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ABSTRACT

A simple static version of the "New Keynesian" macro model illustrates how factor supply increases (depresses) output for many of the same reasons that the government spending multiplier might be less (greater) than one. Data from three 2008-9 recession episodes – the labor supply shifts associated with the seasonal cycle, the 2009 federal minimum wage hike, and the collapse of residential construction spending – clearly show that markets absorb an increased supply of factors of production by increasing output. The findings contradict the "paradox of toil" and suggest that the government spending multiplier is less than one, even during this recession.

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I. Introduction

The Great Recession of 2008-9 has brought forth some intriguing claims about public policy and the nature of factor supply. Using "New Keynesian" models to guide the discussion, a number of economists suggest that government purchases might stimulate private spending, rather than crowd it out, thereby increasing total spending more than dollar-for-dollar (Christiano, Eichenbaum, and Rebelo, 2009; Eggertsson, 2009; Woodford, 2010). At the same time, few have evaluated current macroeconomic policies on the basis of the incentives they provide to supply labor and other factors of production. Is it possible that factor supply does not matter during a recession? Or even worse, that our economy suffers from a "paradox of toil:" expansions in factor supply actually reduce aggregate output (Eggertsson, 2010)?

Economic theory suggests that the government spending multiplier and the paradox of toil are related, because both involve the (general equilibrium) relationship between factor supply conditions and private sector factor demand. Models with crowding out predict that a reduction in the supply of factors to the private sector – either because the government is using some of those factors or because a distortion causes some of the supply to be withheld – ultimately reduces private sector output and factor usage. One mechanism achieving this result is that private sector employers pass on their higher factor costs into output prices, which causes their customers to demand less. In "Keynesian" models, this pass through doesn't happen and perhaps even the high factor rental rates feed back to increased demand for private sector goods.

One approach to these questions would be to use historical data to measure the government spending multiplier (Barro, 1981; Alesina and Ardagna, 2009; Barro and Redlick, 2009; Mountford and Uhlig, 2009; Ramey, 2009) or to measure output effects of factor supply growth. But it has been claimed that historical output responses to government spending impulses ought to be atypical of those that occur today, because today we are in a deep recession, and monetary policy is fundamentally different than it was in the past (Christiano, Eichenbaum, and Rebelo, 2009; Eggertsson, 2009; Woodford, 2010).

Even without the added burden of estimating a separate multiplier for deep recessions, clear and significant shifts in government demand that are economically similar to the kinds of spending proposed in government "stimulus" laws are difficult to find, and thereby difficult to translate into an accurate estimate of the government spending multiplier. The purpose of this paper is to exploit the close relation between the government spending multiplier and the paradox of toil, and the ready availability of obvious factor supply shifts during this recession, to test the paradox of toil hypothesis. The empirical analysis can be interpreted as a test (of whether government spending stimulates private spending) that is admittedly indirect, but not reliant on the historical data.

Sections II and III use a simple static model to show how the government purchases multiplier is related to the output effect of factor supply shifts, and how both of these differ according to whether output prices are "sticky" rather than clearing the market. As in Woodford (2010), for the purposes of illustration I focus on a conception of "sticky prices" for which crowding out is exactly zero (the government purchases multiplier is exactly one), and contrast it with the "flexible price" case in which crowding out is strictly positive. Section IV explains how an economy with fixed output prices may nonetheless occasionally behave like one with flexible prices, as it might under certain monetary rules. Thus, under the sticky price hypothesis, the government purchases multiplier and the output effect of factor supply vary over time, and might be different during this recession than in previous years.

Section V examines three events that happened *during* this recession, for the purpose of determining whether the outcomes confirm the paradoxes rather than showing

significant resource reallocation among competing uses of the economy's output. Those events are: the labor supply shifts associated with the annual seasons, the minimum wage hike of July 24, 2009, and the collapse of residential construction spending. Section VI concludes.

II. A Simple Model for Comparing Fixed and Flexible Price Outcomes

The economic mechanisms behind the government spending multiplier and other Keynesian paradoxes can be illustrated in a simple static model. In order to discuss labor market issues, it helps to have a model that considers leisure or work time separately from commodities: I let N denote aggregate work hours over a given time interval (say, a quarter). In order to discuss nominal prices, it helps to have a numeraire good: I refer to that good as "money" and for simplicity assume that it is in fixed aggregate supply (see also Blanchard and Kiyotaki, 1987). I let C and G denote the aggregate quantity of all other goods, where real private purchases C are distinguished from real public purchases G.

There is a representative consumer and worker with preferences $u(c,m,n,g)$, where m denotes the real quantity of money held by the consumer, and lower case c, g and n denote the consumer's consumption (or supply) of goods purchased privately, goods purchased publicly, and labor, respectively. For simplicity, I assume that neither n nor g affect the marginal rates of substitution between the other goods (that is, utility is additively separable in n and g). Otherwise, the usual regularity conditions are assumed for the function u.[1]

P denotes the nominal price of C and G. Aggregate consistency requires that $c = C$, $n = N$, $g = G$, and $m = M/P$, where M is the fixed aggregate supply of money. The details are not considered here, but C and G can be interpreted as a composite commodity, produced by many independent firms (see Blanchard and Kiyotaki, 1987, Woodford, 2010, and many papers in between using the Dixit-Stiglitz setup). Under this

[1] Thus, leisure (a constant minus n) must be a normal good.

interpretation, the output of each firm contributes to the composite symmetrically, but as imperfect substitutes with each of the others.

Aggregate production $F(N)$ is strictly increasing and weakly concave in the amount of labor N:

$$C + G = F(N) \tag{1}$$

Firms hire labor at nominal rate W, and workers receive rate $(1-\tau)W$, with the amount τWN going to the government as nominal labor income tax revenue. The government finances the remainder of its spending with a lump sum tax (or, if $\tau WN > G$, a lump sum transfer).

The consumer's demand for private commodities and supply of labor satisfy two first order conditions equating marginal rates of substitution in utility to P and $(1-\tau)W$, respectively. When combined with the aggregate consistency conditions, those conditions are:

$$\left.\frac{\partial u / \partial c}{\partial u / \partial m}\right|_{(C, M/P)} = P \tag{2}$$

$$\left.-\frac{\partial u / \partial n}{\partial u / \partial m}\right|_{(N, C, M/P)} = (1-\tau)W \tag{3}$$

Because money is in fixed aggregate supply, equation (2) can be inverted to calculate the private "demand" for goods $C(P)$, which is decreasing in its price P relative to money. The shape of this demand function depends on the aggregate supply of money M and on the shape of the utility function u, but not on any other parameters of the model.[2] This piece of the model is central for understanding how the government multiplier and the other paradoxes relate to price flexibility.

[2] The partial equilibrium demand formula is more complicated – it depends on consumer income, the wage rate, etc. – but those terms cancel when it is combined with the money market clearing condition $m = M/P$.

Equation (3) can be inverted to calculate an aggregate "labor supply" function, which increases in the after-tax wage rate $(1-\tau)W$ because the disutility of work time increases at an increasing rate.

The demand for goods $C(P)$ can be used to begin a calculation of the demand for labor, because enough labor must be used to satisfy the demand $C(P) + G$:

$$N = F^{-1}\left(C(P) + G\right) \tag{4}$$

However, this form of the labor demand function is not useful until the determination of prices is modeled.

When aggregate production is F, the profits of the representative firm are nonnegative if and only if:

$$PF(N) - WN \geq 0 \tag{5}$$

The purpose of this paper is to compare "flexible" and "sticky" price versions of the model. In the "sticky price" version, firms have the choice of whether to produce or not, but otherwise must produce whatever their customers demand at the fixed price P. In this case, the aggregate demand for labor is inelastic – according to (4) – up to the point where $W = PF(N)/N$ and zero above that.

Given P, G, M and τ, a **fixed price equilibrium** is a list of scalars $\{C,N,W\}$ satisfying equations (1), (2), (3), and the inequality (5).

In the flexible price version, each firm sets its price to equate its marginal revenue to its marginal cost. From the perspective of the representative firm, flexible prices mean:

$$\mu = \frac{P}{W / F'(N)} \tag{6}$$

where $\mu \geq 1$ is a constant reflecting the possibility that the representative firm may face a downward sloping demand for its product (that is, a gap between marginal revenue and P) and mark up its price accordingly.

Given G, M, μ, and τ, a **flexible price equilibrium** is a list of scalars $\{C,N,W,P\}$ satisfying equations (1), (2), (3), and (6).

III. Analytics of the Multiplier and Other Paradoxes

Proposition 1 (Crowding Out) Lump-sum tax financed government purchases G reduce private spending C in the flexible price equilibrium and have no effect on private spending in the fixed price equilibrium. G increases total spending in both cases.

Proof From equation (2), G affects C only through P, regardless of which equilibrium applies. By definition, a fixed price equilibrium has P fixed. The comparative statics dC/dG in the flexible and fixed price cases are, respectively:

$$\frac{dC}{dG} = \frac{\dfrac{\partial^2 u}{\partial n^2} - \dfrac{F''(N)}{F'(N)}\dfrac{\partial u}{\partial n}}{-\dfrac{\partial^2 u}{\partial n^2} + \dfrac{F''(N)}{F'(N)}\dfrac{\partial u}{\partial n} - \dfrac{\partial^2 u}{\partial c^2}\left[F'(N)\right]^2} \in (-1,0), \quad \left.\frac{dC}{dG}\right|_{dP=0} = 0 \tag{7}$$

Proposition 2 (Labor Supply) A reduction in the labor income tax rate τ, financed with a change in lump-sum taxes, increases labor usage N and private spending C in the flexible price equilibrium and has no effect on employment and private spending in the fixed price equilibrium.

Proof From equation (2), τ affects C only through P, regardless of which equilibrium applies. P is fixed in a fixed price equilibrium. The comparative statics $dC/d\tau$ in the flexible and fixed price cases are, respectively:

$$\frac{dC}{d\tau} = \frac{-\dfrac{\partial u/\partial n}{1-\tau}F'(N)}{\dfrac{F''(N)}{F'(N)}\dfrac{\partial u}{\partial n} - \dfrac{\partial^2 u}{\partial n^2}}\frac{dC}{dG} < 0, \quad \left.\frac{dC}{d\tau}\right|_{dP=0} = 0 \tag{8}$$

The comparative statics for labor usage are:

$$\frac{dN}{d\tau} = \frac{1}{F'(N)}\frac{dC}{d\tau} < 0\,, \quad \left.\frac{dN}{d\tau}\right|_{dP=0} = 0 \tag{9}$$

The aggregate effects of unemployment benefit payments financed with lump sum taxes are one application of Proposition 2, because unemployment benefits are a transfer payment with positive (implicit) marginal labor income tax rates.[3] Economists debate the magnitude of the incentive effects, but they generally agree that unemployment benefits normally reduce aggregate employment. But the 2008-9 recession has been said to be abnormal in this regard: as one economist put it, "Traditionally, many economists have been leery of prolonged unemployment benefits because they can reduce the incentive to seek work. But that should not be a concern now because jobs remain so scarce."[4] One way to rationalize this view: the fixed price model describes the recession economy, which is otherwise adequately described by the flexible price model. Proposition 2 shows how, in this case, the payment of unemployment benefits would normally reduce aggregate employment, but would not reduce it during a recession. This is why it is important to have empirical evidence on recession-era aggregate effects of labor supply.

Proposition 3 (Tax Contraction) Assuming that the economy is on the upward sloping part of the Laffer curve, labor income taxed financed government purchases G can reduce labor usage N and total spending $C + G$ in the flexible price equilibrium but necessarily increase them in the fixed price equilibrium.

Proof By definition of "upward sloping part of the Laffer curve", an increase in the labor income tax rate τ for a given amount of government purchases requires budget

[3] The marginal tax rate is positive because unemployment benefits cease once the beneficiary becomes employed, which affects the beneficiary's tradeoff between unemployment and employment (Meyer, 1990).
[4] As quoted by Eckholm (2009).

balance via an increase in lump sum taxes, rather than a decrease or no change. Combine Proposition 1 with Proposition 2.

At first glance, a "stimulus" law that had the government purchase goods and services and finance those purchases with public debt would seem to be better described by Proposition 1 than Proposition 3, because the former holds marginal tax rates constant. However, in practice much "stimulus" spending raises marginal tax rate because the government purchases are targeted toward persons with low incomes.[5] In this case, Proposition 3 helps frame the debate about the aggregate effects of stimulus laws: if the recession economy is described by the fixed price model, then the incentive effects of stimulus spending do not matter and that spending does not crowd out private spending. In the flexible price model, stimulus spending crowds out private spending and may ultimately reduce aggregate labor usage.[6]

Figure 1 illustrates the proofs of Proposition 1-3. Labor usage is graphed on the horizontal axis, and the real (pre-tax) wage rate on the vertical axis. In the fixed price model, labor demand is wage inelastic (see equation (4)), and its horizontal position depends only on the level of the fixed price P and the amount of government purchases G. The combination of the two implies that all of the comparative statics for labor usage are zero, except for dN/dG. In particular, distortions τ in the labor market are irrelevant for determining the amount of labor usage.[7] The government can add to these distortions by raising marginal tax rates, imposing minimum wage rules, etc., and, as long as the price level is fixed, have no harmful effect on labor usage. The only effects of distortions are on wage rates paid by employers and received by employees.

In the flexible price model, prices adjust in response to the various impulses. Producers raise prices in response to an increase in government demand, and this induces the private sector to economize on its spending. At a given employment level, an improvement in labor market distortions reduces the amount employers pay for their labor – regardless of whether output prices are fixed or flexible – and in the flexible price

[5] See Mulligan (2010a) for a dramatic example from this recession.
[6] Another reason that private spending might be crowded out, even with sticky prices, is that private and government spending are closes substitutes in utility.
[7] A shift in the distaste for work (not modeled here) is isomorphic to changes in the labor income tax rate.

model producers pass on the cost savings to their customers in the form lower prices. Producers lower their prices knowing that consumers will demand more, so the producers use more labor in order to have that additional production.

For the purposes of studying the flexible price equilibrium, the fixed price labor demand curve (4) is not particularly helpful, because the curve would have to be shifted for every instance of price adjustment. The usual flexible price analysis features a labor demand or marginal productivity schedule for which movements along include the output price adjustments. The flexible price labor demand curve drawn in Figure 1 is therefore the inverse of equation (6) rather than the inverse (4) of equation (1) used to represent the fixed price equilibrium. In this case, Figure 1 clearly shows that labor distortions reduce employment (see also the proof of Proposition 2).

The government purchases multiplier of exactly one, and the exactly zero employment effect of labor market distortions help illustrate a number of paradoxes that arise in public policy discussions, but readers should recognize that other factors can push the multipliers up or down. For example, the government purchases multiplier would be lower in both models if those purchases were close substitutes with private purchases (e.g., the government purchases health care for citizens that is similar to the health care they would have purchased privately). Depending on the future of government purchases and tax rates, the government purchases multiplier could be greater than one in both intertemporal flexible price and intertemporal fixed price models to the degree that investment reacts in the short run to the anticipation of greater labor usage in the long run. Thus, additional government purchases or additional labor market distortions could actually increase private consumption spending in variations of the fixed price model (Eggertsson, 2009, 2010).

IV. Flexible Prices as a Metaphor

The "fixed" versus "flexible" dichotomy has received much attention in macroeconomic theory over the years, and that attention has spawned a number of

empirical studies of whether actual prices are sticky (Davis and Hamilton, 2004; Nakamura and Steinsson, 2008). However, the real issue here is whether *something* in the economy operates to reallocate output among competing uses in response to the impulse of interest. For the purpose of applying the paradoxes, the real question is whether public spending somehow significantly crowds out private spending and whether consumers somehow consume significantly less when the producers of the consumer goods operate in a labor market with greater distortions.

For example, the U.S. government purchased military equipment during World War II, while it also put controls on consumer prices.[8] In a flexible price world, one private sector response would be an increase in the prices of private sector goods (autos, refrigerators, etc.) that would be produced with many of the same resources used by the military equipment sector. In fact, the government ordered that former consumer durable factories be converted to military equipment production, and rationed many of the consumer durables that were put out of production. The end result was that government purchases significantly reduced private spending, which is a result that accords with the flexible price model rather than the fixed price model (Barro, 1987).

Or consider an increase in the minimum wage, and assume that the minimum is above the market clearing wage. In the flexible output price model, consumers would ultimately purchase a lesser volume of goods because the producers of those goods pass their employment costs into output prices. But in reality other mechanisms could produce this response, even (especially) if output prices were fixed. For example, prior to the minimum wage increase, a fraction of producers might have had a price that barely covered their variable costs,[9] and the minimum wage increase pushes them to cease production all together. To the degree that the goods going out of production were imperfect substitutes in utility with the remaining goods, total production and labor usage would fall.

Monetary policy itself is said to help allocate resources in a fixed price economy by adjusting so that the market clearing price is itself fixed over time. In my simple static

[8] WWII is an episode receiving significant attention in the empirical literature on the government purchases multiplier.

[9] Presumably, those producers set their price sometime in the past with the expectation that both variable and fixed costs would be covered, but various information arriving since that time revealed that the price was set too low.

model, this would be achieved merely by adjustments in the stock of money.[10] For example, a reduction in labor market distortions pushes down the (flexible) equilibrium price level for a given money stock, but would be consistent with no price level change if the money stock were increased in just the right amount together with the labor market distortion reduction. In the latter case, both the fixed and flexible price models predict higher labor usage and consumer spending, as described by the left-hand equations (8) and (9).

A rich literature has examined historical data in order to determine whether government purchases crowd out private purchases, and whether labor market distortions like taxes and minimum wages reduced labor usage and output. But it has been argued that the historical patterns should not be expected to repeat themselves during the 2008-9 recession, because past monetary policy responses (and perhaps some of the other mechanisms cited above) resulted in allocations like those that would result from flexible prices (Eggertsson, 2009; Woodford, 2010), but that the "zero interest lower bound" prevent such monetary policy responses from occurring during this recession. In other words, they assert that a simple fixed price model has the more accurate predictions during this recession, even while having less accurate predictions during most of the postwar history.

V. The Great Recession Economy Resembles a Flexible Price Economy

A contribution of this paper is therefore to consider three events that happened *during* this recession, and examine whether the outcomes confirm the paradoxes rather than showing significant resource allocation among competing uses of the economy's output. Those events are: the labor supply shifts associated with the annual seasons, the minimum wage hike of July 24, 2009, and the collapse of residential construction spending.

[10] In a dynamic model, the flexible price equilibrium price level depends on expectations of future money stocks.

V.A. The Seasonal Cycle Proceeded as Usual

Gauti Eggertsson (2010, p. 1) poses the hypothetical question "What happens [if] everyone wakes up [one day] with exactly the same idea: Let's go out and look for some more work?" He suggests that partial equilibrium answers to this question are highly misleading, and that the answer is that aggregate employment may *fall*, at least if the macroeconomy were caught in a liquidity trap, much like the one purported to characterize the U.S. economy during the recession of 2008-9. The model he uses to make his case has the same essential characteristics of the sticky price model I presented above.

Even before Eggertsson wrote his paper, economists had already examined his question, because the end of the academic year is remarkably similar to the question posed (Mulligan, 2009). Schools vary somewhat on the exact day that their academic years end, but during the month of May academic years end rather abruptly around the United States, and many of the teenage students immediately enter the job market to look for work. Academic years begin just as abruptly in late August and early September.

To see how the actual labor market responds to such an event, consider the United States Census Bureau's monthly household survey, whose employment totals (for persons aged 16 and over) have been summarized by the Bureau as national aggregates for each of several age groups. I have used their seasonally *un*adjusted series for persons aged 16-19 to calculate monthly employment deviations from each year's December to December trend. Those deviations are averaged for the five years 2003-7 prior to the current recession, and the April-October result displayed as the black series in Figure 2.[11] For example, a value of 1357 for July means that July teen employment was 1,357,000 above the December to December trend, on average for 2003-7. Figure 3 shows the same calculation for total employment (all ages 16+). Figure 4 shows teen unemployment.

Teen employment is sharply higher in June, and sharply higher again in July, for a total April-July increase of 1,649,000 teen employees. Figure 3 shows how total employment also increases significantly, so the teen rush into the labor market does not merely reallocate jobs from older persons to teens.

[11] The prior literature on teen summer employment has used April as its academic year benchmark (U.S. Bureau of Labor Statistics, 2009).

The summer teen employment surge is largely a consequence of seasonality in supply, not demand.[12] To see this, note that a pure summer demand surge would draw teens into the labor market with low teen summer unemployment, high summer real wages, and low summer unemployment among persons not enrolled in school during the academic year. Figure 4 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 (not shown in the figures) is high throughout the summer, 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), and presumably hourly wages are even lower due to longer teen summer work weeks. These patterns reverse when the academic year ends.

The recession years of 2008 and 2009 were no different in this regard: the academic year came to an end as it usually does, and got started again in the fall. Figures 2, 3, and 4 display series for each of 2008 and 2009 in blue and red, respectively. Consistent with the flexible price model, both teen employment and total employment increased significantly at the beginning of the summer, and fell back to trend when summer ended. The summer teen employment spike is a bit smaller in 2008 and 2009 than it was in prior years, and the summer total employment spike is a bit larger in 2009.[13] These data provide no support for the fixed price model hypothesis that the annual rush of teens into a recession labor market would fail to increase employment, and no support for Eggertsson's hypothesis that it would decrease employment.

V.B. The 2009 Minimum Wage Hike Reversed the Trend for Part-time Work

An increase in the labor market distortion τ, such as an increase in a binding minimum wage rate, raises employer costs. The flexible price model says that the higher costs are passed on to consumers, who demand less product from those employers, and the employers reduce their labor usage. The fixed price model predicts no labor usage effect.

[12] For the purposes of testing the fixed versus flexible price models, it is not necessary to assume that the summer surge is only the result of supply (see Mulligan, 2010b, for a formal analysis of this point).
[13] For econometric analysis of these series over a longer time frame, see Mulligan (2010b).

In July 2007, the federal minimum hourly wage was increased for the first time in 10 years, to $5.85 from $5.15. It was increased again a year later to $6.55, and increased yet again on July 24, 2009 to $7.25. Consumer prices were generally rising prior to the summer of 2008, but fell 2.1 percent from July 2008 to July 2009.[14] Thus, the real minimum wage hike was large in July 2009, and began from the highest base, and is therefore expected to have the largest effect on the costs of firms that employ low-hourly-wage workers. Part-time employees are especially likely to have hourly wages near the federal minimum.

Figure 5's red series displays seasonally adjusted national part-time employment by month, from the Census Bureau's monthly household survey. Prior to July 2009, part-time employment increased by about 3 million during the recession, including ten consecutive months of increases October 2008 - July 2009. July 2009 was the peak level of part-time employment, which by itself suggests that employers of part-time workers reacted to the federal minimum wage hike by cutting employment, as predicted by the flexible price model.

Arguably, part-time employment would have continued to increase but-for the July 2009 hike. Some people laid off from their full-time jobs are having trouble finding another suitable full-time job, so they may be working part-time while they wait. Part-time jobs pay less than full-time jobs — even on an hourly basis — so some employers may be using part-time employees to accomplish tasks where they previously might have used full-time jobs. The blue series in Figure 3 makes a prediction for part-time employment, assuming that one additional part-time job is filled for every five full-time jobs lost.[15] Prior to July 2009, the blue series predicts actual part-time employment well, including the relatively rapid growth period from Fall 2008 through early 2009 and the relatively slow growth period early in 2009. But the series depart dramatically beginning in July 2009, with actual part-time employment 400,000 below predicted part-time employment by December.

[14] The July CPI (NSA) for all items was 219.964 and 215.351 in 2008 and 2009, respectively.
[15] More precisely, a 0.2045 part-time employment increase is predicted for each full-time employment decrease; 0.2045 minimizes the squared prediction errors in Figure 5, summed from January 2008 through June 2009.

V.C. The Housing Bust Fueled a Non-Residential Construction Rebound

In the fixed price model, a demand increase in one sector increases output in that sector, without reducing output in other sectors because the competition for factors of production are not passed into output prices that would otherwise cause production to be reallocated to the demanded sector. For the same reason, a reduction in demand in one sector would not cause the other sectors to produce more.

The residential and nonresidential building sectors are an interesting case study, because the demand for housing surged 2000-2005, and collapsed thereafter. In the flexible price model, a housing boom would reduce nonresidential building unless the demand for nonresidential buildings had been increasing about as much as housing demand.

Figure 6 displays quarterly real residential and real non-residential structures investment since 2000 Q1.[16] Non-residential investment remained low throughout the housing boom. Both residential and non-residential investment turned at almost exactly the same time,[17] in opposite directions. Non-residential investment increased throughout 2006, 2007, and 2008, while residential investment was collapsing. Even by the end of 2009, real non-residential investment was still greater than it was during the housing boom.

The housing bust would increase non-residential building unless the demand for nonresidential buildings had been falling about as much as housing demand. Obviously, the large reduction in the workforce that became apparent by 2009, not to mention tight credit, likely reduced the desired stock of non-residential buildings and this by itself would cut non-residential investment activity, so it can be difficult to separate the effect of increased supply of resources for non-residential investment from reduced demand. One way to make a partial correction for changes in the demand for real business capital is to express all structures investment flows as a ratio to equipment and software investment flows. Figure 7 shows how, by this metric, non-residential structures investment was higher during almost every quarter of the recession than it was for years leading up to it.

[16] Figure 6 is reproduced and updated from Mulligan and Threinen (2008).
[17] This may suggest that much non-residential investment is planned over horizons that are similar to residential investment planning horizons.

VI. Conclusions

From a partial equilibrium perspective, it is surprising that government spending would not crowd out at least some private spending, and that an increase in factor supply would not result in more output. Yet some recent "New Keynesian" models, not to mention much public policy commentary, claim that today's economy has turned this partial equilibrium reasoning on its head, even while it might have been historically valid. This paper shows how the government spending multiplier and the "paradox of toil" are related in theory, and examines evidence *from this recession* on the output effects of factor supply.

The academic year concluded twice during this recession, and both times over a million teens entered the labor market. Well over a million of them found employment, and as a result total employment for the economy was significantly higher in July than it was in April. This pattern reversed itself the two times that the academic year resumed during this recession. The real federal minimum wage was hiked at the end of July 2009 from an already high level relative to the CPI. Employers of part-time workers appeared to respond by significantly cutting part-time employment after July 2009, despite the fact that part-time employment had trended strongly up prior to the hike. Finally, the collapse of housing construction served to shift resources into non-residential building.

Despite the presence of perhaps the deepest recession of our lifetime, and nominal interest rates on government securities that were essentially zero, these three episodes show how factor markets seemed to behave as if output prices were flexible at the margin. In particular, markets absorb an increased supply of factors of production – even during a recession like this one – and do so by increasing output. It would seem, then, that government spending crowds out private spending: the government spending multiplier is less than one.

Nothing about my results implies that this recession was efficient, or that government spending necessarily reduces efficiency. Indeed, my "flexible price model" includes a distortion in the output market (recall the parameter μ) and a distortion in the labor market (recall the parameter τ). As noted by Woodford (2010), the presence of

distortions by itself does not tell us whether government spending stimulates private spending, or how output responds at the margin to factor supply shifts.

This is not to say that output prices were actually flexible during the recession, because producer entry and exit and a variety of other market mechanisms could have many of the qualitative effects of flexible prices. Moreover, even if it were shown that output prices actually were flexible during this recession, that does not preclude the possibility that those prices would be inflexible in response to smaller shocks. But, for the purposes of this recession, models that feature fixed output prices have been a poor description of actual events in the real economy.

Fig 1. Labor Market Equilibrium with Fixed and Flexible Output Prices

When output price *P* is fixed, employers demand the number of employees needed to produce the output demanded, shown as the vertical curve in the Figure. When *P* is flexible, employer demand for labor is elastic according to the marginal product of labor schedule, because he passes on some wage costs to his customers (who have elastic demand curves). The Figure displays a single labor "supply" curve that is common to both models.

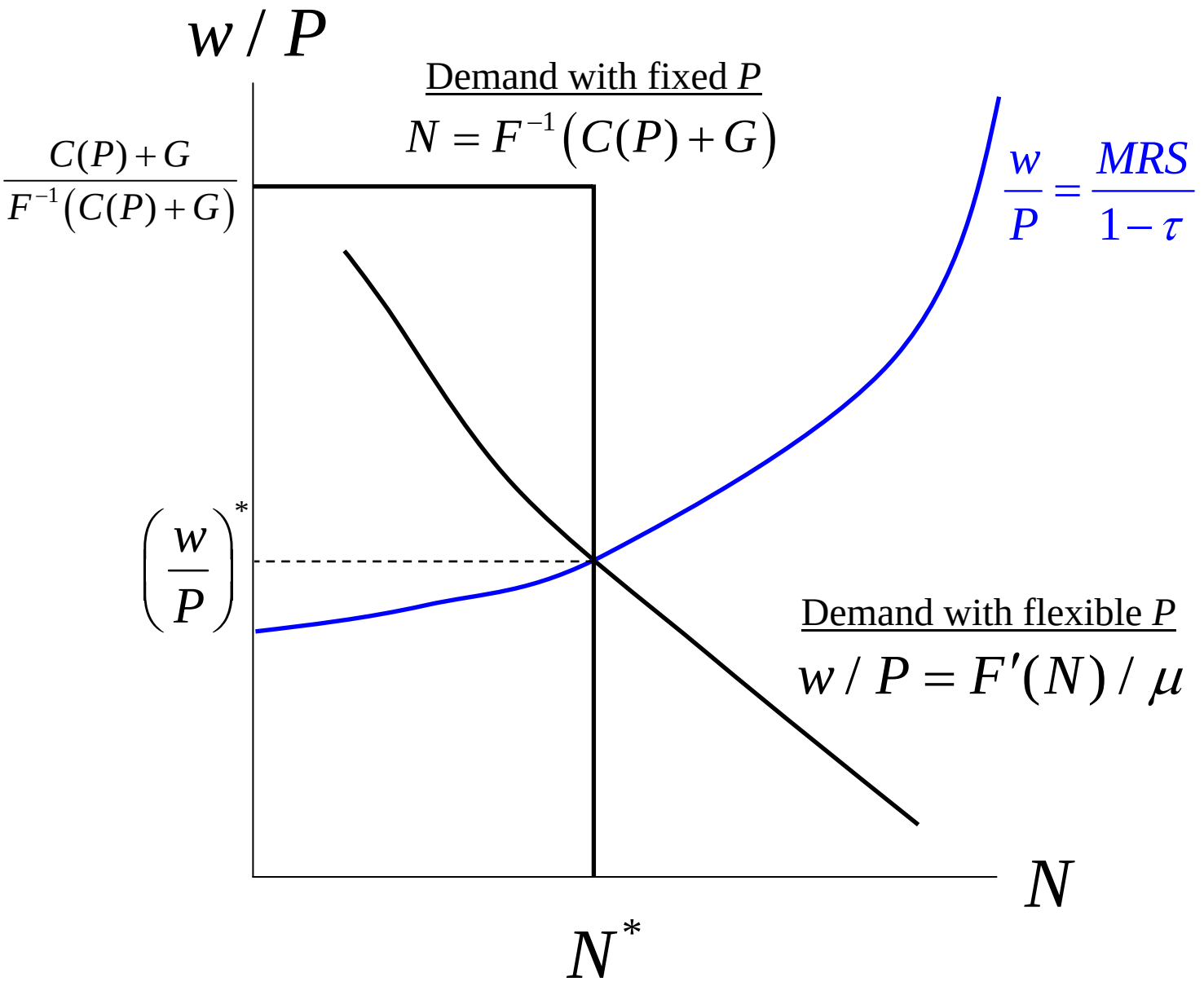


Fig 2. Teen Employment by Month

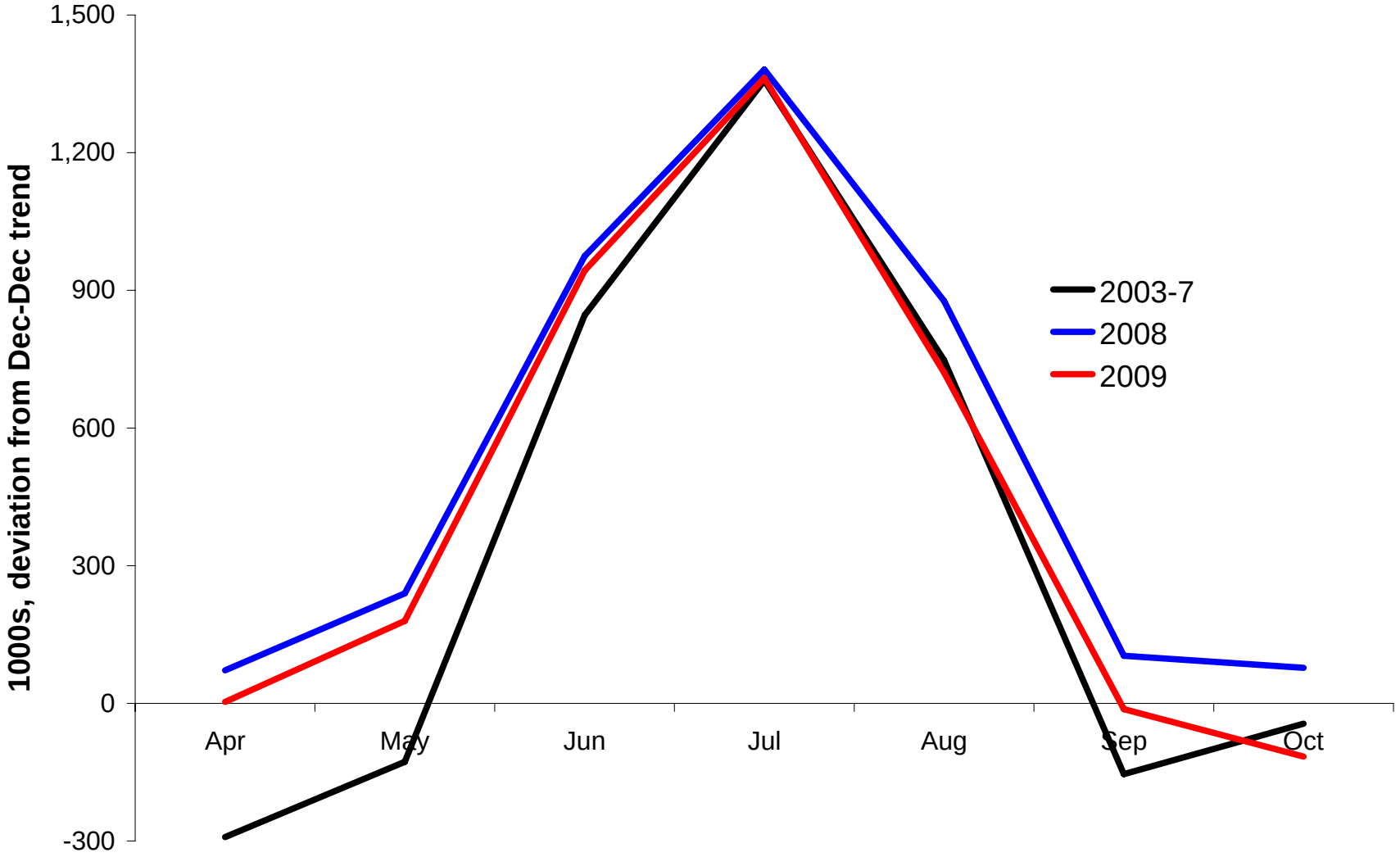


Fig 3. Employment by Month, All Ages 16+

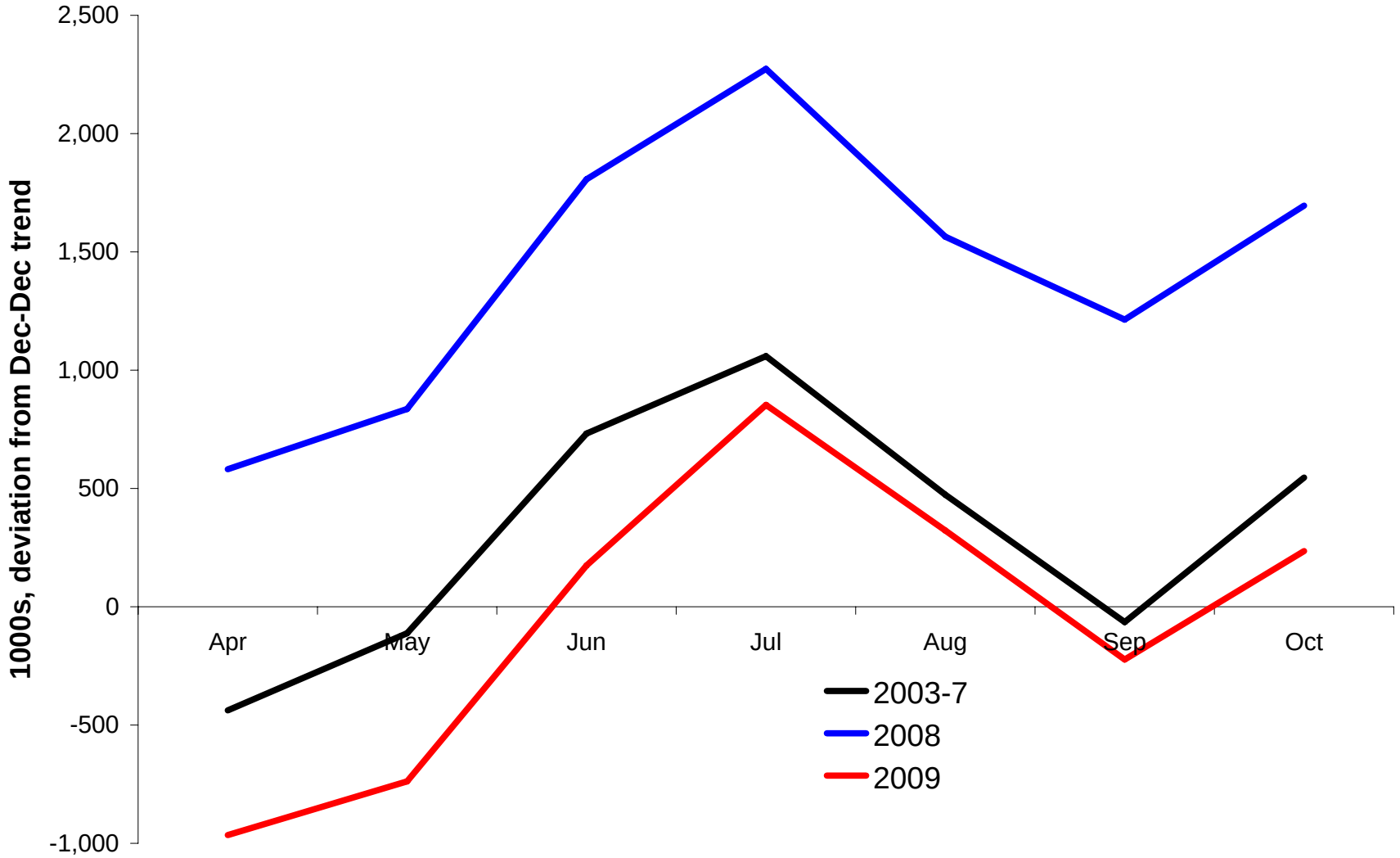
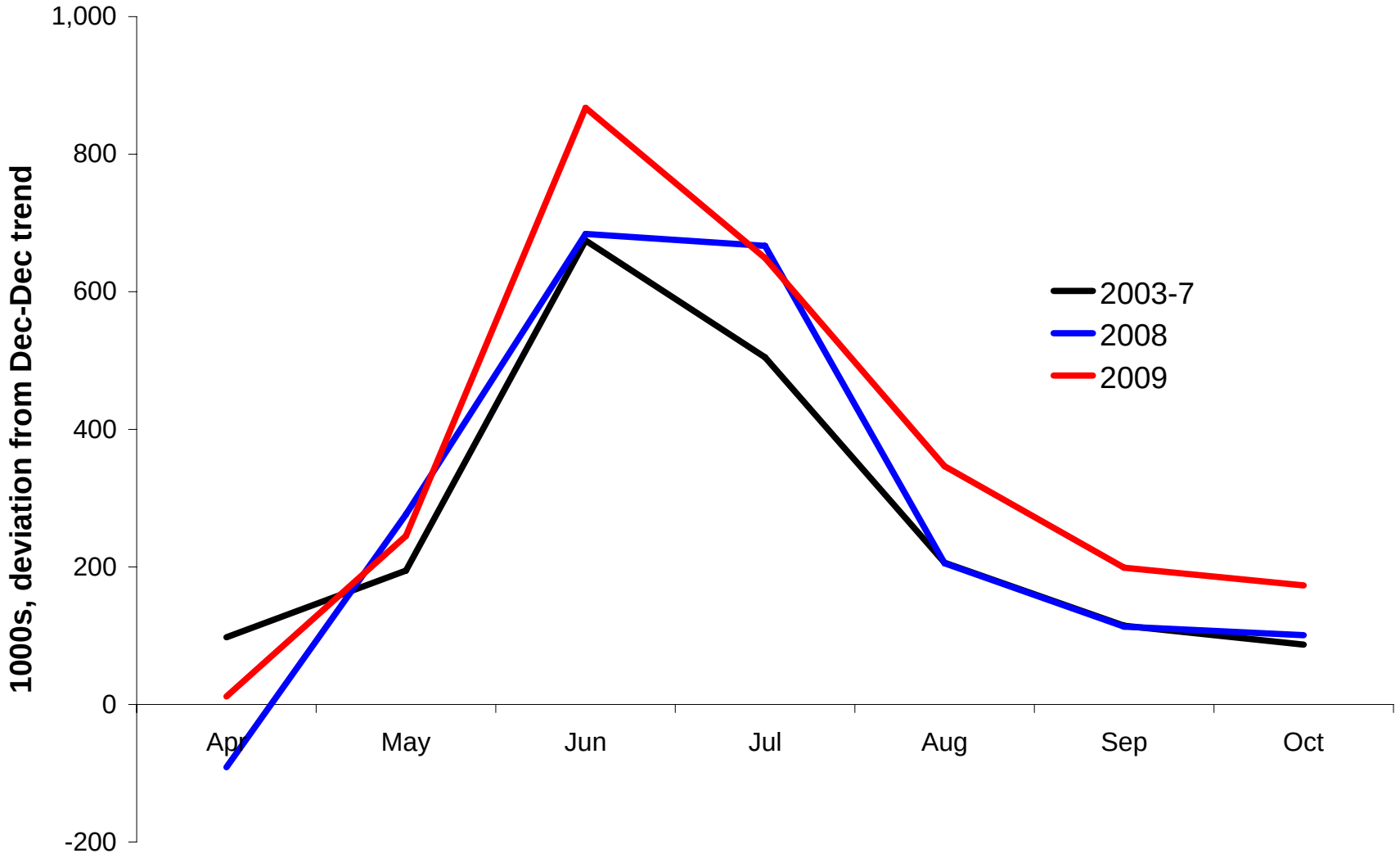


Fig 4. Teen Unemployment by Month



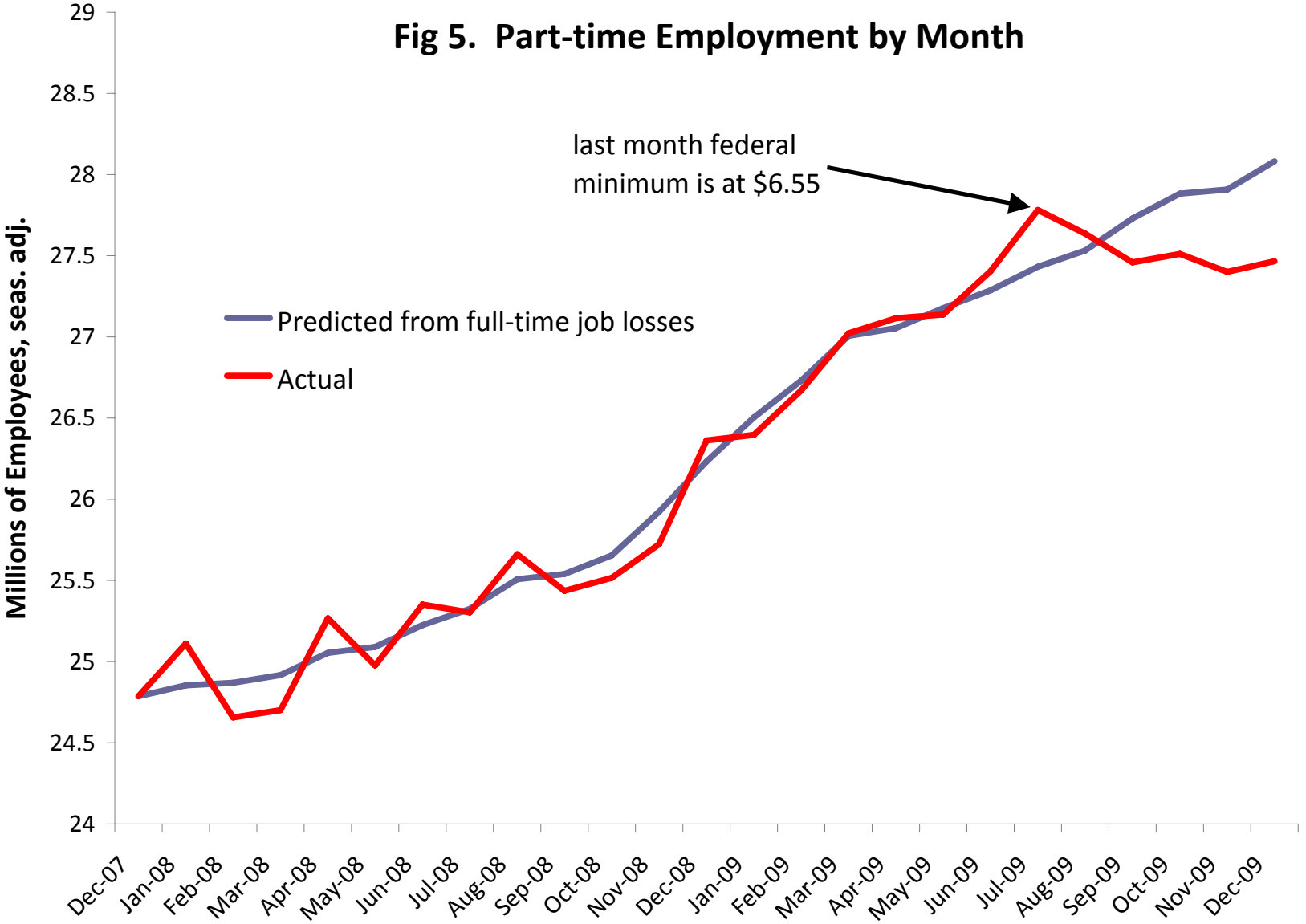


Fig 5. Part-time Employment by Month
Millions of Employees, seas. adj.
29
28.5
28
27.5
27
26.5
26
25.5
25
24.5
24
last month federal
minimum is at $6.55
Predicted from full-time job losses
Actual
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09

Fig 6. Real Investment in Structures: Residential vs. Nonresidential

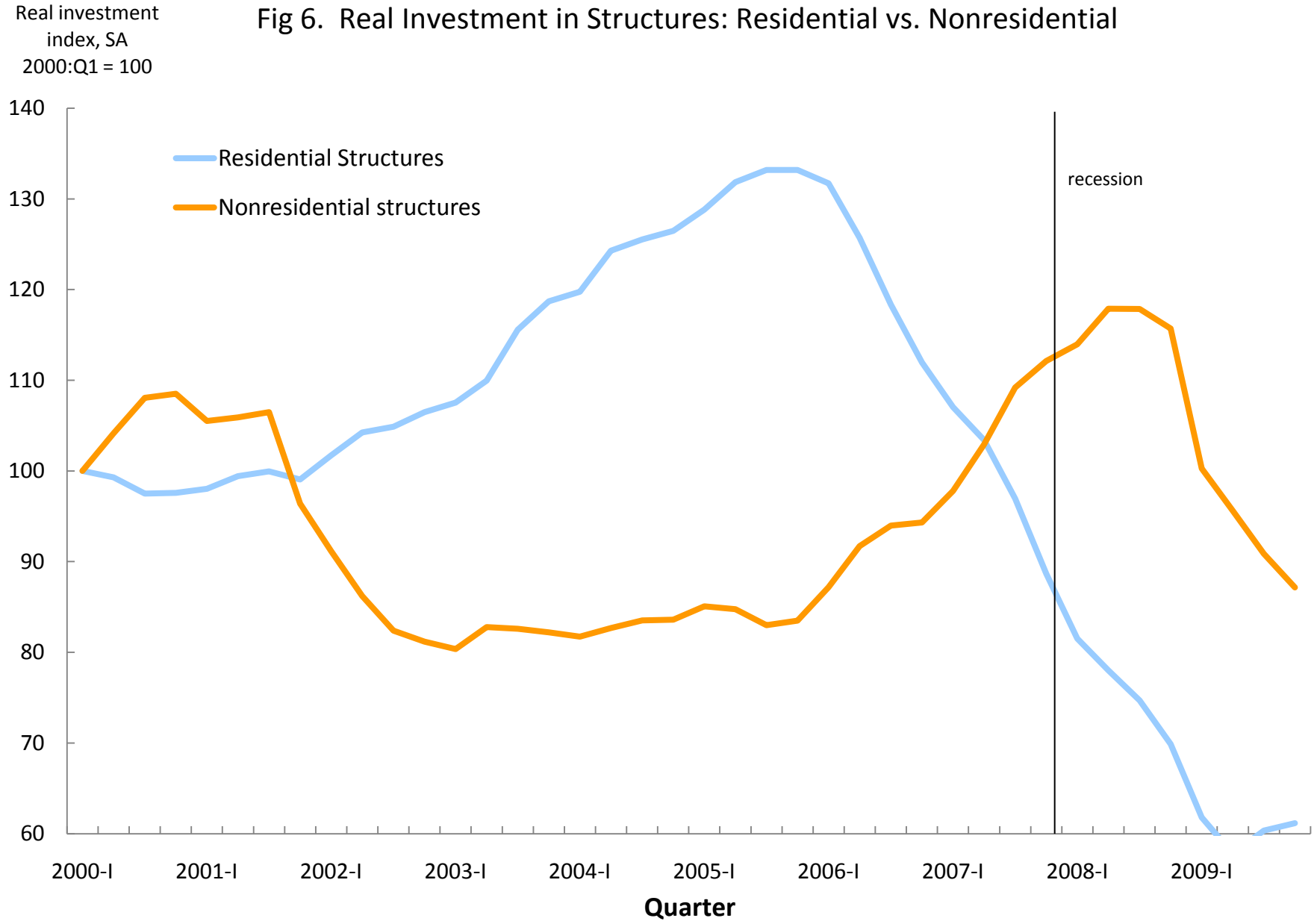
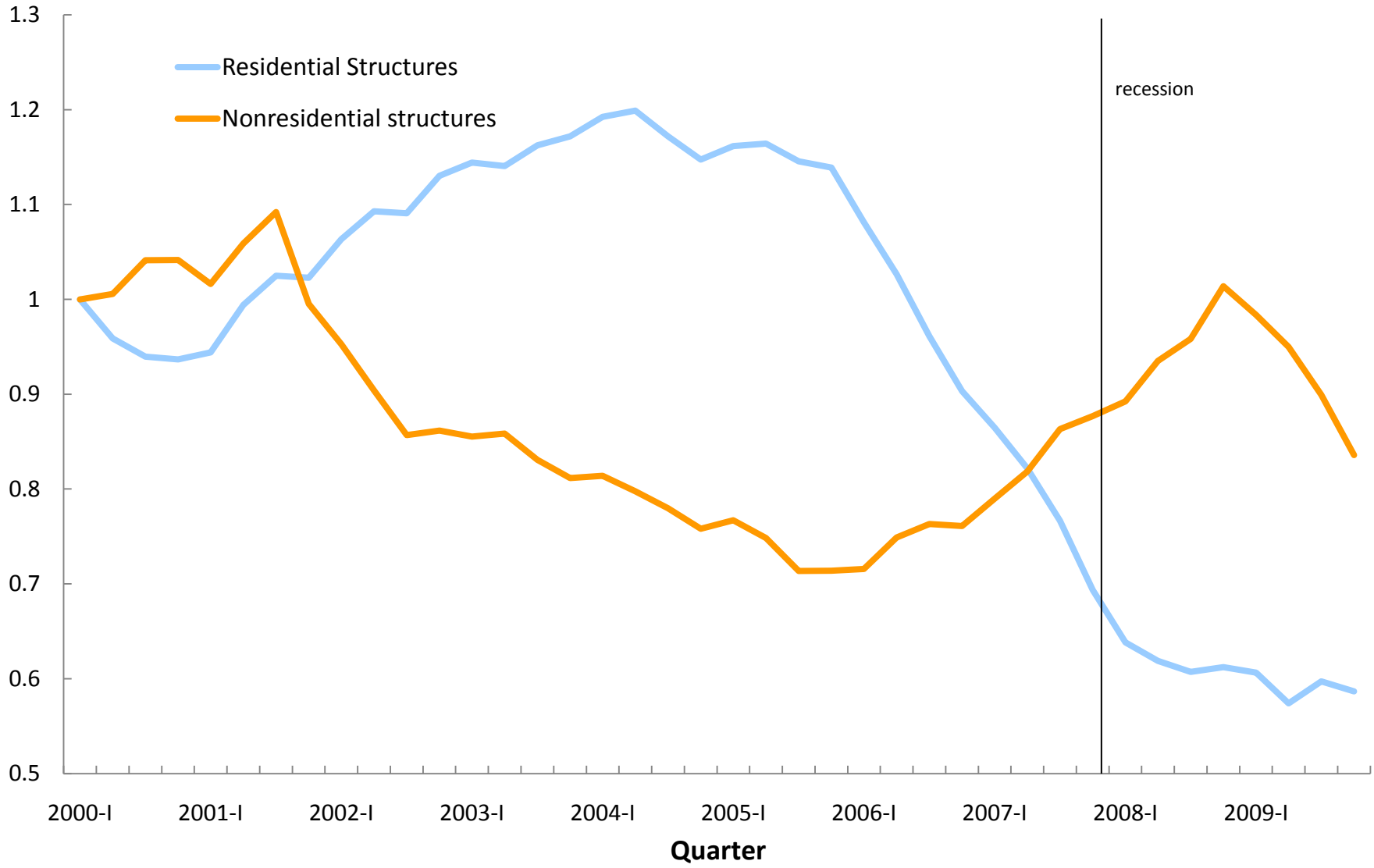


Fig 7. Real Investment in Structures: Residential vs. Nonresidential



VII. References

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

Barro, Robert J. "Output Effects of Government Purchases." *Journal of Political Economy*. 89(6), December 1981: 1086-1121.

Barro, Robert J. *Macroeconomics*. New York: John Wiley, 1987.

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

Blanchard, Olivier and Nobuhiro Kiyotaki. "Monopolistic Competition and Effects of Aggregate Demand." *American Economic Review*. 77(4), September 1987: 647-66.

Christiano, Lawrence, Martin Eichenbaum, and Sergio Rebelo. "When is the Government Spending Multiplier Large?" NBER working paper no. 15394, October 2009.

Davis, Michael C. and James D. Hamilton. "Why Are Prices Sticky? The Dynamics of Wholesale Gasoline Prices." Journal of Money, Credit, and Banking. 36(1), 2004: 17-37.

Eckholm, Erik. "Prolonged Aid to Unemployed is Running Out." *New York Times*. August 1, 2009.

Eggertsson, Gauti. "What Fiscal Policy is Effective at Zero Interest Rates?" Federal Reserve Bank of New York Staff Report no. 402, November 2009.

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

Meyer, Bruce D. "Unemployment Insurance and Unemployment Spells." *Econometrica*. 58(4), July 1990: 757-782.

Mountford, Andrew, and Harald Uhlig. "What are the Effects of Fiscal Policy Shocks?" *Journal of Applied Econometrics*. 24(6), 2009: 960-992.

Mulligan, Casey B. "School's Out for Summer: A Gem in the Jobs Report." *New York Times Economix Blog*, August 11, 2009.

Mulligan, Casey B. "Foreclosures, Enforcement, and Collections under Federal Mortgage Modification Guidelines." NBER working paper #15777, February 2010a.

Mulligan, Casey B. "Does Labor Supply Matter During a Recession? Evidence from the Seasonal Cycle." Manuscript, University of Chicago, February 2010b.

Mulligan, Casey B. and Luke Threinen. "Market Responses to the Panic of 2008." NBER working paper no. 14446, October 2008.

Nakamura, Emi and Jon Steinsson. "Five Facts about Prices: A Reevaluation of Menu Cost Models." *Quarterly Journal of Economics.* 123(4), November 2008: 1415-64.

Ramey, Valerie A. "Identifying Government Spending Shocks: It's All in the Timing." NBER working paper no. 15464, October 2009.

United Status Bureau of Labor Statistics. "Summer Youth Labor Force." August 2009.

United States Census Bureau. "Table A-13: Employment Status of the Civilian Noninstitutional Population by Age, Sex, and Race." *Labor Force Statistics from the Current Population Survey*, various issues.

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