Appendix B: Potential Aggregation Bias

To have an assessment of the amount of transitions lost during the 12 weeks between quarterly observations, I went back to the NLSY disk and extracted the weekly job history for blacks and whites (STAT variable, former A-array) for the two first years of the survey and computed weekly and quarterly transitions for all black and white individuals in the survey. In this exercise, I did not account for dual jobs, wages, hours of work, reason for leaving the employer, nor did I perform any further sample selection, as I do in the paper.

Hereby, I report the percentage of weekly transitions within each quarterly transition computed omitting 12 weeks in-between:

Percentage of weekly transitions within quarterly transitions
for all Blacks and Whites in the NLSY (years 1978 and 1979)

Quarterly Transitions	% of Weekly Transitions: $u_{w+1}\|u_w$	$e_{w+1}\|u_w$	$u_{w+1}\|e_w$	$e_{w+1}\|e_w$	$e'_{w+1}\|e_w$
Blacks					
$u_{q+1}\|u_q$	**94.93**	2.02	2.02	1.02	0.01
$e_{q+1}\|u_q$	53.95	**9.61**	1.95	33.89	0.60
$u_{q+1}\|e_q$	43.26	0.81	**8.41**	47.14	0.37
$e_{q+1}\|e_q$	1.67	0.73	0.73	**95.74**	1.14
$e'_{q+1}\|e_q$	21.21	5.67	5.67	63.90	**3.56**
Whites					
$u_{q+1}\|u_q$	**95.27**	1.76	1.76	1.20	0.02
$e_{q+1}\|u_q$	47.58	**9.60**	1.94	40.20	0.68
$u_{q+1}\|e_q$	39.05	0.93	**8.52**	51.01	0.49
$e_{q+1}\|e_q$	1.93	0.90	0.90	**95.07**	1.20
$e'_{q+1}\|e_q$	19.85	6.39	6.39	64.48	**2.90**

Note: In this table, the sums by row add up to 100.

For both race groups, there is big persistence of employment status within each quarterly transition. Interestingly, each possible weekly transition happens the most at its corresponding quarterly transition. For example, the weekly transition $e_{w+1}|u_w$ attains its highest percentage over the column, around 9.61%, at the quarterly transition $e_{q+1}|u_q$.

To have an idea of how different are inferences made using these two period lenghts, I also report weekly transitions and compare their implied quarterly transitions to quarterly transitions defined at the week when the quarter begins:

Transitions for all Blacks and Whites in the NLSY (years 1978 and 1979)

	Transitions %		
	Weekly	Quarterly implied by Weekly	Quarterly omitting 12 Weeks
Blacks			
$\Pr(u\|u)$	96.61	75.36	82.88
$\Pr(u\|e)$	7.12	51.75	41.39
$\Pr(e\|e)$	91.87	47.74	56.06
Nobs	333270		22218
Whites			
$\Pr(u\|u)$	96.09	68.66	77.39
$\Pr(u\|e)$	4.69	37.59	31.42
$\Pr(e\|e)$	94.20	61.69	66.25
Nobs	788550		52570

The quarterly transitions implied by the weekly transitions are computed iterating the weekly transition matrix 13 times. The quarterly transitions I (and Wolpin 1992) construct do not match exactly the quarterly transitions implied by the weekly transitions. For both race groups they tend to overestimate the persistence of unemployment and employment and underestimate job loss. However, given the substantial omission of weekly observations, one can consider that the quarterly transitions are not that inaccurate.

Appendix C: Numerical Solution of the Model

As mentioned in the main body of the paper, the model is solved on a discretized state space. Certainly, the computation of the DP problem and the criterion function are sensitive to the discretization of the state and choice variables, especially of wealth. Few gridpoints for wealth reduce the accuracy of the model in replicating observed quits and savings, and in estimating the borrowing limit. The choice of 201 gridpoints for wealth, almost four times as much as the number of gridpoints for wages, aims to ameliorate this problem. Fewer than 5% of wealth and 3% of wage observations lie outside the admissible range defined by these bounds. The table below gives further details of this discretization, based on Rendon (2006).

Discretization of variables		
	Assets	Wages
Original Variable	A	ω
Discretized Variable	$A(i)$	$\omega(j)$
Gridpoints	$i = 1, ..., N_A$	$j = 1, ..., N_w$
Number of Gridpoints	$N_A = 201$	$N_w = 51$
Lower Bound	$\underline{A} = -10,250$	$\underline{w} = 1,000$
Upper Bound	$\overline{A} = 55,250$	$\overline{w} = 10,000$
Gridsize	$\Delta_A = \frac{\overline{A} - \underline{A}}{N_A}$	$\Delta_w = \frac{\ln \overline{w} - \ln \overline{w}}{N_w}$

The discrete probability for a wage draw $\omega(j)$ is

$$\widehat{f}(j) = \frac{\Phi\left(\frac{\ln\omega(j)+\Delta_w/2-\mu}{\sigma_w}\right) - \Phi\left(\frac{\ln\omega(j)-\Delta_w/2-\mu}{\sigma_w}\right)}{\Phi\left(\frac{\ln\overline{w}-\mu}{\sigma_w}\right) - \Phi\left(\frac{\ln\underline{w}-\mu}{\sigma_w}\right)}.$$

Wage as a function of age $w_t(\omega)$ is also discretized and becomes $w(j,t)$=$\omega(j)\exp(\alpha_1 t + \alpha_2 t^2)$. Arrival and layoff rates are $q(t) = q_0 \exp(\alpha_q t) / [1 + q_0 (\exp(\alpha_q t) - 1)]$, $q = \{\lambda, \pi, \theta\}$.

The entire working lifetime is assumed to be 162 quarters. As in Wolpin (1992), the solution to the model and estimation is made tractable assuming that the individual solves the DP problem using longer period lengths for the more distant future value functions. Let n be the period length measured in quarters and let t_n be age measured in periods of varying length n. The following scheme illustrates the periods' transformation:

	50 quarterly periods	8 annual periods	10 biannual periods
Quarters t:	1, 2,,,......, 49, 50	51, 52,...., 81, 82	83, 84,......, 161, 162
Period Length:	$n = 1$	$n = 4$	$n = 8$
Transformed periods t_n	1, 2,......, 49, 50	51, 52,...., 57, 58	59, 60,......, 67, 68

Then, the age in quarters measured in periods of varying length $n = \{1, 4, 8\}$ is

$$t(t_n) = \min(t_n, 50) + 4\min(\max(t_n - 50, 0), 58) + 8\max(t_n - 58, 0).$$

Notice that the transformed number of periods t_n does not indicate the *number* of quarterly, annual, biannual periods. This way, a finite horizon DP problem of originally 162 quarterly periods is transformed into a problem of only $T = 68$ periods. However, one has to make several adjustments in the setup to match these varying period lengths.

The arrival and discount rates for a person of age t_n measured in periods of length n are, thus,

$$q_n(t_n) = 1 - (1 - q(t))^n,\ q = \{\lambda, \pi, \theta\}, \quad \beta_n = \beta^n.$$

And the borrowing constraint is just $B_{t_n} = -s\sum_{\tau=t(t_n)}^{T} b/(1+r)^{T-\tau}$. For annual and biannual period lengths, the quarterly consumption is assumed to be constant during that period. If the agent is unemployed and consumes C_u in each quarter, wealth at the end of a period of length n is

$$A_{t_n+1} = (1+r)^n A_{t_n} + b\sum_{j=1}^{n}(1+r)^j - C_u\sum_{j=1}^{n}(1+r)^j.$$

The utility function for a period of length n from quarterly consumption C_u is then

$$\begin{aligned} U_n\left(C_u\right) &= \sum_{t=0}^{n} \beta^t U\left(C_u\right) = \frac{1-\beta^n}{1-\beta} U\left(C_u\right) = \frac{1-\beta^n}{1-\beta} U\left(g_n A_{t_n} + b - g_n \frac{A_{t_n+1}}{(1+r)^n}\right) \\ \text{where} &: \ g_n = \frac{(1+r)^n}{\sum_{j=1}^{n}(1+r)^j} = \frac{1-\frac{1}{(1+r)}}{1-\frac{1}{(1+r)^{n+1}}}. \end{aligned}$$

Consumption is also constant during the period when the individual is employed, without any change in the wage offer distribution, but with an adjustment for wage growth. The quarterly wage for a person of age t_n measured in periods of length n is thus

$$w_n\left(\omega, t_n\right) = \omega \exp\left(\alpha_1 t\left(t_n\right) + \alpha_2 t^2\left(t_n\right)\right).$$

Hence, the utility function for a period of length n from a constant quarterly consumption C_e of an employed agent with initial wage ω and age t_n is

$$U_n\left(C_e\right) = \sum_{t=0}^{n} \beta^t U\left(C_e\right) = \frac{1-\beta^n}{1-\beta}\left[U\left(g_n A_{t_n} + w_n\left(\omega, t_n\right) - g_n \frac{A_{t_n+1}}{(1+r)^n}\right) - \psi\right]$$

This way, the DP problem is solved by choosing wealth next period regardless of the period length, just by making the necessary adjustments in the utility function and its arguments during the backward solution. Note that this procedure does not entail aggregating quarterly observations, because the estimation only uses data from period 1 until period 40, for which I use quarterly periods.

The numerical solution proceeds in the following steps:

1. For $t_n = T+1$ define the discretized value functions:

$$\begin{aligned} \widehat{V}^u\left[i, t_n\right] &= V_R\left(A(i)\right), \text{ and} \\ \widehat{V}^e\left[i, j, t_n\right] &= V_R\left(A(i)\right), \end{aligned}$$

   where $V_R\left(A(i)\right)$ is the discretized value of being retired. For a CRRA utility function, this value function admits an analytical expression:

$$V_t^R\left(A_t\right) = \max_{\{A\}_{s=t}^{T_F}} \sum_{s=t}^{T_F} \beta^{s-t} \frac{\left(A_s - \frac{A_{s+1}}{1+r}\right)^\gamma - 1}{1-\gamma} = \frac{\left(A_t - A_{T_F+1}\right)^{1-\gamma}}{1-\gamma} c_1^\gamma - \frac{1}{1-\gamma} c_2,$$

   where $c_1 = \frac{1-\left[\frac{g}{1+r}\right]^{T_F-T+1}}{1-\frac{g}{1+r}}$, $g = \left[\beta\left(1+r\right)\right]^{\frac{1}{\gamma}}$, $c_2 = \frac{1-\beta^{T_F-T+1}}{1-\beta}$, and $A_{T_F+1} > 0$. Analytical solutions for consumption and for assets are $C_t = \frac{g^{t-T}}{c_1} A_T$ and $A_t = \frac{g^{t-T}}{c_1} A_T \left(\frac{1-\left(\frac{g}{1+r}\right)^{T_F-t+1}}{1-\frac{g}{1+r}}\right)$, respectively. With $\beta\left(1+r\right) < 1$, consumption and assets of the retired decrease monotonically over time. Individuals are assumed to live for 25 years (100 quarters) after retirement. As the value function and the policy rules for retirement admit closed solutions and these functions are only needed at the moment of retirement, their period length is a quarter.

2. Integration. Define the discretized expected values

$$\begin{aligned} W^u[i,t_n] &= \lambda_n(t_n)\sum_{j=1}^{N_w}\max\left[\widehat{V}^e[i,j,t_n],\widehat{V}^u[i,t_n]\right]f(j)+[1-\lambda_n(t_n)]\widehat{V}^u[i,t_n]; \\ W^e[i,j,t_n] &= [1-\theta_n(t_n)]\left(\pi_n(t_n)\sum_{l=1}^{N_w}\max\left[\widehat{V}^e[i,j,t_n],\widehat{V}^e[i,l,t_n],\widehat{V}^u[i,t_n]\right]f(l)\right. \\ &\left. +[1-\pi_n(t_n)]\max\left[\widehat{V}^e[i,j,t_n],\widehat{V}^u[i,t_n]\right]\right) \\ &+\theta_n(t_n)\left(\pi_n(t_n)\sum_{l=1}^{N_w}\max\left[\widehat{V}^e[i,l,t_n],\widehat{V}^u[i,t_n]\right]f(l)+[1-\pi_n(t_n)])\widehat{V}^u[i,t_n]\right). \end{aligned}$$

3. Compute the value function for the previous period

$$\begin{aligned} \widehat{V}^u[i,t_n] &= \max_{m\geq i^*(t_n+1)}\left\{U_n\left(g_nA(i)+b-g_n\frac{A(m)}{(1+r)^n}\right)+\beta_nW^u[m,t_n+1]\right\}, \\ \widehat{V}^e[i,j,t_n] &= \max_{q\geq i^*(t_n+1)}\left\{U_n\left(g_nA(i)+w_n(j,t_n)-g_n\frac{A(q)}{(1+r)^n}\right)+\beta_nW^e[q,j,t_n+1]\right\}, \end{aligned}$$

where $A(i^*(t_n+1)) = B_{t_n+1}$. The maximizers to these problems are $q^* = q^*(i,j,t_n)$ and $m^* = m^*(i,t_n)$; the reservation wage is $j^*(i,t_n) = \left\{j \,\middle|\, \widehat{V}^e[i,j,t_n] \geq \widehat{V}^u[i,t_n] > \widehat{V}^e[i,j-1,t_n]\right\}$.

4. Go to step 2. This process goes backwards and it is repeated until reaching period $t_n = 1$.

Appendix D: Simulated Method of Moments

The discrete distribution of an observed variable is characterized by a set of J frequencies m_j, $j = \{1,..,J\}$. Let n be the total number of observations of the actual variable and n_j the number of observations of the actual variable in the jth cell. The predicted counterparts of the frequencies and the number of observations for the jth cell are $\widehat{m}_j$ and $\hat{n}_j$, respectively. Let $\Delta m' = [\Delta m_1, \cdots, \Delta m_J]'$ be a vector in which $\Delta m_j = m_j - \widehat{m}_j$, that is, the difference between the actual and the predicted percentage for each cell. A method of moments estimation minimizes the weighted average distance between the actual and predicted distributions $\Delta m' W^{-1} \Delta m$, where W is a diagonal matrix in which each element of the main diagonal is $\frac{\widehat{m}_j}{n}$. Then, the weighted average distance of a variable, indexed by k, becomes

$$\Delta m' W^{-1} \Delta m = \sum_{j=1}^{J_k} \Delta m_j^2 \left(\frac{\widehat{m}_j}{n} \right)^{-1} = \sum_{j=1}^{J_k} \frac{(m_j - \widehat{m}_j)^2 n^2}{\widehat{m}_j n} = \sum_{j=1}^{J_k} \frac{(n_j - \hat{n}_j)^2}{\hat{n}_j} = \chi^2_{J_k - 1}.$$

Since a sum of chi-square random variables follows also a chi-square distribution, with this diagonal weighting matrix the weighted average distance is $\chi^2_{L-K} = \sum_{k=1}^{K} \chi^2_{J_k-1}$, where $L = \sum_{k=1}^{K} J_k = 200$ is the number of moments used in the estimation, and $K = 70$ (7 variables $\times 10$ years). Hence, matching the simulated moments to the moments observed in the actual dataset is equivalent to computing a χ^2-statistic for the selected distributions: $S(\Theta) = \chi^2_{L-K}$.

Appendix E: Asymptotic Standard Errors

The asymptotic standard errors are obtained from the criterion function by the following formula:

$$Asy.\ Var(\Theta) = \left[\frac{\partial^2 S(\Theta)}{\partial\Theta\partial\Theta'} \right]^{-1} \approx \left[\frac{\Delta^2 S(\Theta)}{\Delta\Theta\Delta\Theta'} \right]^{-1}$$

The first numerical derivative is computed by increasing each parameter proportionally by h and smoothing the criterion function, which has many discontinuities, with a quadratic approximation. If a first approximation of the first derivative is $\frac{S(\Theta+h\Theta)-S(\Theta)}{h\Theta}$, the relative step-size in each parameter can be further shrinked by $\varepsilon \in (0,1)$. Let $S(\theta + \varepsilon h\theta) - S(\theta) \approx \varepsilon^2 [S(\theta + h\theta) - S(\theta)]$, then $\frac{S(\theta+\varepsilon h\theta)-S(\theta)}{\varepsilon h\theta} \approx \frac{\varepsilon^2[S(\theta+h\theta)-S(\theta)]}{\varepsilon h\theta}$. For $\varepsilon = h$, we obtain $\frac{\Delta S(\Theta)}{\Delta\Theta} = \frac{S\left(\theta+h^2\theta\right)-S(\theta)}{h^2\theta} \approx \frac{S(\theta+h\theta)-S(\theta)}{\theta}$. Alternatively, other methods can be used, such as a kernel approximations for smoothing the computation of these derivatives as in Coppejans and Sieg (2005).

The second derivative is approximated in a similar way, that is, by computing the implied variation in the numerical first derivative implied by a variation of each parameter and smoothing it by the same relative variation:

$$\left[\frac{\Delta^2 S(\Theta)}{\Delta\Theta\Delta\Theta'} \right]_{ij} = \begin{cases} \frac{S(\Theta_{-i,j},\theta_i+h\theta_i,\theta_j+h\theta_j)-S(\Theta_{-i},\theta_i+h\theta_i)-S(\Theta_{-j},\theta_j+h\theta_j)+S(\Theta)}{\theta_i\theta_j}, & \text{if } i \neq j; \\ \frac{S(\Theta_{-i},\theta_i+2h\theta_i)-2S(\Theta_{-i},\theta_i+h\theta_i)+S(\Theta)}{\theta_i^2}, & \text{if } i = j. \end{cases}$$

where $S(\Theta_{-i}, \theta_i + h\theta_i)$ is the criterion function when parameter θ_i is increased by $h\theta_i$ and all the other parameters denoted by Θ_{-i} are unchanged, and $S(\Theta_{-i,j}, \theta_i + h\theta_i, \theta_j + h\theta_j)$ is the criterion function when parameters θ_i and θ_j are increased respectively by $h\theta_i$ and $h\theta_j$ and all of the others, $\Theta_{-i,j}$, are kept fixed.

The parameters' asymptotic standard errors are the square root of the main diagonal of this matrix. I use $h = 0.01$ for the behavioral parameters, and $h = 0.0001$ for the proportions of types.

Appendix F: Wage Peaks by Type

The following table indicates at which quarter wages of each race group reach their maximum level

Maximum Wage by Race, Type and Quarter

Blacks				Whites			
		Wage Peak				Wage Peak	
Types	%	Value	Quarter	Types	%	Value	Quarter
p_{111}	29.1	7458	137	p_{111}	34.2	10018	180
p_{112}	16.6	7539	135	p_{112}	3.5	8180	164
p_{121}	7.4	7470	136	p_{121}	5.4	10018	180
p_{122}	4.2	7540	135	p_{122}	0.6	8180	164
p_{211}	21.6	2591	66	p_{211}	44.1	5194	41
p_{212}	12.3	2557	66	p_{212}	4.6	5634	35
p_{221}	5.5	2596	65	p_{221}	6.9	5195	41
p_{222}	3.1	2557	66	p_{222}	0.7	5634	36

Generally speaking, wages of blacks tend to peak earlier and at lower values than wages of whites. Type combinations formed by Type 1 attain around $7,500 at quarter, the highest maximum wage level of blacks, 135 and 137 after graduation. On the other hand, type combinations formed by Type 2 parameter subset of blacks attain around $2,650 quarterly wages at quarter 65 or 66. Whites of Type 1 in labor market and taste parameters have higher maximum average wages, $10,018 attained later in their careers, at quarter 180, while whites of Type 1 in labor market and Type 1 in taste parameters have medium maximum quarterly wages, $8,180, and peak at quarter 164. White individuals belonging to Type 2 of labor market parameters have lower maximum wages, between $5,200 and $5,600, attained between quarter 35 and 41.

Appendix G: Extended Table 6

The following tables extend the information reported in Table 6 of the main text by providing a detailed report of the actual and predicted choice distributions. Table 6a presents a summary of the actual and predicted distributions of employment status and transitions for years 3, 6, and 9 after graduation for both race groups. Table 6b presents a similar summary of the actual and predicted wealth and wage distributions, as wealth as the corresponding average racial wealth and wage ratios. Both tables include goodness of fit tests.

Table 6a. Summary. Blacks and Whites: Actual and Predicted Choice Distribution.
Employment Status and Transitions for three selected Years after Graduation (in %)

Employment Variables	Year 3 Act.	Year 3 Pred.	Year 3 χ^2	Year 6 Act.	Year 6 Pred.	Year 6 χ^2	Year 9 Act.	Year 9 Pred.	Year 9 χ^2
Unemployment Rate									
Blacks	34.2	32.2	1.1	19.3	25.6	12.6	19.7	19.4	0.0
Whites	18.3	16.4	2.4	10.9	13.3	3.9	8.8	9.6	0.6
Transitions									
From Unemployment to Employment									
Blacks	24.9	28.1	1.1	22.8	27.5	1.7	33.0	27.0	2.1
Whites	37.4	40.6	0.6	45.1	38.2	2.2	47.9	44.6	0.3
Transitions from Employment									
Blacks: job separations	12.2	12.1	0.1	5.9	8.9	5.1	8.3	6.1	4.6
Blacks: job-to-job	9.5	9.9		8.2	7.9		7.4	6.9	
Whites: job separations	8.4	8.0	1.3	6.5	6.2	0.1	5.6	4.6	5.3
Whites: job-to-job	11.3	10.2		8.5	8.3		5.2	7.0	
Quits and Layoffs in job separations									
Blacks	68.9	78.8	2.7	46.2	71.8	8.4	52.8	69.0	4.4
Whites	69.4	72.0	0.2	56.8	72.3	4.5	62.1	73.1	1.8
Quits and Layoffs in job-to-job transitions									
Blacks	52.8	38.2	3.2	27.8	32.5	0.4	41.4	30.0	1.8
Whites	34.3	27.1	1.8	20.0	21.1	0.0	33.3	19.1	4.3

Crit. values at .5% signif.: $\chi^2_{(1)} = 7.9$, $\chi^2_{(2)} = 10.6$.

Table 6b: Summary. Blacks and Whites: Actual and Predicted Choice Distribution. Wealth and Wages for three selected Years after Graduation

Wealth and Wages	Year 3				Year 6				Year 9			
	Blacks		Whites		Blacks		Whites		Blacks		Whites	
	Act	Pre	Act	Pre	Act	Pre	Act	Pre	Act	Pre	Act	Pre
Wealth Distribution:												
$A \leq 0$	2.8	3.7	7.8	15.6	5.7	6.3	13.8	12.6	6.2	7.3	10.7	7.6
$0 < A \leq 10K$	95.8	88.9	76.6	66.7	86.8	86.4	68.8	67.2	83.2	82.6	60.0	47.9
$10K < A \leq 20K$	0.0	5.4	10.9	11.9	4.7	5.6	10.9	14.1	6.2	7.1	12.1	22.4
$20K < A \leq 30K$	1.4	1.5	3.1	4.5	0.9	1.2	2.2	4.3	2.7	2.0	10.7	14.4
$A > 30K$	0.0	0.5	1.6	1.3	1.9	0.6	4.3	1.9	1.8	0.9	6.4	7.7
χ^2	4.7		3.8		3.3		7.0		1.4		14.2	
Average Wealth	1393	2905	4921	5234	3381	3064	5664	6014	3702	3588	8780	11385
Black-White ratio	28	56			60	51			42	32		
Wage Distribution:												
$w \leq 2K$	20.2	19.9	16.7	16.0	12.7	11.6	8.4	7.8	10.9	9.3	4.6	3.2
$2K < w \leq 4K$	61.3	66.3	58.2	57.5	60.7	62.9	50.7	50.5	56.1	51.5	38.2	45.5
$4K < w \leq 6K$	16.2	11.7	18.6	20.7	19.1	19.8	27.6	28.4	21.6	27.8	40.7	33.7
$w > 6K$	2.3	2.2	6.5	5.7	7.5	5.7	13.2	13.3	11.4	11.3	16.5	17.6
χ^2	7.4		2.1		3.5		0.5		8.5		22.4	
Average Wage	3104	2888	3363	3343	3473	3415	4114	3948	3739	3874	4552	4365
Black-White ratio	92	86			84	86			82	89		

Years after Graduation

Crit. values at .5% signif.: $\chi^2_{(3)} = 12.8$, $\chi^2_{(4)} = 14.9$.

Appendix H: Policy simulations

Let denote Θ^b_{ijk}, and Θ^w_{ijk}, $i,j,k = 1,2$, where $\Theta^r_{ijk} = \{\Theta^{1r}_i,\ \Theta^{2r}_j,\ \Theta^{3r}_k\}$, for $r = b,w$, as the behavioral parameters of blacks and whites, respectively. The associated probabilities of being Type 1 for each of the three subset of parameters are $p^r_l = \Pr\left(\Theta^{1r}_l\right)$, $l = 1,2,3$. To perform the counterfactual experiment, say, of assigning blacks the labor market parameters of whites, I proceed as follows:

1. Replace the parameter subset of blacks, Θ^{1b}_1 and Θ^{1b}_2, and the associated Type probability, $p^b_1 = \Pr\left(\Theta^{1b}_1\right)$, by the corresponding parameter subset and Type probability of whites, Θ^{1w}_1 and Θ^{1w}_2 and $p^w_1 = \Pr\left(\Theta^{1w}_1\right)$.

2. Generate eight counterfactual type combinations, $\{\Theta^{1w}_i,\ \Theta^{2b}_j,\ \Theta^{3b}_k\}$, for $i,j,k = 1,2$, and redefine their associated probabilities:

$$
\begin{array}{ll}
p_{111} = p^w_1 p^b_2 p^b_3, & p_{112} = p^w_1 p^b_2 \left(1 - p^b_3\right), \\
p_{121} = p^w_1 \left(1 - p^b_2\right) p^b_3, & p_{122} = p^w_1 \left(1 - p^b_2\right)\left(1 - p^b_3\right), \\
p_{211} = \left(1 - p^w_1\right) p^b_2 p^b_3, & p_{212} = \left(1 - p^w_1\right) p^b_2 \left(1 - p^b_3\right), \\
p_{221} = \left(1 - p^w_1\right)\left(1 - p^b_2\right) p^b_3, & p_{222} = \left(1 - p^w_1\right)\left(1 - p^b_2\right)\left(1 - p^b_3\right).
\end{array}
$$

3. Use these new parameter sets and type probabilities to solve the DP-problems by type combination and generate simulated paths for the variables of interest.

Repeat this process for all counterfactual computations.

Appendix I: Decomposition of racial gaps in labor market, wealth and taste differences

Let denote X_{rst} as the value of a predicted variable implied by a counterfactual parameter combination $\{\Theta^{1r},\ \Theta^{2s},\ \Theta^{3t}\}$, $r,s,t = b,w$, and its associated counterfactual probability masses $p_{ijk}, i,j,k = 1,2$, generated as described in Appendix A8. Then one can decompose a racial gaps in the following way:

$$
\begin{array}{ccc}
\underbrace{(X_{www} - X_{bbb})} & = & \underbrace{(X_{wbb} - X_{bbb})} + \underbrace{(X_{wwb} - X_{wbb})} + \underbrace{(X_{www} - X_{wwb})} \\
\text{Total racial gap} & = & \begin{array}{c}\text{Labor market}\\ \text{component}\end{array} \quad \begin{array}{c}\text{Wealth}\\ \text{component}\end{array} \quad \begin{array}{c}\text{Taste}\\ \text{component}\end{array},
\end{array}
$$

and express everything in relative terms by just dividing all terms by the total racial gap. Notice that in this decomposition the first parameter change is in labor market parameters, then, incrementally, blacks are assigned wealth parameters of whites, and, finally, taste parameters of whites. However, there are altogether six possible sequences for changes in these parameters, which yield six different results. In the decomposition reported in the main text, I take an average of the six possible computations of each of the three components.

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