Welfare Implications of Switching to Consumption Taxation

Working Paper 2018-09

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August 29, 2018

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August 29, 2018

Abstract

We evaluate a reform of the US tax system switching to consumption taxation instead of income taxation. We do so in an environment that allows for progressivity of consumption taxes through differential tax rates between basic and non-basic consumption goods. The optimal tax system involves substantial subsidies to the consumption of basic goods. We find large efficiency gains in the long run, with a very small increase in inequality. However, once we consider the transitional dynamics associated to the reform, only very low productivity households and a handful of high productivity low wealth households experience welfare gains.

Keywords: Incomplete market, Heterogeneous agents, Consumption tax, Differential consumption, Transition dynamics

JEL classification: E2 , D52, H21

1 Introduction

Switching to a tax system based on consumption taxation is often advocated on the grounds of higher economic efficiency. We evaluate the welfare and macroeconomic implications of switching from income taxation to a system that exclusively relies on consumption taxation. In our analysis we distinguish between basic consumption goods, that are subject to a consumption floor, and the rest of consumption goods.

The standard argument in favor of a move towards increasing the reliance on indirect taxation is made on the grounds of efficiency considerations. The argument is that flat consumption taxes that are constant over time are less distortionary than the currently existing income tax code. While this is widely acknowledged among academic economists, it is usually perceived as a policy that increases inequality and reduces the progressivity of the tax system as a whole. We contribute to that literature by quantifying the impact of such reforms in an environment that accounts for differences in expenditure shares depending on earnings as observed in the data. While it is true that inequality would increase in the long run, the magnitudes are not that large. Our results, instead, highlight the importance of the large and widespread welfare losses associated to the transition generated by a reform switching from income to consumption taxation.

In order to perform this policy exercise we use a standard Huggett [1996] and Aiyagari [1994] type of model, with endogenous labor supply. The crucial departure of our analysis is the distinction between two types of consumption goods. In order to discipline this choice, we look at the expenditure shares relative to labor earnings. We follow the criterion of defining basic goods as those for which their expenditure share is decreasing in labor earnings. Based on this criterion we label as basic goods food at home, rent, utilities, prescription medicine, television and books. All other expenditure categories are labeled as non-basic consumption goods.

Table 1 reports expenditure shares as a function of earnings quintiles from the Consumer Expenditure Survey (CEX) 2015 (see Section 2 for details of the procedure to define the two consumption categories). We observe that the share of expenditure in basic goods (labeled as C_1 in Table 1) is around 37-57 percent at the bottom of the earnings distribution, while it falls to less than 15 percent at the top. We carefully calibrate our economy to be consistent with both the observed distribution of earnings and the relationship between earnings and consumption shares across the two types of goods.

In an international comparison we observe that consumption taxes in the US are relatively low, especially when compared to most European economies. The Value Added Tax (VAT) in most European economies is above 20 percent and accounts for a substantial fraction of fiscal revenues, often close to the revenue generated by personal income taxes. In contrast, in the US sales taxes depend on the states and are subject to substantial differences in tax rates.

It is however a common feature to levy different tax rates on different types of consumption goods. Most notably, in the US grocery foods are exempted in 31 states of 46 states that have a

Table 1

Composition of consumption between basic goods (C_1) an the rest (C_2) depending on earnings, in %

	Bottom %			quintile					Top %		
	1	[1, 5]	[6, 10]	Q1	Q2	Q3	Q4	Q5	[91, 95]	[96, 99]	[99, 100]
C_1	46.17	56.22	37.09	41.03	35.98	28.64	22.25	16.61	16.89	14.39	13.39
C_2	53.83	43.78	62.91	58.97	64.02	71.36	77.75	83.39	83.11	85.61	86.61

Notes: Test

state sales tax. Medical services and medicine are universally exempted. In contrast, clothing is exempted in only eight states, and the exemption does not apply to sport goods. A similar pattern emerges in Europe, where many goods are considered basic and therefore are subject to reduced rates. Our category of basic goods overlaps to a large extent with the categories that are exempt or subject to reduced rates in most tax systems around the world.

Our results also suggest a strong rational for the widespread practice of taxing different goods at different rates. In fact, in the optimal tax structure our quantitative results suggest that basic goods should be heavily subsidized (a tax of -22%), with a corresponding tax rate for non-basic goods of 53.6%. In contrast, if we were to impose equal rates across consumption goods, we would obtain a tax of 26.8%.

Even though the long-run increase in efficiency is associated with a very small increase in inequality, still such a reform might be undesirable for most of the population. We perform an exercise where we eliminate income taxes, fix the tax on basic goods and adjust only the tax on non-basic goods along the transition to satisfy the government budget constraint period by period. Such a reform implies that only the very poorest of households gain from such a reform, while a handful of super productive but wealth poor households also experience welfare gains. In contrast, the rest of the population experience welfare losses (that are increasing in wealth holdings). Overall, only ten percent of the population in the benchmark economy are better off with the reform.

There is a long tradition advocating for expenditure taxation instead of income taxation that goes back to at least Kaldor [1955]. In the recent literature, quantitative macroeconomic models similar to ours have been used to quantify the impact of different types of reforms. Exercises quantifying the macroeconomic impact and inequality implications of consumption taxation, flat-tax reforms in the spirit of Hall and Rabushka [1995], or other similar reforms such as negative income taxes, can be found in Krusell et al. [1996], Ventura [1999], Altig et al. [2001], Correia [2010], or Lopez-Daneri [2016], among others.

None of the standard papers in that literature distinguish across different types of consumption goods, and to our knowledge only Lopez-Daneri [2016] also incorporates into the analysis the distribution of transfers as a function of income. For us this is a key ingredient of the analysis, since transfers at the lower end of the income distribution play a key role in allowing individuals to meet the subsistence levels of basic consumption goods. The importance of transfers is highlighted also by the analysis in Correia [2010].

The rest of the paper is structured as follows. Section 2 describes the empirical facts of the exiting consumption tax systems and consumption pattern in the US. Section 3 describes the model and the calibration strategy. The numerical experiments are carried out in Section 4. We first present the steady state results, then the transition dynamics. Section 5 concludes.

2 Empirical Facts on consumption taxation and the composition of consumption

2.1 The Structure of Consumption Taxation

In the US, Pennsylvania was the first state to introduce a sales tax in 1921. Around half of the states introduced their own sales taxes during the 1920s and 1930s, and the rest of them introduced them in the period between the late 1940s and the 1960s. The exception are the states that still have not introduced sales taxes as of today: Alaska, Delaware, Montana, New Hampshire, and Oregon.

Most of the states apply reduced tax rates and exemptions on different categories. Grocery food is exempted in 31 out of 46 states that have sales taxes, and subject to reduced rates in the other states. Medical prescriptions are exempted in 42 states, and there are usually exemptions on newspapers and periodicals, and several services including transportation. The average tax ranges from 4 percent in Alabama to 7.5 percent in California.

In contrast to the US, many countries use a Value Added Tax (VAT) system. VAT is a broad-based tax on consumption by households, that taxes the sale to the final consumer through a staged payment process along the supply chain. Firms collect VAT (and pay it to the tax authority) on their sale revenues net of the VAT on the cost of their purchases of inputs and intermediate goods.

The VAT was first introduced in 1954 and is currently in place in 160 out of 193 countries in the world. All of the European Union members and the rest of OECD countries except the US implement a VAT tax. VAT has become an increasingly larger component of GDP and government revenues. For example, in the OECD countries VAT as a percentage of GDP increased from an average 0.6% in 1965 to 6.8% in 2014. Moreover, VAT was only 2.2% of the OECD total tax revenue in 1965, and in 2014 20.1% of the tax revenue is collected through VAT. For the European Union members, VAT collects 7% of GDP (17% of the total tax revenue) in 2014.

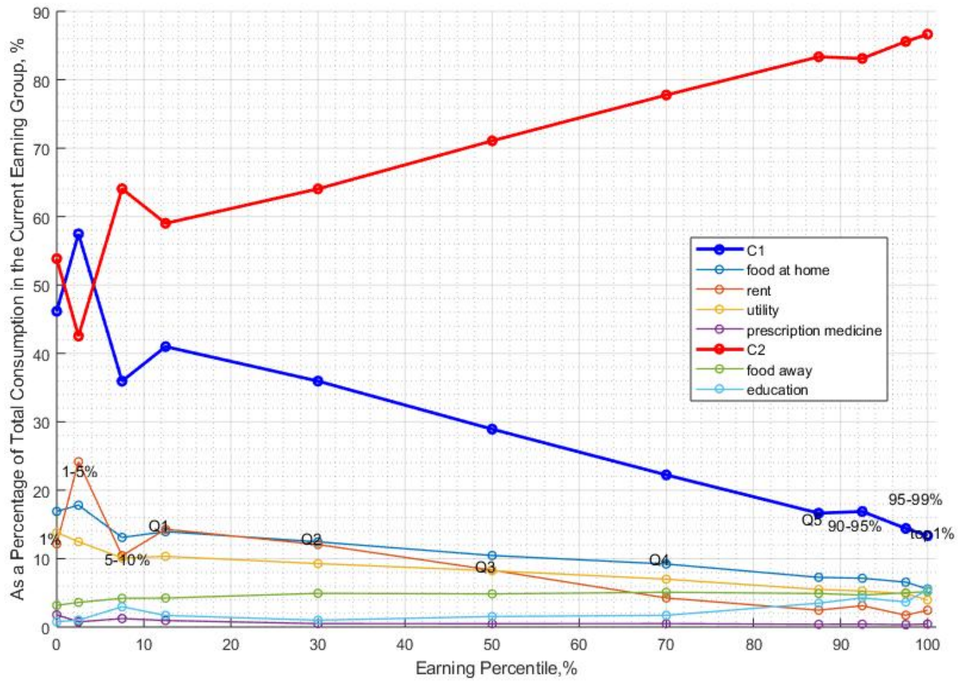
Similar to sales taxes in US states, the VAT consists of a standard tax rate, together with several categories of reduced rates and exemptions. The standard VAT rates vary across countries. Worldwide, the tax rate ranges from 4.5% in Andorra to as high as 27% in Hungary. Within the OECD the average rate was 19.2% in 2014. EU member states are bound by common rules that set the minimum level of the standard rate at 15%. The average VAT rate of EU member states is 21.7%. Moreover, the standard VAT rates are also evolving over time.

More than half of the OECD countries apply reduced tax rates or exemption on categories like food at home, pharmaceutical products, medical and dental care, transportation, hotel accommodation, books newspapers and periodicals, admission to cultural events, supply of water and social services.

2.2 Consumption patterns in the CEX

In order to determine the distinction between basic goods and non-basic goods we look at the composition of consumption in relation to income in the CEX 2015. The consumer unit is one household, the expenditure profile is constructed according to labor earnings. We restrict our sample to households whose household head is between 21 and 65 years old and belongs to labor force. We categorize consumption into two groups: We consider basic goods those categories for which their share in total consumption decreases with earnings; all other categories are characterize as non-basic consumption.

See Figure 1 for the relationship between expenditure shares and earnings for the largest categories of consumption in the CEX.



Notes: test

Figure 1

Examples of C_1 and C_2

The group with a declining consumption share as earnings increase takes up 46.2% of total consumption for the bottom 1% earners and only consists of 13.4% of total consumption of the top 1% earners. The specific categories included are food at home, rent payments, utilities, prescription medicine, television programs and books. Those are the categories we consider in our definition of basic goods, as in Table 1. Notice there is a substantial overlap between those categories and the goods that are usually subject to either reduced rates or exemptions from taxation.

The share of food at home and utilities declines the most with earnings: from 16.9% and 13.8% for the bottom 1 percent earners, to 5.6% and 4.0% for the top 1 percent, respectively. Rent payments also appear to decrease rapidly with earnings, but with the highest share in the bottom 5%. On the other hand, expenses on food away from home and education (another two large categories in aggregate consumption) exhibit increasing patterns with earnings.

3 The Benchmark Economy

3.1 Description of The Model

The model builds on the Huggett [1993] and Aiyagari [1994] tradition, with endogenous labor supply and a government sector. The government sector uses income taxes to finance a given level of government consumption, and provides households with transfers conditional on their labor earnings. The government budget balances period by period.

The economy is populated with a continuum (with measure 1) of infinitely lived households, who differ in asset holdings a, and their stochastic labor efficiency ϵ. Each period, besides their labor and capital income, households also receive government transfer tr, which are conditional on earnings. Households divide their income between consumption on necessities c_1, other consumption goods c_2, and the amount of assets to be carried over to the next period. We assume that c_1 is subject to a minimum consumption level, denoted by $\underline{c}$.

Households solve the following maximization problem:

$$V(a,\epsilon) = \max_{c_1,c_2,l,a'} \{u(c_1,c_2,l) + \beta V(a',\epsilon')\} \tag{1}$$

subject to

$$c_1 + c_2 + a' = (1+r)a + w\epsilon l + tr(w\epsilon l) - tax_a - tax_w - tax_c \tag{2}$$

$$c_1 \geq \underline{c} \tag{3}$$

$$c_2 \geq 0 \tag{4}$$

$$a' \geq 0 \tag{5}$$

$$0 \leq l \leq 1 \tag{6}$$

$$\epsilon' = Q(\epsilon) \tag{7}$$

where tax_a, tax_w and tax_c denotes the capital income, the labor income and the consumption tax, respectively.

The labor efficiency ϵ is assumed to follow a first order Markov process, denoted by $Q(\cdot)$, and is the only source of uncertainty.

The representative firm uses capital K and efficiency units of labor L, and takes equilibrium prices as given. Capital depreciates at rate δ. The firm's maximization problem yields

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

$$w = AF_L(K,L).$$

We assume a balanced budget period-by-period, so that total tax revenues must equal all government outlays. The government budget constraint is then:

$$Tax_c + Tax_a + Tax_w = Tr + G$$

Equilibrium: Given fiscal policy functions tax_a, tax_w, tax_c, a transfer function tr, and a level of government consumption G, a stationary equilibrium is defined as a pair of prices $\{r, w\}$, household value function $V(a, \epsilon)$ and policy functions $\{c_1(a, \epsilon), c_2(a, \epsilon), l(a, \epsilon), a'(a, \epsilon)\}$, aggregate variables $\{C_1, C_2, K, L\}$, and a distribution $\mu(a, \epsilon)$ such that:

1. Given the prices and fiscal functions, $\{c_1(a, \epsilon), c_2(a, \epsilon), l(a, \epsilon), a'(a, \epsilon)\}$ solve the households maximization problem (1), subject to constraints (2) to (7).

2. Firms behave optimally:

$$\begin{aligned} r &= F_1(K, L) - \delta \\ w &= F_2(K, L); \end{aligned}$$

3. The goods market clears:

$$\begin{aligned} C_1 + C_2 + \delta K + G &= F(K, L) \\ C_1 &= \int_{A \times E} c_1(a, \epsilon) d\mu(a, \epsilon) \\ C_2 &= \int_{A \times E} c_2(a, \epsilon) d\mu(a, \epsilon) \\ K &= \int_{A \times E} a d\mu(a, \epsilon); \end{aligned}$$

4. The labor market clears:

$$L = \int_{A \times E} \epsilon l(a, \epsilon) d\mu(a, \epsilon)$$

5. The government budget constraint is satisfied:

$$
\begin{aligned}
Tax_a + Tax_c + Tax_w &= Tr + G \\
Tax_a &= \int_{A \times E} tax_a(ra) d\mu(a, \epsilon) \\
Tax_c &= \int_{A \times E} tax_c(c(a, \epsilon)) d\mu(a, \epsilon) \\
Tax_w &= \int_{A \times E} tax_w(w \epsilon l(a, \epsilon)) d\mu(a, \epsilon) \\
Tr &= \int_{A \times E} tr(w \epsilon l(a, \epsilon)) d\mu(a, \epsilon)
\end{aligned}
$$

6. The distribution evolves according to the Markovian transition rule and households decision rules:

$$\mu(a', \epsilon') = \mu(a, \epsilon) Q(\epsilon, \epsilon') I(a' = a'(a, \epsilon))$$

where $Q(\epsilon, \epsilon')$ is the Markov transition matrix and $I(a' = a'(a, \epsilon))$ is an indicator function that takes value 1 it the expression inside is true and 0 otherwise.

3.2 Calibration

This section describes the calibration strategy. Some of the parameters are determined outside of the model, while others are jointly determined in equilibrium.

The elasticity of intertemporal substitution and the Frisch labor supply elasticity are fixed from the literature. Technology parameters are directly measured from national accounts data. Finally, tax, government consumption and transfer policy are directly obtained from data. All other parameters are jointly determined in equilibrium to target selected data moments.

Table 2

Parameters calibrated outside the model

Parameter	Description	Value
α	Capital share of output	0.330
δ	Capital depreciation rate	0.059
σ	Curvature in utility of cons	1.000
ξ	Frisch Labor Supply Elasticity	0.750
τ_a	Capital income tax	0.400
κ_0	Marginal tax rate	0.414
κ_1	Progressivity	0.888
μ_1	Welfare transfers	2.042
μ_2	Welfare transfers	2.723
μ_3	Welfare transfers	2.349
μ_4	Welfare transfers	4.186
μ_5	Welfare transfers	3.737
μ_6	Welfare transfers	1.005
μ_7	Welfare transfers	0.712

3.2.1 Preferences

The utility function is

$$u(c_1, c_2, l) = \frac{((c_1 - \underline{c})^{\gamma} c_2^{1-\gamma})^{1-\sigma}}{1-\sigma} - B\frac{l^{1+\frac{1}{\chi}}}{1+\frac{1}{\chi}}$$

We set σ equal to 1. Following Chetty et al. [2012], we set the Frisch elasticity of aggregate hours to $\chi = 0.75$. The rest of preference parameters are jointly determined in equilibrium.

The minimum consumption $\underline{c}$ is determined to capture the decreasing share of basic consumption in total consumption. Specifically, we choose $\underline{c}$ to target the $\frac{c_1(Q_1)/c_2(Q_1)}{c_1(Q_5)/c_2(Q_5)}$, where $c_j(Q_i)$ means the consumption of good c_j by the i^{th} earnings quintile. The share of basic consumption, γ, is fixed to match the average shares of the distribution of consumption.

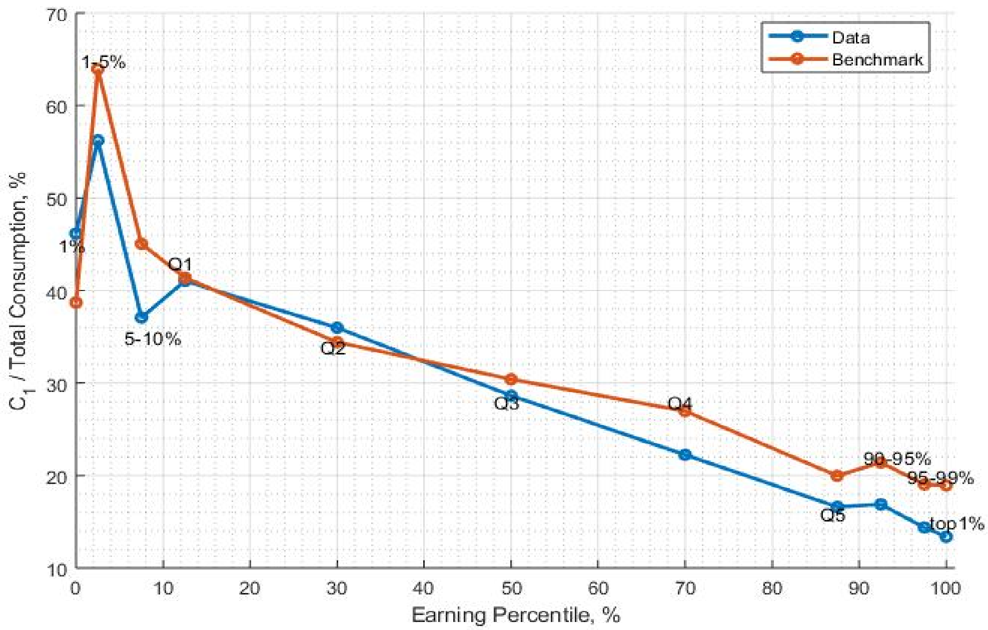


Figure 2

C_1 as percentage of total consumption

Figure 2 shows the fit of the model to the data. The model generates a pattern of the ratio between C_1 and total C as a function of earnings that is roughly consistent with the data.

Finally, B is calibrated such that average hours worked are one third of available time.

3.2.2 Earning process

We use the same strategy to calibrate the earnings process as in Kindermann and Krueger [2014] or Conesa et al. [2017]. This strategy proposes a "normal" productivity process (with 5 states) that follows the typical dynamics of a Markov process consistent with variance and persistence observed in earnings data, enriched with a "super-star" productivity state that is calibrated to be very large relative to the normal process, is infrequent, and has very little persistence.

Productivity processes like this have been shown to generate well the degree of high concentration at the top of the earnings distribution, which is something difficult to achieve with only the "normal" process. See Table 4 for the details of such a procedure.

3.2.3 Technology

The production function is assumed to be Cobb-Douglas, with a capital income share of 0.33. The 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.

3.2.4 Fiscal policy

Without lose of generality, 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:

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

where $y = w\epsilon l$ 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 $\kappa_1 = 0.888$. κ_2 is calibrated to match the total government spending to GDP ratio of 20%.

At the benchmark, we assume no consumption tax, since our exercise concerns switching the federal revenue collection to consumption taxes.

The government provides a variety of mean-tested welfare programs to help families with low income and protect them against hardship. 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.

From all available sources, we calculate the spending of the largest welfare programs, their proportions in total federal outlays and in total GDP, constructed from the White House Office of Management and Budget Historical tables.

The largest welfare programs are 1. Medicaid (7.3% in the total federal outlays); 2. UI (1.8%); 3. SNAP (1.6%); 4. Housing Assistance (1.5%); 5. Earned Income Tax Credit (1.5%); 6. SSI (1.4%); 7. TANF (0.8%); 8. Children's Nutrition Program (0.5%); 9. Child Tax Credit (0.5%); 10. 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%, on average over the period 1997 to 2016. Hence we fix transfers to 17.4% of total government outlays. For the distribution of the welfare transfer, we use PSID as the main data source and CEX and MEPS as supplement.

PSID is a thorough survey on households' income sources. Moreover, PSID also keeps records on welfare transfers, like food stamps (TANF), SSI, energy assistance and unemployment compensation, etc. To our knowledge, PSID is the dataset that includes most of the welfare programs. [1] However, 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 in CEX, we only include households from PSID and MEPS whose head of household is between 21 and 65 years old and belongs to labor force.

Because of the differences in data samples, survey frequency and survey questions, there are several inconsistencies in the outcomes. For example, the average earnings in MEPS is roughly 80% the averge 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 predetermined parameters are shown in Table 2. We choose a piece-wise linear function to describe the welfare transfers as a function of earnings. That is

$$\begin{aligned} tr = (&\mu_1 I_{y \in bottom1} + \mu_2 I_{y \in bottom1-5} + \mu_3 I_{y \in bottom5-10} \\ &+ \mu_4 I_{y \in Q1} + \mu_5 I_{y \in Q2} + \mu_6 I_{y \in Q3} + \mu_7 I_{y \in Q4} + \mu_8 I_{y \in Q5}) \times Tr \end{aligned}$$

where I is an indicator that takes value 1 if the criterion is satisfied, y denotes labor earnings, and Tr is the total amount of welfare transfers.

We take $\{\mu_i\}_{i=1}^7$ from the data and adjust μ_8 such that the total welfare transfer takes up 17.4% of the government spending.

[1] SSIP also cover many of the welfare transfers, and even more detailed programs than PSID. However, most of these survey questions do not disclose the actual amount that households receive, but rather whether they receive it.

Table 3

Parameters calibrated in equilibrium

Parameter	Description	Target	Value
B		Average hour=1/3	12.000
β	Discount factor	$K/Y = 3.3$	0.948
$\underline{c}$	minimum consumption	$\frac{C_1(Q_1)/C_2(Q_1)}{C_1(Q_5)/C_2(Q_5)} = 2.0$	0.140
γ	Necessity share in total consumption	$(C_1 - \bar{c})/C_2 = 0.2$	0.150
σ_s	Variance	earning gini $= 0.63$	8.000
σ_{s1}	Variance	C_1/Con as a function of earning percentile	2.000
ϵ_{top}	Productivity at the top	earning share at top 1% $= 0.148$	24.000
π_{top}	Probability at the top	earning share at top 10% $= 0.435$	0.006
ρ_{norm}	Persistence at the bottom	2-year earning persistence at bottom 80% $= 0.94$	0.901
ρ_{top}	Persistence at the top	2-year earning persistence at top 1% $= 0.58$	0.775
κ_2	labor tax	government revenue $= 0.2$ GDP	0.40
μ_8		$Tr/G = 17.38\%$	0.406

The ratios and distribution we explicitly calibrated to are shown in Table 4. We can see that the model generates a distribution of earnings that matches fairly well with the data, except that the Gini of earnings is slightly larger in the model. The welfare transfers match the data almost perfectly. Of course, this is attributable to the piece-wise linear function we assumed for the transfer function.

Table 5 reports the equilibrium distribution of wealth and tax burden. Note that we do not use these statistics for calibration purposes. We observe that the model falls short of generating as much concentration of wealth as in the data, while the equilibrium distribution of the tax burden in the benchmark model is closer to its data counterpart.

Table 4

Distribution of earning, consumption and welfare transfer, in %

	Gini	Bottom%			quintile					Top%		
		1	[1, 5]	[6, 10]	Q1	Q2	Q3	Q4	Q5	[91, 95]	[96, 99]	[99, 100]
						Earning						
Data	0.648	-0.0598	0	0	-0.0598	2.752	11.054	21.738	64.515	13.329	17.663	15.316
Model	0.649	0.0114	0.0951	0.2236	1.186	4.562	7.868	14.213	72.171	14.693	20.028	13.224
						Necessity Consumption C_1						
data	0.266	0.6842	2.681	4.251	16.073	18.575	20.099	21.172	24.081	6.352	5.403	1.537
Model	0.254	0.7087	2.237	3.235	11.192	16.626	18.205	19.097	34.880	7.410	7.587	2.247
						Other Consumption C_2						
data	0.442	0.2765	0.7085	1.956	6.808	10.378	15.732	23.468	43.614	11.477	11.504	4.096
Model	0.514	0.4000	0.4499	1.407	5.652	11.294	14.841	18.436	49.777	9.792	11.497	3.427
						Welfare transfer, according to earning quintile						
data		1.747	9.474	9.768	41.000	28.478	13.266	10.433	6.597	1.284	0.7132	0.0663
Model		1.656	8.698	10.631	38.641	30.647	14.688	9.492	6.532	1.660	1.172	0.3336

Table 5

Distribution of wealth and tax burden, in %

	Gini	Bottom %			quintile					Top %		
		1	[1, 5]	[6, 10]	Q1	Q2	Q3	Q4	Q5	[91, 95]	[96, 99]	[99, 100]
						Wealth						
Data	0.781	-0.219	-0.0376	0.00046	-0.219	1.333	5.249	13.447	80.189	14.107	25.674	25.794
Model	0.6286	0.0	0.1876	0.2160	1.795	2.602	6.553	24.494	64.556	14.523	22.641	5.302
						Tax burden						
Data	0.798	-0.00331	-0.0357	-0.229	-1.040	0.608	7.791	20.768	71.873	16.608	23.533	12.011
Model	0.7216	0.206	0.1195	0.6323	2.316	4.680	6.253	9.961	76.790	13.433	22.378	15.871

4 Numerical Experiments

In this section, we perform a series of experiments that replace income taxes with consumption taxes. The post reform budget constraint for households becomes

$$(1+\tau_{c1})c_1 + (1+\tau_{c2})c_2 + a' = (1+r)a + w\epsilon l + tr(w\epsilon l)$$

The way we proceed is as follows. We first present the steady state results and then discuss the welfare effects along the transition paths. For the steady state results, we fix the tax rate on basic goods τ_{c1} on a given grid of points, and then we let the tax rate on the rest of consumption τ_{c2} adjust to balance the government budget. We obtain a different equilibrium for each value on the grid of basic good taxation.

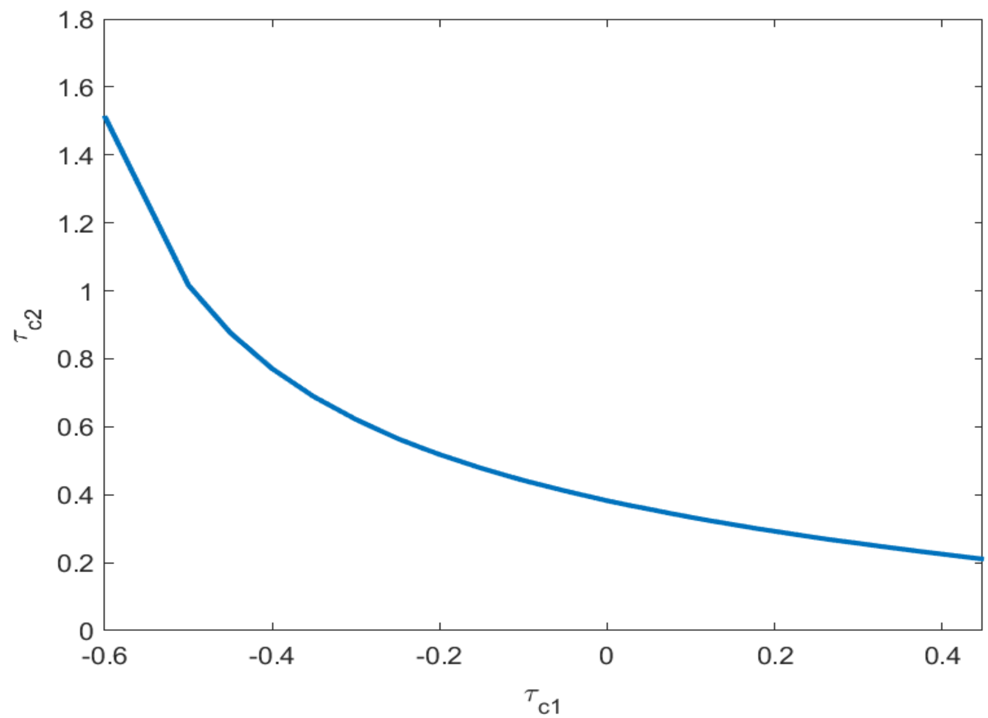


Figure 3

Consumption Taxes

Figure 3 plots the value of taxation of non-basic consumption goods that corresponds to each value of taxation of basic goods in the stationary equilibrium.

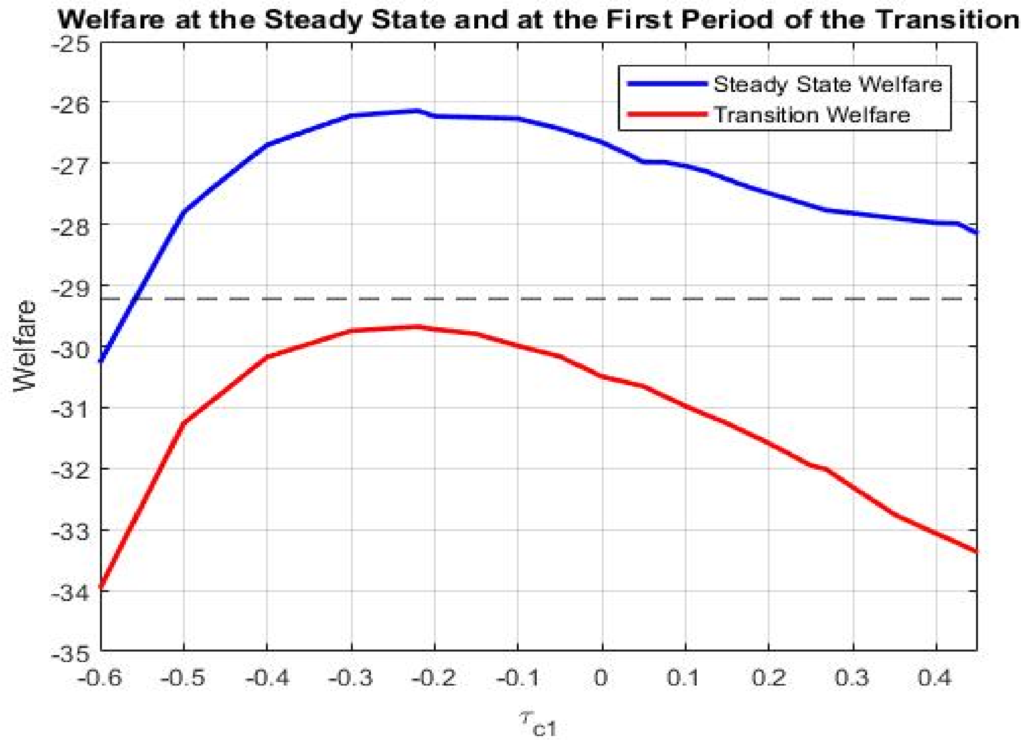


Figure 4

Welfare

Figure 4 plots average welfare associated to each posible value of basic goods taxation. We report both average welfare in the stationary equilibrium, and along the transition. For this second case we impose the tax on basic goods, then let the tax on non-basic goods adjust along the transition to satisfy the government budget constraint, and we report the average welfare over the initial distribution of households in the benchmark economy. Notice that a subsidy on basic consumption goods, ($\tau_{c1} = -0.22$), achieves the highest average welfare both in the stationary equilibrium and in the transition exercise.

4.1 Steady State analysis

Table 6 shows the steady state results for the benchmark economy and three experiments. The first experiment, labeled as "Optimal", corresponds to the policy that generates the highest average social welfare in the stationary equilibrium. That happens for a subsidy on basic goods of 22% and a tax on other consumption goods of 53.6%.

The second experiment we report, labeled as $\tau_{c1} = \tau_{c2}$, corresponds to a policy exercise where we constraint taxes to be equal across the two consumption categories. The corresponding value is a tax rate of 26.8%. Finally, we report the case $\tau_{c1} = 0$, which would attain the highest possible welfare if you do not allow for subsidies. This last exercise implies a taxation of 38.2% of non-basic consumption goods.

Table 6

Steady state aggregates

Parameter	Benchmark	Optimal	$\tau_{c1} = \tau_{c2}$	$\tau_{c1} = 0$
τ_{c1}	0.0	-0.220	0.268	0.0
τ_{c2}	0.0	0.5364	0.268	0.382
r	0.040	0.015	0.014	0.015
y	1.642	1.961	2.021	1.979
		(19.46%)	(23.08%)	(20.52%)
K	5.497	8.734	9.163	8.801
		(58.88%)	(66.68%)	(60.11%)
H	0.309	0.3000	0.326	0.311
		(-2.89%)	(5.47%)	(0.70%)
L	1.060	1.100	1.123	1.110
		(3.80%)	(6.02%)	(4.77%)
$earn$	1.100	1.314	1.353	1.326
		(19.41%)	(23.00%)	(20.50%)
$Con1$	0.277	0.410	0.302	0.348
		(47.97%)	(9.01%)	(25.65%)
$Con2$	0.778	0.778	0.920	0.854
		(-0.04%)	(18.20%)	(9.81%)
Wel	-29.22	-26.14	-27.77	-26.65
K/Y	3.348	4.453	4.534	4.448
C_1/C_2	0.356	0.528	0.329	0.408
$earn - top1$	13.223	13.700	13.400	13.629
$earn - top10$	47.945	49.510	48.838	50.052
$Gini_y$	0.649	0.664	0.660	0.666
$Gini_a$	0.629	0.680	0.669	0.694

All of the reforms we explore have a substantial gain in terms of production efficiency, with gains in output per capita ranging between 19.5% and 23.1%. All of the gains are driven by much larger capital accumulation, resulting in a substantial increase in the capital output ratio, and an increase in aggregate labor input in efficiency units.

While the effect on labor supply is mixed, and some individuals might end up working less (in the optimal reform the average individual works less), all of the reforms result in a substantial increase in aggregate labor input in efficiency units. The reason is that all the reforms increase the incentives to work for high productivity individuals.

In the "optimal" case, when we subsidize basic consumption goods, C_1 experiences an increase of 48.0%, while C_2 does not change. This is of course not the case in the other reforms.

All of the reforms we consider imply a moderate increase in inequality. In the optimal reform, the Gini coefficient on earnings goes up from 0.65 to 0.66, while that of wealth goes up from 0.63 to 0.68. The numbers do not change much in the two other reforms.

Table 7

Distribution of earning, wealth and tax burden, in %

	Gini	Bottom %			quintile					Top %		
		1	[1, 5]	[6, 10]	Q1	Q2	Q3	Q4	Q5	[91, 95]	[96, 99]	[99, 100]
							Earnings					
Data	0.648	-0.0598	0	0	-0.060	2.752	11.054	21.738	64.515	13.329	17.663	15.316
Benchmark	0.649	0.0114	0.0951	0.2236	1.186	4.562	7.868	14.213	72.171	14.693	20.028	13.224
Optimal	0.664	0.01	0.08	0.18	1.24	4.25	6.81	13.84	73.86	13.90	21.91	13.70
$\tau_{c1} = \tau_{c2}$	0.660	0.010	0.1171	0.2572	1.748	4.197	6.991	13.897	73.166	13.729	21.708	13.401
$\tau_{c1} = 0$	0.666	0.0093	0.1171	0.1976	1.596	4.108	6.748	13.800	73.748	14.621	21.802	13.627
							Wealth					
Data	0.781	-0.219	-0.0376	0.00046	-0.219	1.333	5.249	13.447	80.189	14.107	25.674	25.794
Benchmark	0.629	0.0	0.188	0.216	1.795	2.602	6.553	24.494	64.556	14.523	22.641	5.302
Optimal	0.680	0	0.1	0.23	1.04	1.57	4.85	23.81	68.74	16.30	20.48	9.02
$\tau_{c1} = \tau_{c2}$	0.669	0.0001	0.1280	0.1734	1.036	1.731	5.158	24.062	68.013	16.148	20.108	8.645
$\tau_{c1} = 0$	0.694	0	0.0590	0.0854	0.5617	0.8147	4.339	24.067	70.218	16.843	20.758	8.796
							C_1					
data	0.266	0.6842	2.681	4.251	16.073	18.575	20.099	21.172	24.081	6.352	5.403	1.537
Benchmark	0.254	0.7087	2.237	3.235	11.192	16.626	18.205	19.097	34.880	7.410	7.587	2.247
Optimal	0.353	0.54	1.67	2.48	9.93	15.92	14.80	19.14	40.21	8.32	9.17	3.04
$\tau_{c1} = \tau_{c2}$	0.295	0.6276	2.064	2.799	12.481	15.315	15.980	19.282	36.942	7.612	8.387	2.705
$\tau_{c1} = 0$	0.324	0.5918	1.933	2.506	11.679	15.124	15.482	19.166	38.549	8.279	8.774	2.851
							C_2					
data	0.442	0.2765	0.7085	1.956	6.808	10.378	15.732	23.468	43.614	11.477	11.504	4.096
Benchmark	0.513	0.4000	0.4499	1.407	5.652	11.294	14.841	18.436	49.777	9.792	11.497	3.427
Optimal	0.536	0.33	0.43	1.17	5.71	12.92	11.98	18.71	50.68	10.06	11.90	4.05
$\tau_{c1} = \tau_{c2}$	0.550	0.3080	0.4540	0.8450	5.993	11.367	12.387	18.687	51.566	9.954	12.254	4.092
$\tau_{c1} = 0$	0.542	0.3267	0.4083	0.9756	6.293	11.656	12.460	18.600	50.991	10.363	12.049	4.025
							Tax Burden					
Data	0.798	-0.00331	-0.0357	-0.229	-1.040	0.608	7.791	20.768	71.873	16.608	23.533	12.011
Benchmark	0.7216	0.2067	0.1195	0.6323	2.316	4.680	6.253	9.961	76.790	13.433	22.378	15.871
Optimal	0.590	0.27	0.09	0.80	4.54	12.09	11.21	18.58	53.58	10.54	12.66	4.32
$\tau_{c1} = \tau_{c2}$	0.487	0.3871	0.8523	1.329	7.598	12.343	13.276	18.834	47.948	9.375	11.297	3.749
$\tau_{c1} = 0$	0.542	0.3267	0.4083	0.9756	6.293	11.656	12.460	18.601	50.991	10.363	12.049	4.025

According to Table 7 the big changes in inequality occur in consumption. All of the reforms increase substantially the inequality in basic consumption, especially the optimal one, while the increase in inequality of non-basic consumption is much smaller. Finally, notice that all the reforms reduce the Gini coefficient of the tax burden, which means that the reforms reduce the degree of tax progressivity by lowering the concentration of the tax burden at the top of the distribution (the Gini drops from 0.72 in the benchmark to 0.59 in the "optimal" reform). This latter aspect is key for the welfare consequences of the reforms. All of the reforms we study transfer a substantial fraction of the tax burden from the top of the distribution to the rest of the distribution. While the top 1% pays 15.9% of the taxes in the benchmark (the top quintile pays 76.8% in the benchmark economy, compared to 71.9% in the data), in the case of the "optimal" reform the top 1% ends up paying 4.3% of the taxes (the top quintile pays 54.6% of the taxes). In contrast, the fourth (third) quintile goes from 10% (6.3%) in the benchmark to 18.6% (11.2%) in the "optimal" reform.

4.2 Transitional dynamics

We now turn to evaluating the transitional dynamics associated to the tax reforms we have been discussing. Figure 5 presents the transition paths of the optimal consumption tax, the zero basic consumption tax reform, and the flat reform. In these three reforms, we fix τ_{c1} and adjust τ_{c2} to balance the government budget period by period. On impact at the beginning of the reform τ_{c2} shoots up due to the still smaller tax base. As time goes by, capital is accumulated, leading consumption to raise and the tax base to expand. Consequently, τ_{c2} gradually falls until convergence to the new steady state levels. In all the reforms non-basic consumption C_2 is subject to higher tax rates than in the benchmark, so it falls below the benchmark level during the first several periods of the transition. This pattern is also observed in C_1 in the flat reform for the same reason.

The distribution of the welfare impact of the optimal reform is shown in Figure 6. This figure displays the welfare gain (in wealth equivalent) on impact of the optimal reform, by asset level and labor efficiency. The figure shows that the reform only favors households at the extremes of the productivity distribution.

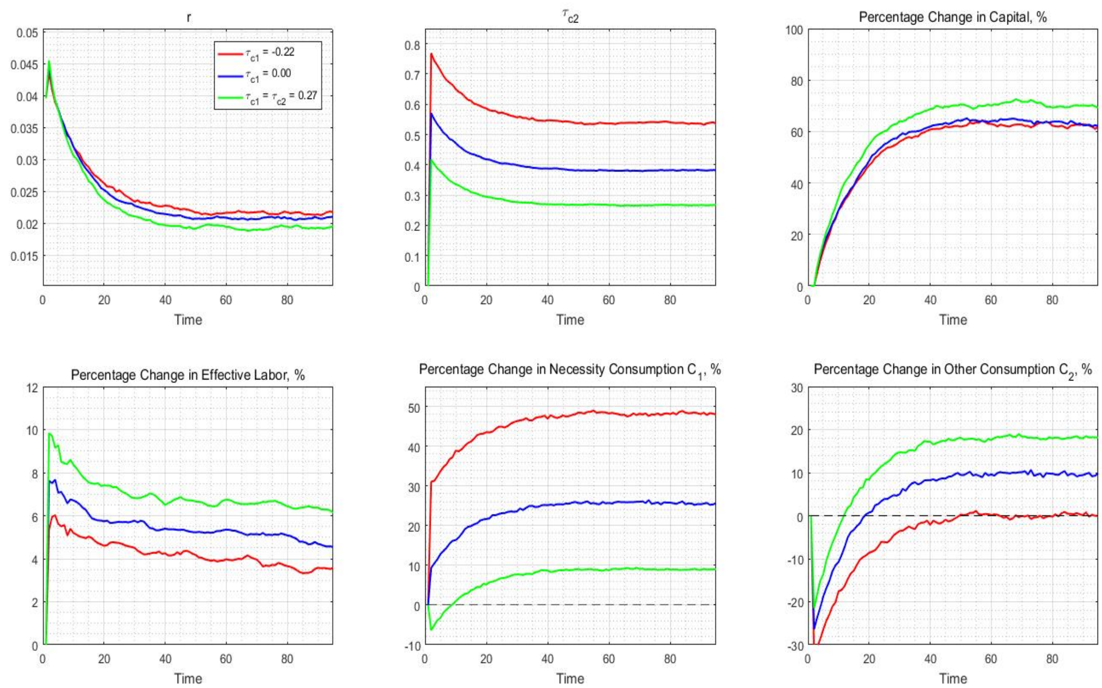


Figure 5

Transition Paths

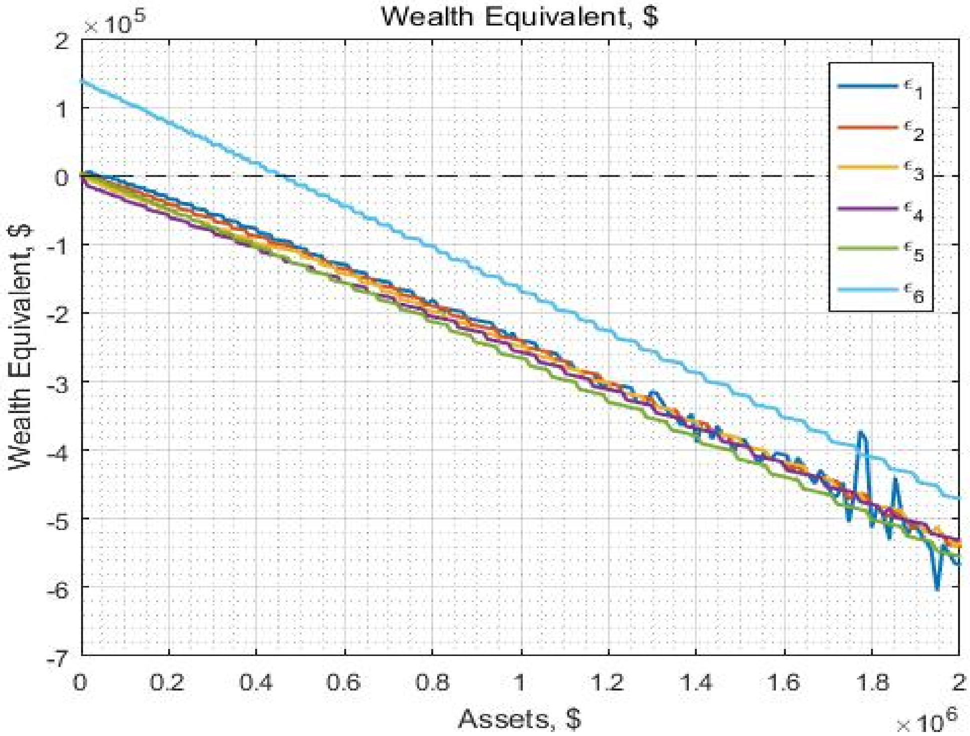


Figure 6

Decomposition of Welfare Gain

Households with the top productivity realization and zero wealth experience a welfare gain equivalent to a transfer of around $140,000. However, since non-basic consumption is increasing in wealth the welfare gains are decreasing in wealth. At the opposite extreme, households with 2 million dollars of wealth experience welfare losses equivalent to half a million dollars with little variation depending of their labor productivity. In the end, only 26.3% of the super-productive individual gain from the reform, since most of those individuals have wealth holdings larger than $440,000. In contrast, the reform benefits also households with the lowest productivity realization and very little wealth because of the subsidy on basic consumption, and since most of them have very little wealth 91.3% of them will experience welfare gains with the reform. In total, though, only 10.3% of the overall population are better off with the optimal reform.

We also performed a partial equilibrium exercise: We fix the interest rate and the wage rate throughout the transition, whereas the tax rates are adjusted period by period to balance the government budget. The overall percentage of households with higher welfare drops to only 2.14% because now individuals do not rip the benefits of wage increases.

Table 8

Percentage of people with welfare gain

	ϵ_1	ϵ_2	ϵ_3	ϵ_4	ϵ_5	ϵ_6	total
% welfare gain	91.31	4.69	0	0	0.68	26.29	10.33
% in total population	8.63	18.56	22.04	28.46	19.15	2.32	100

All in all, our quantitative results suggest that the reforms we analyze imply a large redistribution of the tax burden towards the middle class that results in generalized welfare losses along the transition.

5 Conclusion

The standard argument in favor of a reform switching from income to consumption taxation argues that efficiency gains could be large. We find that a reform that subsidizes basic consumption by as much as 22% and taxes the rest of consumption at 54% maximizes average welfare, both in the stationary equilibrium and along the transition. Our quantitative exercise is consistent with the view that productive efficiency experiences large gains, since output per capita increases around 20%. We also find that inequality would increase in the long run, even though the magnitudes are not large.

Our results highlight, though, the importance of transitional dynamics: Most of the individuals experience welfare losses with such a reform. The reform only benefits households with very low levels of wealth at the extremes of the productivity distribution. The least productive individuals consume disproportionately basic goods, that are now subsidized, and gain from the reform. The most productive individuals see very progressive income taxes removed and consequently their tax burden is lowered. In contrast, the middle class sees an increase in overall taxes paid and looses from the reform, regardless of the general equilibrium effects. As a result, only 10% of the population experience welfare gains, even less so if we abstract from changes in relative prices.

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