)
Recession Seasonal/ Non-recession Seasonal	Emp.	0.95	0.93	0.94	1.00	1.04	1.01
		(0.03)	(0.03)	(0.02)	(0.06)	(0.12)	(0.08)
	Unemp.	0.91	1.08	0.96	0.69	1.25	0.93
		(0.10)	(0.16)	(0.10)	(0.26)	(0.46)	(0.13)

Notes:

OLS standard errors in parentheses

Independent variables are: NBER recession dummy, a 3rd order time polynomial (time 0 = 1980) and a constant.

When applicable, the May-September average is weighted to reflect that the July reference week is not equidistant between the May and September reference weeks

Table 2. Christmas Seasonals For Retail Sales, Employment, and Unemployment

Each column of the Table reports results from a retail sales regression, an establishment employment regression, a household employment regression, and an unemployment regression. The dependent variable is 100 times the deviation of log per capita (sales, employment, or unemployment) from the value interpolated from October and January.

Statistic		Relative to Oct-Jan Interpolation: Nov-Dec	Dec only
	Retail Sales	16.00	26.40
		(0.59)	(0.78)
	Emp., Est.	1.20	1.60
Non-recession Seasonal,		(0.04)	(0.05)
100ths of log points	Emp., HH	0.70	1.00
		(0.05)	(0.07)
	Unemp.	-6.60	-10.00
		(0.59)	(0.71)
	Labor Force	0.30	0.40
		(0.05)	(0.07)
	Retail Sales	-1.32	-2.00
		(0.88)	(1.18)
	Emp., Est.	-0.08	-0.14
Recession Coefficient,		(0.06)	(0.08)
100ths of log points	Emp., HH	0.06	0.02
		(0.09)	(0.11)
	Unemp.	-1.90	-0.84
		(1.02)	(1.23)
	Labor Force	-0.06	-0.09
		(0.08)	(0.11)
	Retail Sales	0.92	0.92
		(0.05)	(0.04)
	Emp., Est.	0.93	0.91
Recession Seasonal/		(0.05)	(0.05)
Non-recession Seasonal	Emp., HH	1.03	1.02
		(0.10)	(0.10)
	Unemp.	1.29	1.08
		(0.19)	(0.14)
	Labor Force	0.79	0.79
		(0.21)	(0.28)

Notes: OLS standard errors in parentheses
Independent variables are: NBER recession dummy, a 3rd order time polynomial (time 0 = 1980) and a constant.

Fig 1. Summer Log Employment Seasonals, Ages 16-19

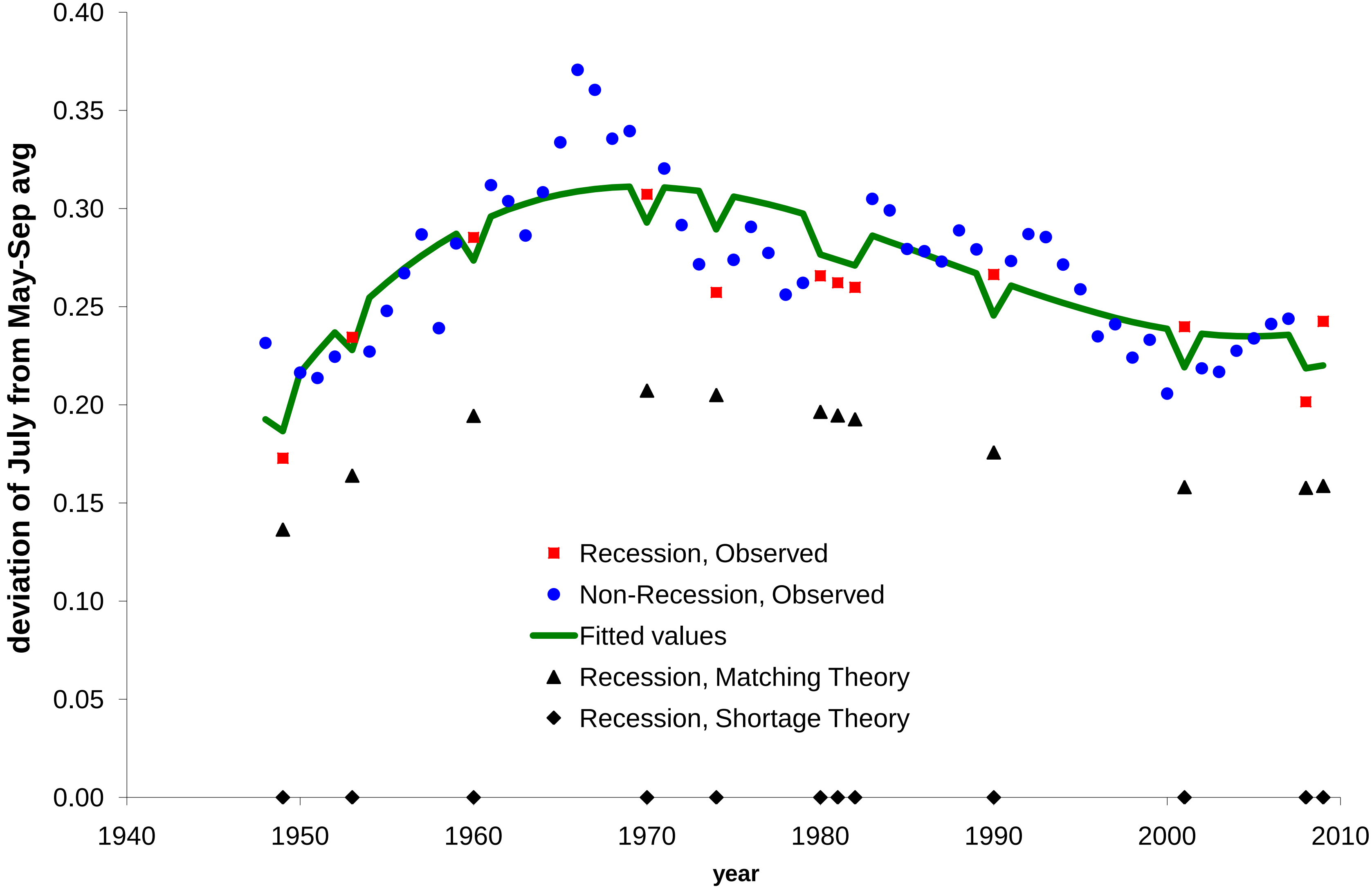


Fig 2. Summer Log Unemployment Seasonals, Ages 16-19

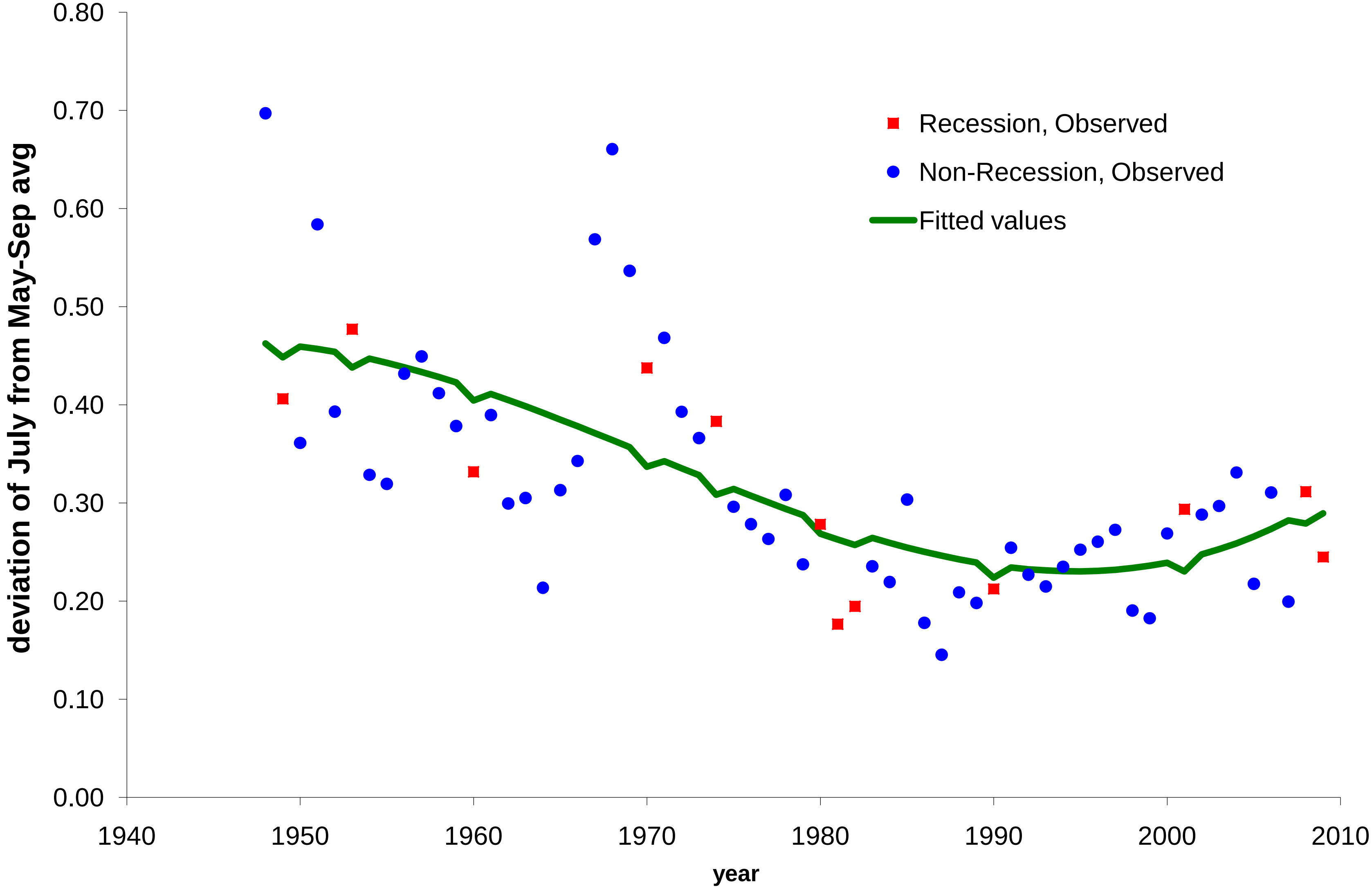


Fig 3. Christmas Log Payroll Employment Seasonals, All Ages

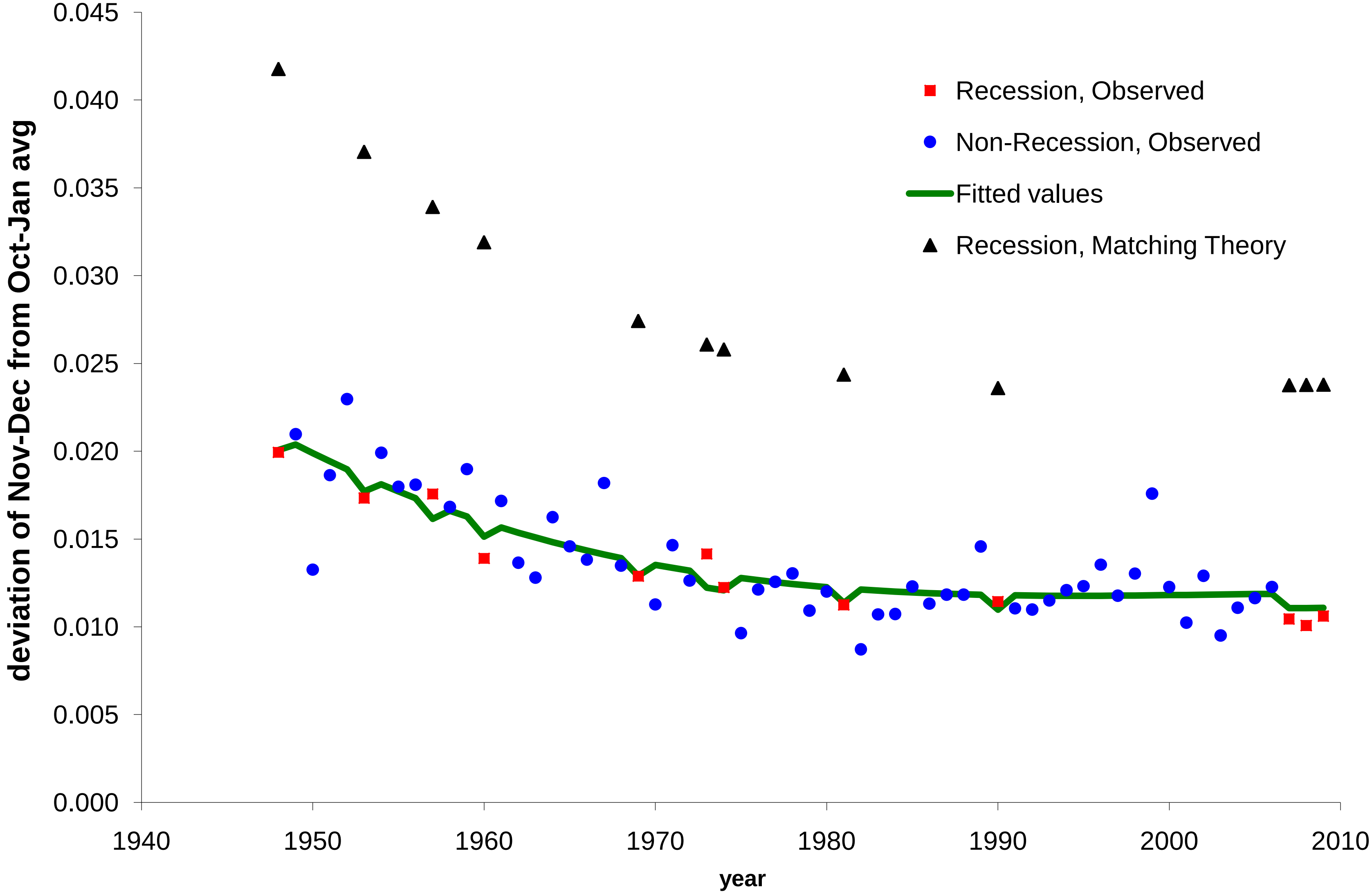


Fig 4. Christmas Log CPS Employment Seasonals, All Ages

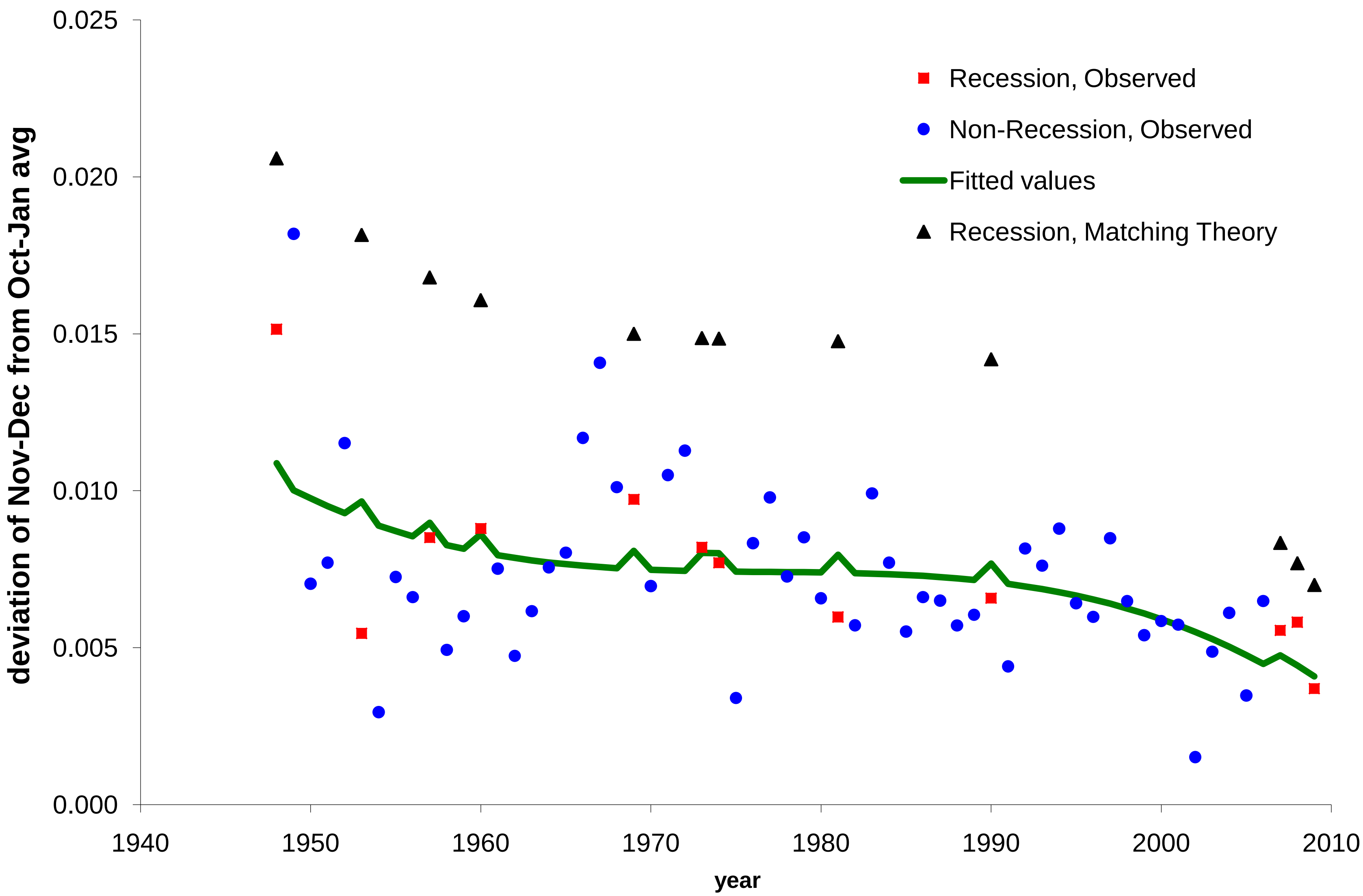
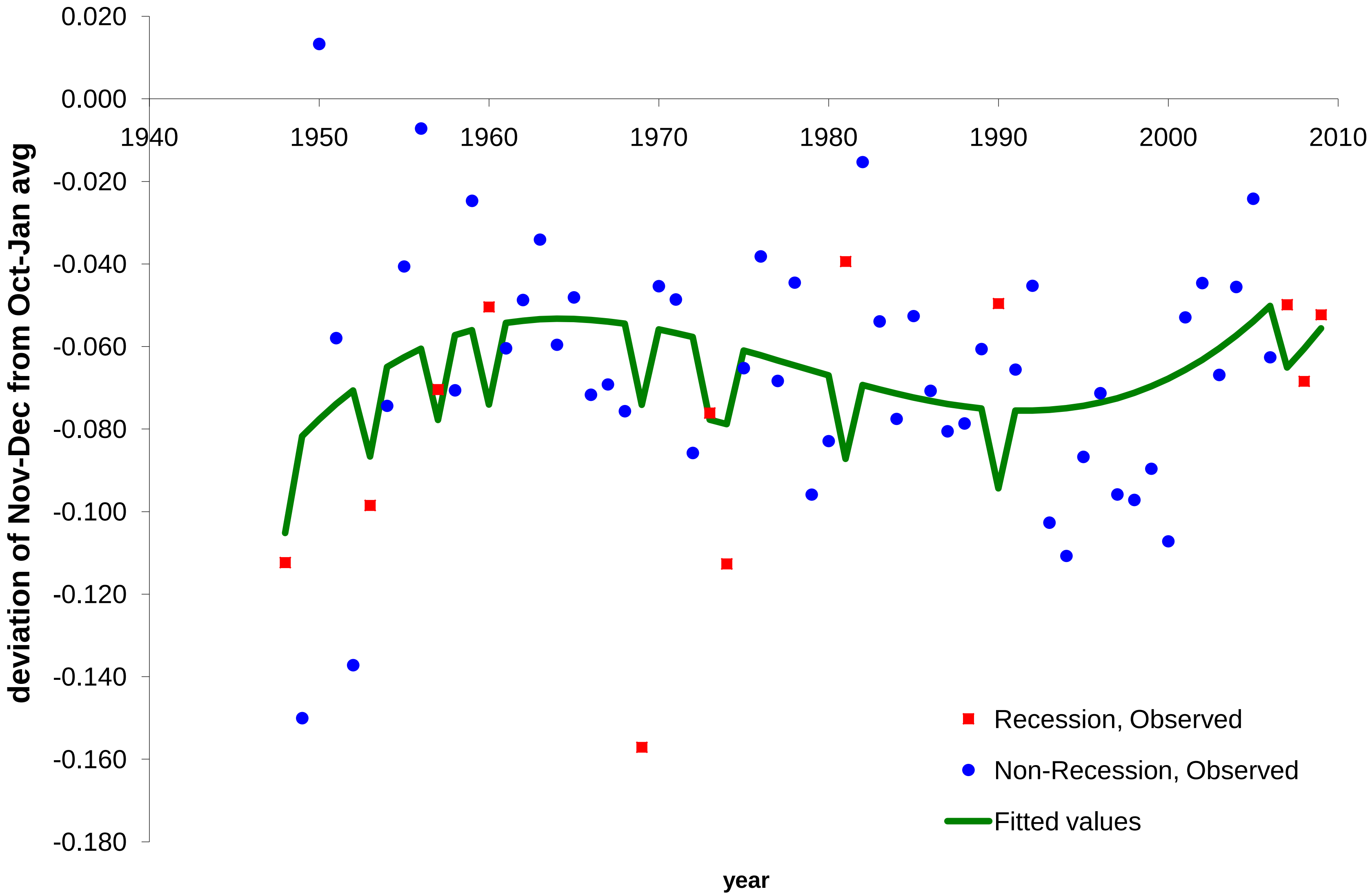


Fig 5. Christmas Log Unemployment Seasonals, All Ages



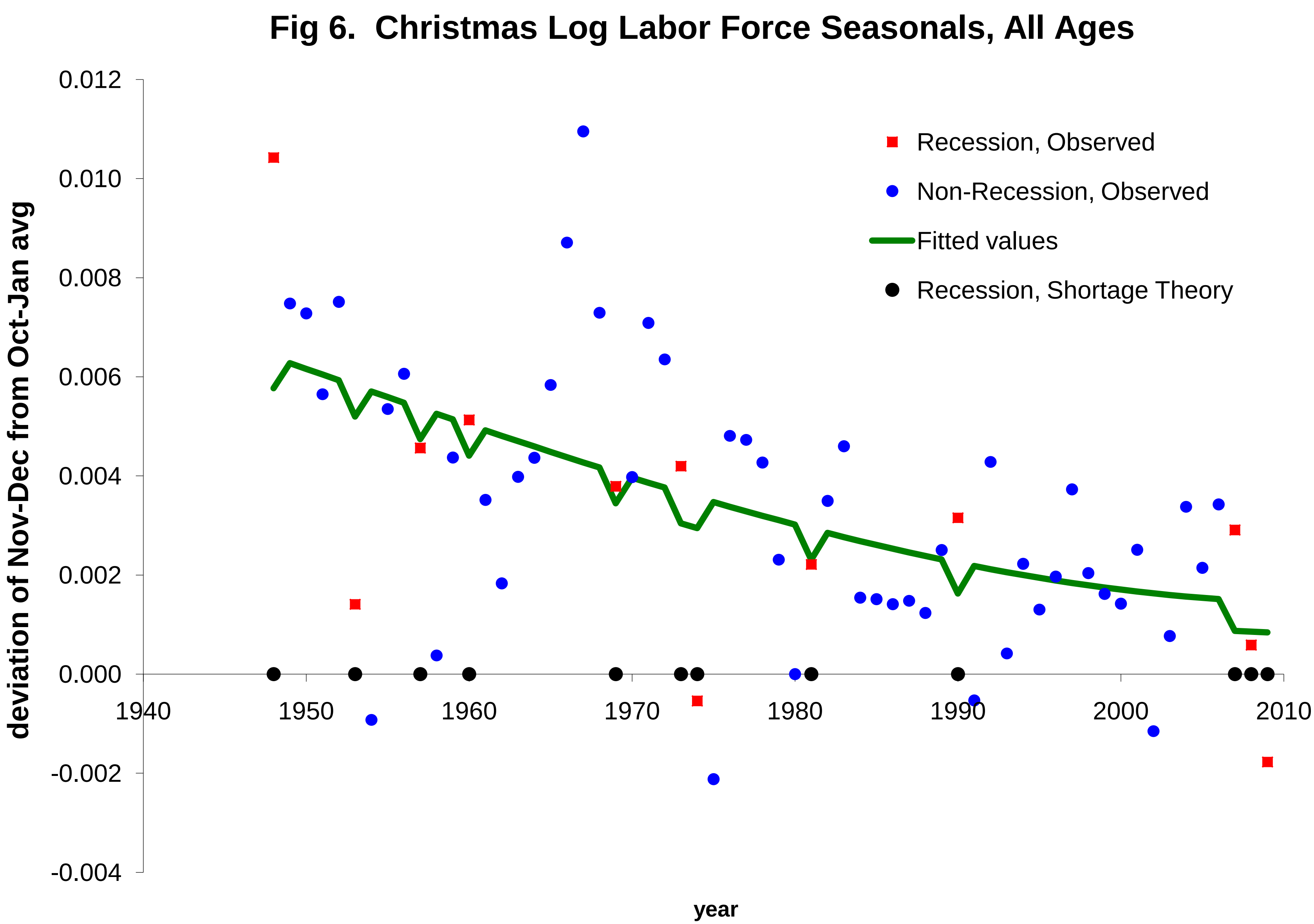


Fig 6. Christmas Log Labor Force Seasonals, All Ages
deviation of Nov-Dec from Oct-Jan avg
0.012
0.010
0.008
0.006
0.004
0.002
0.000
-0.002
-0.004
1940
1950
1960
1970
1980
1990
2000
2010
year
Recession, Observed
Non-Recession, Observed
Fitted values
Recession, Shortage Theory

Fig 7. Employment per Person Seasonals, by Age

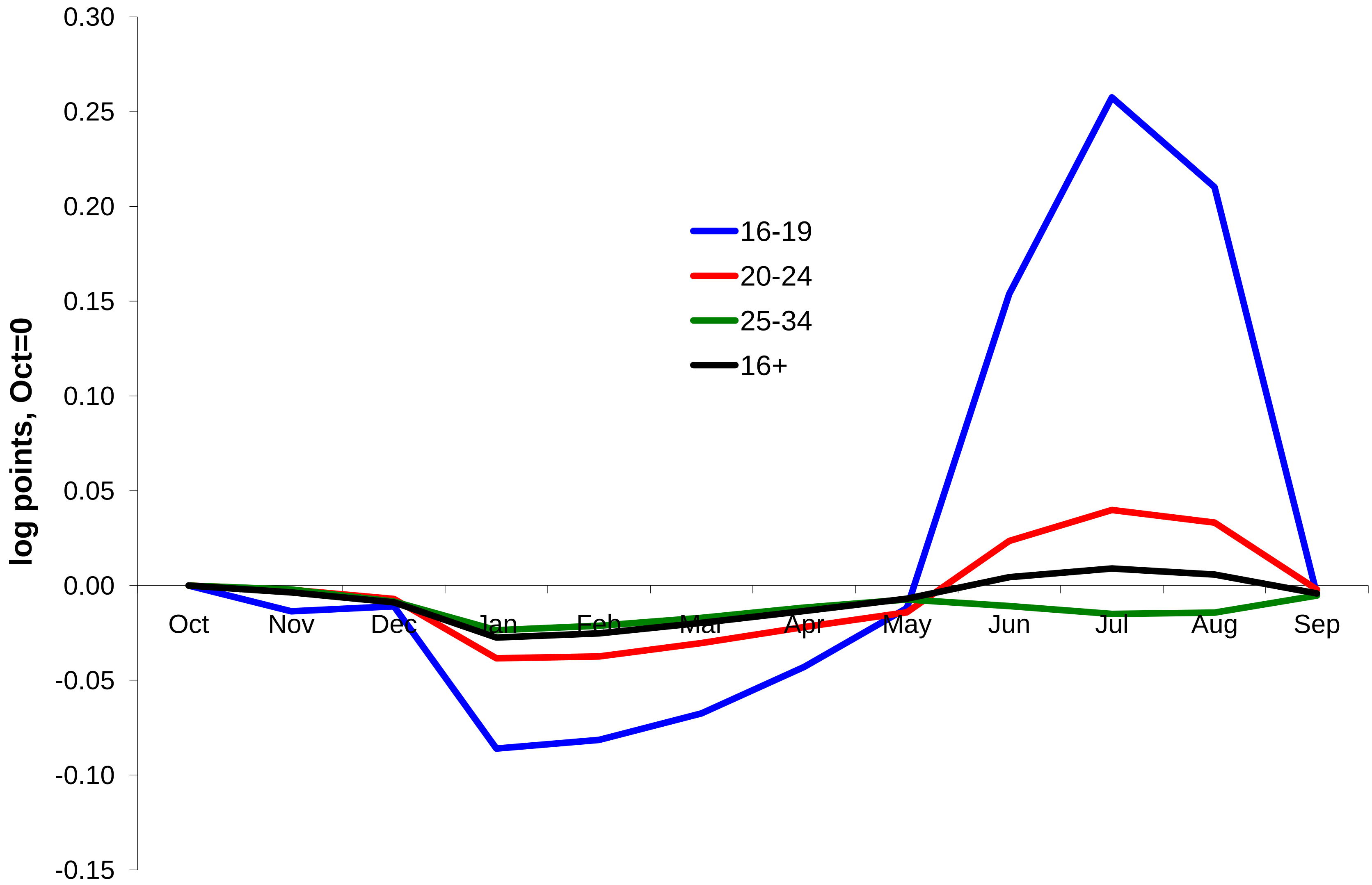
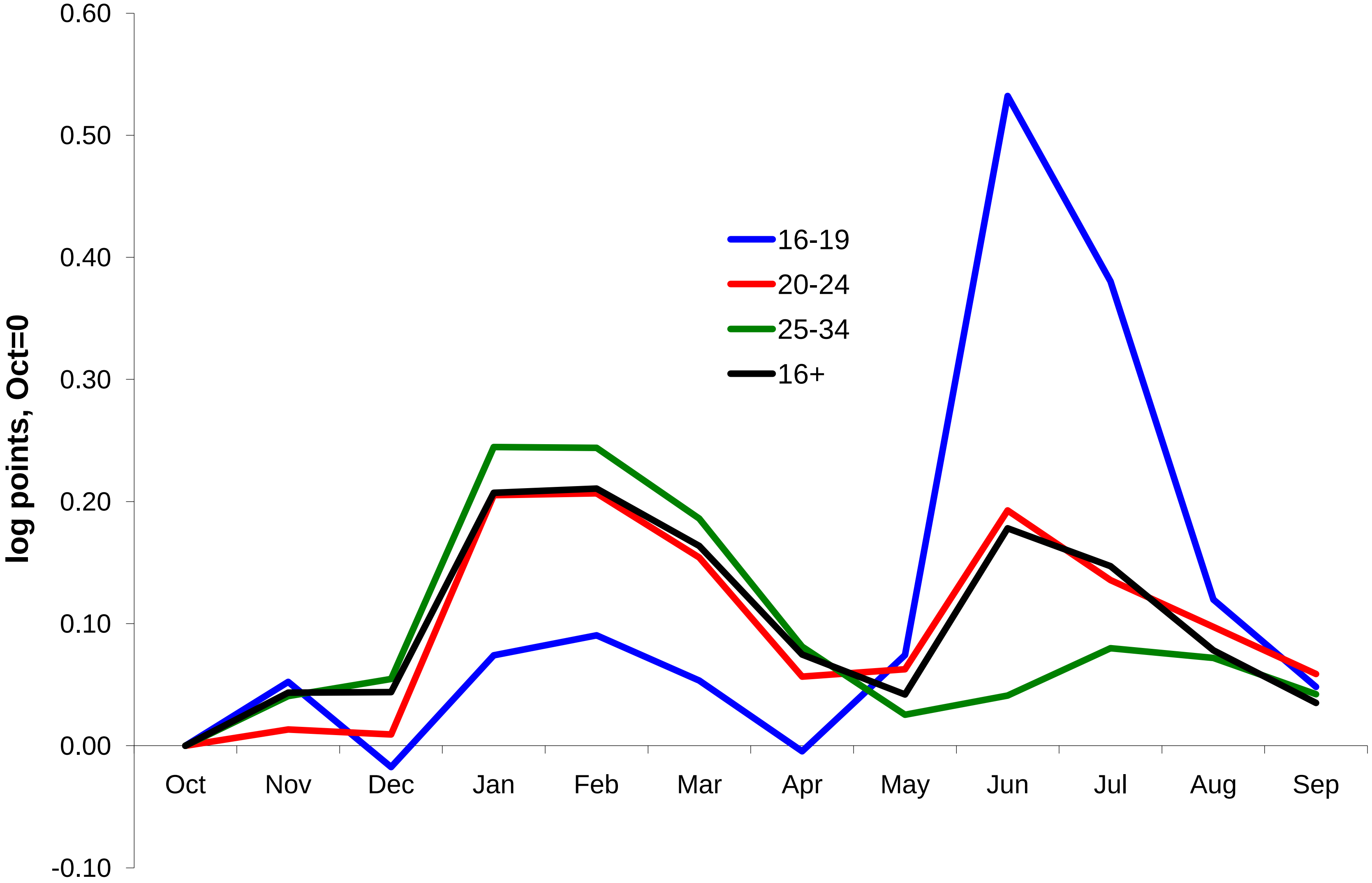


Fig 8. Unemployment per Person Seasonals, by Age



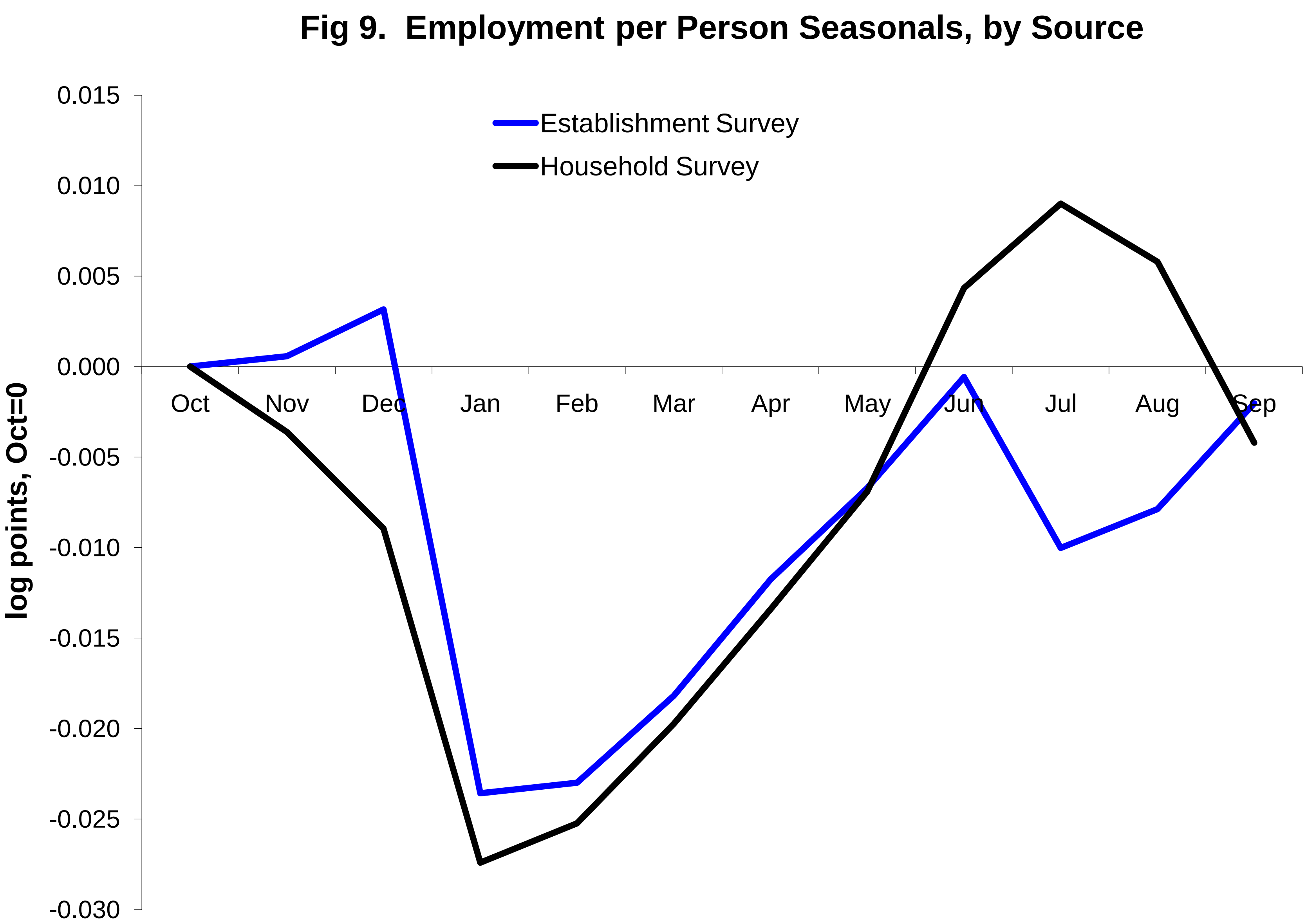


Fig 9. Employment per Person Seasonals, by Source
log points, Oct=0
0.015
0.010
0.005
0.000
-0.005
-0.010
-0.015
-0.020
-0.025
-0.030
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Establishment Survey
Household Survey

Fig 10. Per Capita Retail Employment and Sales Seasonals

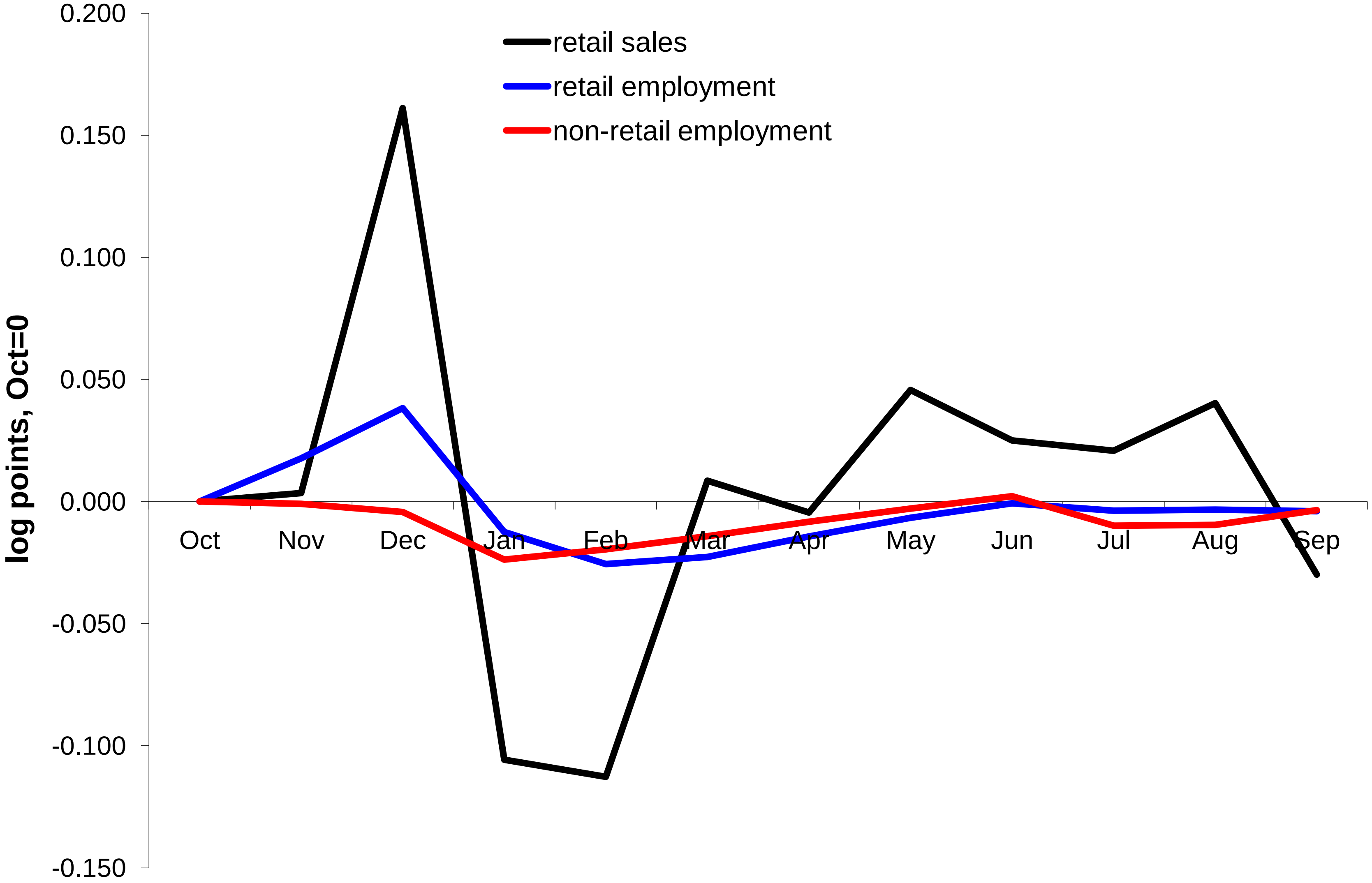
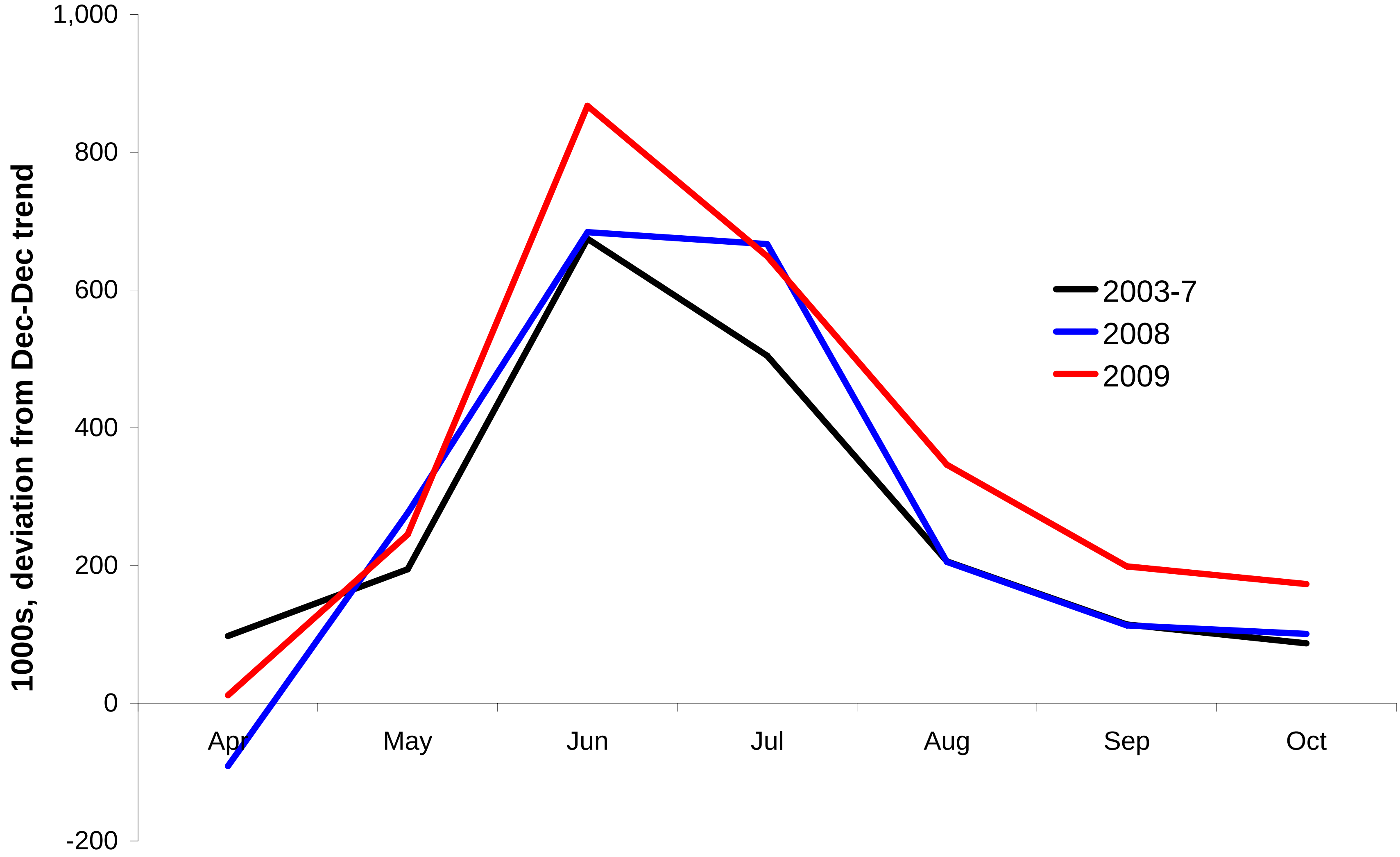


Fig 11. Teen Unemployment by Month



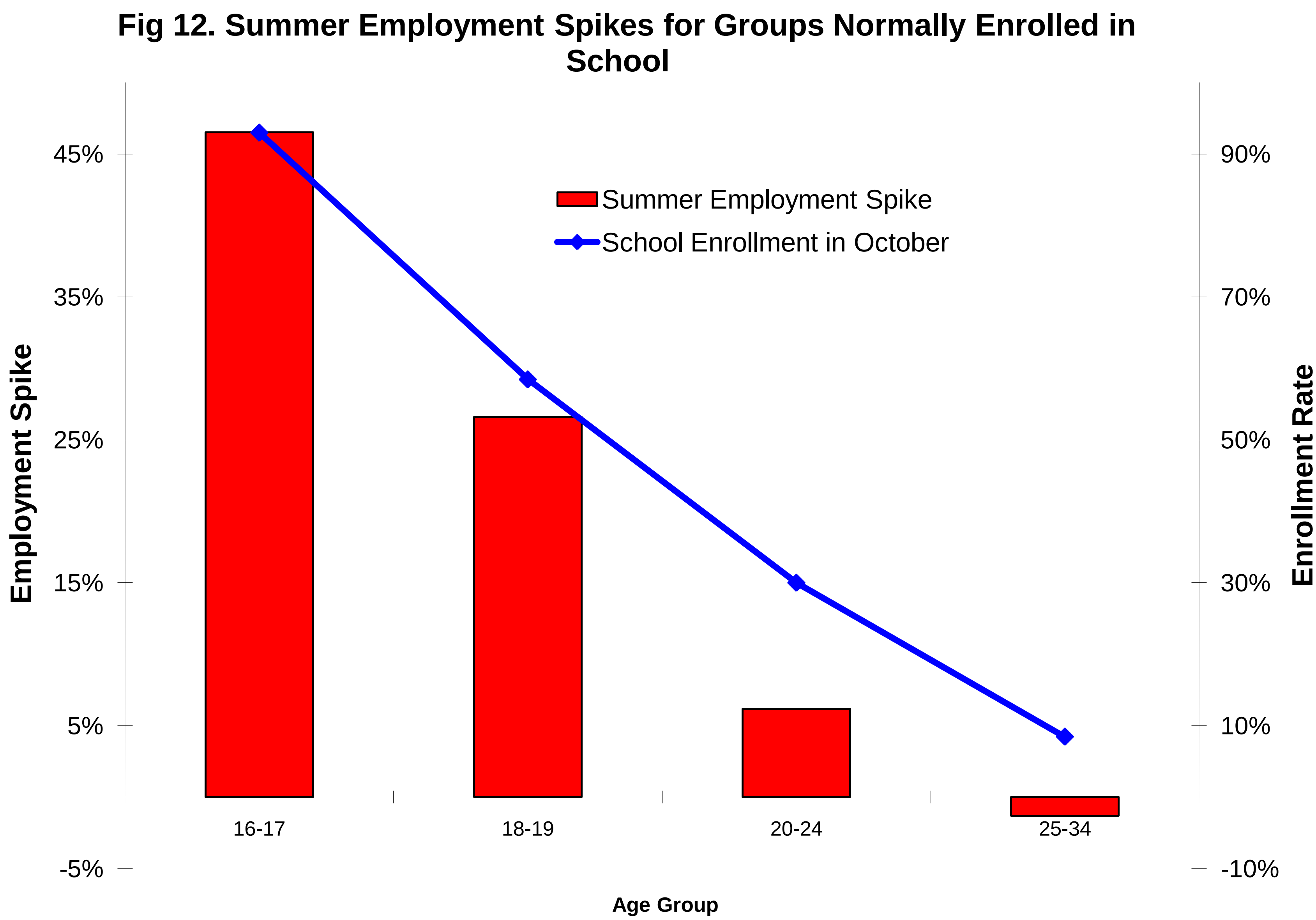
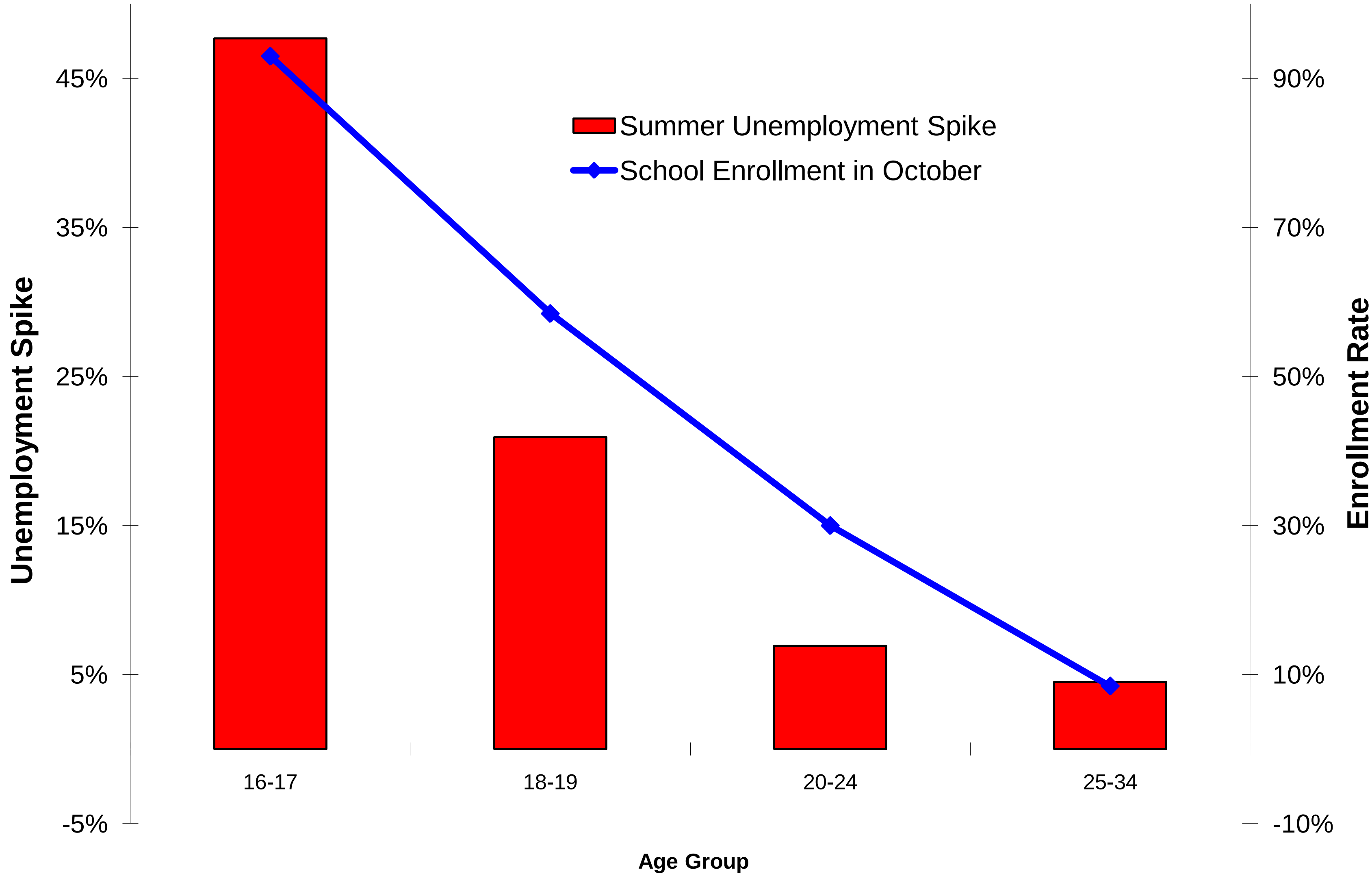


Fig 12. Summer Employment Spikes for Groups Normally Enrolled in School
Summer Employment Spike
School Enrollment in October
Employment Spike
Enrollment Rate
45%
35%
25%
15%
5%
-5%
90%
70%
50%
30%
10%
-10%
16-17
18-19
20-24
25-34
Age Group

Fig 13. Summer Unemployment Spikes for Groups Normally Enrolled in School



VII. References

Alesina, Alberto F. and Silvia Ardagna. "Large Changes in Fiscal Policy: Taxes Versus Spending." NBER working paper no. 15438, October 2009.

Anderson, Patricia M. and Simon M. Burgess. "Empirical Matching Functions: Estimation and Interpretation using State-level Data." *Review of Economics and Statistics*. 82(1), February 2000: 93-102.

Auerbach, Alan J. and Yuriy Gorodnichenko. "Measuring the Output Responses to Fiscal Policy." NBER working paper no. 16311, August 2010.

Barro, Robert J. and Charles J. Redlick. "Macroeconomic Effects from Government Purchases and Taxes." NBER working paper no. 15369, September 2009.

Barro, Robert J. and Herschel I. Grossman. "A General Disequilibrium Model of Income and Employment." *American Economic Review*. 61(1), March 1971: 82-93.

Barsky, Robert B. and Jeffrey A. Miron. "The Seasonal Cycle and the Business Cycle." *Journal of Political Economy*. 97(3), June 1989: 503-534.

Christiano, Lawrence J. and Richard M. Todd. "The Conventional Treatment of Seasonality in Business Cycle Analysis: Does It Create Distortions?" *Journal of Monetary Economics*. 49(2), March 2002: 335-64.

Congressional Budget Office. "Economic Effects of the American Recovery and Reinvestment Act of 2009." Washington, DC. March 2, 2009.

Eggertsson, Gauti. "The Paradox of Toil." Working paper, Federal Reserve Bank of New York, January 2010a.

Eggertsson, Gauti. "A Comment on Casey Mulligan's Test of the Paradox of Toil." Working paper, Federal Reserve Bank of New York, May 2010b.

Fullerton, Don and Gilbert E. Metcalf. "Tax Incidence." in A.J. Auerbach and M. Feldstein, eds. *Handbook of Public Economics*. Vol 4. 2002.

Krane, Spencer and William Wascher. "The Cyclical Sensitivity of Seasonality in U.S. Employment." *Journal of Monetary Economics*. 44(3), December 1999.

Matas-Mir, Antonio and Denise R. Osborn. "Does Seasonality Change over the Business Cycle? An Investigation using Monthly Industrial Production." *European Economic Review*. 48(6), 2004: 1309-32.

Mulligan, Casey B. “Means-Tested Mortgage Modification: Homes Saved or Income Destroyed?” NBER working paper no. 15281, August 2009.

Mulligan, Casey B. “Simple Analytics and Empirics of the Government Spending Multiplier and Other “Keynesian” Paradoxes.” NBER working paper no. 15800, March 2010.

Miron, Jeffrey A. *The Economics of Seasonal Cycles*. Cambridge, MA: M.I.T. Press, 1996.

Rampell, Catherine. “Fewer Jobless Workers per Opening in June.” *New York Times Economix*, August 11, 2010.

Sumner, Daniel A. “Measurement of Monopoly Behavior; An Application to the Cigarette Industry.” *Journal of Political Economy*. 89(5), October 1981: 1010-1019.

Topel, Robert H. and Finis Welch. “Unemployment Insurance: Survey and Extensions.” *Economica*. 47(187), 1980: 351-79.

Woodford, Michael. “Simple Analytics of the Government Expenditure Multiplier.” NBER working paper no. 15714, January 2010.