Raising the Overtime Premium and Reducing the Standard Workweek: Short-Run Impacts on U.S. Manufacturing

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Research Seminar

October 2018

Introduction

- The standard work week is defined as the normal (statutory) hours worked beyond which an overtime premium wage applies to the hours worked in excess of the standard workweek.
- South Korean labor law (Labor Standards Act)
  1. Normal working hours are defined as 40 hours per week/8 hours per day - standard workweek.
  2. With some exceptions, employer/worker agreements can allow up to a maximum of overtime work of 12 hours per week.
  3. Overtime hours must be compensated at 1.5 times the normal (straight-time) hourly wage - overtime premium.
- U.S. Fair Labor Standard Act (FLSA)
  1. The standard workweek is 40 hours/week.
  2. The overtime premium for covered workers is 1.5.
- Potential economics effects of overtime hours regulation could exceed the effects of minimum wage legislation.

Introduction

- Arguments in favor of raising overtime premiums and reducing the standard workweek
  1. Increase employment/reduce unemployment.
  2. Reduce or completely eliminate overtime hours to bring about substitution of employment for hours.
- Arguments against raising overtime premiums and reducing the standard workweek
  1. Increased production costs would have negative (output) scale effects that offset the substitution of employment for hours by reducing the demand for all inputs, including labor.
  2. Workers whose overtime hours are reduced or eliminated would seek second jobs, thus competing with unemployed workers.
  3. Overtime workers on average are more skilled than the unemployed, so that the new job vacancies could not be filled by the currently unemployed.

Research Objectives

- Determine the monthly short-run impacts on U.S. Manufacturing of
  1. raising the overtime premium from 1.5 to 2.0, and
  2. reducing the standard workweek from 40 hours to 35 hours.
- Outcome variables of interest:
  1. Employment
  2. Average workweek hours per worker
  3. Aggregate hours of work
  4. Average weekly earnings per worker
  5. Aggregate labor earnings
  6. Non-labor input usage

Background literature

- Increase in Overtime Premium:
    - Increase in employment and decrease in overtime hours - Ehrenberg (1971), Trejo (1991), Martins (2016)
    - No change in working hours - Asai (2014), no effect on overtime hours - Bell and Hart (2003)
- Decrease in Standard Workweek:
    - Decrease in hours worked - Hunt(1999), Chen and Wang (2011)
    - Increase in the straight-time hourly wages - Friesen (2001), Raposo and van Ours (2010)
    - Increase in probability of moonlighting Renna (2006)

Conceptual Framework

Cobb-Douglas production function:

$$Q = Ae^{f(M,t)} E_1^{\alpha_1} E_2^{\alpha_2} E_3^{\alpha_3} E_4^{\alpha_4} h_1^{\beta_1} h_2^{\beta_2} h_3^{\beta_3} h_4^{\beta_4} K^{\gamma}$$

where $0 < \alpha_j, \beta_j, \gamma < 1, \alpha_j > \beta_j, \gamma + \sum_{m=1}^{4} \alpha_j \neq 1, j = 1...., 4$

$$f(M,t) = \sum_{m=1}^{12} (g_{1m}t + g_{2m}t^2) M_m$$

$$M_m = 1\,(\text{month=m})\,, t = \text{time period}$$

The 'g' parameters capture the (neutral) monthly output growth trends:

$$g_{mt} = (g_{1m} + 2g_{2m}t) M_m, \; m = 1,2,...,12.$$

1 and 2 subscripts refer to production workers
3 and 4 subscripts refer to non-production workers
1 and 3 subscripts refer to overtime
2 and 4 subscripts refer to non-overtime

Conceptual Framework

Production cost equation:

$$C = \{W_1 [h^* + \lambda (h_1 - h^*)] + V_1\} E_1 + [W_2 h_2 + V_2] E_2 + \{W_3 [h^* + \lambda (h_3 - h^*)] + V_3\} E_3 + [W_4 h_4 + V_4] E_4 + rK$$

h^* is the standard workweek
W_j is straight-time hourly wage rates
V_j is quasi-fixed/overhead labor cost
$\lambda \geq 1$ is the overtime premium
r is the rental rate/user cost of capital

Note that V_j represents weekly per worker costs that do not vary with hours worked. In addition to fringe benefits to workers, V_j also includes fixed labor costs associated with hiring/firing, administrative payroll costs, etc.

Conceptual Framework

Weekly hours equations per worker:

- Overtime production workers
  $$\frac{MP_{E_1}}{MP_{h_1}} = \frac{MC_{E_1}}{MC_{h_1}}$$
  $$\Rightarrow ln\left(h_1\right) = ln\left(\frac{\beta_1}{\alpha_1 - \beta_1}\right) + ln\left[\left(1-\lambda\right)h^* + \frac{V_1}{W_1}\right] - ln(\lambda).$$
  Note that $h_1 > h^* > 0$ implies $\frac{V_1}{W_1} > \left(\frac{\alpha_1}{\beta_1}\lambda - 1\right)h^*$ and coupled with $\alpha_1 > \beta_1$ implies $\left[\left(1-\lambda\right)h^* + \frac{V_1}{W_1}\right] > 0$.

Similar efficiency conditions yield weekly hours equations for the remaining labor inputs.

Conceptual Framework

- Non-overtime production workers

$$ln\left(h_2\right) = ln\left(\frac{\beta_2}{\alpha_2 - \beta_2}\right) + ln\left(\frac{V_2}{W_2}\right).$$

- Overtime non-production workers

$$ln\left(h_3\right) = ln\left(\frac{\beta_3}{\alpha_3 - \beta_3}\right) + ln\left[\left(1-\lambda\right)h^* + \frac{V_3}{W_3}\right] - ln(\lambda).$$

- Non-overtime non-production workers

$$ln\left(h_4\right) = ln\left(\frac{\beta_4}{\alpha_4 - \beta_4}\right) + ln\left(\frac{V_4}{W_4}\right).$$

Note that the weekly hours for each labor input do not depend on the level of output or output price.

Conceptual Framework

Employment efficiency conditions:

After simplifying and collecting terms, we can express each employment and nonlabor input as a function of E_1.

$$\frac{MP_{E_1}}{MP_{E_j}} = \frac{MC_{E_1}}{MC_{E_j}}, j \neq 1 \Rightarrow$$

$$ln(E_2) = ln\left(\frac{\alpha_2 - \beta_2}{\alpha_1 - \beta_1}\right) + ln\left(\frac{W_1}{V_2}\right) + ln\left[(1-\lambda)\, h^* + \frac{V_1}{W_1}\right] + ln(E_1).$$

$$ln(E_3) = ln\left(\frac{\alpha_3 - \beta_3}{\alpha_1 - \beta_1}\right) + ln\left(\frac{W_1}{W_3}\right) + ln\left[(1-\lambda)\, h^* + \frac{V_1}{W_1}\right] - ln\left[(1-\lambda)\, h^* + \frac{V_3}{W_3}\right] + ln(E_1).$$

$$ln(E_4) = ln\left(\frac{\alpha_4 - \beta_4}{\alpha_1 - \beta_1}\right) + ln\left(\frac{W_1}{V_4}\right) + ln\left[(1-\lambda)\, h^* + \frac{V_1}{W_1}\right] + ln(E_1).$$

$$ln(K) = ln\left(\frac{\gamma}{\alpha_1 - \beta_1}\right) + ln\left(\frac{W_1}{r}\right) + ln\left[(1-\lambda)\, h^* + \frac{V_1}{W_1}\right] + ln(E_1).$$

Assume $MR = P$ so that under profit maximization

$$MP_{E_j} \cdot P = MC_{E_j} \Rightarrow$$
$$ln(MP_{E_j}) + ln(P) = ln(MC_{E_j})$$

Upon further substitution for the inputs as functions of E_1, collecting terms and simplifying, we arrive at the employment demand functions for each labor input.

For simplicity, the employment demand functions listed below are expressed in terms of parameters that are functions of the structural parameters of the production function.

Employment demand equations

- Overtime production workers

$$
\begin{aligned}
ln(E_1) = \theta_{0\lambda} + ln(-\theta_8) - ln(\theta_1) + \sum_{m=1}^{12}(b_{1m}t + b_{2m}t^2)M_m \\
+ \theta_1 ln\left(\frac{P}{W_1}\right) + \theta_2 ln\left(\frac{W_1}{V_2}\right) + \theta_3 ln\left(\frac{W_1}{W_3}\right) + \theta_4 ln\left(\frac{W_1}{V_4}\right) + \theta_5 ln\left(\frac{V_2}{W_2}\right) \\
+ \theta_6 ln\left(\frac{V_4}{W_4}\right) + \theta_7 ln\left(\frac{W_1}{r}\right) + (\theta_8 - 1)\, ln\left[(1-\lambda)\,h^* + \frac{V_1}{W_1}\right] \\
+ \theta_9 ln\left[(1-\lambda)\,h^* + \frac{V_3}{W_3}\right]
\end{aligned}
$$

- Non-overtime production workers

$$
\begin{aligned}
ln(E_2) = \theta_{0\lambda} + ln(\theta_2 - \theta_5) - ln(\theta_1) + \sum_{m=1}^{12}(b_{1m}t + b_{2m}t^2)M_m \\
+ \theta_1 ln\left(\frac{P}{W_1}\right) + (\theta_2 + 1) ln\left(\frac{W_1}{V_2}\right) + \theta_3 ln\left(\frac{W_1}{W_3}\right) + \theta_4 ln\left(\frac{W_1}{V_4}\right) + \theta_5 ln\left(\frac{V_2}{W_2}\right) \\
+ \theta_6 ln\left(\frac{V_4}{W_4}\right) + \theta_7 ln\left(\frac{W_1}{r}\right) + \theta_8 ln\left[(1-\lambda)\,h^* + \frac{V_1}{W_1}\right] \\
+ \theta_9 ln\left[(1-\lambda)\,h^* + \frac{V_3}{W_3}\right]
\end{aligned}
$$

Conceptual Framework

Employment demand equations

- Overtime non-production workers

$$ln(E_3) = \theta_{0\lambda} + ln(-\theta_9) - ln(\theta_1) + \sum_{m=1}^{12}(b_{1m}t + b_{2m}t^2)M_m$$
$$+ \theta_1 ln\left(\frac{P}{W_1}\right) + \theta_2 ln\left(\frac{W_1}{V_2}\right) + (\theta_3 + 1) ln\left(\frac{W_1}{W_3}\right) + \theta_4 ln\left(\frac{W_1}{V_4}\right) + \theta_5 ln\left(\frac{V_2}{W_2}\right)$$
$$+ \theta_6 ln\left(\frac{V_4}{W_4}\right) + \theta_7 ln\left(\frac{W_1}{r}\right) + \theta_8 ln\left[(1-\lambda)\, h^* + \frac{V_1}{W_1}\right]$$
$$+ (\theta_9 - 1) ln\left[(1-\lambda)\, h^* + \frac{V_3}{W_3}\right],$$

- Non-overtime non-production workers

$$ln(E_4) = \theta_{0\lambda} + ln(\theta_4 - \theta_6) - ln(\theta_1) + \sum_{m=1}^{12}(b_{1m}t + b_{2m}t^2)M_m$$
$$+ \theta_1 ln\left(\frac{P}{W_1}\right) + \theta_2 ln\left(\frac{W_1}{V_2}\right) + \theta_3 ln\left(\frac{W_1}{W_3}\right) + (\theta_4 + 1) ln\left(\frac{W_1}{V_4}\right) + \theta_5 ln\left(\frac{V_2}{W_2}\right)$$
$$+ \theta_6 ln\left(\frac{V_4}{W_4}\right) + \theta_7 ln\left(\frac{W_1}{r}\right) + \theta_8 ln\left[(1-\lambda)\, h^* + \frac{V_1}{W_1}\right]$$
$$+ \theta_9 ln\left[(1-\lambda)\, h^* + \frac{V_3}{W_3}\right],$$

Data

- Monthly data for U.S. manufacturing
- Sources:
  - Bureau of Labor Statistics;
  - Bureau of Economic Analysis;
  - Federal Reserve Bank, St. Louis;
  - Monthly CPS
- Period: March 2006 - December 2017

Data

Caveats

- The official monthly statistics report data only for the broad categories of production workers and non-production workers in U.S. manufacturing.
- The number of workers who worked overtime in any given month are not reported.
- We use the monthly CPS data to determine the fraction of manufacturing workers who work overtime.
    - The CPS overtime fraction is used to estimate the total number of manufacturing workers who work overtime each month.
    - We set the ratio of overtime production workers to overtime non-production workers equal to the ratio of average weekly overtime for production workers to average weekly overtime for non-production workers.

- We are able to infer the monthly employments of overtime production workers (E_1), overtime non-production workers (E_3), and non-overtime production workers (E_2), and non-overtime, non-production workers (E_4).
- From the data on total overtime hours for production workers and for non-production workers, we can measure the average weekly hours for each of our four categories of labor inputs: h_1, h_2, h_3, and h_4.
- We can infer the monthly straight-time hourly wage of production workers W_p and of non-production workers W_{np} and use this information to construct the monthly straight-time hourly wages for each of the four labor inputs: W_{1t}, W_{2t}, W_{3t}, W_{4t}.

- Construction of average weekly overhead labor costs (V) per worker for each labor input.
  - The available monthly data on V is industry-wide, is limited, and as a lower bound all most surely underestimates overhead labor costs.
  - We first construct the V/W_p and V/W_{np} ratios for production workers and for non-production workers.
  - We next scale V/W_p by h_1/h_2 to obtain a preliminary ratio $(V_1\_W_1)_0$ for overtime production workers and by h_2/h_1 to obtain a preliminary ratio $(V_2\_W_2)_0$ for non-overtime production workers. Similarly for non-production workers.
  - If necessary, the ratios are adjusted to satisfy the theoretical restriction that $(1-\lambda)h^* + V_{jt}/W_{jt} \geq 0$ for overtime workers and < 0 for non-overtime workers, where $V_{1t} = (V_1\_W_1)_t * W_{1t}$, $V_{2t} = (V_2\_W_2)_t * W_{2t}$, $V_{3t} = (V_3\_W_3)_t * W_{3t}$, and $V_{4t} = (V_4\_W_4)_t * W_{4t}$.

Data

Summary Statistics

Variable	Mean	Std Dev	Min	Max
Total Production Employment, thousands	8802.56	665.27	7938.00	10258.00
E_1 (Overtime)	3329.72	450.54	2079.84	4613.97
E_2 (Non-overtime)	5472.84	390.82	4800.01	6445.25
Total Non-production Employment	3656.41	161.58	3402.00	4045.00
E_3 (Overtime)	819.08	152.42	382.08	1262.68
E_4 (Non-overtime)	2837.33	216.99	2425.06	3644.92
Straight-Time Hourly Wage of Production Workers	18.04	2.58	31.43	41.27
W_1 (Overtime)	27.05	1.64	23.76	30.21
W_2 (Non-overtime)	9.36	1.35	5.32	12.85
Straight-Time Hourly Wage of Non-production Workers	36.22	1.10	15.84	20.14
W_3 (Overtime)	54.32	3.87	47.15	61.91
W_4 (Non-overtime)	29.32	3.04	22.06	36.63
Weekly Hours of Production Workers	44.10	0.48	42.30	44.90
h_1 (Overtime)	50.85	0.92	47.98	53.91
h_2 (Non-overtime)	35.65	0.54	33.82	36.63
Weekly Hours of Non-production Workers	38.84	1.25	36.43	40.00
h_3 (Overtime)	44.52	0.44	43.38	45.79
h_4 (Non-overtime)	35.95	0.93	32.73	37.90
Weekly Overhead Labor Cost per Worker	449.75	46.62	387.20	538.40
V_1 (Overtime, Prod.)	961.96	100.33	842.49	1163.70
V_2 (Non-overtime, Prod.)	163.55	25.93	88.86	240.62
V_3 (Overtime, Non-prod.)	1157.63	104.41	1000.60	1366.98
V_4 (Non-overtime, Non-prod.)	294.66	42.43	200.87	394.11
Share of Workers Working Overtime	0.33	0.02	0.22	0.37

Estimation Strategy

The empirical (log) weekly hours demand functions are conveniently expressed by

$$\tau_{1t} = ln\left[\theta_8 + \theta_1 - (1 + \theta_2 + \theta_3 + \theta_4 + \theta_7)\right] - ln(-\theta_8) + \varepsilon_{h1t}$$
$$\tau_{2t} = ln(\theta_5) - ln(\theta_2 - \theta_5) + \varepsilon_{h2t}$$
$$\tau_{3t} = ln(\theta_3 + \theta_9) - ln(-\theta_9) + \varepsilon_{h3t}$$
$$\tau_{4t} = ln(\theta_6) - ln(\theta_4 - \theta_6) + \varepsilon_{h4t}, \text{ where}$$
$$\tau_{1t} \equiv ln(h_{1t}) - ln\left[(1-\lambda)\, h^* + \frac{V_{1t}}{W_{1t}}\right] + ln(\lambda),$$
$$\tau_{2t} \equiv ln(h_{2t}) - ln\left(\frac{V_{2t}}{W_{2t}}\right),$$
$$\tau_{3t} \equiv ln(h_{3t}) - ln\left[(1-\lambda)\, h^* + \frac{V_{3t}}{W_{3t}}\right] + ln(\lambda),$$
$$\tau_{4t} \equiv ln(h_{4t}) - ln\left(\frac{V_{4t}}{W_{4t}}\right).$$

Estimation Strategy

- Our strategy is to jointly estimate the input demand functions through NLSUR with cross-equation restrictions on the θ parameters for the nonconstant term regressors.
- Single equation Prais-Winsten regressions revealed first-order serial correlation in the log employment and weekly hours equations.
- Based on the Phillips-Perron test, we failed to reject the null hypothesis of unit roots for τ_{1t}, τ_{2t}, and τ_{4t}.
  - Because these equations are simply constants plus an error process, first-differencing eliminates the constants so that there is nothing to estimate.
  - In the case of the τ_{3zt} hours equation, joint estimation involves estimating only a constant term without restrictions and a serial correlation coefficient. Since this does not really contribute much to the overall model, we also drop this equation from joint estimation of the empirical model.

Estimation Strategy

- Although the Phillips-Perron test rejects the null hypothesis of a unit root for $ln(E_{1t})$, joint estimation yielded a 1st order serial correlation coefficient slightly in excess of 1.0.
  - We decided to replace the equation for $ln(E_{1t})$ with its first-differenced form.
  - Since the re-estimated serial correlation coefficients for the remaining employment demand equations were very nearly the same, we re-estimated the joint model under the restriction that the serial correlation coefficient is the same for labor inputs 2,3, and 4.

NLSUR Estimation Results

Parameter	Estimate	Std Errors	Parameter	Estimate	Std Errors
b_{1_1}	-0.00371***	0.00026	b_{2_1}	0.00002***	0.00000
b_{1_2}	-0.00375***	0.00025	b_{2_2}	0.00002***	0.00000
b_{1_3}	-0.00369***	0.00026	b_{2_3}	0.00002***	0.00000
b_{1_4}	-0.00367***	0.00025	b_{2_4}	0.00002***	0.00000
b_{1_5}	-0.00357***	0.00025	b_{2_5}	0.00002***	0.00000
b_{1_6}	-0.00337***	0.00024	b_{2_6}	0.00002***	0.00000
b_{1_7}	-0.00339***	0.00024	b_{2_7}	0.00002***	0.00000
b_{1_8}	-0.00328***	0.00024	b_{2_8}	0.00002***	0.00000
b_{1_9}	-0.00331***	0.00024	b_{2_9}	0.00002***	0.00000
b_{1_10}	-0.00336***	0.00024	b_{2_10}	0.00002***	0.00000
b_{1_11}	-0.00337***	0.00024	b_{2_11}	0.00002***	0.00000
b_{1_12}	-0.00340***	0.00024	b_{2_12}	0.00002***	0.00000
θ_1	0.05080*	0.02665			
θ_2	-0.47247***	0.00268			
θ_3	0.33158***	0.05743			
θ_4	-0.61122***	0.00678			
θ_5	-0.05064*	0.02824			
θ_6	-0.26815***	0.02714			
θ_7	0.00658	0.02007			
θ_8	0.20681***	0.01498			
θ_9	0.03453***	0.00143			
ρ_E	0.87573***	0.01540			
θ_{02}	8.54233***	0.07964			
θ_{03}	4.99136***	0.43337			
θ_{04}	8.46238***	0.09322			

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NLSUR Estimation Results

- All but one of the parameters are statistically significant, though the implied estimates of the structural Cobb-Douglas production function parameters were not always of the theoretically correct signs or magnitudes.
- Nevertheless, cross-equation restrictions on the θ and ρ parameters affords parsimony in model specification.
- Technologically neutral monthly growth rates for the factor inputs can be estimated from $\hat{g}_{mt} = \hat{b}_{1m} + 2\hat{b}_{2m}t$, $m = 1, ..., 12$.
    - The monthly growth rates were growing over the entire period of the data (2006 - 2016), but were negative until 2013 and then turned positive.
    - We evaluated the growth rates for each month of the year at the mean value of t over the period (2014 - 2016) and found that the annualized growth rates were the highest in February, March, and April (1.5%) and the lowest in September, October, and November (1.2%) .

Policy Simulation Strategy

- Simulations are conducted to estimate the counterfactual policy effects on growth rates of the outcome variables.
  - Elements of the theoretical constant terms in the log employment equations involve logs of parameters that were estimated to be negative.
  - Therefore, we cannot generally identify the policy effects on (log) employment levels.
- The baseline (control solution) values are the actual historical growth rates of the outcome variables.
- Residuals from the predicted historical growth rates are added to the predicted policy growth rates from the estimated model to obtain the simulated growth rates under the counterfactual overtime policy changes.
- In the case of the nonlabor inputs $ln(K_t)$ there is no residual because its estimated demand function is simply inferred from the estimated parameters of the labor input demand functions.

Policy Simulation Strategy

Overtime Premium

- Increase the mandated overtime premium from $\lambda = 1.5$ to $\lambda^p = 2.0$
- Overtime labor inputs (E_1 and E_3)
  - It turns out that $(1-\lambda^p)\, h^* + \dfrac{V_{jt}}{W_{jt}} < 0 \quad \forall t$.
  - Consequently, overtime hours would be completely eliminated.
  - The lower bound condition $\dfrac{V_{jt}}{W_{jt}} < \left(\dfrac{\alpha_j}{\beta_j} - 1\right) h^*$ for the standard work week is unchanged.
  - Thus, the former overtime workers would now have their hours reduced to the standard workweek, i.e. $h_{jt}^{(\lambda_p)} = h^* = 40, j = 1, 3$.
- Non-overtime labor inputs (E_2 and E_4)
  - No change in boundary conditions.
  - Consequently, no change in work week, i.e. $h_{jt}^{(\lambda_p)} = h_{jt}, j = 2, 4$.
- The input demand equation specifications are modified to correspond to the implied change in the production function specification.

Policy Simulation Strategy

Standard Workweek

- Reduce the standard workweek from $h^* = 40$ to $h^{*p} = 35$ hours.
- Overtime labor inputs (E_1 and E_3)
  - Overtime employment requires $\frac{V_{jt}}{W_{jt}} > \left(\frac{\alpha_j}{\beta_j}\lambda - 1\right) h^{*p}$ for $j = 1, 3$.
  - $\left(\frac{\alpha_j}{\beta_j}\lambda - 1\right) h^* > \left(\frac{\alpha_j}{\beta_j}\lambda - 1\right) h^{*p} \Rightarrow \frac{V_{jt}}{W_{jt}} > \left(\frac{\alpha_j}{\beta_j}\lambda - 1\right) h^{*p}$.
  - Therefore, overtime for inputs 1 and 3 will continue under the lower standard workweek.
- Non-overtime labor inputs (E_2 and E_4)
  - $\frac{V_{jt}}{W_{jt}} < \left(\frac{\alpha_j}{\beta_j} - 1\right) h^{*p}$ for those working less than the new standard workweek. This condition is satisfied for those who were already working less than the new standard workweek, i.e. $h_{jt} < h^{*p}$,
  - since $0 < h_{jt} = \frac{\beta_j}{\alpha_j - \beta_j} \frac{V_{jt}}{W_{jt}} < h^{*p}$. Therefore, $h_{jt}^{*p} = h_{jt}$.

- Now consider non-overtime workers for whom previously $h^{*p} \leq h_{jt} < h^{*}$.
  - It is theoretically possible that some of these workers could now work overtime, i.e. $h_{jt}^{*p} \geq h^{*p}$.
  - Empirically, in these periods the excess hours over the new standard workweek averaged less than 1 hour.
  - Therefore, we assume that in these cases $\left(\frac{\alpha_j}{\beta_j} - 1\right) h^{*p} \leq \frac{V_{jt}}{W_{jt}} \leq \left(\frac{\alpha_j}{\beta_j}\lambda - 1\right) h^{*p}$.
  - Efficiency dictates that the hours of these workers will be reduced to the new standard workweek, i.e. $h_{jt}^{*p} = h^{*p}$.

- We now have 4 distinct regimes under the new standard workweek policy:

  R1: $h_{1t}^{*p}, h_{3t}^{*p} > h^{*p}; h_{2t}^{*p} = h_{4t}^{*p} = h^{*p}$
  R2: $h_{1t}^{*p}, h_{3t}^{*p} > h^{*p}; h_{2t}^{*p} = h^{*p}, h_{4t}^{*p} = h_{4t} < h^{*p}$
  R3: $h_{1t}^{*p}, h_{3t}^{*p} > h^{*p}; h_{2t}^{*p} = h_{2t} < h^{*p}, h_{4t}^{*p} = h^{*p}$
  R4: $h_{1t}^{*p}, h_{3t}^{*p} > h^{*p}; h_{2t}^{*p} = h_{2t} < h^{*p}, h_{4t}^{*p} = h_{4t} < h^{*p}$.
- The input demand equation specifications are modified to correspond to the implied change in the production function specification for each of the 4 regimes.
- Industry-wide growth rate effects obtained by sample weighting across the 4 regimes.

Simulation Results

- Let Δ be the first difference operator such that for a variable X_t (in logs), $\Delta X_t = X_t - X_{t-1}$ is the monthly growth rate.
- Let Δ^p be the policy operator such that $\Delta^p(\Delta X_t) = \Delta X_t^p - \Delta X_t$, which we express on an annualized basis.
- The simulated percentage point (pp) policy effects on the annualized monthly growth rates are computed for the following outcome variables:
  - $E_{jt}, j = 1, ...4$ (employment) ,E_t (total manufacturing employment)
  - $y_{jt}, j = 1, ...4$ (weekly earnings per worker), y_t (industry-wide weekly earnings per worker)
  - $Y_{jt}, j = 1, ...4$ (total weekly earnings), Y_t (industry-wide total weekly earnings)
  - $h_{jt}, j = 1, ..., 4$ (weekly hours worked per worker), h_t (industry-wide average weekly hours worked per worker)
  - H_t (total hours worked in manufacturing)

Simulation Results in Mean Growth Rates

Variable	Overtime Premium	Standard Workweek				
		Overall	Regime 1	Regime 2	Regime 3	Regime 4
$\Delta^{\lambda p}[\Delta ln(E_{1t})]$	0.31	0.03	0.99	-7.05	-2.67	10.30
$\Delta^{\lambda p}[\Delta ln(E_{2t})]$	-0.16	-0.76	-0.66	-0.06	1.87	-10.22
$\Delta^{\lambda p}[\Delta ln(E_{3t})]$	-0.05	-0.51	-0.33	-5.15	-0.13	9.44
$\Delta^{\lambda p}[\Delta ln(E_{4t})]$	-0.05	1.30	1.10	0.21	3.92	2.40
$\Delta^{\lambda p}[\Delta ln(E_{t})]$	-0.21	-0.24	0.06	-2.20	1.15	-2.65
$\Delta^{\lambda p}[\Delta ln(K_{t})]$	-0.19	-0.51	-1.07	0.23	-2.51	11.41
$\Delta^{\lambda p}[\Delta ln(Y_{1t})]$	-0.21	-0.10	0.40	-6.43	-0.90	11.95
$\Delta^{\lambda p}[\Delta ln(Y_{2t})]$	-0.16	-1.61	-1.19	-3.67	1.87	-10.22
$\Delta^{\lambda p}[\Delta ln(Y_{3t})]$	-0.38	-0.63	-0.88	-4.05	0.80	10.93
$\Delta^{\lambda p}[\Delta ln(Y_{4t})]$	-0.05	-1.58	-1.67	0.21	-5.19	2.40
$\Delta^{\lambda p}[\Delta ln(Y_{t})]$	-0.26	-1.34	-1.01	-3.56	-0.59	-2.04
$\Delta^{\lambda p}[\Delta ln(y_{1t})]$	-0.52	-0.13	-0.60	0.62	1.77	1.65
$\Delta^{\lambda p}[\Delta ln(y_{2t})]$	0.00	-0.85	-0.53	-3.61	0.00	0.00
$\Delta^{\lambda p}[\Delta ln(y_{3t})]$	-0.33	-0.12	-0.55	1.10	0.93	1.49
$\Delta^{\lambda p}[\Delta ln(y_{4t})]$	0.00	-2.88	-2.77	0.00	-9.11	0.00
$\Delta^{\lambda p}[\Delta ln(y_{t})]$	-0.05	-1.10	-1.07	-1.36	-1.75	0.62
$\Delta^{\lambda p}[\Delta ln(h_{1t})]$	-0.39	-0.08	-0.41	0.77	0.85	1.11
$\Delta^{\lambda p}[\Delta ln(h_{2t})]$	0.00	-0.85	-0.53	-3.61	0.00	0.00
$\Delta^{\lambda p}[\Delta ln(h_{3t})]$	-0.23	-0.07	-0.38	1.06	0.39	1.05
$\Delta^{\lambda p}[\Delta ln(h_{4t})]$	0.00	-2.88	-2.77	0.00	-9.11	0.00
$\Delta^{\lambda p}[\Delta ln(h_{t})]$	-0.03	-1.10	-1.03	-1.32	-2.02	0.44
$\Delta^{\lambda p}[\Delta ln(H_{t})]$	-0.24	-1.34	-0.97	-3.52	-0.86	-2.22
Number of Months	142	142	105	18	13	6
Proportion of the Sample	100%	100%	74.9%	12.7%	9.2%	4.2%

Tentative Conclusions

- Overtime policy changes have heterogeneous effects across different categories of labor inputs.
- Raising the overtime premium to double-time
  - Modest negative impact on growth rates of employment (-0.21pp), earnings (-0.26pp), total weekly hours (-0.24pp) and non-labor inputs (-0.19pp).
  - Average growth rate effects on per worker weekly hours and earnings are negligible.
- Reducing the standard workweek from 40 hours to 35 hours
  - Modest negative growth rate effects on employment (-0.24pp) and non-labor inputs (-0.51pp).
  - Fairly large negative effects on growth rates of total earnings (-1.34pp), earnings per worker (-1.10pp), weekly hours per worker (-1.10pp), and total weekly hours (-1.34pp).
- In the light of the overall reduction in the growth rates of labor and non-labor inputs, one can infer that the growth rate of industry output would be reduced as well.