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The Black and white differential in income and consumption dynamics

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Abstract
With 20 years of PSID data, we document persistent racial differentials in consumption dynamics. Starting from similar positions in the consumption distribution Blacks end up in lower percentiles than Whites. Education, income, and wealth are three key drivers of these different dynamics. Blacks tend to save less, and hence have less buffer than the Whites to prevent them from falling in the lower part of the consumption distribution.

Keywords Consumption · Income · Savings · Inequality · Persistence

1 Introduction

Economic inequality remains one of the major challenges for policy-makers and economists. In recent years there has been a burgeoning literature in this area. Starting from Piketty and Saez (2003), several authors have documented and investigated the rising income, and wage inequality, in the US and other countries (see Autor et al. 2008; Bonhomme and Robin 2009a; Primiceri and Van Rens 2009; Heathcote et al. 2010; Atkinson et al. 2011; Auten et al. 2013; Attanasio and Pistaferri 2014, 2016; Blundell 2014; Chetty et al. 2014a). Given that consumption is tightly related to permanent income and it is a driver of individual utility more than income itself, a related literature has also stressed the importance of focusing on consumption inequality in order to draw conclusions about households' well-being (see

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for example Blundell and Preston 1998; Meyer and Sullivan 2003; Krueger and Perri 2006; Blundell et al. 2008; Attanasio et al. 2014; Aguiar and Bils 2015; Attanasio and Pistaferri 2016; Blundell et al. 2016).

A stream of the literature, close in spirit to the current paper, has investigated the existing differences in earnings levels between Black and White individuals in the US. Chetty et al. (2014b) study the influence of race on intergenerational income mobility via the channel of geographical segregation. Blau and Beller (1992) put under scrutiny sex differences in the Black-White earnings gap, whereas the quantity and quality of schooling has also been found to be a relevant driver of the black/white earnings gap (see e.g. Card and Krueger 1992; Heckman et al. 2000 and Bayer and Charles 2018). Further, the college wage premium appears different between black and white workers (Chay and Lee 2000). Black workers are less often in performance-pay jobs, and this exacerbates the racial earnings gap (Heywood and Parent 2012). Oaxaca and Ransom (1994) find evidence of discrimination in the labor market against Black workers, and Peoples and Talley (2001) show that privatization, e.g. in the public transport sector, is associated with a decline in the racial earnings differential. Further, civil right legislation helped reducing the Black/White earnings gap in the 1960's (Card and Krueger 1993).

The current paper focuses on a relatively unexplored area: the differential in consumption dynamics between Blacks and Whites in the US over the past two decades. To the best of our knowledge, apart from the work by Charles et al. (2009), who show that Blacks devote a larger share of their expenditure bundles to *conspicuous* goods than do comparable Whites, racial differences in consumption, and in particular in consumption persistence over the life cycle, have not been investigated in the literature.

The analysis of consumption dynamics adds to the literature on inequality on important dimensions as the typical income inequality literature (e.g. Piketty and Saez 2003; Chetty et al. 2014a and others) focuses on cross-sectional facts. While cross-sectional inequality gives a static view of potentially temporary inequality, the focus of consumption and its dynamics gives a permanent and dynamic perspective on inequality. Related points have been made in Heathcote et al. (2005). It is important to focus on measures of permanent inequality for a variety of reasons, but fundamentally as it calls for different policy actions that temporary inequality. Somewhat akin to the relationship between income and consumption inequality. We believe that depicting permanent facts and the transitions over time should be a central part of the analysis of inequality. Temporary or cross-sectional inequality in income can be addressed with temporary policy measures, however permanent inequality requires more long-sighted policy actions.

We use PSID data from 1999 to 2017 to document persistent racial differentials in consumption dynamics across the distribution. More specifically, we document large differences between Blacks and Whites in terms of mobility along the consumption distribution. Blacks, independently of the initial percentiles, tend, over time, to end up in lower percentiles than white individuals. Individual characteristics like age and sex do not seem to account for these differences, while education, income and wealth, when considered together, essentially close the gap at the top and substantially reduce it at the bottom of the distribution.

Our paper is close to the work of Chetty et al. (2020) on the inter-generational persistence of racial differences in income. In particular, the authors focus on the "intergenerational gaps", i.e. differences by race in children's incomes conditional on parental income. They find that such gaps are persistent over time and, conditional on parent income, they are mainly driven by differences in wages and employment rates. Further, Ganong et al. (2020) use bank data matched with voter registry and firm-wide wage changes data in order to estimate the transmission of unexpected income shocks into consumption by race. They, too, link race

differentials in the degree of insurance against shocks to the different amount of wealth held by Blacks and Whites. However, differently from our work, they exclusively focus on short-term consumption changes in reaction to income shocks. Our paper focuses instead on racial differences in consumption persistence.

It is important to note that racial dynamics in consumption, as well as education, income, and wealth might arise in the presence of several forms of discrimination (in education Rodgers and Spriggs 2002; Spriggs and Williams 1996 for occupational segregation, and Darity et al. 2022 for an insightful study of the cumulative cost of racism on the racial wealth gap).

The remainder of the paper is organized as follows: Section 2 presents the data. Section 3 provides evidence on the (unconditional) consumption persistence for Blacks and Whites. Section 4 explores conditional consumption persistence of Blacks and Whites. Section 5 concludes. In Appendix A we cover some additional analyses on income and consumption profiles, while in Appendix B we present a series of robustness checks.

2 Data

We use data from the Panel Study of Income Dynamics (PSID), a longitudinal survey conducted by the University of Michigan. The PSID is a nationally representative sample of households. The PSID collects a wide range of variables, including information on demographics, income, and consumption. Most data is collected at the household level, though information for PSID-defined household "heads" and "wives" is also gathered. A limited selection of questions are asked about other family members. Typically, a family head is the male in a married pair with primary financial responsibility for the family. A wife is the female counterpart of the married couple. Females only qualify as heads in single adult households (single males can also be heads, of course). If a female head marries a man, he becomes the new head and the woman's classification changes to 'wife'.

To create our dataset, we append together all waves from 1999-2017. This choice is dictated by the fact that information on actual consumption is only collected starting in 1999.[1] We include only current heads, since they are the individuals with the richest and most consistent set of observables over time. As there is one head per household, our analysis is therefore effectively at the household level.

We then create a consistent race indicator for all individuals. The PSID asked heads to identify their race in every wave. For all heads, we assign race as the mode value of race from all reported years. Due to the limited sample size of some reported races, we only keep individuals identifying themselves as Black or White. Our full sample, for the years under scrutiny, includes 153,592 individual-year observations.

The PSID consistently asks respondents to report their household's total monetary income, defined as the sum of the taxable income of the head and wife, the total transfers of the head and the wife, the taxable income of other family unit members, and the transfer income of other family unit members. Beginning with the 1994 wave, the measure also includes total family Social Security income.

Any negative or zero values are recorded to $1 in the PSID, and because this practice occurs for many years, we apply the same rule to the remaining years of data. To convert nominal incomes to real terms, we divide the nominal measure by the Consumer Price Index

[1] In previous versions of the current paper we included older PSID waves and performed a consumption imputation to deal with the missing consumption categories, see De Giorgi et al. (2020).

(CPI). In order to create a per capita measure, we then divide total family income by an Adult Equivalent scale, given by:

$$AE = 1 + 0.7(A - 1) + 0.5K \tag{1}$$

where A is the number of adults in the household and K is the number of children in the household. This scale assigns a value of 1 to the first household member, of 0.7 to each other adult in the household and 0.5 to each child. This scale, which is sometimes called the "Oxford scale", has been first proposed by the OECD in 1982. We also probe the robustness of the results to the chosen scale in Appendix B, where we apply a different equivalence scale.

Our measure of real adjusted family income (TFA) is

$$TFA_i = \left(\frac{Nominal\ Family\ Income \times 100}{CPI \times AE} \right). \tag{2}$$

We multiply Family income by 100 to preserve the scale of the variable given that CPI is equal to 100 in the base year. Similarly, we construct the following measure of real adjusted wealth as follows:

$$RealAdjWealth_i = \left(\frac{Nominal\ Wealth \times 100}{CPI \times AE} \right). \tag{3}$$

We compute wealth as comprehensively as we can in the PSID, summing up seven asset types: value of farm or business, value of cash savings, value of real estate other than home, value of stocks, value of vehicles, value of other assets, value of home equity net of debt.[2] This wealth measure is then divided by the Consumer Price Index (CPI), in order to obtain a measure of wealth in real terms.

Starting in 1999, the PSID asked its respondents the amount spent over different categories of goods, always at the household level. The expenditure categories for which we have information are the following: food at home, food out, food stamps (if used), rent or rent equivalent, home insurance, electricity, heating, water, other utilities, car insurance, car repairs, gas, parking, bus, train, cab, other transportation, cost of school, cost of childcare, health insurance, expenditures on hospitals, doctors, and drugs. We construct our measure of actual consumption as the sum of all these expenditure categories.[3] This definition of total household consumption is the same as in Attanasio and Pistaferri (2014, 2016).[4] It is worth noting here that our rent equivalent measure combines values for both renters and homeowners. We define homeowners as households who report a non-zero positive house-value. We create a yearly rent equivalent by taking 6% of this house-value (Dougherty and Van Order 1982). For those who do not report a positive house-value, the PSID provides annual rent payments for the period under scrutiny. Then, similarly to what we did already in the case of total family income, we deflate this measure by CPI and we divide it by the same equivalence

[2] All liabilites are deducted from this wealth measure.

[3] Our consumption measure is constructed as comprehensively as possible given the information available in the PSID. However, some, limited, expenditure cathegories are not covered by the survey, such as holidays and investments in durables.

[4] Unfortunately, the measurement of consumption through surveys is bound to be plagued by error, this is extensively discussed for both the PSID and the CEX in Carroll et al. (2015), we make no strides on that in the current paper. We note, however, that we are not interested in consumption level per se in the current work, but rather in the transition overtime.

scale as above, in order to take adequately into account different family compositions. Real adjusted family consumption is hence defined as

$$TC_i = \left(\frac{Nominal\ Family\ Consumption \times 100}{CPI \times AEscale} \right). \quad (4)$$

We multiply Family consumption by 100 to preserve the scale of the variable given that CPI is equal to 100 in the base year.

In Table 1 we report the descriptive statistics for the main variables used in the present paper in the base year 1999. There are a few facts of interest in the simple descriptives. Consumption expenditure per adult equivalent ranges between about 1,400 - 1,800 USD (Q1 Blacks - Whites respectively) to almost 9,700 - 10,700 USD (Q5 Blacks - Whites respectively), with the two distributions being fairly close to each other in particular for the middle 3 quintiles. Total family income (per adult equivalent) ranges from 4,700 USD for Blacks in Q1 to almost 29,000 USD in Q5 for Whites with the Whites distribution dominating Blacks. Blacks tend to have larger families along the consumption distribution and in particular at the bottom of the distribution, i.e. 4.5 members vs. 3.6, but at the very top the situation is reversed with Blacks having smaller families than Whites (2.5 vs. 2.6 members). By using measures of total family income, total consumption and wealth that have been adjusted by an adult equivalence scale, as explained above, we are able to take into account differences in family composition between black and white households. Further, in Appendix B we probe the robustness of our results to the use of an alternative adult equivalence scale. Other two relevant facts stand out from Table 1 in terms of demographics: Blacks are younger than Whites at the top of the distribution by about 4.5 years. Perhaps, even more striking is the prevalence of female-headed (single parent) households among Blacks: 65% of households are female-headed in the bottom quintile vs. 37% for Whites, while at the top only 34% of Blacks households are female-headed (of course the share for Whites is lower at 17%). In terms of wealth it is noticeable how Whites have roughly three times larger wealth than Blacks along the distribution. Lastly, in terms of education it is easy to see how the large majority of households in the first quintile have at most a high-school degree (80% and 86% for Whites and Blacks respectively). We also note that in Q5 67% of Whites have at least some college, while that percentage is 58% for Blacks.

3 Unconditional consumption dynamics

We turn now our attention to unconditional dynamics. More specifically we describe racial differences in terms of dynamics over time within the consumption distribution. We use rank-rank regressions to assess in which part of the distribution individuals starting from a given percentile end up ten years later. In Fig. 1, each individual in a given year is assigned to a consumption percentile according to her position in the overall consumption distribution of that particular year (that is the consumption distribution including Blacks and Whites). Our aim here is to describe the dynamics along the national distribution rather than within race: we believe this to be the relevant measure of inequality.

In order to obtain insights on the differences in the degree of consumption persistence of Blacks and Whites along the overall distribution, we perform a rank-rank analysis in the spirit of Chetty et al. (2020). We consider ten-year transitions, e.g. from 1999 to 2009, from 2001 to 2011 and so on. We then stack all the percentiles ranking in year t=1999, 2001, ..., 2007 and construct a second variable, ranking in t+10 so that we have all the transitions together

Table 1 Descriptive Statistics in base year 1999, by race and actual consumption quintile

	Whites					Blacks				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
Consumption	1819.77	3157.24	4374.82	5946.47	10653.04	1439.01	3115.53	4345.85	5943.8	9659.08
Expenditure	(568.88)	(367.84)	(361.20)	(576.22)	(4594.86)	(676.73)	(370.78)	(378.38)	(599.76)	(5078.71)
Total Family	6218.05	11081.72	14557.92	18986.3	28673.8	4691.11	7684.35	10549.85	12521.29	17335.16
Income	(10852.34)	(8434.98)	(9124.11)	(13532.52)	(31816.35)	(5663.31)	(4685.23)	(6606.61)	(7202.83)	(11174.41)
Family size	3.60	3.73	3.13	3.03	2.61	4.43	3.89	3.69	3.22	2.46
	(1.86)	(1.67)	(1.39)	(1.40)	(1.27)	(2.05)	(1.80)	(1.50)	(1.42)	(1.24)
Age	38.61	40.72	40.25	41.09	43.29	39.10	42.67	40.29	39.66	38.91
	(16.47)	(14.23)	(13.40)	(13.03)	(13.55)	(12.37)	(13.35)	(11.07)	(11.07)	(11.56)
Wealth	7644.13	22663.09	33935.34	53231.49	110725.4	1733.39	7608.48	9223.21	17930.7	50968.3
	(25221.23)	(54797.44)	(100764)	(233931.3)	(389992)	(6229.25)	(19273.47)	(17616.55)	(48726.1)	(213315.8)
Female	0.37	0.22	0.21	0.17	0.17	0.65	0.47	0.39	0.30	0.34
Education										
Grades 0-11	0.41	0.28	0.18	0.13	0.09	0.46	0.31	0.23	0.18	0.14
High School	0.39	0.38	0.34	0.31	0.24	0.4	0.4	0.4	0.38	0.28
Some College	0.16	0.17	0.26	0.26	0.25	0.13	0.24	0.31	0.27	0.37
BA or higher	0.04	0.18	0.22	0.3	0.42	0.01	0.05	0.06	0.17	0.21
Obs	1119	2348	2581	3110	3342	3050	1821	1587	1062	822

Consumption expenditure is our measure of total consumption as expressed by Eq. 4, Total Family Income is the variable defined by Eq. 2, family size is the number of individuals in the family, age is age of the household head, wealth is real adjusted wealth as expressed by Eq. 3, female is a dummy taking value 1 if the household head is a women and zero otherwise, and Education is one of the four education dummies standing, respectively, for grades 0-11, high school, some college, BA or higher degree

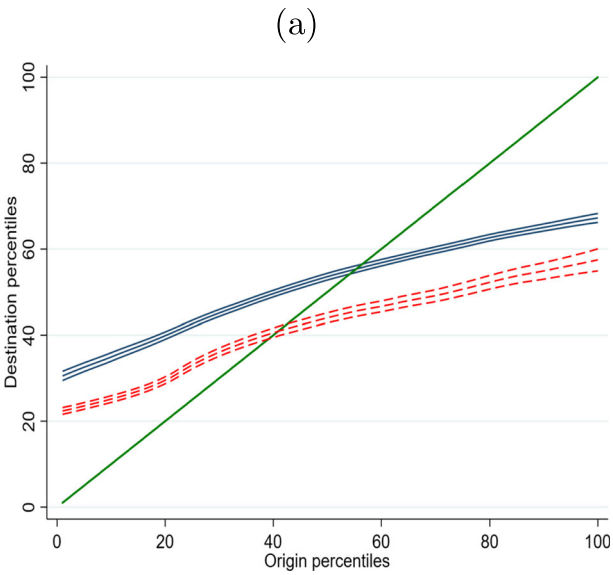

Fig. 1 Average actual consumption rank after 10 years for an individual who was in each consumption percentile 10 years before, by race. The blue line refers to Whites and the red line to Blacks. 99% confidence bands are reported. Panel (a) no controls. PSID weights are used

in a stacked formulation. The unit of observation is individual-by-year in 1999, 2001, ..., 2007. We then run a local linear regression of $p_{t+10} = f(p_t)$, that smoother takes care of excess noise and non-parametrically produces the relationship between origin and destination ranking for Blacks and Whites separately. The Silverman rule-of-thumb bandwidth equal to $1.06\hat{\sigma}n^{-1/5}$ where $\hat{\sigma}$ is the estimated standard deviation of the outcome variable of interest, is applied in all the local regressions performed. The rank-rank analysis allows us to address the issue of persistence over a certain time span (10 years in this case), separately by race, with a simple graphic intuition of the results. We focus on 10 years transitions because these are long enough to give a peek into longer run mobility while preserving a reasonable number of observations, and limiting our ability to focus specific years start-end.

We perform this analysis separately by race in an unconditional fashion in Fig. 1, later in the paper (Section 4) we will show how controlling for individual characteristics, namely age, sex, income, education and wealth changes the results. On the x-axis we have the origin percentiles of actual consumption while on the y-axis we report the destination percentiles after a 10-year span. In all graphs we include the 45 degree line indicating perfect persistence, i.e. an identical rank after 10 years. The flatter the slope of the rank-rank regressions, the higher is the mobility over time. The blue line refers to Whites and the red line to Blacks. The figure reports the point estimate together with the 99% confidence bands.[5]

We note several interesting facts. First, the blue line is always above the red line, meaning that for any possible percentile of origin in the consumption distribution, the average percentile of destination of Blacks is lower than that of Whites. The unconditional difference

[5] In the Appendix, in Fig. B9, we repeat the exercise of the present Section, this time by considering the average rank in years 1999, 2001 and 2003 as the origin rank and the average rank in years 2009, 2011 and 2013 as the destination ranks. The results are notably close to the one obtained with the procedure described above.

in the average destination percentile of consumption after 10 years between Blacks and Whites is around 10 percentiles at the top (80th percentile), and only slightly diminishes going toward the bottom of the consumption distribution. Overall, black individuals tend to shift downward in the consumption distribution. At the bottom of the distribution, white individuals tend to reach higher percentiles than black individuals, and at the top Whites are much more persistent than Blacks. Just to provide an example, from Fig. 1 we see that if a Black individual was around the 99th percentile of consumption in year t, then on average she will end up below the 60th percentile after 10 years. While a White individual being in the 99th (top) percentile in year t will end up on average in the 68th percentile after 10 years. The vertical distance between the two lines relates to the rank distance of Bayer and Charles (2018). Second, the intersection with the 45 degree line for Blacks coincide with about the 40th percentile while for Whites with the 55th. Figure 1 shows that on average Blacks tend to occupy lower percentiles than those they started off 10 years prior.

In essence the rest of the paper is dedicated to understanding why these different profiles emerge.

As an exploratory analysis, below we report transition matrices between period $t-1$ and period t for each available couple of years between 1999 and 2017, for consumption quintiles, separately for Blacks and Whites. Since the PSID is biannual since 1997, a period corresponds to two years.

Transition matrices are one of the most commonly used methods to assess the degree of positional/rank mobility within an economy (see e.g. Shorrocks 1978; Fields and Ok 1999; Bonhomme and Robin 2009b). In all the transition matrices presented in this Section, rows stand for past quintiles, whereas columns stand for present quintiles. The row totals of each matrix are equal to one. For example the cell in the second row, first column of Table 2, means that, among all individuals who were in the second consumption quintile in period $t-1$, around 16% fell in the first (i.e. bottom) consumption quintile in period t. Conversely, the cell in the first row, second column of the same Table signifies that, among all individuals who were in the bottom quintile at time $t-1$, around 24% ended up in the second quintile in period t. In Tables 2, 3, 4 and 5, an individual is recorded as a stayer if he/she is recorded to be in the same consumption quintile in period $t-1$ and in period t, and a mover otherwise. The percentages of stayers are displayed in bold along the main diagonal of the transition matrix.

Table 2 Empirical 1-period (i.e. two-year) transition matrices, Present quintile is on the columns, past quintile is on the rows

Origin / Destination	1	2	3	4	5
1	**0.4552**	0.2066	0.1147	0.1097	0.1138
	(0.0043)	(0.0035)	(0.0027)	(0.0027)	(0.0027)
2	0.1992	**0.4643**	0.2296	0.0841	0.0228
	(0.0034)	**(0.0042)**	(0.0036)	(0.0024)	(0.0013)
3	0.0659	0.1844	**0.4537**	0.2256	0.0704
	(0.0018)	(0.0028)	**(0.0036)**	(0.003)	(0.0018)
4	0.0382	0.0461	0.1932	**0.5089**	0.2135
	(0.0013)	(0.0014)	(0.0026)	**(0.0033)**	(0.0027)
5	0.0258	0.0102	0.0433	0.1801	**0.7406**
	(9.50E-04)	(6.10E-04)	(0.0012)	(0.0023)	**(0.0026)**

Row total is 1. Transitions are computed on the basis of total consumption (TC) for white individuals only

Table 3 Empirical 1-period (two-year) transition matrices, Present quintile is on the columns, past quintile is on the rows

Origin / Destination	1	2	3	4	5
1	**0.6201**	0.2538	0.0794	0.0326	0.0141
	(0.0037)	(0.0033)	(0.0021)	(0.0013)	(9.00E-04)
2	0.2742	**0.4658**	0.1925	0.0544	0.013
	(0.0038)	**(0.0043)**	(0.0034)	(0.0019)	(9.70E-04)
3	0.0819	0.2729	**0.4265**	0.1749	0.0439
	(0.0028)	(0.0045)	**(0.005)**	(0.0039)	(0.0021)
4	0.0434	0.107	0.2585	**0.4568**	0.1343
	(0.0026)	(0.0039)	(0.0055)	**(0.0063)**	(0.0043)
5	0.0277	0.054	0.1073	0.2744	**0.5367**
	(0.0031)	(0.0042)	(0.0058)	(0.0083)	**(0.0093)**

Row total is 1. Transitions are computed on the basis of total consumption (TC) for black individuals only

Of course, a limitation of the transition matrix approach is that all intra-quintile transitions are disregarded.

The simple comparison of Tables 2 and 3 provides descriptive evidence that Black individuals are less mobile than Whites at the bottom of the distribution, as the share of stayers in the bottom quintile is 62% vs around 46%. Further, Blacks are less persistent at the top of the consumption distribution, as the share of stayers is 54% vs around 74% for the Whites. Of course, this analysis is unconditional, i.e. it does not take into account the effect of covariates such as age, sex, income or education. For this reason, in what follows we present a similar analysis but in a conditional version, i.e. based on residual consumption quintiles, where residual consumption is estimated via the following regression:

$$LTC_{it} = \alpha_0 + \alpha_1 Age_{it} + \alpha_2 AgeSq_{it} + \alpha_3 Educ_{it} + \alpha_4 Female_{it} + \alpha_5 LTFA_{it} + \varepsilon_{it} \quad (5)$$

where LTC_{it} is the log of total consumption as defined in Eq. 4, Age_{it} and $AgeSq_{it}$ stand, respectively, for individual age and individual age squared, $Educ_{it}$ is the years of education achieved by the individual, $Female_{it}$ is a dummy equal to 1 if the head of household is a

Table 4 Residual 1-period (two-year) transition matrices, Present quintile is on the columns, past quintile is on the rows

Origin / Destination	1	2	3	4	5
1	**0.4992**	0.2399	0.1281	0.0771	0.0557
	(0.0049)	(0.0041)	(0.0032)	(0.0026)	(0.0022)
2	0.1632	**0.4179**	0.2177	0.1287	0.0725
	(0.0029)	**(0.0039)**	(0.0033)	(0.0026)	(0.0021)
3	0.0717	0.1991	**0.3927**	0.2194	0.1171
	(0.0019)	(0.0029)	**(0.0035)**	(0.003)	(0.0023)
4	0.0417	0.0911	0.2174	**0.4256**	0.2242
	(0.0014)	(0.002)	(0.0029)	**(0.0035)**	(0.0029)
5	0.0266	0.0588	0.101	0.2327	**0.5809**
	(0.0011)	(0.0016)	(0.0021)	(0.0029)	**(0.0034)**

Row total is 1. Transitions are computed on the basis of residual TC for white individuals only

Table 5 Residual 1-period (two-year) transition matrices, Present quintile is on the columns, past quintile is on the rows

Origin / Destination	1	2	3	4	5
1	**0.613**	0.1952	0.0927	0.0534	0.0457
	(0.004)	(0.0033)	(0.0024)	(0.0018)	(0.0017)
2	0.2698	**0.3684**	0.1863	0.105	0.0705
	(0.0044)	**(0.0047)**	(0.0038)	(0.003)	(0.0025)
3	0.1637	0.244	**0.3086**	0.1771	0.1067
	(0.0042)	(0.0048)	**(0.0052)**	(0.0043)	(0.0035)
4	0.1112	0.1478	0.2309	**0.33**	0.1801
	(0.0039)	(0.0044)	(0.0053)	**(0.0059)**	(0.0048)
5	0.1052	0.1187	0.1377	0.2102	**0.4282**
	(0.0041)	(0.0043)	(0.0046)	(0.0055)	**(0.0066)**

Row total is 1. Transitions are computed on the basis of residual TC for black individuals only

women and zero otherwise, for clarity females head of household could be single as well as married,[6] and $LTFA_{it}$ is the log of total family income as defined in Eq. 2. We then take the estimated residuals from this equation, $\hat{\varepsilon}_{it}$, and we construct the quintiles on the basis of this variables. In the following, we report transition matrices of the residuals between period t and period $t-1$, for each available couple of years between 1999 and 2017, separately for black and white individuals. The results, reported in Tables 4 and 5, show that, even after controlling for the standard set of socio-demographic variables presented above, there are notable differences in the transition patterns of Blacks and Whites. Albeit such difference are now attenauted. Indeed, Blacks are still more persistent at the bottom of the distribution (61% vs 50% of stayers) and less persistent at the top of the residual consumption distribution (43% vs 58% of stayers in the top residual quintile).

The transition matrices reported above show descriptively the existence of a black/white differential in consumption persistence. This will be the main object of our investigation in the remainder of the paper.

4 Conditional consumption dynamics

We turn now our attention the conditional version of the consumption dynamics decribed in Section 3.

We perform this analysis separately by race controlling for individual characteristics, namely age, sex, income, education and wealth. Age, sex and education are measured for the household head, whereas for income and wealth, as explained above, we use real adjusted measures that take into account the family composition, i.e. we divide by the adult equivalence scale. We compute wealth as comprehensively as we can in the PSID, summing up seven asset types: value of farm or business, value of cash savings, value of real estate other than home, value of stocks, value of vehicles, value of other assets, value of home equity net of debt. This wealth measure is then divided by the Consumer Price Index (CPI), in order to obtain a measure of wealth in real terms.

[6] Specifically, in our sample only 0.46% of female head of household are married, the rest are either never married, separated, divorced or widowed.

In performing this conditional rank-rank analysis, we use residual consumption for the analysis. In practice, first we regress actual consumption on the control variables as described above, then we rank the residuals of this regression for each year of the analysis. The approach allows then for the control variables to have different effects in different years.

In Fig. 2, we report the results of the (smoothed) rank-rank conditional regressions. As in Fig. 1, on the x-axis we have the origin percentiles of actual consumption while on the y-axis we report the destination percentiles after a 10-year span. In all graphs we include the 45 degree line indicating perfect persistence, i.e. an identical rank after 10 years. In the different panels of Fig. 2 we use different sets of controls. Panel (a) displays the results for the unconditional case for ease of comparison, i.e. no controls. In Panel (b) the controls are age and sex; in Panel (c) the controls are age, sex, and total family income (TFA); in Panel (d) the controls are age, sex, and wealth. In Panel (e) the controls are age, sex and education. Finally, in Panel (f) the controls are age, sex, TFA, wealth and education.

Let us focus on the results when controlling for demographics and other factors, i.e. in Panels (b)-(f). We start by controlling for age and sex, as we showed in the descriptive table that these demographics appear to be important correlates of consumption rank. Panel (b) shows the results. The picture is similar to that for the unconditional case, with essentially no quantitative change in the destination percentile, neither for the Blacks, nor for the Whites. Despite the large difference in demographics shown in Table 1, those variables do not appear to close the gap between Blacks and Whites.

Another candidate to explain the differences in consumption dynamics is income. Consumption dynamics could differ simply because of racial differences in income dynamics. Thus, we repeat the analysis adding total family income (TFA) to the controls. Panel (c) reports the results. The differences between the percentiles of destination of Whites and Blacks are mitigated, but only at the top of the distribution, relative to the unconditional case. The difference in the average destination percentile of consumption is around 7 percentiles at the top (80th percentile), but stays at around 10 percentiles both at the 50th percentile and at the bottom (20th percentile). Income partially mitigates the gap between Blacks and Whites at the top but not at the bottom.

Further, wealth is crucial to insure away transitory and permanent shocks, while sustaining high consumption levels.[7] We hence control for age, sex and wealth in Panel (d). The resulting picture is, not surprisingly, close to the one that we obtain when controlling for Total Family Income. In particular, in Panel (d) the gap in the average consumption destination percentile between Whites and Blacks is reduced (with respect to the unconditional case) to around 7-8 percentiles not only at the top, but across the whole consumption distribution.

In Panel (e), in addition to age and sex we also control for education. In this case, we notice that, unlike for the other controls, the gap is reduced to around 5-6 percentiles across the whole consumption distribution. The reduction is particularly evident at the top, where the gap is essentially closed down to 2-3 percentiles. Even if we are not able to control for the quality of education, we notice that the highest level of education achieved by the individual can explain a large part of the Black/White consumption gap, i.e. more than TFA and wealth can do.

Finally, In Panel (f) we control simultaneously for age, sex, TFA, real adjusted wealth and education. The gap is substantially reduced for all of the percentiles. It is essentially zero

[7] In a companion paper we discuss to role of insurance as a crucial driver of consumption dynamics over the life cycle. Insurance to permanent and transitory shocks helps understanding the fall in consumption for Blacks.

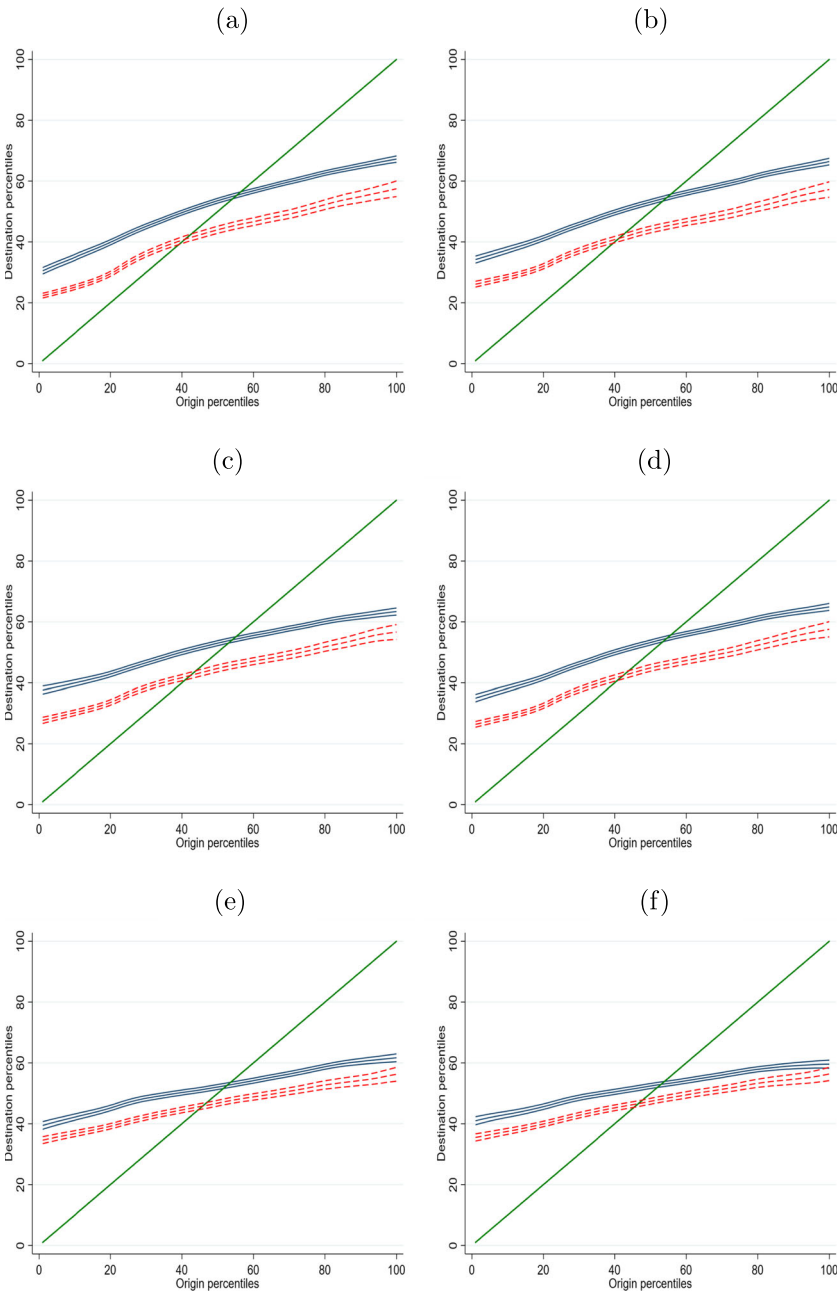

Fig. 2 Average actual consumption rank in after 10 years for an individual who was in each consumption percentile in 10 years before, by race. The blue line refers to Whites and the red line to Blacks. 99% confidence bands are reported. Panel (a) no controls. Panel (b): controls: age and sex. Panel (c): controls as in (b) plus Total Family Income. Panel (d): controls as in (b) plus real adjusted wealth. Panel (e): controls as in (b) plus education. Panel (f): controls as in (b) plus education, TFA and real adjusted wealth. We control for wealth dynamically, e.g. we take the value of wealth in each of the years of the analysis. PSID weights are used in all the panels

at the top of the consumption distribution and around 5 percentiles at the bottom and in the middle of the consumption distribution.

From the evidence above, we conclude that there are three factors that explain a substantial portion of consumption dynamics racial differentials: income, wealth and education, However, while the three of them matter for the top of the distribution, at the bottom and the middle of the distribution education seems to be the most important variable to reduce the gap.

Note that the results presented in Fig. 2 are such that, we first control for two variables that we deem fully exogenous (i.e. sex and age) and we then add a different additional covariate in each panel (i.e. TFA, education and real adjusted wealth). Only in the last panel all controls are included together. There is no sequential adding of covariates and we are able to evaluate the contributions of TFA, real adjusted wealth and education separately. Hence, we deem as not necessary to perform a decomposition in the spirit of Gelbach (2016).[8]

We are not able to directly assess what are the driving factors behind differences in income, education, and wealth among Black and White individuals. For example, discrimination in the labor market could be one such factor (Oaxaca and Ransom 1994), while geographical segregation (Chetty et al. 2014b) might impede intergenerational income mobility, another factor could be the quantity and quality of schooling (see e.g. Card and Krueger 1992; Heckman et al. 2000 and Bayer and Charles 2018).

The mobility gap could be due racial discrimination which could play an important role even if Black individuals had the same level (and quality) of education and savings.

It is worth noting that education seems to explain more of the gap than, say, TFA or wealth. We deem that this may be the case because education is a good proxy for permanent income (Rothstein and Wozny 2013; Attanasio and Pistaferri 2014).

The PSID also includes intergenerational information, such as the education level achieved by the parents of the individual. It would be possibile to include, say, father's education among the controls used for the analysis reported in the rank-rank regressions. However, father's education is likely to be highly correlated with both TFA, real adjusted wealth and individual educational level. This is why we do not include this additional variable in the previous analysis.

Our results reported in Fig. 2 are robust to a series of checks that are reported in Appendix B. The overall picture does not change if we use the Square Root Equivalence scale instead of the Oxford Equivalence. Further, our rank-rank regression results are robust to running the estimates on the SRC sample of the PSID only, as well as to using 5-year averages of TFA and real adjusted wealth (instead of annual values) as controls.

In Fig. 3 we extend the rank-rank analysis to focus on the rank percentile gap, i.e. we investigate which percentile of the consumption distribution would the Blacks occupy if they had the same age, sex and education distribution than the Whites. In practice, we regress each outcome variable (e.g. consumption percentile and log real adjusted wealth) on age, gender education dummies, log TFA (in panel (b) and (c)) and log adjusted real wealth (in panel (c) only) in the subsample of black indivduals. Then, we use the estimated coefficients to predict the outcome in the subsample of white individuals. In the histograms, we compare the distribution of such predictions with the real outcome distribution for the Whites. This counterfactual exercise is carried out in the spirit of Bayer and Charles (2018). This exercise

[8] Such a decomposition has been developed to analyze the contribution of different covariates to the race wage gap. Its framework is essentially static and does not fit well to our dynamic analysis of rank mobility.

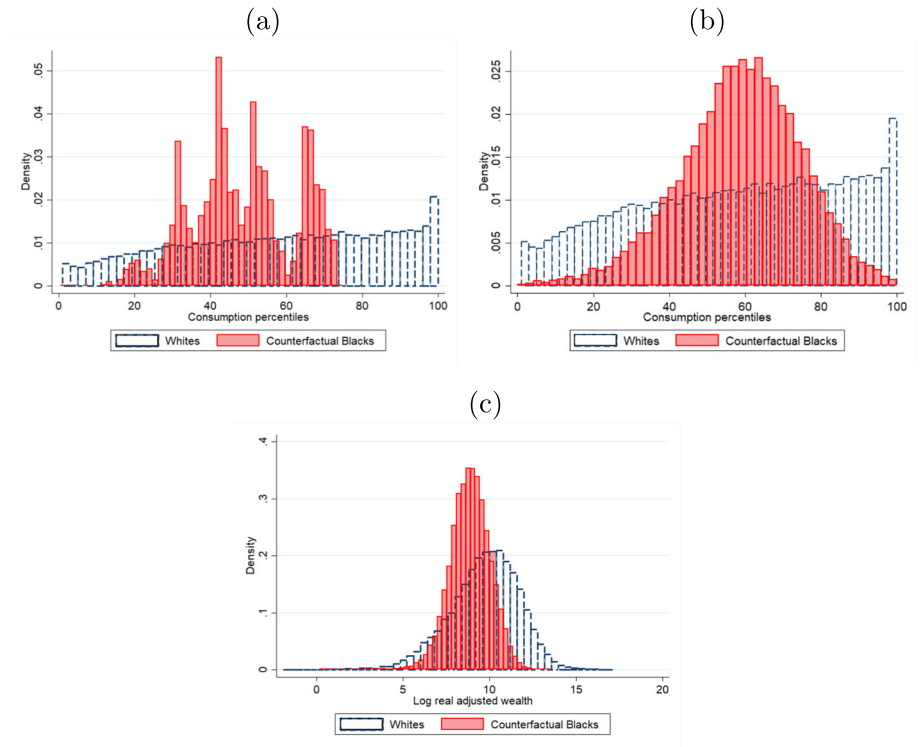

Fig. 3 Impact of being Black on consumption percentile, based on the estimation of the difference between the actual TC percentiles of the Whites and the counterfactual TC percentiles of the Blacks. Blue stands for the Whites, red for the Blacks. Data for 1999-2017. Panel (a): we replace the actual distribution of the Blacks with their counterfactual TC percentiles distribution if they had the same age, sex and education distribution as the Whites. Panel (b): we replace the actual distribution of the Blacks with their counterfactual TC percentiles distribution if they had the same age, sex, education, log TFA and log adjusted real wealth distribution as the Whites. In Panel (b) top 1% of predicted consumption percentiles has been trimmed for graph readability. Panel (c): we replace the actual distribution of the Blacks with their counterfactual (log) real adjusted wealth distribution if they had the same age, sex, education and log TFA distribution as the Whites

highlight how observables are not capable of explaining the distributional differences in Blacks and Whites consumption and wealth. Once more suggesting that discrimination could play a key role. In Panel (a) we notice a wide difference between the consumption rank distribution of the Whites and the counterfactual rank consumption distribution of the Blacks if they had the same distribution of age, sex and education as the Whites. From Panel (b) we notice that this difference in consumption ranks is substantially attenuated (but does not fully vanish) if we assign to the Blacks the same distribution of age, sex, education, TFA and real adjusted wealth as the Whites. These pictures are fully consistent with the results of our conditional rank-rank analysis reported above. Finally, in Panel (c) of Fig. 3, we compare the distribution of real adjusted wealth for the Whites and the counterfactual distribution of real adjusted wealth for the Blacks, if they had the same age, sex, education and income distribution as the Whites. Taking the above-mentioned covariates into account, the difference between the two wealth distributions is attenuated, however it does not disappear.

5 Concluding remarks

Our analysis of racial differential in consumption dynamics focuses on the role of income, education, and wealth and we cannot exclude that discrimination plays a fundamental role on all those dimensions. What we show is that Blacks at the top of the consumption distribution tend to fall in the ranking much more than Whites after a few years. At the same time while socio-demographics characteristics such as age or sex do not close the different dynamics between Blacks and Whites in any part of the consumption distribution, income, education and wealth together, make the gap at the top of the distribution much smaller. Further, when controlling for all these three variables, the gap is essentially reduced (to around half of its original size) at the bottom and in the middle of the consumption distribution as well. It is well known, and confirmed in the current paper, that Blacks and Whites differ substantially in their amount of savings and wealth, it is however novel that we show how those differences persist even when comparing Blacks and Whites with initially similar levels of consumption.

As a final word of caution, we note that we are not able to investigate which are the driving factors behind differences in income, education and wealth among Black and White individuals, and in particular we do not address the important issue of discrimination in society at large. The interested reader could refer to Oaxaca and Ransom (1994) for evidence of discrimination in the labor market, Chetty et al. (2014b) on geographical segregation which might dampen intergenerational income mobility, and Card and Krueger (1992); Heckman et al. (2000) and Bayer and Charles (2018) for the quantity/quality of schooling, and to Darity et al. (2022) for a recent comprehensive study on the effect of racism on wealth inequality. An in-depth analysis of the role of discrimination on consumption mobility is left for future research.

Our results have clear implications for the intragenerational evolution of inequality within and between race, in particular we show that there is clear mean reversion and much more so for Blacks, who are reverting to a lower mean and in fact this points towards a fall in within race inequality and an increase in between races inequality over time.

What we believe is important here is to highlight that Blacks' consumption tend to fall more than White's consumption over the lifecycle. This fact calls for more prominent insurance for Blacks and, perhaps surprisingly, for Blacks at the top of the distribution. While better education relates to both cross sectional and overtime inequality, the accumulation of wealth and policies devoted to such aspect are more in line with our findings and our analysis. Self-insurance, through incentivizing savings for example is crucial in this case, and to achieve that target a possible policy would be to encourage higher saving rates for Blacks and possibly better access to financial markets. One such a policy would be that of introducing financial education in schooling (see Lusardi 2009), as well as through a rebalancing of financial access across races.

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Declarations

Competing interests The authors declare no competing interests.

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