Racial Wage Gaps and Barriers to Non-White Entrepreneurship

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July 21, 2024

Abstract

Can the racial wage gap between white and non-white workers explain the racial gap in business ownership? We develop a dynamic heterogeneous agents model that endogenously links racial wage gaps to racial asymmetries in business ownership. In the model, white and non-white workers with different education levels, labor productivity, and wealth choose between working for another entrepreneur or opening a business and becoming entrepreneurs themselves. Calibrating the model to the Brazilian economy, we show that, in general equilibrium, closing the racial wage gap leads to (i) a higher share of non-white business owners; (ii) exit of firms owned by white entrepreneurs with relatively low productivity; and (iii) GDP and TFP gains.

Keywords: Racial Inequality, Misallocation, Entrepreneurship

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1 Introduction

Racial inequality is a predominant feature in developed and developing countries. There has been a lot of research focusing on the determinants of economic disparities by race Lang and Lehmann (2012); Lang and Kahn-Lang Spitzer (2020) and its consequences in many areas of society such as education, crime, and health. However, there is significantly less understanding of the macroeconomic consequences of racial inequality. Hsieh et al. (2019) makes the argument that labor market barriers defined by race and gender generate a misallocation of talent in the economy, leaving talented workers out of more productive occupations. It is natural to think that labor market barriers to specific groups can also have consequences on the decision to start a business. Understanding the decision of business ownership and its interplay with the labor market opens up different dimensions through which racial disparities can affect the economy.

In this paper, we investigate the interplay between racial disparities in the labor market and entrepreneurship and the resulting effect on macroeconomic outcomes. We develop a dynamic heterogeneous agents model in which white and non-white individuals choose between employment and entrepreneurship and have the same distribution of productivity conditional on education levels, but are remunerated differently in the labor market. We calibrate the model to match empirical moments from the Brazilian economy, drawn from unique owner-employer-employee administrative data that allows us to track the race of entrepreneurs and workers. The model endogenously links racial wage gaps to racial asymmetries in entrepreneurship and allows us to create counterfactuals through which we investigate the role of racial disparities in macroeconomic outcomes. In our main findings, we show that eliminating racial wage gaps reduces the misallocation of talent in the economy, increasing aggregate output by 1.26%.

We begin by highlighting stylized facts from the Brazilian economy. Despite corresponding to 45% of the population in the formal labor force, non-white individuals only correspond to 30% of business owners. The non-white population is also much less likely to be college educated and have wages on average 30% lower than white workers. When adjusting for observable characteristics such as age, gender, and geographic location, the racial wage gap falls to 16.2% for college-educated workers and 6.64% for non-college-educated workers. Following Hsu Rocha and Dias (2021), we

also show differences in the racial wage gap in firms with white and non-white entrepreneurs. On average, the racial wage gap in firms with non-white entrepreneurs is 25% smaller than in firms with only white entrepreneurs. This is true for both college-educated and non-college-educated workers.

We then outlay our model, designed to replicate the stylized facts, and understand the interplay between racial wage gap and racial disparities in entrepreneurship. In our model, agents can be white or non-white, and have a given education level. Within each education level, white and non-white workers have the same innate distribution of productivity. At every period, white and non-white individuals can choose whether to start their own businesses or to supply labor to other entrepreneurs. In the labor market, non-white workers face a wage penalty relative to white workers that we set exogenously to reflect wage gaps estimated using the Brazilian context. To open a business, workers must pay a fixed entry cost, which generates a barrier that workers who desire to venture into entrepreneurship need to overcome by saving on a risk-free asset. Therefore, wage gaps can generate entrepreneurial gaps as non-white workers are not able to accumulate assets as intensely as white workers do.

The dynamic nature of our model incorporates new channels through which labor market disparities reflect in entrepreneurship differences. Static models of entrepreneurial choice that feature wage gaps in the labor market would generate entrepreneurial gaps that favor the groups of workers being discriminated against. Because non-white workers face a wage penalty relative to white workers, they would have a smaller opportunity cost of starting a business. In a dynamic model with asset accumulation, we still have the opportunity cost channel, but we also incorporate the savings channels, through which lower labor market earnings decrease entry into entrepreneurship.

We then calibrate the model in order to match empirical moments describing the Brazilian labor market and entrepreneurial environment. Through counterfactual exercises in which we reduce the labor market penalties by race, we quantify the role of racial wage gaps in explaining racial differences in business ownership. We also explore the role of differences in college education observed in the non-white and white populations and how that accounts for racial differences in entrepreneurship. Finally, we measure the potential macroeconomic gains in terms of GDP and TFP in counterfactual scenarios in which: wage gaps are removed; the entry cost of opening a business is reduced for non-white workers; and a larger share of non-white workers

is college educated.

Removing wage gaps have heterogeneous effects on non-white business ownership rates depending on both the education level of the worker and the race of the employer. Removing wage gaps for non-white workers with at most a High School degree have a bigger impact on non-white entrepreneurship than removing wage gaps for college-educated non-white workers. Moreover, closing the wage gaps for non-white workers working for white employers also have stronger effects on non-white entrepreneurship when compared to the group of non-white workers working for non-white employers. Lifting the wage penalty for non-white workers with a High School degree or less translate into GDP and TFP gains of 1.04% and 1.24%. Removing wage gaps for all non-white workers, regardless of their education status or employer's race, increases the GDP by 1.26% and the TFP by 1.27%, while the welfare gains in terms of consumption for non-white workers can be as high as 3.53%.

Increasing the share of college educated non-white workers is not as effective at boosting non-white entrepreneurship as reducing the entry fixed cost for non-white agents. However, similar increases in non-white business ownership induced by college education have stronger effects on the economy's GDP than the ones caused by alleviating the entry cost for potential non-white entrepreneurs. The stronger effects on aggregate output from closing the college gap relative to a reduction in entry costs arise from the fact that entry into non-white entrepreneurship exerts weaker externalities on white entrepreneurship. Because college educated workers have higher labor market earnings on average, increasing the share of college educated non-white workers increases entrepreneurship rates for that group only. Reducing fixed costs of entry for all non-white workers boosts entrepreneurship for college and non-college educated workers alike. The response in equilibrium wages is stronger in the second counterfactual scenario, leading to higher exit rates from entrepreneurship within the white population that are induced by smaller profits combined with a higher opportunity cost of opening a business.

Related Literature

We relate to a large literature studying the interplay between liquidity constraints and entrepreneurial choice. In Evans and Jovanovic (1989), one of the earliest attempts to estimate the degree of liquidity constraints in a static model of entrepreneurial choice, authors conclude that financial frictions matter not only for

business ownership, but also generate significant sub-optimal allocations of capital conditional on entry into entrepreneurship. More recently, Cagetti and De Nardi (2006), Buera (2009) and Moll (2014) investigate the role of financial frictions for business ownership and optimal capital allocation in a dynamic setting, where wealth accumulation is endogenously determined and self-financing exerts a role at mitigating liquidity constraints. We contribute to this literature by considering racial disparities in the ability to accumulate resources and evaluating how wage gaps deter business ownership for individuals discriminated in the labor market. We also disentangle the role of capital constraints in the extensive and intensive margin of entrepreneurial activity, separating how entry costs matter for business ownership from the presence of credit constraints in the allocation of capital once a business is formed.

This paper also connects to a nascent literature in macroeconomics studying the aggregate implications and efficiency losses derived from markets that feature discrimination more generally. For instance, Chiplunkar and Goldberg (2021) develop a static multi-sector model to quantify barriers to female entrepreneurship in India and what are the potential output and welfare gains from removing the gender-based barriers altogether. In another effort to measure the extent to which gender disparities affects growth, Cavalcanti et al. (n.d.) develops a two period model of occupational choice in which fertility decisions disproportionately affect women's capacity to invest in human capital and enter the labor force. They conclude that about 30% of the US growth in the past decades can be accounted for by the loosening of barriers to female labor force participation.

Lastly, this paper contributes to an active literature on racial disparities in labor markets and entrepreneurship. (see Lang and Lehmann (2012); Lang and Kahn-Lang Spitzer (2020) for reviews of the literature on racial labor market disparities). Many papers have focused on identifying discrimination (Bertrand and Mullainathan, 2004; Glover et al., 2017; Kline and Walters, 2021; Kline et al., 2021), and recent work has moved towards understanding more aggregate patterns of racial disparities in labor market outcomes Derenoncourt (2019); Derenoncourt and Montialoux (2021). On the entrepreneurship side, the literature's main focus has been on explaining the reasons why racial minorities are underrepresented in entrepreneurship (Fairlie, 1999; Fairlie and Robb, 2008; Chatterji and Seamans, 2012) and how businesses owned by URM perform relative to the average business owned by white individuals (Fairlie and Robb, 2008; **?**). Racial disparities have been carefully described in Latin America and

Brazil as well. The seminal work in Oliveira et al. (1985) uses household survey data from 1976 to thoroughly describe the differences in labor market outcomes between white and non-white workers in Brazil. There is growing literature using the RAIS matched employer-employee to study racial differences in the Brazilian labor market (Hirata and Soares, 2020; Derenoncourt et al., 2021b,a).

This paper is structured as follows. In Section 2 we discuss the racial differences in the Brazilian labor market in terms of both wage gaps and entrepreneurial rates. We estimate wage gaps for non-white workers and show how they vary with respect to their education level and the race of their employer. In Section 3, we lay down a dynamic model of self-financing and entrepreneurial choice that accounts for the estimated patterns in the Brazilian labor market. Then, we describe the model's parametrization and discuss our calibration strategy in Section 4. Finally, in Section 5, we provide the counterfactual exercises in which we quantify the aggregate implications of removing wage gaps, alleviating fixed entry costs for non-white workers and increasing the share of college education for the non-white population.

2 Context

Brazil is the largest country in Latin America, with 220 million inhabitants. Since colonial times, its history has been defined by racial inequalities as the country that received the most people through slavery institutions from sub-Saharan Africa and the last country in the Americas to abolish slavery. Brazil's official classification of race encompasses 5 categories: *pretos*, *pardos*, *indigenas*, *brancos*, and *amarelos*. For all purposes, in this paper, we group the first three categories as *non-white*, whereas the two latter are grouped as white[1].

Racial inequalities are observed in both employment and entrepreneurship outcomes. We show descriptive statistics of the Brazilian formal Labor Market between 2011 and 2015 in Table 1[2]. The average white worker has 1.5 more years of schooling than the average non-white worker. There are also large differences in the share of white and non-white workers that are highly educated. 32 % of white workers have

[1]Despite large sociological and Political debates about the differential racial treatment between *Pretos* and *Pardos*, the two groups have similar economic outcomes.Hsu Rocha and Dias (2021) have an extensive discussion of why the 5 categories are grouped in these 2.

[2]These were created using PNAD (*Pesquisa Nacional por Amostra Domicilar*) which is a household survey conducted by the Brazilian Institute of Geography and Statistics.

some college education, while the share is only 15% for non-white workers.

Table 1: Summary Statistics of Brazilian Economy

	(1) All	(2) White	(3) Nonwhite
Characteristics of all Individuals in the Labor Force			
Sh. with some College	0.247	0.326	0.157
Avg. Schooling Years	9.855	10.57	9.038
Sh. Female	0.378	0.413	0.339
Average Age	38.38	38.71	37.99
Sh. in North or Northeast Regions	0.216	0.119	0.328
Avg. Mo Earnings (2019 RS)	2695.2	3272.7	2033.6
1 if employer; 0 otherwise	0.0671	0.0923	0.0382
Characteristics of Full time Workers in the Formal Sector			
Sh. with some College	0.236	0.313	0.152
Avg. Schooling Years	9.754	10.46	8.988
Sh. Female	0.383	0.422	0.341
Average Age	38.04	38.25	37.81
Avg. Mo Wage (2019 RS)	2320.9	2762.6	1843.5
Characteristics of Formal Entrepreneurs			
Sh. with some College	0.412	0.460	0.278
Avg. Schooling Years	11.26	11.62	10.28
Sh. Female	0.313	0.326	0.278
Average Age	43.05	43.24	42.52
Avg. Mo Earnings (2019 RS)	7194.8	7664.3	5895.8
Observations	265101	131557	133544

Notes: This Table provides summary statistics of Brazilian Labor Markets constructed using PNAD data from 2011 to 2015. The sample is restricted to individuals between 25 and 60 years old working as employees or entrepreneurs in the private formal sector. Employees are defined as formal if they have a signed working permit, and entrepreneurs are defined as those who employ at least one worker and contribute to social security.

These differences are also observed in wages and in the probability of being an entrepreneur. Through Mincerian regressions, we can characterize these wage gaps controlling for observable characteristics such as education, age, gender and geographic location[3] We use data from 2011 to 2015 to estimate versions of the following regression:

$$Y_i = \alpha + \beta \cdot Non - white_i + \Gamma' X_i + \epsilon_i \tag{1}$$

where $Non-white_i$ is a dummy that takes value one if the individual is non-white and X_i is a vector of controls that include state fixed effects, age, gender and education dummies.

We observe large differences in earnings and the likelihood of being an entrepreneur between white and non-white individuals. We show our estimates of coefficient β from equation 1 in Table 2. Non-white workers in the private formal sector on average earn 28% than white ones. A large share of the difference can be explained by observable characteristics, namely education. Nevertheless, an earnings gap of 10.5% and 15% for workers and entrepreneurs remain even after controlling for observables.

The same patterns are observed in the last two columns where β gives us the difference in the likelihood of becoming entrepreneurs. Column (5) indicates that 9.2% of white workers in the private-formal sector are entrepreneurs, where for non-white workers this share is 5.4 percentage points smaller, thus indicating that only 3.8% of non-white workers in the private formal sector are entrepreneurs. Controlling for observable characteristics non-white individuals are 4p.p. less likely to be entrepreneurs than white individuals.

[3]As shown in Table 1, non-white workers are more concentrated in the north and northeast regions, which are less economically developed than the southern regions of the country.

Table 2: Mincerian Regression Coefficients

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Log (Wages)				I[Entrepreneur]	
Nonwhite Individual	-0.279	-0.105	-0.232	-0.148	-0.0541	-0.0403
	(0.00265)	(0.00224)	(0.0149)	(0.0152)	(0.00105)	(0.00108)
Workers' Observables	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Dep. Var. Mean	7.61	7.61	8.51	8.51	.092	.092
Observations	247879	247879	17220	17220	265101	265101

Notes: This Table shows the coefficient β from equation 1. The sample is restricted to individuals between 25 and 60 years old working as employees or entrepreneurs in the private formal sector in PNAD data from 2011 to 2015. Employees are defined as formal if they have a signed working permit, and entrepreneurs are defined as those who employ at least one worker and contribute to social security.

2.1 Racial Disparities and the Race of Entrepreneurs

In this subsection we show the relation between racial gaps in labor market outcomes and racial composition of entreprenuers. We use identified data on firm owners and link it to matched employer-employee data on the universe of formal labor markets. The data procedures are all detailed in Appendix **??**. With this combination, we are able to identify the race of entrepreneurs and of workers.

Sorting of Non-white Workers to Firms with Non-white owners: We begin by showing that firms with non-white entrepreneurs have a significantly higher share of non-white employees. This is not explained by other observable characteristics of either firms or workers. To describe and access the magnitude of this pattern, we estimate equations 2 and 3:

$$\text{Share Worker}_j^{NW} = \beta_0 + \beta_1 \cdot \mathit{Entreprenuer}_j^{NW} + \mathbf{X}_j^T \Gamma + \epsilon_j \tag{2}$$

Equation 2 is at the firm level. Share Worker_j^{NW} is the share of non-white workers among employees in firm j. $\mathit{Entreprenuer}_j^{NW}$ indicates if at least one of the entrepeneurs who own firm j is non-white. $\mathbf{X}_j$ is a set of control variables that include sector, municipality, average age, gender and education of workers and entrepreneurs, number of partners, firm entry year, and 10 firm size categories. β_1 gives a straight-

forward magnitude of the difference in the racial composition of firms with white and non-white entrepreneurs

We also provide evidence at the worker level. For this, we estimate the following equation.

$$Entrepreneur_{j(i)}^{NW} = \beta_0 + \beta_1 \cdot Worker_i^{NW} + \mathbf{X}_i^T \beta_3 + \epsilon_i \tag{3}$$

in which $Entreprenuer_{j(i)}^{NW}$ is an indicator that the owner of firm $j(i)$ is non-white, $Worker_i^{NW}$ is an indicator that worker i is non-white, and $\mathbf{X}_i$ is a vector of control variables. Similar to the firm-level analysis, we can add variables to the control vector to observe how or sorting estimates change with each set of controls.

In equation 3, coefficient β_1 is interpreted as the difference in the probability of being employed by a non-white entrepreneur if the worker is non-white relative to if she was white. We show our estimates for firm level regressions in columns (1)-(4) and for worker level regressions in columns(5)-(7) of Table 3.

We observe that firms with non-white entrepreneurs have a higher share of non-white employees. Comparing our estimates in columns (1) and (3), we find that sorting patterns are not explained by sector or other characteristics of workers or entrepreneurs. However, a large part of the difference is explained by geographic variation, as we observe in column (3) that the coefficient decreases to 6.3 p.p.. In column (4) we weight our estimates by the number of employees in each firm, and we observe no significant changes in the coefficient[4]. Overall, controlling for geographic, firm and worker characteristics, our estimates suggest that firms with non-white owners have a 24% higher share of non-white employees than the average white owned firm.

Similar to firm level results, in columns (5)-(7) we observe that geographic variation explains a large share of the sorting of non-white workers and non-white entrepreneurs. Our estimates in column (7) suggests that non-white workers are 27% more likely to be employed by non-white entrepreneurs than white workers.

[4]Miller and Schmutte (2021) argues that larger firms hire more non-white workers, thus there could be differences driven by weighting firms with different sizes.

Table 3: Sorting of Non-white Workers and Non-white Entrepreneurs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Firm Level				Worker Level		
Dependent Variable	Share of Nonwhite Employees				I[Nonwhite Entrepreneur]		
Nonwhite Entrepreneur	0.329	0.319	0.0631	0.0624			
	(0.000811)	(0.000815)	(0.000816)	(0.00302)			
Nonwhite Worker					0.207	0.193	0.0473
					(0.000221)	(0.000218)	(0.000232)
Dep. Var. Mean	.25	.25	.25	.25	.17	.17	.17
Worker and Firm Characteristics	No	Yes	Yes	Yes	No	Yes	Yes
Observations	No	No	Yes	Yes	No	No	Yes
N	1253066	1252998	1252854	1252854	17249458	17249450	17249422

Notes: This Table shows the coefficients β_1 from equation 2 and 3. In columns (1) - (4) the dependent variable mean is the average share of non-white workers in firms with white entrepreneurs. In columns (5)-(7) the dependent variable mean is the unconditional probability that a white worker is employed by a non-white entrepreneur. Sample includes all for-profit firms for whom we can identify the race of the owner. In column 4, observations are weighted by the number of employees in each firm. Robust standard errors in parenthesis.

Racial Wage Gap and Race of Entrepreneurs: Next, we re-examine the racial wage gap using our combination of administrative records. The advantage is that in this exercise we can look at how the racial wage gap varies according to the race of entrepreneurs.

Our main specification follows the following equation:

$$ln(wage)_i = \psi_{j(i)} + \beta_1 \cdot Worker_i^{NW} + \beta_2 \cdot Worker_i^{NW} \cdot Entrepreneur_{j(i)}^{NW} + \mathbf{X}_i^T \Lambda + \epsilon_i \quad (4)$$

in which $Entrepreneur_{j(i)}^{NW}$ is an indicator that the firm j where individual i is employed has at least one non-white entrepreneur, $Worker_i^{NW}$ is an indicator that worker i is non-white, $\psi_{j(i)}$ are Fixed Effects for the firm j where worker i is employed, and $\mathbf{X}_i$ is a vector of control variables at the worker level which include age, gender and education.

In this specification, β_1 captures racial wage gap adjusted for observable characteristics in firms without non-white entrepreneurs. The sum of β_1, β_2 is the racial wage gap in firms with non-white entrepreneurs.

As shown in Table 2, differences in education are a key factor in explaining the racial wage gap. Furthermore, the racial wage gap is bigger for employees with some college. We also investigate if there are differences in how firms with and without non-white entrepreneurs pay workers with or without college attainment. To do so,

we also estimate the following equation:

$$\begin{aligned} ln(wage)_i &= \psi_{j(i)} + \beta_1 \cdot Worker_i^{NW} + \beta_2 \cdot HS_i + \beta_3 \cdot HS_i \cdot Worker_{j(i)}^{NW} \\ &+ \beta_4 \cdot Coll_i \cdot Worker_{j(i)}^{NW} \cdot Entre_{j(i)}^{NW} \\ &+ \beta_5 \cdot HS_i \cdot Worker_{j(i)}^{NW} \cdot Entre_{j(i)}^{NW} + \mathbf{X}_i^T \Lambda + \epsilon_i \end{aligned} \tag{5}$$

where $Coll_i$ is an indicator if the worker has some college education, and HS_i is an indicator if the worker has at most a high school degree.

In this specification, the wages of white workers are the baseline value. β_1 gives us the racial wage gap for non-white workers with some college in firms with only white entrepreneurs. β_2 is the average difference in earnings between workers with and without college. The sum $\beta_1 + \beta_3$ is the racial wage gap for workers without college in firms with white entrepreneurs. Coefficients β_4 and β_5 gives the difference in the racial gap between firms with white and non-white entrepreneurs for workers with High School and College respectively.

Results: In column (1) of Table 4, we show that the raw wage gap in our sample is of approximately 29%. In column (2), we add firm FE, and age and gender as controls. We observe that the racial wage gap decreases to 8.6% with the addition of these variables. Overall, we find that in our sample of administrative data, observable characteristics explain around two thirds of the total racial wage differentials. The results are similar to what we document with household survey data.

Next, in columns (3) we show how the racial wage gap differs according to the educational attainment of workers. The baseline value shows the racial wage gap for workers with college, whereas the sum of rows 1 and 3 give the racial wage gap for workers without college. We observe that the gap is significantly higher for college-educated workers.

In columns (4) and (5) we can look at the difference in the racial wage gap between firms with white and non-white entrepreneurs. When we pool workers with all education levels, we observe that the racial wage gap is on average 3.3 p.p. smaller in firms with non-white entrepreneurs. This represents a difference of 25%.

Lastly, in column (5), we can observe the same difference by education level. For workers with some college, the difference in the racial wage gap in firms with white

and non-white owners is 5 p.p. whereas for workers with high school education or less is 2.8 p.p..

Table 4: Racial Wage Gap in Firms with White and Non-white Entrepreneurs

	(1)	(2)	(3)	(4)	(5)
			Log(Wages)		
Nonwhite Worker	-0.291	-0.0857	-0.162	-0.139	-0.184
	(0.000314)	(0.00408)	(0.0173)	(0.00730)	(0.0185)
Nonwhite Worker x Nonwhite Entr.				0.0336	
				(0.00423)	
Nonwhite worker x HS or less Education			0.0956		0.110
			(0.0182)		(0.0193)
NW worker x HS or less Education x NW Entr.					0.0280
					(0.00185)
NW worker x Some College x NW Entr.					0.0497
					(0.00884)
HS or less Educatoin			-0.548		-0.554
			(0.0179)		(0.0203)
Dep. Var. Mean	7.81	7.82	7.82	7.82	7.82
Firm F.E.	No	Yes	Yes	Yes	Yes
Worker and Firm Characteristics	No	Yes	Yes	Yes	Yes
Observations	17249458	16857233	16857233	16857234	16857234

Notes: This Table shows the coefficients from equation 4 and 5. Sample includes all for-profit firms for whom we can identify the race of the owner. In column 4, observations are weighted by the number of employees in each firm. Robust standard errors in parenthesis.

3 Model

3.1 Environment

Time is discrete with an infinite horizon. The economy is populated by workers (employees) and entrepreneurs (employers). Workers are heterogeneous with respect to their assets a, their labor productivity z, their race $g \in \{\text{white}, \text{non-white}\}$, the race of their employer $\tilde{g} \in \{\text{white}, \text{non-white}\}$ and their education status $e \in$

$\{\text{high school}, \text{college}\}$.[5] Entrepreneurs also differ based on their assets, education status and race. We set the mass of white agents to be equal to one. Agents cannot change their education status; instead, for a given race g, there is a mass of agents with education status e given by $M(e, g)$, which is disciplined by the Brazilian micro-data .

Workers do not face the risk of unemployment. However, at every period, they can decide to run their own business and become entrepreneurs themselves. On the other hand, firms ran by entrepreneurs can exogenously close, changing their owners' employment status from employers to employees. We describe below the utility maximization problem of workers (W) and entrepreneurs (E).

Workers

Non-white workers are subject to a wage gap relative to white workers. It is not the purpose of this paper to provide an explanation for the sources of racial wage gaps. Instead, we take the wage gap as a primitive of the economy, allowing for it to capture features of the Brazilian labor market. For instance, we let the racial wage gap vary with respect to the education status of workers. Moreover, non-white workers of a given education status face different wage gaps depending on the race of their employer. As shown in Section 2, non-white employees employed by non-white business owners face a smaller wage gap than non-white workers employed by white entrepreneurs. Therefore, racial imbalances in the composition of employers account for part of the average racial wage gap in the economy and thus form a link connecting entrepreneurial gaps to wage gaps.

Workers value current and future consumption and decide how much to save in the risk-free asset a at every period to maximize the present discounted value of lifetime utility. The return on the risk-free asset is given by the interest rate r, which is common for all agents. Workers choose whether to open a business and become employers or to continue supplying labor to other entrepreneurs. In order to open a business, workers must pay a fixed entry cost κ_g that might be different for non-white and white workers.

Alternatively, workers can decide to stay in the labor market, but they would not

[5]For exposition purposes, we will refer to non-white agents as non-white workers and non-white entrepreneurs. In addition, we refer to agents with some college as being college educated and agents with at most a High School degree as agents with a High School degree.

know the race of their future employer.[6] The probability that a worker is employed by a non-white employer is a strictly increasing function $g(\cdot)$ of the share of non-white entrepreneurs in the economy p_b, satisfying $g(0) = 0$ and $g(1) = 1$. The share of non-white entrepreneurs in the economy is endogenously determined by workers' optimal occupational choices.

The recursive representation of workers' utility maximization problem is given below,

$$V^{\mathrm{W}}(a, z, e, g, \tilde{g}) = \max_{a'} \; u(c) + \beta V^{\mathrm{cont}}(a', z', e, g, \tilde{g}')$$

$$\text{subject to} \quad \log \; z' = \rho \log \; z + \varepsilon, \quad \varepsilon \sim N(\mu_e, \sigma^2),$$

$$c + a' = w(e, g, \tilde{g})z + (1 + r)a \quad \text{and} \quad a' \geq 0,$$

where the labor productivity z follows a log-normal distribution with a mean that depends only on the education status of the worker, and $w(e, g, \tilde{g})$ is the state-dependent wage, to be explicitly characterized later.

The continuation value of workers embeds the possibility of paying the fixed cost to start a business. Let $o \in \{0, 1\}$ denote the occupational choice of a worker, where $o = 1$ denotes a worker that decides to become an employer. If workers decide not to open a business ($o = 0$), they might be employed by a non-white entrepreneur with probability $g(p_b)$. Thus, the continuation value of a worker is given by

$$V^{\mathrm{cont}}(a', z', e, g, \tilde{g}') = \max_{o \in \{0,1\}} \; oV^{\mathrm{E}}(a' - \kappa_g) +$$

$$(1 - o)\mathbb{E}\{g(p_b)V^{W}(a', z', e, g, \text{non-white}) + [1 - g(p_b)]V^{\mathrm{W}}(a', z', e, g, \text{white})|z\},$$

where the expectation operator $\mathbb{E}[\cdot|z]$ is taken over the probability distribution of future labor productivity outcomes, conditional on the current productivity draw z.

Entrepreneurs

Entrepreneurs inherit the characteristics they possessed when they were workers. However, after incurring the racial-based fixed cost of opening a business, the

[6] For simplicity, we assume that a job spell lasts for a single period, so that there is a constant churn of workers across employers of different race. Alternatively, one could include an exogenous job separation rate so that only a fraction of employees change jobs. Our model choice is not only more parsimonious but also more conservative. Because there is a substantially larger share of white employers in the Brazilian economy, a richer model in which a fraction of employees do not have a chance to change jobs would lead to more non-white workers stuck at worse employment outcomes in terms of wages.

entrepreneurs' demographic characteristics do not affect their utility maximization problem; the only variable that affects entrepreneurs' optimization problem is their assets. Entrepreneurs also value current and future consumption streams and their utility maximization problem has the recursive representation below,

$$V^{\mathrm{E}}(a) = \max_{a'} u(c) + \beta(1-\eta)V^{\mathrm{E}}(a')$$
$$\text{subject to} \quad c + a' = \pi(a,\theta) + (1+r)a \quad \text{and} \quad a' \geq 0,$$

where η is an exogenous exit probability from entrepreneurship[7], and $\pi(a,\theta)$ is the profits collected by an entrepreneur that runs a business with wealth level a and a constant and common productivity θ.

Entrepreneurs produce output by combining labor (n) and capital (k) according to a decreasing returns to scale production function $f(n,k;\theta)$. As in Moll (2014), entrepreneurs face a collateral constraint when choosing the optimal amount of capital to hire. The collateral constraint is based on the amount of assets owned by the entrepreneurs, so that wealthier entrepreneurs face looser restrictions and are therefore more likely to operate their business at its optimal size.

The profit maximization problem for entrepreneurs is given below

$$\pi(a,\theta) = \max_{n,k} f(n,k;\theta) - wn - (r+\delta)k$$
$$\text{subject to} \quad k \leq \lambda a,$$

where r is the risk-free interest rate, δ is the depreciation rate of capital, and λ characterizes the extent of the financial friction: the higher its value, the capital constraint is less binding . The presence of a binding financial friction induces an extra incentive to save for both employers and workers who are considering to become entrepreneurs.

Employers pay wage w per unit of labor, regardless of the race and education status of the employee. However, the employees take home only a fraction $\tau(g,e,\tilde{g}) \in (0,1]$ of the wage paid by entrepreneurs. This fraction depends on the worker's race g, education status e and the race of the employer $\tilde{g}$. As mentioned before, we do not

[7]By assumption, upon exit, entrepreneurs go back to the labor force with the same asset level, but they do not internalize this possibility in their utility maximization problem, attributing a zero value to this outcome. This allows for solving the entrepreneurial utility maximization problem independently from solving the Bellman Equation for workers. We also abstract from endogenous exit, where entrepreneurs would optimally choose whether to keep their companies or to go back to working for someone else.

microfound $\tau(\cdot)$, but rather estimate it empirically using Brazilian labor market data. We set $\tau(\text{white}, \text{college}, \cdot) = 1$ so that college educated white workers receive the base wage of the economy. All other demographic groups face a wage gap relative to college-educated white workers. Therefore, the per-productivity labor market earnings for a worker of race g, education status e and employed by an entrepreneur with race $\tilde{g}$ is given by $w(g, e, \tilde{g}) = \tau(g, e, \tilde{g})w$.[8]

In the model economy, entrepreneurs are not the only agents responsible for producing the final output. As in Cagetti and De Nardi (2006), there is a corporate sector that acts as a representative firm. It also combines capital and labor using the same production function $f(n, k; \theta_c)$, but it is subject to its own Hicks-neutral productivity parameter θ_c. The corporate sector takes as given the same input prices paid by the entrepreneurs.

3.2 Steady-State Equilibrium

In steady state, an equilibrium consists of a wage w and an interest rate r such that: (i) workers and entrepreneurs maximize their utility; (ii) the labor and capital demanded by the entrepreneurial and corporate sector match respectively the supply of labor and the assets owned by both workers and entrepreneurs; (iii) the distributions of agents over the state space, $\mu^i(\cdot)$, $i \in \{\text{W}, \text{E}\}$, is time invariant and satisfy the following system of equations, where $\Omega_e(\cdot)$ is the ergodic distribution of workers' labor productivity with education e:

1. *Mass of workers with state space (a, z, e, g) employed by white entrepreneurs:*

$$\mu^{\text{W}}(a, z, e, g, \text{white}) = [1 - g(p_b)]$$
$$\cdot \left\{ \sum_{\tilde{g}} \left[\int_A \int_Z \mathbb{1}\{a' = a \cap o = 0\} \text{Prob}[z' = z|Z] \mu^{\text{W}}(A, Z, e, g, \tilde{g}) dZ dA \right] + \eta \Omega_e(z) \mu^{\text{E}}(a, g, e) \right\};$$

2. *Mass of workers with state space (a, z, e, g) employed by non-white entrepreneurs:*

$$\mu^{\text{W}}(a, z, e, g, \text{non-white}) = g(p_b) \left\{ \sum_{\tilde{g}} \left[\int_A \int_Z \mathbb{1}\{a' = a \cap o = 0\} \right. \right.$$

[8] This setting implies that there is a loss in economic resources as the entrepreneurs' expenditure on labor is not fully absorbed by the workers in the economy. We provide a lump-sum transfer of the unabsorbed share of wages to all agents, workers and entrepreneurs, so that in the aggregate the losses are undone.

$$\cdot \text{Prob}[z' = z|Z]\mu^{\text{W}}(A, Z, e, g, \tilde{g})dZdA\Big] + \eta\Omega_e(z)\mu^{\text{E}}(a, g, e)\Big\};$$

3. *Mass of entrepreneurs with state space* (a, e, g)*:*

$$\mu^{\text{E}}(a, g, e) = (1 - \eta)\int_A \mathbb{1}\{a' = a\}\mu^{\text{E}}(A, g, e)dA$$
$$+\sum_{\tilde{g}}\int_A\int_Z \mathbb{1}\{a' = a \cap o = 1\}\mu^{\text{W}}(A, Z, e, g, \tilde{g})dZdA;$$

4. *Share of non-white entrepreneurs:*

$$p_b = \frac{\sum_e \int_A \mu^{\text{E}}(A, e, \text{non-white})dA}{\sum_g \sum_e \int_A \mu^{\text{E}}(A, e, g)dA};$$

5. *Mass of agents with education* e *and race* g*:*

$$\sum_{\tilde{g}}\Big[\int_A\int_Z \mu^{\text{W}}(A, Z, e, g, \tilde{g})dZdA\Big] + \int_A \mu^{\text{E}}(A, e, g)dA = M(e, g).$$

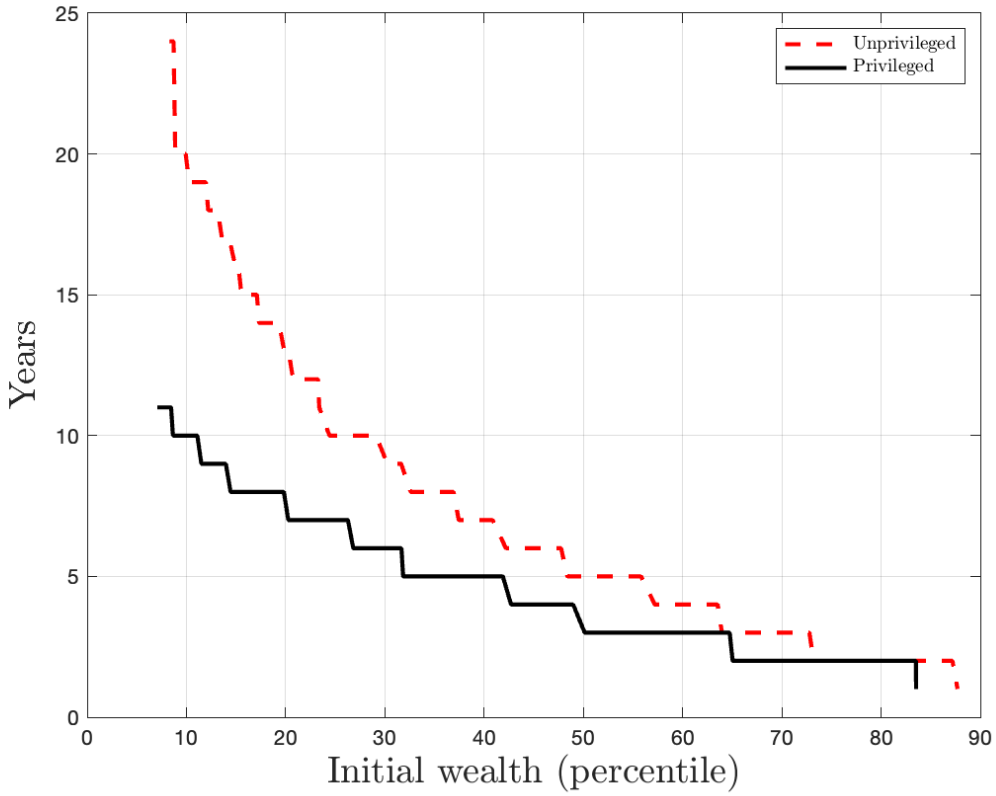
3.3 The link between wage gaps and the entrepreneurial gap

As usual in the heterogeneous agents literature, workers are subject to idiosyncratic risks in their labor market earnings due to the stochastic nature of labor productivity. Because of the incompleteness of the asset market, this risk is uninsurable. Savings are an increasing function of agents' own income. Workers with the same asset level and labor productivity, but with distinct wages, would carry different levels of assets to the next period. Therefore, the presence of a racial wage gap would imply that a white worker would acquire more assets than an otherwise identical non-white worker. In such a scenario, on average, white workers are more likely to reach asset levels that would enable them to afford the entry cost to become an entrepreneur, endogenously generating a racial entrepreneurial gap.

To illustrate this point, consider a simpler version of the model where all workers have the same education status and the race of their employers does not matter for determining wage gaps. The only state variables that distinguish employees are their assets, labor productivity and race. Figure (1) plots how many years would it take for white (privileged) and non-white (unprivileged) workers to open their business, given an initial asset level. Workers in the lowest percentiles of the wealth distribution take longer to become entrepreneurs. Moreover, because the accumulation of assets

is faster the higher the agents' income, racial wage gaps generate time gaps, i.e. non-white workers with the same asset level owned by a white worker would take more years to start a business.

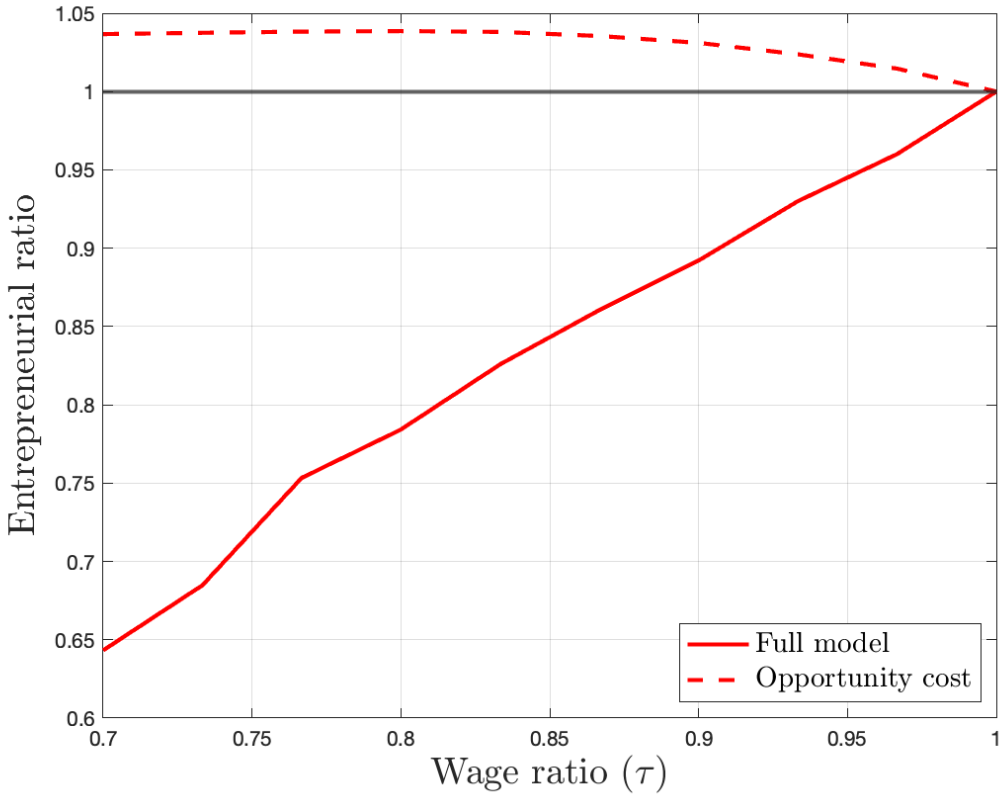
Figure 1: Racial Time Gap to Open a Business



Although racial wage gaps create barriers to non-white entrepreneurship through the savings channel, they also lower non-white workers' opportunity cost to open a business. If a non-white worker expects to receive a relatively low wage in the labor market, she would be better off by starting a business an become an employer instead of being an employee with a smaller payoff than a white worker. This channel alone would predict that in labor markets with a higher racial wage gap, non-white workers would be willing to open a business more so than white workers, generating an entrepreneurial gap in favor of non-white business owners. Therefore, the presence of racial wage gaps has two opposing forces operating on the entrepreneurial gap.

In Figure (2), we plot the equilibrium entrepreneurial ratio, measured as the mass of non-white entrepreneurs divided by the mass of white entrepreneurs, as a function of the ratio of non-white and white workers' wages. We decompose this relationship for a simple version of the model with a standard calibration in order to isolate the opportunity cost channel from a version of the model where both savings and opportunity cost are present. To get the opportunity cost channel, we turned off the importance of assets in opening up a business: we set the fixed cost of opening a firm κ_g to zero and the financial friction parameter λ to infinity. The opportunity cost channel predicts that the smaller the relative wage of non-white workers, in equilibrium, the majority of entrepreneurs would be non-white. When we let the fixed cost of opening a business to be high enough and having binding financial frictions, there is positive relationship connecting the wage ratio to the entrepreneurial ratio. The magnitude of the savings channel would be the distance between the dashed and solid lines.

Figure 2: Opportunity Cost versus the Savings Channel



4 Calibration

Before proceeding to the quantitative results, we calibrate a subset of the model parameters to match empirical moments describing the Brazilian economy. In this section we make explicit our preferred functional forms and discuss how we identify the associated parameters.

In the data, we let a firm belong to the entrepreneurial sector if it is privately held, has at least one formally registered employee (other than the owner) and operates in the private sector. Within this group of firms, we exclude observations above the 99th percentile of the firm size distribution, measured with respect to the number of employees. We gather information on the firm's owners to establish their race. If a firm is owned by multiple partners, we say its owner is black if at least one of the partners is black. We let a firm be part of the corporate sector if it operates

in the private sector and is publicly listed in the stock market or if it is above the 99th percentile of the firm size distribution. Since we can only observe employer and employee matches in the formal sector, we also confine the workers in the data to be formally employed. We also exclude workers employed by firms in the public sector. Then we gather their demographic information, such as race, education status and the race of their employer.

We set the mass of the white population to be 1, so that the mass of black agents is given in relative terms. Within each race g, the share of college educated agents $M_{g,\text{coll.}}$ is also disciplined by the data. We set the mean of log labor productivity innovations for college-educated workers μ_{college} to be zero. Then, we identify the mean of log innovations for workers with high-school degree by matching the average skill premium of workers in terms of labor market earnings. To identify the autocorrelation of the productivity processes and the variance of the innovation term, we use panel data at the employee level on earnings to estimate an AR(1) process, controlling for workers' characteristics.

We let workers and entrepreneurs have identical CRRA preferences with parameter γ. The probability of a worker to be employed by a black entrepreneur is linear on the share of black employers in the economy, i.e., $g(p_f) = p_f$. The production function of sector $i \in \{entrepreneurial, corporate\}$ is given by a decreasing returns to scale Cobb-Douglas, with output elasticities for labor and capital given by α_n and α_k, satisfying $\alpha_n + \alpha_k < 1$, i.e., $f(n, k; \theta_i) = \theta_i n^{\alpha_n} k^{\alpha_k}$.

The sectorial Hicks-neutral productivities θ_i cannot be identified separately. We set the corporate sector productivity to unity and let the entrepreneurial sector productivity be such that the model matches the share of the labor force that is employed by firms we identify as belonging to the entrepreneurial sector in the data. We let the racial based fixed cost of opening a firm κ_g to be such that we match the share of business owners within the white and black populations.

Table 5 exhibits all the model parameters, broken down into two sets. The first set consists of the parameters we externally calibrate by either choosing standard values from the literature or pinning down directly from the data. The second set consists of four parameters we calibrate internally with the purpose of matching model generated moments to their empirical counterparts. The share of entrepreneurs within the white and black populations would discipline the fixed cost of entry parameter κ_g: the higher the parameter values, the harder it is the asset requirement for workers to start a

business. The average earnings ratio between high school and college workers pins down the log mean productivity of a high school degree. Finally, the share of the labor force employed by the model entrepreneurs vis-a-vis the corporate sector disciplines the entrepreneurial sector productivity, since it increases each entrepreneur's labor demand.

Table 5: Calibrated Parameters

Externally Calibrated Parameters

Parameter	Description	Value	Source
β	Discount Factor	0.95	Standard
γ	CRRA Parameter	2	Standard
δ	Depreciation Rate of Capital	7%	Standard
α_n	Output Elasticity of Labor	0.4	Standard
α_k	Output Elasticity of Capital	0.2	Standard
$\theta_{\text{corporate}}$	Hicks-Neutral Productivity (Corporate Sector)	1	Numeraire
η	Exit Rate	4.63%	Annual Exit Rate from Entrepreneurship (IBGE,2015)
ρ_{college}	Autocorrelation for College Productivity	0.84	Panel Data on Annual Earnings for College
σ_{college}	Std Dev. for Productivity Innovations (College)	0.41	Panel Data on Earnings for College
μ_{college}	Mean Log Productivity for College	0	Numeraire
ρ_{HS}	Autocorrelation for High School Productivity	0.73	Panel Data on Earnings for High School
σ_{HS}	Std Dev. for Productivity Innovations (HS)	0.52	Panel Data on Earnings for High School
M_{white}	Mass of white agents	1	Set to 1 (to be the numeraire)
$M_{\text{white,college}}$	Mass of college (white)	33%	Share of college educated population (white)
M_{black}	Mass of black agents	0.8511	Measure of black agents
$M_{\text{black,college}}$	Mass of college (black)	16%	Share of college educated population (black)
$\tau_{\text{white,college}}$	Fraction of wages absorbed by college educated white workers	1	Panel Data on Earnings (Numeraire)
$\tau_{\text{white,HS}}$	Fraction of wages absorbed by high school educated white workers	1	Panel Data on Earnings (Numeraire)
$\tau_{\text{black,black,college}}$	Fraction of wages absorbed by blacks working for blacks (college)	0.86	Panel Data on Earnings
$\tau_{\text{black,white,college}}$	Fraction of wages absorbed by blacks working for whites (college)	0.82	Panel Data on Earnings
$\tau_{\text{black,black,HS}}$	Fraction of wages absorbed by blacks working for blacks (HS)	0.96	Panel Data on Earnings
$\tau_{\text{black,white,HS}}$	Fraction of wages absorbed by blacks working for whites (HS)	0.93	Panel Data on Earnings

Internally Calibrated Parameters

Parameter	Description	Value	Moment
κ_{white}	Fixed Cost of Entrepreneurship (white)	12.93	Share of Entrepreneurs (within the White Population)
κ_{black}	Fixed Cost of Entrepreneurship (black)	14.10	Share of Entrepreneurs (within the Black Population)
μ_{HS}	Mean Log Productivity for High School	-0.22	Average Earnings of High Schoolers (Relative to College Workers)
$\theta_{\text{entrepreneur}}$	Hicks-Neutral Productivity (Entrepreneurs)	3.36	Share of Labor Force Employed by Entrepreneurs

The calibrated value of the fixed cost parameter κ for white entrepreneurs is approximately 12.93 model units, which is close to 2 times larger than the average asset level of the economy. The same parameter for the black entrepreneurs is approximately 14.10 model units, which translates to an entry cost that is 9.04% higher for black agents. Once workers become entrepreneurs, they endow a constant productivity $\theta_{\text{entrepreneur}}$, inferred to be 3.36 times larger than the corporate sector's Hicks-Neutral productivity. Its value needs to be large in order for the model to simultaneously conciliate with two data facts: (i) the share of entrepreneurs in the economy is small (only 9.23% and 3.82% of the white and black population are re-

spectively employers); and (ii) even though the number of firm owners vis-a-vis the number of workers is small, they employ a large share of the labor force (close to 56%) in the formal private sector. Finally, college educated workers are on average 22% more productive than workers with a high school degree.

To assess the model's performance, we compare in Table 6 model generated moments to the data. The model is able to closely match the share of white and black entrepreneurs in the economy, the share of the labor force employed by the entrepreneurial sector and the average earnings of workers with a high school degree. The model gets relatively close to matching some untargeted moments such as the share of white entrepreneurs without a college degree and the economy's aggregate capital to output ratios. However it understates the fraction of black entrepreneurs with at most a high school degree and the average firm size in terms of number of employees.

Table 6: Model Performance

	Model	**Data**
Targeted Moments		
Share of Entrepreneurs (White)	9.49%	9.23%
Share of Entrepreneurs (Black)	3.81%	3.82%
Avg. High School Earnings to College Ratio	51.91%	52.89%
Share of Labor Force Employed by Entrepreneurs	55.35%	56.1%
Untargeted Moments		
Share of Entrepreneurs with High School (White)	50.43 %	53.97%
Share of Entrepreneurs with High School (Black)	59.53%	72.15%
Avg. Firm Size (number of employees per firm)	4.90	7.50
Capital to Output Ratio	2.70	2.5

5 Quantitative Results

In this section, we quantify the impact of closing the wage gap on the share of non-white entrepreneurs in the economy and on other macroeconomic outcomes, such as the GDP and TFP. We also evaluate how closing the wage gap for different groups of non-white employees may have heterogeneous effects on the same outcomes. For

example, we close the wage gap for college educated non-white workers employed by white entrepreneurs, while keeping unaltered the wage gaps faced by other groups of non-white workers. Finally we quantify the aggregate role of racial differences in college education and the fixed costs of entry.

5.1 Closing the Wage Gaps

As discussed in Section 3, closing the wage gap exerts two competing forces on non-white entrepreneurship. First, there is the savings channel, through which closing the wage gap for non-white workers allows them to save more and reach asset levels high enough for them to pay the fixed cost of opening a business. The second force is the opportunity cost channel, in which closing the wage gap for non-white workers increases their value of working vis-a-vis- that of running a business, causing a decrease in non-white entrepreneurship. A general equilibrium model allows us to quantify which of the two forces dominate.

In the baseline economy, we set the model parameters as displayed in Table 5. Then we close the wage gap for each group of non-white workers: for each education status e (high school and college) and employer's race $\tilde{g}$ (non-white and white), we set $\tau(\text{non-white}, \tilde{g}, e) = 1$. Finally we close the wage gap for all non-white workers at once.

In Table 7, we present the results of the proposed exercises. In column (1) we show model statistics describing the entrepreneurial activity for the baseline economy. Then, in columns (2) to (5), we close the wage gap for each group of non-white workers. Finally, in column (6), we close the wage gap for all non-white workers simultaneously.

Table 7: Effects of Closing Wage Gaps on Entrepreneurship

		High School		College		
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome	**Baseline**	**Non-white Employer**	**White Employer**	**Non-white Employer**	**White Employer**	**All**
Share of Entrep. (within Non-white)	3.81%	3.70%	4.16%	3.83%	3.77%	4.10%
Share of Entrep. (within White)	9.49%	9.49%	9.56%	9.49%	9.70%	9.63%
Average Wage Gap	7.74%	6.77%	3.75%	7.15%	5.83%	0%

Closing the wage gap for distinct groups of non-white workers have heterogeneous aggregate impacts on the entrepreneurial activity. Because non-white workers employed by white entrepreneurs face a larger wage penalty when compared to their peers that work for non-white employers, closing their wage gap has a larger effect overall on non-white entrepreneurship rates and also on the average wage gap in the

economy. Moreover, closing the wage gap for non-white workers with a high school degree and employed by white entrepreneurs boosts non-white entrepreneurship from a baseline level of 3.81% to 4.16%. Closing the wage gap for other groups of non-white workers, such as those employed by non-white entrepreneurs, can have a negative, albeit small, impact on the share of entrepreneurs within the non-white population, highlighting the opportunity cost channel associated with exogenous increases in the labor market earnings. Overall, removing the wage gap for all non-white workers increases the share of entrepreneurs among non-white agents from 3.81% to 4.10%, with positive externalities on the share of entrepreneurs within the white population (it grows from 9.49% to 9.63%).

The increase in non-white entrepreneurship induced by the elimination of racial wage gaps may have large macroeconomic effects as shown in Table 8. Closing the wage gap for non-white workers with a high school degree working for white employers (column 2) increases the GDP of the entrepreneurial sector by nearly 2.61% (or 260.49 bps), which represents an increase in the economy's GDP of approximately 1.05%. Closing the wage gap for all non-white workers improves the economy's GDP by 1.27% (and the entrepreneurial sector's output by 2.07%). [9] This also translates into gains in TFP. Removing wage gaps for all non-white workers improves the aggregate productivity by nearly 1.27%. In terms of welfare, we also measure the effects of lifting the wage penalty for non-white workers on non-white workers' aggregate consumption. Depending on the education status of the worker and the race of their employers, closing the racial wage gap can increase consumption for non-white workers by at least 0.73% (73.36 bps) and at most 3.53%, when it is closed for all non-white agents simultaneously.

Table 8: Macroeconomic Effects of Closing Wage Gaps

	High School		**College**		
	(1)	(2)	(3)	(4)	(5)
Outcome	**Non-white Employer**	**White Employer**	**Non-white Employer**	**White Employer**	**All**
Output (Entrepreneurs)	-80.78 bps	260.49 bps	8.97 bps	104.41 bps	206.53 bps
Output (All)	-25.41 bps	104.64 bps	6.59 bps	53.19 bps	126.32 bps
Consumption (Non-white Workers)	73.36 bps	126.88 bps	99.44 bps	140.82 bps	353.24 bps
TFP (Entrepreneurs)	-32.63 bps	124.37 bps	5.41 bps	49.09 bps	126.63 bps

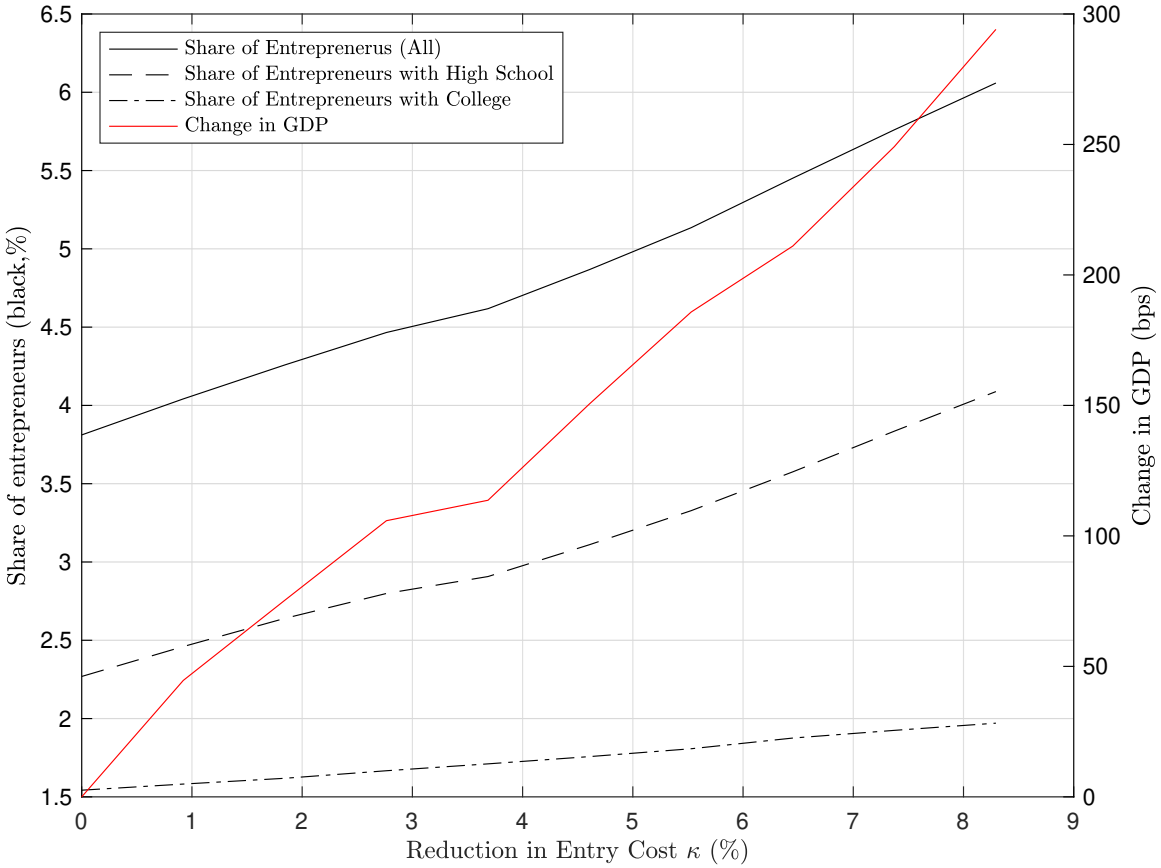
[9] The effect of closing the wage gap on the economy's GDP is always smaller in magnitude to the isolated effect on the entrepreneurial sector's output. The reason is that the two sectors compete for the same inputs, so that any expansion in the entrepreneurial activity happens at the expense of the corporate sector.

5.2 Reducing Entry Barriers for Non-white Entrepreneurs

In this exercise, we investigate how the fixed cost κ of opening a business affects the entrepreneurial activity. Specifically, we reduce the fixed cost κ for potential non-white entrepreneurs while keeping unchanged its value for the white population. Then we quantify its implications for the overall entrepreneurial activity and macroeconomic outcomes. The usefulness of this exercise is to measure the possible benefits and externalities associated with public policies designed to foster entrepreneurship targeted at unprivileged groups via start-up capital relief.

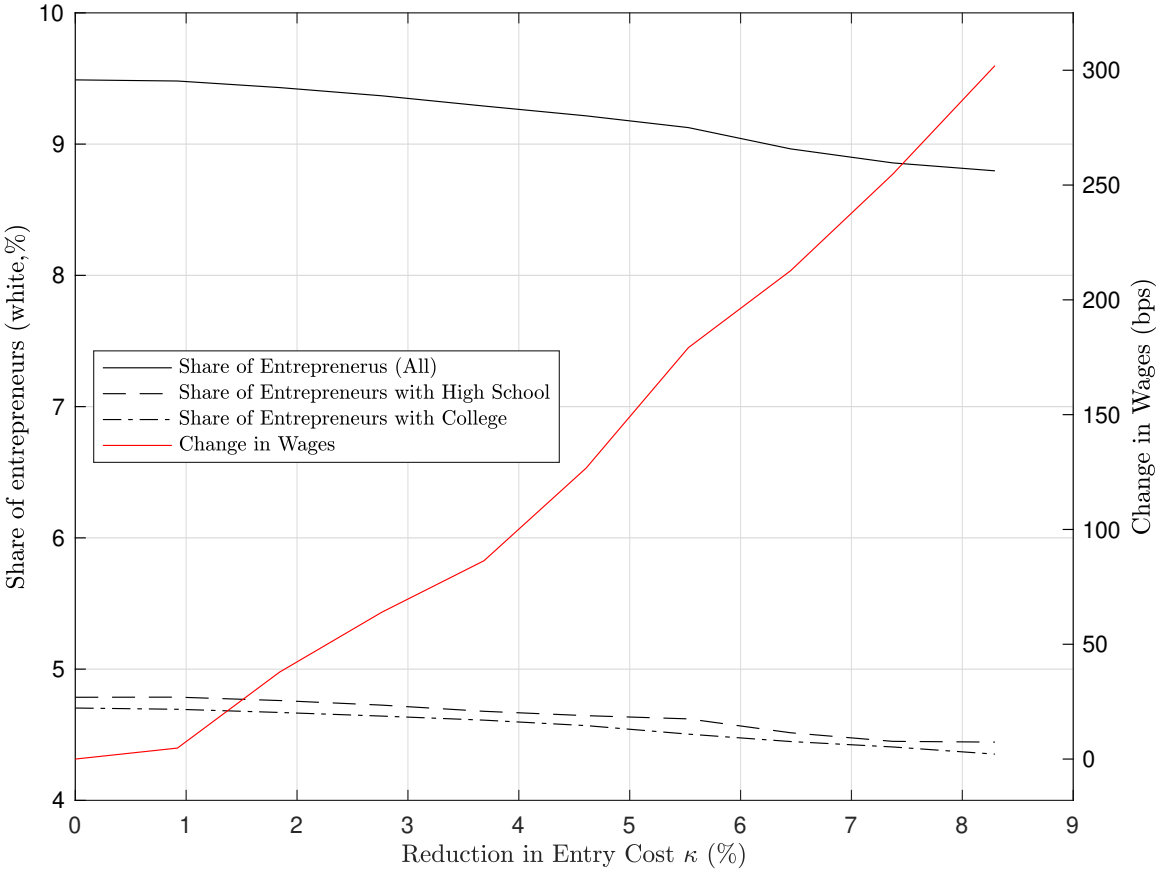
In Figure 3, we plot both the response of entrepreneurship as a share of the non-white population and the associated changes in the economy's GDP as result of percent reductions of the fixed cost κ, from its baseline value up until it reaches the same value as the cost faced by white entrepreneurs. Such a policy is highly effective at fostering the ownership of businesses by the non-white population. A reduction of 8% in the fixed cost of opening a business for non-white entrepreneurs (which is equivalent to equating κ_g for all races) increases the share of entrepreneurs within the non-white population to 6%. This effect is stronger for entrepreneurs with a High School education. Moreover, reducing the entry cost for non-white owned business is associated with an increase in GDP of nearly 3% (or 300 bps).

Figure 3: Reducing Entry Fixed Cost for Non-white Population



However, there are externalities generated by the entry of non-white workers into employer status exerted on entrepreneurship rates within the white population. As more non-white workers choose to open a business, labor demand increases at the same time as labor supply falls, promoting an increase in the equilibrium wages. Such a change in wages increases the value of working, diminishing the incentive for white workers to become business owners themselves. The opportunity cost channel is stronger for college educated employers, decreasing their participation in the entrepreneurial sector as shown in Figure 4.

Figure 4: White Entrepreneurship and the Opportunity Cost Channel

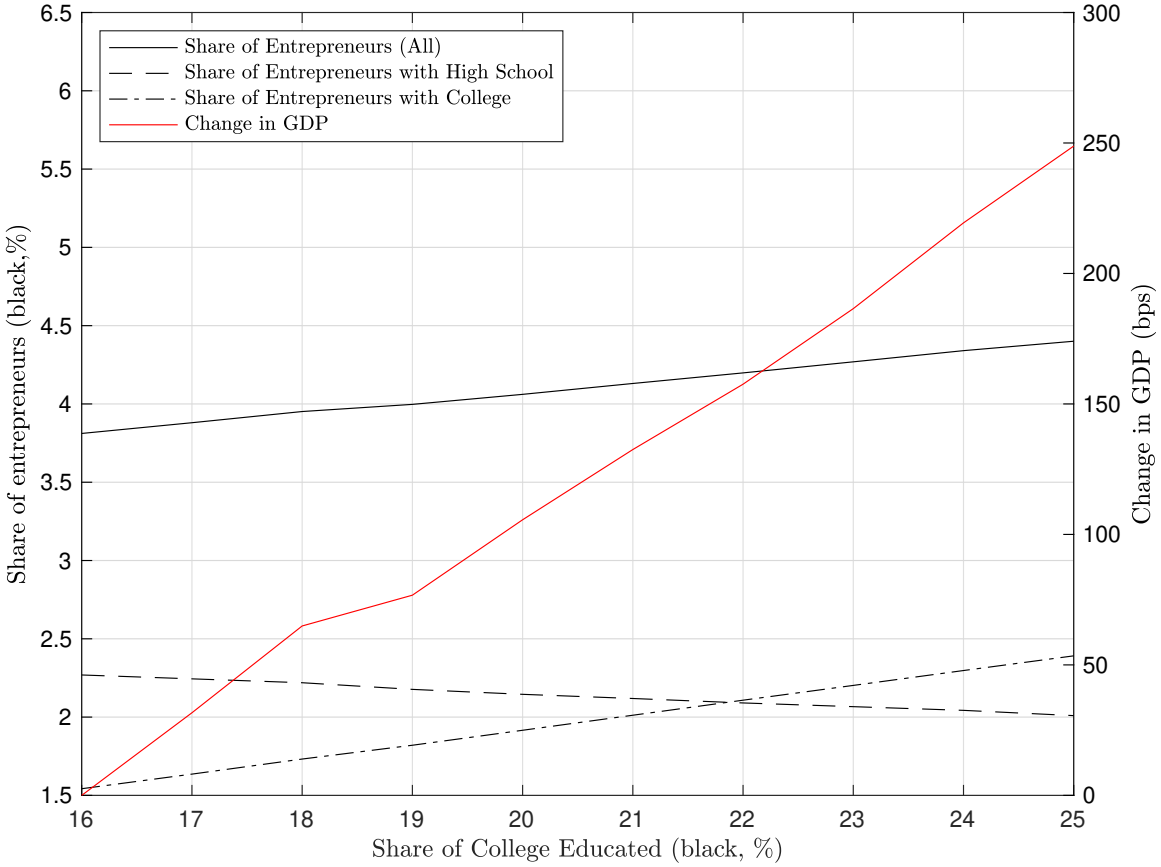


5.3 Increasing the Share of College Educated Non-white Agents

In Brazil, there is a gap in college education between the non-white and the white population. While 33% of the latter group possess a college degree, only 16% of non-white Brazilians finish their higher education. In the model, as expressed in Table 6, there is an over-representation of college educated agents in the entrepreneurial sector for both races. The reason is that college educated workers have a higher labor productivity on average and thus face higher labor market earnings, save more and are more likely to reach an asset level that enables them to open a business.

Thus, part of the entrepreneurial gap in the rate of entrepreneurship between non-white and white agents can be attributed to the aforementioned differences in college education. In order to understand the role of college education on entrepreneurial participation, we gradually increase the share of college educated non-white agents and quantify its effects on non-white entrepreneurship and the economy's GDP. The results are presented in Figure 5 below.

Figure 5: Overall Effects of Increasing College Education for Non-white Agents

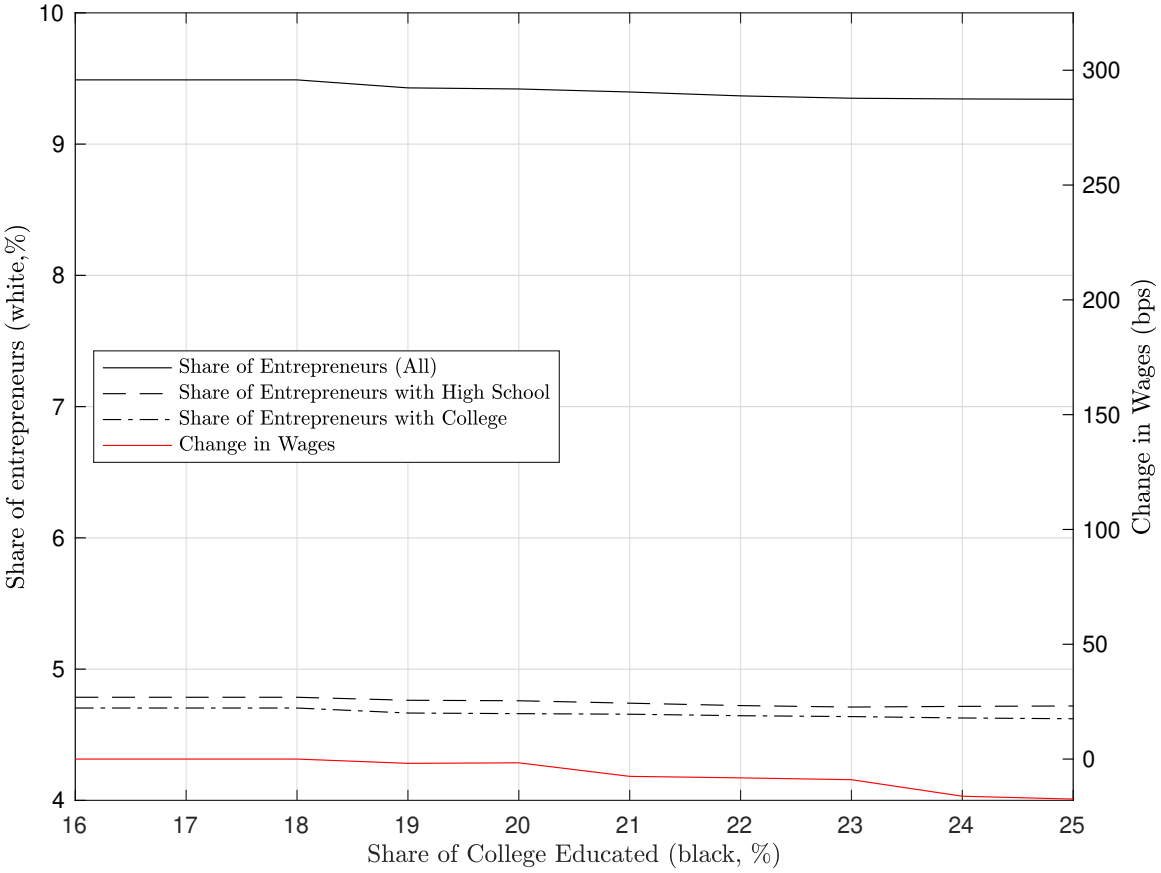


Two notable distinctions stand out from this exercise when compared to reducing the fixed costs of opening a business for the non-white population. First, increasing the share of college education from 16% to 25% has a positive effect on the share of entrepreneurs in the non-white population (from 3.81% to nearly 4.5%). This increase in entrepreneurial activity is modest compared to the effects of reducing the fixed cost of opening a business (see Figure 3).

However, the gains in terms of GDP associated with the entry of non-white workers into entrepreneurship induced by increasing their college education is significantly higher than the gains in GDP induced by reductions in the entry fixed cost. For example, to reach a 2.5% gain in GDP through increasing the college education, non-white entrepreneurship needs to increase from 3.81% to a share just below 4.5%. To get the same gains in GDP through reductions in the entry cost for non-white entrepreneurs, the share of non-white employers need to grow to 5.5%.

The reason for the different response in GDP between both exercises can also be attributed to the externalities caused upon white entrepreneurs in the economy. A relatively small entry of non-white workers into entrepreneurship do not exert as much upward pressure on equilibrium wages. Therefore the opportunity cost channel that would inhibit white entrepreneurship is nearly silent which would help preserving higher production in the entrepreneurial sector. The effects of increasing the share of college educated non-white agents on white entrepreneurship and equilibrium wages are shown in Figure 6.

Figure 6: White Entrepreneurship and the Opportunity Cost Channel



6 Conclusion

In this paper we study the aggregate consequences of racial discrepancies in labor market earnings and business ownership in the context of large developing economy, Brazil. We show that non-white workers face wage gaps that vary not only with their education status, but also with the race of their employers. Non-white workers with at most a High School degree earn between 92% and 96% of what similar white workers do, depending on the race of their employer. Those with some college education earn from 82% to 86% of college educated white workers' wages in the formal sector. Moreover, we showed that only 3.8% of the non-white population owns a business in the private formal sector, as opposed to an entrepreneurial rate of 9.2% within the white labor force.

In order to quantitatively assess the importance of racial wage gaps for business formation, we develop a heterogeneous agents model of occupational choice calibrated to match moments from the Brazilian labor market and business environment. We show that removing wage gaps increases the rate of business ownership with the non-white population, leading to a GDP and TFP growth of 1.26% and 1.28%, respectively. Moreover, we quantified the positive association between entrepreneurial rates in the non-white population and the economy's GDP caused by (i) reducing entry costs for non-white agents and (ii) increasing the share of college education within the non-white population. We conclude that exercise (ii) leads to a steeper curve connecting entrepreneurial rates and GDP, due to smaller negative externalities exerted on business ownership within the white population.

This paper provides a tractable framework for analysing business formation in the context of unequal labor markets, endogenizing the link between wage gaps and business ownership. Its dynamic nature allows for studying the short and long run implications of policies destined to foster entrepreneurial participation for minority groups and discriminated populations. Future research could help us better understand how labor productivity correlates with entrepreneurial talent. A testable implication of our model is that more productive workers are more likely to open a business. Further, if their productivity as workers is predictive of their productivity as entrepreneurs once they open a firm, the removal of labor market barriers can have positive and substantial effects for GDP, TFP and welfare.

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