Should We Fear the Robot Revolution?

(The Correct Answer is Yes)

Discussion by

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Motivation

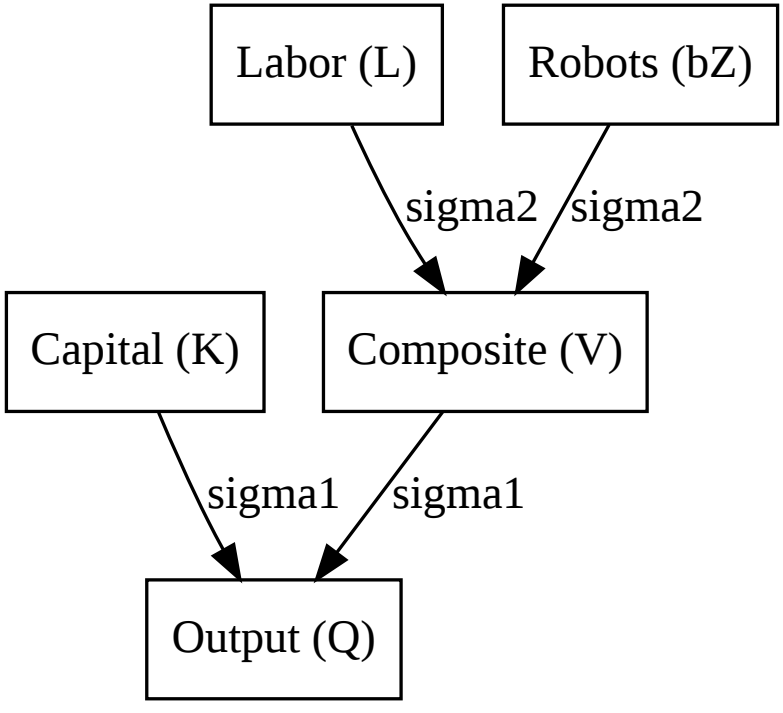
How would a large improvement in robotics technology affect wages and inequality in the short and long run?

This paper models robots as a new type of capital that is potentially strongly substitutable for labor

A variety of different model configurations and parameterizations are explored

Analytic results for the short run and simulation for the long run

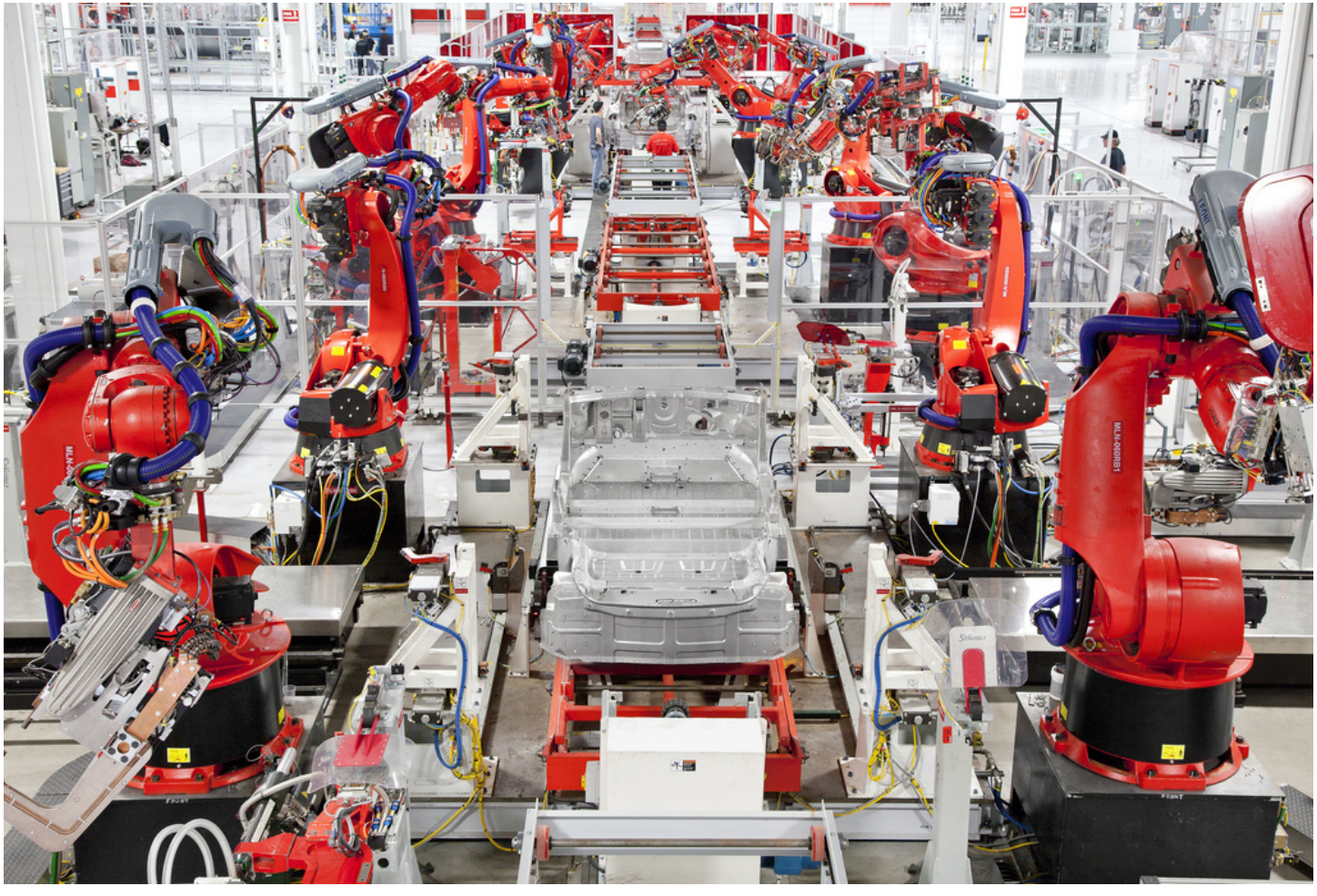
Baseline Model (Uber?)



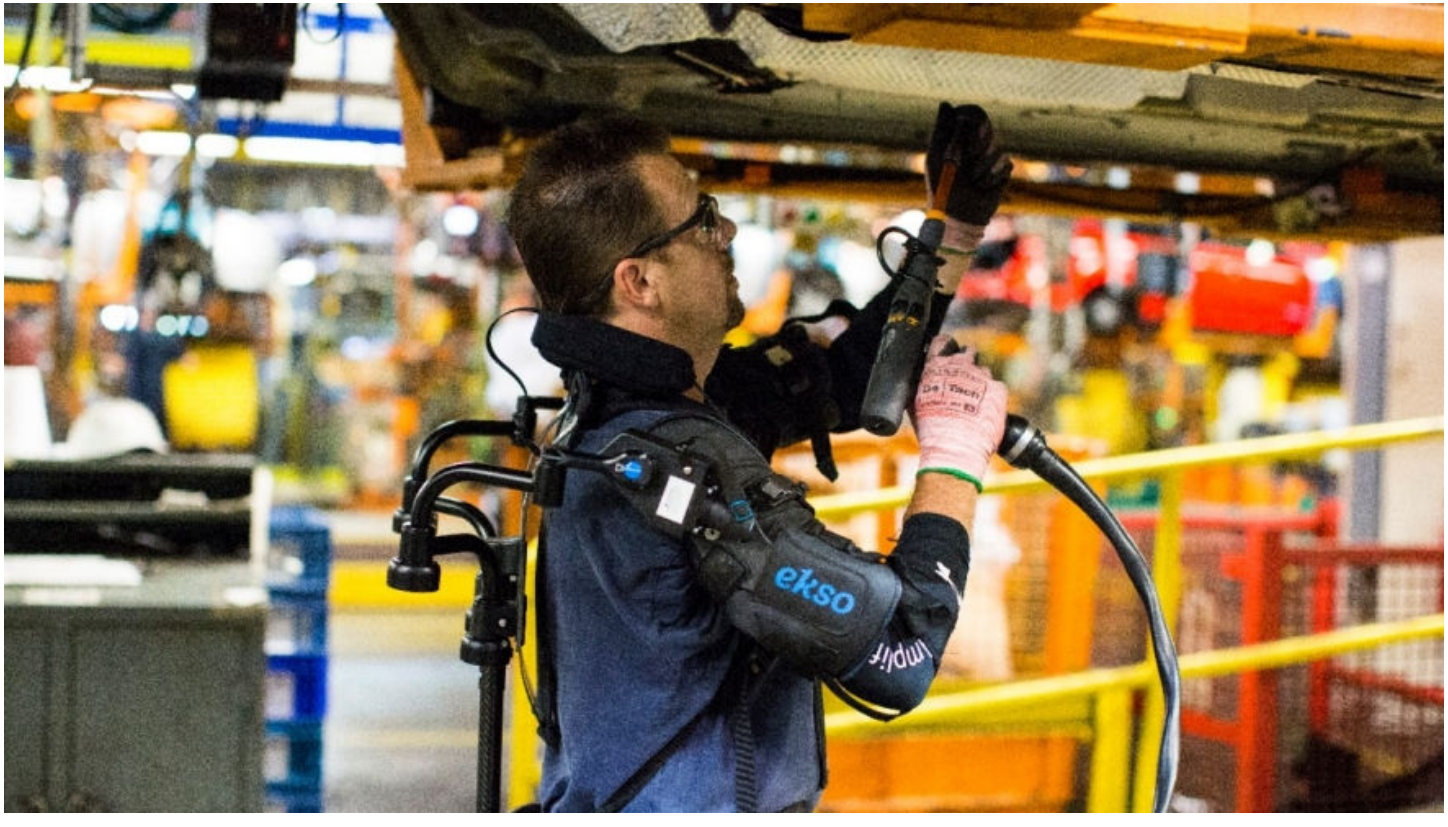
Very clever derivation of laws of motion for this CES system

As we've learned: elasticity of substitution is key!

Substitutes



Complements



Results

Wage law of motion for small proportional changes denoted by hats

$$\hat{w} = \left(\frac{1}{\sigma_2} - \frac{\theta_K}{\sigma_1} \right) \alpha_z (\hat{b} + \hat{Z}) + \frac{\theta_K}{\sigma_1} \hat{K}$$

Capital is a double edged sword, inducing initial wage drop but generating wage boost in the long run

Given substantial changes in b and resulting transition dynamics, not sure about a linearized approach, particularly in the long run. Also why initial jump?

Inequality

Given long adjustment processes at play, long-term predictions are not enough. Even medium-term covers the bulk of current generation's lifespan

A stark divide -- workers and capitalists -- means that inequality is determined by interest rate to wage ratio

Would be nice to see paths of formal measures of inequality

$$\hat{r}_k - \hat{w} = \left(\frac{1}{\sigma_1} - \frac{1}{\sigma_2} \right) \alpha_z (\hat{b} + \hat{Z}) - \frac{1}{\sigma_1} \hat{K}$$

$$\hat{r}_z - \hat{w} = \hat{b} - \frac{1}{\sigma_2} (\alpha_L + \alpha_Z)(\hat{b} + \hat{Z})$$

Interpretation

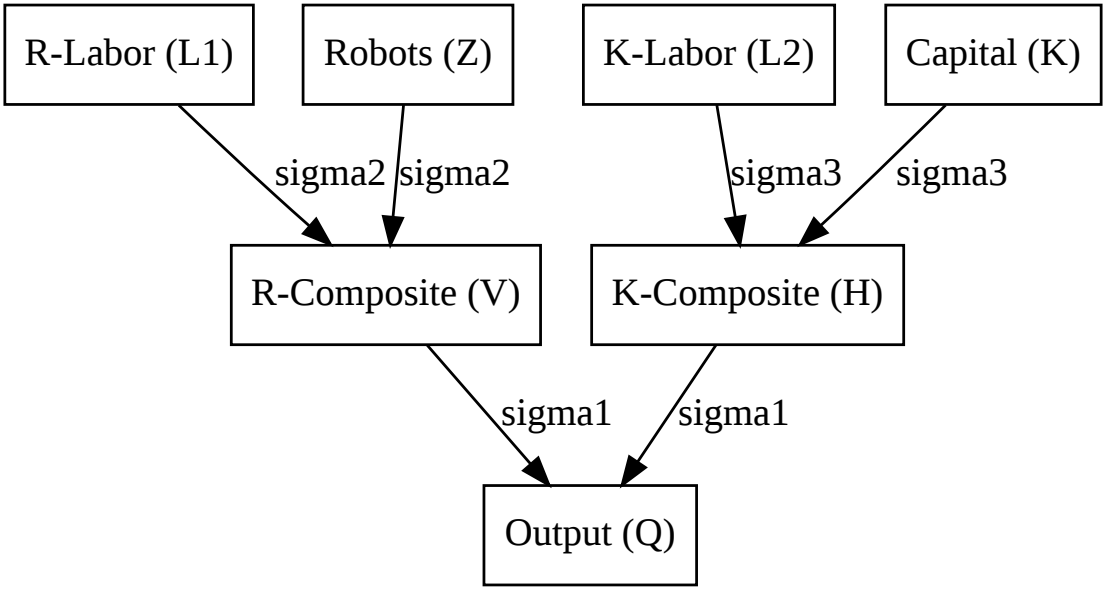
Without capital, immediate wage response is $\frac{\alpha_z}{\sigma_2}\hat{b} > 0$ since supply is fixed and output rises

This bZ structure renders Z a general purpose technology: changes in b can be utilized immediately

Alternative is a vintage capital model in which changes in b would have no immmdiate effect

Is b software and Z haredware? Hardware and software get less coupled over time. Same happened with computers in 80's and 90's

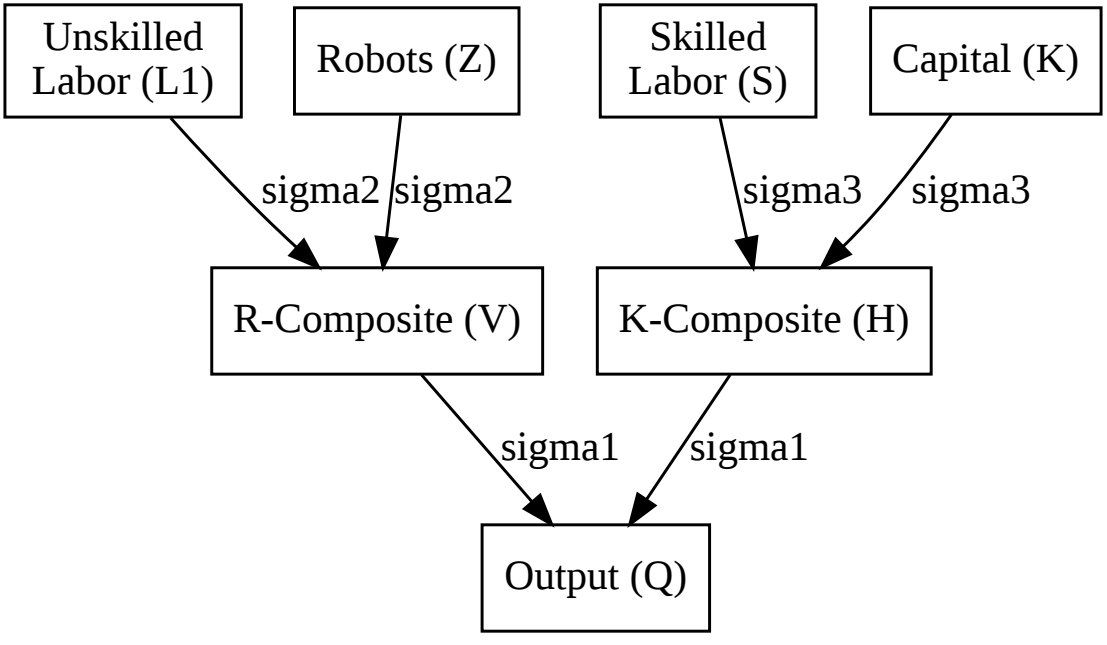
Separate Sectors



Labor freely mobile across sectors

Results qualitatively similar

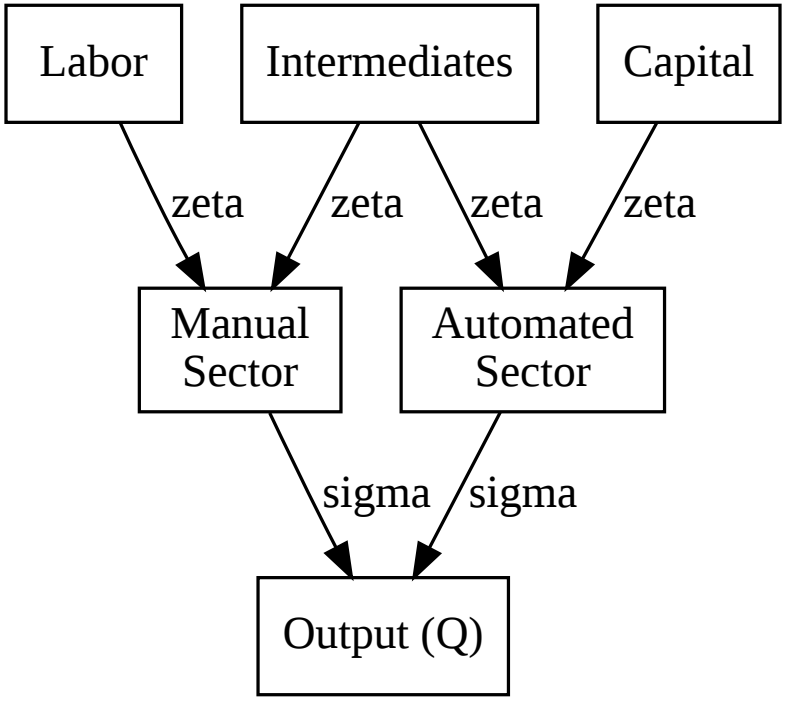
Skilled Labor



Reminiscent of Autor, Levy, and Murnane (2003) in which software is perfectly substitutable for routine tasks but not for others

Related Work

Acemoglu and Restrepo (2017a) allow endogenous choice between manual and automated for each product



Related Work

A-R have endogenous investment in new tasks for which labor has a comparative advantage

Familiar implications

- Long-run wage rises, but there may be a lengthy dip
- Labor share falls for sure

Hemous and Olson (2016) study a similar model and find

- Wages still grow, but skill premium diverges
- Low-skill share converges to zero

Role of Technology

Interesting to think of the role of non-excludable technology such as (perhaps) software in this setting

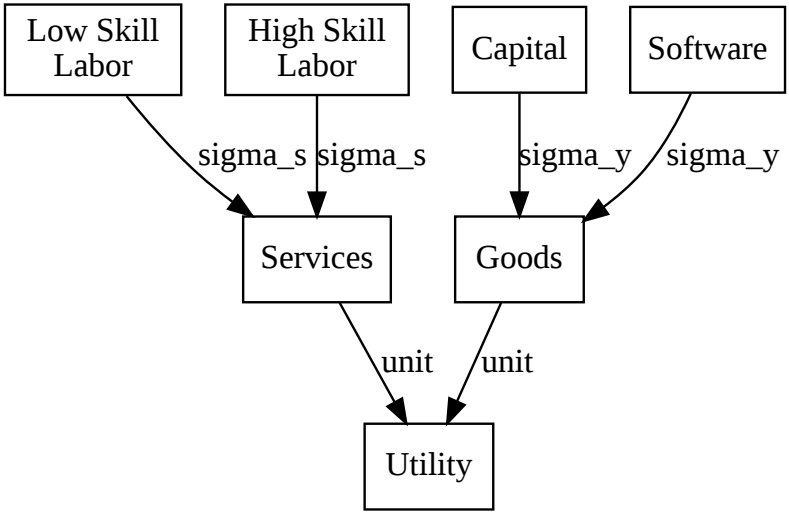
Depending on the microstructure, open source software and other informational public goods could "level the playing field" with regards to AI and capital ownership

This is an explicit goal of Elon Musk and Sam Altman's OpenAI research outfit

Much of ML research happens at universities or is publicly released by firms such as Google or Facebook (very different for self driving cars)

Role of Software

Benzell, Kotlikoff, LaGarda, and Sachs (2016) consider robots as a combination of both hardware and software



More software leads to immiseration through a reduction in investment

Proliferation of Models

Many different production and elasticity structures in the literature, without a lot of agreement

Might be better to focus on the quantitative fit of one particular model, rather than working through many different variants

Empirical Evidence

Acemoglu and Restrepo (2017b) look at changes in industrial robot adoption across commuting zones in US

Instrumenting for industry level robot adoption by European countries, they find significant effects on wages and employment

Comparable to the short-run effect of robots in this paper

- Reduction in wages
- Reduction in labor

Validation

The process of automation is and has been underway for some time in some form or another

It should be possible to constraint the parameters of the model using the last decade or two

This would allow one to at least extrapolate from past experience, perhaps providing a lower bound for the scale of the transition

Thanks!