Fordham University
Department of Economics
Discussion Paper Series

Unemployment Reduction Prowess Under Bush versus Obama Years

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Discussion Paper No: 2012-02
October 2012

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September 24, 2012

Abstract

This paper attempts to compare the performance of presidents George W. Bush and Obama in the context of reduction of unemployment by comparing the Beveridge curve tradeoffs between vacancy and unemployment rates. We consider monthly data and measure the output of the economy as gross value of industrial production to define the output labor ratio. A new production function model estimates distinct "friction scale elasticities," marginal elasticities and elasticities of substitution under Bush and Obama. The discrepancy is related to our not including capital input, interest rates, wage rates and similar important variables in our simplified model. However we provide new isoquant maps with distinct appearances during Bush and Obama years providing mild support for Zingales (2012). Ultimately, there might be distinct employer evaluations of expected future profitability during the Bush and Obama periods. We implement all this in a completely reproducible and transparent manner using the free R software.

1 Introduction

In the current political season Republicans are blaming President Obama for high unemployment. A Chicago University professor Zingales (2012) is

*Professor of Economics, Fordham University, Bronx, New York, USA 10458. E-mail: vinod@fordham.edu. The paper is available at http://ssrn.com/abstract=2149316 claiming that health care reform and bailing out GM when the government "bullied the bankruptcy judge and creditors into giving preferential treatment to the unions' financial claims, overstepping existing contracts. This behavior undermined the rule of law." This paper uses empirical data to see whether alleged increase in uncertainty and changed incentives have made an observable difference to measurable parameters of the labor market.

Which labor parameters? We begin with the Beveridge curve (BC) discussed by macroeconomists at least since an important article by Blanchard and Diamond (1989). It shows a trade-off type relation between vacancy rate on the vertical axis and unemployment rate on the horizontal axis. It is similar to the usual indifference curves in consumer theory whose shape is a rectangular hyperbola.

Recently, Daly et al. (2012) discuss the BC along with an apparently first empirical estimate of the job creation curve (JCC) defined as an aggregate demand curve for labor based on employers wanting to create jobs. A typical JCC is upward sloping with the slope affected by several real world issues from the goods and labor markets including bargaining and macro economic conditions. According to macroeconomic theory, the intersection of BC and JCC curves gives the equilibrium level of frictional unemployment which is also called the "natural unemployment" rate. Daly et al. (2012) focus on the movements along the BC, shifts in BC and equilibrium with the JCC. These authors use average vacancy rate at empirically estimated approximate values of the natural rate of unemployment to estimate its long-run upward slope and equate it to the upward slope of the JCC.

Macro economists link the Keynesian "aggregate demand" to this equilibrium by noting that during recessions both aggregate demand and marginal (revenue) product of labor (MPL) decreases giving a smaller incentive for creating additional jobs. Why produce more when there is reduced demand? However, in terms of physical outputs the MPL is not necessarily dependent on demand for output per se.

This paper uses the monthly data on aggregate output as the gross value of industrial production and considers BC as "level curves" being different at each level of output. In other words we consider a three dimensional surface with output as the third dimension with higher rate of vacancies associated with a lower unemployment rate at each level of output, depicting the usual axes of the BC. A movement along the BC will then represent a curve analogous to the indifference curve representing the mismatch between skill set and location of available labor and available jobs in the current context of comparing the performance of the US economy under two recent administrations. For example, see Figure 3. We consider these issues from an objective viewpoint of econometric data analysis tools discussed in my recently published textbook Vinod (2008), rather than engaging in politicians' blame game.

Let us initialize our R session with my favorite set of commands to clean up the slate, set the seed for random numbers (if any), replace the usual prompt ">" with a space, to permit direct 'copy and paste? from our pdf output files.

```
rm(list=ls())
seed <- 42
set.seed(seed)
options(prompt = " ", continue = "  ", width = 60,
 useFancyQuotes = FALSE)
```

First, we read the seasonally adjusted US non-farm vacancies data from Job Openings and Labor Turnover Survey and display it in Figure 1.

```
da=read.table(file=
 "http://www.fordham.edu/economics/vinod/jobVacanciesBLS.csv",
 header=TRUE, sep=",",skip=10)
da2=da[,2:13]#ignore first and last column
da3=c(t(da2)) #Ms. Voitle suggestion
da4=da3[!is.na(da3)];da3=da4
vacancies=ts(da3,start=c(2000,1),frequency=12)
```

Now, we read the seasonally adjusted unemployment rate data based on Labor Force Statistics from the Current Population Survey, and display it in Figure 2.

```
dau=read.table(
 file="http://www.fordham.edu/economics/vinod/unemprate.csv",
 header=TRUE, sep=",",skip=9)
dau2=dau[,2:13]#ignore first column
dau3=c(dau2[1,12],dau2[2,], dau2[3,], dau2[4,], dau2[5,], dau2[6,],
 dau2[7,], dau2[8,], dau2[9,], dau2[10,], dau2[11,], dau2[12,],
 dau2[13,1:6])
unem=ts(dau3,start=c(2000,1),frequency=12)
```

```
plot(vacancies)
```

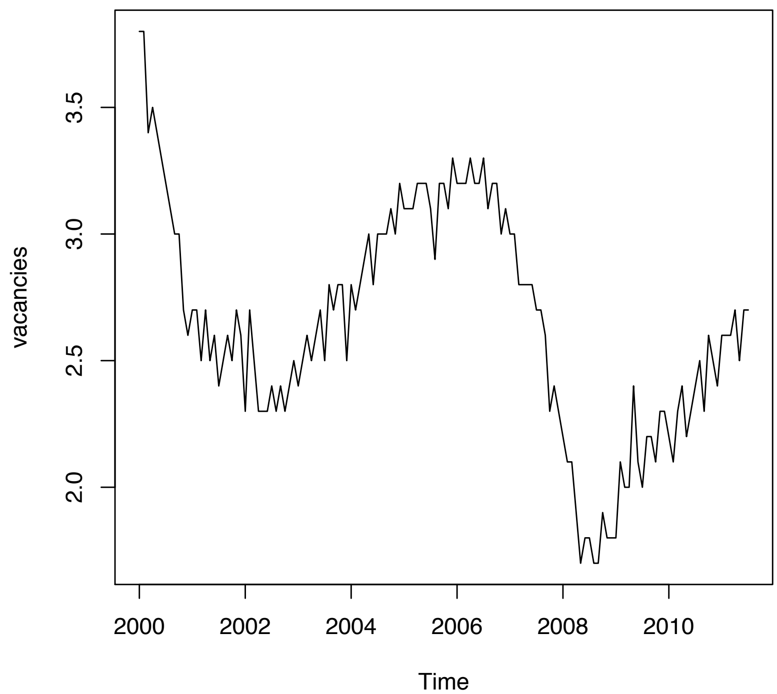

Figure 1: “Job vacancies rate during Bush and Obama years”

```
plot(unem)
```

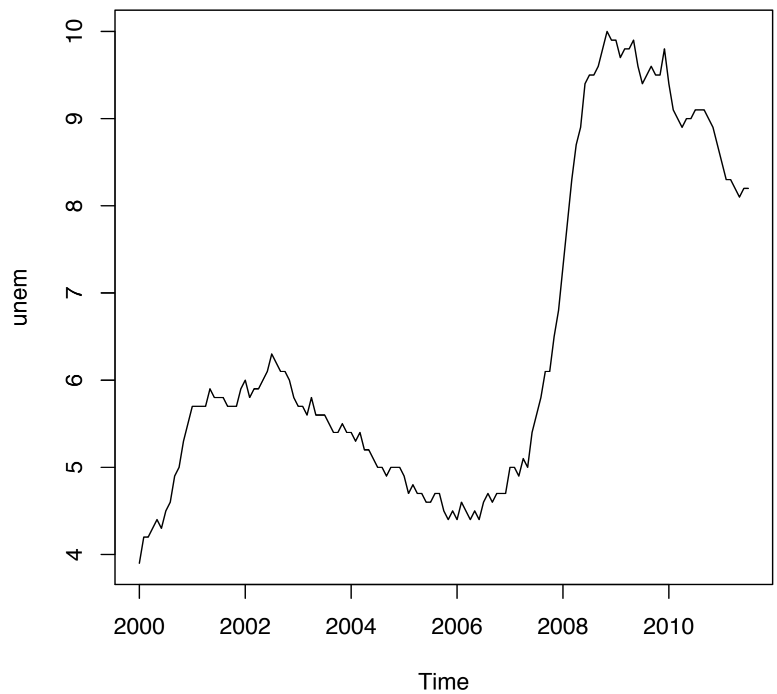

Figure 2: "Unempolyment rate during Bush and Obama years"

```r
require(car)
scatterplot(as.numeric(unem[1:96]),as.numeric(vacancies[1:96]),
 reg.line=FALSE, xlab="Unemployment Rate",ylab="Vacancies Rate")
```

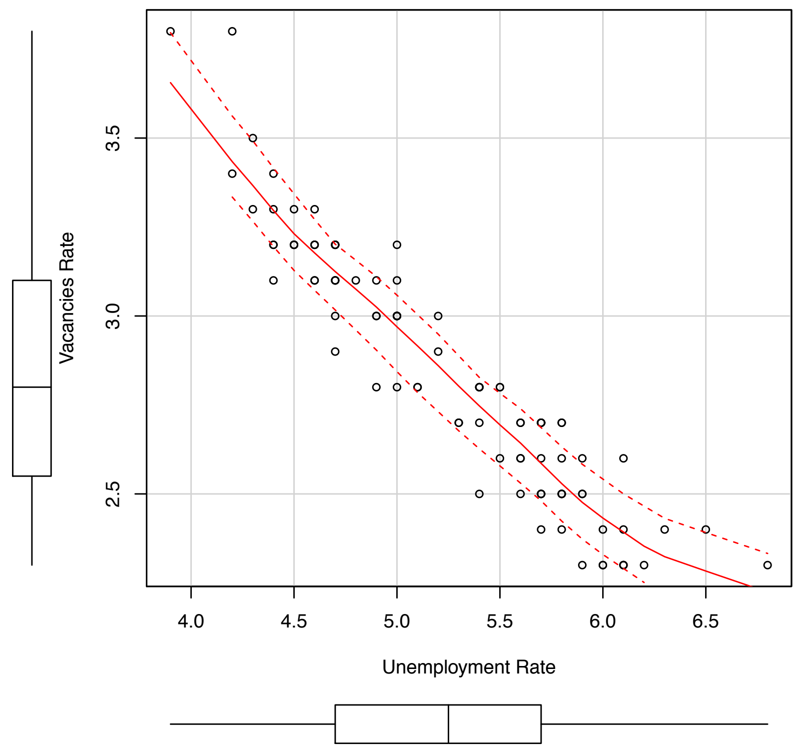

Figure 3: "Beveridge Curve Scatter During Bush years"

```
require(car)
scatterplot(as.numeric(unem[97:139]),as.numeric(vacancies[97:139]),
 reg.line=FALSE, xlab="Unemployment Rate",ylab="Vacancies Rate")
```

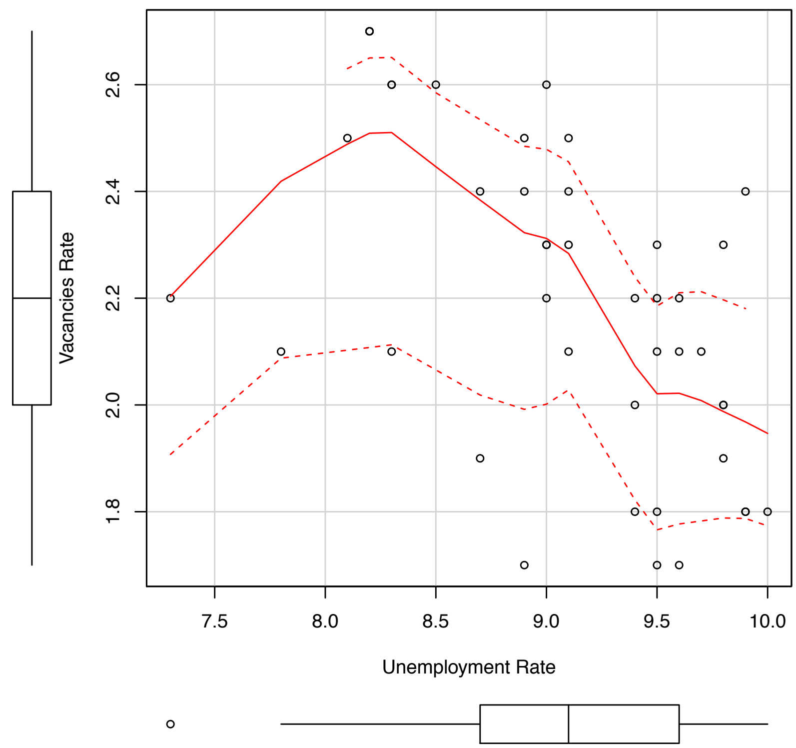

Figure 4: "Beveridge Curve Scatter During Obama years"

Beveridge curve scatter diagrams during Bush and Obama administrations respectively are depicted in Figures 3 and 4, respectively. The figures also include a locally best fitting nonlinear curve for a possible relationship between the variables. The curves and relationships are obviously distinct. While the theoretical tradeoff seems plausible during Bush years, the tradeoff is less visible during the Obama years. We also notice generally low vacancy rates and high unemployment rates during the Obama years.

2 A New Look at the Beveridge Curve

Each point on the Beveridge curve is, of course, affected by the level of output (industrial production) during that month. We propose explicitly incorporating the output variable in the model by considering a production function where the capital labor ratio is involved.

In macroeconomic theory, the aggregate output is a function of capital and labor inputs

$$Y_t = F(K_t,\, L_t) \tag{1}$$

where F is assumed to be a homogeneous production function. That is, if we multiply each input by λ, the output is also multiplied by the λ^ρ by the Euler theorem on homogeneous functions.

Accordingly, $\lambda^\rho\, Y_t = F(\lambda K_t,\, \lambda L_t)$, where ρ is the returns to scale parameter. If the production function is linearly homogeneous, $\rho = 1$, we can divide through both sides of equation (1) by L_t leading to a production function in terms of output and capital per unit of labor by setting $\lambda = 1/L_t$. Also, we can write:

$$Y_t = (\frac{\partial F}{\partial K_t})K_t + (\frac{\partial F}{\partial L_t})L_t, \tag{2}$$

Now let us make the capital labor ratio κ as the sole input to write

$$F(K_t/L_t, 1) = F(\kappa, 1) \tag{3}$$

It is easy to verify that the marginal product of capital, as sell as, labor depends only on κ the capital labor ratio.

When we introduce unemployment rate (u_t) coexisting with unfilled vacancies (v_t) in the neat picture of neoclassical production function certain visualizations will have to change. Let us consider the following non-standard 'production function':

$$Y_t/L_t = F(v_t,\, u_t),\ \text{where}\,(v_t, u_t) \propto (1/\kappa) \tag{4}$$

where u_t is the the usual unemployment rate and v_t is the the usual vacancy rate.

Although the equation (4) suggests a tempting inverse proportionality between the capital labor ratio and u_t, v_t, this is an empirical question, depending on the data and time period. Recall that the model (3) makes output per unit of labor as a function of the capital labor ratio. In our monthly data, labor input (L_t) and industrial production (Y_t) are changing. We now recognize the fact that due to a mismatch between skills and locations of workers and jobs a certain (u_t) percent of those seeking work are unemployed. We are also cognizant that employers are unable to fill v_t percent of job vacancies. Thus the US economy is obviously not at a full employment profit maximizing equilibrium solution.

We try to fit the function (4) using the available data plotted above and estimate a new pseudo production function by the usual tools. Since the GDP output data is available only on a quarterly basis, we use the available monthly industrial production (seasonally adjusted gross value of final products and industrial supplies) data as a proxy.

```
dai=read.table(
 file="http://www.fordham.edu/economics/vinod/industrialprod.csv",
 header=TRUE, skip=4, sep=",")
dai2=dai[15:27,2:13]#ignore data for 1986 to 1999
#dai2[1,]
#dai2[13,]
dai3=c(dai2[1,12],dai2[2,], dai2[3,], dai2[4,], dai2[5,], dai2[6,],
 dai2[7,], dai2[8,], dai2[9,], dai2[10,], dai2[11,], dai2[12,],
 dai2[13,1:6])
indprod=ts(dai3,start=c(2000,1),frequency=12)
```

We need seasonally adjusted total civilian employment data from the Federal Reserve Bank database (FRED). We load this from the Internet as follows and plot it in Figure 6. September 11, 2001 terrorist attacks caused the total employment to drop, as is seen from the initial part of the plot.

```
plot(indprod)
```

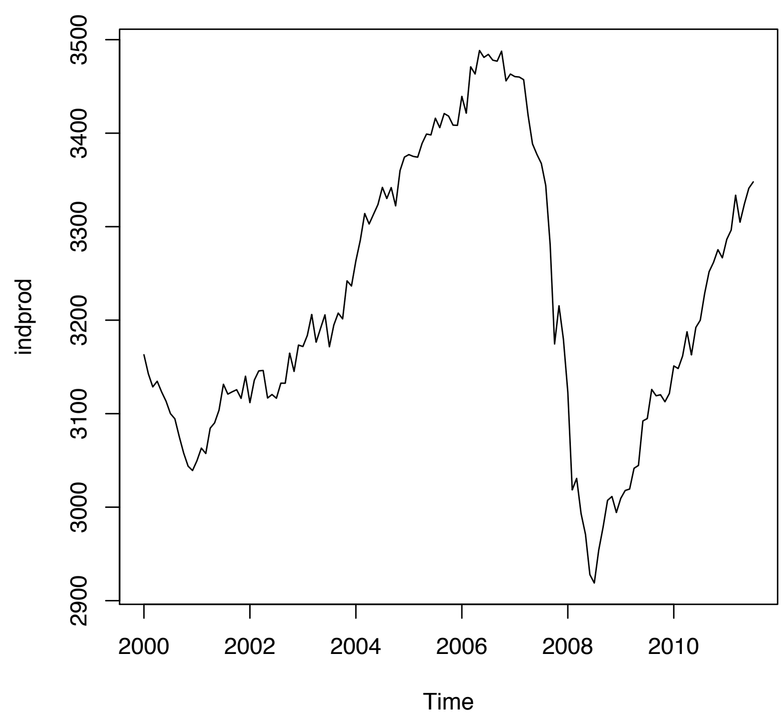

Figure 5: “Industrial Production during Bush and Obama years”

```
library(fImport)
CEM=fredSeries("PAYNSA", from="2000-12-01",
 to="2012-06-01")

emp=ts(CEM$PAYNSA, start=c(2000,12),end=c(2012,6),frequency=12)

plot(emp)
```

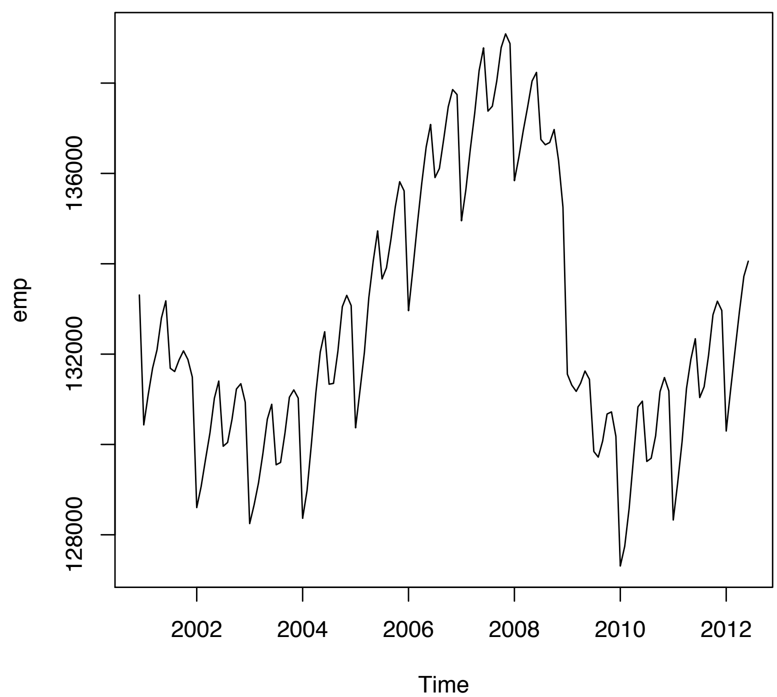

Figure 6: “Total Employment during Bush and Obama years”

Recall that when we visualize the usual production function eq. (1) as a three dimensional production surface, the height of the surface is low near the origin and increases in the North-East direction along the capital labor axes.

If we consider the trade-off between vacancies and unemployment in production of output labor ratio, the higher level of (Y_t/L_t) might be associated with *lower* levels of unemployment and vacancies. We shall see that this holds during the Bush presidency months. This is an 'empirical' question for our non-standard production function, mainly because we are not explicitly including the effect of the capital input, interest rates, wage rates and similar important variables. Hence this is not at all similar to the usual depiction of a production function. The output value along the third dimension here for equation (4) is generally higher near the origin and declines as unemployment and/ or vacancy rates increase in the North-East direction.

We define Ly as the log of the output to employment ratio, $Lvac$ as the log vacancy rate and $Lunem$ as the log unemployment rate. Now we fit a multiplicative non-homogeneous production function, Vinod (1972), defined as:

$$Ly = \alpha_0 + \alpha_1 Lvac + \alpha_2 Lunem + \alpha_3 (Lvac * Lunem), \tag{5}$$

where the interaction term $(Lvac * Lunem)$ between logs of the two inputs distinguishes it from the usual Cobb-Douglas form which assumes $\alpha_3 = 0$. It is shown to have variable elasticity of substitution.

The elasticity of substitution (EOS) for the functional form of eq. (5) is readily obtained from the two marginal elasticities (partials of log of output wrt partial of an input, evaluated at the means of relevant variables). Let the sum of the two marginal elasticities be denoted as $FSCE$ for the 'friction' scale elasticity. If both inputs $(vac, unem)$ increase by one percent, the friction in the labor market increases by one percent. Now FSCE measures the impact of such increase on (Y_t/L_t).

According to Vinod (2008, Sec. 1.8) the EOS for eq. (5) is given by the simple formula:

$EOS = FSCE/(FSCE + \alpha_3)$.

Let us now compute these quantities from the available US data.

```
Ly=log(as.numeric(indprod)/ as.numeric(emp))
Lvac=log(as.numeric(vacancies));
Lunem=log(as.numeric(unem))
regB=lm(Ly[1:96]~Lvac[1:96]+Lunem[1:96]+(Lvac[1:96]*Lunem[1:96]))#bush
regO=lm(Ly[97:139]~Lvac[97:139]+Lunem[97:139]+(Lvac[97:139]*Lunem[97:139]
 ))
```

```
suB=summary(regB)
suO=summary(regO)
```

Tables 1 and 2 report summaries of the regression results for Bush and Obama monrhs, respectively. The adjusted R-square for the Bush era model is 0.28298, while the Obama era value is 0.81205. The overall fit is somewhat poorer for the Bush data while the p-values for the F test for the overall model are close to zero for both Bush and Obama. The individual regression coefficients are generally statistically significant for both data sets, with p-values never exceeding 0.05.

```
require(xtable)
xtab1=xtable(suB,label="tab.suB",caption=
 "Multiplicative Non-homogeneous Production Function During Bush Years")
xtab2=xtable(suO,label="tab.suO",caption=
 "Multiplicative Non-homogeneous Production Function During Obama Years")
```

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-2.3714	0.3344	-7.09	0.0000
Lvac[1:96]	-1.0934	0.2773	-3.94	0.0002
Lunem[1:96]	-0.7995	0.1846	-4.33	0.0000
Lvac[1:96]:Lunem[1:96]	0.6547	0.1621	4.04	0.0001

Table 1: Multiplicative Non-homogeneous Production Function During Bush Years

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-5.2679	0.5167	-10.20	0.0000
Lvac[97:139]	1.7710	0.6402	2.77	0.0086
Lunem[97:139]	0.6068	0.2330	2.60	0.0129
Lvac[97:139]:Lunem[97:139]	-0.6920	0.2903	-2.38	0.0221

Table 2: Multiplicative Non-homogeneous Production Function During Obama Years

Next, we compute the sample means of Lvac and Lunem data, needed in the computation of marginal elasticities to be evaluated in the sequel. We also keep the option of evaluating monthly elasticities.

```
cB=coef(regB)#for Bush
cO=coef(regO)#for Obama
Bvac=mean(Lvac[1:96])
Ovac=mean(Lvac[97:139])
Bunem=mean(Lunem[1:96])
Ounem=mean(Lunem[97:139])
Bvac.t=(Lvac[1:96])
Ovac.t=(Lvac[97:139])
Bunem.t=(Lunem[1:96])
Ounem.t=(Lunem[97:139])
```

The marginal elasticities evaluated at the means of relevant variables are computed next.

```
MEvacB=cB[2]+cB[4]*Bunem
MEunemB=cB[3]+cB[4]*Bvac
MEvacO=cO[2]+cO[4]*Ounem
MEunemO=cO[3]+cB[4]*Ovac
cb1=cbind(MEvacB, MEvacO)
rownames(cb1)="Vacancy Marginal Elasticities"
print(cb1)
```

```
                                   MEvacB    MEvacO
Vacancy Marginal Elasticities -0.01408345 0.2455514
```

```
cb2=cbind(MEunemB, MEunemO)
rownames(cb2)="Unemployment Marginal Elasticities"
print(cb2)
```

```
                                     MEunemB  MEunemO
Unemployment Marginal Elasticities -0.1194552 1.117003
```

```
MEvacB.t=cB[2]+cB[4]*Bunem.t
MEunemB.t=cB[3]+cB[4]*Bvac.t
MEvacO.t=cO[2]+cO[4]*Ounem.t
MEunemO.t=cO[3]+cB[4]*Ovac.t
```

```
SCEbush=(MEvacB+MEunemB)
SCEobama=(MEvacO+MEunemO)
cbe=cbind(SCEbush,SCEobama)
rownames(cbe)="Scale Elasticities"
print(cbe)
```

```
                      SCEbush SCEobama
Scale Elasticities -0.1335386 1.362555
```

```
SCEbush.t=(MEvacB.t+MEunemB.t)
print(mean(SCEbush.t))
```

```
[1] -0.1335386
```

```
SCEobama.t=(MEvacO.t+MEunemO.t)
print(mean(SCEobama.t))
```

```
[1] 1.362555
```

Above, we report the scale elasticities evaluated at means of data and also the average of the changing elasticities evaluated for each month for both presidents. The respective plots are in Figures 7 and 8, respectively.

Now we estimate the elasticities of substitution.

```
EOSBush=(MEvacB+MEunemB)/ (MEvacB+MEunemB+cB[4])
EOSObama=(MEvacO+MEunemO)/ (MEvacO+MEunemO+cO[4])
cb3=cbind(EOSBush,EOSObama)
rownames(cb3)="Elasticities of Substitution"
print(cb3)
```

```
                                EOSBush EOSObama
Elasticities of Substitution -0.2562147 2.032003
```

```
plot(SCEbush.t,typ="l")
```

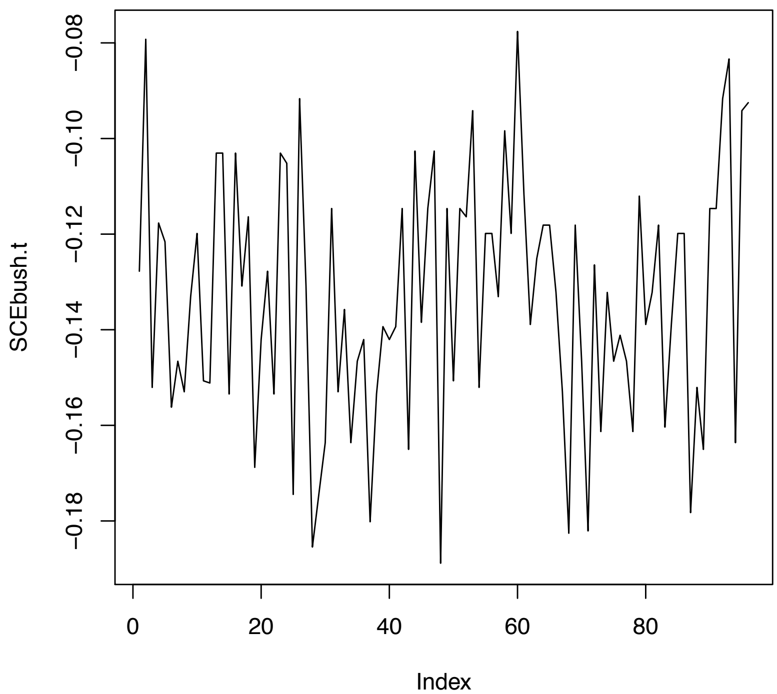

Figure 7: “Monthly scale elasticities during Bush years.”

```
plot(SCEobama.t,typ="l")
```

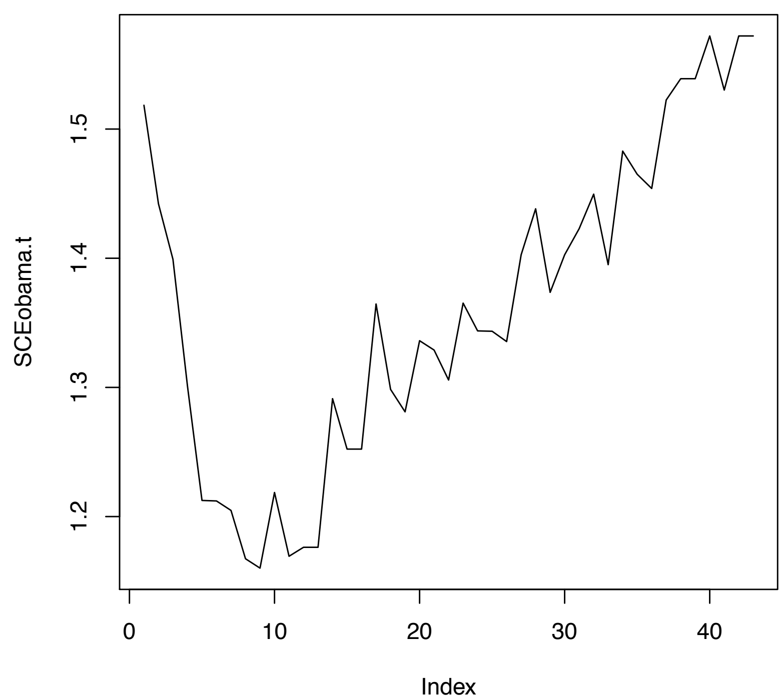

Figure 8: "Monthly scale elasticities during Obama years."

```
plot(EOSBush.t,typ="l")
```

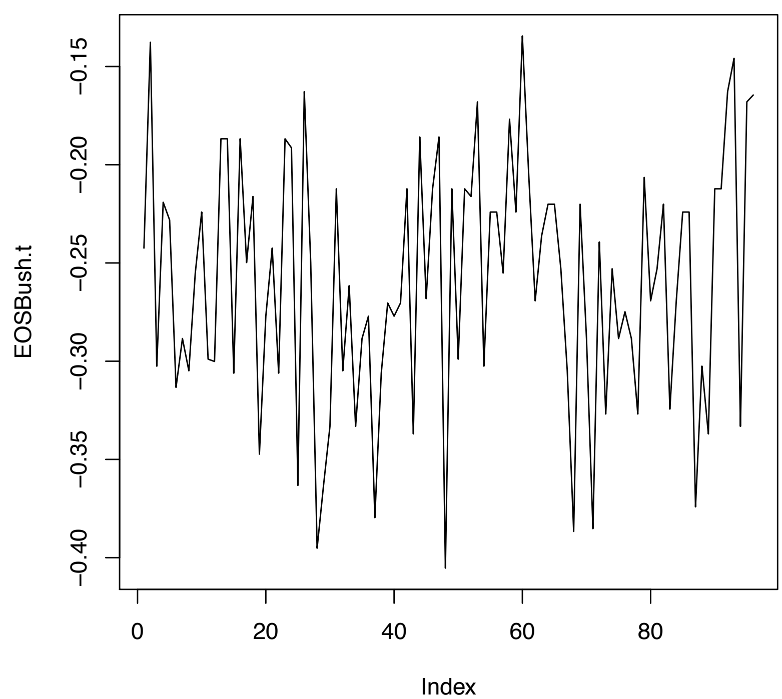

Figure 9: “Monthly elasticities of substitution during Bush years.”

```
plot(EOSObama.t,typ="l")
```

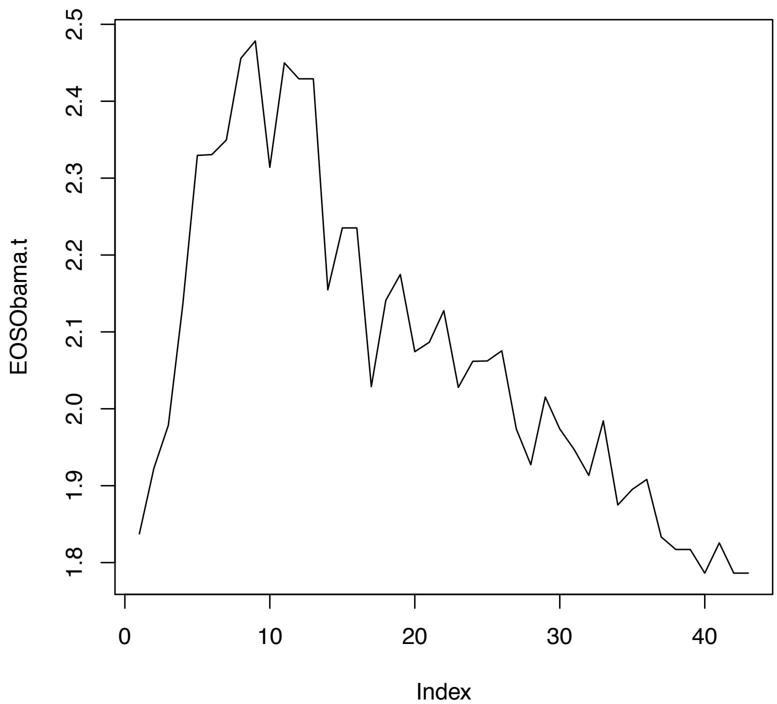

Figure 10: "Monthly elasticities of substitution during Obama years."

```
EOSBush.t=(MEvacB.t+MEunemB.t)/ (MEvacB.t+MEunemB.t+cB[4])
EOSObama.t=(MEvacO.t+MEunemO.t)/ (MEvacO.t+MEunemO.t+cO[4])
```

The average of monthly EOS depicted in Figure 9 is 0 under Bush and the average of monthly EOS depicted in Figure 10 is 2 under Obama.

It is possible to use the multiplicative non-homogeneous tools described in Vinod (2008, Sec. 1.8.2) to depict the isoquants or level curves for the production surface during the Bush years.

```
source(file=
 "http://www.fordham.edu/economics/vinod/HandsOn1.8.2.txt")
```

We use the R function 'pfcontour' reported in Vinod (2008, Sec. 1.8.2).

```
Ly.b=as.numeric(Ly[1:96])
Ly.o=as.numeric(Ly[97:139])
Lvac.b=as.numeric(Lvac[1:96])
Lvac.o=as.numeric(Lvac[97:139])
Lunem.b=as.numeric(Lunem[1:96])
Lunem.o=as.numeric(Lunem[97:139])
```

The Figure 11 depicts the isoquants for Bush years showing that the (Y_t/L_t) ratio steadily increases as the unemployment rate decreases. However, the relation between (Y_t/L_t) ratio and vacancies is ambiguous.

The Figure 12 depicts the isoquants for Obama years showing that the (Y_t/L_t) ratio directly increases with the vacancy rate, but unemployment rate is less directly related.

3 Conclusions

Our empirical results indicate that our new look at the Beveridge Curve has yielded some new insights regarding the frictions in the US job market. The marginal elasticity of output labor ratio wrt unemployment is -0.11946 during the Bush years whereas it is 1.117 during Obama years, showing opposite signs. That is, a one percent increase in the unemployment rate is associated with a decrease in output labor ratio during the Obama years, but associated with an increase during the Bush presidency.

The marginal elasticity of output labor ratio wrt vacancy rate is -0.01408 during the Bush years whereas it is 0.24555 during Obama years, again showing opposite signs. That is, a one percent increase in the vacancy rate is

```
pfcb=pfcontour(Ly.b,Lvac.b,Lunem.b, level=FALSE, type="MNH",
 n50=length(Ly.b),xlab="vacancies rate",
 ylab="unemployment rate")
```

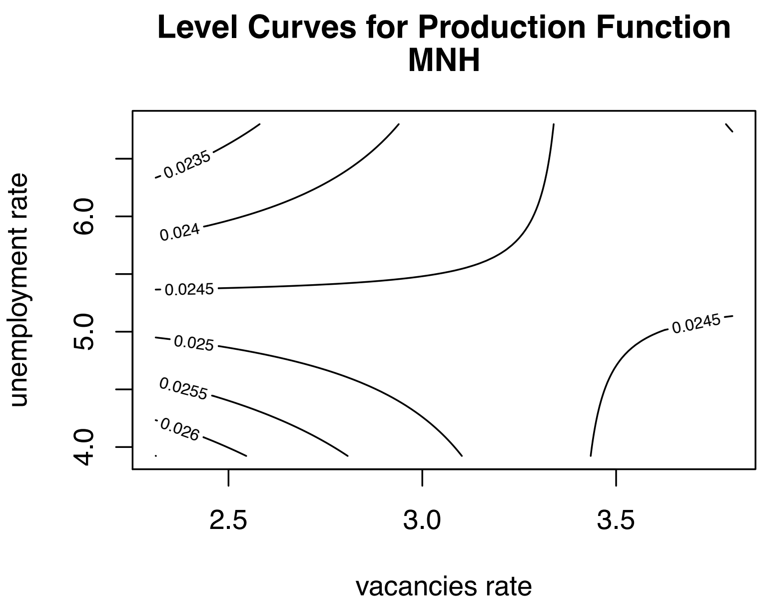

Figure 11: "Isoquants during Bush years."

```
pfco=pfcontour(Ly.o,Lvac.o,Lunem.o, level=FALSE, type="MNH",
 n50=length(Ly.o),xlab="vacancies rate",
 ylab="unemployment rate")
```

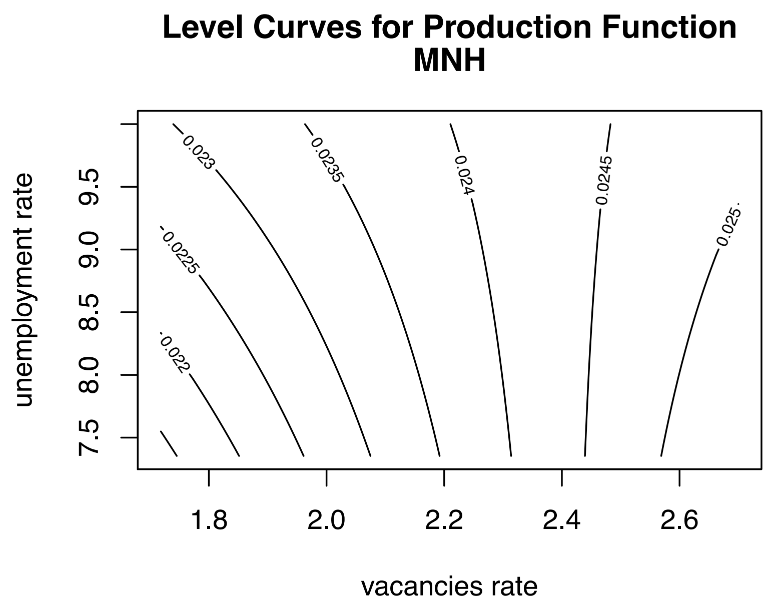

Figure 12: "Isoquants during Obama years."

associated with a decrease in output labor ratio during the Bush years, but associated with an increase during the Obama presidency.

The returns to scale parameter (friction scale elasticities) are estimated as −0.13354 and 1.36255 for Bush and Obama, respectively. When unemployment and/or vacancies rise we expect the output per unit of labor to decrease, as was true during the Bush years. It is somewhat strange that the friction scale elasticity is positive and fairly large during the Obama years. Since higher output is associated with higher unemployment, it suggests a problem with business confidence and unusual frictions in the labor market.

While the Cobb-Douglas functional form forces the elasticity of substitution (EOS) between the two inputs to be always unity, our multiplicative non-homogeneous functional form (having the cross product of logs of inputs) allows the EOS to be distinct. EOS measures the percent change in the $(vac/unem)$ ratio associated with a one percent change in the marginal rate of technical substitution (ratios of marginal productivities). The EOS during the Bush presidency is estimated to be −0.25621, whereas the corresponding Obama value is 2.032. Since the signs are distinct, the labor markets appear to be deeply different during the two administrations.

Isoquants for Bush years show that the (Y_t/L_t) ratio increases steadily as unemployment rate increases. By contrast, the isoquant map for Obama years is different.

We have shown that the Beveridge Curve can be used to study the dynamics of the tradeoff between job vacancies and unemployment. It is possible to compute and compare various elasticities across two or more presidential administrations. This is claimed to be a new tool worthy of further attention. Despite limitations of aggregate production functions, the sign reversals between Bush and Obama elasticities seem to suggest new labor market frictions, perhaps related to the unknown employer expectations regarding their future profitability. The unemployment rate under Obama is staying high even when output per unit of labor increases and vacancies increase.

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