A Quantitative Evaluation of Universal Basic Income *

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Abstract

We provide a quantitative evaluation of the impact of Universal Basic Income (UBI) on macroeconomic aggregates, inequality and welfare, exploring different levels of UBI generosity, paired with different strategies to finance it. We find that different levels of UBI can generate welfare improvements in the long-run, and that more generous UBI requires financing through consumption taxes. While welfare improvements are possible for individuals entering the steady state, the analysis of the transitional dynamics suggest generalized welfare losses for existing individuals, casting doubt on the desirability of such reforms. These losses are increasing in the level of generosity of UBI.

Keywords: Incomplete market, Heterogeneous agents, Consumption tax, Universal basic income, Transitional dynamics

JEL classification: E2 , D52, H21

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1 Introduction

The current US welfare state consists of different public programs that target different segments of the population and usually provide transfers (cash or in-kind) that are means tested. This arrangement allows to target resources to those individuals most in need, at the expense of introducing substantial distortions and disincentives at the bottom of the income distribution (see Moffitt (2002) or Wellschmied (2021), among others). UBI is viewed in several political and academic circles as an alternative to such means-tested transfers. Its universal nature eliminates the large effective marginal tax rates at the bottom of the distribution introduced by means-tested programs, but it raises the fundamental question of how to pay for it and its impact on overall economic performance. Surprisingly, there are very few quantitative evaluations to inform this debate, and our exercise contributes by providing a thorough analysis of the implications of different levels of UBI generosity and alternative financing schemes.

In order to perform this policy exercise, we use an overlapping generations model where households face uninsurable idiosyncratic labor productivity risk in the spirit of Huggett (1993) and Aiyagari (1994). Households in the model choose whether to enter the labor market, hours worked and savings, so that a system of taxes and mean-tested transfers introduces potential distortions on all those margins. One crucial departure of our analysis is the distinction between two types of consumption goods. Basic consumption goods are subject to a minimum level of consumption, while the rest of consumption goods are not. This feature naturally introduces the notion of a basic income, and at the same time allows for the possibility of progressive consumption taxes (by taxing less basic goods than non-basic ones).

UBI is not a new idea, and it connects back to the discussion by Friedman of a Negative Income Tax. UBI is in sharp contrast with the current targeted welfare transfers, provoking heated debates in policy and academic circles, for example Yang (2018), Stern (2016) and Van Parijs and Vanderborght (2017). Hoynes and Rothstein (2019) provides an excellent overview of the different proposals and pilot programs around the world, and argues that a UBI generous enough to make a difference for the poor would be too costly.

The papers closer to our approach are Lopez-Daneri (2016), Luduvice (2019) and Daruich and Fernandez (2020), and all use very similar model environments (overlapping generations models with uninsurable productivity risk). The details of the models and the calibration process differ substantially, though. For example, Luduvice (2019) and Daruich and Fernandez (2020) incorporate human capital accumulation and we don't, while we distinguish between basic and non-basic consumption goods and they don't. There are many other features that vary across these papers, making them very complementary, but also difficult to compare in terms of results. A key difference is that our analysis focuses on a much broader set of alternatives in terms of both the level of generosity in UBI and the tax instruments used on the revenue side.

In previous research, see Conesa et al. (2020), we have evaluated the role of progressive consumption taxes in an infinite-horizon model with uninsurable productivity shocks. In this paper we also allow for progressive consumption taxes, and evaluate their role in the financing of generous UBI schemes.

Our key insights from the steady state analysis can be summarized as follows:

1. The maximum amount of UBI that can be financed with income taxes is around $15,000 per household.

2. Much more generous UBI is feasible when financed with consumption taxes. It is welfare enhancing (especially for non-college households), but the efficiency loss is large because of the negative impact on non-college labor supply.

3. College newborns' welfare gains are decreasing in UBI generosity, and become negative after $15,000 if income taxes are kept unchanged ($25,000 if income taxes are eliminated as part of the fiscal reform).

4. The welfare gains of non-college newborns are increasing in UBI generosity, especially when income taxes are kept unchanged.

5. Progressive income taxes are preferable to flat income taxes, while progressive consumption taxes do not seem to generate much additional welfare gains.

The welfare consequences judging from the perspective of expected life-time utility of newborns do not generalize over the entire population. This is especially relevant when we move to the analysis of the transitional dynamics. When we evaluate the transitional dynamics associated to three prototypical reforms, we find that the type of reform that generates the largest fraction of people with welfare gains implies a relatively low UBI (around \$15,000 per household) financed with progressive consumption taxes and keeping income taxes unchanged. Still, this type of reform falls substantially short in generating welfare gains for a majority of households. More generous UBI reform perform even worse in terms of welfare changes and potential support.

The paper is organized as follows. Section 2 describes the model. Section 3 discusses the calibration strategy and the model validation. The numerical results in steady state are discussed in Section 4. Section 5 discusses the transitional dynamics of a specific reform. Section 6 concludes.

2 The model of the benchmark economy

2.1 Demographics

Time is discrete and the economy is populated by J_1 overlapping generations. In each period a continuum of new households is born, whose mass grows at a constant rate n. Each household works J_0 years and lives up to a maximum of J_1 years. Each household faces a positive probability of survival to next period. Let $\phi_j = Prob(alive\ at\ j+1|alive\ at\ j)$ denote the conditional survival probability from age j to age $j+1$. At age J_1 households die with probability one, i.e., $\phi_{J_1} = 0$.

We denote the mass of population as $\psi : A \times \Xi \times \Theta \times J \rightarrow \mathbb{R}_+$, where A, Ξ, Θ, J are the state spaces for financial assets a, education level ξ, labor efficiency θ and age j. Define $\tilde{\Psi}_j : A \times \Xi \times \Theta \rightarrow \mathbb{R}_+$ as the conditional cumulative distribution function of financial asset, ability level and labor efficiency for a given age j; $\tilde{\Psi}_{\xi,j} : A \times \Theta \rightarrow \mathbb{R}_+$ as the conditional cumulative distribution function of financial asset and labor efficiency for a given ability level ξ and age j ; and $\psi_j : J \rightarrow \mathbb{R}_+$ as the marginal density function of age.

2.2 Endowments

Each household enters the labor market with some given levels of education, and labor productivity follows a stochastic process that depends on age and education. Households are endowed with one unit of time in each period. At working age, time is divided between work and leisure; after retirement, households enjoy leisure full-time. Households enter the market with a given amount of financial assets. We assume that households have no bequest motives, but there are accidental bequests that are equally distributed among the surviving population.

2.3 Preferences

Households derive utility from basic consumption c_1, non-basic consumption c_2, and experience disutility from labor supply h. We model labor supply both at the extensive and the intensive margins. In order to do so we introduce a fixed utility cost of working $\zeta_{\xi,j}$, that depends on education and age. The future utility is discounted by the factor β and conditional survival probability ϕ_j. The objective function of a newborn household is

$$E \sum_{j=1}^{J_1} \beta^j \left(\Pi_{s=1}^{j} \phi_s\right) u(c_{1,j}, c_{2,j}, h_j).$$

The rationale for distinguishing between basic and non-basic consumption goods follows Conesa et al. (2020). Targeted transfers or Universal Basic Income are intended to guarantee basic living standards for everybody. Introducing a minimum target level of basic consumption goods makes operational the notion of minimum living standards.

2.4 Earnings

During their working age households have a labor income of $we_{\xi,j}\theta_{\xi,j}$, where w denotes the aggregate wage, $e_{\xi,j}$ is the deterministic component of labor productivity, and $\theta_{\xi,j}$ is the stochastic component of labor productivity. The last two factors depend on both education and age.

After retirement, households receive a social security benefit pen_ξ, with a replacement ratio of b_ξ. Notice that we are assuming that the pension is based on households' permanent income, which is determined by one's education level.

The earnings function for workers and retirees is as follows:

$$y^{earn} = \begin{cases} we_{\xi,j}\theta_{\xi,j}h, & j \leq J_0 \\ pen_{\xi}, & j > J_0. \end{cases}$$

2.5 Welfare transfers

Each period, households receive welfare transfers $tr(y^{inc})$ from the government. The welfare transfers are means tested, and they are assumed to depend on pre-tax income, denoted by y^{inc}, which consists of capital income and labor earnings.

2.6 Production

There is a representative firm renting capital K and labor L to produce output Y, which is used for basic consumption C_1, non-basic consumption C_2, capital investment I, as well as government consumption G. Firms behave as price takers in input markets so that capital and labor are paid their net marginal product. The depreciation rate of capital is denoted by δ, so that the law of motion of capital accumulation is $K' = (1-\delta)K + I$.

2.7 Government and fiscal policy

Each period, the government collects its revenue through income taxes. This paper focuses on federal-level fiscal reforms, so we ignore the taxes at the state and local levels. The capital income tax is assumed to be proportional to capital income ra, and is taxed at the rate of τ_a. The labor income tax function is denoted by $T(\cdot)$. For working households, the taxable income includes earnings y^{earn} and one half of social security tax contributions ss, where $ss = \tau^{ss}\min\{y^{earn}, \bar{y}\}$ with $\bar{y}$ being the social security cap and τ_{ss} being the social security tax rate.[1] According to the current tax system, pensions and social security benefits of retirees are also treated as taxable labor income.

[1]Here, we abstract from the double taxation problem of capital income and summarize the overall capital taxes paid by households and firms into a single tax on the net return of capital.

The tax that a household pays to the government is:

$$Tax = \begin{cases} \tau^a ra + T\big(y^{earn} - 0.5ss\big) & j \leq J_0 \\ \tau^a ra + T\big(y^{earn}\big) & j > J_0 \end{cases}$$

Government revenue is used to finance a stream of exogenously given government consumption, G, and Tr is used for welfare transfers. Transfers depend on households' type. Throughout the paper, we assume that the social security system is self-financed.

2.8 Equilibrium

Definition: Given an exogenous government policy, a stationary equilibrium is a household value function $V(a, \xi, \theta, j)$ and its associated decision rules $c_1(a, \xi, \theta, j)$, $c_2(a, \xi, \theta, j)$, $a'(a, \xi, \theta, j)$ and $h(a, \xi, \theta, j)$; taxes paid to the government $Tax(a, \xi, \theta, j)$, social security tax $ss(a, \xi, \theta, j)$, welfare transfer received $tr(a, \xi, \theta, j)$ and social security benefits pen_ξ; factor prices r and w; aggregate basic consumption C_1, aggregate non-basic C_2 , aggregate capital K, and aggregate labor L; and a measure $\psi : A \times \Xi \times E \times J \rightarrow \mathbb{R}_+$, a conditional cumulative distribution function for a given age $\tilde{\Psi}_j : A \times \Xi \times E \rightarrow \mathbb{R}_+$; a conditional cumulative distribution function for a given ability and age $\tilde{\Psi}_{\xi,j} : A \times \Xi \rightarrow \mathbb{R}_+$, and a marginal density function of age $\psi_j : J \rightarrow \mathbb{R}_+$ such that:

1. Given prices and tax policies, $\{V, c_1, c_2, a', h\}$ solve the households' maximization prob-

lem:

$$V(a,\xi,\theta,j) = \max_{\{c_1,c_2,a',h\}} u(c_1,c_2,h) + \beta\phi_{j+1}EV(a',\xi,\theta',j+1)$$

$$\text{s.t. } c_1 + c_2 + a' = \begin{cases} (1+r)a + y^{earn} - Tax(a,\xi,\theta,j) - ss + tr(a,\xi,\theta,j), & j \leq J_0 \\ (1+r)a + y^{earn} - Tax(a,\xi,\theta,j) + tr(a,\xi,\theta,j), & j > J_0 \end{cases}$$

$$y^{earn} = \begin{cases} we_{\xi,j}\theta_{\xi,j}h, & j \leq J_0 \\ pen_{\xi}, & j > J_0 \end{cases}$$

$$Tax = \begin{cases} \tau^a ra + T\big(y^{earn} - 0.5ss\big), & j \leq J_0 \\ \tau^a ra + T\big(y^{earn}\big), & j > J_0 \end{cases}$$

$$ss = \tau^{ss}\min\{y^{earn}, \bar{y}\}$$

$$c_1, c_2 > 0, a' \geq 0, 0 < h < 1$$

2. Production factors are paid their net marginal return:

$$r = F_K(K,L) - \delta$$

$$w = F_L(K,L)$$

3. Markets clear:

 (a) The goods markets clear

$$C_1 + C_2 + K' - (1-\delta)K + G = F(K,L)$$

$$C_1 = \sum_{j=1}^{J_1} \psi_j \int_{A\times\Xi\times\Theta} c_1 d\tilde{\Psi}_j(a,\xi,\theta)$$

$$C_2 = \sum_{j=1}^{J_1} \psi_j \int_{A\times\Xi\times\Theta} c_2 d\tilde{\Psi}_j(a,\xi,\theta)$$

 (b) The capital markets clear

$$K' = \sum_{j=1}^{J_1} \psi_j \int_{A\times\Xi\times\Theta} a' d\tilde{\Psi}_j(a,\xi,\theta)$$

(c) The labor markets clear

$$L = \sum_{j=1}^{J_1} \psi_j \int_{A\times\Xi\times\Theta} e_{\xi,j}\theta_{\xi,j} h d\tilde{\Psi}_j(a,\xi,\theta)$$

4. Fiscal policy is such that:

(a) The government general budget constraint is satisfied:

$$\sum_{j=1}^{J_1} \psi_j \int_{A\times\Xi\times\Theta} Tax d\tilde{\Psi}_j(a,\xi,\theta) = \sum_{j=1}^{J_1} \psi_j \int_{A\times\Xi\times\Theta} tr d\tilde{\Psi}_j(a,\xi,\theta) + G$$

(b) The social security budget constraint is satisfied:

$$pen_\xi = \frac{b_\xi w \sum_{j=1}^{J_0} \psi_j \int_{A\times\Theta} e_{\xi,j}\theta_{\xi,j} h d\tilde{\Psi}_{\xi,j}(a,\xi,\theta)}{\sum_{j=1}^{J_0} \psi_j \int_{A\times\Theta} d\tilde{\Psi}_{\xi,j}(a,\xi,\theta)}$$

$$pen_\xi \sum_{j=J_0+1}^{J_1} \psi_j \int_{A\times\Theta} d\tilde{\Psi}_{\xi,j}(a,\xi,\theta) = \tau_{ss} w \sum_{j=1}^{J_0} \psi_j \int_{A\times\Theta} e_{\xi,j}\theta_{\xi,j} h d\tilde{\Psi}_{\xi,j}(a,\xi,\theta)$$

5. The measure over the state space evolves according to the Markovian transition matrix:

$$\psi(a',\xi,\theta',j+1) = \phi_j \psi(a,\xi,\theta,j)\Pi_{\xi,j}(\theta,\theta')\mathbf{1}_{a'}(a,\xi,\theta,j)$$

where $\mathbf{1}(\cdot)$ denotes the indicator function that takes value 1 if $a' = a'(a,\xi,\theta,j)$ and 0 otherwise.

3 Calibration and model validation

This section presents the calibration strategy and model validation. One period in the model is the equivalent of four natural years. The reason for doing so is to make sure that the sample size for the estimation of productivity processes is sufficiently large (see Section 3.5). Some parameters are determined exogenously, while others are jointly calibrated in equilibrium to match the data, and they are reported from Table 2 to Table 5.

3.1 Demographics

The annual population growth rate is set to 1.2 percent, which means that the four-year population growth rate is $n = 4.9\%$. The conditional survival probabilities ϕ_j are obtained from Bell and Miller (2002). In Bell and Miller (2002), they provide conditional cohort probabilities of survival at age 0, 30, 60, 65, 75 and 100. We interpolate the conditional survival probabilities at each age, then multiply the consecutive four years as the conditional survival probability of our model time interval, Figure 1 shows the interpolated probabilities that we use in the model.

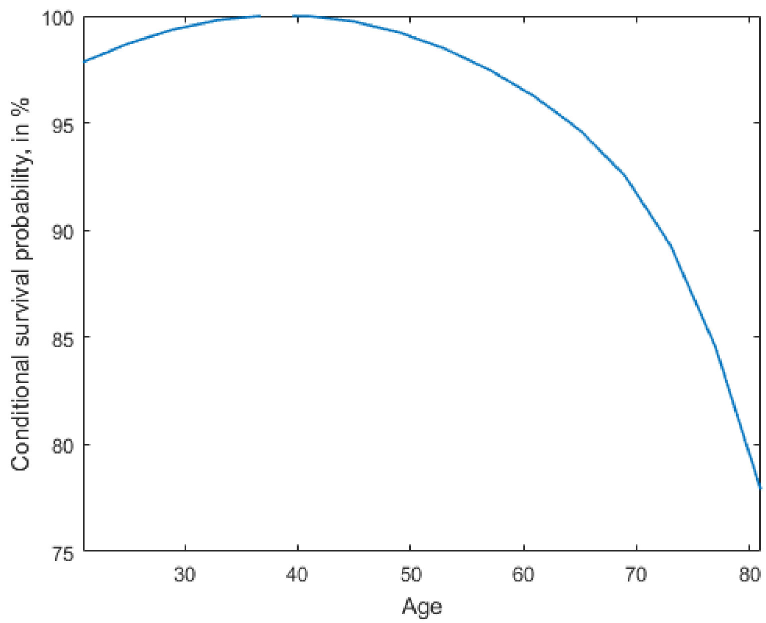


Figure 1: Conditional survival probability, interpolated, in%

3.2 The definition of basic consumption: Expenditure patterns in the CEX

In order to distinguish between basic goods and non-basic goods we follow Conesa et al. (2020). The consumer unit is one household, and we use CEX 2017 data to obtain the expenditure profiles according to income. We consider basic goods those categories for which their share in total consumption decreases with income. Based on this criterion we label as basic goods food at home, rent, utility, prescription medicine and television. We also include health insurance and medical services[2] as basic goods. Notice that there

[2]A large number of papers find that bad health is a big obstacle to participation in labor and financial markets, and eventually leads to low income. See De Nardi et al. (2018), Currie and Madrian (1999), Poterba

is a substantial overlap between those categories and the goods that are usually subject to reduced consumption tax rates or even exempt from taxation. All other expenditure categories are labeled as non-basic consumption goods.

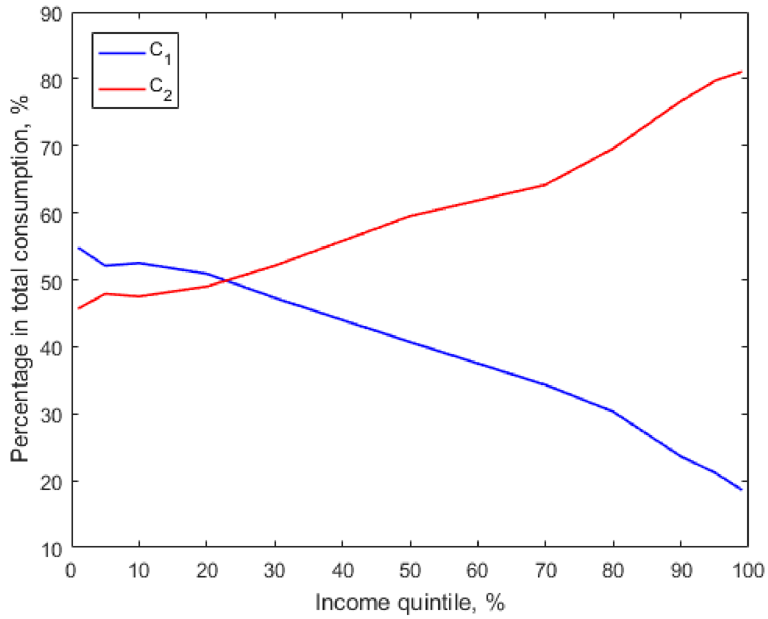


Figure 2: Share of C_1 and C_2 in total C by pre-tax income quintile, in %

Figure 2 shows the relationship between expenditure shares and income. Examples of non-basic and basic consumption, as well as their share in total consumption can be found in Conesa et al. (2020).

3.3 Preferences

The utility function is given by:

$$u(c_1, c_2, h) = \begin{cases} \frac{\left(\left(\gamma(c_1-\underline{c})^{\nu}+(1-\gamma)c_2^{\nu}\right)^{1/\nu}\right)^{1-\sigma}}{1-\sigma} + B\frac{(1-h)^{1+\frac{1}{\chi}}}{1+\frac{1}{\chi}} - \zeta_{\xi,j} & \text{if } h > 0 \\ \frac{\left(\left(\gamma(c_1-\underline{c})^{\nu}+(1-\gamma)c_2^{\nu}\right)^{1/\nu}\right)^{1-\sigma}}{1-\sigma} & \text{if } h = 0 \end{cases}$$

We set σ equal to 2. The parameter γ governs the share of basic consumption in total consumption. Under the assumption that the minimum consumption $\underline{c}$ is irrelevant for

et al. (2017) and De Nardi et al. (2010).

households at the top of the income distribution, γ is the share of basic consumption in total consumption at the top of the income distribution, which is 0.21. The elasticity of substitution between c_1 and c_2, $\frac{1}{1-\nu}$, is assumed to be 1 in the benchmark case. That is $\nu = 0$ and utility takes the Cobb-Douglas form. The minimum consumption $\underline{c}$ is chosen to target the ratio of aggregate $C_1/C_2 = 0.5$.

Following Erosa et al. (2010), we choose $\chi = -0.5$ as the Frisch elasticity of leisure. Parameter B is calibrated such that average hours worked are one third of available time.

Finally, the fixed cost of supplying labor is reflected by an age- and education-dependent parameter $\zeta_{\xi,j}$, calibrated to match the labor force participation (henceforth LFP) rate for each age and education group. Due to the fixed cost, a household is either not in the labor force or employed, consistent in the interpretation of Holter et al. (2019).

3.4 Life-cycle profiles of labor productivity

We use PSID data from 1969 to 2017 to form a household panel at four-year intervals. Conesa et al. (2020) gives a more detailed description of the data treatment. Basically, we keep in the sample households that: 1. are in the non-immigration sample; 2. whose head is between 21 and 65 years old; 3. whose head's annual hours worked is above 260 hours; 4. whose earnings are not completely from self-employment; 5. whose wage rate (household total earning over total hours worked) is above one half of the minimum wage rate. We split the sample into two ability levels: non-college and college graduates (throughout the paper, we use "low skilled" and "high skilled" exchangeably with "non-college" and "college graduates"). The deterministic life-cycle profiles are obtained by regressing logarithm wage rate on age, age squared and cohort dummies. This estimation is done for both education levels separately. Figure 3 presents the findings.

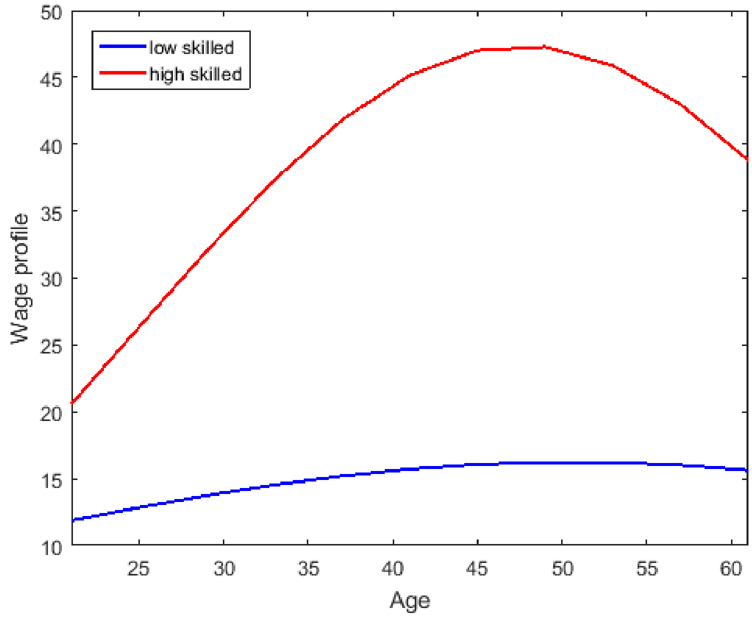


Figure 3: Life cycle wage profile, in 2017 $

3.5 The stochastic process of labor productivity

The stochastic component of labor productivity is taken directly from the data. In the spirit of De Nardi et al. (2019), our procedure is to compute age-education dependent Markov processes that impose no constraints on the stochastic properties of the shocks. In particular, our parameterization allows for the type of deviations from log-normality emphasized in Guvenen et al. (2019).

Taking the residuals from the regression that provides the deterministic life-cycle profiles, we split households for each educational class according to 11 age groups within a 4-year interval; within each age and education group, residuals are categorized into 11 shocks corresponding to the percentiles of the Lorenz curve of the distribution of residuals. The age and education-dependent realization of the shock θ takes the median value for each group.

For the transition matrix, we simply compute age-education dependent transitions over four year intervals as the probability of a household moving from one percentile group this period to another group next period. We use order probit regressions to estimate those probabilities.

The procedure we have used for obtaining the age-dependent states and transition matrices is similar to De Nardi et al. (2019), but allows for more general structure of the shocks. In their paper, after removing the life-cycle profile, they split the residuals into a persistent component and a white noise component, and then estimate the persistence and variances. Using the estimation results, they simulate each component and construct a set of artificial residuals. Then they perform the same exercise as we described above to obtain transition probabilities. In their procedure, they inevitably assume a functional form for the distribution of residuals, whereas in our approach we do not need to impose any restriction on the structure of shocks.

3.6 The initial distribution of assets

We take the initial distribution of assets for households of age 21-24 directly from the data. We compute the distribution of assets within each education-productivity group. That process generates an additional source of heterogeneity across newborns, which is necessary to capture the differences in labor market behavior. If all individuals enter the economy with zero asset (the standard assumption), then the youngest cohorts would always work no matter how low the productivity is or how high the fixed costs of working are. Otherwise consumption would fall below the minimum consumption, even while receiving the targeted transfers. With zero assets for newborns, to match the initial employment rates from the data (75.88% for non-college households and 87.47% for college ones at age 21-24), the fixed cost of young cohorts goes to infinity in the calibration process and still LFP is 100 percent. Incorporating a non-trivial initial distribution of assets is enough to allow for finite fixed costs at an early age (as reported in Table 3) to induce some young households to stay out of the labor force as in Figure 5.

3.7 Technology

The aggregate production function is assumed to be Cobb-Douglas, with a capital income share of 0.33. The annual capital depreciation rate is set to be 0.059, to match investment ratios in the steady state of the benchmark economy to averages in the data. This means that the capital depreciation rate for four years is 0.24.

3.8 Fiscal policy in the benchmark economy

In the benchmark economy we only consider income taxes. We assume that there are no consumption taxes because our exercise concerns the federal budget. However, in our policy experiments we will allow for consumption taxes. Moreover, following Conesa et al. (2020) we will explore the possibility of differential tax treatment between basic consumption goods and other categories, as is commonly done at the U.S. state and local level and in countries with a VAT system. Notice that this allows for a consumption tax scheme that is potentially progressive, by taxing more non-basic goods than basic goods.

3.8.1 Income Taxation

We assume that the capital income tax is proportional to net earnings from wealth, with a marginal tax rate of $\tau_a = 0.396$ (see Domeij and Heathcote (2004)). The labor income tax follows Gouveia and Strauss (1994) and takes the form:

$$T(y^{earn}) = \kappa_0(y^{earn} - ((y^{earn})^{-\kappa_1} + \kappa_2)^{-1/\kappa_1})$$

where y^{earn} is labor earnings, κ_0 is the marginal tax rate at the top of the earnings distribution, and κ_1 governs the degree of progressivity (how fast the marginal tax rate increases from 0 to κ_0). Following Anagnostopoulos et al. (2012) we set $\kappa_0 = 0.414$ and $\kappa_1 = 0.888$. Finally, κ_2 is calibrated to match a total government spending to GDP ratio of 20%.

3.8.2 Welfare transfer programs

The government provides a variety of means-tested welfare programs to help families with low income and protect them against hardship. The Congressional Research Service (CRS) identifies 83 overlapping federal welfare programs, classified into ten categories: cash assistance, medical, food, housing, energy and utilities, education, training, services, child care and child development, and community development. Differently than in Conesa et al. (2020) we distinguish here between EITC, Unemployment Insurance, and all the other transfers.

The reason to do so is that the first two are specifically a function of labor market status. Table 1 reports the share of major welfare transfers in total federal outlays, constructed from the White House Office of Management and Budget Historical tables.

Table 1: Major welfare transfers as a fraction of government outlays, averaging between 1997 and 2016, in %

Medicaid	UI	SNAP	TANF	SSI	EITC	HA	CTC	CNSM	CHI	WIC	LIHEA	Average
7.37	1.85	1.56	0.80	1.41	1.47	1.49	0.44	0.51	0.19	0.20	0.09	**17.39**

Averaging over 1997 to 2015, the largest welfare programs are: 1. Medicaid (7.3% in the total federal outlays); 2. Unemployment Insurance (UI, 1.8%); 3. Supplemental Nutrition Assistance Program (SNAP, 1.6%); 4. Housing Assistance (1.5%); 5. Earned Income Tax Credit (EITC 1.5%); 6. Supplemental Security Income (SSI, 1.4%); 7. Temporary Assistance for Needy Families (TANF, 0.8%); 8. Children's Nutrition Program (0.5%); 9. Child Tax Credit (0.5%); 10. Women, Infants, and Children (WIC, 0.2%); 11. Children's Health Insurance Program (CHIP, 0.2%); 12. Low Income Home Energy Assistance (LIHEA, 0.1%). Summing up, the total share of these welfare programs in federal outlays is 17.4 percent.

We recover the distribution of overall welfare transfers from multiple datasets, including PSID, CEX and MEPS. PSID is a thorough survey on households' income sources and it keeps records on welfare transfers, like food stamps, TANF, SSI, energy assistance, unemployment compensation, etc. Unfortunately, PSID does not included tax credits and Medicaid, so we obtain information about EITC and child tax credit from CEX, and Medicaid from MEPS. As with the CEX, we only include households from PSID and MEPS whose head of household is between 21 and 65 years old and belongs to the labor force, having hours worked exceeding 260 hours per year, as well as the household wage rate being more than half of the minimum wage.

Notice that we use different data sources, and there are differences in data samples, survey frequency and survey questions. Because of that the data is not directly comparable across these data sources. For example, the average earnings in MEPS is roughly 80 percent of the average earning in PSID and CEX; PSID has the earnings at the top 1 group almost twice as that in MEPS. We adhere to PSID earnings' data for its thoroughness, and interpolate EITC and child tax credits in CEX and Medicaid in MEPS to PSID earning level. The details regarding the data and the interpolation algorithm are discussed in Conesa et al. (2020).

Because all these welfare programs are means-tested, requiring earnings and/or asset tests, the families at the bottom of the income distribution do not necessarily receive the highest transfers. For example, only \$453 of EITC transfers go to the bottom 1 percent due to the fact that many of these households do not have a job, whereas households with slightly more income at the bottom $1 \sim 5\%$ are the biggest recipients of EITC. Overall, the welfare transfers decline with income. The average welfare transfer is roughly \$2,500, with households whose income is at $1 \sim 5\%$ receiving the most.

In the model, we split welfare transfers into EITC, UI and other transfers. For each category, we choose a piece-wise linear function to describe the welfare transfers as a function of income. That is:

$$eitc = \mathbf{1}_{a\leq\bar{a},h>0}\big(\sum_{i=1}^{11}\mu_i^{eitc}\mathbf{1}_{y\in income\ group\ i}\big)\times EITC$$

$$ui = \mathbf{1}_{a\leq\bar{a},h=0}\big(\sum_{i=1}^{11}\mu_i^{UI}\mathbf{1}_{y\in income\ group\ i}\big)\times UI$$

$$other = \mathbf{1}_{a\leq\bar{a}}\big(\sum_{i=1}^{11}\mu_i^{eitc}\mathbf{1}_{y\in income\ group\ i}\big)\times Other$$

where $\mathbf{1}$ is an indicator that takes value 1 if the criterion is satisfied, y denotes income, $eitc$ is the amount of EITC transfers, $other$ refers to other transfers. Income groups are the same ones corresponding to the Lorenz curve for productivity: the bottom 1%, $1 \sim 5\%$, $5 \sim 10\%$, $10 \sim 20\%$, $20 \sim 40\%$, $40 \sim 60\%$, $60 \sim 80\%$, $80 \sim 90\%$, $90 \sim 95\%$, $95 \sim 99\%$ and the top 1%. The parameters $\{\mu_i\}_{i=1}^{10}$ are the ratio of a transfer received by this income group to the average welfare transfer. These ratio are directly taken from data except for μ_{11}, which is adjusted endogenously such that the EITC takes up 1.47 percent of the government revenues, and UI takes up 1.85 percent and other welfare transfers account for 14.07 percent.

Moreover, in the welfare function, $\mathbf{1}_{a\leq\bar{a},h}$ is an indicator for asset and employment test. For the welfare programs we consider, Medicaid, SNAP (in most states), SSI and TANF are subject to an asset tests, whereas the rest of the programs are not.[3] Usually when a welfare

[3]See Wellschmied (2021) for a thorough investigation.

program is subject to an asset test, assets are split into two categories: uncountable and countable assets. Uncountable assets refer to the ones that are not account for the eligibility of a specific program and are considered as "exempted".

For example, in Medicaid, the assets that are exempted include 1. the first $2,000 of bank accounts and cash; 2. funeral and burial funds; 3. insurance policies below $1,500 (this amount varies); 3. primary home below $595,000 in most states and up to $893,000 in other states; 5. vehicles. Other asset test programs share similar criterion.

Because we do not distinguish between financial assets and real estate in our model, we set the asset limit for the overall welfare transfer programs to be $600,000, nearly ten times the GDP per capita.

The parameters that we feed in the benchmark model are shown from Table 2 to Table 5.

Table 2: Parameters

Parameter	Targets	Values
Demographics		
g	Annual population growth rate	1.20%
ϕ_j	Conditional survival probability	see text
Preferences		
β	$K/Y = 3$ annually	0.93
σ		2.00
γ	C_1/C_2 at top income percentile	0.21
$\underline{c}$	Average $C_1/C_2 = 0.5$	0.55
ν	Elasticity of substitution between c_1 and c_2	0.00
B	Average hours worked $= 0.33$	0.74
ξ	Elasticity of labor supply	-0.50

Table 3: Parameters, contd, $\zeta_{\xi,j}$

age	1	2	3	4	5	6	7	8	9	10	11
low skilled	0.89	0.72	0.57	0.40	0.31	0.25	0.25	0.21	0.19	0.16	0.22
high skilled	0.09	0.11	0.13	0.09	0.06	0.03	0.04	0.04	0.03	0.04	0.04

Table 4: Parameters, contd

Technology		
α	Capital share of income	0.36
δ	Annual capital depreciation rate	0.069
Fiscal policy		
τ_a	Capital income tax rate	0.39
κ_0	Average level of labor income tax	0.26
κ_1	Progressivity of labor income tax	0.79
κ_2	$G/Y = 0.2$	1.00
τ_{c1}	basic consumption tax rate	0.00
τ_{c2}	non-basic tax rate	0.00
τ_{ss}	Social security tax rate	0.13
$\bar{y}^{earn}$	Ratio of social security tax cap to average earnings	2.46
b	Replacement ratio for self-financed SS system	0.48

Table 5: Parameters, contd

	$1 \sim 5\%$	$5 \sim 10\%$	$10 \sim 20\%$	Q2	Q3	Q4	$80 \sim 90\%$	$90 \sim 95\%$	$95 \sim 99\%$	top 1%
EITC	3.62	3.46	3.08	1.44	0.36	0.07	0.05	0.03	0.00	0.00
UI	1.68	1.60	1.24	1.37	0.89	0.88	0.60	0.00	0.00	0.00
others	3.52	2.61	2.43	1.09	0.68	0.45	0.34	0.19	0.35	0.62

3.9 Model validation

Given those parameter values we compute the equilibrium in the benchmark economy. Now we turn to the comparison of the benchmark economy to the data. Figure 4 presents basic consumption C_1 as a proportion of aggregate consumption C for all income levels. The model generates a pattern of C_1/C as a function of income that is comparable with the data. Notice that we did not target this income profile, since we matched the average.

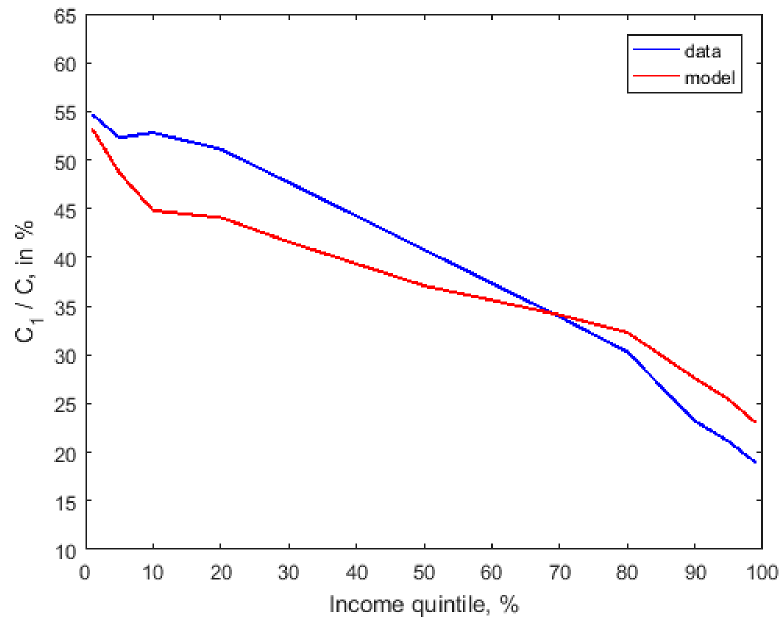
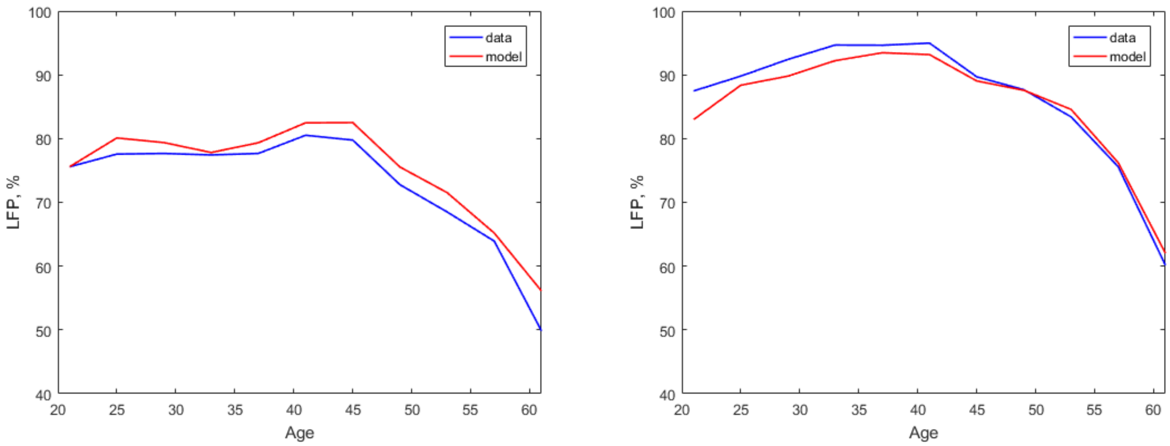


Figure 4: Data vs Model: C_1 as percentage of total consumption by income quintile, in %

Figure 5 compares the model LFP rates across age and education groups with those in data. It shows that given our age- and education-dependent parameters, LFP rates match the data fairly well provided that we feed in the model the initial assets distribution of the data (see the discussion in Subsection 3.6).



(a) Low skilled

(b) High skilled

Figure 5: Labor force participation rate, data v.s. model, in %

Table 6 compares the unconditional distributions between model and data. Table 7 shows the distribution conditional on income of the model versus that of data. Of these variables, only the distribution of EITC transfer, UI transfer and other welfare transfers are directly targeted through calibration. Of course, the welfare transfers match the data almost perfectly, which is attributable to the piece-wise linear function we assumed for the transfer functions. The model generates a distribution of earning that matches fairly well with data, except that the Gini of earning is slightly larger in the model, because the concentration of earnings at the top is a bit larger in the model than in the data. While we target the age-profile of LFP, we do not directly target the distribution of earnings. Hence, a good fit of the earnings distribution indicates that the model performs well in predicting who works and how much they work.

Table 6: Data vs Model: Distribution of earning, consumption and welfare transfers

	Gini	Bottom%			quintile					Top%		
		1	$[1,5]$	$[6,10]$	Q1	Q2	Q3	Q4	Q5	$[91,95]$	$[96,99]$	$[99,100]$
						Earnings						
Data	0.48	0.00	0.00	0.00	0.06	9.28	18.20	25.04	47.41	11.00	11.85	9.11
Model	0.50	0.00	0.00	0.00	0.00	8.84	16.30	23.85	51.01	11.74	13.89	8.55
						Wealth						
Data	0.78	-0.22	-0.04	0.00	-0.22	1.33	5.25	13.45	80.19	14.11	25.67	25.79
Model	0.61	0.00	0.00	0.00	0.30	3.90	11.00	22.61	62.19	14.37	18.28	9.85
						Income						
Data	0.48	0.00	0.01	0.18	1.78	8.30	14.82	25.52	49.58	11.41	12.69	7.39
Model	0.42	0.00	0.29	1.19	5.07	10.13	15.00	21.75	48.05	11.20	13.62	7.43
						Basic Consumption C_1						
Data	0.25	0.25	1.46	2.35	9.72	14.29	18.02	22.58	35.38	8.69	8.90	3.49
Model	0.14	0.66	2.83	3.61	14.84	16.65	18.52	21.22	28.79	7.12	6.52	2.60
						Non-basic C_2						
Data	0.40	0.06	0.62	1.15	4.98	10.18	15.96	23.64	45.25	11.08	12.07	4.99
Model	0.26	0.35	1.78	2.45	10.29	13.74	17.20	22.29	36.48	8.96	8.82	3.91
						Hours worked						
Data	0.31	0.00	0.00	0.00	0.85	17.70	23.73	24.29	33.43	8.65	7.85	3.32
Benchmark	0.30	0.00	0.00	0.00	0.00	17.65	23.94	28.08	30.33	7.60	6.24	1.96

Table 7: Data vs Model: Distribution of taxes and transfers by pre-tax income quintile

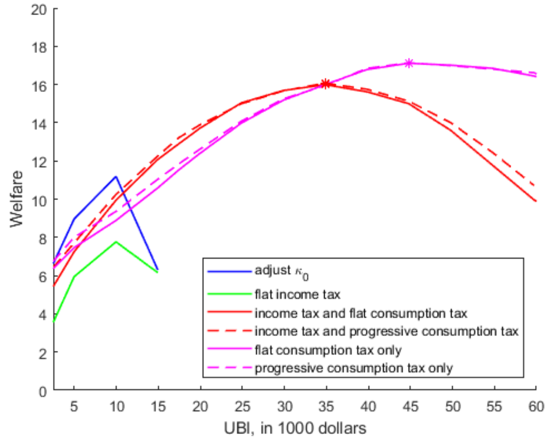
	Bottom%			quintile					Top%		
	1	[1, 5]	[6, 10]	Q1	Q2	Q3	Q4	Q5	[91, 95]	[96, 99]	[99, 100]
LFP by income quintile											
Data	5.58	3.20	20.95	36.34	78.43	90.75	95.25	96.40	93.41	94.46	95.93
Model	0.00	2.35	25.92	29.74	80.53	90.97	94.80	98.50	97.76	98.99	100.00
Share of hours worked by income quintile											
Data	0.18	1.75	2.94	12.20	16.99	20.09	24.23	26.48	6.65	5.45	1.30
Model	0.00	0.09	1.69	7.79	22.15	23.25	23.31	23.51	5.65	4.74	1.47
Share of tax pre-transfer by income quintile											
Data	0.00	0.03	0.29	1.51	5.98	10.94	20.50	61.07	13.86	21.46	9.67
Model	0.00	0.35	1.22	4.91	8.85	14.32	22.38	49.53	12.13	13.73	6.80
Share of tax post-transfer by income quintile											
Data	-0.03	-0.63	-0.58	-1.67	4.13	10.31	21.21	66.00	15.04	23.32	10.48
Model	-0.76	-1.83	-0.92	-2.62	8.26	14.40	24.22	55.74	13.73	15.57	7.73
Share of EITC transfer by income quintile											
Data	0.61	14.11	17.39	61.10	29.31	7.53	1.37	0.69	0.17	0.00	0.00
Model	1.10	13.71	16.45	59.77	29.04	8.95	1.58	0.66	0.16	0.00	0.00
Share of UI by income quintile											
Data	13.95	33.72	31.93	24.86	27.38	17.92	17.73	12.12	0.00	0.00	0.00
Model	13.10	33.71	28.45	24.77	28.04	17.95	17.58	13.66	0.16	0.00	0.00
Share of other welfare transfer by income quintile											
Data	3.87	14.13	12.94	48.87	22.20	13.70	9.21	6.03	1.03	0.58	0.62
Model	3.53	12.80	12.07	50.26	21.79	13.39	8.56	5.99	0.89	1.27	0.61

The model falls short of matching the distribution of wealth. Typically this kind of model does not generate as much concentration of wealth as in the data. As a result the model generates a lower concentration of consumption and tax burdens as well, especially at the top of the distribution. Notice that we have used top-coded PSID data to construct our measures of labor productivity and that we have abstracted from self-employment. While the model performs well relative to the earnings distribution as measured in the PSID, it falls short of accounting for the wealth distribution as measured in the CPS. This type of model can generate much larger wealth inequality by introducing super-star productivity realizations as in Kindermann and Krueger, explicitly modeling entrepreneurship, see Quadrini (2009), or modeling bequests as in De Nardi (2004).

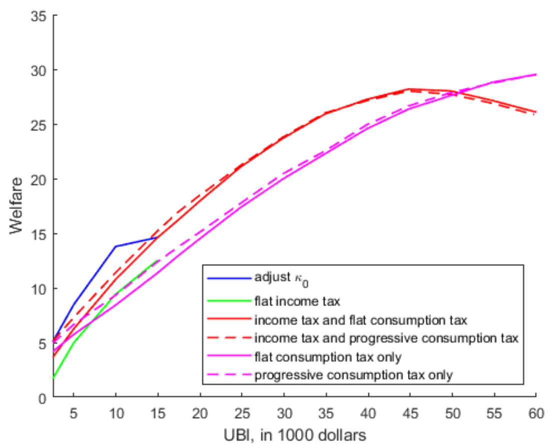
4 Substituting existing targeted transfers with UBI

The exercises we perform replace all targeted transfers with UBI. We allow for different generosity of the UBI system, and we explore alternative ways to finance government outlays (UBI and government consumption). Notice that through all the experiments we remove all existing transfers, including social security taxes and benefits.

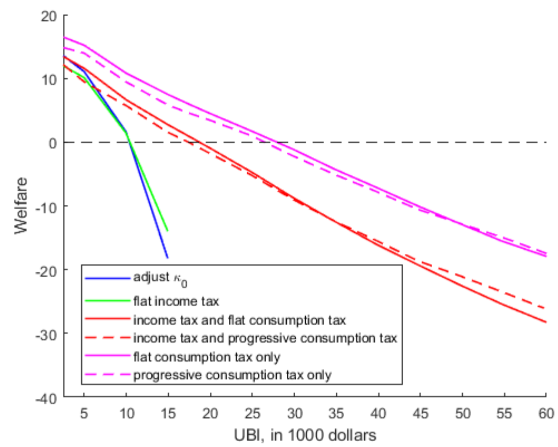
We first discuss the steady state implications, and later we will discuss the implications of the transition for specific policy reforms.



(a) Average, in %



(b) Low skilled, in %



(c) High skilled, in %

Figure 6: Welfare gain with different levels of UBI and financing schemes, in %

Figure 6 summarizes the steady state welfare results. It reports the welfare gains relative to the benchmark economy of different levels of UBI under different financing arrangements. Welfare gains are measured in consumption equivalent units for newborns.

4.1 Financing UBI through income taxes

First, we investigate the effects of financing UBI exclusively through income taxes. The welfare implications are reported in Figure 6. The first thing to notice is that the level of UBI that can be financed through income taxes is limited (the maximum is around $15,000).

Secondly, a flat tax yields lower welfare gains than the existing progressive scheme. Finally, while the welfare gain of non-college newborns is always increasing in UBI, the welfare gain of college newborns is decreasing and becomes negative for levels of UBI above around $10,000.

These results suggest that low levels of UBI financed through income taxes are feasible and even constitute a Pareto improvement (from the perspective of newborns' welfare). In order to further understand the macroeconomic consequences of these type of reforms, we focus on the specific case of reforms that keep the progressivity of the income tax schedule.

We report the main macroeconomic variables of the different reforms relative to the benchmark in Table 8. The second column refers to a reform that takes the aggregate of all benchmark transfers and distributes them as UBI among the entire population, resulting in a UBI of $2,500. The additional columns report levels of UBI multiples of that, up to $15,000.

Table 8: Steady state, financing UBI through adjusting labor income tax

	Benchmark	×1	×2	×4	×6
UBI		$2,500	$5,000	$10,000	$15,000
κ_0	0.26	0.27	0.33	0.48	0.74
r	0.16	0.11	0.12	0.13	0.18
		(-32.95)	*(-25.17)*	*(-18.07)*	*(14.45)*
w	0.57	0.62	0.61	0.60	0.56
		(8.33)	*(6.40)*	*(4.72)*	*(-2.12)*
Y	5.88	6.19	5.92	5.51	4.46
		(5.23)	*(0.69)*	*(-6.39)*	*(-24.24)*
K	4.87	5.81	5.38	4.85	3.47
		(19.32)	*(10.48)*	*(-0.35)*	*(-28.71)*
K_{low}	4.22	4.97	4.57	4.04	2.86
		(17.68)	*(8.16)*	*(-4.26)*	*(-32.31)*
K_{high}	6.37	7.76	7.26	6.73	4.89
		(21.88)	*(14.06)*	*(5.71)*	*(-23.12)*
LFP	78.98	83.49	81.92	77.02	69.17
		(4.51)	*(2.94)*	*(-1.96)*	*(-9.81)*
LFP_{low}	75.88	81.09	79.01	72.17	60.97
		(5.21)	*(3.13)*	*(-3.71)*	*(-14.91)*
LFP_{high}	86.21	89.10	88.70	88.32	88.31
		(2.89)	*(2.49)*	*(2.11)*	*(2.10)*
H	0.33	0.33	0.32	0.28	0.22
		(0.02)	*(-4.41)*	*(-15.59)*	*(-34.81)*
H_{low}	0.35	0.35	0.33	0.29	0.21
		(1.70)	*(-3.67)*	*(-17.47)*	*(-40.38)*
H_{high}	0.29	0.28	0.27	0.26	0.24
		(-4.61)	*(-6.44)*	*(-10.38)*	*(-19.38)*
C_1	1.19	1.19	1.17	1.13	1.02
		(0.12)	*(-1.68)*	*(-5.36)*	*(-14.68)*
$C_{1,low}$	1.07	1.07	1.06	1.03	0.95
		(-0.02)	*(-1.36)*	*(-4.16)*	*(-11.48)*
$C_{1,high}$	1.47	1.48	1.44	1.36	1.17
		(0.35)	*(-2.23)*	*(-7.39)*	*(-20.12)*
C_2	2.38	2.40	2.32	2.15	1.73
		(0.69)	*(-2.70)*	*(-9.62)*	*(-27.15)*
$C_{2,low}$	1.93	1.94	1.88	1.77	1.48
		(0.47)	*(-2.34)*	*(-8.19)*	*(-23.45)*
$C_{2,high}$	3.44	3.46	3.32	3.04	2.33
		(0.69)	*(-3.46)*	*(-11.75)*	*(-32.21)*
Δ		6.63	8.97	11.19	6.30
Δ_{low}		5.07	8.47	13.78	14.61
Δ_{high}		13.56	11.05	1.62	-18.22

Notice that replacing transfers with UBI of the same size does not require much change in the tax rate (27 percent instead of 26 percent in the benchmark), while more generous UBI requires substantial increases in the tax rate. For low levels of UBI the reforms increase output, driven by an increase both in capital and labor supply. However, more generous UBI implies substantial tax increases and lower output.

A small UBI, say of \$2,500, makes the system less progressive than in the benchmark. That disproportionately benefits the college households, who experience welfare gains equivalent to nearly 14 percent higher consumption (compared to 5 percent for non-college households). As we increase the generosity of UBI this result reverses.

One of the common concerns regarding UBI proposals is its potential effect on labor supply. In Figure 7 we report LFP, average hours worked and assets as a function of age. These results correspond to a reform that provides a UBI of \$2,500.

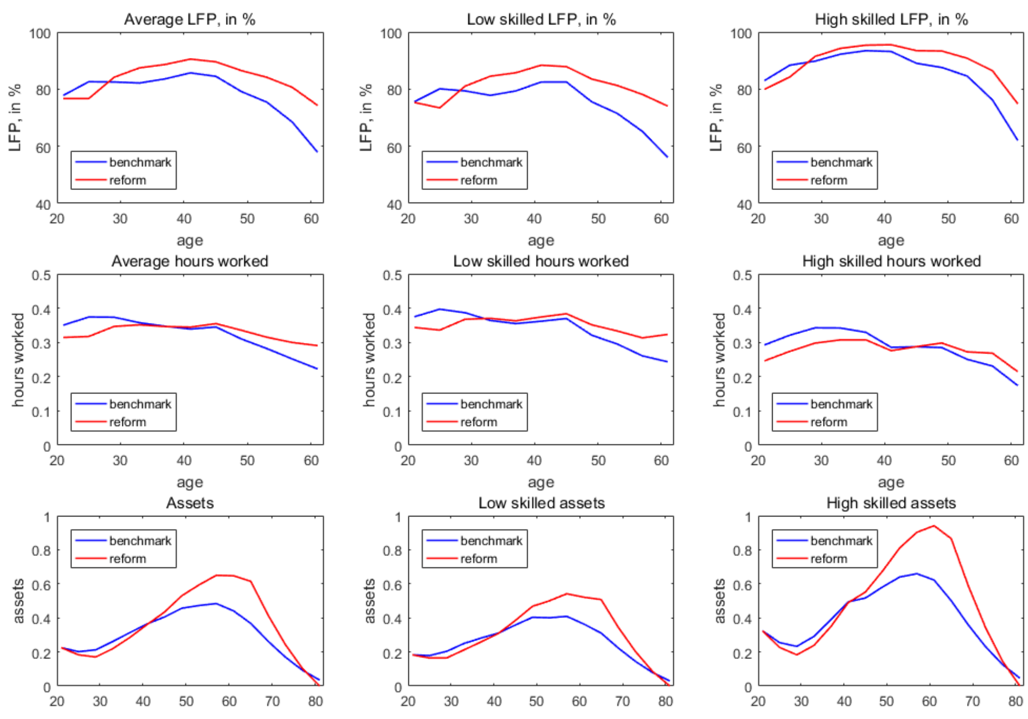


Figure 7: Labor force participation rate, hours worked and assets by skill and age

Our quantitative results suggest a substantial increase in labor supply, especially for non-college households. Notice that redistributing existing transfers to the entire population results in the individuals at the bottom of the income distribution receiving less transfers with UBI (a negative income effect), at the same time that distortions on working incentives are eliminated. As a result LFP increases, with the only exception of the very young households. In addition, hours worked shift from young to old age. Finally, because UBI is lower than pensions in the benchmark economy, savings and hence wealth increase substantially at old ages.

Of course, those results depend on the level of UBI. More generous UBI increases the income effect for everybody, while increasing the distortions on labor supply at the margin (through the increase in the marginal labor tax rate). Therefore, more generous UBI lowers the efficiency gains or even reverts them, mostly through a large negative impact on the labor supply of non-college households.

A flat income tax allows to lower the marginal tax rate on both capital and labor income. The results do not differ much from the ones we have discussed here, but the welfare gains are lower, especially for non-college households. This was to be expected since a flat income tax increases taxes paid at the bottom of the income distribution (in the benchmark they pay nearly no taxes).

We now turn to the discussion of more generous UBI proposals, that are only possible when financed through consumption taxes.

4.2 Financing UBI through consumption taxes

In order to discuss the feasibility of more generous UBI, we explore the impact of financing UBI with a consumption tax. Figure 6 shows that using a consumption tax allows for much more generous UBI. In particular, leaving the income tax as in the benchmark and introducing a uniform consumption tax, we can reach levels of UBI more generous than before. Welfare gains are also increasing in UBI generosity for non-college households and decreasing for college ones. Moreover, welfare gains become negative for college households if UBI is larger than $15,000. It is feasible to finance UBI much more generous than that, but those would come at the expense of welfare losses (relative to the benchmark) for college households.

Table 9 reports the macroeconomic impact of different levels of UBI financed through a uniform consumption tax. Of course, the consumption tax is increasing in the level of UBI, reaching levels above 100 percent slightly below $35,000 UBI. As was the case before, with low levels of UBI (up to $15,000) the economy experiences an increase in output, households work and save more, and both types of households benefit from the reform.

Table 9: Steady state, financing UBI through an additional flat consumption tax

	Benchmark	×1	×2	×6	×10	×14	×18	×22	×24
UBI		$2,500	$5,000	$15,000	$25,000	$35,000	$45,000	$55,000	$60,000
$\tau_{c1,c2}$	0.00	0.02	0.08	0.35	0.66	1.02	1.41	1.84	2.06
r	0.16	0.11	0.11	0.09	0.09	0.09	0.09	0.09	0.09
		(-33.79)	*(-33.87)*	*(-46.42)*	*(-46.35)*	*(-46.68)*	*(-46.40)*	*(-45.78)*	*(-45.43)*
w	0.57	0.62	0.62	0.64	0.64	0.64	0.64	0.64	0.64
		(8.54)	*(8.56)*	*(11.91)*	*(11.89)*	*(11.98)*	*(11.90)*	*(11.73)*	*(11.63)*
Y	5.88	6.24	6.12	5.94	5.60	5.28	5.02	4.79	4.69
		(6.10)	*(4.10)*	*(1.02)*	*(-4.75)*	*(-10.27)*	*(-14.71)*	*(-18.58)*	*(-20.22)*
K	4.87	5.87	5.77	5.91	5.57	5.25	4.99	4.75	4.64
		(20.63)	*(18.40)*	*(21.26)*	*(14.32)*	*(7.83)*	*(2.37)*	*(-2.54)*	*(-4.66)*
K_{low}	4.22	5.03	4.91	4.89	4.53	4.17	3.86	3.58	3.46
		(19.13)	*(16.31)*	*(15.97)*	*(7.29)*	*(-1.17)*	*(-8.47)*	*(-15.12)*	*(-18.05)*
K_{high}	6.37	7.85	7.77	8.27	7.99	7.77	7.61	7.46	7.41
		(23.27)	*(21.94)*	*(29.77)*	*(25.49)*	*(22.03)*	*(19.41)*	*(17.17)*	*(16.30)*
LFP	78.98	83.82	82.47	74.68	68.53	60.31	54.46	49.69	47.81
		(4.84)	*(3.49)*	*(-4.30)*	*(-10.45)*	*(-18.67)*	*(-24.52)*	*(-29.29)*	*(-31.17)*
LFP_{low}	75.88	81.46	79.63	68.60	60.01	48.30	40.15	33.48	30.97
		(5.58)	*(3.75)*	*(-7.28)*	*(-15.87)*	*(-27.58)*	*(-35.73)*	*(-42.40)*	*(-44.91)*
LFP_{high}	86.21	89.33	89.10	88.87	88.42	88.35	87.84	87.54	87.12
		(3.12)	*(2.89)*	*(2.66)*	*(2.21)*	*(2.14)*	*(1.63)*	*(1.33)*	*(0.91)*
H	0.33	0.33	0.32	0.28	0.24	0.20	0.18	0.16	0.15
		(0.71)	*(-2.72)*	*(-15.99)*	*(-26.72)*	*(-38.23)*	*(-45.66)*	*(-51.53)*	*(-53.79)*
H_{low}	0.35	0.35	0.34	0.28	0.23	0.18	0.15	0.12	0.11
		(2.44)	*(-1.78)*	*(-18.76)*	*(-32.39)*	*(-47.48)*	*(-57.06)*	*(-64.68)*	*(-67.53)*
H_{high}	0.29	0.28	0.28	0.27	0.26	0.25	0.25	0.25	0.25
		(-4.04)	*(-5.33)*	*(-8.32)*	*(-11.01)*	*(-12.61)*	*(-14.08)*	*(-15.11)*	*(-15.74)*
C_1	1.19	1.19	1.18	1.13	1.08	1.04	1.00	0.97	0.95
		(0.11)	*(-1.05)*	*(-3.92)*	*(-4.26)*	*(-4.31)*	*(-3.55)*	*(-3.16)*	*(-1.37)*
$C_{1,low}$	1.07	1.07	1.06	1.02	0.99	0.95	0.92	0.90	0.89
		(0.07)	*(-0.79)*	*(-3.32)*	*(-3.41)*	*(-3.76)*	*(-2.93)*	*(-2.61)*	*(-1.09)*
$C_{1,high}$	1.47	1.47	1.45	1.38	1.30	1.23	1.17	1.12	1.10
		(0.16)	*(-1.50)*	*(-4.93)*	*(-5.74)*	*(-5.28)*	*(-4.65)*	*(-4.16)*	*(-1.90)*
C_2	2.38	2.39	2.34	2.17	1.99	1.81	1.67	1.55	1.50
		(0.20)	*(-1.97)*	*(-7.41)*	*(-8.37)*	*(-8.83)*	*(-7.63)*	*(-7.09)*	*(-3.21)*
$C_{2,low}$	1.93	1.93	1.90	1.77	1.64	1.50	1.39	1.30	1.26
		(0.15)	*(-1.63)*	*(-6.97)*	*(-7.43)*	*(-8.55)*	*(-7.02)*	*(-6.52)*	*(-2.83)*
$C_{2,high}$	3.44	3.45	3.37	3.10	2.80	2.54	2.33	2.14	2.06
		(0.26)	*(-2.40)*	*(-7.98)*	*(-9.61)*	*(-9.22)*	*(-8.47)*	*(-7.89)*	*(-3.75)*
Δ		5.43	7.25	12.08	15.04	15.99	15.00	11.79	9.96
Δ_{low}		3.85	6.53	14.60	21.10	25.90	28.18	27.15	26.13
Δ_{high}		13.42	11.56	2.75	-4.69	-12.46	-19.30	-25.43	-28.11

When UBI becomes more generous, a much higher consumption tax is required and the tax burden falls primarily on college households. Additional average welfare gains are possible until reaching a UBI of $45,000, but those come at the cost of welfare losses for college households.

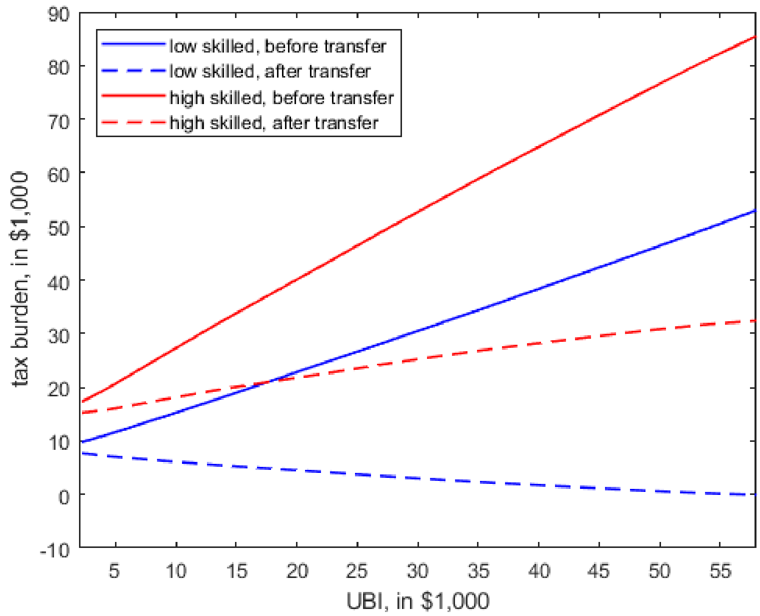


Figure 8: Tax burden before and after the UBI transfer by education level, in $1,000

Figure 8 presents the tax burden before and after the UBI transfer for the two types of households. Both college and non-college households pay more taxes the higher the level of UBI. However, in net terms, the tax-transfer burden is increasing for the college ones and decreasing for non-college households. This accounts for the direction of welfare changes. From the figure we also see that strong redistribution is associated with higher UBI and thus higher tax.

Following Conesa et al. (2020) we additionally explore the potential for progressive consumption taxes. The distinction between basic and non-basic consumption allows us to discuss the effect of a progressive consumption tax, which potentially further enhances redistribution.

Table 10: Steady state, financing UBI through an additional progressive consumption tax

	Benchmark	×1	×2	×6	×10	×14	×18	×22	×26
UBI		\$2,500	\$5,000	\$15,000	\$25,000	\$35,000	\$45,000	\$55,000	\$60,000
				Reform A					
τ_{c1}	0.00	-0.10	0.00	0.20	0.60	1.00	1.50	2.20	2.50
τ_{c2}	0.00	0.08	0.16	0.40	0.70	1.03	1.34	1.57	1.73
r	0.16	0.11	0.09	0.09	0.09	0.09	0.09	0.09	0.09
		(-34.18)	*(-46.57)*	*(-46.36)*	*(-46.58)*	*(-46.92)*	*(-46.81)*	*(-46.29)*	*(-45.81)*
w	0.57	0.62	0.64	0.64	0.64	0.64	0.64	0.64	0.64
		(8.59)	*(11.90)*	*(11.85)*	*(11.91)*	*(12.00)*	*(11.97)*	*(11.83)*	*(11.69)*
Y	5.88	6.19	6.37	5.90	5.59	5.27	5.03	4.88	4.79
		(5.30)	*(8.21)*	*(0.36)*	*(-5.05)*	*(-10.44)*	*(-14.46)*	*(-17.07)*	*(-18.66)*
K	4.87	5.84	6.33	5.86	5.55	5.25	5.01	4.84	4.74
		(19.85)	*(29.94)*	*(20.40)*	*(14.04)*	*(7.71)*	*(2.82)*	*(-0.54)*	*(-2.65)*
K_{low}	4.22	4.98	5.36	4.84	4.51	4.16	3.89	3.70	3.58
		(18.10)	*(27.05)*	*(14.75)*	*(6.91)*	*(-1.31)*	*(-7.80)*	*(-12.40)*	*(-15.26)*
K_{high}	6.37	7.83	8.58	8.25	7.99	7.77	7.61	7.52	7.46
		(22.88)	*(34.74)*	*(29.46)*	*(25.36)*	*(21.94)*	*(19.52)*	*(18.05)*	*(17.09)*
LFP	78.98	83.29	82.27	74.28	68.19	60.20	54.75	51.28	49.59
		(4.31)	*(3.29)*	*(-4.70)*	*(-10.79)*	*(-18.78)*	*(-24.23)*	*(-27.70)*	*(-29.39)*
LFP_{low}	75.88	80.78	79.09	68.06	59.52	48.14	40.57	35.73	33.32
		(4.90)	*(3.21)*	*(-7.82)*	*(-16.36)*	*(-27.74)*	*(-35.31)*	*(-40.15)*	*(-42.56)*
LFP_{high}	86.21	89.16	89.68	88.81	88.42	88.35	87.84	87.58	87.55
		(2.95)	*(3.47)*	*(2.60)*	*(2.21)*	*(2.14)*	*(1.63)*	*(1.37)*	*(1.34)*
H	0.33	0.33	0.32	0.27	0.24	0.20	0.18	0.17	0.16
		(-0.69)	*(-3.31)*	*(-17.04)*	*(-27.27)*	*(-38.43)*	*(-45.27)*	*(-49.45)*	*(-51.66)*
H_{low}	0.35	0.35	0.34	0.28	0.23	0.18	0.15	0.13	0.12
		(-0.34)	*(-3.78)*	*(-20.91)*	*(-33.81)*	*(-48.26)*	*(-57.00)*	*(-62.37)*	*(-65.23)*
H_{high}	0.29	0.28	0.28	0.27	0.26	0.25	0.25	0.25	0.25
		(-3.97)	*(-4.24)*	*(-8.04)*	*(-10.52)*	*(-12.17)*	*(-13.50)*	*(-14.24)*	*(-14.54)*
C_1	1.19	1.28	1.24	1.21	1.11	1.04	0.98	0.91	0.89
		(8.00)	*(4.75)*	*(2.12)*	*(-6.90)*	*(-12.33)*	*(-17.52)*	*(-23.37)*	*(-24.93)*
$C_{1,low}$	1.07	1.14	1.11	1.09	1.01	0.96	0.91	0.85	0.84
		(7.25)	*(4.43)*	*(2.41)*	*(-5.45)*	*(-10.32)*	*(-14.91)*	*(-20.17)*	*(-21.55)*
$C_{1,high}$	1.47	1.61	1.55	1.49	1.33	1.24	1.15	1.05	1.02
		(9.27)	*(5.32)*	*(1.66)*	*(-9.34)*	*(-15.72)*	*(-21.93)*	*(-28.79)*	*(-30.64)*
C_2	2.38	2.28	2.33	2.06	1.95	1.80	1.71	1.67	1.63
		(-4.34)	*(-2.07)*	*(-13.55)*	*(-18.17)*	*(-24.28)*	*(-28.39)*	*(-29.99)*	*(-31.73)*
$C_{2,low}$	1.93	1.85	1.89	1.68	1.61	1.49	1.42	1.39	1.36
		(-4.26)	*(-1.81)*	*(-12.71)*	*(-16.68)*	*(-22.66)*	*(-26.46)*	*(-27.70)*	*(-29.32)*
$C_{2,high}$	3.44	3.29	3.36	2.94	2.75	2.53	2.38	2.31	2.24
		(-4.44)	*(-2.42)*	*(-14.66)*	*(-20.12)*	*(-26.38)*	*(-30.92)*	*(-32.98)*	*(-34.87)*
Δ		6.43	7.71	12.26	14.99	16.07	15.13	12.87	11.11
Δ_{low}		5.13	7.30	15.20	21.23	26.00	28.01	27.54	26.49
Δ_{high}		12.15	9.45	1.54	-5.18	-12.42	-18.67	-23.49	-26.04

Table 10 shows that when UBI is relatively small, the progressivity in consumption taxes is large.[4] As UBI increases the preferred progressivity of consumption taxes decreases. Over the range of our experiments, non-college households prefer a progressive consumption tax

[4]Each column in this table presents the optimal combination of consumption taxes for a given level of UBI.

than a flat tax when the redistribution from UBI is small, but a flat tax when UBI is large enough. This is exactly the opposite for college households. Overall, though, the additional welfare gains that progressive consumption taxes can potentially generate are quite small. And also the conclusions regarding the generosity of UBI are unaffected.

We will further compare the implications of some of those reforms. In particular, we label “Reform A” the option of financing UBI with progressive consumption taxes leaving income taxes unchanged. This reform is interesting because it is the largest level of UBI for which both types of households experience welfare gains.

4.3 A more comprehensive fiscal reform

Lastly, we consider a comprehensive fiscal reform that removes the current income taxes completely and uses consumption taxes alone to finance government consumption and different levels of UBI. There is a long tradition in public finance discussing the pros and cons of consumption taxes over income taxes. It is widely believed that consumption taxes can improve efficiency at the cost of lower redistribution (see, among many others, Hall and Rabushka (1995), Krusell et al. (1996), Ventura (1999), Altig et al. (2001),Correia (2010) or Conesa et al. (2020)). In this section, we explore whether this type of reform, in addition to UBI, can generate much better welfare and efficiency outcomes.

Figure 6 shows that using consumption taxes alone decreases the welfare gains for non-college households, while it increases the welfare gains of college ones, as compared to using consumption taxes but keeping income taxes unchanged. This was to be expected since switching to consumption taxes alone increases the tax burden of non-college households who pay few income taxes.

This comprehensive reform promotes capital accumulation via the elimination of capital income taxes. This generates a much larger response of relative prices, increasing wage rates. Because of the lower tax burden and the higher wages, college households are able to experience welfare gains over a wider range of UBI. As a result more generous UBI (up to $25,000) is compatible with welfare gains for both types of households. We label this reform(financing UBI of $25,000 with a progressive consumption tax) as ”Reform B” for further comparison.

Table 11: Steady state, financing UBI through a flat consumption tax only

	Benchmark	×1	×2	×6	×10	×14	×18	×22	×24
UBI		$2,500	$5,000	$15,000	$25,000	$35,000	$45,000	$55,000	$60,000
$\tau_{c1,c2}$	0.00	0.32	0.38	0.63	0.92	1.25	1.60	1.98	2.17
r	0.16	0.05	0.05	0.03	0.03	0.04	0.04	0.04	0.04
		(-70.31)	*(-69.99)*	*(-78.71)*	*(-78.26)*	*(-78.11)*	*(-77.77)*	*(-77.36)*	*(-76.90)*
w	0.57	0.68	0.68	0.70	0.69	0.69	0.69	0.69	0.69
		(19.12)	*(19.02)*	*(22.01)*	*(21.85)*	*(21.80)*	*(21.67)*	*(21.53)*	*(21.37)*
Y	5.88	6.92	6.82	6.74	6.40	6.09	5.82	5.58	5.49
		(17.64)	*(16.06)*	*(14.61)*	*(8.86)*	*(3.64)*	*(-0.98)*	*(-5.05)*	*(-6.65)*
K	4.87	7.69	7.57	7.81	7.40	7.04	6.72	6.43	6.30
		(57.82)	*(55.42)*	*(60.41)*	*(52.01)*	*(44.60)*	*(37.91)*	*(31.98)*	*(29.44)*
K_{low}	4.22	6.62	6.49	6.55	6.11	5.71	5.33	5.00	4.86
		(56.79)	*(53.85)*	*(55.18)*	*(44.73)*	*(35.25)*	*(26.32)*	*(18.51)*	*(15.14)*
K_{high}	6.37	10.18	10.08	10.76	10.42	10.16	9.95	9.75	9.68
		(59.83)	*(58.26)*	*(68.91)*	*(63.65)*	*(59.44)*	*(56.19)*	*(53.14)*	*(51.88)*
LFP	78.98	84.47	83.49	78.90	73.30	66.74	60.86	56.01	54.55
		(5.49)	*(4.51)*	*(-0.08)*	*(-5.68)*	*(-12.24)*	*(-18.12)*	*(-22.97)*	*(-24.43)*
LFP_{low}	75.88	82.01	80.69	74.04	66.20	57.00	48.75	41.87	39.88
		(6.13)	*(4.81)*	*(-1.84)*	*(-9.68)*	*(-18.88)*	*(-27.13)*	*(-34.01)*	*(-36.00)*
LFP_{high}	86.21	90.22	90.05	90.23	89.87	89.47	89.13	89.01	88.79
		(4.01)	*(3.84)*	*(4.02)*	*(3.66)*	*(3.26)*	*(2.92)*	*(2.80)*	*(2.58)*
H	0.33	0.34	0.33	0.30	0.27	0.24	0.21	0.19	0.18
		(2.85)	*(0.46)*	*(-8.81)*	*(-18.29)*	*(-28.17)*	*(-36.38)*	*(-42.77)*	*(-44.79)*
H_{low}	0.35	0.36	0.35	0.31	0.27	0.23	0.19	0.16	0.15
		(3.73)	*(0.80)*	*(-11.01)*	*(-22.98)*	*(-35.66)*	*(-46.24)*	*(-54.52)*	*(-57.00)*
H_{high}	0.29	0.28	0.28	0.28	0.27	0.26	0.26	0.26	0.26
		(-1.97)	*(-2.79)*	*(-4.72)*	*(-6.97)*	*(-8.72)*	*(-10.05)*	*(-11.01)*	*(-11.66)*
C_1	1.19	1.21	1.20	1.17	1.13	1.09	1.05	1.02	1.01
		(2.30)	*(1.29)*	*(-1.57)*	*(-5.22)*	*(-8.59)*	*(-11.52)*	*(-14.10)*	*(-15.06)*
$C_{1,low}$	1.07	1.09	1.08	1.05	1.02	0.99	0.96	0.94	0.93
		(1.83)	*(1.05)*	*(-1.27)*	*(-4.36)*	*(-7.31)*	*(-9.85)*	*(-12.08)*	*(-12.80)*
$C_{1,high}$	1.47	1.51	1.49	1.44	1.37	1.31	1.26	1.21	1.19
		(3.11)	*(1.71)*	*(-2.07)*	*(-6.65)*	*(-10.75)*	*(-14.35)*	*(-17.52)*	*(-18.88)*
C_2	2.38	2.48	2.44	2.31	2.15	2.00	1.87	1.75	1.71
		(4.31)	*(2.43)*	*(-2.93)*	*(-9.78)*	*(-16.11)*	*(-21.60)*	*(-26.44)*	*(-28.24)*
$C_{2,low}$	1.93	2.00	1.97	1.88	1.75	1.63	1.53	1.44	1.41
		(3.80)	*(2.19)*	*(-2.63)*	*(-9.08)*	*(-15.22)*	*(-20.50)*	*(-25.14)*	*(-26.64)*
$C_{2,high}$	3.44	3.61	3.54	3.33	3.07	2.85	2.65	2.47	2.40
		(4.99)	*(2.74)*	*(-3.32)*	*(-10.69)*	*(-17.26)*	*(-23.05)*	*(-28.14)*	*(-30.32)*
Δ		6.37	7.46	10.59	13.98	15.99	17.11	16.85	16.44
Δ_{low}		4.18	5.75	11.37	17.40	22.26	26.36	28.80	29.50
Δ_{high}		16.47	15.19	7.48	1.74	-4.27	-10.07	-15.54	-17.79

Table 12: Steady state, financing UBI through a progressive consumption tax only

	Benchmark	$\times$1	$\times$2	$\times$6	$\times$10	$\times$14	$\times$18	$\times$22	$\times$26
UBI		$2,500	$5,000	$15,000	$25,000	$35,000	$45,000	$55,000	$60,000
					Reform B		Reform C		
τ_{c1}	0.00	0.10	0.20	0.40	0.80	1.10	1.50	2.10	2.30
τ_{c2}	0.00	0.45	0.49	0.78	1.00	1.35	1.67	1.90	2.09
r	0.16	0.05	0.05	0.03	0.03	0.04	0.04	0.04	0.04
		(-70.05)	*(-70.03)*	*(-78.42)*	*(-78.27)*	*(-78.00)*	*(-77.69)*	*(-77.34)*	*(-76.98)*
w	0.57	0.68	0.68	0.69	0.69	0.69	0.69	0.69	0.69
		(19.04)	*(19.03)*	*(21.91)*	*(21.85)*	*(21.76)*	*(21.65)*	*(21.53)*	*(21.40)*
Y	5.88	6.87	6.78	6.68	6.37	6.06	5.80	5.61	5.51
		(16.78)	*(15.22)*	*(13.53)*	*(8.38)*	*(3.11)*	*(-1.29)*	*(-4.51)*	*(-6.23)*
K	4.87	7.62	7.52	7.73	7.37	7.00	6.69	6.46	6.33
		(56.45)	*(54.34)*	*(58.66)*	*(51.34)*	*(43.78)*	*(37.43)*	*(32.71)*	*(30.08)*
K_{low}	4.22	6.54	6.43	6.45	6.07	5.66	5.30	5.04	4.90
		(54.96)	*(52.40)*	*(52.74)*	*(43.92)*	*(34.15)*	*(25.66)*	*(19.44)*	*(16.04)*
K_{high}	6.37	10.14	10.05	10.72	10.40	10.13	9.94	9.78	9.69
		(59.15)	*(57.75)*	*(68.23)*	*(63.20)*	*(59.04)*	*(55.97)*	*(53.55)*	*(52.12)*
LFP	78.98	83.92	82.56	77.96	72.59	66.25	60.56	56.61	54.87
		(4.94)	*(3.58)*	*(-1.02)*	*(-6.39)*	*(-12.73)*	*(-18.42)*	*(-22.37)*	*(-24.11)*
LFP_{low}	75.88	81.24	79.40	72.70	65.18	56.37	48.36	42.72	40.31
		(5.36)	*(3.52)*	*(-3.18)*	*(-10.70)*	*(-19.51)*	*(-27.52)*	*(-33.16)*	*(-35.57)*
LFP_{high}	86.21	90.18	89.94	90.23	89.87	89.32	89.04	89.00	88.84
		(3.97)	*(3.73)*	*(4.02)*	*(3.66)*	*(3.11)*	*(2.83)*	*(2.79)*	*(2.63)*
H	0.33	0.33	0.33	0.30	0.27	0.23	0.21	0.19	0.18
		(1.42)	*(-1.01)*	*(-10.50)*	*(-19.26)*	*(-28.96)*	*(-36.78)*	*(-41.94)*	*(-44.29)*
H_{low}	0.35	0.36	0.35	0.30	0.27	0.22	0.19	0.16	0.15
		(1.91)	*(-1.07)*	*(-13.20)*	*(-24.23)*	*(-36.65)*	*(-46.74)*	*(-53.42)*	*(-56.39)*
H_{high}	0.29	0.28	0.28	0.28	0.27	0.26	0.26	0.26	0.26
		(-2.29)	*(-3.11)*	*(-4.97)*	*(-7.11)*	*(-8.94)*	*(-10.19)*	*(-10.96)*	*(-11.50)*
C_1	1.19	1.36	1.31	1.28	1.17	1.13	1.07	1.00	0.99
		(14.72)	*(10.41)*	*(8.19)*	*(-1.42)*	*(-4.91)*	*(-9.52)*	*(-15.86)*	*(-16.84)*
$C_{1,low}$	1.07	1.21	1.17	1.15	1.06	1.03	0.98	0.92	0.91
		(13.08)	*(9.25)*	*(7.58)*	*(-0.90)*	*(-3.91)*	*(-7.99)*	*(-13.68)*	*(-14.47)*
$C_{1,high}$	1.47	1.73	1.65	1.61	1.44	1.37	1.29	1.18	1.16
		(17.52)	*(12.37)*	*(9.24)*	*(-2.29)*	*(-6.58)*	*(-12.11)*	*(-19.54)*	*(-20.85)*
C_2	2.38	2.31	2.30	2.16	2.08	1.93	1.83	1.79	1.74
		(-3.20)	*(-3.51)*	*(-9.40)*	*(-12.50)*	*(-18.76)*	*(-23.11)*	*(-24.79)*	*(-26.82)*
$C_{2,low}$	1.93	1.86	1.86	1.75	1.70	1.58	1.50	1.48	1.44
		(-3.49)	*(-3.72)*	*(-9.08)*	*(-11.80)*	*(-17.82)*	*(-21.97)*	*(-23.44)*	*(-25.25)*
$C_{2,high}$	3.44	3.35	3.33	3.10	2.98	2.75	2.59	2.53	2.45
		(-2.81)	*(-3.23)*	*(-9.82)*	*(-13.42)*	*(-19.99)*	*(-24.61)*	*(-26.56)*	*(-28.85)*
Δ		6.75	8.00	11.04	14.08	15.94	17.13	17.02	16.84
Δ_{low}		4.96	6.57	12.38	17.78	22.51	26.64	28.73	29.82
Δ_{high}		14.82	13.96	5.82	1.01	-5.10	-10.59	-14.93	-17.32

Table 11 and Table 12 show that average welfare is maximized at a UBI of $45,000 when financed with consumption taxes only, with the progressive consumption tax resulting in a slightly higher welfare gain. Even though this reform would generate substantial welfare losses for the college educated, we report in detail its distributional and welfare impact since it is illustrative of the impact of more generous UBI reforms. We label it "Reform C", and we will compare its implications with "Reform A" (UBI of $15,000 keeping income taxes unchanged) and "Reform B" (UBI of $25,000 eliminating income taxes).

Table 13 reports the distributional impact of reforms A, B and C, relative to the data and the benchmark economy. The three reforms would increase the degree of inequality both in earnings and wealth. However, they do not necessarily imply a worse distribution of consumption. In fact, quite the opposite, the Gini coefficient on both types of consumption goods is lower than that in the benchmark economy. At the same time, such reforms also shifts hours worked from low skilled households to high skilled ones, resulting in an increased Gini index of working hours. This is especially true for Reform C, that provides a much more generous level of UBI.

Table 13: Distribution of earning, wealth, consumption and hours in optimal reform, in %

	Gini	Bottom%			quintile					Top%		
		1	[1, 5]	[6, 10]	Q1	Q2	Q3	Q4	Q5	[91, 95]	[96, 99]	[99, 100]
						Earnings						
Data	0.48	0.00	0.00	0.00	0.06	9.28	18.20	25.04	47.41	11.00	11.85	9.11
Benchmark	0.50	0.00	0.00	0.00	0.00	8.84	16.30	23.85	51.01	11.74	13.89	8.55
Reform A	0.55	0.00	0.00	0.00	0.00	5.81	15.30	23.84	55.05	12.56	14.83	9.77
Reform B	0.56	0.00	0.00	0.00	0.00	5.34	15.13	24.00	55.53	12.71	15.02	9.74
Reform C	0.63	0.00	0.00	0.00	0.00	0.16	14.11	24.76	60.97	13.95	16.69	10.90
						Wealth						
Data	0.78	-0.22	-0.04	0.00	-0.22	1.33	5.25	13.45	80.19	14.11	25.67	25.79
Benchmark	0.61	0.00	0.00	0.00	0.30	3.90	11.00	22.61	62.19	14.37	18.28	9.85
Reform A	0.63	0.00	0.00	0.00	0.00	3.15	10.27	23.29	63.29	15.33	18.09	9.36
Reform B	0.65	0.00	0.00	0.00	0.00	2.77	9.37	22.45	65.41	15.79	19.32	9.66
Reform C	0.68	0.00	0.00	0.00	0.00	1.79	8.09	20.95	69.17	16.63	21.00	10.76
						C_1						
Data	0.25	0.25	1.46	2.35	9.72	14.29	18.02	22.58	35.38	8.69	8.90	3.49
Benchmark	0.14	0.66	2.83	3.61	14.84	16.65	18.52	21.22	28.79	7.12	6.52	2.60
Reform A	0.13	0.63	2.66	3.72	14.74	16.90	18.82	21.37	28.16	7.00	6.28	2.35
Reform B	0.13	0.63	2.78	4.25	14.84	16.96	18.87	21.40	27.93	7.00	6.17	2.25
Reform C	0.12	0.21	3.25	3.72	15.18	17.45	19.10	21.29	26.97	6.83	5.88	2.09
						C_2						
Data	0.40	0.06	0.62	1.15	4.98	10.18	15.96	23.64	45.25	11.08	12.07	4.99
Benchmark	0.26	0.35	1.78	2.45	10.29	13.74	17.20	22.29	36.48	8.96	8.82	3.91
Reform A	0.24	0.33	1.69	2.51	10.31	14.30	17.82	22.54	35.03	8.68	8.28	3.40
Reform B	0.25	0.30	1.72	2.86	10.18	14.25	17.86	22.65	35.06	8.80	8.21	3.28
Reform C	0.24	0.22	1.76	2.19	10.05	14.72	18.14	22.67	34.41	8.72	8.00	3.14
						Hours worked						
Data	0.31	0.00	0.00	0.00	0.85	17.70	23.73	24.29	33.43	8.65	7.85	3.32
Benchmark	0.30	0.00	0.00	0.00	0.00	17.65	23.94	28.08	30.33	7.60	6.24	1.96
Reform A	0.34	0.00	0.00	0.00	0.00	13.69	24.37	28.23	33.71	8.84	6.77	2.22
Reform B	0.35	0.00	0.00	0.00	0.00	12.26	24.77	28.78	34.19	8.58	6.83	2.26
Reform C	0.46	0.00	0.00	0.00	0.00	0.47	26.14	33.06	40.33	10.17	8.51	2.77

In all our analysis we have taken the change in lifetime welfare of newborns as the criterion for welfare comparisons. In Figure 9 we report welfare gains relative to the benchmark for all households depending on age, skill, productivity, and assets. This figure suggests that welfare gains are concentrated in the young and middle age of low productivity and wealth. In contrast, the old and wealthy experience very large welfare losses because the interest rate is very low and consumption taxes are high.

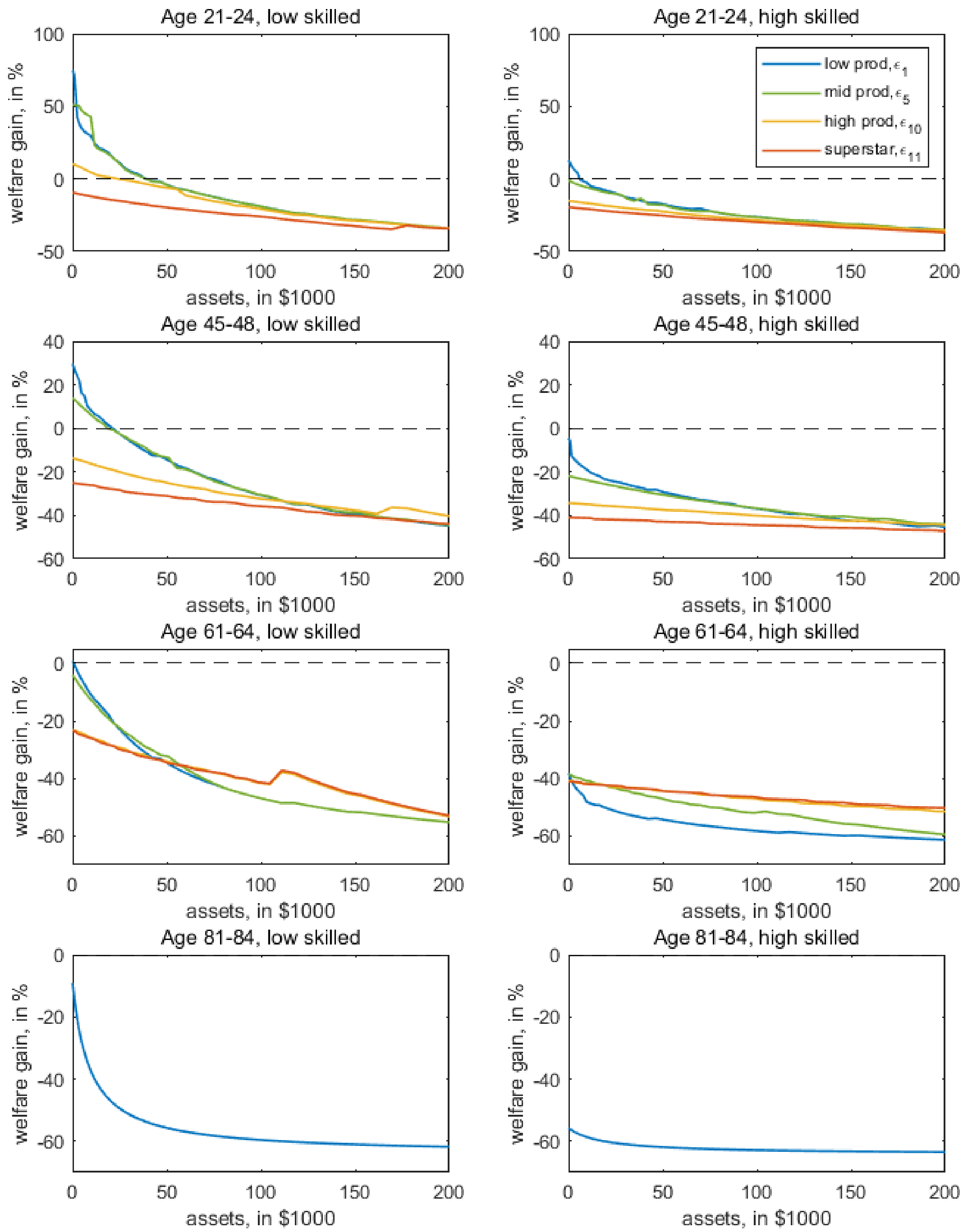


Figure 9: Steady state welfare gain by age, skill, productivity and asset, in %

The welfare changes we have reported suggest that gaining support for such reforms would be problematic. In order to explore this idea in more detail, we compute the transitional dynamics associated with all three reforms and evaluate the welfare implications for the initial cohorts of the benchmark economy at the moment each of the reforms is announced and implemented.

5 The analysis of transitional dynamics

In this section, we discuss the implications of the transitional dynamics of a reform that imposes on impact the optimal tax on basic goods, and we let the tax on non-basic goods adjust period by period to balance the government budget.

Figure 10 plots the transitional paths of selected aggregate variables of the three reforms we consider. In all these reforms, the tax rates on non-basic consumption shoot up immediately with the reform, depressing C_1 and C_2 with different magnitudes. The larger the consumption taxes, the bigger the initial drop in consumption. The sudden switch to a generous UBI system also discourages labor market activity, and LFP and hours worked drop. Reform C provides the most generous UBI, and as a consequence it generates the largest impact on labor markets.

Capital accumulation increases in the long run for different reasons. In Reform A capital accumulation mainly comes from the middle to old aged groups in order to support retirement. Reforms B and C, in addition, increase capital because of the elimination of income taxes. This impact is the largest for Reform B, with a less generous UBI. As aggregate capital gradually increases to the steady state level, consumption and output increase, and the consumption tax rate on non-basic consumption declines.

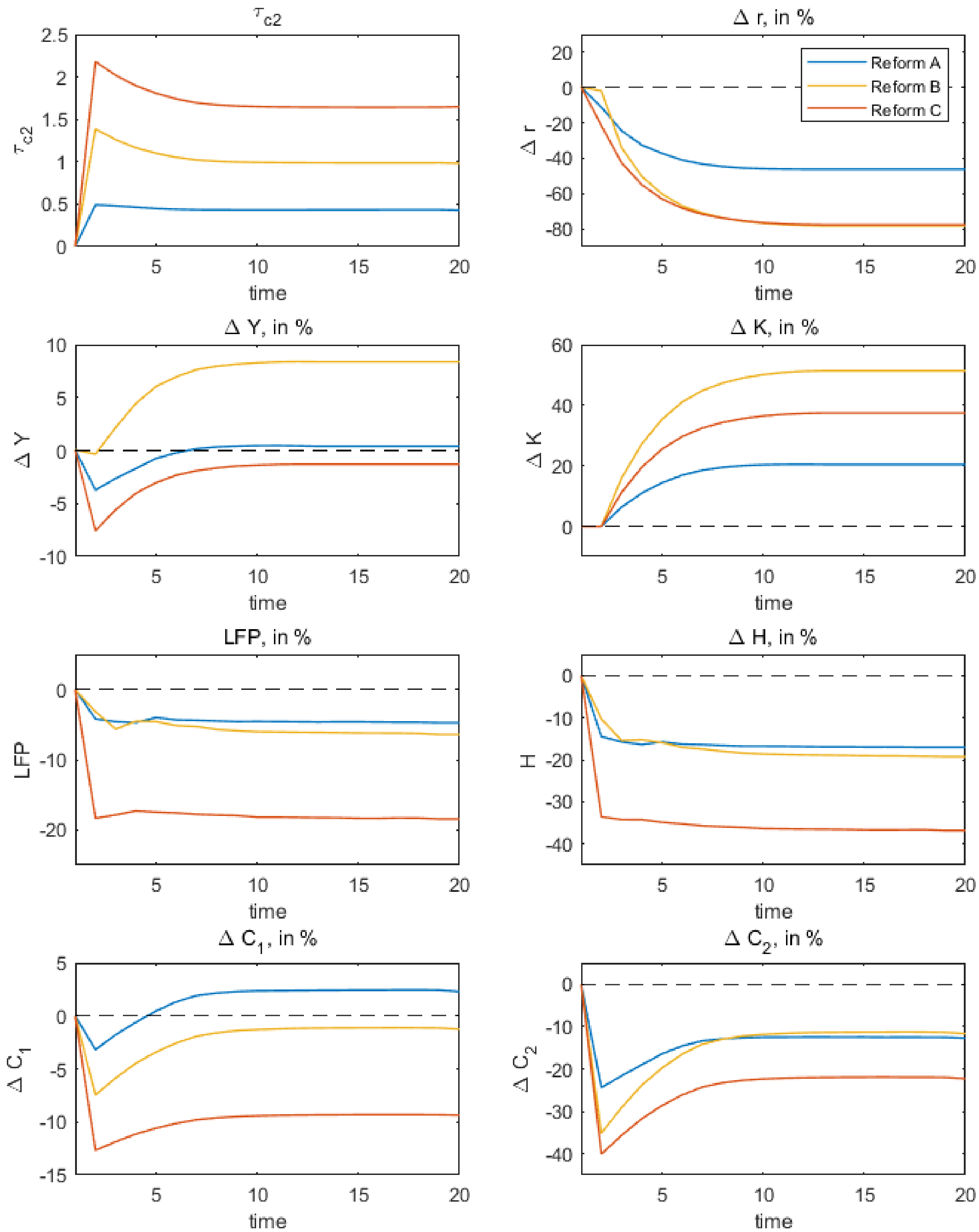


Figure 10: Transition path

In Table 14 we report the fraction of households who experience welfare gains for the

Table 14: Fraction experiencing welfare gains by skill and productivity, in %

Efficiency	θ_1	θ_2	θ_3	θ_4	θ_5	θ_6	θ_7	θ_8	θ_9	θ_{10}	θ_{11}	ave
Reform A												
Non-college	31.78	31.60	31.85	33.36	36.86	23.37	19.45	12.70	13.79	9.06	0.00	24.87
College	23.17	21.42	15.26	15.06	7.49	8.24	7.78	7.80	0.00	0.00	0.00	9.70
Reform B												
Non-college	29.48	25.75	25.40	25.68	31.83	17.22	13.55	8.28	9.11	9.06	0.00	19.48
College	0.00	4.62	2.78	4.46	2.28	0.00	0.00	0.00	0.00	0.00	0.00	1.49
Reform C												
Non-college	41.83	38.97	35.05	36.28	34.44	19.35	12.42	8.28	7.61	8.17	0.00	22.55
College	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

three reforms we consider. It is clear that more generous UBI (reforms B and C) only generate welfare gains for some of the non-college households (those with lowest productivity realizations). In contrast, a small UBI keeping income taxes unchanged (Reform A) is the reform that generates the widest possible support, with almost 25 percent of non-college households and nearly 10 percent of college households experiencing welfare gains. Two aspects contribute to this result. First, Reform A involves lower tax rates, and thus less of a tax burden on college households. Second, college households have accumulated a substantial amount of assets, and the drop in the return to capital is smaller in Reform A.

In order to further understand the impact of Reform A, we report a more disaggregated portrait of the welfare changes in Figure 11. We see that welfare changes for the initial cohorts along the transition especially favor the young with low productivity and fewer assets. In contrast, the middle age and the old experience substantial welfare losses that are increasing in wealth.

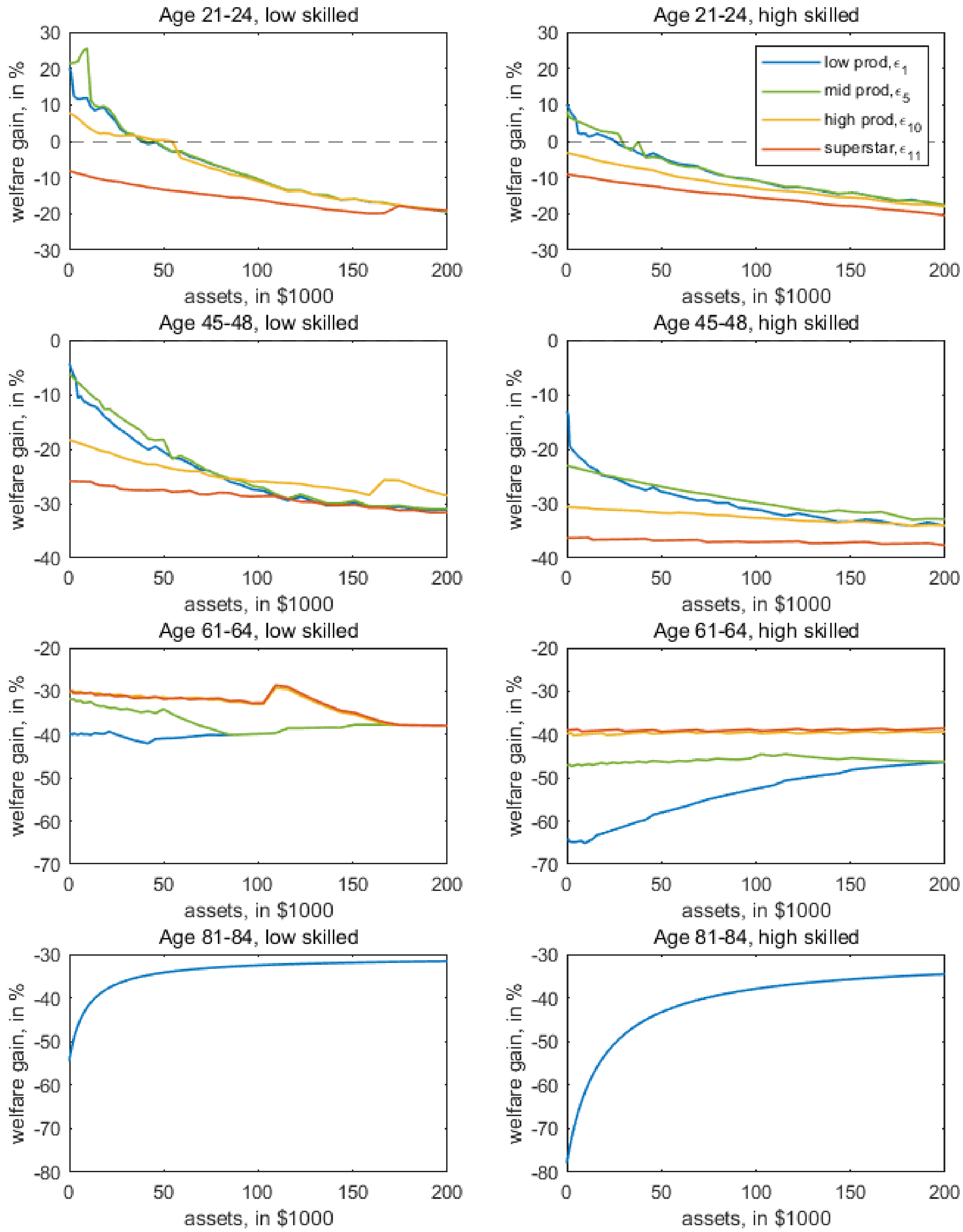


Figure 11: Transitional welfare gain by age, skill, productivity and asset

6 Conclusion

Advocates for UBI argue that there are multiple gains from eliminating the complex and inefficient existing network of welfare programs. Our results provide mixed partial support for such a view. It is possible to find levels of UBI and a financing scheme that would generate gains in terms of the expected welfare of individuals entering the labor market in the long run. However, the computation of the transitional dynamics suggest that almost all of the initial generations would lose in such a reform.

In the steady state analysis, we find that for relatively small levels of UBI it is possible (and even desirable) to finance government outlays with the existing income tax schedule, adjusting the highest marginal tax rates to balance the budget. More generous UBI schemes are also possible, and in fact more desirable from the perspective of non-college newborns, but those would require high consumption taxes to finance them, have a large negative impact on the labor supply decisions of non-college households, and might result in negative welfare impact for college households (for very generous UBI levels).

In the transitional dynamics we find that the type of reform that generates the largest fraction of people experiencing welfare gains is one with moderate UBI (around $15,000) keeping income taxes unchanged. Still, this type of reform falls substantially short in generating welfare gains for a majority of households. More generous UBI reforms perform even worse in terms of potential support from current cohorts.

Our analysis has focused on the distortions for labor and savings decisions inherent in means-tested welfare programs, but we have abstracted from a wide range of issues that are also part of the debate. We abstract from the discussion regarding new technologies and their impact on employment opportunities for the less skilled. Also, we do not include in the analysis the administrative costs of existing welfare programs and the potential savings of UBI along this margin. Another potential margin is that in frictional labor markets UBI would change the incentives to search for and retain jobs.

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