Online Appendix

Universal Basic Income: A Dynamic Assessment

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A Stationary Equilibrium

We introduce some notation to define the equilibrium more easily. Let $s_j \in S_j$ be the age-specific state vector of an individual of age j, as defined by the recursive representation of the individual's problems in Section 2. Let the Borel sigma-algebras defined over those state spaces be $\mu = \{\mu_j\}$. Then, a stationary recursive competitive equilibrium for this economy is a collection of: (i) decision rules for education $\{d^e(s_{j=5})\}$, consumption, labor supply, and assets holdings $\{c_j(s_j), h_j(s_j), a'_j(s_j)\}$, parental investments $\{m_j(s_j)\}$, and parental transfers $\{\hat{a}(s_j)\}$; value functions $\{V_j(s_j), V^s_j(s_j), V^{sw}(s_j)\}$; (iii) aggregate capital and labor inputs $\{K, H_0, H_1\}$; (iv) prices $\{r, w_0, w_1\}$; (v) tax policy $\{\tau_c, \lambda_y, \tau_y, \tau_a, \omega\}$; and (vi) a vector of measures μ such that:

1. Given prices, decision rules solve the respective household problems and $\{V_j(s_j), V^s_j(s_j), V^{sw}(s_j)\}$ are the associated value functions.

2. Given prices, aggregate capital and labor inputs solve the representative firm's problem, i.e., it equates marginal products to prices.

3. Labor market for each education level clears.
   For high-school level:
   $$H_0 = \sum_{j=5}^{16} \int_{S_j} E_{j,0}(\theta, \eta)\, h_j(s_j|e=0)\, d\mu_j + \sum_{j=5}^{5} \int_{S_j} E_{j,1}(\theta)\, h_j(s_j|e=1)\, d\mu_j$$
   where the first summation is the supply of high-school graduates while the second is the labor supply of college students (their labor is equivalent to that of high-school agents in period 5).
   For college level:
   $$H_1 = \sum_{j=6}^{16} \int_{S_j} E_{j,1}(\theta, \eta)\, h_j(s_j|e=1)\, d\mu_j.$$

4. Asset market clears
   $$K = \sum_{j=5}^{20} \int_{S_j} a_j(s_j)\, d\mu_j.$$
   Note that the asset positions $a_j(s_j)$ include the parental transfers $\hat{a}$ since they are measured after such transfers take place.

5. Good market clears:
   $$\sum_{j=5}^{20} \int_{S_j} c_j(s_j)\, d\mu_j + \delta K + G + \sum_{j=5}^{5} \int_{S_j} p_e 1\{d^e_j(s_j) = 1\}\, d\mu_{j=5} + \sum_{j=8}^{11} \int_{S_j} m_j(s_j)\, d\mu_j = F(K, H)$$

where the last two term on the left hand side represent the expenditures on college and childhood skill formation, respectively.

6. Government budget holds with equality

$$\sum_{j=17}^{20} \int_{S_j} \pi(\theta, e)\, d\mu_j + G = \sum_{j=5}^{20} \int_{S_j} T\left(y\left(s_j\right), k\left(s_j\right), c\left(s_j\right)\right) d\mu_j.$$

   Government expenditures on retirement benefits and G equal net revenues from taxes—which include the lump-sum transfer ω.

7. Individual and aggregate behaviors are consistent: measures μ is a fixed point of $\mu(S) = Q(S, \mu)$ where $Q(S, \cdot)$ is transition function generated by decision rules and exogenous laws of motion, and S is the generic subset of the Borel-sigma algebra defined over the state space.

B Estimation

B.1 Externally calibrated parameters

See Table B1.

B.2 College Loans Transformation

We transform college loans into regular bonds using the following formula:

$$\tilde{a}^s(a') = a' \times \frac{r^s}{1-(1+r^s)^{-5}} \times \frac{1-\left(1+r^b\right)^{-5}}{r^b}$$

Stafford college loans, the ones on which our estimation is based, have various repayment plans during which the borrower pays a fixed amount each month. Even though repayment plans typically last 10 years, they can be extended to up to 25 years. As in Abbott et al. (Forthcoming), we choose 20 years for our fixed payment plan.

B.3 Replacement benefits: US Social Security System

The pension replacement rate is obtained from the Old Age Insurance of the US Social Security System. We use education as well as the skill level to estimate a proxy for average lifetime income, on which the replacement benefit is based. Average income at age j is estimated as $\widehat{y}_j(\theta_c, e) = w_e E_{j,e}(\theta_c, \overline{\eta}) \times \overline{h}$ where $\overline{\eta}$ is the average shock (i.e., zero) and $\bar{h}$ are the average hours worked (in the initial steady state – and calibrated to match the data). Averaging over j allows average lifetime income $\widehat{y}(\theta_c, e)$ to be calculated and used in (15) to obtain the replacement benefits.

Table B1: Estimation: Externally calibrated parameters

Parameter	Value	Description	Source
Taxes			
τ_a	0.36	Tax rate on capital returns	Trabandt and Uhlig (2011)
τ_c	0.05	Tax rate on consumption	Trabandt and Uhlig (2011)
τ_y	0.18	Progressivity of labor income tax	Heathcote et al. (2017)
Borrowing Limit & Rates			
$\underline{a}^s$	0.09	College loan: \$23,000	Stafford Loans
ι	0.10	Wedge of 10% (relative to r)	Gross and Souleles (2002)
ι^s	0.01	Wedge of 1% (relative to r)	Daruich and Kozlowski (2020)
Preferences			
β	0.92	Annual discount rate of 0.98	Standard
γ_c	1	Intertemporal elasticity of substitution of 1	Standard
γ_h	2	Frisch elasticity of 1/2	Standard
$\overline{h}$	0.27	Being in college requires 30 hours per week	NCES
Intergenerational Persistence of Initial Skills			
$\hat{\rho}_c$	0.03	Cognitive skills	Cunha et al. (2010)
$\hat{\rho}_{nc}$	0.39	Noncognitive skills	Cunha et al. (2010)
Aggregate Production Function			
A	4.35	Average annual income of high-school household, age 48	Normalization
α_c	1/3	Capital income share of 1/3	Standard
δ_k	0.24	Annual depreciation rate of 6.5%	Standard
Ω	0.43	Substitutability in aggregate labor H	CPS (1962–2015)
s	0.53	High-school weight in aggregate labor H	CPS (1962–2015)

Notes: For the parameters relevant to pension benefits, see Appendix B.3; for intergenerational skill transmission, see Appendix B.4; for wage process, out-of-work shock, and return to skills, see Appendix Table B4, Appendix Figure B1, and Appendix Figure B2.

The pension formula is given by

$$\pi(\theta_c, e) = \begin{cases} 0.9\widehat{y}(\theta_c, e) & \text{if } \widehat{y}(\theta_c, e) \leq 0.3\bar{y} \\ 0.9(0.3\bar{y}) + 0.32(\widehat{y}(\theta_c, e) - 0.3\bar{y}) & \text{if } 0.3\bar{y} \leq \widehat{y}(\theta_c, e) \leq 2\bar{y} \\ 0.9(0.3\bar{y}) + 0.32(2 - 0.3)\bar{y} + 0.15(\widehat{y}(\theta_c, e) - 2\bar{y}) & \text{if } 2\bar{y} \leq \widehat{y}(\theta_c, e) \leq 4.1\bar{y} \\ 0.9(0.3\bar{y}) + 0.32(2 - 0.3)\bar{y} + 0.15(4.1 - 2)\bar{y} & \text{if } 4.1\bar{y} \leq \widehat{y}(\theta_c, e) \end{cases} \tag{15}$$

where $\bar{y}$ is the average income (calculated as the wage times the average hours worked in the initial steady state – and calibrated to match the data) of approximately \$288,000 (\$72,000 annually).

B.4 Child Skill Production Function

We use Cunha et al. (2010) estimates of the multistage production functions for children's cognitive and noncognitive skills:

$$\theta'_{k,q} = \left[\alpha_{1qj}\theta_{k,c}^{\varphi_{jq}} + \alpha_{2qj}\theta_{k,nc}^{\varphi_{jq}} + \alpha_{3qj}\theta_c^{\varphi_{jq}} + \alpha_{4qj}\theta_{nc}^{\varphi_{jq}} + \alpha_{5qj}I^{\varphi_{jq}}\right]^{1/\varphi_{jq}} \exp\left(\nu_q\right), \qquad \nu_q \sim N(0, \sigma_{j,\nu_q})$$

for $q \in \{c, nc\}$, i.e., cognitive and noncognitive skills. Using a nonlinear factor model with endogenous inputs, their main estimates, which are based on 2-year periods, are reported in Table B2. We interpret their 1st stage estimates as referring to the period in which the child is born in our model, i.e., the parent's period-age is $j = 8$ (child's period-age is $j' = 1$, or 0–3 years old). The 2nd stage is assumed to refer to the period before the child makes their college decision, i.e., the parent's period-age is $j = 11$ (child's period-age is $j' = 4$, or 12–15 years old). We use linear interpolation to obtain the estimates for $j = 9$ and $j = 10$.

Table B2: Child Skill Production Function: estimates from Cunha et al. (2010)

	Cognitive Skills		**Non-Cognitive Skills**	
	1st Stage ($j = 8, j' = 1$)	**2nd Stage** ($j = 11, j' = 4$)	**1st Stage** ($j = 8, j' = 1$)	**2nd Stage** ($j = 11, j' = 4$)
Current Cognitive Skills $(\hat{\alpha}_{1qj})$	0.479	0.831	0.000	0.000
	(0.026)	(0.011)	(0.026)	(0.010)
Current Non-Cognitive Skills $(\hat{\alpha}_{2qj})$	0.070	0.001	0.585	0.816
	(0.024)	(0.005)	(0.032)	(0.013)
Parent's Cognitive Skills $(\hat{\alpha}_{3qj})$	0.031	0.073	0.017	0.000
	(0.013)	(0.008)	(0.013)	(0.008)
Parent's Non-Cognitive Skills $(\hat{\alpha}_{4qj})$	0.258	0.051	0.333	0.133
	(0.029)	(0.014)	(0.034)	(0.017)
Investments $(\hat{\alpha}_{5qj})$	0.161	0.044	0.065	0.051
	(0.015)	(0.006)	(0.021)	(0.006)
Complementarity parameter $(\hat{\varphi}_{jq})$	0.313	-1.243	-0.610	-0.551
	(0.134)	(0.125)	(0.215)	(0.169)
Variance of Shocks $\left(\hat{\sigma}_{j,\nu_q}\right)$	0.176	0.087	0.222	0.101
	(0.007)	(0.003)	(0.013)	(0.004)

Notes: Standard errors in parentheses. The 1st stage refers to the period in which the child is born, i.e., the parent's period-age is $j = 8$ (child's period-age is $j' = 1$, or 0–3 years old). The 2nd stage refers to the period before the child becomes independent, i.e., the parent's period-age is $j = 11$ (child's period-age is $j' = 4$, or 12–15 years old).

To go from 2-year periods to 4-year periods needed in our model, we follow similar steps as in Daruich (2021). Using $\hat{\alpha}$ to denote the estimates in Cunha et al. (2010) and α for the values in our model, the two main steps/assumptions for the transformation are: (i) we iterate in the production function under the assumption that the shock ν only takes place in the last iteration, i.e., replace $\theta_{k,q}$ by $\left[\alpha_{1qj}\theta_{k,c}^{\varphi_{jq}} + \alpha_{2qj}\theta_{k,nc}^{\varphi_{jq}} + \alpha_{3qj}\theta_{c}^{\varphi_{jq}} + \alpha_{4qj}\theta_{nc}^{\varphi_{jq}} + \alpha_{5qj}I^{\varphi_{jq}}\right]^{1/\varphi_{jq}}$;[74] and (ii) we assume that the cross-effect of skills (i.e., of cognitive on non-cognitive and of non-cognitive on cognitive) is only updated every two periods.[75] Under these assumptions, the persistence parameter needs to be squared (i.e., $\alpha_{1cj} = \hat{\alpha}_{1cj}^2$ and $\alpha_{2ncj} = \hat{\alpha}_{2ncj}^2$), while other parameters inside the CES function need to be multiplied by 1 plus the persistence parameter (e.g., $\alpha_{2cj} = \left(1 + \hat{\alpha}_{1cj}\right)\hat{\alpha}_{2cj}$).

[74] We assume that the variance of the shock in the 4-year model is twice the one in the 2-year model (i.e., $\sigma j, {\nu_q}^2 = \hat{\sigma} j, {\nu_q}^2$).

[75] Removing this assumption does not change results significantly since the weights corresponding to these elements are very small or even zero in the estimation (in Table B2, see row 2 under columns 1 and 2, as well as row 1 under columns 3 and 4), but it eliminates the CES functional form if $\varphi_{jc} \neq \varphi_{jnc}$.

B.5 Wage Process and Age Profiles

Table B3: Wage Age Profiles by Education Group

	(1) High School	(2) College
Age	0.0234***	0.0552***
	(0.00315)	(0.00469)
Age^2	-0.000199***	-0.000513***
	(3.76e-05)	(5.63e-05)
Inv. Mills Ratio	-0.843***	-1.630***
	(0.0267)	(0.0859)
Constant	2.247***	1.953***
	(0.0634)	(0.0954)
Observations	14,580	8,546
R-squared	0.086	0.124
# of households	2256	1165

*Source: PSID (1968–2016). A period is 4 years long. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The regressions include year fixed effects. To control for selection into work we use a Heckman-selection estimator. The inverse Mills ratios is constructed by estimating the labor force participation equation separately for each education group, using the number of children as well as year-region (as defined by the Census) fixed effects. Standard errors in parentheses.*

Table B4: Returns to skill and wage process by education group

	(1) High School	(2) College
λ^e	0.654	0.976
	(0.0250)	(0.0559)
ρ^e	0.921	0.978
	(0.0005)	(0.0006)
σ_z^e	0.040	0.045
	(0.0001)	(0.0002)
$\sigma_{\eta_0}^e$	0.046	0.055
	(0.0002)	(0.0003)

Source: PSID (1968–2016) and NLSY (1979–2012). A period is 4 years long. Cognitive skills (from NLSY) are measured using log(AFQT), i.e., the natural logarithm of the AFQT raw score. The regressions include year fixed effects. Robust standard errors are reported in parentheses for λ^e. Bootstrap standard errors are reported in parentheses for ρ^e, σ_z^e, and $\sigma_{\eta_0}^e$ (i.e., the parameters estimated using the minimum distance estimator).

B.6 Out of Work Estimation

Using PSID data, we estimate the Probit model $\Pr\left(\text{Working}_{i,t}\right) = \Phi(\alpha + \beta_1 \text{Working}_{i,t-1} \times \text{Age}_{i,t} + \beta_2 \text{Working}_{i,t-1} \times \text{Age}^2_{i,t} + \beta_3 \text{Working}_{i,t-1} + \beta_4 \text{Age}_{i,t} + \beta_5 \text{Age}^2_{i,t} + \gamma_t + \text{Female}_i + \varepsilon_{i,t})$, where $\text{Age}_{i,t}$ is the age of the household head and Female_i is a dummy variable that takes the value of one if the household head is female and γ_t is a year fixed effect.[76] We also include fixed effects for number of children, a two-adult-household dummy, and region. A household is coded as not working if (all) its adult members are not working that year.[77] We then use these to calculate the transition probabilities for the model periods (e.g., the probability of being out of work in period j corresponding to ages 44-47 given that the household worked in period $j-1$ is calculated as $Pr(NW_{t=44}|W_{t=43}) \prod_{t=45}^{t=47}(NW_t|NW_{t-1})$, where t indicates age).

Table B5: Yearly Probability of Working

	(1) Non-College	(2) College
Working_{t-1}	0.653	-0.489
	(0.538)	(1.250)
$\text{Working}_{t-1} \times \text{Age}$	0.0795***	0.134**
	(0.0267)	(0.0654)
$\text{Working}_{t-1} \times \text{Age}^2$	-0.000746**	-0.00133*
	(0.000311)	(0.000802)
Age	-0.0331	-0.0834
	(0.0243)	(0.0610)
Age^2	1.48e-05	0.000536
	(0.000282)	(0.000751)
Female	0.0617	0.265***
	(0.0468)	(0.101)
Constant	1.227**	2.382**
	(0.501)	(1.173)
Observations	39,868	19,583

*Source: PSID (1968–1996). Regressions include fixed effects for the interaction between number of children, a two-adult-household dummy, and region. Robust standard errors in parentheses. *, **, *** denote statistical significance at the 10, 5, and 1 percent level, respectively. Methodology is explained in the main text.*

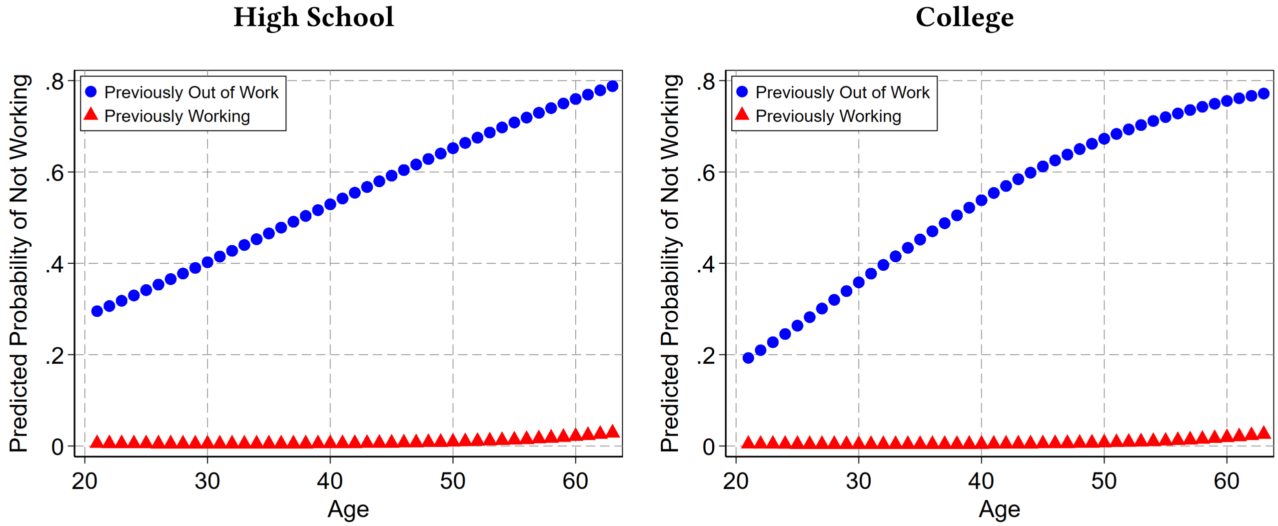
B.7 Wage Process Using Yearly Data

In the baseline estimation of the wage process we use wage data averaged over 4 years, following the definition of the model periods. An alternative, as in Krueger and Ludwig (2016), is to estimate the wage process using yearly data and then transform the estimates to 4-year periods. Denoting with

[76] We do not use PSID years after 1996 since the surveys are biennial after that year.

[77] Retirees, students, and those denoted as "housewives" by the PSID are not included in the "out-of-work" calculations.

Figure B1: Data: Yearly Out-of-Work Transition Probabilities



Notes: College refers to those with at least a four-year college degree. High school refers to those with less than a four-year college degree. Source: PSID, 1968-1996.

$\hat{\rho}^e$ and $\hat{\sigma}_z^e$ the yearly variables, the corresponding 4-year period variables are $\rho^e = (\hat{\rho}^e)^4$ and $\sigma_z^e = \left[1 + (\hat{\rho}^e)^2 + (\hat{\rho}^e)^4 + (\hat{\rho}^e)^6\right] \hat{\sigma}_z^e$. Table B6 shows the results from the estimation, transformed to the 4-year period equivalent. The results are very similar to the baseline estimation reported in Appendix Table B4.

Table B6: Returns to skill and wage process by education group using yearly data

	(1) High School	(2) College
λ^e	0.568	0.950
ρ^e	0.893	0.962
σ_z^e	0.045	0.050
$\sigma_{\eta_0}^e$	0.026	0.030

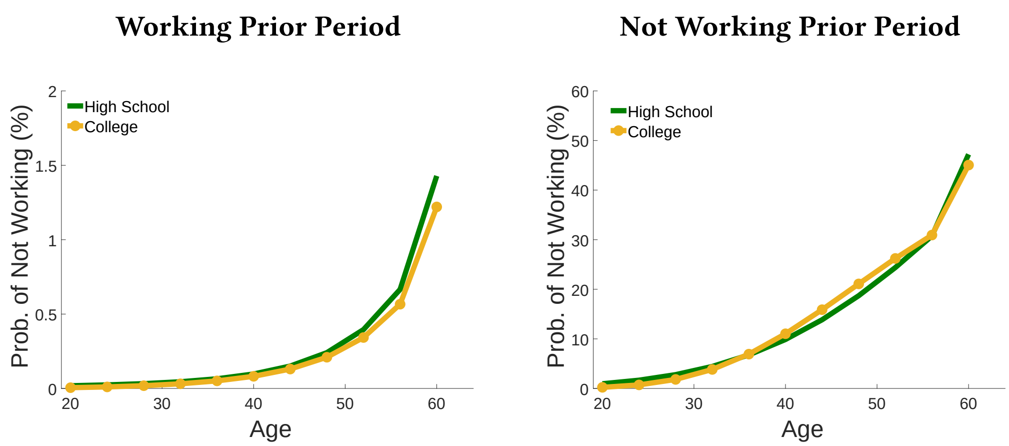
Source: PSID (1968–2016) and NLSY (1979–2012). Estimation using yearly data and then transformed to 4-year periods.

B.8 UBI with increased wage shocks variance

The baseline model essentially assumes complete markets within a 4-year-long period and, by doing so, may diminish the welfare consequences of a UBI policy. To evaluate the importance of this assumption, we double the variance of the wage shocks, σ_z^e, and examine how this affects the welfare gains from UBI.

The first column of Table B7 reproduces the results from introducing UBI keeping τ_y unchanged. The second column shows the results of doubling the variance of the wage shocks (leaving all other parameter values unchanged). Welfare reacts in a similar pattern as before, but with smaller losses both in the short and long run.

Figure B2: Model: Period (4-Year) Out-of-Work Transition Probabilities



Notes: The probability of not working next period by age, conditional upon working the prior period (left) and not working the prior period (right) as calculated using PSID data for college and non-college households.

Table B7: UBI: Robustness to Large Wage Shocks

	Baseline	**Double** σ_z^e
Adults at $t = 0$		
Welfare gains	-5.9%	-3.5%
Share in favor	26.6%	34.0%
Steady State		
Welfare gains	-21.9%	-18.3%
Output Y	-19.5%	-18.9%
Capital K	-25.8%	-26.7%
Hours worked	-21.3%	-20.8%
Avg. marginal tax rate	106.2%	103.5%
Labor productivity	-1.3%	-1.0%
College share	-4.2%	-3.3%
Parental investment m	-11.4%	-9.3%
Reg: m to income	-1.2%	-7.8%
Parental transfers $\hat{a}$	-31.0%	-34.0%
Reg: College to income	-8.5%	-6.3%
Income inequality	-50.4%	-53.6%
Wealth share: Above 99.9 pct	-5.6pp	-4.3pp
Wealth share: 99-99.9 pct	10.6pp	9.5pp
Wealth share: 80-99 pct	-8.6pp	-8.1pp
Wealth share: 60-80 pct	-1.9pp	-1.8pp
Wealth share: Below 60 pct	5.5pp	4.7pp
Intergenerational mobility	4.0%	4.3%
Upward mobility	4.8%	1.2%

Notes: $t = 0$ refers to the period in which the policy is introduced. Welfare gains are in percentage change in consumption equivalent units. Income inequality is measured as the variance of log(after-tax income) in the cross-section of agents.

C Welfare Definition: Consumption Equivalence

Let $P = \{0, 1, 2, ...\}$ denote the policy introduced, with $P = 0$ being the initial economy in steady state. We refer to consumption equivalence as the percentage change in consumption (Δ) in the initial economy that makes agents indifferent between the initial economy ($P = 0$) and the one with the policy P in place.

For agents about to become adults (having received the transfer from their parent but not the realization of the school taste shock), in particular, let $\tilde{V}^P_{j=5}(a, \theta, \varepsilon, \Delta)$ be the expected welfare of agents with initial states (a, θ, ε) in the economy P if their consumption (and that of their descendants) were multiplied by $(1 + \Delta)$:

$$\tilde{V}^P_{j=5}(a, \theta, \varepsilon, \Delta) = E^P \left\{ \sum_{j=5}^{j=20} \beta^{(j-5)} u\left(c^P_j (1 + \Delta), h^P_j\right) + \beta^{(12-5)} \delta \tilde{V}^P_{j'=5}(\hat{a}, \theta_k, \varepsilon', \Delta) \right\}$$

where, to simplify notation, we do not include time subscripts (needed for the transition analysis), the school taste parameter, nor show that the policy functions depend on the state. Note that these policy functions are assumed to be unchanged when Δ is introduced (e.g., c^P refers to the consumption chosen by an individual in economy P and is unchanged by Δ). For agents of other ages $j \neq 5$, we define a similar element as $\tilde{V}^P_j(z, \Delta)$ where z is a vector of state variables corresponding to period j.

For any agent we define the consumption equivalence $\Delta^P_j(z)$ as the Δ that makes individuals indifferent between being in the initial economy ($P = 0$) and the one with policy P in place,

$$\tilde{V}^0_j\left(z, \Delta^P_j(z)\right) = \tilde{V}^P_j(z, 0)$$

And we can obtain a measure of average welfare (equivalent to welfare under the veil of ignorance) as

$$\bar{V}^P(\Delta) = \int_z \tilde{V}^P_j(z, \Delta)\, \mu^P_j(z)$$

where μ^P_j refers to the distribution over states z in the economy P. Then, we define the consumption equivalence $\bar{\Delta}^P_j$ to be the one that makes a cohort indifferent between the initial steady-state economy and having policy P in place, i.e.,

$$\bar{V}^0_j\left(\bar{\Delta}^P_j\right) = \bar{V}^P_j(0)$$

D Small Increase in Tax Progressivity

As shown in the first line of Table 12, which only considers the mechanical effect of the change in tax mix, this policy increases (utilitarian) welfare significantly. It allows λ to increase by .476% (permitting agents to keep a greater proportion of their after-tax income, ceteris paribus) and it increases the labor income cutoff at which agents pre-tax labor income is equal to after-tax labor income from \$16,913 to \$17,207. The next line shows that introducing behavioral effects but allowing only one cohort to face the new tax policy delivers smaller welfare gains and there are welfare losses for the children of this cohort. Hours worked fall as does labor income, requiring labor taxes to increase. Next, when all cohorts face this same policy in partial equilibrium, adults gain on average but there are welfare losses in the steady state. The greater redistribution is welfare enhancing, but the fall in parental skill investments and transfers decreases the proportion of college workers and lowers labor productivity. Furthermore, the large fall in capital of over 3% decreases tax revenue, requiring further adjustments in λ and overall decreasing the welfare of future generations. The combined changes in τ and λ imply that the average marginal labor tax rate increases by 2.62% (0.85pp) in the new (partial equilibrium) steady state. Once general equilibrium effects are introduced, the welfare gains to adults is almost doubled relative to partial equilibrium. The prior large fall in the steady state capital stock is mitigated by the increase in the interest rate, allowing the new steady-state λ to actually be higher than in the original steady state (i.e., agents keep a greater proportion of their labor income, ceteris paribus). The decrease in wages, however, leads parents to invest less in child skills and to lower transfers, resulting in a lower proportion of college workers. Hours worked fall and welfare in the new steady state is lower but the decline is 78% smaller than in partial equilibrium.

E Alternative Implementations of UBI

In this Appendix we examine in greater depth alternative ways to implement UBI. We first consider the case in which the UBI reform results in the current progressive tax rate on labor income being replaced with a linear schedule. This is a way to study a reasonable alternative scenario in which UBI replaces some current spending on lower-income individuals. Next, similar in spirit to the exercise with linear taxation, we study the case in which UBI eliminates the current social programs captured by ω. Relatedly, we examine how the welfare results are modified when UBI allows administrative costs to fall. Lastly, we study the case of UBI financed by consumption taxes. With the exception of linear taxation, these alternatives result in UBI becoming more popular with agents who are adults when the policy is introduced. Table E1 summarizes the results for each alternative discussed below.

UBI and Linear Labor Income Taxation

In the main analysis, UBI is modeled as an additional source of income redistribution beyond that already provided by the current tax and transfer system. This system includes social programs and benefits primarily targeted to poorer households as well as redistribution (e.g., Medicaid, food stamps, AFDC, and EITC). Given that the UBI policy would ensure that households did not fall below the poverty level, a reasonable conjecture is that some of these programs would be cut back or even eliminated. Reducing the importance of these social programs could be interpreted, through the lens of the tax function, as a reduction of the tax progressivity parameter τ_y since it would reduce the tax benefits of low-income households.[78] Although the degree to which these programs would be reduced is unclear, one way to explore this question is by evaluating the extreme case of a linear labor income tax. Thus, in this section we model UBI as an increase in ω as before but simultaneously set $\tau_y = 0$. The level of non-modeled government expenditures G remains unchanged, hence the labor tax parameter λ must adjust to balance

[78]Note that the calibrated tax function of the economy without UBI implies that individuals below a certain level of labor earnings receive net transfers from the government (in addition to ω).

the budget.

Table E1: UBI: Alternative Implementations

	Benchmark	UBI Substitutes Current Progressivity			Cons. Taxation
		(i) $\tau_y = 0$	(ii) Replaces ω	(i) + (ii)	
Adults at $t = 0$					
Welfare gains	-5.9%	-6.0%	-3.0%	-5.2%	1.6%
Share in favor	26.6%	15.4%	32.9%	7.8%	60.2%
Steady State					
Welfare gains	-21.9%	-15.8%	-12.3%	-11.4%	7.2%
Output Y	-19.5%	-8.7%	-13.1%	-2.5%	-7.1%
Capital K	-25.8%	-10.3%	-18.1%	-1.2%	-7.6%
Hours worked	-21.3%	-13.1%	-14.1%	-6.8%	-10.1%
Avg. marginal tax rate	106.2%	80.0%	74.9%	52.4%	-3.8%
Income tax level (λ)	-53.7%	-49.5%	-38.3%	-38.5%	0.0%
Consumption tax rate	0.0%	0.0%	0.0%	0.0%	755.0%
Labor productivity	-1.3%	-0.8%	-0.7%	-0.6%	0.8%
College share	-4.2%	-2.5%	-2.4%	-1.7%	2.2%
Parental investment m	-11.4%	-7.9%	-6.4%	-5.2%	7.5%
Reg: m to income	-1.2%	1.8%	-3.5%	5.2%	-27.3%
Parental transfers $\hat{a}$	-31.0%	-29.4%	-22.3%	-22.1%	-22.8%
Reg: College to income	-8.5%	-4.2%	-5.4%	-0.2%	-8.0%
Income inequality	-50.4%	-24.8%	-38.3%	-9.0%	-34.1%
Wealth share: Above 99.9 pct	-5.6pp	16.1pp	-4.1pp	20.2pp	1.7pp
Wealth share: 99-99.9 pct	10.6pp	4.0pp	7.4pp	0.1pp	1.4pp
Wealth share: 80-99 pct	-8.6pp	-11.3pp	-5.7pp	-10.1pp	-1.8pp
Wealth share: 60-80 pct	-1.9pp	-6.0pp	-1.2pp	-6.2pp	-1.2pp
Wealth share: Below 60 pct	5.5pp	-2.7pp	3.6pp	-4.1pp	-0.0pp
Intergenerational mobility	4.0%	8.9%	3.2%	9.6%	14.9%
Upward mobility	4.8%	5.1%	2.5%	5.8%	5.0%

Notes: All entries other than wealth shares are expressed in percentage change relative to the steady-state without UBI. Wealth shares are in percentage points. $t = 0$ refers to the period in which the policy is introduced. Welfare gains are in percentage change in consumption equivalent units. Income inequality is measured as the variance of log(after-tax income) in the cross-section of agents. See the notes of Table 2 and of Figure 4 for remaining definitions.

Given that the policy experiment essentially consists of two parts (i) a change in the marginal tax system to a linear tax (i.e., τ_y is set to zero) and then (ii) an increase in ω by the amount of the UBI transfer, it is useful to first ask how much each contributes to the change that is required in λ. If the change were restricted to setting $\tau_y = 0$, λ would decrease from its original value of .82 to .73 in the first period, eventually increasing to .74 in the new steady state. In terms of the average marginal labor-income tax rate, this would decrease by 17.1% (5.6pp) in the first period and by 20.9% (6.8) in the new steady state. The cutoff level under which individuals receive a net transfer (ignoring consumption and asset taxation) decreases to \$6,513 as opposed to \$16,913 under the initial steady state demonstrating the importance of the progressive labor tax in the first place.

Next, we ask the new tax system to fund the increase in ω required by UBI via changes in λ (as in the benchmark UBI implementation). This policy requires a smaller increase in the average marginal labor-income tax rate (which is now the same for all labor income, i.e., it is $(1-\lambda)$ given that $\tau_y = 0$) than when τ_y was left unchanged. When the policy is introduced, the average labor-income tax rate requires an immediate 74% increase, in contrast with the 88% required in the benchmark case. Parental investments in child skills (m) are reduced by 7.9% in the new steady state, less than the 11.4% for the benchmark UBI policy. The share of agents with a college education falls by 0.8 percentage points (or 2.5%) in the new steady state, significantly smaller than the decrease under the benchmark UBI policy.

The decreased progressivity of the tax system reduces the effect of UBI on inequality. The variance of the log of post tax income falls by significantly less than before and the wealth share of the top 0.1 percentile increases by 16 percentage points instead of falling substantially as in the benchmark policy.

Lastly, the welfare consequences of this policy are slightly more negative for current adults. The consumption equivalent welfare loss for them is 6%, even though the steady-state welfare losses are one-quarter smaller than for the benchmark UBI. Part of the long-run differences stem from the much smaller decline in the capital stock, given that more wealth is now accumulated at the top.

UBI eliminates initial ω

The previous section studied a UBI policy in which the current degree of progressivity of the taxation of labor income was replaced by a linear tax, i.e., $\tau_y = 0$. An alternative way to model the idea that UBI could replace other forms of transfers to lower-income households is to instead have it eliminate the original level of transfers, i.e., ω. We study this alternative by assuming that the net increase in UBI per person per year is $6,368, i.e., the $8,000 (benchmark UBI value) minus $1,632 (the estimated value of ω in the non-UBI steady state). The third column of Table E1 shows that the welfare losses for adults are almost half as large as those obtained under the original UBI policy (and 44% smaller in the steady state), reflecting the reduced tax burden and the positive consequences from what is essentially a lower level of UBI.[79]

UBI reduces administrative costs

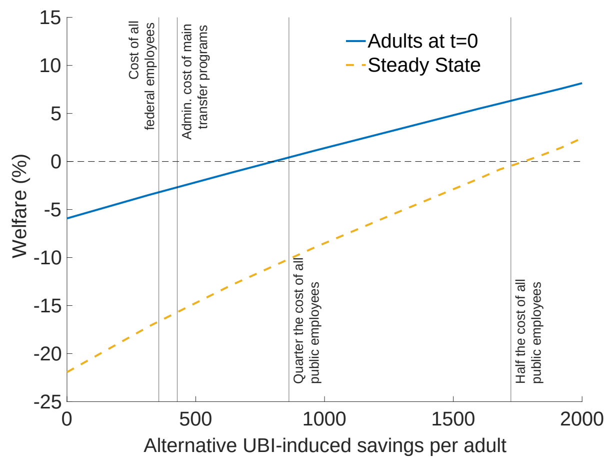
Proponents of UBI suggest that an important benefit of the policy is that it would reduce the administrative costs of targeted programs. Given its universal character, UBI would not require as high a degree of monitoring and red tape as these other programs (e.g., TANF, SNAP, SSDI). How much existing costs would be reduced is unclear. Rather than take a stand on which programs would be eliminated, we instead calculate an upper bound to these potential gains of eliminating the costs associated with these programs without reducing their associated benefits. Thus, we evaluate alternative scenarios in which UBI reduces government expenditures G by different amounts, allowing the labor tax rate parameter λ to adjust so as to keep the budget balanced as usual.

Figure E1 shows the welfare gains/losses both for adults at $t = 0$ and for cohorts born in the new steady state, under alternative reductions of G per adult. The benchmark UBI policy assumes no reduction in G, so it is represented by the zero on the x axis. As expected, both adults at $t = 0$ and future cohorts gain as the UBI-induced savings increase. To aid with the interpretation of the saving mag-

[79]Column 4 of Table E1 shows that allowing UBI to replace current tax progressivity through both τ_y and ω also reduces long-run losses, but only slightly more than in the case when only ω is reduced.

nitudes, the vertical lines show the estimated cost per adult of (i) all (civilian) federal employees; (ii) the administrative costs of the largest current transfer programs (as studied in Hoynes and Rothstein (2019)); (iii) 50% of the cost of all public employees at the local, state, and federal levels.[80] As shown in the figure, the cost reductions would need to be immense for there to be steady-state welfare gains. Eliminating the expenses associated with all federal employees or all administrative costs of current transfer programs would fall substantially short of what would be required. Only by eliminating close to a quarter and close to a half of the cost of all public employees would the savings be large enough for UBI to lead to welfare gains among current adults and in the long run, respectively.

Figure E1: UBI: Reducing Administrative Costs



Notes: $t = 0$ refers to the period in which the policy is introduced. Welfare gains are in percentage change in consumption equivalent units. The vertical lines show the estimated cost per adult of (i) all (civilian) federal employees; (ii) the administrative costs of the largest current transfer programs; (iii) 50% of the cost of all public employees at the local, state, and federal levels. See text for details. Sources: CBO, Center on Budget and Policy Priorities, Brock (2001), and Hoynes and Rothstein (2019).

UBI and Consumption Taxation

An alternative to increased taxation of labor income would be to increase the taxation of consumption to finance UBI.

A consumption tax funded UBI policy requires an increase in the consumption tax of 36 percentage points right away. Over time, a further increase is needed, bringing the steady-state increase to 38 percentage points. The welfare consequences of this UBI policy differ radically from those of studied previously. As can be seen in Figure E2, all cohorts gain on average. For agents who are adult when the policy is introduced, the average welfare gain is of 1.6%. Steady-state welfare gains under the veil of ignorance are 7.2%.[81] As shown in Table E1, output, capital, and time worked fall less than in the

[80] The Congressional Budget Office estimates that federal civilian employees represent 1.5% of the US workforce. Brock (2001) estimates that public employees (at local, state and federal levels) amount to 14.5% of the workforce. We estimate the costs of these workers by multiplying these shares by the total labor income generated by the steady-state of the model (equivalent to assuming the same average wage for public workers as in the general economy). For the administrative costs, Hoynes and Rothstein (2019) estimate that current transfer programs (excluding retirement benefits) cost 1,541 billion dollars (in 2017 dollars). The Center on Budget and Policy Priorities estimates that administrative costs of such programs are between 1 and 10%. We use 10% in order to estimate an upper bound on potential savings.

[81] Luduvice (2021) also finds that a UBI policy (of a similar magnitude to the one here) financed by consumption taxes

benchmark UBI policy. Furthermore, parental investment in child skills, the share of college workers, and labor productivity increase even relative to the no-UBI steady state. Parental transfers decrease less but the reduction in various measures of inequality are smaller than with with UBI financed via labor taxation, perhaps because the wealth distribution changes less. An exception to this is the rank-rank measure of intergenerational mobility (and to a smaller extent the mobility of the bottom quintile) which increases substantially relative to benchmark financing. This policy would have the support of 60% of the adult population, more than double the share that would favor UBI financed via greater reliance on labor income taxation.

To gain a better understanding of the welfare results, it is useful to perform an alternative exercise. Suppose that *prior* to any UBI policy, we increase the consumption tax by the full 38pp that would be required under the consumption-tax-financed UBI policy, allowing the labor income tax λ to adjust so that the budget remains balanced. That is, we are simply changing the tax instrument mix without introducing UBI, so as to keep the government budget balanced. The consequences of this change are welfare gains among those who are adults when this change is introduced (2.8% in consumption equivalence units) and large steady-state gains of 14.4%, basically twice as large as the ones of UBI combined with consumption taxation, echoing the findings in favor of consumption taxation in the literature (e.g., Coleman, 2000; Correia, 2010). This indicates that the gains from a consumption-tax-financed UBI are due to the change in tax system – to a greater reliance on consumption as opposed to labor taxation – rather than to the insurance or credit-constraint changing properties of the UBI payment.[82,83]

F A Riskier Economy and UBI

This section examines how the effects of UBI depend on the degree of risk in the economy. A major concern regarding greater robotization/automation is that it will considerably reduce the number of jobs available by making certain occupations obsolete. From this perspective, it is argued by some that a UBI policy would help provide the basic needs of individuals who were negatively impacted.[84] Although the present model is not designed to understand automation, it is able to reflect an important concern in a simple fashion by viewing the consequences of this accelerated technological change as an increase in the proportion of workers who receive an out-of-work shock.[85]

leads to long-run welfare gains. Our evaluation of UBI financed with labor income taxes vs. consumption taxes suggests that this is likely due to the larger role played by consumption taxation rather than to UBI itself, as discussed in further detail below.

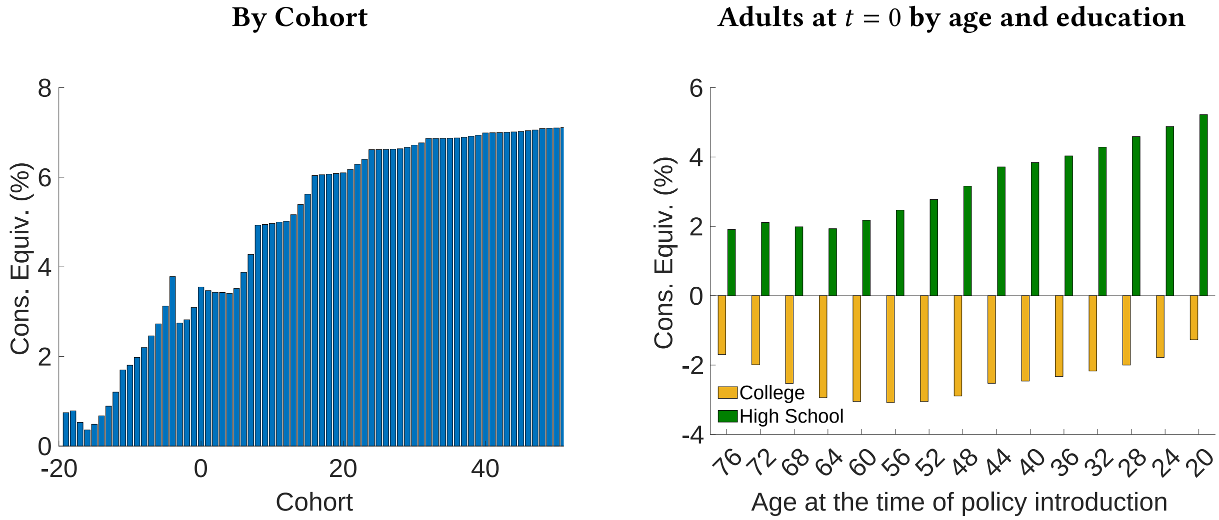
[82]Indeed, eliminating labor taxes altogether and relying instead on consumption taxation without UBI (i.e., setting $\lambda = 1$, $\tau_y = 0$, and increasing τ_c to balance the budget), yields welfare gains among the current adults (of 1.7%) and large steady-state welfare gains (of 8.3%).

[83]Note that, of course, this does not imply that consumption taxes without UBI are Pareto preferred to consumption taxes with UBI. The (utilitarian) welfare gains in the former, however, are larger.

[84]This has been suggested, among others, by Elon Musk, Richard Branson, and Mark Zuckerberg (see, e.g., Clifford, 2018).

[85]Acemoglu and Restrepo (2020) show that commuting zones most exposed to industrial robots saw decreases in employment and wages.

Figure E2: Welfare Dynamics of UBI: Financed with Consumption Tax



Notes: See notes of Figure 6.

Higher Frequency of "Out of Work" Shocks from Automation/Robotization

The initial steady state of the model implies that, conditional upon working in the current period, individuals between age $j = 5$ to $j = 10$ inclusive experience an out-of-work shock with probability 0.5% over the next 6 periods (i.e., 0.5% of the individuals between 16 and 40 years old and working will get hit by an out-of-work shock over the next 24 years as they age and turn 44 to 64 years old). McKinsey (2017) and OECD (2019) predict the share of current jobs lost as a result of automation could be between 5% and 15% but numbers even closer to 25 or 30% have been suggested (Frey and Osborne, 2017). Most of the empirical evidence also suggests that the occupations of less-educated individuals are more likely to be affected. We introduce the higher rate of occupational obsolescence by increasing each age-dependent probability of entering the out-of-work state (as shown by the left panel of Appendix Figure B1) by a common education-specific factor in such a way as to match estimates on the share of jobs that would be lost over 6 periods (24 years). Following the estimates of McKinsey (2017), we assume that the probability that a college graduate loses their job is 58% lower than the one for a high-school graduate.[86] We leave unchanged the probability of a worker transitioning from out-of-work to employment as how automation affects job creation is unclear.

Note that, ceteris paribus, a higher frequency of out-of-work shocks for high-school educated workers implies a lower college premium: high-school workers essentially become scarcer (see equation 4). As this is simply a consequence of using a model in which unemployed workers do not compete for jobs and, furthermore, contradicts most predictions regarding the returns to less-skilled labor, we adjust the weight s of college vs. high-school work in the aggregate production function (3) such that, keeping the aggregate capital stock fixed at its initial steady-state value and allowing the aggregate labor supply (H_0 and H_1) to adjust only due to the exogenous increase in the probability of being out-of-work (i.e., no endogenous changes in skills, education or labor supply), the unit wage of high-school educated work-

[86]Hence, the probability of being out of work in period j if an individual with education e was working in period $j-1$ goes from x_j^e to $x_j^e(1+q^e)$ for all working periods, $e \in \{0, 1\}$.

ers, w_0, is unchanged.[87] Lastly, as there is no reason to believe that technological change would reduce GDP (which would otherwise fall, ceteris paribus, simply as a result of greater out-of-work shocks), we increase total factor productivity in (3) such that, after adjusting s, GDP remains constant at the original capital stock and aggregate labor (with the latter adjusted mechanically for the higher probability of being out of work).[88]

More rigorously, let H_0^*, H_1^*, and K^* be the initial steady-state values of high-school labor, college labor, and capital, respectively. Let $\hat{H}_0$ and $\hat{H}_1$ be the corresponding values if the only adjustment were in the (exogenous) increase in the probability of being out-of-work (i.e., keeping unchanged skills, education, and labor supplied conditional on working). To keep the return to an efficiency unit of high-school workers unchanged, we find $\hat{s}$ such that $w_0\left(\hat{H}_0, \hat{H}_1, K^*|\hat{s}\right) = w_0\left(H_0^*, H_1^*, K^*|s\right)$, as defined by equation (4). Let $\hat{H}(\hat{s})$ be the resulting aggregate labor supply using $\hat{s}$. To keep output unchanged, we then increase total factor productivity, (previously normalized to equal 1), to $\hat{A}$ such that $\hat{A}\left(K^*\right)^\alpha\left(\hat{H}(\hat{s})\right)^{1-\alpha} = A\left(K^*\right)^\alpha\left(H^*\right)^{1-\alpha}$.

Appendix Table F1 reports some key aggregate variable values for the new steady state reached under different occupation/job destruction rates, ranging from 5% to 15%, assuming throughout that the change in the destruction rate was unforeseen at $t = 0$. These are all indicated in percentage change relative to the initial steady state. GDP decreases monotonically, driven mainly by labor reduction. Although time worked decreases with the percentage of jobs destroyed, the capital stock increases when the percentage of jobs destroyed becomes larger, as agents save more to better protect themselves against the increased income risk. The share of college-educated workers moves non-monotonically, despite the increased general risk, because the greater capital stock at the higher job destruction rates increases the return to college workers and they face a lower job destruction risk relative to high-school workers. Agents also work more conditional upon not being hit by the out-of-work shock (as can be seen by the row that excludes the out-of-work agents) and the unit wage of college and high-school workers increases. TFP increases (exogenously) as a result of the procedure described previously.

UBI In A Riskier Economy

We next ask how the introduction of UBI affects welfare in these riskier environments. We assume that the policy is introduced at the same time that the economy becomes riskier – in period $t = 0$ – and thus that adults already have their skills set, parental transfer, and, except for those adults of period-age j=5 (i.e., 16–19 year olds), their college decisions are already made.

The first row of Table F2 reports, in consumption equivalence units, the average percentage of consumption adults would be willing to sacrifice in order to have the benchmark UBI policy introduced. Note that the comparison therefore is between an economy with or without UBI and not with the original steady state without the increased risk of job destruction. The second row performs a similar consumption equivalence exercise, but this time for cohorts born in the new steady state of the econ-

[87] This strategy implies that college workers have a more sizable role in the economy which is in line with the prediction that the new jobs created by automation will require more skills (e.g., McKinsey, 2017; Frey and Osborne, 2017; OECD, 2019).

[88] A full model of automation would endogenize the latter and specify who gets the returns associated with technological change.

Table F1: Greater Job Destruction: Long-Run Aggregate Effects

Jobs Destroyed	5%	10%	15%
	Change from Initial Steady State (%)		
GDP	-0.81%	-1.86%	-2.89%
Capital	0.76%	1.27%	1.58%
Labor (Efficiency Units H)	-2.69%	-5.76%	-8.71%
College Share	-0.05%	-0.12%	-0.08%
Average Labor Productivity: Non-College	-0.04%	-0.09%	-0.15%
Average Labor Productivity: College	-0.00%	-0.00%	0.01%
Average Hours Worked: Non-College	-2.30%	-4.92%	-7.49%
Average Hours Worked: College	-1.08%	-2.40%	-3.79%
Average Hours Worked: All, Excl. Out of Work	0.20%	0.38%	0.52%
Total Factor Productivity $\hat{A}$	0.76%	1.70%	2.69%
Aggregate Production Function $\hat{s}$	-0.52%	-1.16%	-1.81%
Interest Rate r	-9.01%	-2.77%	2.19%
Non-College Wage w_0	0.95%	1.84%	2.68%
College Wage w_1	1.33%	2.87%	4.34%
Average Marginal Labor-Income Tax Rate	0.47pp	1.00pp	1.53pp
Welfare in Steady State	-1.76%	-3.56%	-5.10%
Welfare for Adults at $t = 0$	-0.96%	-2.08%	-3.13%

omy with the UBI policy (under the veil of ignorance) relative to the steady state of the riskier economy without UBI.

Both adult cohorts and future generations lose as a result of introducing UBI into a riskier economy.[89] The response to greater risk, however is different: the welfare losses become a bit smaller for adult cohorts as risk increases but become significantly larger in the steady state. This asymmetry is due to the fact that adults are less able to optimize their decisions to adjust to a riskier environment (as their state variables and asset accumulation decisions have been determined in a less risky economy) and UBI provides a cushion against these shocks. Future cohorts are also more likely to be out of work, but the losses from UBI are larger since the capital stock, investment in child skills, parental transfers, and the share of college educated agents have all fallen. The average marginal labor-income tax rate required to fund UBI is therefore increasing in the share of jobs destroyed, further increasing the welfare losses to the cohorts born in the new steady state.

[89] Appendix Table G.4 shows that welfare losses are also present when the sole change is to make jobs riskier, leaving all the parameters of the production function as in the benchmark model.

Table F2: Greater Job Destruction + UBI

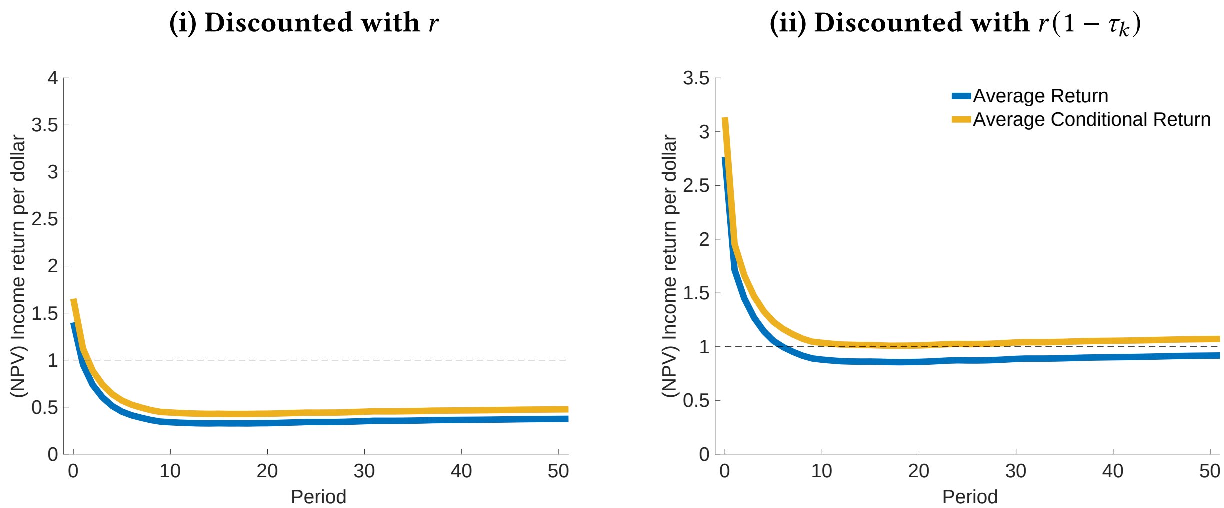
Jobs Destroyed	Benchmark (0.5%)	5%	10%	15%
Adults at $t = 0$				
Welfare gains	-5.9%	-5.9%	-5.7%	-5.7%
Steady State				
Welfare gains	-21.9%	-23.6%	-26.4%	-30.7%
Output Y	-19.5%	-21.5%	-24.0%	-27.1%
Capital K	-25.8%	-27.6%	-30.0%	-33.0%
Hours worked	-21.3%	-23.8%	-26.9%	-30.6%
Avg. marginal tax rate	34.5pp	36.1pp	38.4pp	41.3pp
Labor productivity	-1.3%	-1.5%	-1.7%	-2.1%
College share	-4.2%	-4.8%	-5.7%	-6.9%
Parental investment m	-11.4%	-12.7%	-14.6%	-17.2%
Reg: m to income	-1.2%	-0.4%	1.7%	3.1%
Parental transfers $\hat{a}$	-31.0%	-30.4%	-30.8%	-32.1%
Reg: College to income	-8.5%	-7.1%	-6.3%	-4.8%
Income inequality		-50.4%	-49.7%	-50.0%
-51.9%				
Wealth share: Above 99.9 pct	-5.6pp	-5.2pp	-5.0pp	-4.8pp
Wealth share: 99-99.9 pct	10.6pp	11.8pp	12.9pp	13.9pp
Wealth share: 80-99 pct	-8.6pp	-8.3pp	-8.6pp	-9.1pp
Wealth share: 60-80 pct	-1.9pp	-2.4pp	-2.7pp	-3.1pp
Wealth share: Below 60 pct	5.5pp	4.1pp	3.3pp	3.0pp
Intergenerational mobility	4.0%	3.9%	4.4%	5.6%
Upward mobility	4.8%	-10.6%	-14.1%	-15.4%

Notes: Efficiency units of labor H is defined in Appendix A. Labor productivity refers to the value of $e^{\lambda^e \log(\theta_c)}$. Adults at $t = 0$ refers to agents who are adults when the policy is introduced; steady state refers to agents born in the new steady state with welfare evaluated behind the veil of ignorance. See the notes of Table 2 and of Figure 4 for remaining definitions.

G Additional Tables and Figures

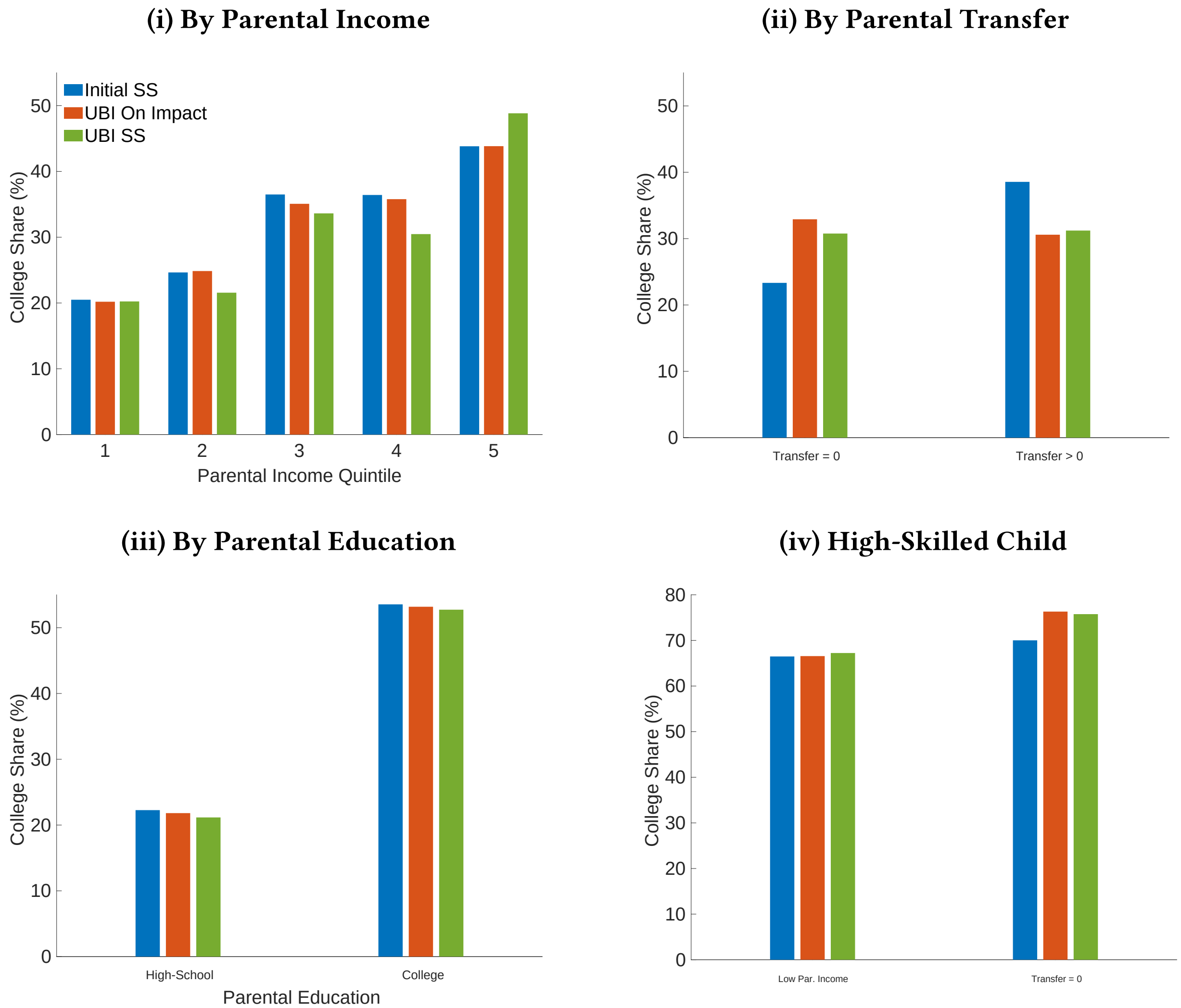
G.1 Return to college and other college determinants

Figure G1: Income Return to College Investment



Notes: This figure shows the labor income return (in net present value and net of taxes) expressed per dollar of college price, all relative to high school and assuming that hours worked are equal across education groups. Income is discounted by either the gross rate of return (r) or its value net of taxes ($r(1-\tau_k)$). The average return across individuals is reported, both unconditionally as well as conditional on individuals choosing to go to college.

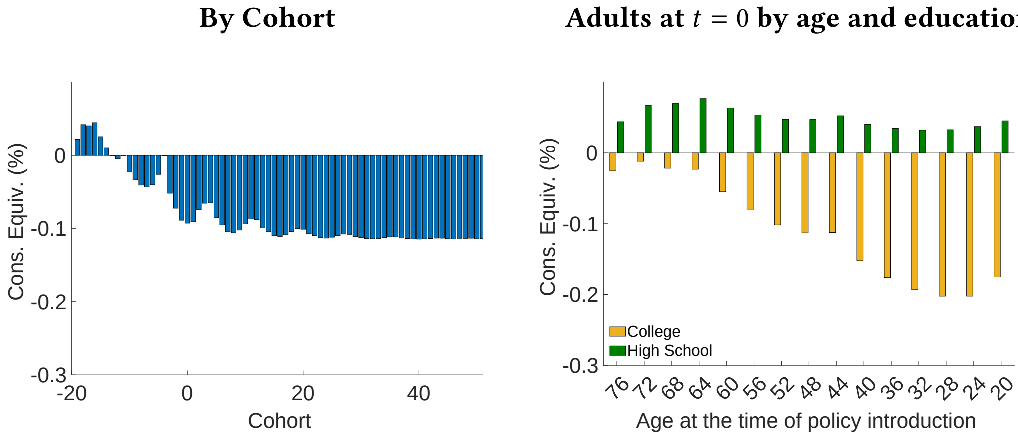
Figure G2: College Share



Notes: This figure reports the effect of UBI the share of college graduates by certain characteristics, in the first the period UBI is introduced ("On Impact") and in the new steady state. For comparison, it also reports the values in the initial steady state (i.e., the one without UBI). Low parental income refers to parents with total income in the lowest decile. High-skilled children are defined as those with skills in the top quartile.

G.2 Small Increase in Lump Sum Transfers

Figure G3: Welfare Dynamics of a Small Increase in Lump Sum Transfers



Notes: Welfare gain (as measured by consumption equivalence) from increasing lump-sum transfers ω by the equivalent of $150 annually for different cohorts. In the left-hand figure, cohort 0 is the one born the period in which the policy is introduced. A cohort with a negative number indicates that it was born that (absolute) number of periods prior to the introduction of the policy whereas a positive number indicates a cohort that will be born that number of periods after the policy is introduced. The right-hand figure depicts welfare changes for different cohorts (here indicated by their age at the beginning of period 0) and by education. See the text for details.

Table G1: An Even Smaller Increase in Lump Sum Transfers: A Mirrleesian-Style Decomposition

		A. Change from Initial Steady State (%)					
Alternative Models		Welf. Adults	Welf. SS or Children	Taxes λ	Skill Inv. m	Parental Transfers	College
Mechanical	PE	0.0486	0.0627	-0.4244	–	–	–
Short run	PE	0.0052	0.0082	-0.5624	0.0276	0.0152	0.0037
Long run	PE	-0.0091	-0.1163	-0.5440	-0.0229	-0.6650	-0.0060
Long run	GE	0.0001	-0.0346	-0.5061	0.0002	-0.2854	0.0017

		B. Change from Initial Steady State (%)						
Alternative Models		Hours Worked	Labor Prod.	Labor Income	Capital K	Wage w_0	Wage w_1	Int. Rate r
Mechanical	PE	–	–	–	–	–	–	–
Short run	PE	-0.1509	0.0014	-0.1078	-0.3099	–	–	–
Long run	PE	-0.1608	-0.0017	-0.1091	-0.5245	–	–	–
Long run	GE	-0.1758	0.0009	-0.1465	-0.1970	-0.0165	-0.0469	0.1243

Notes: This table evaluates the effects of increasing lump-sum transfers ω by the equivalent of $100 annually, financed by adjusting λ. Across both panels, the total effects are decomposed into: a mechanical component (i.e., without any behavioral adjustments) in the first row; a short-run PE exercise that incorporates behavioral changes but only provides the tax and transfer change to one cohort; a long-run PE exercise that permanently implements the policy change; and finally the incorporation of GE effects. All the numbers reported are in percentage change. See text for details.

Table G2: An Even Smaller Increase in Lump Sum Transfers: Alternative Models

Alternative Models with Fixed:		**A. Change from Initial Steady State (%)**					
		Welf. Adults	Welf. SS or Children	Taxes λ	Skill Inv. m	Parental Transfers	College
Capital	PE	0.0154	-0.0591	-0.4823	-0.0101	-0.7411	-0.0040
Capital	GE	0.0798	0.0352	-0.4541	0.0152	-0.6921	0.0044
Skills	GE	-0.0023	-0.0373	-0.5210	–	-0.0617	-0.0116
Skills & Capital	GE	0.0659	0.0201	-0.4682	–	-0.3990	-0.0128

Alternative Models		**B. Change from Initial Steady State (%)**						
		Hours Worked	Labor Prod.	Labor Income	Capital K	Wage w_0	Wage w_1	Int. Rate r
Capital	PE	-0.1577	-0.0010	-0.1078	–	–	–	–
Capital	GE	-0.1570	0.0017	-0.0523	–	0.0561	0.0496	–
Skills	GE	-0.1995	-0.0020	-0.1503	-0.2355	-0.0186	-0.0265	0.0909
Skills & Capital	GE	-0.1864	-0.0022	-0.0745	–	0.0516	0.0441	–

Notes: This table evaluates the effects of increasing lump-sum transfers ω by the equivalent of $100 annually, financed by adjusting λ, in the alternative models. In both panels, the first row evaluates this experiment in the long run but partial equilibrium setting. The next row does so in GE. The third and fourth rows study the long-run GE intervention for the model with fixed skills and with both fixed capital and skills, respectively. All the numbers reported are in percentage change. See text for details.

G.3 Models with Fixed Skills and Fixed Capital Stock

Table G3: Fixed Skills Model: Estimation Moments

Parameter	Value	Description	Moment	Data	Model
Preferences					
μ	40.8	Mean labor disutility	Avg. weekly hours worked	31.0	29.8
δ	0.66	Altruism	Intergenerational persistence of income	0.31	0.28
School Taste: $\kappa(\varepsilon, \theta) = \alpha + \alpha_{\theta_c} log(\theta_c) + \alpha_{\theta_{nc}} log(\theta_{nc}) + \varepsilon$; $\varepsilon \sim N(\bar{\varepsilon}_{e_p}, \sigma_\varepsilon)$; $\bar{\varepsilon}_{e_p=0} = 0, \bar{\varepsilon}_{e_p=1} = \bar{\varepsilon}$					
α	60.6	Avg. taste for college	College share	0.33	0.32
α_{θ_c}	-76.3	College taste and cog. skills relation	College: cog skills slope	0.37	0.35
$\alpha_{\theta_{nc}}$	-19.5	College taste and noncog. skills relation	College: noncog skills slope	0.12	0.09
σ_ε	61.3	SD of college taste shock	College: residual variance	0.18	0.15
$\bar{\varepsilon}$	-43.5	Draw of school taste: mean by parent's education	Intergenerational persistence of education	0.69	0.69
Investment in Skill Formation: $I = \bar{A}m$					
$\bar{A}$	8.5	Productivity normalization	Average log-skills	0.0	0.0
Superstar Shock					
$\bar{\eta}$	6.11	Efficiency in superstar state	Income share top 5pct	0.33	0.32
$\bar{\pi}$ $(\times 10^4)$	2.23	Probability of entering state	Wealth share top 1pct	0.34	0.36
$\underline{\pi}$	0.34	Probability of exiting state	Wealth share top 0.1pct	0.17	0.18
Labor Income Tax: $y - \lambda y^{1-\tau} - \omega$					
λ	0.82	Tax function	Gov. Expenses/Output	0.19	0.19
ω $(\times 10^2)$	5.91	Lump-sum transfer	Income variance ratio: Disposable to pre-gov	0.63	0.63

Notes: See the text for definitions and data sources. The model is not re-estimated, thus this table is simply to see how well the fixed skills model fits the moments estimated by the benchmark model.

Table G4: Fixed Skills and Fixed Capital Model: Estimation Moments

Parameter	Value	Description	Moment	Data	Model
Preferences					
μ	40.8	Mean labor disutility	Avg. weekly hours worked	31.0	29.8
δ	0.66	Altruism	Intergenerational persistence of income	0.31	0.28
School Taste: $\kappa(\varepsilon, \theta) = \alpha + \alpha_{\theta_c} log(\theta_c) + \alpha_{\theta_{nc}} log(\theta_{nc}) + \varepsilon$; $\varepsilon \sim N(\bar{\varepsilon}_{e_p}, \sigma_\varepsilon)$; $\bar{\varepsilon}_{e_p=0} = 0, \bar{\varepsilon}_{e_p=1} = \bar{\varepsilon}$					
α	60.6	Avg. taste for college	College share	0.33	0.32
α_{θ_c}	-76.3	College taste and cog. skills relation	College: cog skills slope	0.37	0.35
$\alpha_{\theta_{nc}}$	-19.5	College taste and noncog. skills relation	College: noncog skills slope	0.12	0.09
σ_ε	61.3	SD of college taste shock	College: residual variance	0.18	0.15
$\bar{\varepsilon}$	-43.5	Draw of school taste: mean by parent's education	Intergenerational persistence of education	0.69	0.69
Investment in Skill Formation: $I = \bar{A}m$					
$\bar{A}$	8.5	Productivity normalization	Average log-skills	0.0	0.0
Superstar Shock					
$\bar{\eta}$	6.11	Efficiency in superstar state	Income share top 5pct	0.33	0.32
$\bar{\pi}$ ($\times 10^4$)	2.23	Probability of entering state	Wealth share top 1pct	0.34	0.35
$\underline{\pi}$	0.34	Probability of exiting state	Wealth share top 0.1pct	0.17	0.18
Labor Income Tax: $y - \lambda y^{1-\tau} - \omega$					
λ	0.82	Tax function	Gov. Expenses/Output	0.19	0.19
ω ($\times 10^2$)	5.91	Lump-sum transfer	Income variance ratio: Disposable to pre-gov	0.63	0.63

Notes: See the text for definitions and data sources. NThe model is not re-estimated, thus this table is simply to see how well the fixed skills model fits the moments estimated by the benchmark model.

G.4 Sensitivity to Out of Work Shock

Table G5: Sensitivity to Out of Work Shock

	Income Share Q1	Welf. Adults	Welf. S. State
Benchmark Model	7.4	-5.9	-21.9
5 $\times$ Out of Work Probability	6.9	-6.1	-23.2
10 $\times$ Out of Work Probability	6.4	-6.2	-25.0

Notes: This table reports the welfare change from UBI in the benchmark economy as well as in two additional economies with a higher probability of receiving the out of work shock.

G.5 Parameter Sensitivity

Table G6: Change in Welfare From UBI Given 1% Greater Parameter Value

Parameter Increased by 1%	Change in Welfare	
	Adult	Long-Run
μ	0.05%	0.05%
δ	-0.04%	0.37%
α	0.03%	-0.13%
α_{θ_c}	0.02%	-0.56%
$\alpha_{\theta_{nc}}$	0.00%	0.19%
σ_{ε}	-0.00%	0.32%
$\bar{\varepsilon}$	0.02%	-0.31%
$\bar{A}$	-0.02%	0.26%
$\bar{\eta}$	0.06%	0.04%
$\bar{\pi}$	0.00%	0.22%
$\underline{\pi}$	0.00%	0.00%
λ	0.48%	1.51%
ω	0.01%	0.04%
Baseline	**-5.96%**	**-22.31%**

Notes: This table reports the welfare change from UBI given a 1% increase in the parameter indicated, where the welfare change reported for the economy with the new parameter value vis a vis the benchmark model with UBI.