AI-Robo Economy: A DSGE Framework with Ramsey UBI Financing

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Abstract

We develop a tractable DSGE model for an economy in which all market production is performed by AI-robots owned by a competitive capital sector and rented to competitive final-good firms. Humans receive income via (i) ownership claims to the robot sector (for a subset of the population) and (ii) a government-financed Universal Basic Income (UBI). We characterize competitive equilibrium, the Ramsey planner's steady-state problem, and provide a steady-state UBI calculator. A core result is that financing UBI with a broad consumption tax and a zero long-run tax on robot rentals preserves capital deepening while delivering substantial redistribution. We extend the framework with a money block to discuss Modern Monetary Theory (MMT) interpretations and compare tax needs under non-MMT vs MMT when inflation is targeted at 2%.

1 Introduction

Rapid advances in general-purpose AI and robotics are shifting value creation from human labor to autonomous capital. If robots outperform humans across most tasks, the wage-based transmission from productivity to household income weakens or vanishes. This paper asks a simple policy question: *What fiscal architecture sustains human consumption when robots do all the work?*

Methodologically, we build on medium-scale DSGE modeling (Smets and Wouters, 2007; Christiano et al., 2005). Substantively, our work connects to the economics of automation and the future of work (Acemoglu and Restrepo, 2018; Autor, 2015; Acemoglu and Restrepo, 2022) and to the normative debate on unconditional transfers (Van Parijs and Vanderborght, 2017). Our contribution is to embed a fully automated production structure into a standard macro framework and derive implementable UBI financing rules.

2 Non-technical Summary

Imagine that every good and service is produced by AI-robots. Firms do not hire people because robots are faster and cheaper. People still need to buy food, pay rent, and pursue meaningful lives—they just do not earn wages. In our model, the government pays everyone a universal basic income (UBI) financed by broad-based taxes so households can participate in the economy as consumers. A minority of humans own shares in the robot sector and receive dividends; UBI ensures that non-owners also benefit. We show how to size UBI so that it is fiscally sustainable and preserves robot investment.

3 Model Setup

Technology and final-good firms. Final-good firms rent robot capital K_t and produce

$$Y_t = A_t K_t^{\alpha}, \qquad \alpha \in (0,1), \quad \log A_t = \rho_A \log A_{t-1} + \varepsilon_t. \tag{1}$$

Perfect competition implies the rental condition

$$R_t^k = \alpha A_t K_t^{\alpha-1} \quad \Rightarrow \quad R_t^k K_t = \alpha Y_t, \tag{2}$$

and profits $\pi_t = Y_t - R_t^k K_t = (1-\alpha) Y_t$.

AI-robo firms (capital owners/lessors). They choose investment I_t subject to convex adjustment costs,

$$K_{t+1} = (1-\delta) K_t + I_t, \tag{3}$$

$$\Phi\left(\tfrac{I_t}{K_t}\right) = \frac{\phi}{2}\left(\tfrac{I_t}{K_t} - \delta\right)^2 K_t. \tag{4}$$

Dividends (given a rental tax τ_t^k) are

$$\text{DIV}_t = R_t^k K_t + \pi_t - I_t - \Phi\left(\tfrac{I_t}{K_t}\right) - \tau_t^k R_t^k K_t. \tag{5}$$

Let Q_t be the shadow value of installed robots. The Q-conditions are

$$Q_t = 1 + \frac{\partial \Phi}{\partial I}\left(\tfrac{I_t}{K_t}\right), \tag{6}$$

$$Q_t = \beta E_t\left[\frac{u'(c_{O,t+1})}{u'(c_{O,t})}\left(R_{t+1}^k(1-\tau_{t+1}^k) + (1-\delta) Q_{t+1} - \frac{\partial \Phi}{\partial K}\right)\right]. \tag{7}$$

Households. A unit mass of humans is split into a measure θ of *owners* (hold robot equity) and $1-\theta$ *non-owners*. Preferences:

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{c_{i,t}^{1-\sigma} - 1}{1-\sigma}, \qquad i \in \{O, N\}. \tag{8}$$

Each trades a one-period bond $b_{i,t+1}$ at price q_t (gross return $R_t^b = 1/q_t$). Budget constraints:

$$c_{O,t} + q_t b_{O,t+1} = R_t^b b_{O,t} + \frac{\text{DIV}_t}{\theta} + T_t, \tag{9}$$

$$c_{N,t} + q_t b_{N,t+1} = R_t^b b_{N,t} + T_t. \tag{10}$$

Euler equations: $c_{i,t}^{-\sigma} = \beta R_t^b E_t[c_{i,t+1}^{-\sigma}]$.

Government. Per-capita UBI T_t is financed by a consumption tax τ_t^c, an optional rental tax τ_t^k, and debt B_t^g:

$$T_t + R_t^b B_{t-1}^g = \tau_t^c C_t + \tau_t^k R_t^k K_t + B_t^g. \tag{11}$$

Resource and market clearing.

$$Y_t = C_t + I_t + \Phi\left(\frac{I_t}{K_t}\right), \qquad C_t = \theta c_{O,t} + (1-\theta) c_{N,t}, \tag{12}$$

$$\theta b_{O,t} + (1-\theta) b_{N,t} + B_t^g = 0. \tag{13}$$

4 Ramsey Program (Steady State)

We focus on constant (T, τ^c) with long-run $\tau^k = 0$. The planner maximizes $\theta \frac{c_O^{1-\sigma}-1}{1-\sigma} + (1-\theta)\frac{c_N^{1-\sigma}-1}{1-\sigma}$ subject to steady-state equilibrium. With $A = 1$,

$$\alpha K^{\alpha-1} = \delta + \beta^{-1} - 1, \qquad Y = K^\alpha, \qquad I = \delta K, \qquad \Phi = 0, \tag{14}$$

$$T = \tau^c C, \qquad \text{DIV} = Y - \delta K, \qquad c_O = \frac{\text{DIV}}{\theta} + T, \qquad c_N = T. \tag{15}$$

5 Calibration and Steady State

Quarterly baseline: $\beta = 0.99$, $\sigma = 2$, $\delta = 0.02$, $\alpha = 0.35$, $\phi = 4$, $\rho_A = 0.9$, $\theta = 0.20$. With $A = 1$, the steady-state system pins down (K, Y, I, C) and C/Y. For a UBI share $s \equiv T/Y$, the implied consumption tax is $\tau^c = s/(C/Y)$. Values around $s \approx 0.15$–0.20 imply $\tau^c \approx 25$–35% in this calibration.

6 Policy Implications: EU-wide UBI Example

We assume the consolidated fiscal/monetary authority targets steady inflation $\pi^* = 2\%$. Using EU-27 population of about 449.2 million on 1 Jan 2024 (Eurostat, 2024) and EU nominal GDP of about EUR 18.35 trillion in 2023 (, n.d.), nominal GDP per capita is roughly EUR 40,900. A UBI equal to *15% of GDP* would be about EUR 6,100 per person per year (≈ EUR 510/month); *18%* would be about EUR 7,350 (≈ EUR 610/month). In purchasing-power terms, EU PPP GDP was about $27.13 trillion in 2023 (, n.d.). Per-capita PPP GDP is roughly $60,400, so a UBI at 15% corresponds to about $9,050 per year (≈ $755/month), and at 18% to about $10,860 (≈ $905/month). Under a 2% inflation target, steady-state seigniorage is small (see Appendix 7): it lowers required tax financing by roughly $\pi^*(M/P)/Y$, which is a few tenths of GDP if money balances are modest. See Appendix 7 for details.

7 Conclusion

We provide a compact DSGE architecture for a robot-only production economy and derive implementable UBI financing. The steady-state Ramsey logic points toward zero long-run taxes on robot rentals and consumption-based financing of transfers. Substantively, this architecture channels robot-driven abundance into broad-based human welfare while preserving investment incentives. Future work should examine transition dynamics, heterogeneity, and optimal mix of instruments.

Appendix A: Equilibrium Conditions

Households: budgets and Euler equations. Firms: rental FOC, Q-conditions, capital law. Government: budget. Markets: resource and bond clearing. Shock: A_t AR(1).

Appendix B: Integrating MMT into the DSGE UBI Framework

Conceptual change. Consolidate the fiscal authority and central bank: solvency is not binding in own currency; the constraint is inflation. Taxes do not "finance" UBI ex ante; they withdraw purchasing power to stabilize inflation and anchor currency demand.

Money block. Add real money balances via money-in-utility or a reduced-form money demand

$$\frac{M_t}{P_t} = \ell(i_t, Y_t), \tag{16}$$

and either set money growth μ_t or follow an interest-rate rule. The consolidated real budget becomes

$$T_t = \tau_t^c C_t + \tau_t^k R_t^k K_t + \underbrace{\Delta\left(\frac{M_t}{P_t}\right) + \pi_t \frac{M_{t-1}}{P_{t-1}}}_{\text{seigniorage}}. \tag{17}$$

Seigniorage arithmetic. In steady state with constant real balances, the seigniorage share of GDP s_M satisfies

$$s_M \equiv \frac{\pi(M/P)}{Y} \approx \pi \cdot \frac{M/P}{Y}. \tag{18}$$

If $\frac{M}{PY} \approx 0.10$ and $\pi = 2\%$, then $s_M \approx 0.2\%$ of GDP; if $\frac{M}{PY} \approx 0.50$, then $s_M \approx 1\%$. Hence, large UBI shares cannot be money-financed at low inflation; taxes (or other drains) remain necessary.

Policy frontier. Use money finance for slack periods and taxes (e.g., τ^c) to cool demand near capacity. A state-contingent UBI rule can scale transfers with the output gap and inflation to maintain stability around target π^*.

Appendix C: Non-MMT vs MMT at a 2% Target

Let $s \equiv T/Y$ be the UBI share of GDP and let $c \equiv C/Y$ denote the steady-state consumption share. Under the non-MMT benchmark (no monetary financing in steady state), required tax revenue is

$$\tau^c_{\text{nonMMT}} = \frac{s}{c}. \tag{19}$$

Under MMT with an inflation target π^* and stable real balances, steady-state seigniorage is $s_M \approx \pi^* \, (M/P)/Y$. Thus the required tax wedge is reduced by this amount:

$$\tau^c_{\text{MMT}} \approx \frac{s - s_M}{c} = \frac{s}{c} - \frac{\pi^*}{c} \cdot \frac{M/P}{Y}. \tag{20}$$

Calibration Example. Assume steady-state real money balances are $(M/P)/Y = 0.10$ (10% of GDP) and the inflation target is $\pi^* = 0.02$ (2%). Then seigniorage revenue is

$$s_M = \pi^* \cdot \frac{M/P}{Y} = 0.02 \times 0.10 = 0.002 \quad \text{(i.e., 0.2\% of GDP)}. \tag{21}$$

In the MMT approach, this reduces the required tax financing of UBI by 0.2 percentage points of GDP compared to the non-MMT balanced-budget case. For higher real money balances, the contribution is proportionally larger; for lower balances, it is smaller.

References

(n.d.).

Acemoglu, D. and Restrepo, P. (2018), 'The race between man and machine: Implications of technology for growth, factor shares, and employment', *American Economic Review* **108**(6), 1488–1542.

Acemoglu, D. and Restrepo, P. (2022), 'Tasks, automation, and the rise in us wage inequality', *Econometrica* **90**(5), 1973–2016.

Autor, D. H. (2015), 'Why are there still so many jobs? the history and future of workplace automation', *Journal of Economic Perspectives* **29**(3), 3–30.

Christiano, L. J., Eichenbaum, M. and Evans, C. L. (2005), 'Nominal rigidities and the dynamic effects of a shock to monetary policy', *Journal of Political Economy* **113**(1), 1–45.

Eurostat (2024), 'Eu population increases again in 2024', https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240711-1. News release, 11 July 2024. EU population 449.2m on 1 January 2024.

Smets, F. and Wouters, R. (2007), 'Shocks and frictions in us business cycles: A bayesian dsge approach', *American Economic Review* **97**(3), 586–606.

Van Parijs, P. and Vanderborght, Y. (2017), *Basic Income: A Radical Proposal for a Free Society and a Sane Economy*, Harvard University Press.