

# Searching for Wage Growth: Policy Responses to the Robot Revolution

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**How do recently enacted/proposed US fiscal policies look through the lens of BBZ (2018)?**

- Framework: BBZ (2018)
- Policy: Berg et al (2018)
- Conclusion

- Aggregate production function:

$$Y = F[H(K, S), V(b \cdot Z, L)]$$

- Technology and demographics:

- ① Capital: traditional ( $K$ ) and robots ( $Z$ )
- ② Agents: capitalists/skilled workers ( $S$ ), hand-to-mouth workers ( $L$ )
- ③ Robot revolution:  $b \uparrow$

- Aggregate production function:

$$Y = F[ \underbrace{H(K, S)}_{\text{Complements}}, \underbrace{V(b \cdot Z, L)}_{\text{Substitutes}} ]$$

$\underbrace{\hspace{15em}}_{\text{Complements}}$

- Technology and demographics:

- 1 Capital: traditional ( $K$ ) and robots ( $Z$ )
- 2 Agents: capitalists/skilled workers ( $S$ ), hand-to-mouth workers ( $L$ )
- 3 Robot revolution:  $b \uparrow$

- Critically:

- Traditional capital and unskilled/robot labor: **complements** ( $\sigma < 1$ )
- Unskilled workers and robots: **substitutes** ( $\sigma > 1$ )

- Authors explore 4 variations of this production function

# Effect of robot revolution

$$Y = F[H(K, S), V(b \cdot Z, L)]$$

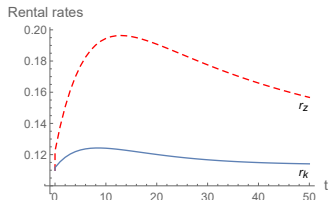
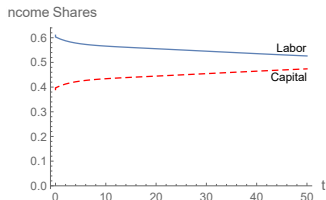
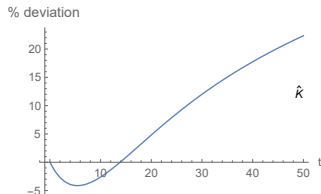
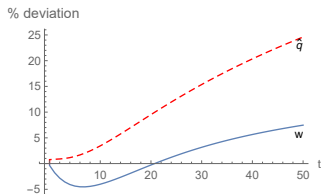
## Robot revolution ( $b \uparrow$ ) hurts unskilled workers

- Existing literature: *relative* to skilled workers/capitalists
  - Unskilled labor share falls
- BBZ: in *absolute and relative* sense
  - Unskilled real wage falls (for plausible parameterization)
  - Unskilled labor share falls
- Why?

$$w = \underbrace{MP_L}_{\text{MP Unskilled}} = \underbrace{\frac{\partial F}{\partial V}}_{\text{MP Labor Composite}} \times \underbrace{\frac{\partial V}{\partial L}}_{\text{Labor Supply Effect}}$$



# Effect of robot revolution - Dynamics



Notes: Transition path when  $\sigma_2 = 2.5$  and  $b$  increases from .5 to 1.5 in the long run. The paths for the real wage ( $w$ ), GDP, and the non-robot capital stock ( $K$ ) show the percentage deviations from initial values.

- 1 Model too techno-pessimistic?
  - Techno-optimism: invention of wonderful new things (tasks) for humans to do
  - Acemoglu and Restrepo (2017) highlight importance of this channel
  - Martinez (2018): absent introduction of new tasks, US labor share would have fallen much more in last decades
- 2 Worker retraining/demographic shifts
  - Currently: labor supply inelastic
  - How would retraining/demographics affect magnitudes?
- 3 Empirical/calibration questions
  - What is traditional vs robot capital?
  - Magnitudes of various elasticities?

$$Y = \underbrace{G}_{\text{Infrastructure}} \times F[H(K, S), V(Z, L)]$$

- 3 policies (ranked by effectiveness):
  - 1 Investments in education (increases supply of high skill workers)
  - 2 Infrastructure investment ( $G \uparrow$ )
  - 3 Cutting corporate tax rate
- Intuition: higher/faster accumulation of complementary factors  $G$  and  $H(\cdot)$  improves lot of low-skill workers

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- Suggestions:
  - Explicit social welfare function to facilitate comparison
  - Optimal policy a useful benchmark?
  - Other policies: robot tax?

# Conclusion

- Exciting times in macro!
- Really well written, thought provoking paper with a very clear message
- Looking forward to further policy implications of BBZ (2018)