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ORIGINAL RESEARCH

Did Biden-Harris's reforms on the Paycheck Protection Program reduce racial disparities in lending?

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Abstract
Introduced under the Trump-Pence Administration, the Paycheck Protection Program (PPP) provided short-term relief loans to small American businesses during the peak of the Coronavirus pandemic. The initial design of the PPP faced significant criticism from researchers due to racial disparities, among other issues, in its lending process. Minority groups received smaller PPP loan amounts during the original two tranches released in 2020. To increase equitable access for all, in February 2021 the Biden-Harris Administration enforced swift changes to the initial PPP aimed at favouring access to PPP loans for minority-owned small businesses that had been disadvantaged by the program's original design under the Trump-Pence Administration. By exploiting a granular dataset of 1,759,270 PPP loans granted between Q2 2020 and Q2 2021 and by implementing a difference-in-differences approach (DID), this paper provides novel evidence on the effectiveness of the Biden reforms in reducing racial disparities within the Paycheck Protection Program. Indeed, we observe a significant increase in the volume of PPP loans granted to minority-owned businesses in the period following the Biden-Harris Administration's reforms. Furthermore, among different minority groups, the reforms appear most effective for Native American minority groups (including American Indians, Alaska Natives, Native Hawaiians and/or Other Pacific Islanders), followed by Black Americans and Asian business owners. Our findings offer novel contributions to the existing literature on institutional discrimination, particularly regarding the initial PPP design. Our findings are especially valuable for policy makers as they underscore the importance of radical changes in addressing racial disparities. Our paper also offers evidence of how a public credit guarantee program should be designed to empower and promote economic inclusion for all, regardless of ethnicity, aligning with the UN's Sustainable Development Goals.

Keywords Paycheck Protection Program · Lending · Minorities · Institutional discrimination · Racial disparities

JEL Codes: G01 · G21 · G28 · J15

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1 Introduction

Due to the COVID-19 pandemic, economies globally suffered from one of the worst economic downturns in recent history. Governments were forced to employ national lockdowns, causing major shutdowns of key industries. Enforcement of self-isolation and state-level lockdowns caused a 9.3% decrease in the U.S. GDP (The Bureau of Labor and Statistics, 2020). Such unprecedented protocols led to mass reduction of employees by businesses. The U.S. unemployment rate peaked, rising in the early month of 2020 from 3.6 to 10.1% (FRED, 2020). In response to the pandemic, the U.S. Congress passed the Coronavirus Aid, Relief, and Economic Security (CARES) Act 2020. Signed by Former U.S. President Donald Trump, the stimulus bill intended to cater for individuals, families, and small businesses who were the most severely affected to receive financial assistance. Solely dedicated to helping small businesses, a federal fiscal policy called the Paycheck Protection Program (PPP hereinafter) was introduced. The PPP intended to provide forgivable loans, guaranteed by the Small Business Administration (SBA), to eligible firms. With current political and cultural issues arising at the time, race, and ethnicity became the focal point of interest for media and studies. In light of the program, questions were raised about the equitable fairness of loan distributions. Countless studies found disparities within the program (e.g., Lederer and Oros 2020; Wang and Zhang 2021; Kelly and van Holm 2021; Santellano 2021; Kickul et al. 2021; Howell et al. 2022; Atkins et al. 2022; Chernenko et al. 2023; Lester and Wilson 2023; Howell et al. 2024; Chernenko and Scharfstein 2024; Kotomin et al. 2024; Lelo de Larrea et al., 2024). The PPP only reached up to 20% of all eligible firms in rural-dominated states with the highest concentration of Black-owned small businesses. An alarming statistic when considering two thirds of such rural areas suffered the highest recorded number of COVID-19 cases at the reported time, contradicting the primary target of the PPP and the CARES Act 2020 which promised to help and protect small businesses most severely affected by the Coronavirus pandemic (Mills and Battisto 2020).

After the 2020 presidential election, the Biden-Harris Administration set out new reforms to the PPP. Amongst such changes, arguably the most important reform attempting to address racial disparities was the inclusion of small business owners with non-fraudulent felonies or delinquencies on federal student loans. This previously excluded group of owners consisted of disproportionately large amounts of Black-American individuals. In theory, the implementation of such reform alone should welcome more business owners to the program who identify as part of minority groups. Accompanied by the rest of the reforms these changes claim to improve the equitable distribution of forgivable loans to minority-owned small businesses, according to official statements from the White House (2021).

The PPP intends to provide equitable, forgivable loans to small businesses most severely affected by the Coronavirus pandemic. Following the first two tranches employed by the Trump-Pence Administration, reports of lending discrimination towards minorities sparked. Ever since, the program has undergone design reforms in an attempt to increase equal distribution of forgivable loans to U.S. small business owners of varying racial backgrounds as well as industries. Henceforth, this paper investigates the true fairness of PPP loan distribution to small U.S. firms under the new design conditions. Our methodology is designed to analyse the effect of reforms enacted by the Biden-Harris Administration in February 2021 to tackle racial disparities in lending under the PPP.

Conjointly, our paper intends to contribute towards existing literature proclaiming the previous PPP design suffered from racial and/or implicit bias, causing racial disparities in loan distribution to minority business owners as well as receiving lower loan amounts than White American counterparts. From the perspective of this study, this is one of, if not, the first study conducted on the PPP that takes into account reforms made to the federal fiscal policy and its effects on equitable distribution to non-white business owners.

By way of preview, our findings confirm the existence of racial disparities in granting PPP loans, consistent with the existing studies showing that racial minority groups received disproportionately less than to their White counterparts as part of an ongoing issue with institutional racism within the U.S. lending industry (Santellano 2021). Further to the point, our results convey that the implemented reforms expanded the scope of racial minority owners approved for forgivable loans as well as increased the loan amount permitted for certain minority groups. Among present minority groups, we find that business owners belonging to Native American minority groups (American Indian, Alaska Native, Eskimo & Aleut, Native Hawaiian and/or Other Pacific Islanders), as well as Black Americans and Asian business owners benefitted the most, in terms of access to PPP loans, from the introduction of the Biden-Harris reforms. Our paper provides novel evidence on the effectiveness of the reforms introduced by the Biden-Harris Administration in reducing racial bias in PPP lending to minority business owners, as compared to the previous US Administration.

This study is closely related to several papers showing disparities - whether based on gender, race, or other borrower characteristics - existing within the PPP program, which was designed to be accessible to businesses which were the most disadvantaged by the pandemic (Howell et al. 2024). Previous papers considered discrimination based on lenders' behaviour (Lederer and Oros 2020; Kickul et al. 2021; Chernenko et al. 2023; Howell et al. 2022, 2024; Atkins et al. 2022; Chernenko and Scharfstein 2024; Kotomin et al. 2024; Lelo de Larrea et al., 2024), or discrimination based on applicants' self-selection behaviour; Chernenko et al. 2023; Chernenko and Scharfstein 2024), or inequality of opportunity (Wang and Zhang 2021; Kelly and van Holm 2021), as sources of disparities in credit access within the PPP.

Our research differentiates from the extant literature on PPP, as we examine institutional discrimination, that refers to laws, policies or practices that are not necessarily discriminatory in intent, but nevertheless contribute indirectly to favouring certain groups and penalising others (Guimond 2023). In other terms, we consider a source of disparities that has its origin in the way institutions, and not simply individuals, operate and design economic policy measures.

Compared to previous studies that examine institutional discrimination within PPP, our paper is unique in the external validity, in the scope of analysis and in the period of investigation. While Santellano (2021) draws on interviews at Latino-owned coffee shops in Los Angeles during Covid-19 to contend that the way PPP has played out is part of an exclusionary history in entrepreneurship, we analyse a wider dataset on PPP loans gathered from the SBA website to evaluate the effectiveness of the reforms enacted under the Biden-Harris Administration in reducing race disparities. Moreover, while Lester and Wilson (2023) examine the effectiveness of preliminary changes to the PPP before the beginning of Biden's mandate, we consider the subsequent, much broader, reforms of the program that were introduced from February 24, 2021.

First, we show that the initial design of the PPP implemented under the Trump-Pence Administration did not ensure an adequate reach of small businesses, penalising minority-

owned firms. Second, we find that the radical reforms implemented by the Biden-Harris Administration significantly reduced disparities among the different ethnic groups in obtaining PPP loans. This is a distinct part of our research design that has, so far, not been investigated by the extant literature.

This paper adds insights into the causes and consequences of inequality, hence providing guidance to policy makers when conceiving business relief measures that also address inequality and reduce disparities in resource allocation. In particular, our study takes up the idea that in government efforts a greater concern must be put behind ensuring equity in the distribution of funds (Kelly and van Holm 2021). More generally, this paper also offers evidence of how a public credit guarantee program should be designed to empower and promote the economic inclusion of all, irrespective of ethnicity, in line with the UN's Sustainable Development Goal 10 ('Reduce inequality within and among countries'). Indeed, inequality undermines long-term social and economic development, hampers poverty reduction and wrecks people's sense of accomplishment and self-worth. This, in turn, can feed crime, disease and environmental degradation. Greater efforts are needed to progressively eradicate inequalities through inclusive political, economic, and social policies.

The remainder of the paper is structured as follows. Section 2 provides details about the PPP and the reforms implemented by the Biden-Harris Administration to reduce racial bias. Section 3 reports the related literature on racial disparities according to the PPP as well as the hypotheses tested. Section 4 describes the data used for this study and documents our empirical methodology. Section 5 describes the results. Finally, Sect. 6 concludes the paper.

2 The Paycheck protection program and the Biden-Harris administration

Enacted by former U.S. President Donald Trump on 27th March 2020, the PPP paved the way for a temporary solution for the growing issue of unemployment within American small businesses. The original infrastructure for the program was to be funded $349 billion, through the CARES Act 2020, and allocate firms with up to 500 employees with forgivable loans no more than $10 million (SBA 2020). Funding utilized the E-TRAN system, developed by the SBA to reduce processing time of PPP loans for banks (SBA 2020; Bartik et al. 2021). PPP loans were distributed through banking institutions as the assumption of pre-existing relationships between business owners and lenders would increase disbursement (Grandja, Makridis, Yannelis, and Zwick, 2021).

Applicable to the program, so-called "forgivable loans" add further incentives to borrowers. To receive such incentives, eligible business owners within the first two tranches must retain employee compensation identical to pre-pandemic levels, spend loan proceeds on miscellaneous business expenses and utilize at least 60% of loan amount for payroll. If satisfied 8 to 24 weeks following loan disbursement, the full amount is to be forgiven (SBA 2020). Due to the large demand for these loans intensified by worsening COVID-related events, the first tranche of PPP loans was exhausted within 2 weeks of its launch (April 3–16, 2020). With virus infections continuing to soar and national restrictions crippling small businesses, a second tranche of forgivable loans were introduced under the Trump-Pence Administration through the enactment of the Paycheck Protection Program and Health Care Enhancement Act. This act added $310 billion to be further allocated to

business owners, with or without a pre-existing PPP loan. The second tranche was available from April 27th and was exhausted by the 8th of August 2020. The depletion of funds provided by the CARES Act and Health Care Enactment Act caused the PPP to discontinue the distribution of forgivable loans to small business owners (Balyuk, Prabhal and Puri, 2021). The introduction of the Consolidation Appropriations Act (CAA) 2021 allocated a third tranche of forgivable loans worth $284 billion. Some changes were introduced compared to the previous two tranches that responded to criticisms that the program did not adequately reach small and minority-owned businesses. The first week of the third round was only open to small lenders and participating SBA-approved Community Financial Institutions. An amount of $35 billion was set aside for first-time borrowers and further $35 billion were addressed to first- and second-draw borrowers with 10 or fewer employees or loans less than $250,000 in a low-or moderate-income community. The third tranche, made available from January 19, had an expiration date of May 31, 2021. At the end of its operation, the PPP accounted for the distribution of $943 billion in forgivable loans to American small businesses.

Following the successful 2020 presidential election, the Biden-Harris Administration announced a plethora of reforms to the PPP advocating for equitable access to relief loans and addressing higher rates of access to PPP funding for minority-owned small businesses as compared to their White-owned counterparts (Fairlie 2020; Misera 2020). One of the most important reforms introduced by the Biden-Harris Administration was the restructuring of the previous loan calculation formula for self-employed individuals. Recognising that businesses may have had negative net profits on their balance sheets, changes to the loan calculations of the PPP allowed owners the choice between using their business' net profit or gross profit. The relaxed loan calculation meant, in theory, that small business owners would receive more substantial PPP loan amounts compared to the previous design (O'Rourk and Bobrosky 2021). In addition to the funding from the Consolidation Appropriations Act, the Biden-Harris Administration allocated a further $1 billion for small businesses within these business categories located in lower to middle income neighbourhoods. A welcomed change to the program's design as 70% of such businesses are owned by people of colour, yet from previous tranches, numerous owners only received a couple of dollars as loan allocations (Office of Advocacy 2018; The White House 2021). In addition, reforms removed the exclusionary restrictions on individuals previously convicted of non-fraudulent felonies as well as those with delinquencies on federal student loans. This is part of the PPP Second Chance Act that the Biden-Harris Administration implemented with the objective to allow more businesses to access PPP loans than the previous PPP tranches under the Trump-Pence Administration. This is more significant for minorities such as Black Americans, who have disproportionately higher amounts of delinquency on student loans as well as felony convictions (The White House 2021). Our study analyses loans released before and after the new reforms to the PPP introduced by the Biden-Harris Administration were in effect.

3 Related literature and hypotheses development

One of many major responses during an economic crisis is mass-scale public lending (Kelly and van Holm 2021). Given its scope and the relevance of its purpose, the PPP has attracted the interest of academic scholars, who examined the reach of this government-funded stim-

ulus program (Schweitzer and Guo 2024), its effect on small business performance (Staples and Krumel 2023), and on the risk-taking of US banks (Filomeni 2023). With relevant political and cultural issues arising at the time of the PPP enactment, disparities became the focal point of interest. Questions on the true equitable distribution of loan distributions to small business owners were raised, race being one of the most critical topics of research within the context of the PPP. Exploring existing studies on racial disparities is essential in understanding the level of inequality within the U.S. small business lending industry. Among the countries whose population includes people with different origins and cultures, the U.S. is a particularly interesting context for our analysis, since racial discrimination has very deep historical roots.

Discrimination in access to the credit market is a widely studied phenomenon in the United States, with reference to both the residential mortgage segment and small business lending. Regarding credit to small businesses, the empirical evidence has shown that ethnic minority groups are less likely to receive loans (Bostic and Lampani 1999; Cavalluzzo and Wolken 2002; Cavalluzzo et al. 2002; Blanchflower et al. 2003; Blanchard et al. 2008; Asiedu et al. 2012; Mijid and Bernasek 2013; Rakshit and Peterson 2022), they are charged with a higher interest rate (Blanchflower et al. 2003; Blanchard et al. 2008; Asiedu et al. 2012), or are even discouraged from applying for funding (Bates and Robb 2015a, b).

The literature on the PPP has confirmed these findings, attributing race disparities mainly to lenders' behaviour and their beliefs distorted by prejudice and hostility (taste-based discrimination). Lederer and Oros (2020) conducted 63 fair lending matched-pair audit tests of financial institutions in Washington, DC, and found a difference of treatment in 43% of cases with White testers being favoured over Black testers in the pre-application stage. Moreover, disparities also regarded the gender of testers. Differences emerged in the level of encouragement, the products offered, information provided, and information requested. More precisely, bank employees informed White testers that they would qualify for a loan at a significantly higher rate than Black testers. Besides, women were offered less information about the PPP products compared to men. Moreover, a statistically significant difference was found in information discussed around the type of loan and purpose of the loan with the bank employee discussing this information more with the White male tester compared to the Black male tester and the female testers. In addition, the Black tester was asked more personal questions about identifying his business and was told less information such as fees and interest rates. On the contrary, the White tester was told specific information without having to verify any information about his business. Chernenko and Scharfstein (2024) highlighted that Black and other minority restaurant owners in the State of Florida were 25% less likely to receive PPP compared to White-owned restaurants. Moreover, minorities were 36.2% less likely to even attain forgivable loans with respect to their non-minority counterparts. The authors explained these disparities by pointing to the existence of racial bias in the way banks processed PPP loan applications. Moreover, even if there was no discrimination in the application process at banks, a legacy of past discrimination and poor treatment discouraged minority-owned businesses from even approaching banks for a PPP loan. Thus, disparities can be originated by both lenders' conduct and borrowers' self-selection behaviour.Similar findings were reached by Lelo de Larrea et al. (2024) who analysed differences in PPP approval amounts based on race and gender in the U.S. hospitality industry and found significant differences between White- and Black or African American-owned businesses and

between male- and female-owned businesses, with the latter of these groups at a considerable disadvantage.

Examining the differences in PPP approval amounts based on the type of lenders, Howell et al. (2022) observed that Black-owned businesses secured more PPP loans through non-traditional lending institutions (such as FinTech lenders) than those who applied through traditional banks relying more on soft information-intensive relationship banking. Indeed, the authors attribute these results to the automation of lending processes that are likely to lead to higher amounts of loan approvals for Black business owners (PPP loan approval rates increased by 20% post-automation of existing loan approval systems). This, in turn, reduces bias on race/ethnicity within banking institutions in their PPP lending activity. In a subsequent study, Howell et al. (2024) found Black-owned businesses were about 12% points more likely than other firms to receive their PPP loans from a fintech lender, mainly due to preference-based discrimination. After conventional lenders automated their lending processes, their rates of lending to Black-owned businesses increased substantially. Similar findings are achieved by Atkins et al. 2022. However, in a study based on the 2020 Small Business Credit Chernenko et al. (2023) found that approval disparities were similar in magnitude at banks and fintechs. The authors argued that there was more scope for racial bias to influence approval decisions at banks, since their PPP approval process was generally more hands-on and interactive, particularly in more racially-biased locations. The approval process at fintechs, by contrast, was far less personalised. However, the hands-on approach better positioned banks to help applicants resolve documentation gaps and determine the correct loan amounts. Conversely, fintechs did not have enough employees to help submit a successful application. While fintech automation could be helpful in reducing taste-based discrimination in small business lending, it could be ill-suited to helping firms through the application process. More recently, Kotomin et al. (2024) highlighted that institutional and racial disparities persist during the PPP loan forgiveness stage. Controlling for various loan- and borrower-level characteristics, they demonstrated that relationship lenders — community banks, credit unions, and farm credit institutions — are associated with higher rates of PPP loan forgiveness. In contrast, automated lenders — fintechs and fintech banks — exhibit the lowest forgiveness rates. Black borrowers experience the poorest forgiveness outcomes, except for loans issued by non-depository fintech where they outperform White borrowers.

Some studies analysed the spatial distribution of PPP loans, finding that over-reliance on established financial institutions led to disparities within financially under-connected communities. In this case, disparities in access to PPP loans were not driven by lenders or applicants' behaviour but inequality of opportunity, deriving from circumstances over which individuals have no control, such as unequal access to bank branches and 'banking deserts'. Wang and Zhang (2021) provided evidence that Zip codes with higher density of Black-owned businesses received a lower chance of connecting to an enrolled bank branch. Reasoning behind this was correlated to both lower numbers of bank branches in neighbourhoods with a predominant African American presence but also branches that were present in the area had little to no prior relationships with the SBA. Kelly and van Holm (2021) found that communities with more eligible firms, larger access to bank branches and areas experiencing higher rates of unemployment received more loans per capita. Supporting findings of Wang and Zhang (2021), zip codes with predominantly white inhabitants received more and larger amounts of PPP loans than neighbourhoods composed mostly of minority citizens.

So far, only a few studies concerning the PPP have traced race disparities back to institutional discrimination. Santellano (2021) investigated how small businesses owned by Latino individuals were able to access PPP loans in Los Angeles. Based on first-hand interviews with Latino coffee shop owners, the author provides evidence that a lower number of PPP loans were distributed to small business owners of colour. This result is attributable to the deepening institutional discrimination reportedly involved within the PPP application process. More recently, Lester and Wilson (2023) compared PPP to existing residential and small business lending patterns and found that the program mostly followed existing mechanisms of capital flow that resulted in fewer resources reaching communities of colour and low-income neighbourhoods. The policy changes after the second phase of the PPP, including early access to SBA-approved Community Financial Development Institutions and setting aside specialised loan pools for first-time borrowers and very small businesses, corrected in part previous barriers. However, those changes did not seem to significantly reduce disadvantage in majority Latinx areas.While most past studies on PPP lending highlight the existence of racial disparities in the distribution of loans, Sant'Anna et al. (2023) come to partially different results. They find that African American farmers received more PPP loans both on the absolute amount and per employee basis than white farmers. Yet, African American farmers living in rural counties or belonging to low- to moderate-income groups received lesser amounts of PPP loans relative to African American farmers who did not belong to those groups. The authors explain their findings presuming that approved farmers had an established borrower-lender relationship with the lender they used to apply for PPP. If true, a previous borrower-lender relationship would mean that these farmers were potentially less risky, making their access to capital easier.

In general, the current literature agrees that minority-owned businesses were at a disadvantage in being granted PPP loans. The extant literature has provided a variety of explanations for the presence of the racial disparities within the PPP. Following Santellano (2021) and Lester and Wilson (2023), our study focuses on disparities deriving from institutional discrimination that involves the procedures, routines, and organisational culture of any institution that, often without intent, contribute to less favourable outcomes for minority groups than for the majority of the population, from the institution's actions and services. The first step of our analysis grounds on the theory of institutional discrimination that was originally formulated by Carmichael and Hamilton (1967) to look at how institutional policies create consequences that perpetuate and worsen racial disparities. Members of racial minority groups may be systematically discriminated not only by the wilful acts of individuals, but also because of a range of policies and practices by state or non-state institutions, that contribute – often unintentionally – to the structural disadvantage of members of certain ethnic groups (Pager and Shepherd 2008; Fibbi et al. 2021). In the U.S., historical experiences of economic, social, and political exclusion based on race (Watts et al. 1999), have made inequality an enduring self-perpetuating phenomenon. The production and reproduction of inequalities are at the foundation of institutional discrimination. Because of their cumulative disadvantage, minorities lag behind on almost every measure of prosperity (i.e., employment, criminal justice, economic resources, health, and education). Consequently, the eligibility criteria for the PPP program under the Trump-Pence Administration indirectly penalised minority-owned small businesses compared to White-owned counterparts. Despite the preliminary changes introduced after the first two tranches under the Trump-Pence Administration and the fact that fintech companies were already included among the

PPP lenders, racial disparities persisted, based on the overall design of the program that reproduced and reinforced inequalities.

Our discussion on racial disparities in lending within the initial design of the PPP, i.e., from April 3, 2020, to February 24, 2021, the first phases implemented under the Trump-Pence Administration, can be summarized in our first hypothesis (H1) as follows:

H1 *Minority-owned small businesses received less PPP loan amounts than their White-owned counterparts within the first two tranches.*

The existing literature investigating the PPP has not examined the consequences of the new reforms implemented by the U.S. Biden-Harris Administration in February 2021 designed to allow equitable distribution of PPP loans to small businesses independently of the gender or race/ethnicity of their owner. Sourcing from the organisational culture field and endogenous models of change (Morrill 2008), we look at Biden-Harris's reforms of the PPP as an example of institutional heterogeneity that lays the foundations for the search for affirmative action policies aiming at equity, through critical questioning of past institutions' actions. The reforms of the PPP are an endogenous source of change of the previous institutional procedures, routines, and organisational culture, which interrupted the nurturing of cumulative disadvantage of minority-owned small businesses. As a second step of our analysis, we aim at evaluating the effectiveness of the broad, radical reforms of the PPP enacted under the Biden-Harris Administration, in reducing race disparities deriving from institutional discrimination. In this regard, following the implementation of the latter reforms by the Biden-Harris Administration, we expect minority-owned small businesses to receive more PPP loan amounts with respect to the previous Trump-Pence Administration, in line with further efforts to increase the equitable distribution of PPP loans to small businesses in need of them to survive in period of acute financial instability. Our discussion on the effectiveness of the Biden-Harris reforms in reducing racial bias in lending on the PPP can be summarized in our second hypothesis (H2) as follows:

H2 *The reforms introduced by the Biden-Harris Administration to the PPP design decreased racial disparities in PPP loan distribution.*

Surrounding the scope of racial disparity, the PPP reforms aimed to reduce such arbitrariness for all racial minority groups. Nonetheless, the present literature does not highlight equal effects of design changes across all racial groups. As mentioned, current affairs at the time circulated racial issues and news items, more importantly towards the African American community. According to Pew Research Center's 2021 statistics, nearly half of Americans (46%) thought there was a lot of discrimination against Black people, while about three-in-ten saw a lot of discrimination against Hispanic people (30%) and Asian people (27%). Higher exposure of racial issues for a specific minority group, compared to other racial minority groups, could boast the higher possibility of resolution specific to their cases, leaving other racial minority groups to potentially benefit less from design changes compared to African American counterparts. This expectation is coherent with the notion that media play a significant role in shaping the social context in which policies are developed, influencing agendas, resource allocation and decision-making in ministries and agencies. When media pressure and broad public support build up, action is particularly taken when the issues are

deemed important by political actors (Tresch et al. 2013; Figenschou et al. 2019). Concerning that point, we anticipate that small businesses owned by individuals of African American descent to obtain higher PPP loan amounts compared to other racial minority groups, post-enactment PPP reforms between February 24 – May 31, 2021. The argument of racial impartiality of the Biden-Harris reforms imposed on the PPP can be summarized in our third and final hypothesis (H3), as follows:

H3 *Black American small business owners received higher PPP loan amounts after the enactment of the PPP reforms by the Biden-Harris Administration in comparison to other racial minority groups.*

4 Data and estimated models

To test our hypotheses, we use granular loan-level data on 1,759,270 PPP loans collected over the whole PPP lending period, i.e., between the periods of April 3–16, 2020, April 27 – August 8, 2020, and January 19 – May 31, 2021, from the section of the Small Businesses Administration (SBA)'s website that provides PPP loan data.

The SBA constructed multiple excel sheets containing all PPP approved loans pooled from all periods mentioned above. Along with the ethnicity of the borrowing business owner, data on other characteristics of the borrowers were available, as well as the loan amount approved, the approval date, and the forgiven amount of the loan (i.e., the amount of the PPP loan that did not have to be paid back). The loan amount approved is our main dependent variable. We used the forgiven amount of the loan for robustness checks. The main independent variable of interest for our analysis is represented by the ethnicity of the small business owners. We built a large dataset comprising a total of 1,759,270 loans, spanning from April 3, 2020, to May 31, 2021. The description of each variable is provided in Table 1. The dependent and explanatory variables and their descriptive statistics, as well as the correlation matrix, are reported in Tables 2 and 3, respectively. In Table 3, any pair-wise correlation beyond ±10% is significant at the 10% level at least. In this regard, Table 3 shows that the majority of the pair-wise correlations in regression analysis are within acceptable bounds. Moreover, in Table 4 we report the Variance Inflation Factor (VIF) generated by our baseline regression model to show that multicollinearity does not affect our main regression results. In this regard, Table 4 shows that the VIF values generated by the regression analysis are not critical as they show a moderate correlation among the variables.

Our baseline model tests the existence of racial disparities in lending within the initial design of the PPP. To this aim we run OLS regression by including only the observations pertaining to the first phases of the implementation of the PPP under the initial Trump-Pence Administration, i.e., until February 24, 2021. We measure racial disparity by testing the significance of the effect of the borrower's race (*Minority*), on the approved loan amount (*PPP loan amount*), taken in natural logarithm. The latter represents our dependent variable in all our regression models, while our main independent variable of interest *Minority* captures the intensity of racial bias within the initial design of the PPP. In all our regression models,

Table 1 Variable description

Variables	Definition
PPP loan amount	Approved loan amount for the borrower.
Forgiven amount	Amount of the PPP loan that has been forgiven.
Minority	Dummy variable equal 1 if the owner racially identifies as part of a minority group (Asian; Black; Latino; Native) ; 0 otherwise (White).
Post-PPP reforms	Dummy variable equal 1 if the loan was approved post-enactment of the Biden-Harris Administration' reforms (February 24, 2021-May 31, 2021) on the Paycheck Protection Program; 0 otherwise.
Area	Dummy variable equal 1 if the business operates within a Rural area; 0 otherwise.
Hubzone	Dummy variable equal 1 if the business operates within a Hubzone area; 0 otherwise.
LMI	Dummy variable equal 1 if the business owner had Low to Middle Income (≤58,020 $) Debentures at the time of loan approval; 0 otherwise.
Firm Size	Number of workers employed by the business.
Asian	Dummy variable equal 1 if the race of the borrower is Asian; 0 otherwise.
Black	Dummy variable equal to 1 if the race of the borrower is Black; 0 otherwise.
Latino	Dummy variable equal 1 if the race of the borrower is Latino; 0 otherwise.
Native	Dummy variable equal 1 if the race of the borrower is Native; 0 otherwise.
Firm Age	Categorical variable equal to 1 if the firm has experienced a "Change of Ownership", to 2 if the firm is "Existing or more than 2 years old", to 3 if the firm is a "New Business or 2 years or less", to 4 if the firm is a "Startup, Loan Funds will Open Business", and to 5 if "Unanswered".
Payroll Expenses	Numerical variable reflecting the loan proceeds that are used to cover the firm's payroll costs.
Utility Expenses	Numerical variable reflecting the loan proceeds that are used to cover the firm's utility costs.
Loan Maturity	Numerical variable reflecting the loan's maturity expressed in months.
Loan Status	Categorical variable equal to 1 if the loan is "paid in full," which means the borrower paid the money back or paid it partially back and received forgiveness on the rest, to 2 if the loan is "exemption 4," which means the firm received the money but the loan hasn't been forgiven (the loan could be in the process of forgiveness or could be "charged off," which means the lender has written it off as a loss because the borrower may have shut down, filed for bankruptcy or died), and to 3 if the loan is "active un-disbursed," which means the loan was approved but the lender hasn't reported it as disbursed.

we also account for several control variables that might affect *PPP loan amount* other than our variable of interest[1].

Following Atkins et al. (2022), our OLS regression model for racial disparities in lending within the initial design of the PPP takes the following form:

$$\begin{aligned}\text{PPP loan amount}_{i,t} = \alpha + \beta_0\ \text{Minority}_i + \sum_{j=1}^{z} \delta_j \text{Borrower's characteristics}_{i,t} \\ + \text{Business Type FE} + \text{Quarter FE} + \text{State FE} + \text{Industry FE} + \varepsilon_{i,t}\end{aligned} \tag{1}$$

where the subscript *i* indicates the given borrowing firm being granted PPP lending in quarter *t*; *Minority*$_i$ indicates the race of the owner of borrowing firm *i*; *Borrower's characteristics*$_{i,t}$

[1] Although no reverse causality-related issues are likely to affect our regression estimates, we cannot rule out the possibility that the latter might be affected by endogeneity issues due to omitted variable bias to some extent.

Table 2 Descriptive statistics

Variables	Obs.	Mean	Std. dev.	Min.	Max.
PPP loan amount	1,759,270	58,318.03	204,484.4	2,907	10,000,000
Forgiven amount	1,362,882	61,153.98	210,493.8	0	10,000,000
Minority	1,759,270	0.41	-	0	1
Race					
Asian	161,329	0.0917	-	0	1
Black and African American	516,787	0.2938	-	0	1
Latino	123	0.00007	-	0	1
Native	50,530	0.0287	-	0	1
White	1,030,501	0.5858	-	0	1
Area					
Rural	411,478	0.2339	-	0	1
Urban	1,347,792	0.7661	-	0	1
Hubzone					
Yes	570,761	0.3244	-	0	1
No	1,188,509	0.6756	-	0	1
LMI					
Yes	537,385	0.3055	-	0	1
No	1,221,884	0.6945	-	0	1
Firm Size	1,759,270	6.6259	20.41	1	500
Firm Age	1,759,270	2.13	-	1	5
Payroll Expenses	1,757,496	56,527.19	195,544.3	1	10,000,000
Utility Expenses	797,073	1,189.10	18,961.47	0	8,111,700
Loan Maturity	1,759,270	48.81	16.24	3	60
Loan Status	1,759,270	2.58	-	1	3

Notes Data are collected from the section of the Small Businesses Administration (SBA)'s website that provides PPP loan data

is a vector of borrower-specific characteristics described at the end of this section; *Business Type FE* controls for type of business fixed effects based on how the borrower has registered his entity[2]; *Quarter FE* presents quarterly fixed effects; *State FE* controls for US State fixed effects based on the State where the small business operates; and *Industry FE* indicates industry fixed effects identified via the NAICS code associated with the loan approved[3].

Secondly, to investigate the effectiveness of the Biden-Harris Administration's reforms in reducing racial disparity present in PPP lending, we employ a difference-in-differences (DID) approach since minority-owned small businesses are most likely to be influenced by the new reforms to the PPP implemented by the Biden-Harris Administration. Hence, following the above argument, our empirical analysis is conducted by exploiting small businesses' racial/ethnicity heterogeneity. To identify small businesses' differential exposure to the aforementioned reforms, we therefore implement a difference-in-differences (DID) analysis by constructing the treated and control groups based on firms' status of being

[2] The degree of correlation between business type and industry fixed effects is low (i.e., -0.0246), thus ruling out possible multicollinearity issues.

[3] Given the cross-sectional nature of the dataset in which each borrower participating in the Paycheck Protection Program is observed once, adding borrower fixed effects for borrowers with a single observation would be equivalent to dropping this borrower from our sample, thus making the inclusion of borrower fixed effects not feasible.

Table 3 Correlation matrix

	PPP loan amount	Minority	Area	Hubzone	LMI	Firm size	Business Type	Industry	State
PPP loan amount	1								
Minority	-0.1224***	1							
Area	-0.0741***	-0.2635***	1						
Hubzone	-0.0307***	0.1665***	0.0574***	1					
LMI	-0.0207***	0.2394***	-0.1275***	0.4459***	1				
Firm size	0.5366***	-0.1167***	-0.0188***	-0.0267***	-0.0241***	1			
Business Type	-0.2586***	0.1344***	0.0806***	0.0712***	0.0567***	-0.1716***	1		
Industry	-0.0027***	0.2354***	-0.2351***	0.0363***	0.0825***	0.0190***	-0.0246***	1	
State	-0.0341***	-0.0771***	0.1277***	-0.0058***	-0.0429***	-0.0205***	-0.0061***	-0.0429***	1

Notes Data are collected from the section of the Small Businesses Administration (SBA)'s website that provides PPP loan data. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, respectively

minority-owned. The main variable of interest is the coefficient β_1 of the interaction term of *Minority * Post-PPP reforms*, that captures whether the minority-owned small businesses in the post-PPP reforms period are able to improve their access to PPP lending, increasing the approved loan amount, relative to their non-minority owned counterparts. Figure 1 verifies the parallel trend assumption by providing graphical evidence that PPP loan amounts display a similar trend over time for the treated and the control groups and that this trend changed after the reforms introduced by the Biden-Harris administration. Moreover, the sign and statistical significance of the correlation coefficients for the treatment and control groups, before and after the introduction of the Biden reforms to the Paycheck Protection Program, at -0.1227*** and 0.0239*** respectively, further underscore the effectiveness of these reforms in reducing racial bias.

Following Bose et al. (2021)[4], our DID analysis for racial disparities in lending after the reforms introduced by the Biden-Harris Administration to the PPP takes the following form:

$$\begin{aligned} \text{PPP loan amount}_{i,t} = {} & \alpha + \beta_0 \,(\text{Post} - \text{PPP reforms}) \\ & + \beta_1 \,\text{Minority}_i + \beta_2 \,\text{Minority}_i \times (\text{Post} - \text{PPP reforms}) \\ & + \sum_{j=1}^{z} \delta_j \,\text{Borrower's characteristics}_{i,t} + \text{Business Type FE} \\ & + \text{Quarter FE} + \text{State FE} + \text{Industry FE} + \varepsilon_{i,t} \end{aligned} \tag{2}$$

Finally, to examine the equality of the Biden-Harris Administration's reforms in reducing racial disparity for all involving minority communities, we employ further a difference-in-differences (DID) approach, similar to H2. This model uses a dataset primarily consisting of PPP loans obtained by racial minority business owners, since such communities were the primary targets of the new program changes. Similar to the previous methodology, we invoke a difference-in-difference (DID) method by producing the treated and control groups with respect to the two minority groups previously mentioned. A unique feature of this model is the inclusion of a dummy variable for each racial minority group, enabling the model to recognise whether a certain racial minority group achieved greater advantage in relation to other minority-owned firms.

Corresponding to Bose et al. (2021), our DID approach to investigate the impartiality of the Biden-Harris Administration reforms to the PPP on all racial minority groups can be summarized as follows:

[4] We follow Bose et al. (2021) to set up our difference-in-differences (DID) methodology given the suitability of this method for our empirical analysis, even if the latter manuscript employs this methodology in a different context to analyse the impact of a new bankruptcy law on the performance of distressed firms in India.

Table 4 Variance inflation factor (VIF)

Variable	VIF	1/VIF
Minority	2.58	0.388116
PPP_dummy	3.35	0.298554
PPP_minority	3.69	0.271149
Area	1.23	0.811049
Hubzone	1.29	0.773448
LMI	1.32	0.756862
Firm size	1.08	0.923202
Mean VIF	2.07	

Notes Variance Inflation Factor (VIF) for the regression model generated by Eq. (2)

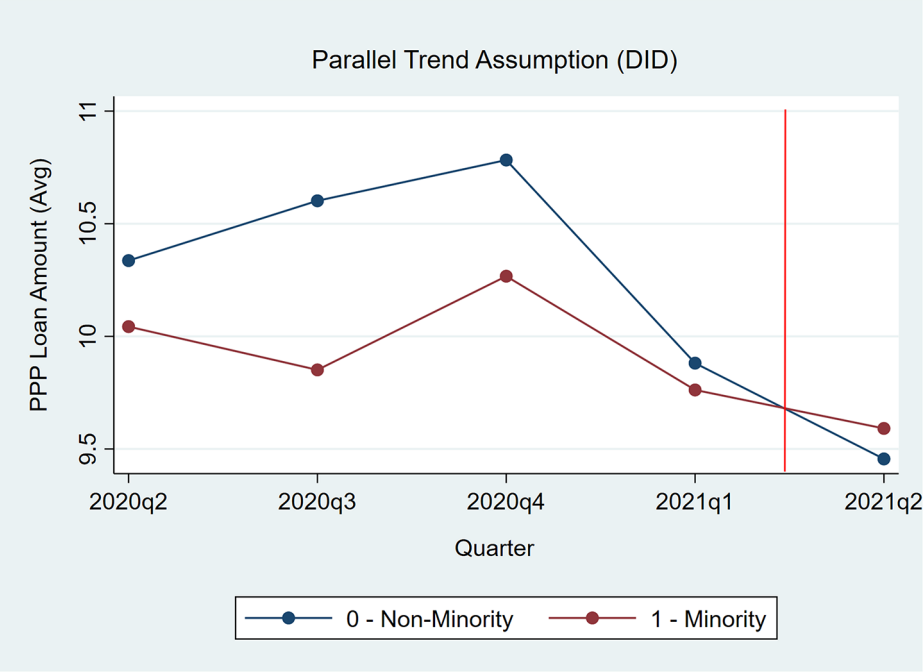

Fig. 1 Parallel trend assumption (DID). *Notes* Data are collected from the section of the Small Businesses Administration (SBA)'s website that provides PPP loan data

$$
\begin{aligned}
\text{PPP loan amount}_{i,t} = {} & \alpha + \beta_0\,(\text{Post} - \text{PPP reforms}) \\
& + \beta_1 \text{Asian}_i + \beta_2 \text{Asian}_i \times (\text{Post} - \text{PPP reforms}) \\
& + \beta_3 \text{Black}_i + \beta_4 \text{Black}_i \times (\text{Post} - \text{PPP reforms}) \\
& + \beta_5 \text{Latino}_i + \beta_6 \text{Latino}_i \times (\text{Post} - \text{PPP reforms}) \\
& + \beta_7 \text{Native}_i + \beta_8 \text{Native}_i \times (\text{Post} - \text{PPP reforms}) \\
& + \sum_{j=1}^{z} \delta_j \text{Borrower's characteristics}_{i,t} \\
& + \text{Business Type FE} + \text{Quarter FE} \\
& + \text{State FE} + \text{Industry FE} + \varepsilon_{i,t}
\end{aligned}
\tag{3}
$$

In all our regressions, to isolate the effect of race on *PPP loan amount*, we control for a large number of possible confounding factors related to the characteristics of the given borrowing firm. We control for the lower to middle income debentures that the borrower could accrue prior to the inception of PPP (i.e., *LMI*), to account for the fact that businesses with prior established relationships with the SBA, through the potential use of other programs which invested in low-to-middle income communities, received higher *PPP loan amounts*. In addition, we control for the rural or urban indicator which dictates the area in which the borrower operates (i.e., *Area*), to account for the fact that business owners, regardless of their race, received higher amounts of PPP loans in urban rather than in rural areas. We also control for the Hubzone indicator (i.e., *Hubzone*), that indicates whether the borrowing firm operates within an area which has been historically under industrialised. Lastly, we control for the size of the business proxied by the number of employees reported to be on the payroll (i.e., *Firm size*), where the maximum number of employees for a business to be eligible for a PPP loan is 500 and the minimum value is 1.

5 Results

First, in Table 5, we report the regression results for racial disparities in lending within the initial design of the PPP under the initial Trump-Pence Administration, therefore prior to the introduction of the reforms to the PPP by the subsequent Biden-Harris Administration. Racial bias hypothesis testing is conducted empirically by investigating the sign and significance of the coefficient $\widehat{\beta_0}$ in Eq. (1), which reflects the minority group belonging status of the small business owner. If $\widehat{\beta_0}$ is not statistically significant, then the race/ethnicity of the business owner would not influence the PPP loan amount received and racial disparity in the PPP lending would be absent. In contrast, a positive and statistically significant coefficient for *Minority*, i.e., $\widehat{\beta_0} > 0$, would indicate that belonging to a minority group is associated with higher PPP loan amounts, while $\widehat{\beta_0} < 0$ would indicate that belonging to a minority group is associated with lower PPP loan amounts being granted. We find a negative and statistically significant coefficient $\widehat{\beta_0}$ which indicates that belonging to a minority group has a negative effect on the PPP loan amount received. Therefore, our results indicate that White business owners received significantly larger PPP loan amounts compared to minority business owners prior to the PPP reforms implemented by the Biden-Harris Administration. These findings are supported by Chernenko and Scharfstein (2024) who illustrated

Table 5 PPP lending and minority groups

Variables	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Minority	-0.381***	-0.222***	-0.339***	-0.178***
	(0.003)	(0.003)	(0.003)	(0.003)
Area			-0.298***	-0.173***
			(0.003)	(0.003)
Hubzone			0.014***	0.035***
			(0.003)	(0.003)
LMI			0.026***	0.036***
			(0.003)	(0.003)
Firm size			0.029***	0.024***
			(0.000)	(0.000)
Observations	903,224	903,224	903,224	903,224
R^2	0.02	0.28	0.32	0.47
Quarterly FE	NO	YES	NO	YES
Business Type FE	NO	YES	NO	YES
Industry FE	NO	YES	NO	YES
State FE	NO	YES	NO	YES

Notes In all models the dependent variable is *PPP loan amount*, a continuous variable equal to the amount of granted forgivable credit, taken in logarithm. Robust standard errors are reported in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, respectively

that minority business owners experienced severe difficulties to be granted PPP loans as compared to their White-owned counterparts under the initial Trump-Pence Administration.

Secondly, in Table 6 we report the regression results for the effectiveness of the Biden-Harris Administration's reforms in reducing racial disparities in PPP lending. Interestingly and in line with our expectations, our findings suggest that the reforms to the PPP introduced by the Biden-Harris Administration significantly and positively moderate the negative effect of *Minority* on *PPP loan amount*. This result is empirically achieved by investigating the sign and the significance of coefficient $\widehat{\beta_2}$ associated with the interaction term *Minority* * *Post-PPP reforms* in Eq. (2). This effect is significant at the 1% level. The latter results highlight the successfulness of the Biden-Harris Administration's reforms in reducing racial bias in PPP lending. Therefore, the reforms to the PPP implemented by the Biden-Harris Administration expanded the small business base eligible for the PPP by successfully tackling institutional discrimination within the distribution of financial resources, in a scenario where minority individuals could now be encouraged to apply for PPP lending without being deterred by the fear of institutional racism (Santellano, 2020). As a result, after the implementation of the aforementioned reforms, small businesses owned by minority individuals have benefitted from an increased amount of forgivable PPP loans received. All in all, these findings contribute to proving the effectiveness of government intervention in resolving institutional discrimination that was a significant source of disparities in credit access within the PPP.

Finally, in Table 7, we provide the regression findings to evaluate the impartiality of the Biden-Harris Administration's reforms to reduce racial disparities within PPP lending, within the context of all racial minority groups involved. Our results suggest that the PPP reforms introduced by the Biden-Harris Administration moderated the influence of *Minority* on *PPP loan amount* for the firm owned by almost every minority group. This emerges from the careful observation of the signs and the statistical significance of the coefficients of the interaction terms for the different minority groups. Moreover, the results in Table 5 show that Black American small business owners received higher PPP loan amounts after

Table 6 PPP lending reforms and minority groups

Variables	(1)	(2)	(3)	(4)
	DID	DID	DID	DID
Minority	-0.381***	-0.260***	-0.320***	-0.212***
	(0.003)	(0.003)	(0.003)	(0.003)
Post-PPP reforms	-0.744***	-0.248***	-0.522***	-0.214***
	(0.003)	(0.003)	(0.003)	(0.003)
Minority * Post-PPP reforms	0.429***	0.460***	0.374***	0.403***
	(0.004)	(0.003)	(0.003)	(0.003)
Area			-0.251***	-0.155***
			(0.002)	(0.002)
Hubzone			0.016***	0.042***
			(0.002)	(0.002)
LMI			0.010***	0.026***
			(0.002)	(0.002)
Firm size			0.031***	0.026***
			(0.000)	(0.000)
Observations	1,759,211	1,759,211	1,759,211	1,759,211
R^2	0.07	0.28	0.32	0.44
Quarterly FE	NO	YES	NO	YES
Business Type FE	NO	YES	NO	YES
Industry FE	NO	YES	NO	YES
State FE	NO	YES	NO	YES

Notes In all models the dependent variable is *PPP loan amount*, a continuous variable equal to the amount of granted forgivable credit, taken in logarithm. Robust standard errors are reported in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, respectively

the enactment of PPP reforms in comparison to other racial minority groups. Our hypothesis H3 is thus confirmed. Small businesses owned by the Asian minority group also took advantage from the PPP reforms implemented by the Biden-Harris Administration, but to a relatively lower extent. An opposite result is achieved for Native-owned small businesses that obtained a lower loan amount after the PPP reforms. Since a much smaller percentage of such firms operated in the industries hardest hit by the COVID-19 pandemic in comparison with other racial groups (Atkins 2022), it is reasonable to presume that they requested less credit through the PPP, which could explain why their PPP loan amount decreased even following the program reforms. The coefficient of the interaction term *Latino * Post-PPP reforms* is not statistically significant, but the very small number of Latino businesses in our sample (0.007%) limits the detection of the effect of PPP reforms on that subgroup with statistical significance.

All in all, these results further support the effectiveness of the reforms employed by the Biden-Harris Administration in reducing racial bias within the PPP. The widened demographics of business owners eligible for forgivable loans undoubtedly encouraged more racial minority owners to apply for the program. Nevertheless, the results obtained for Native-owned small businesses suggest that the PPP reforms have contributed to mitigate only partially racial disparities existing among minority groups.

Table 7 Biden-Harris reforms and PPP lending by minority group

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	DID	DID	DID	DID	DID	DID	DID	DID
Asian	-0.387***	-0.316***						
	(0.004)	(0.004)						
Asian * Post-PPP reforms	0.111***	0.068***						
	(0.006)	(0.005)						
Black			-0.075***	-0.048***				
			(0.004)	(0.003)				
Black * Post-PPP reforms			0.386***	0.350***				
			(0.004)	(0.004)				
Latino					0.106	0.135		
					(0.153)	(0.142)		
Latino * Post-PPP reforms					0.236	0.226		
					(0.183)	(0.168)		
Native							-0.074***	-0.072***
							(0.007)	(0.006)
Native * Post-PPP reforms							-0.119***	-0.115***
							(0.010)	(0.009)
Post-PPP reforms	-0.083***	-0.065***	-0.171***	-0.149***	-0.066***	-0.054***	-0.064***	-0.051***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
Area		-0.173***		-0.128***		-0.160***		-0.160***
		(0.002)		(0.002)		(0.002)		(0.002)
Hubzone		0.046***		0.032***		0.049***		0.049***
		(0.002)		(0.002)		(0.002)		(0.002)
LMI		0.029***		0.009***		0.028***		0.028***
		(0.002)		(0.002)		(0.002)		(0.002)
Firm size		0.026***		0.026***		0.026***		0.026***
		(0.000)		(0.000)		(0.000)		(0.000)
Observations	1,759,211	1,759,211	1,759,211	1,759,211	1,759,211	1,759,211	1,759,211	1,759,211
R^2	0.28	0.44	0.28	0.44	0.27	0.43	0.27	0.43
Quarterly FE	YES	YES	YES	YES	YES	YES	YES	YES
Business Type FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
State FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes In all models the dependent variable is *PPP loan amount*, a continuous variable equal to the amount of granted forgivable credit, taken in logarithm. Robust standard errors are reported in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, respectively

6 Robustness Tests

To draw stronger causal inference between the enactment of the PPP reforms by the Biden-Harris Administration and the reduction of racial disparity in PPP lending, we carried out a series of robustness checks on the DID estimation corresponding to Eq. 2.

First, we used an alternative dependent variable, that is *Forgiven amount* (i.e., the amount of the PPP loan that did not have to be paid back) instead of *PPP loan amount*, taken in logarithm. According to the Paycheck Protection Program (PPP), borrowers may be eligible for loan forgiveness if the funds were used for eligible payroll costs, business mortgage interest payments, rent, or utilities during either the 8- or 24-week period following disbursement. Since for most borrowers, the loan amount forgiven proxies the initial principal amount granted, the variable "forgiven amount" can be likely used as an appropriate substitute for "PPP loan amount" for robustness purposes. The results are stable (Table 8), confirming the findings of our previous analysis.

Second, considering that our models corresponding to Eq. 2 include many levels of fixed effects (for business type, industry, State, and quarterly time), we ran the DID regressions using the estimator of Correia (2016), which is an iterative process that can deal with multiple high dimensional fixed effects[5]. The results shown in Table 9 confirm the robustness of our main empirical findings.

Table 8 Robustness: forgiven amount as alternative dependent variable

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	DID	DID	DID	DID	DID	DID
Minority	-0.324***	-0.054***	-0.378***	-0.287***	-0.337***	-0.240***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Post-PPP reforms			-0.788***	-0.258***	-0.542***	-0.226***
			(0.003)	(0.003)	(0.003)	(0.003)
Minority * Post-PPP reforms			0.460***	0.502***	0.394***	0.441***
			(0.004)	(0.004)	(0.004)	(0.004)
Area					-0.263***	-0.162***
					(0.002)	(0.002)
Hubzone					0.017***	0.038***
					(0.002)	(0.002)
LMI					0.023***	0.030***
					(0.002)	(0.002)
Firm size					0.030***	0.026***
					(0.000)	(0.000)
Observations	1,362,835	1,362,835	1,362,835	1,362,835	1,362,835	1,362,835
R^2	0.01	0.28	0.07	0.29	0.33	0.45
Quarterly FE	NO	YES	NO	YES	NO	YES
Business Type FE	NO	YES	NO	YES	NO	YES
Industry FE	NO	YES	NO	YES	NO	YES
State FE	NO	YES	NO	YES	NO	YES

Notes In all the models the dependent variable is *Forgiven amount*, a continuous variable equal to the amount of the PPP loan that did not have to be paid back, taken in logarithm. Robust standard errors are reported in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, respectively

[5] Correia (2016)'s estimator addresses many shortcomings of existing estimators, which had slow convergence properties, especially with large and complex datasets like ours. Therefore, it provides a suitable

Table 9 Robustness: estimator of Correia (2016)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	DID	DID	DID	DID	DID	DID
Minority	-0.312***	-0.312***	-0.381***	-0.381***	-0.320***	-0.212***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Post-PPP reforms			-0.744***	-0.744***	-0.522***	-0.214***
			(0.002)	(0.002)	(0.002)	(0.003)
Minority * Post-PPP reforms			0.429***	0.429***	0.374***	0.403***
			(0.004)	(0.004)	(0.003)	(0.003)
Area					-0.251***	-0.155***
					(0.002)	(0.002)
Hubzone					0.016***	0.042***
					(0.002)	(0.002)
LMI					0.010***	0.026***
					(0.002)	(0.002)
Firm size					0.031***	0.026***
					(0.000)	(0.000)
Observations	1,759,210	1,759,210	1,759,210	1,759,210	1,759,210	1,759,210
R^2	0.01	0.01	0.07	0.07	0.32	0.44
Quarterly FE	NO	YES	NO	YES	NO	YES
Business Type FE	NO	YES	NO	YES	NO	YES
Industry FE	NO	YES	NO	YES	NO	YES
State FE	NO	YES	NO	YES	NO	YES

Notes In all models the dependent variable is *PPP loan amount*, a continuous variable equal to the amount of granted forgivable credit, taken in logarithm. Robust standard errors are reported in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, respectively

To further corroborate our empirical findings, we implement propensity score matching (PSM) method according to the nearest neighbour matching approach with a caliper value of 0.1. According to the latter method, matched samples are chosen where minority-owned businesses (treated group) are matched to the nearest neighbour of non-minority-owned businesses (control group) using all variables included in our baseline regression of Eq. (2). Our PSM results, reported in Table 10, corroborate our main findings that minority business owners received larger loan amounts after changes to the Paycheck Protection Program were implemented by the Biden-Harris Administration. Specifically, Column (1) in Table 10 re-runs our baseline model generated by Eq. (2) using the restricted sample selected through propensity score matching, while Column (2) re-estimates the causal effect by including propensity scores as weights in our baseline model for further robustness. Overall, our PSM robustness results suggest that the difference in PPP lending volume observed by minority-owned businesses in the post-PPP period is not driven by existing differences in the two groups, further corroborating our novel evidence that minority business owners received larger loan amounts after changes to the Paycheck Protection Program were implemented by the Biden-Harris Administration. Therefore, our main results prove to be robust also to this matching technique.

Lastly, following Balyuk et al. (2021), we now re-run our baseline model specification generated by Eq. (2) by incorporating several other control variables related to firm and loan characteristics that may exert an influence on the amount of PPP loans. Specifically, our

method to assess the robustness of the estimation results in the context of our empirical analysis.

Table 10 Robustness: propensity score matching (PSM)

Variables	(1)	(2)
	DID	DID
Minority	-0.114***	-0.174***
	(0.007)	(0.003)
Post-PPP reforms	-0.158***	-0.187***
	(0.005)	(0.004)
Minority * Post-PPP reforms	0.373***	0.359***
	(0.008)	(0.004)
Area	-0.174***	-0.143***
	(0.002)	(0.002)
Hubzone	-0.004	0.016***
	(0.003)	(0.002)
LMI	0.032***	0.036***
	(0.004)	(0.003)
Firm size	0.028***	0.030***
	(0.000)	(0.000)
Observations	411,473	1,753,248
R-squared	0.44	0.45
Quarterly FE	YES	YES
Business Type FE	YES	YES
Industry FE	YES	YES
State FE	YES	YES

Notes The Table reports propensity score matching (PSM) method according to the nearest neighbour matching approach with a caliper value of 0.1 for our baseline regression model generated by Eq. (2), using all the variables for the matching. Specifically, Column (1) re-runs our baseline model of Eq. (2) using the restricted sample selected through propensity score matching while Column (2) re-estimates the causal effect by including propensity scores as weights in our baseline model specification as a further robustness test

baseline model now controls for the maturity of the given PPP loan (i.e., Loan Maturity), for the PPP loan status (i.e., Loan Status), for the firm's age (i.e., Firm Age), for the specific US district in which the borrowing firm operates (i.e., Firm District), and for the firm's payroll and utility expenses (i.e., Payroll Expenses and Utility Expenses, respectively). Overall, the new estimation results, reported in Table 11, further corroborate the evidence that minority business owners received larger loan amounts after the Biden-Harris Administration implemented changes to the Paycheck Protection Program.

7 Conclusions

The introduction of the PPP has been a key factor in providing short term aid for small businesses around the U.S., during the height of the Coronavirus pandemic. The implementation of new reforms, enacted by the Biden-Harris administration towards the PPP, resulted in the reduction of racial disparities within its loan allocation process.

Within this paper, we observed the implication of PPP reforms with regards to its effects on the ability of minority business owners to achieve larger loan amounts compared to when changes were absent. We utilized a granular dataset of 1,759,270 loans across Q2 2020 – Q2 2021 which confirmed our expectation that the introduction of the reforms would reduce racial disparities in PPP lending. Overall, our paper provides a novel contribution to existing literature by demonstrating that minority business owners received larger loan amounts after changes were implemented by the Biden-Harris Administration. This also indicates the effectiveness of government intervention with regards to reforming racial bias within the lending industry. Reforms enacted by the Biden-Harris Administration opened the PPP

Table 11 Robustness: additional firm- and loan-specific control variables

Variables	(1)	(2)	(3)	(4)
	DID	DID	DID	DID
Minority	-0.197***	-0.176***	-0.218***	-0.177***
	(0.003)	(0.003)	(0.005)	(0.005)
Post-PPP reforms	-0.308***	-0.190***	-0.380***	-0.190***
	(0.003)	(0.003)	(0.005)	(0.004)
Minority * Post-PPP reforms	0.253***	0.314***	0.255***	0.282***
	(0.003)	(0.003)	(0.005)	(0.005)
Area	-0.249***	-0.113***	-0.205***	-0.106***
	(0.002)	(0.002)	(0.003)	(0.003)
Hubzone	0.022***	0.038***	0.012***	0.030***
	(0.002)	(0.002)	(0.002)	(0.002)
LMI	0.012***	0.016***	-0.010***	0.003
	(0.002)	(0.002)	(0.002)	(0.002)
Firm size	0.015***	0.011***	0.012***	0.008***
	(0.000)	(0.000)	(0.001)	(0.001)
Loan maturity	-0.010***	-0.012***	-0.010***	-0.014***
	(0.000)	(0.000)	(0.000)	(0.000)
Firm age	-0.105***	-0.028***	-0.133***	-0.088***
	(0.002)	(0.001)	(0.006)	(0.006)
Loan status	0.031***	-0.029***	0.048***	-0.034***
	(0.002)	(0.002)	(0.002)	(0.002)
Payroll Expenses	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Utility Expenses			-0.000***	-0.000***
			(0.000)	(0.000)
Observations	1,757,436	1,757,436	795,687	795,687
R^2	0.37	0.48	0.40	0.50
Quarterly FE	NO	YES	NO	YES
Business Type FE	NO	YES	NO	YES
Industry FE	NO	YES	NO	YES
State FE	NO	YES	NO	YES
District FE	NO	YES	NO	YES

Notes In all models the dependent variable is *PPP loan amount*, a continuous variable equal to the amount of granted forgivable credit, taken in logarithm. Robust standard errors are reported in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, respectively

to more underserved small businesses than ever before, which in turn expanded the reach of the PPP to more small business owners belonging to racial minority groups. Additionally, we find that business owners belonging to the Black American minority group, as well as Latin American and Asian business owners benefited the most, in terms of access to PPP loans, from the introduction of the Biden-Harris reforms.

Our findings are beneficial to policy makers and lawmakers as we provide evidence that drastic reforms implemented in credit programs could address the ongoing issue of institutional discrimination. We also show that when governments administer credit guarantee

programs accounting for pre-existing inequities in those systems, specific reforms can be enacted to avoid reproducing the same inequities when rebooting those programs.

Moreover, our analysis shows how an adequate design of a public credit guarantee program can provide a substantial contribution to the reduction of racial disparities in the distribution of financial resources, which in turn can favour the economic inclusion of all, moving forward in the accomplishment of the UN's Sustainable Development Goal 10 ('Reduce inequality within and among countries').

Overall, this paper provides a glimpse into an ever-growing issue of institutional bias within the finance industry and paves the way for further research into the topic.

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Declarations

Competing interests The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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