# Impact of 'Safety Net' Removal on Labour Price Index

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# Outline

1. Definitions: LPI, SNAs and WorkChoice
2. Goals
3. Formalism for seasonal impact estimation
4. Formalism for trend-break estimation
5. Results
6. Future?

# The Labour Price Index (LPI)

- Measures <u>changes</u> over time in the cost of labour to employers.
- Includes wages and salaries, overtime, bonuses, leave, super, payroll tax and worker's comp.
- Unaffected by changes in the quality and quantity of work and the composition of the labour force.

# LPI contd..

- LPI can be used to answer:

*How much would it cost at some period t, relative to some earlier reference period t = 0 to purchase the same 'quantity' of labour that was present at the earlier period?*

$$LPI(t) = 100 \times \frac{\sum_i p_{it} q_{i0}}{\sum_i p_{i0} q_{i0}}$$

$$= 100 \times \sum_i w_{i0} \left( \frac{p_{it}}{p_{i0}} \right)$$

$$\text{where } w_{i0} = \frac{p_{i0} q_{i0}}{\sum_i p_{i0} q_{i0}}$$

- The weight, $w_{i0}$ represents the "expenditure share" of job group *i*: depends on state, sector and occupation characteristics.

# Definitions

Safety Net Adjustments (SNR): Jan 1991 ~ Jul 2006

- Assist minimum wage employees through federal and state awards who are unable to make workplace agreements.
- Phased-out over Aug-Oct 2006.

New WorkChoices Scheme: effective ~ 1st Dec 2006

- Promote individual contracts and agreements (e.g. AWA)
- Protection against unfair treatment, greater security?
- Australian Fair Pay Commission (AFPC) set up to protect minimum and award classification wages.

# Goals

- What are the impacts SNA phase-out on the LPI?

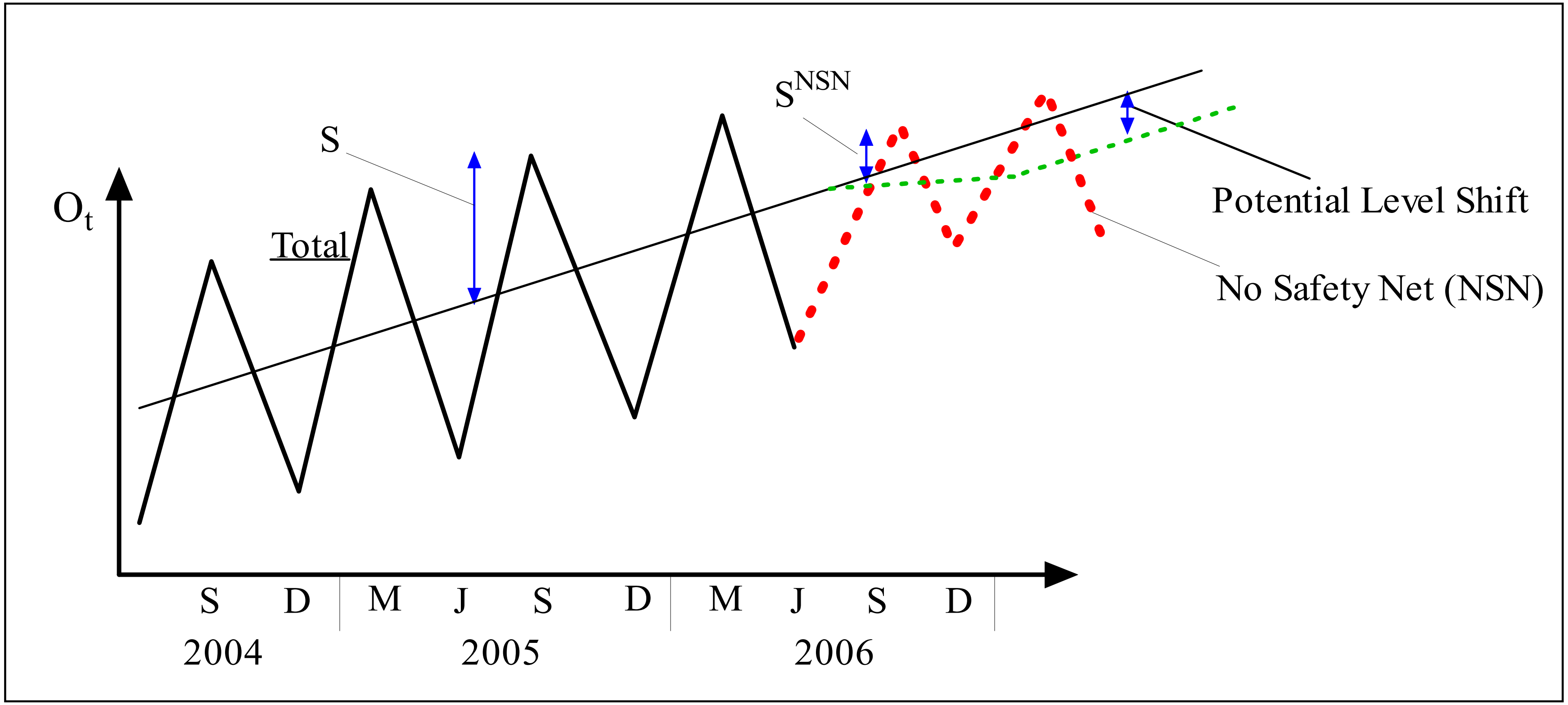
  Can manifest as:
  1. Change in seasonal pattern (seasonal break - SB)
  2. Change in series level (potential trend break - TB)

- Want to estimate expected prior corrections (SBs and TBs ) apriori from real-world information:
  e.g. the contribution of SNA-based jobs to movements in LPI

- Apply and refine these corrections when real, future LPI data becomes avalaible.

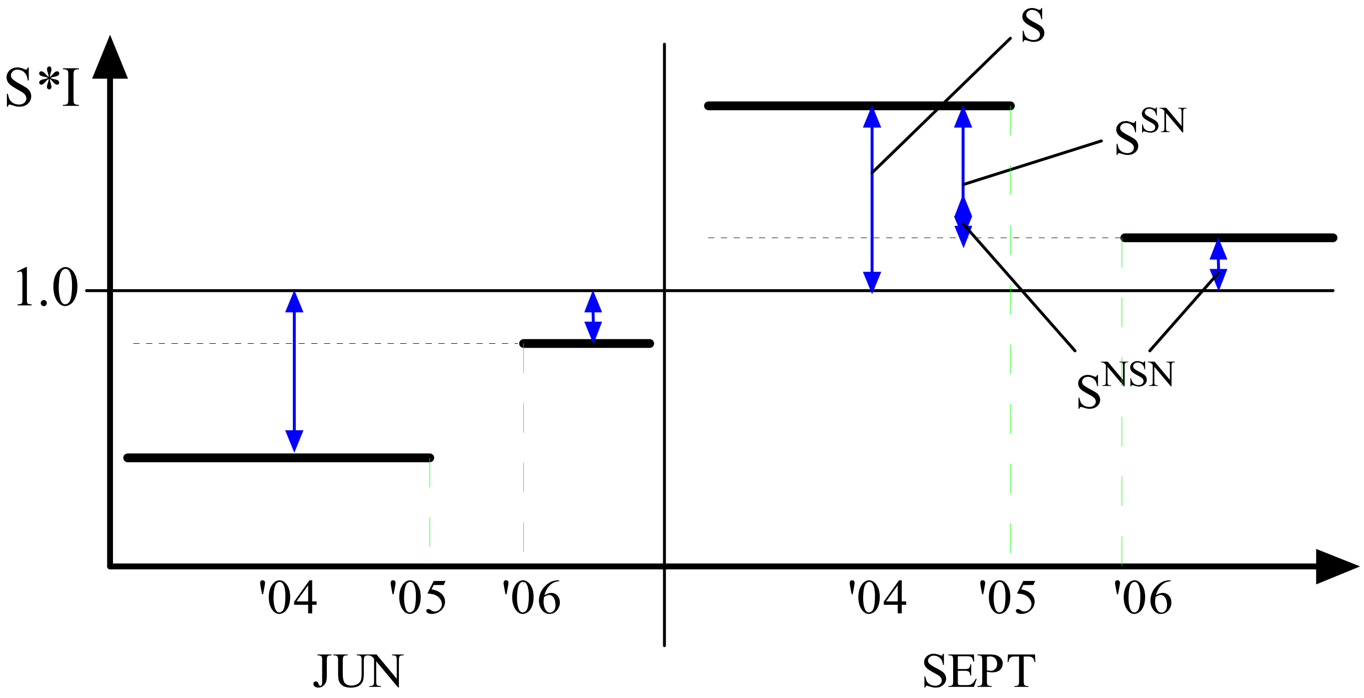
# Goals contd..

Exagerated schematic of LPI series with/without SNA contributions. SNAs phased-out by Sep. 2006.



# Goals contd..

In terms of Seasonal*Irregular chart:




where:

S = total seasonal factor estimate

$S^{SN}$ = seasonal factor due to Safety Net jobs alone

$S^{NSN}$ = seasonal factor due to Non Safety Net jobs

# Seasonal Break Estimation

- SB priors can be estimated from the ratio of seasonal factors for a quarter *t* at end of 2006 (following SNA phase-out) and in previous years <=2005:

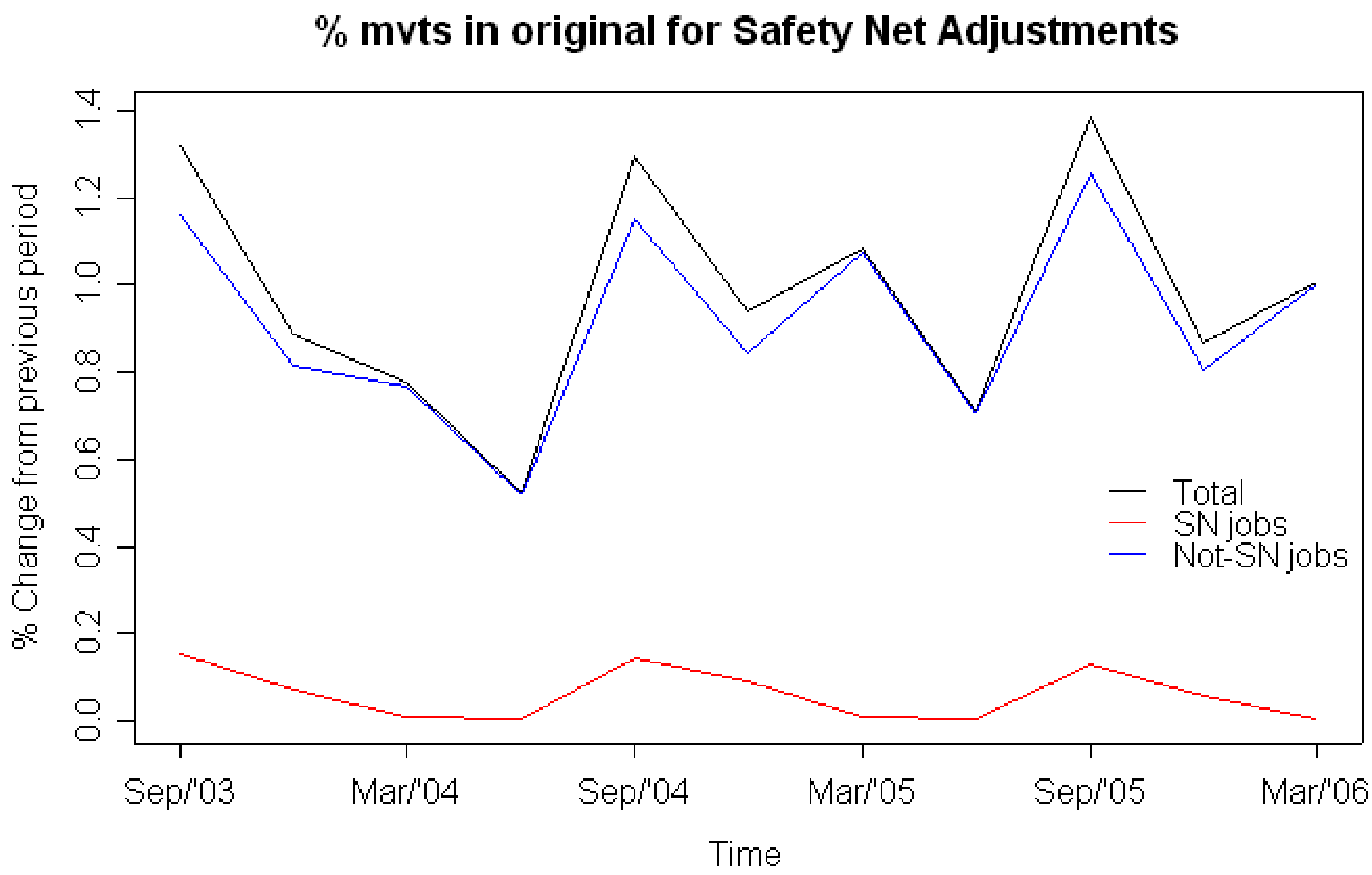
$$SB_t = \frac{S_{t\,\in\,\{\geq 2006\}}}{S_{t\,\in\,\{\leq 2005\}}} \qquad (1)$$

- Assume this can be estimated from the contribution of Non-Safety Net jobs (NSN) during periods containing SNAs:

$$SB_t \approx \frac{S^{NSN}_{t\,\in\,\{\leq 2005\}}}{S_{t\,\in\,\{\leq 2005\}}} \qquad (2)$$

# Inputs

- The only input to the problem are the period-to-period movements in LPI series over a span where SNA contributions are available:



# SB estimate: method

- LPI movements from only Non Safety Net (NSN) jobs:

$$m_t^{NSN} = m_t^{O} - m_t^{SN} \quad (3)$$

- Unknown NSN levels can be reconstructed from chained mvts:

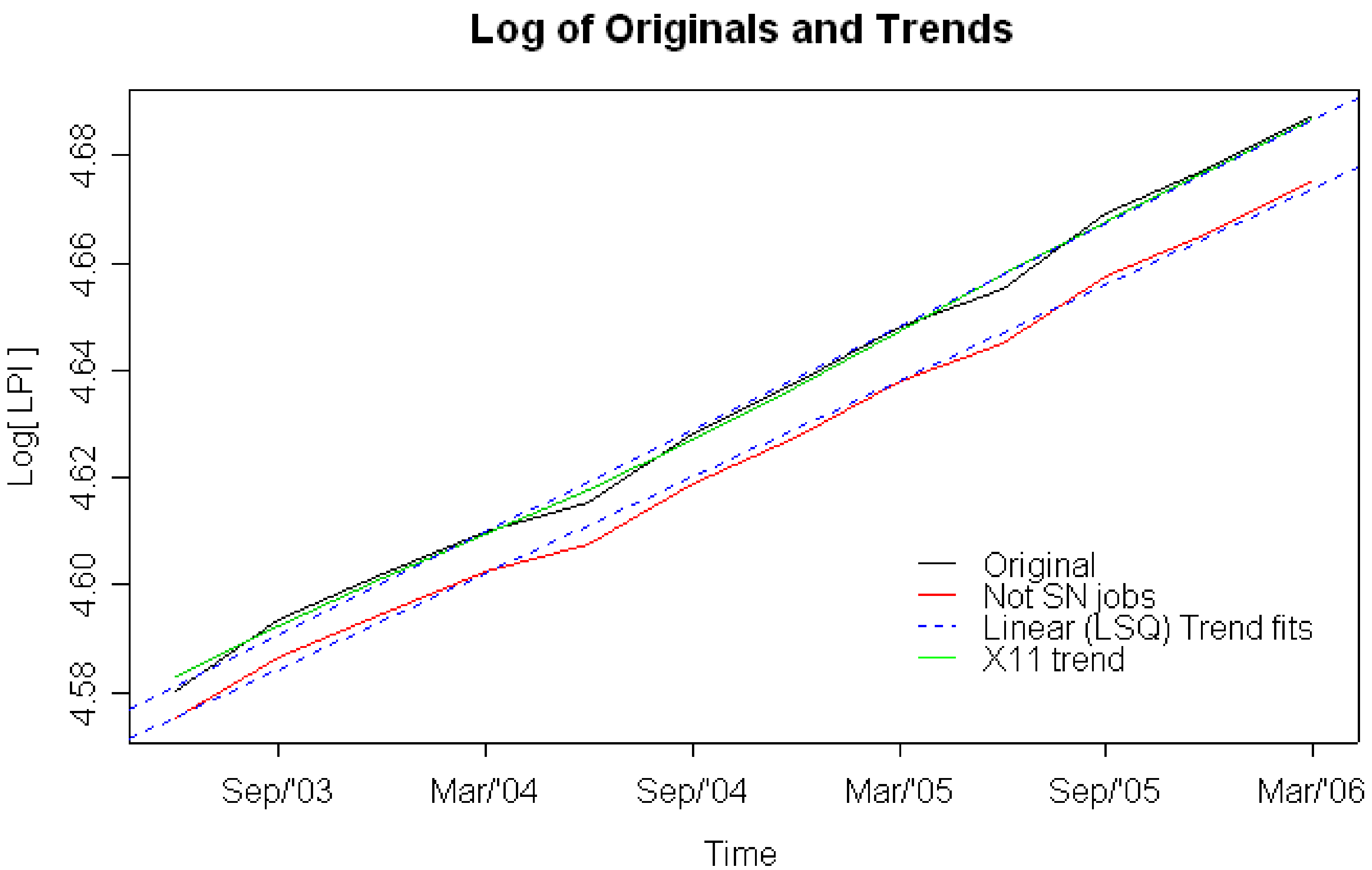
$$O_t^{NSN} = O_1^{NSN} \prod_{i=2}^{t} \left(1 + m_i^{NSN}\right), \quad (4)$$

$$o_t^{NSN} = o_1^{NSN} + \sum_{i=2}^{t} \log\left(1 + m_i^{NSN}\right) \quad (5)$$

$$o_t^{NSN} \approx o_1^{NSN} + \sum_{i=2}^{t} m_i^{NSN} \quad (6)$$

# SB estimate: method contd..

- Next we estimate trend components for the total and NSN series using linear least squares fits to originals:



# SB estimate: method contd..

- Next, assume a multiplicative decomposition model:

$$O_t = T_t S_t I_t$$

$$O_t^{NSN} = T_t^{NSN} S_t^{NSN} I_t^{NSN}$$

$$o_t = t_t + s_t + i_t$$

$$o_t^{NSN} = t_t^{NSN} + s_t^{NSN} + i_t^{NSN}$$

- Volatility in LPI series is tiny (I/C ~ 0.02) => $i_t \approx 0$
- Residuals in fitted (linear) trends = log of seasonal factors:

$$\hat{s}_t = \hat{o}_t - \hat{t}_t$$

$$\hat{s}_t^{NSN} = \hat{o}_t^{NSN} - \hat{t}_t^{NSN}$$

- Actual seasonal break prior factor sought for at time t:

$$\widehat{SB}_t = \frac{S_t^{NSN}}{S_t} = \exp\left[ \hat{s}_t^{NSN} - \hat{s}_t \right]$$

# SB estimate: alternative method

- As a check to first method (estimates very nearly the same):
- Period-to-period ratios for total and NSN series under x model:

$$\frac{O_t}{O_{t-1}} = \frac{T_t}{T_{t-1}} \frac{S_t}{S_{t-1}} \frac{I_t}{I_{t-1}}$$

$$\frac{O_t^{NSN}}{O_{t-1}^{NSN}} = \frac{T_t^{NSN}}{T_{t-1}^{NSN}} \frac{S_t^{NSN}}{S_{t-1}^{NSN}} \frac{I_t^{NSN}}{I_{t-1}^{NSN}}$$

$$\Rightarrow \left(\frac{1+m_t^{NSN}}{1+m_t^{O}}\right) = \left(\frac{1+m_t^{TNSN}}{1+m_t^{T}}\right)\left(\frac{1+m_t^{INSN}}{1+m_t^{I}}\right)\left(\frac{S_t^{NSN}}{S_t}\right)\left(\frac{S_{t-1}}{S_{t-1}^{NSN}}\right)$$

- Taking logs and defining variables:

$$r_t^{NSN} = r_t^{TNSN} + sb_t - sb_{t-1} + \varepsilon_t$$

# SB estimate: alternative method

- Estimate seasonal break factors ($sb_t$) by minimising MSE:

$$\left\langle \varepsilon_t^2 \right\rangle = \frac{1}{N-1}\sum_{t=2}^{N}\left(r_t^{NSN} - r_t^{TNSN} - sb_t + sb_{t-1}\right)^2$$

$$\frac{\partial\left\langle \varepsilon_t^2 \right\rangle}{\partial sb_1} = \frac{\partial\left\langle \varepsilon_t^2 \right\rangle}{\partial sb_2} = \frac{\partial\left\langle \varepsilon_t^2 \right\rangle}{\partial sb_3} = \frac{\partial\left\langle \varepsilon_t^2 \right\rangle}{\partial sb_4} = 0$$

$$\Rightarrow \begin{pmatrix} 5 & -2 & 0 & -3 \\ -2 & 4 & -2 & 0 \\ 0 & -2 & 5 & -3 \\ -3 & 0 & -3 & 6 \end{pmatrix} \begin{pmatrix} sb_1 \\ sb_2 \\ sb_3 \\ sb_4 \end{pmatrix} = \begin{pmatrix} \Sigma_1 \\ \Sigma_2 \\ \Sigma_3 \\ \Sigma_4 \end{pmatrix}$$

$$\Rightarrow AX = B \quad \text{where } X \text{ is vector of unknowns.}$$

- Matrix *A* is singular! Due to repeating nature of unknowns: $sb_t$ and $sb_{t-1}$ across multiple years.

# SB estimate: alternative method

- Overcome singular system by using constraint for seasonal break factors under an additive model (since log transformed):

$$sb_1 + sb_2 + sb_3 + sb_4 = 0$$

*Proof:*

$$\sum_i^4 s_i = \sum_i^4 \log S_i = 0 \quad \longleftarrow \text{before seasonal brk}$$

$$\sum_i^4 s_i^{NSN} = \sum_i^4 \log\left[\frac{S_i}{SB_i}\right] = 0 \quad \longleftarrow \text{after seasonal brk}$$

$$\Rightarrow \sum_i^4 \log S_i - \sum_i^4 \log SB_i = 0$$

$$\Rightarrow \sum_i^4 \log SB_i = \sum_i^4 sb_i = 0$$

- Note: under multiplicative model: $\sum_i^4 S_i = 4 \not\Rightarrow \sum_i^4 SB_i = 4$

# SB estimate: alternative method

- Going back to matrix system, rank = 3 (number of linearly independent rows or columns), can replace an equation with constraint equation: $\Sigma sb_i = 0$:

$$\begin{pmatrix} 1 & 1 & 1 & 1 \\ -2 & 4 & -2 & 0 \\ 0 & -2 & 5 & -3 \\ -3 & 0 & -3 & 6 \end{pmatrix} \begin{pmatrix} sb_1 \\ sb_2 \\ sb_3 \\ sb_4 \end{pmatrix} = \begin{pmatrix} 0 \\ \Sigma_2 \\ \Sigma_3 \\ \Sigma_4 \end{pmatrix}$$

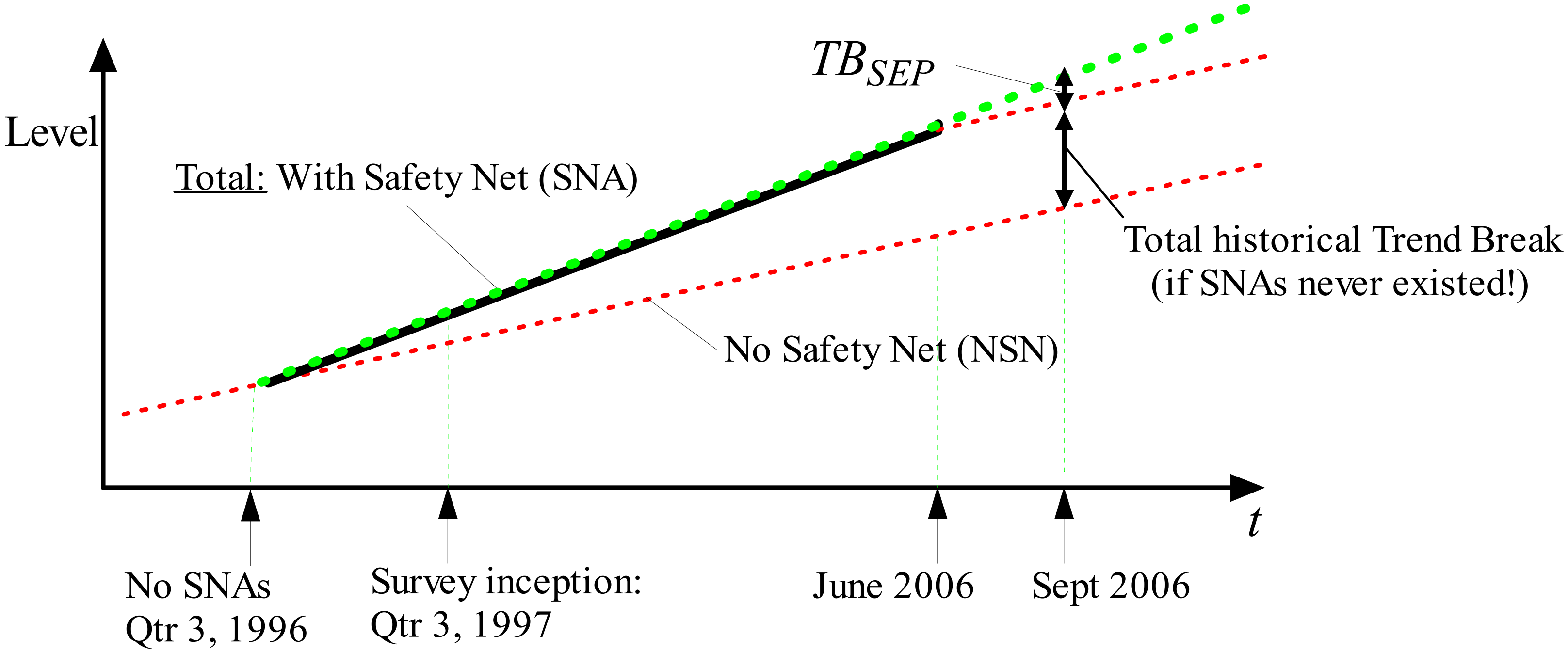
- Solution for SBs in original multiplicative space:

$$SB_t = \frac{S_t^{NSN}}{S_t} = \exp[\mathbf{X}]$$

$$\text{where } \mathbf{X} = \begin{pmatrix} sb_1 & sb_2 & sb_3 & sb_4 \end{pmatrix}^T$$

# TB estimate: method

- Seasonal break could be accompanied by trend break!
- Evidence: total and NSN trend series mvts differ (~0.06%)




$$TB_{SEP} = \frac{T^{O}_{SEP06}}{T^{O}_{JUN06} + \left(T^{NSN}_{SEP06} - T^{NSN}_{JUN06}\right)}$$

# Prior Estimates: summary

## Seasonal Breaks

| Sector | QTR 1 | QTR 2 | QTR 3 | QTR 4 |
|---|---|---|---|---|
| *private* | 1.0000966 | 1.0007652 | 0.9996790 | 0.9994598 |
| *public* | 0.9999814 | 1.0000292 | 1.0000377 | 0.9999517 |
| *priv+public* | 1.000066 | 1.000578 | 0.999771 | 0.999585 |

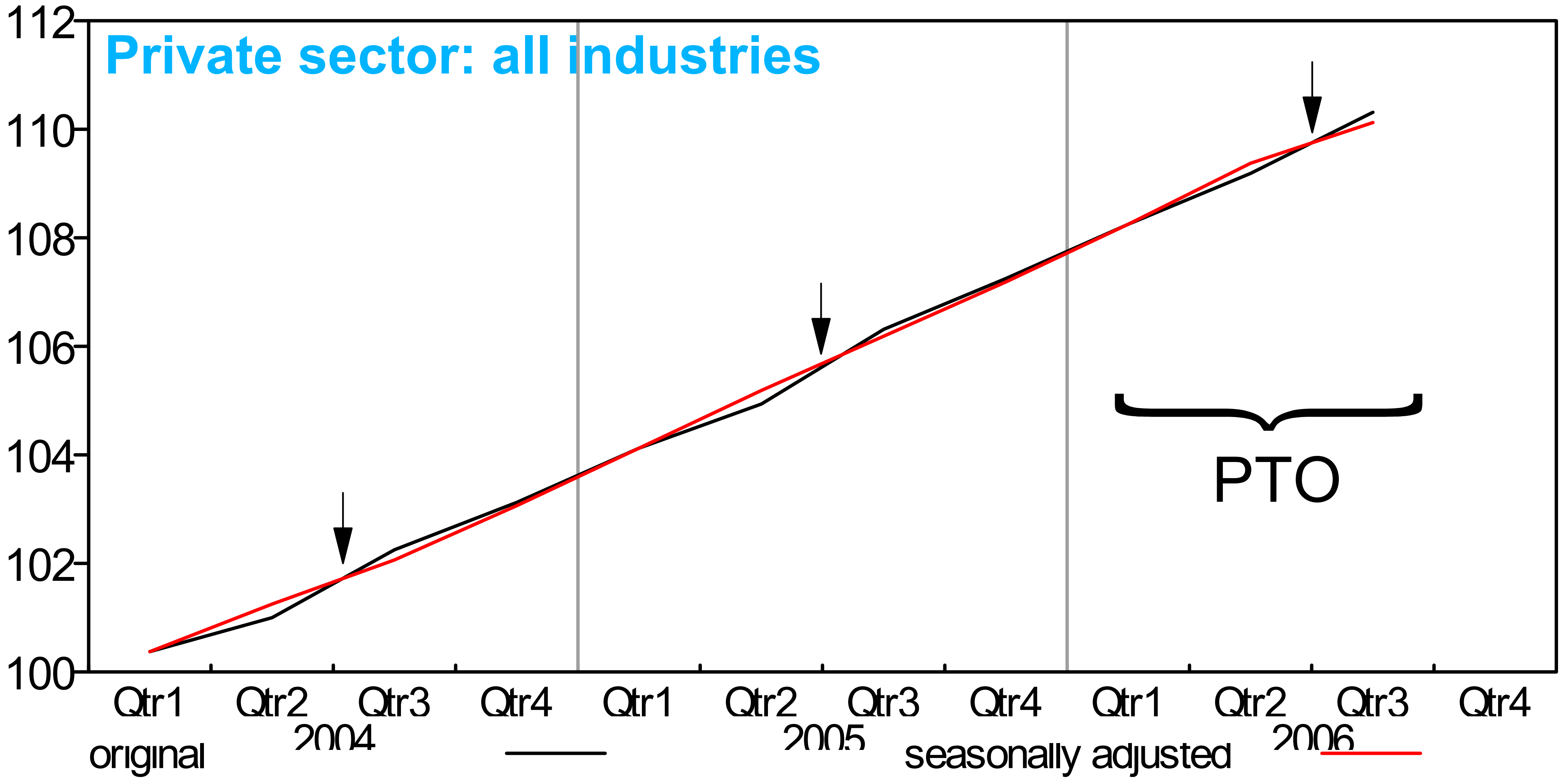
~0.03%

## Trend Breaks

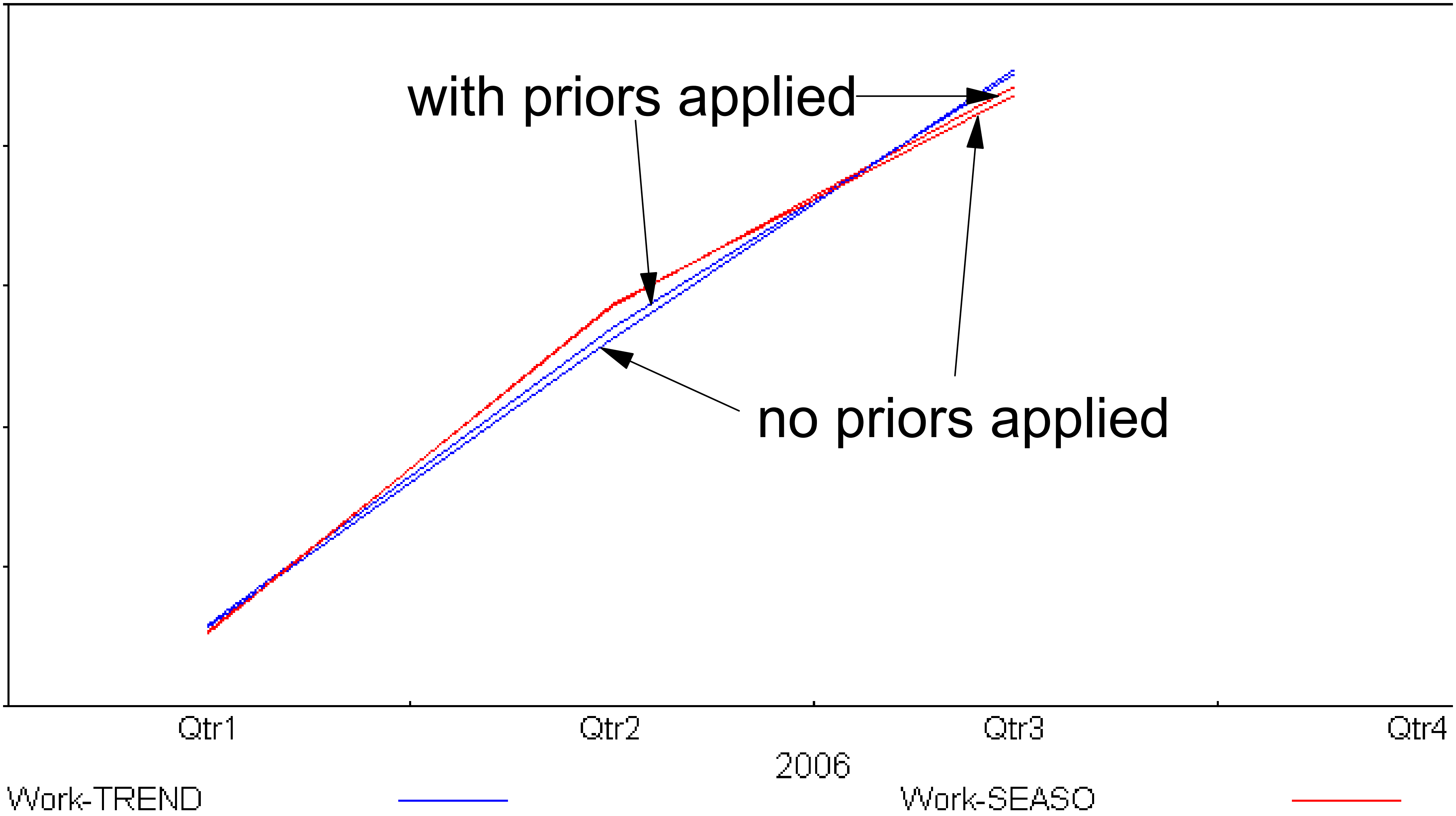
| Sector | Sep'06 TB |
|---|---|
| *private* | 1.001028 |
| *public* | 1.000087 |
| *priv+public* | 1.000802 |

~0.103%

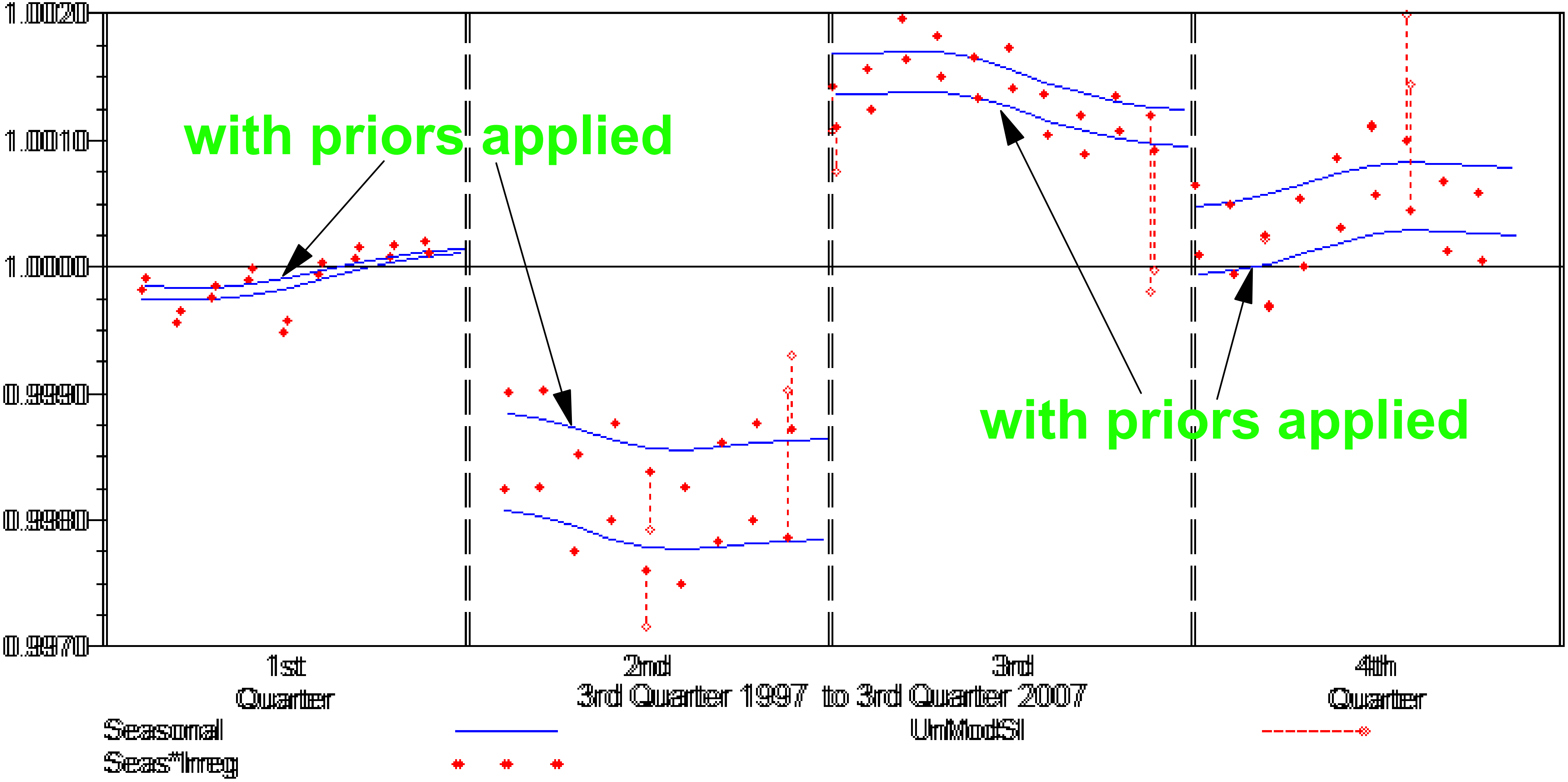
# LPI to Sep Qtr '06



# LPI Trend and SA to Sep Qtr '06

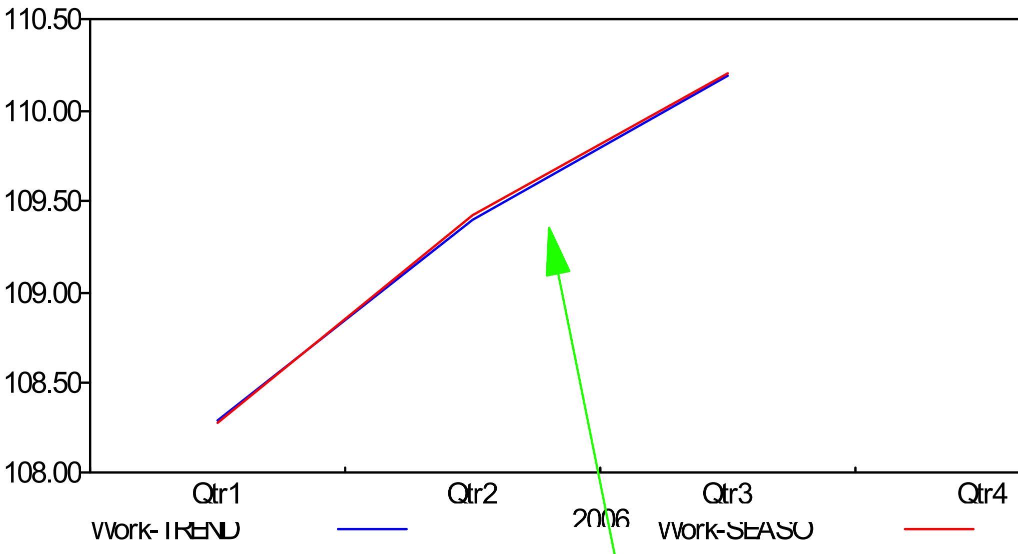


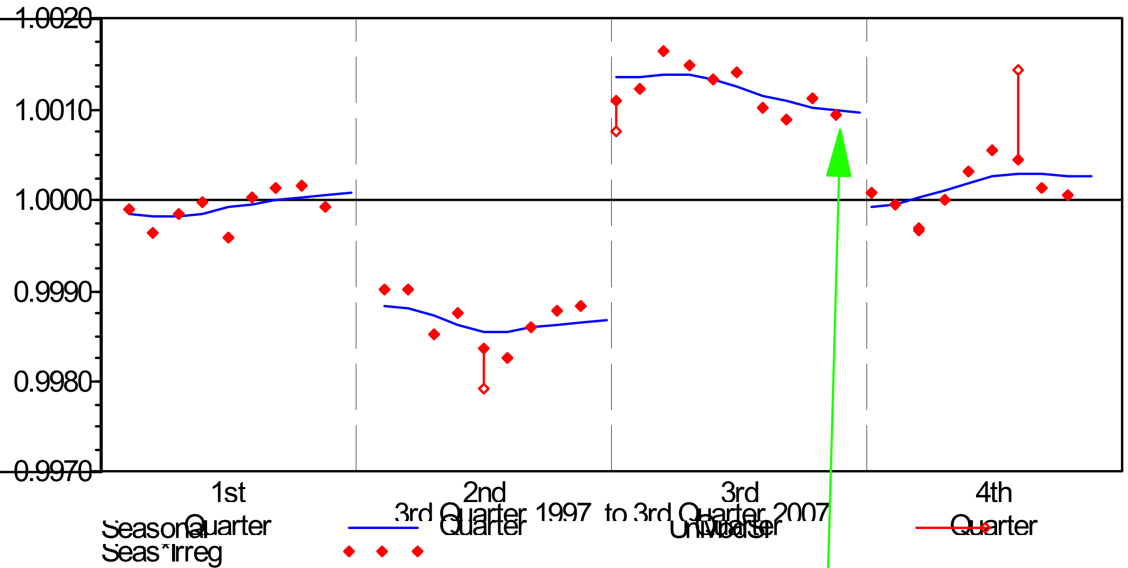
# S*I chart to Sep Qtr '06



# What the LPI data suggests

- Priors appear underestimated (mostly TB):
  we estimated ~0.103%, data suggests ~0.28%
- With TB correction of ~0.28%, we get graphs below.
  Since LPI volatility tiny => SA ~ Trend



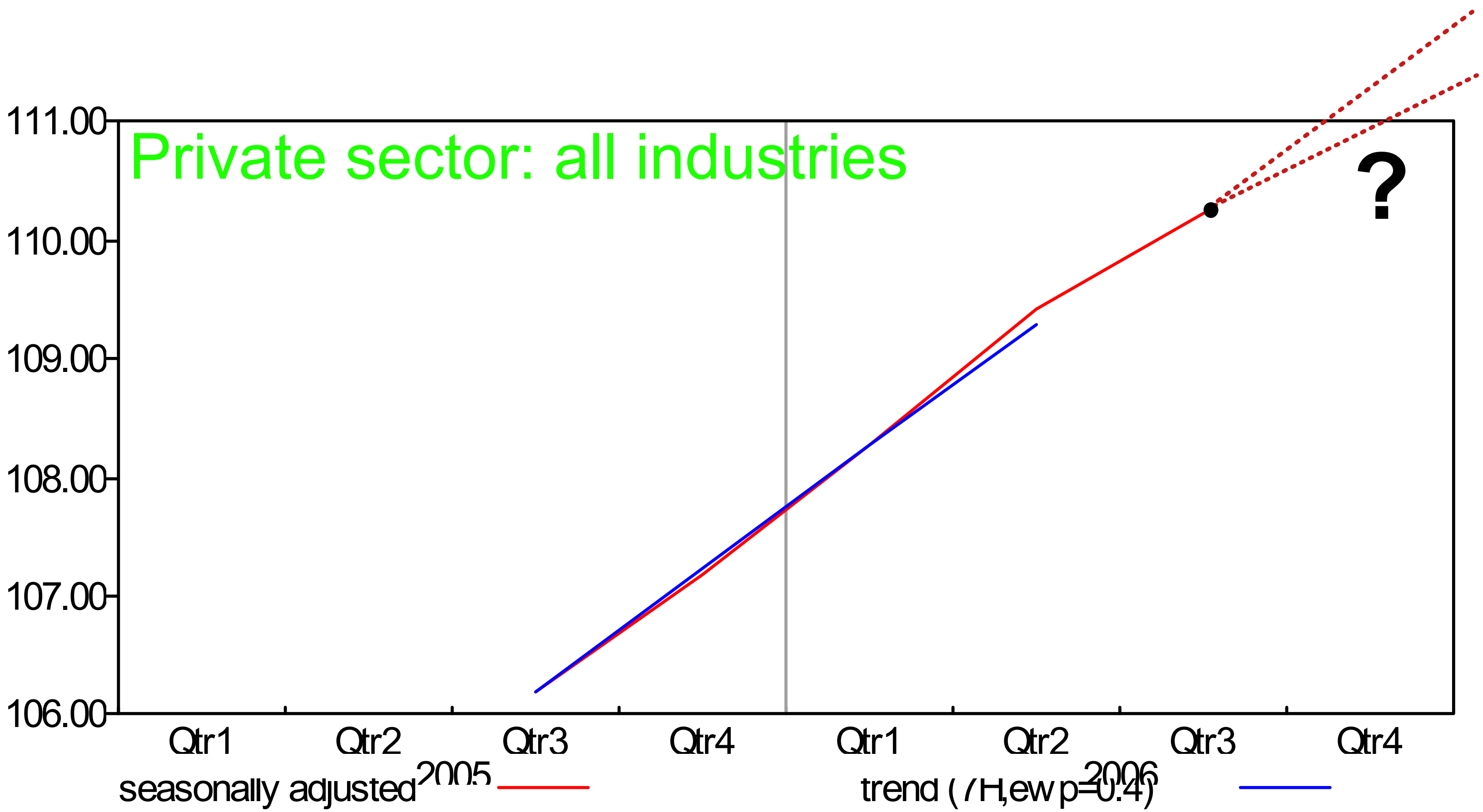

SA~Trend

Internal correction gone

# Strategy and Future

- Since only have one data point following SNA removal (Qtr 3 2006), cannot reliably estimate and distinguish TB vs. SB.
- Nonetheless, estimated priors => level shift is dominant.
- Now we have:
  1. Inserted a TB in order to stabilise seasonal factor estimates.
  2. Suspended the trend from June Qtr '06 onwards since otherwise misleading. Resume trend later.

# Impacts from WorkChoice?




- Phase-in of <u>WorkChoice</u> scheme (Dec '06 / Mar '07) will muddy the water. Effective priors (with SNA) will be needed.