Estimating Constant-Employment-Rate (CER) NFP Growth

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Notation

- N: Non-farm payrolls (All Employees) in the CES
- E: Employment levels from the CPS
- P: Population from the CPS
- e: The employment-to-population ratio such that $e = E/P$.

Let i denote demographic groups (e.g. 'Foreign-born, 16-24') and t denote time periods (e.g. Jan-2020). CPS variables (e.g. E) are measured at the cohort-time level. Aggregate variables are given by

- $E_t = \sum_i E_{it}$
- $P_t = \sum_i P_{it}$
  and aggregate EPR, e_t, is given by $e_t = \sum_i P_{it} e_{it}$ (Population-weighted EPR at the cohort level)

Calculating CER NFP Growth

Take two time periods t' and t, with $t' > t$. Suppose that CES and CPS employment are proportional to each other, such that

$$\frac{N_{t'}}{N_t} = \frac{E_{t'}}{E_t} \frac{A_{t'}}{A_t} \frac{\mu_{t'}}{\mu_t}$$

where A is an adjustment term that captures differences in CES and CPS employment definitions (e.g. multiple jobholders, self-employed, etc) and μ is a time-varying "error" term that captures other differences between CES and CPS measures (sampling noise, for example).

Some algebraic manipulation (see the appendix) shows that the growth in aggregate CPS employment is given by

$$\frac{E_{t'}}{E_t} = \left(\frac{\sum_i E_{it} (e_{it'}/e_{it})}{E_t} \right) \left(\frac{\sum_i P_{it'} e_{it'}}{\sum_i P_{it} e_{it'}} \right)$$

That is, the increase in employment is the employment-weighted change in cohort EPRs, times a term that captures changes in employment due to population growth and cohort population changes. Plugging this into our decomposition of NFP growth:

$$\frac{N_{t'}}{N_t} = \left(\frac{\sum_i E_{it}(e_{it'}/e_{it})}{E_t}\right)\left(\frac{\sum_i P_{it'}e_{it'}}{\sum_i P_{it}e_{it'}}\right)\frac{A_{t'}}{A_t}\frac{\mu_{t'}}{\mu_t}$$

or in growth rate terms,

$$g_N = g_{\tilde{e}} + g_{\tilde{p}} + g_A + g_\mu$$

So NFP growth can be decomposed into a term that captures changes in cohort-level EPRs, a term that captures population growth, changes in the definition adjustment term A, and other errors.

We calculate the CER-NFP growth rate as the observed growth in NFP, less changes in cohort-level EPRs and the adjustment term:

$$g_{CER} = g_{\tilde{p}} + g_\mu = g_N - g_{\tilde{e}} - g_A$$

g_{CER} captures the growth rate of NFPs that is due to population change, plus the other errors we were not able to measure.

Implementation

We use 12-month windows ($t' = t + 12$) to avoid issues with non-seasonally-adjusted series.

In practice, we need to calculate g_N, $g_{\tilde{e}}$, and g_A. g_N is simply calculated by taking the growth rate of NFP (CES Series CES0000000001). $g_{\tilde{e}}$ is calculated using the non-seasonally-adjusted employment-to-population ratios of the age groups 16-19, 20-24, ..., 70-74, 75+.

For the adjustment term A, we take BLS series LNS16000000, which is aggregate employment in the CPS adjusted for CES employment definitions, and divide it by total employment in the CPS (LNS12000000).

Apdx. Derivation of $E_{t'}/E_t$

Noting that $E = \sum_i P_i e_i$,

$$
\begin{aligned}
\frac{E_{t'}}{E_t} &= \frac{\sum_i P_{it'} e_{it'}}{\sum_i P_{it} e_{it}} \\
&= \left(\frac{\sum_i P_{it} e_{it'}}{\sum_i P_{it} e_{it}} \right) \left(\frac{\sum_i P_{it'} e_{it'}}{\sum_i P_{it} e_{it'}} \right) \\
&= \left(\frac{\sum_i P_{it} e_{it} (e_{it'}/e_{it})}{\sum_i P_{it} e_{it}} \right) \left(\frac{\sum_i P_{it'} e_{it'}}{\sum_i P_{it} e_{it'}} \right) \\
&= \left(\frac{\sum_i E_{it} (e_{it'}/e_{it})}{E_t} \right) \left(\frac{\sum_i P_{it'} e_{it'}}{\sum_i P_{it} e_{it'}} \right)
\end{aligned}
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