Evaluating welfare and economic effects of raised fertility

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with Krzysztof Makarski and Joanna Tyrowicz

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Motivation

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- declining population and multiple long-term implications
  $\Longrightarrow$ social security, pension system and health care expenditures
- introduction a variety of costly natalist policies and instruments
- vast empirical literature evaluating previous policy interventions $\Longrightarrow$ negligible effects, "too soon to tell", methodological issues

Literature review

- empirical evaluation with negative effects

  Olivetti and Petrongolo (2017), Baizan et al. (2016), Rossin-Slater (2018)

- empirical evaluation with positive effects

  Drago et al. (2011), Milligan (2005), Brewer et al. (2012), Frejka and Zakharov (2013), Garganta et al. (2017), Lalive and Zweimueller (2009), Rindfuss et al. (2010), Havnes and Mogstad (2011), Bauernschuster et al. (2015), Del Boca et al. (2009)

- evaluation within OLG framework

  Fehr et al. (2017), Georges and Seekin (2016), Mamota (2016), Hock and Weil (2012)

- endogenous fertility

  Liao (2011), Ludwig et al. (2012), Hock and Weil (2012)

Remaining questions

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2. Assumming effectiveness of policies, how much can be spent to achieve certain fertility targets and maintain long-term aggregate welfare unharmed?
3. Is there a differenece between intensive (families with chilldren have more kids) and extensive (more families have children) margin adjustments?

Outline

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What do we do?

- We develop large OLG model with family structure.
  Things we really care for:

Model | Calibration | Demography

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  - no direct utility from having children

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Demographics

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- *status quo* demographic projection
- unchanged fertility 1.44 (data averaged for 2006-2014)
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  - Does it matter? Yes.

Results

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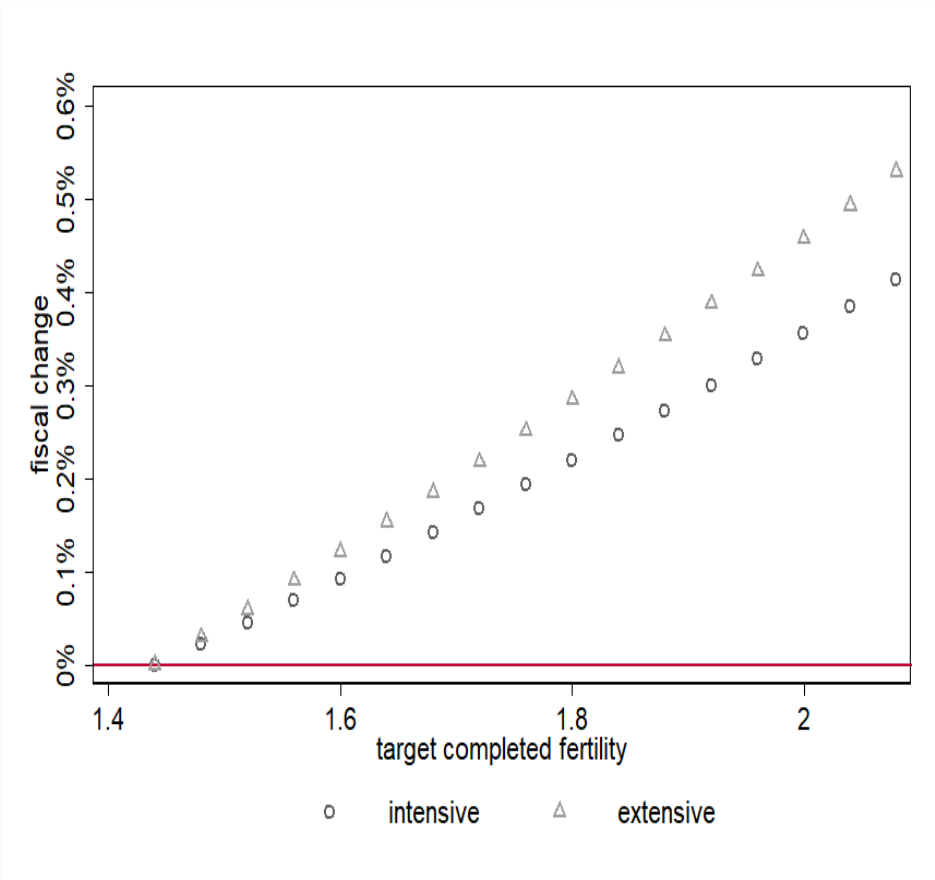
Measuring fiscal effects



- the net surplus of the government budget, after price adjustment (GE)

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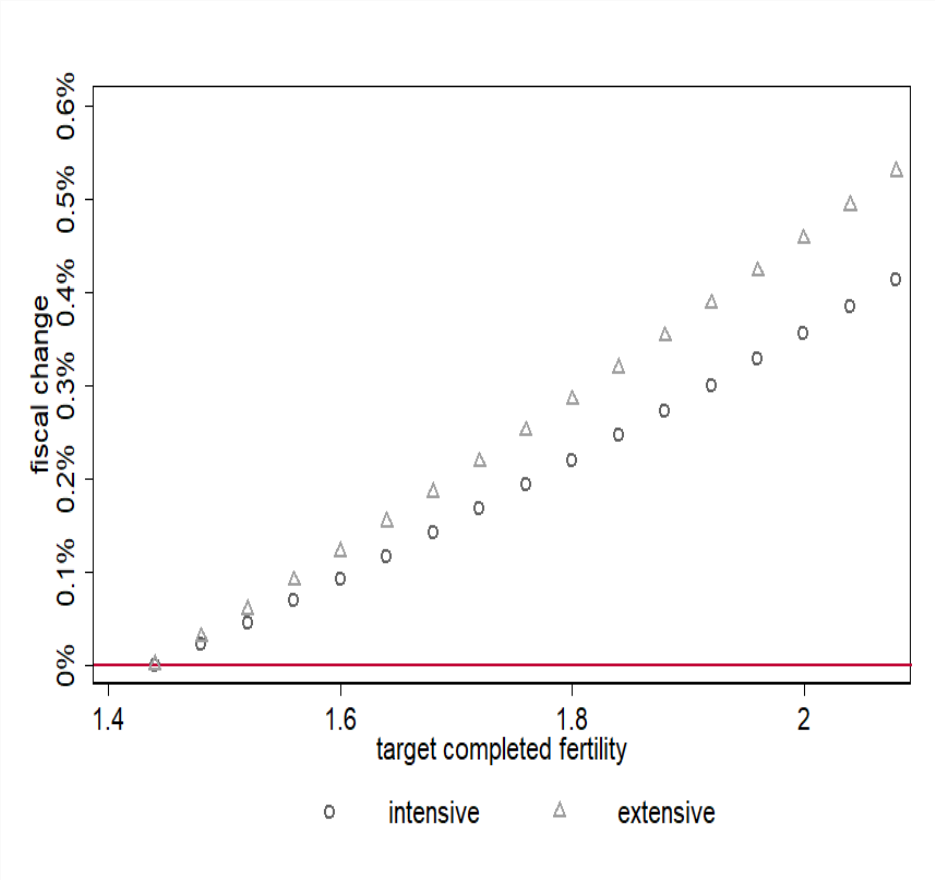

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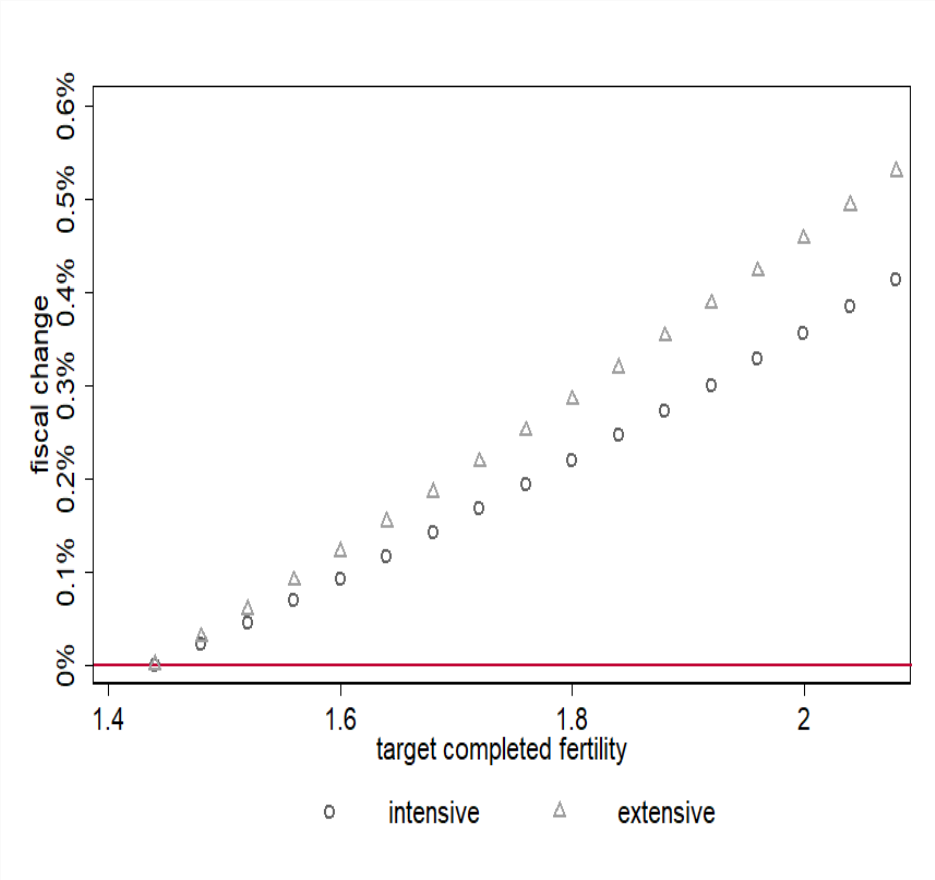

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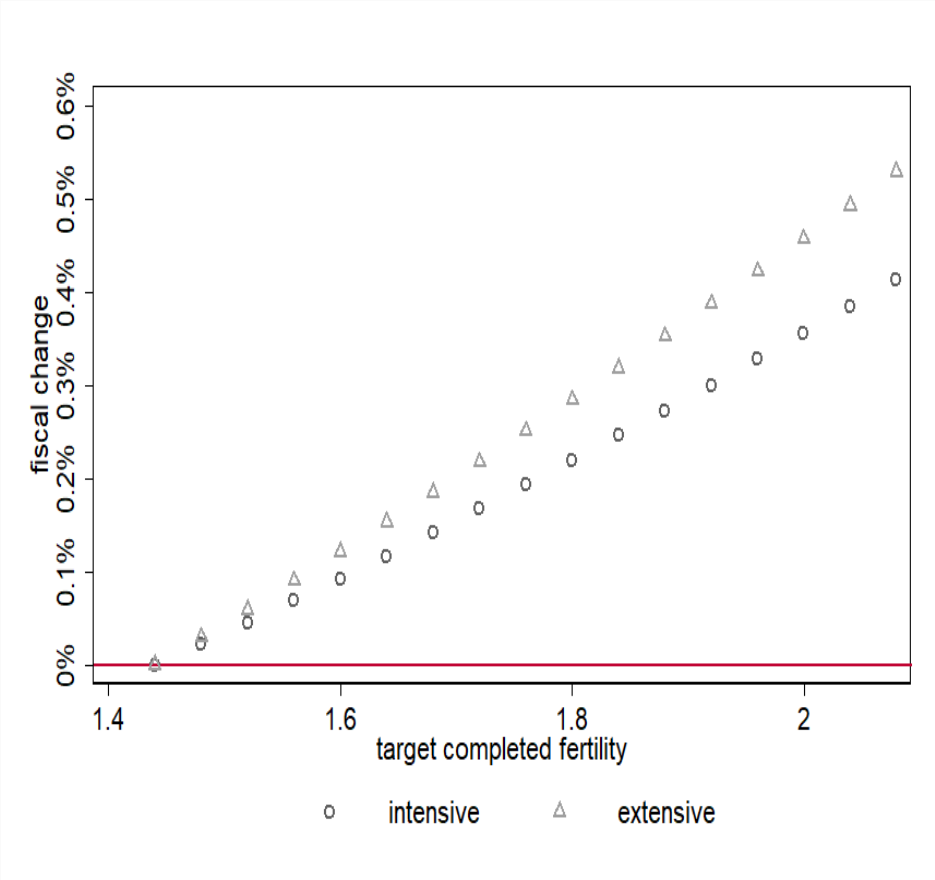

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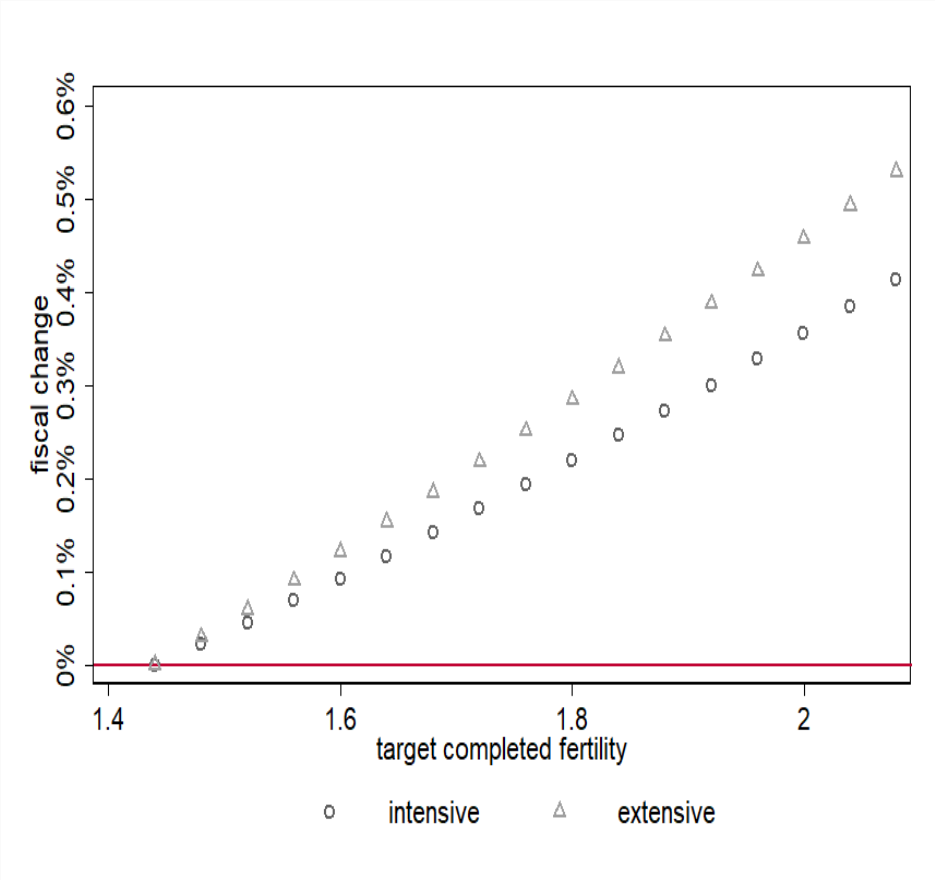

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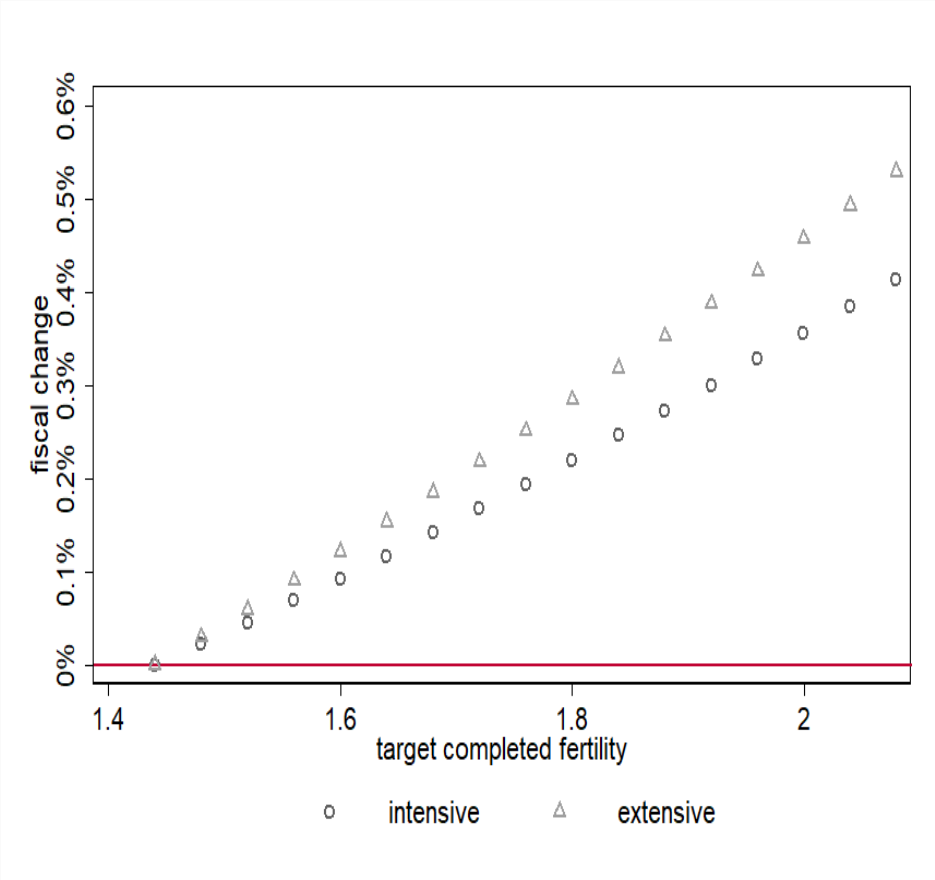

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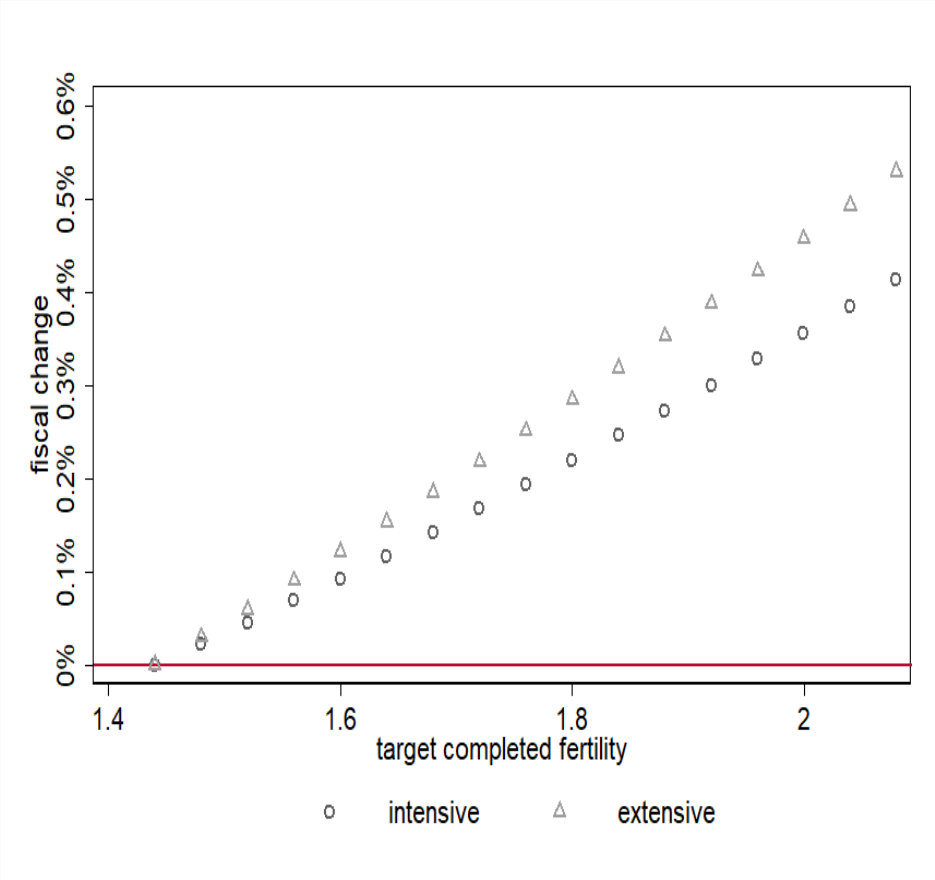

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- $(-)$ labor market
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- $(+)$ labor market
  $(+)$ higher tax base in the future
- immediate costs $<$ delayed gains
- universal result Sensitivity

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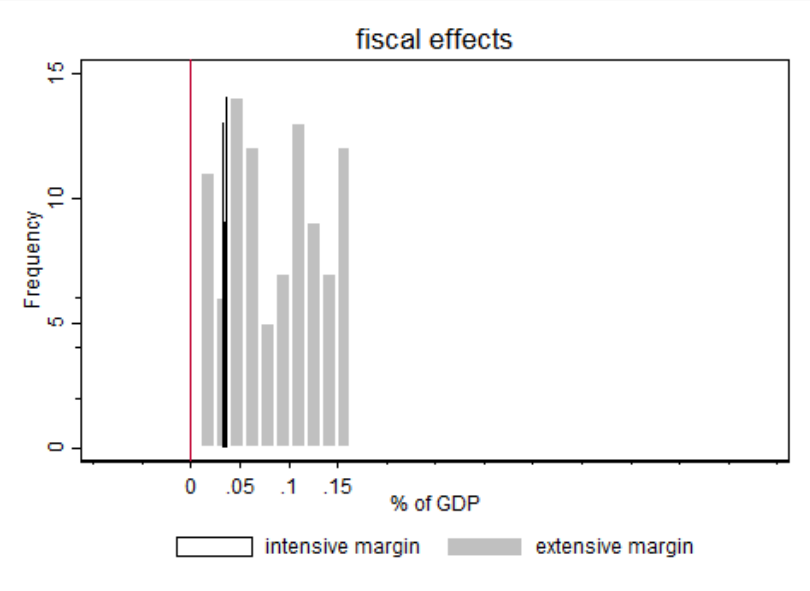
Measuring fiscal effects

How much can we spend every year, assuming increase to fertility

1.50



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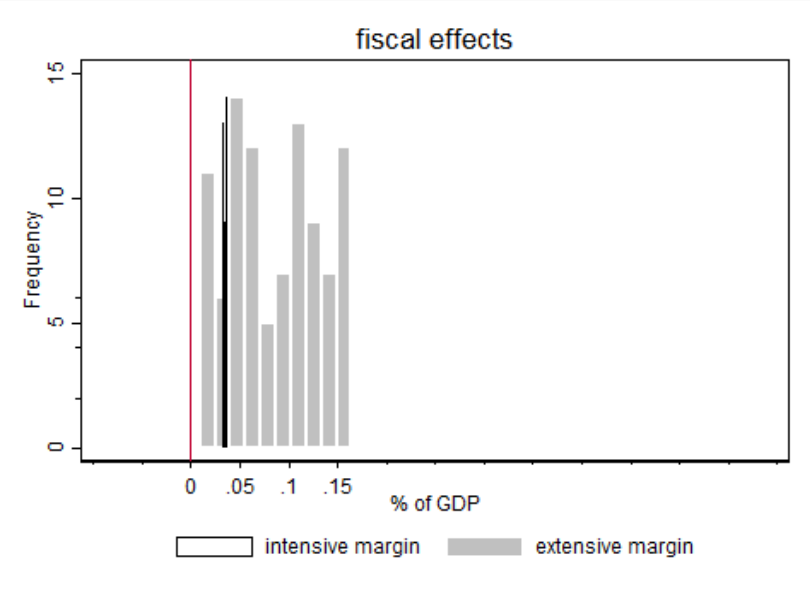

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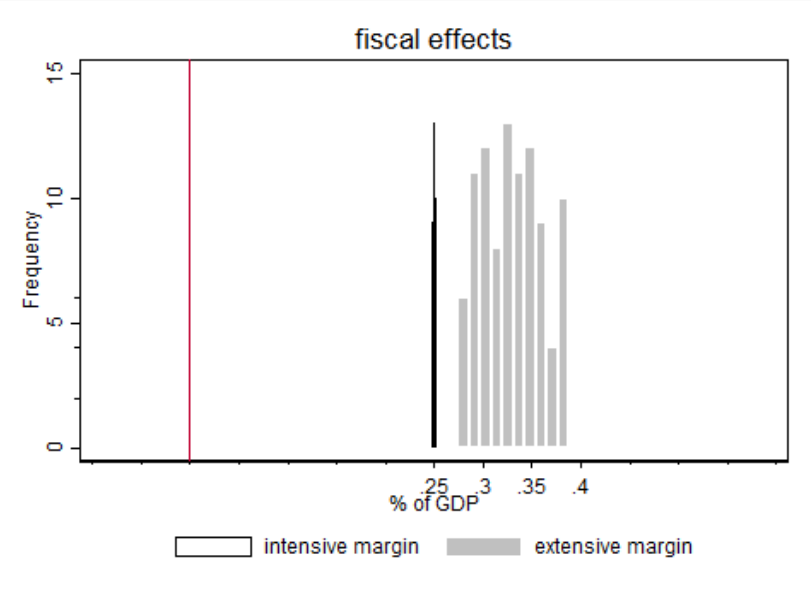

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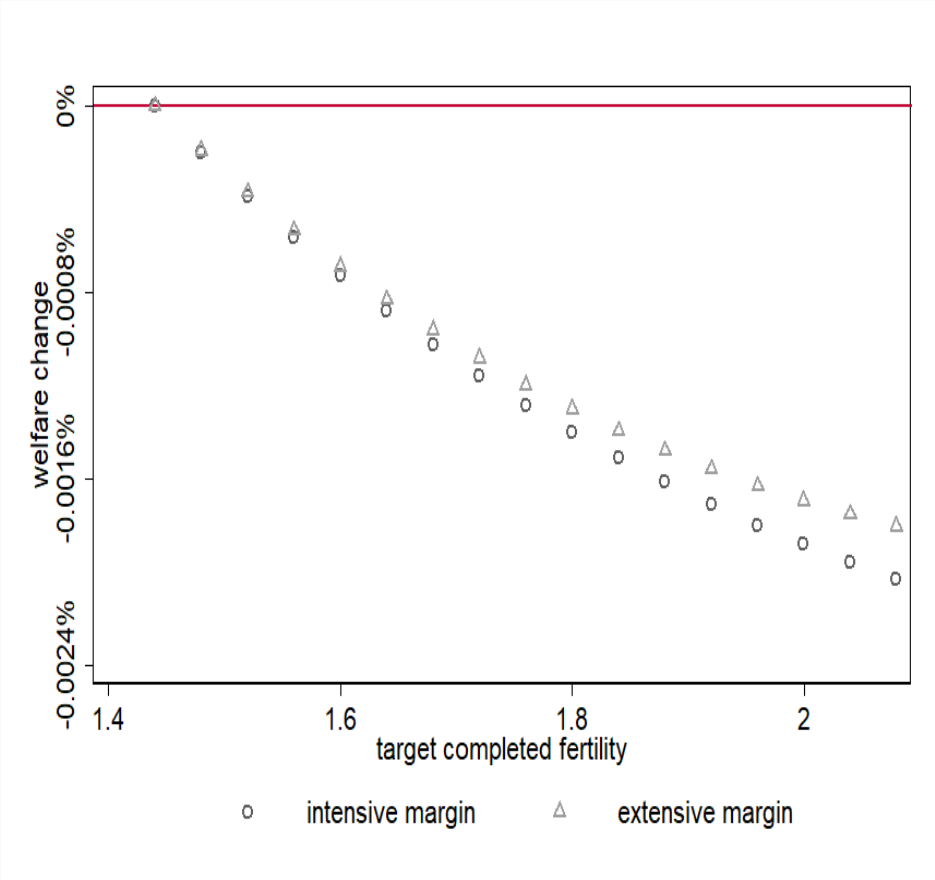

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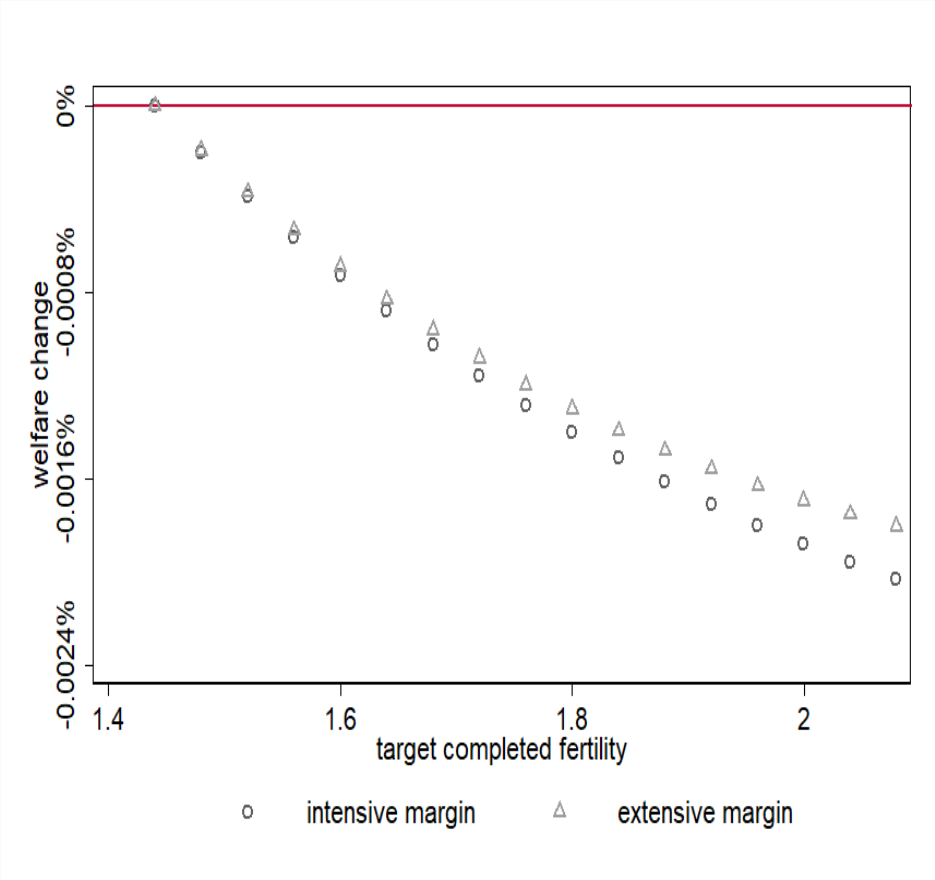

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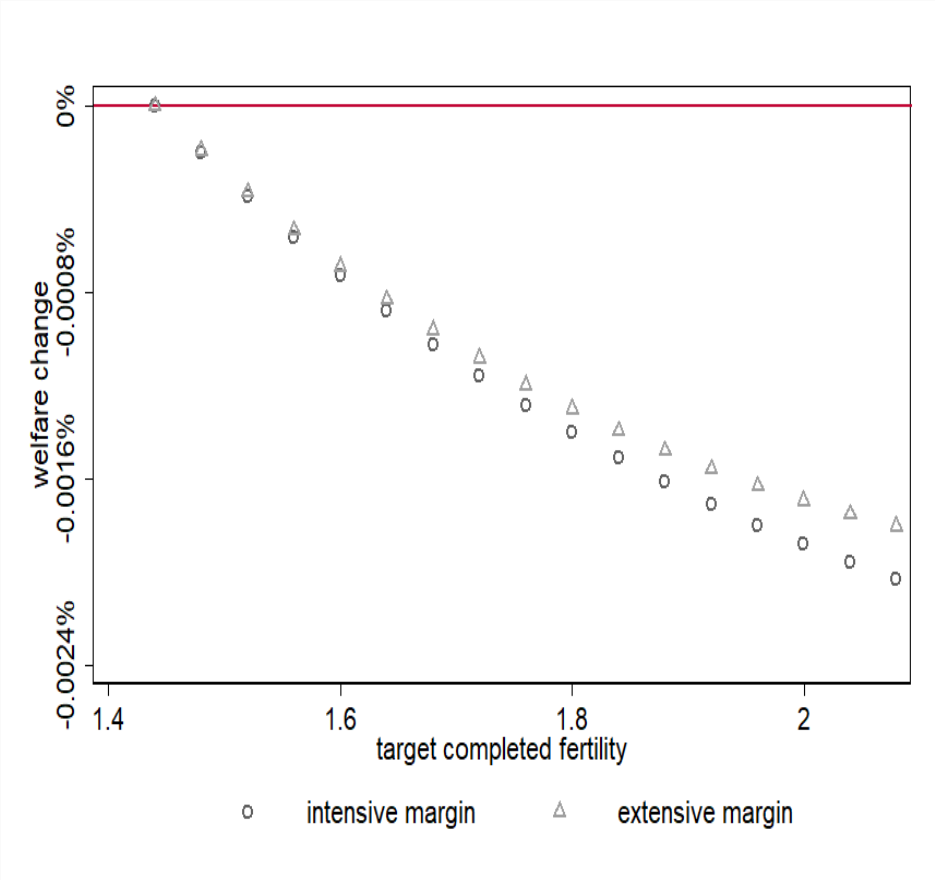

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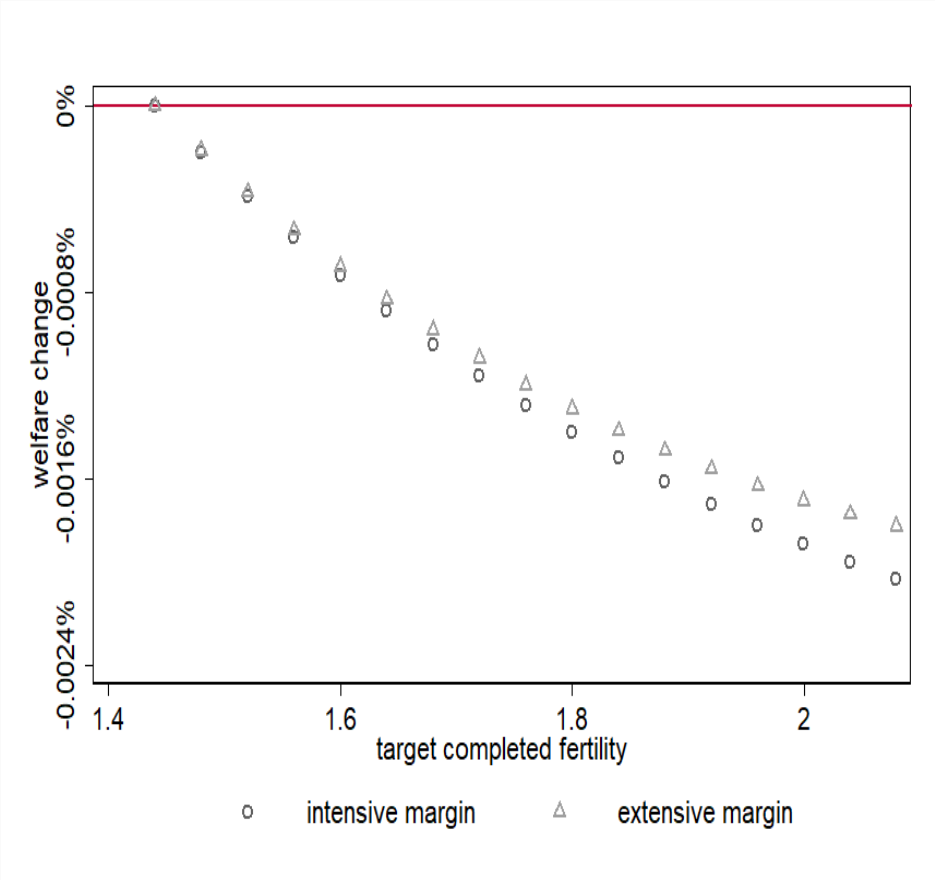

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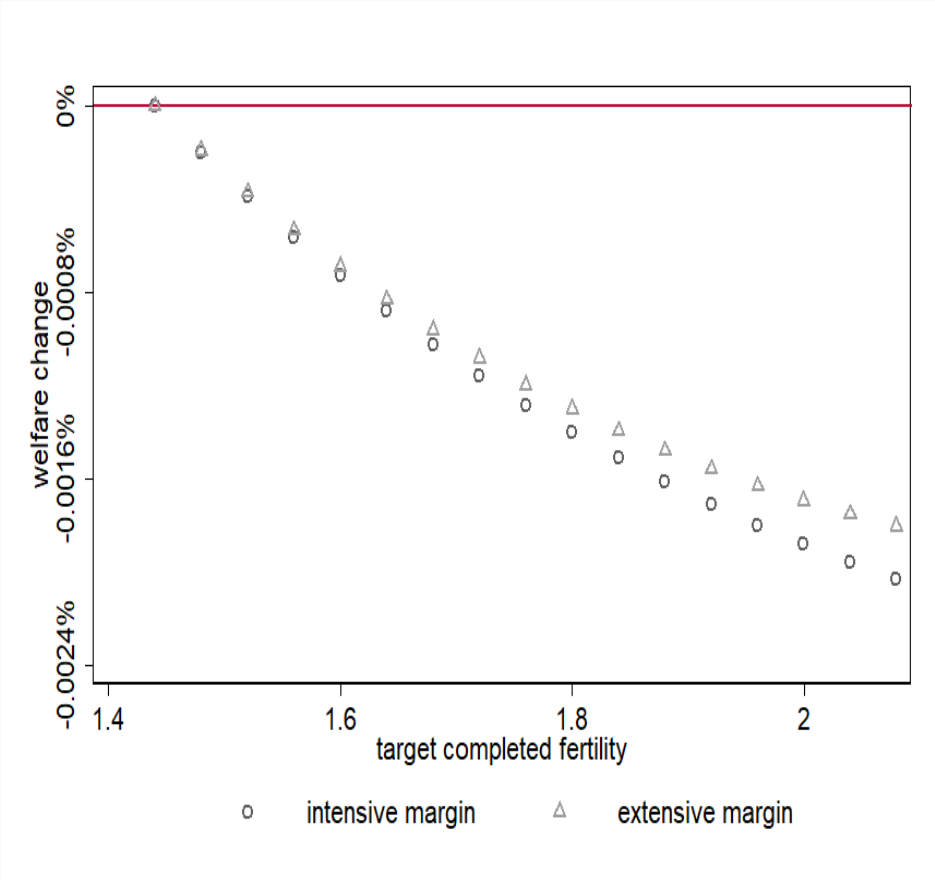

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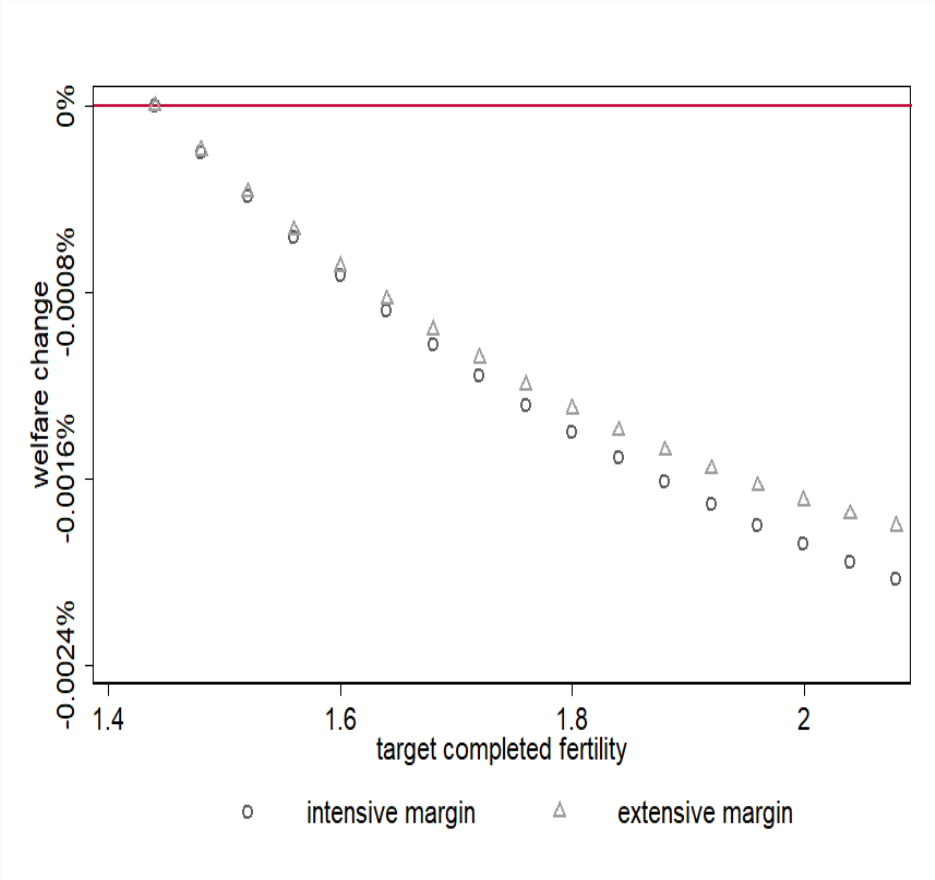

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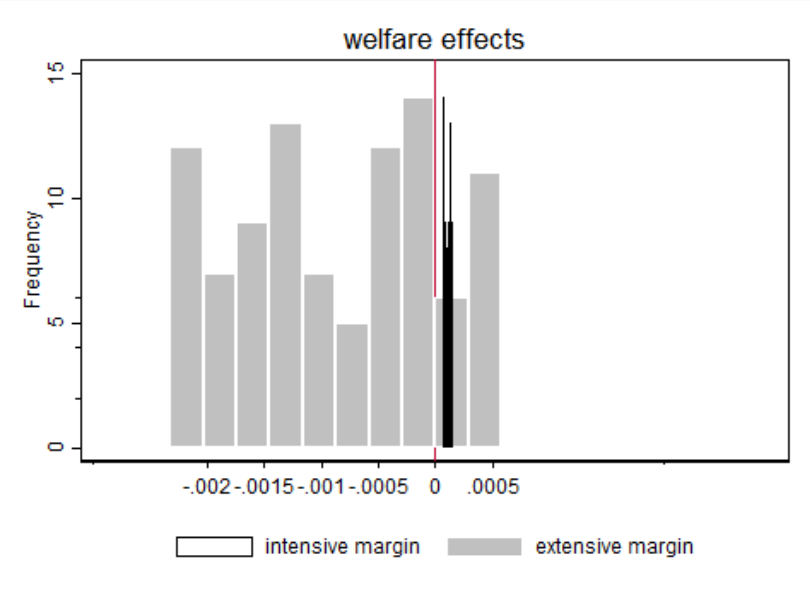
Does intensive and extensive margin matter?

fertility increase to 1.50



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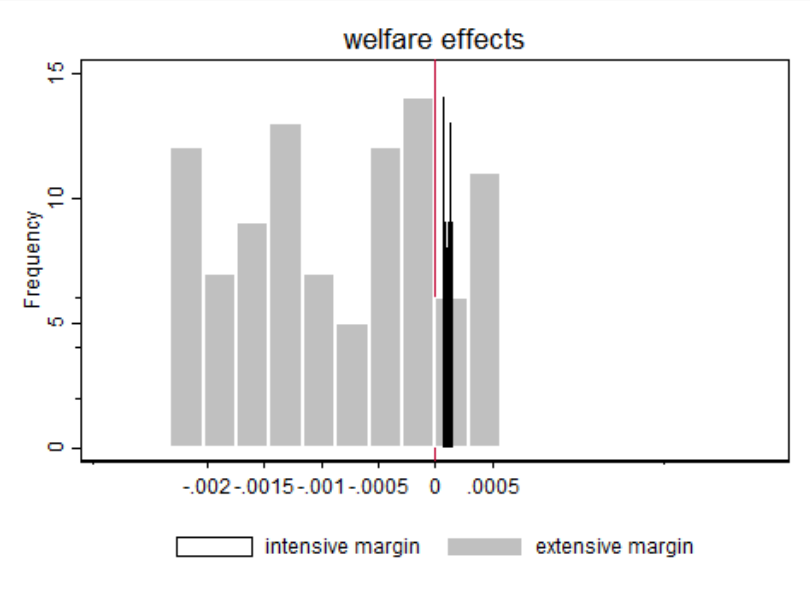

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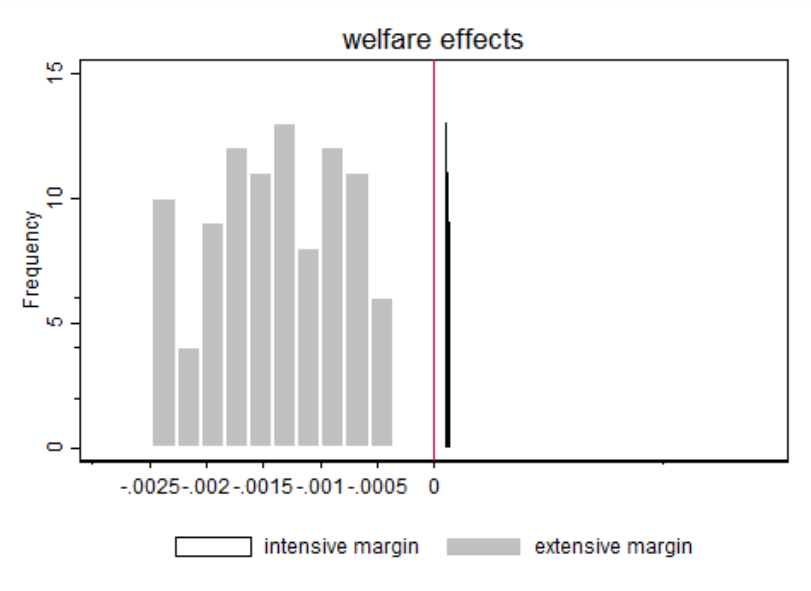

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   - small, but universal fiscal gains
   - for central path 0.2% GDP
2. WELFARE: negative welfare effect
   - fertility$\uparrow \longrightarrow$ welfare$\downarrow$
   - intensive and extensive margin matters (change in sign), but extensive margin can be unrealistic (no trend in data)

Questions or suggestions?

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Thank you!

Producers

- Perfectly competitive representative firm
- Standard Cobb-Douglas production function

$$Y_t = K_t^{\alpha}(z_t L_t)^{1-\alpha},$$

- Profit maximization implies

$$w_t = (1-\alpha)K_t^{\alpha} z_t (z_t L_t)^{-\alpha}$$
$$r_t = \alpha K^{\alpha-1}(z_t L_t)^{1-\alpha} - d$$

where d is the capital depreciation rate

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- reaching adulthood $j = 21$ they form their own household and observe the realization of the fertility

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- optimize lifetime utility derived from leisure and consumption

$$\sum_{j=21}^{J} \beta^{j-21} \pi_{j,t+j-21} [u_j \left(\tilde{c}_{\kappa,j,t+j-21}, l_{\kappa,j,t+j-21} \right) + u_j^* \left(\tilde{c}_{\kappa,j,t+j-21}, l^*_{\kappa,j,t+j-21} \right)]$$

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- with individual consumption as follows

$$\tilde{c}_{\kappa,j,t} = \frac{1}{(2 + \vartheta\kappa)^{\varpi}} c_{\kappa,j,t} = \Xi_\kappa c_{\kappa,j,t}$$

ϑ child consumption scaling factor,
ϖ consumption scaling factor, Ξ_κ scale effect

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\text{women in age} \quad & j < 41: && u_j^*(\tilde{c}_{\kappa,j,t}, l^*_{\kappa,j,t}) = \log \tilde{c}_{\kappa,j,t} + \phi \log(1 - l^*_{\kappa,j,t} - \varphi(\kappa)) \\
\text{women in age} \quad & 41 \leq j < \bar{J}: && u_j^*(\tilde{c}_{\kappa,j,t}, l^*_{\kappa,j,t}) = \log \tilde{c}_{\kappa,j,t} + \phi \log(1 - l^*_{\kappa,j,t}) \\
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\end{aligned}
$$

- subjected to the following budget constraint

$$
\begin{aligned}
(1 + \tau_c) c_{\kappa,j,t} + \tilde{s}_{\kappa,j+1,t+1} \quad = \quad & (1 - \tau - \tau_l) w_{j,t} l_{\kappa,j,t} + (1 - \tau - \tau_l) w_{j,t} l^*_{\kappa,j,t} \\
& + (1 + r_t(1 - \tau_k))\, \tilde{s}_{\kappa,j,t} \\
& + (1 - \tau_l) b_{\kappa,j,t} + (1 - \tau_l) b^*_{\kappa,j,t} \\
& + beq_{\kappa,j,t} + \Upsilon_t
\end{aligned} \tag{1}
$$

Government

- collects taxes

$$T_t = \tau_l(1-\tau)w_t L_t + \tau_l B_t + \tau_c C_t + \tau_k r_t S_t + \Upsilon_t$$

L_t, C_t, S_t, B_t denote labor, consumption, savings and benefits

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- finances spending on public goods and service $G_t = g_t Y_t$,
- and services debt $\Delta D_t = (1 + r_t)D_{t-1} - D_t$

$$T_t = G_t + \Delta D_t$$

DC pension system

- PAYG defined contribution pension system with mandatory τ

$$b_{\kappa,\bar{J},t} = \frac{\sum_{s=1}^{\bar{J}_t-1}\left[\Pi_{\iota=1}^{s}(1+r^{I}_{t-j+\iota-1})\right]\tau w_{t-j+s-1} l_{\kappa,s,t-j+s-1}}{\prod_{s=\bar{J}}^{J}\pi_{s,t}}$$

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- pensions indexed annually with the rate of payroll growth

$$1 + r^{I}_{t} = \gamma_t \frac{L_{t+1}}{L_t}$$

GO BACK

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- Labor income tax (τ_l) matches revenues to GDP ratio of 4.5%
- Consumption tax (τ_c) matches revenues to GDP ratio of 11%
- Capital tax (τ_k) *de iure* = *de facto*

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- Labor income tax (τ_l) matches revenues to GDP ratio of 4.5%
- Consumption tax (τ_c) matches revenues to GDP ratio of 11%
- Capital tax (τ_k) *de iure* = *de facto*
- Technological progress according to EC AWG projections, growth at 1.4%

Note: averages for 2000-2010 (investment rate) and 2005-2014

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Preferences

- Preference for leisure (ϕ) matches participation rate of 56.8%

Preferences

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- Consumption scaling factor (ϖ) and child consumption scaling factor (ϑ_κ) matches OECD equivalence scale of 0.5, 0.65, 0.62 and 0.6 depending on κ

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GRAPE

Demographic assumptions

- no mortality until children are raised ($j < 41$)
- historical data on fertility and mortality 1964-2014
- AWG projections until 2080, at the same level afterwards
- completed fertility from household structure for 2006-2014

Data match

	Data	Model
Completed fertility	1.38-1.52	1.44
Share of cohorts at $j < 21$	0.23	0.23
Share of cohorts at $20 < j < 41$	0.31	0.30
Share of cohorts at $j \geq \bar{J}$	0.18	0.19

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Life expectancy at $j = \bar{J}$	15.41	15.42
Shares of childless women	0.36	0.35
Shares of women with one child	0.16	0.16
$s_1 : s_2 : s_{3+}$	0.16 : 0.28 : 0.2	0.16 : 0.29 : 0.2

Note: Completed fertility measured as realized fertility for women aged 45 years, data averaged over 2006-2014. Shares of age groups based on population structure data, averaged over 2006-2014. Data from Eurostat.

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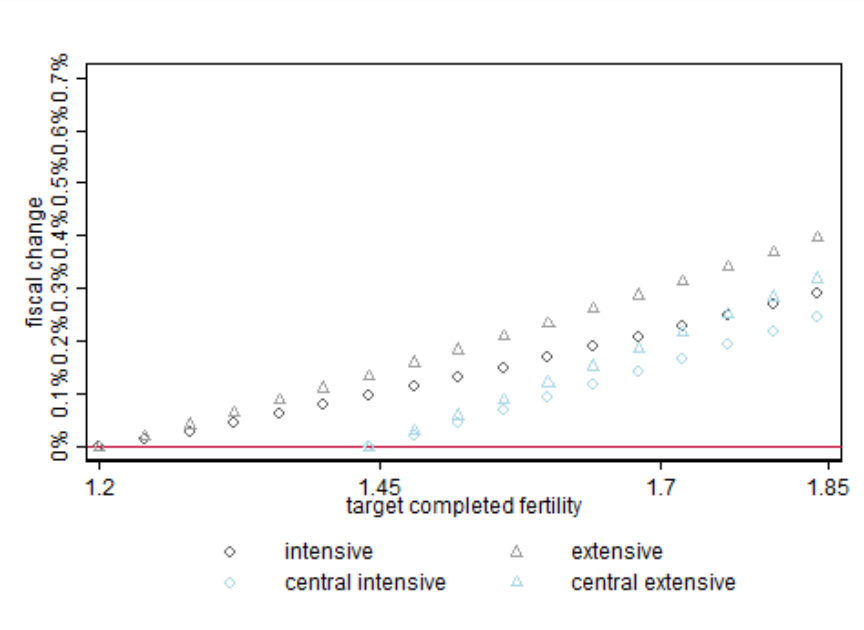
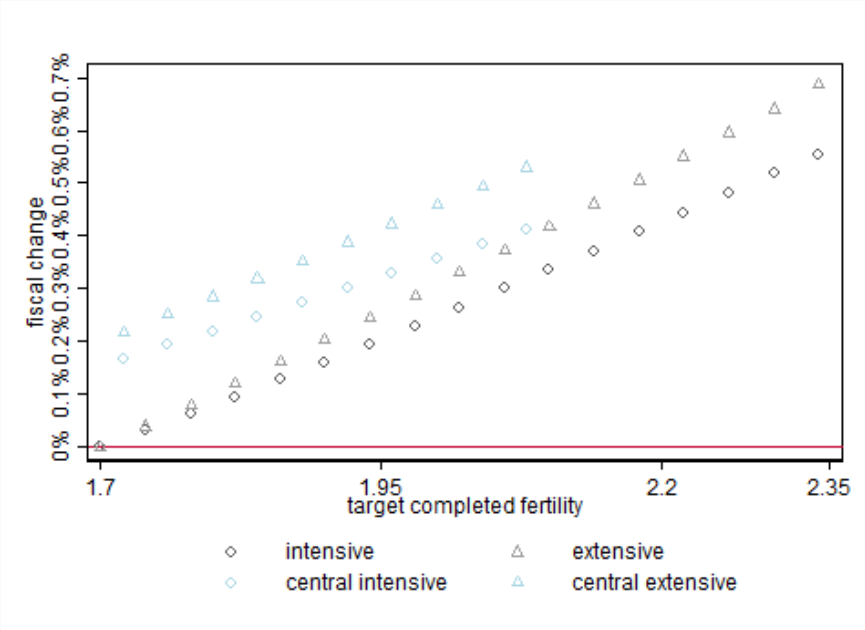
Sensitivity analysis: fiscal effect

Fertility rate prior to the simulated increase

1.20



1.70



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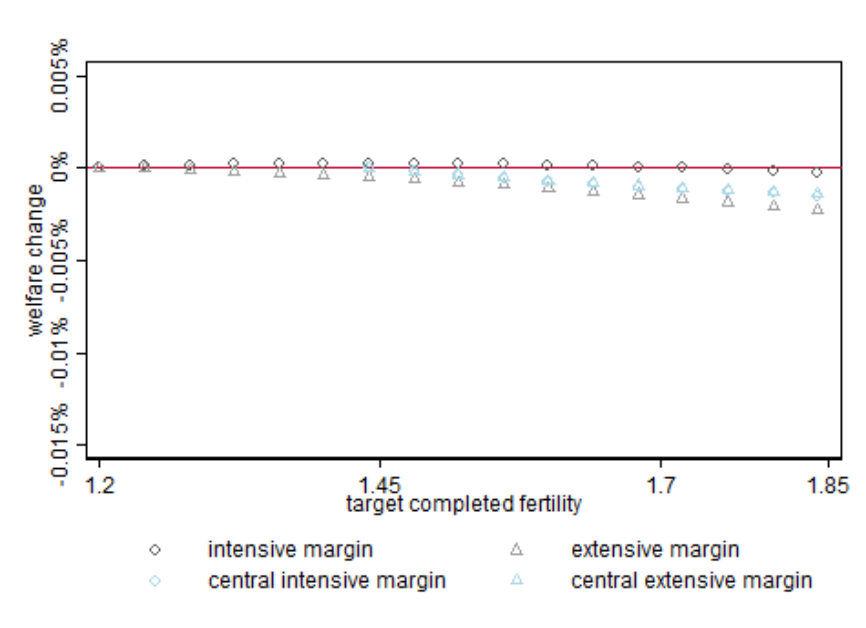
Sensitivity analysis: welfare effect

Fertility rate prior to the simulated increase

1.20



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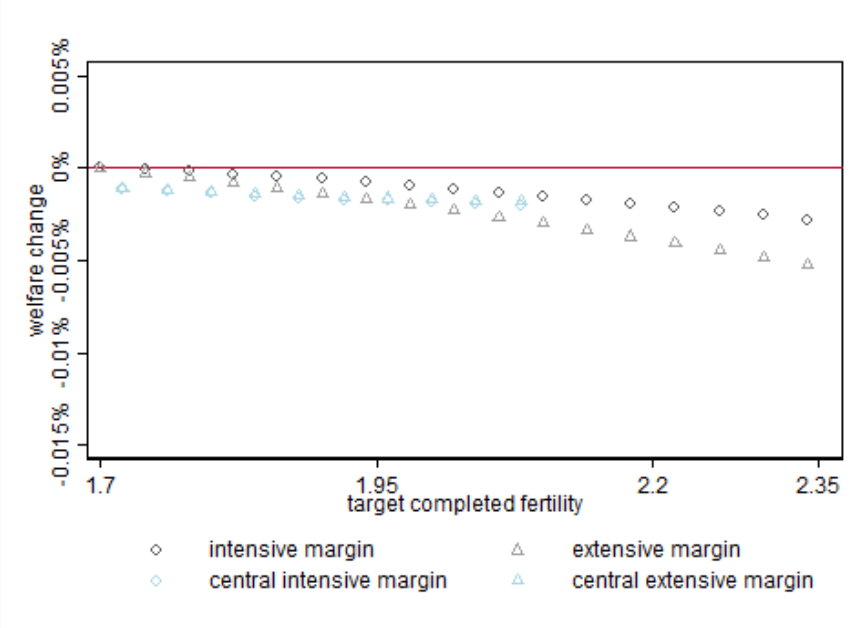

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