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Understanding the effects of racial classification in Apartheid South Africa ☆

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ABSTRACT

The apartheid era began in 1948 in South Africa, and was implemented by passing several racially discriminatory laws. Most of the key legislative changes were introduced between 1949 and 1953. The cornerstone of this racially stratified legal system was the Population Registration Act of 1950, which required that all South Africans needed to be registered and assigned to an official racial category. We study the effect of racial classification in the context of these legislative reforms, by estimating the causal effect of being classified as White, relative to being classified as Coloured, on labour market outcomes. For identification we exploit a policy change that privileged ancestry over appearance in the process of racial classification for those born after 1951. Using census data from 1980, 1991, and 1996, we find a discontinuity in racial shares for cohorts born after 1951. Our preferred estimates indicate that being classified as White resulted in a more than fourfold increase in income for men. This corresponds to over 90% of the difference in mean incomes between men in the two population groups. Our findings for women are inconclusive.

1. Introduction

Apartheid South Africa presents a unique case study within which to study the effects of discrimination. South Africa's apartheid government implemented a comprehensive system of discrimination against "non-Whites". In addition to legislated labour market discrimination in the form of job reservations and pay scales, discrimination in educational opportunities, healthcare, residential locations, and neighbourhood quality were designed to create productivity differentials across race groups. This comprehensive discriminatory system required that the entire population be officially classified in terms of race. Being classified as "White" as opposed to "non-White" led to radically different experiences in virtually all facets of life.[2]

We can learn a lot about discrimination from a context where discrimination was not only legal, but mandatory for all members of society. First, the estimates obtained from the apartheid era would almost surely represent an upper limit on the magnitude of discrimination, for any non-coercive market economy. This can be helpful for interpreting the magnitudes of discrimination found in other locations. Second, the South African case offers a unique opportunity to estimate the combined effects of pre-market discrimination policies together with labour market discrimination. An exclusive focus on the labour market or on some aspects of human capital will probably render important complementarities invisible. Third, contemporary South Africa remains a highly stratified society, where the primary social cleavage continues to be race. This occurs even though all of the discriminatory laws were repealed by the early 1990s, and despite several affirmative action policies being implemented over the past 25 years. These persistence dynamics would probably also apply to other highly stratified societies, including ones with other social cleavages such as caste or ethnicity.

In this study, we estimate the effects of racial classification in response to the 1950 reforms in apartheid South Africa. This was a unique period in history, during which the building blocks of the Apartheid architecture were set up. Key amongst these was the Population Registration Act of 1950, which required the assignment of an official racial category to all South Africans. We make use of census

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[1] Both authors, Miquel Pellicer and Vimal Ranchhod, contributed equally to each section of this paper.

[2] We recognize that the use of the term "non-White" is problematic. We apologize for this, but it has proven to be impossible to write this paper without using apartheid-era terminology and racial groups. The four official racial groups in South Africa are African, Coloured, Indian/Asian, and White. The term "Coloured" is not considered to be derogatory or offensive in South Africa.

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data from the 1980s and 1990s to estimate the effect of racial classification on economic outcomes in apartheid South Africa. This was a context with extremely large raw differences in educational attainment and income between population groups. In our sample, White people obtained on average about 5 more years of education than Coloured people, and White men earned approximately 4.5 times more income than Coloured men.[3]

We estimate the causal effect of racial classification by exploiting a change in the racial classification process that applied to children born after 1951. At the onset of apartheid, an individual's racial classification was determined by the criteria set out in the Population Registration Act of 1950, and the 1951 Census was the key source of information used for implementation of the Act. Racial classification involved three criteria; appearance, social acceptability, and ancestry or descent. However, for South Africans born before 1951, it was not practical to use ancestry as a criterion, due to incomplete records relating to the race of the parents. For these people, the main criteria used for classification were appearance and social acceptance. In contrast, for people born after the 1951 Census, the official race of the individual's parents became the main criterion for classification.[4] In places where there had been a long history of inter-racial marriage or coupling, this change in policy generated an exogenous change in the population shares of various race groups. We use this change as an instrument to identify the effects of being White, relative to being Coloured, on education, employment and income.

Our data exhibits a clear discontinuity in racial shares for cohorts born after 1951, implying a decreased likelihood of being classified as White of between 3 and 4 percentage points for these cohorts. These discontinuities are present even though no discontinuity is detected for the overall size of cohorts over the same time period. Data limitations prevent us from reaching definitive conclusions regarding the size of the effects. However, our results suggest that being classified as White as opposed to Coloured conferred an extremely large advantage in terms of education for both men and women, and of income for men. Our preferred estimates imply that being classified as White resulted in a 1.43 unit increase in log income for men (i.e. more than a four-fold increase in wage). This estimate corresponds to approximately 94% of the very large disparity in mean incomes between the two population groups.[5] Even the lower bound of the 95% confidence interval of our benchmark estimate implies that being classified as a White man, as opposed to Coloured man, more than doubled one's income.

Our estimates of the effects of discrimination are larger than those usually found in the literature, both in absolute terms and relative to the raw differences between groups. Earlier discrimination studies used wage regressions to decompose racial differentials into a part "explained" by observable characteristics and a part "unexplained" by these characteristics, which was attributed to discrimination. An illustrative example of this approach (Altonji and Blank, 1999) found the "unexplained" part to be between 37% and 62%, depending on the characteristics that were controlled for. These studies had a relatively narrow focus on labour market discrimination, which implied that their discrimination estimates did not incorporate the effect of discrimination on "pre-market" domains, such as education. The current generation of empirical literature on discrimination, the so called "correspondence studies", has a more causal but also a narrower focus (for recent reviews on the empirical literature on discrimination, see Neumark (2018) and Bertrand and Duflo (2017)). These studies measure call-back rates to CVs that differ only on some group marker with no direct bearing on productivity (for example, a "White-sounding" vs. "Black-sounding" name). The most famous of these is probably the work by Bertrand and Mullainathan (2004) in the US, which recorded a 50% higher job call-back rate to CVs with "White-sounding" names relative to "Black-sounding" names. Since then, many more studies of this type have been conducted, including for outcomes outside of the labour market. For example, in the US housing rental market, the effects of 'race' on call-back rates tend to range between 10% and 20% (see Bertrand and Duflo (2017)). Our estimates are much higher than all of these estimates, probably for two reasons. First, we focus on a context where discrimination was mandated and applied to virtually all facets of life. Second, our focus on the effect of racial classification delivers the *combined effect* of all of these specific types of discrimination as well as their interactions, instead of narrowly focusing on discrimination in wage-setting, job call-backs, or housing rental call-backs in isolation.

Our paper illustrates a novel way to identify the causal effects of racial classification on economic outcomes, which can hopefully be useful to other researchers as well. In essence, we are estimating the economic effects of group membership, where membership guarantees differential rights and privileges, and is determined by some formal classification system. Any exogenous change in the classification system yields an opportunity to estimate the effect of membership, for the subset of people affected by the change in the classification system. Some groups and places where this might be useful would include Scheduled Castes in India, Indigenous people in Brazil, Native Americans in the USA, First Nations people in Canada, and Malays in Malaysia.

2. South African history and Apartheid

South Africa as a country with its current borders was formed in 1910 when the South African Union was granted independence from Britain and became a self-governing dominion of the British Empire. This followed two and a half centuries of European settlement, expansion, and conquest in South Africa, beginning with the first Dutch settlement in 1652 in what is now the city of Cape Town.

Apartheid as official state policy was introduced by the newly elected National Party in 1948, and ended with the first fully democratic election in South Africa in 1994. The system was based on a belief in scientific racism and White supremacy, and emphasized racial 'Separateness' as its core principle. Practically, the policy involved the statutory classification of all people into mutually exclusive racial groups. These groups had varying degrees of state support, legal rights, access to healthcare and education, and geographic mobility; with White people always receiving vastly better opportunities, facilities, subsidies, and welfare transfers. Implementation was achieved by passing into law several statutes that were complete in their coverage and effectively generated different legal systems for people of different races. This led to the creation and stabilization of a social and economic class structure that was fully congruent with the apartheid racial hierarchy.

A thorough discussion of what apartheid was and how it operated is beyond the scope of this article. At the same time, it is important for our purposes to note a few salient points. The following discussion draws on the books by Clark and Worger (2016), Dubow (2014) and Thompson (2001).

First, while Apartheid was ostensibly motivated by beliefs about racial purity and White supremacy, it was also very much about economic rent seeking by a political group that had kept the majority of the population disenfranchised. Such rent seeking involved explicit affirmative action and job reservation for working class Whites. In

[3] We use upper case names for race groups corresponding to those used in South Africa. At various points in time the South African legislature referred to 'Natives' or 'Bantu', these are substantively the same as African.

[4] This change was formalized by an Amendment to the Population Registrations Act in 1967, which was applied retroactively to 1950, whereby one's racial classification was determined by the racial classification of one's parents, regardless of one's own appearance.

[5] The estimate of 94% applies to men with strictly positive income levels. Moreover, our causal estimates applies only to the 'compliers' of the policy, whereas the raw differences applies to the whole population. Thus, strictly speaking, we cannot conclude that racial classification accounted for 94% of the observed income differentials between White and Coloured men.

addition, White-owned businesses benefited from an over-supply of cheap and unskilled black labour, while also being protected from competition by heavily regulating and stifling black owned businesses.[6]

Moreover, South Africa prior to 1948 was already a heavily racialized and stratified society, much like all of the British colonies in Africa. Indeed, one of the most destructive laws for African people was the Natives Land Act of 1913, which prevented Africans from owning or renting land in designated areas that accounted for 93% of the total land area.[7] This, in turn, strongly encouraged Africans to seek wage labour on White-owned farms and in the White-owned mines in Johannesburg and Kimberly. Where South Africa's history does diverge from that of its neighbours is in the period following World War II. While the rest of Africa went through a sustained period of decolonization and withdrawal of the settler communities, the South African experience involved a sharp increase in the subjugation and racial exploitation of non-White people by White people.

While the primary discrimination cleavage was between Whites and non-Whites, there were nevertheless important differences in the treatment of different non-White groups. African blacks, in particular, were especially discriminated against. They faced important additional restrictions in terms of residence, geographic mobility, labour market opportunities and access to educational institutions.

It is difficult to convey the breadth and depth to which race circumscribed an individual's life experience under apartheid. Which healthcare facility one was born in (if any), where one lived, what schools one attended, what subjects and to what level one was allowed to study, one's employment prospects and socio-economic mobility, who one could marry and have a family with, which churches one could attend, the ability to own property or start a business, and which graveyard one would eventually be buried in: these were all strongly constrained by one's racial classification. Thus race affected one's life experiences 'from the cradle to the grave', quite literally, without a moment's respite.

This excessively racialized society was attained by means of several statutes that legally entrenched discrimination as part of national policy. Of these, some of the more far reaching were:

- The Prohibition of Mixed Marriages Act, 1949. This made it illegal for White people and people from non-White race groups to be legally married. This law was followed by the Immorality Amendment Act, 1950 — which prohibited sexual relationships between Whites and members of the other race groups.
- The Population Registration Act, 1950. This required that every individual be classified and provided with an official racial category.[8]
- The Group Areas Act, 1950. This provided for separate residential areas for members of different races, which allowed the state to invest heavily in infrastructure in White areas while providing minimal levels of services in black areas. It also facilitated the geographic exclusion of black communities by forcing them to take up residences in townships on the periphery of urban centres.
- The Bantu Authorities Act, 1951. This law enabled the development of 'independent' homelands that were effectively rural reservations where Africans of different linguistic groups were forcibly removed to. These were ruled by tribal chiefs, and were used to strip Africans of citizenship rights in the 'White' South Africa.
- The Bantu Education Act, 1953. This was used to intentionally limit the type and quality of education that Africans were provided with, so that they would only be adequately trained for subservient and menial tasks in the employment of Whites.
- The Separate Amenities Act, 1953. This governed which public goods people could access, depending on their race. This ranged from relatively petty levels of discrimination such as exclusion from parks, beaches, and restrooms; to more important facilities such as public transport networks and hospitals.

Once one understands the breadth and complexity of the legal framework that was used to implement the apartheid system, it becomes clear that it was necessary for every individual to have an official racial classification. This would be required so that people understood which laws applied to them and which did not, so that officers of the law could quickly and consistently determine an individual's race in order to determine whether a transgression had occurred, and so that different members of the judiciary or bureaucracy would be able to adjudicate or process violations consistently across time and space. In the next section we discuss the process by which racial classification occurred, which in turn enables us to explain our identification strategy.

3. Racial classification

3.1. Racial classification during apartheid

One of the challenges facing the National Party when they came to power in 1948 was that there were many people who were either racially ambiguous or who held different racial identities in different social settings. The need for clarity on what constituted a race and how to determine an individual's racial category was addressed from a legal perspective by the Population Registration Act of 1950. This act required that every individual be classified and needed to obtain a South African ID card that would state the person's official racial category.

In terms of definitions, the Act provided for the creation of three categories[9]:

- A "White person" means a person who in **appearance** obviously is, or who is **generally accepted** as a White person; but does not include a person who, although in appearance obviously a White person, is **generally accepted** as a Coloured person.
- A "Native" means a person who in fact is or is generally accepted as a member of any aboriginal race or tribe of Africa;
- A "Coloured person" means a person who is **not a White person or a Native**;

There is a vagueness and self-referential structure in the definition of "White" and it appears that this was both intentional and pragmatic. The architects of apartheid had in their minds the ideal of racial purity, with racially pure Europeans being White and superior to all other race groups. At the same time, a large part of the National Party's voter base were Afrikaners, i.e. South Africans of primarily Dutch descent who had originally settled in the Cape. Over the course of the preceding centuries, some degree of racial mingling had occurred, such that no Afrikaner could be absolutely certain about their ancestry. A practical issue thus arose whereby the people designing the law, while also considering the challenges of implementation, wrote the law while not mentioning "European" as the basis for being White. Related to these concerns was the existence of a sizeable number of "marginal Whites", estimated at close to 100 000, who represented a threat to the

[6] We use the term 'black' here to refer to all of the 'non-White' groups in South Africa.

[7] An amendment to the 1913 Natives Land Act was passed in 1936 that increased the percent of total land area where Africans could own property from 7% to 13%. Whites, who made up less than 20% of the population, were allotted over 80% of the land.

[8] We discuss this law in detail in the next section.

[9] The Indian/Asian race group was initially part of Coloured group, but later became an official separate category through a different piece of legislature in 1959.

process of racial classification if they were forced to become officially Coloured (James, 1992).

The main administrative device used for the initial classification was the South African Census of May 1951. In this Census, the enumerators would fill in the name and address of the respondent, as well as the enumerator's belief about the respondent's race. The actual process of assigning people with a classification was done by "Race Classification Boards". Officials who worked for these boards would use the data from the Census, as well as a photograph that was submitted by the applicant, as the basis for an initial classification. This initial classification would then be that individual's official racial category unless they appealed the decision. There were many levels of appeal but the first one involved sending the person to get an official photograph from a group of state vetted official photographers who would submit a new photograph. The process could continue on appeal if no resolution was achieved, but there was an eventual endpoint where a state official would use any number of physical 'tests' to determine a person's race.

Implementation of the Act was achieved fairly quickly and completely, and by 1958 95% of Whites, Coloureds and Indians had been issued with identity documents that included a racial category (Breckenridge, 2014). Also worth noting is the relatively low levels of resistance to the classification process.

In terms of implementation, we see that throughout the existence of the Population Registration Act[10] there were three different criteria being articulated as the basis for racial classification. These were appearance, social acceptance, and ancestry or descent. This being said, at least for the stock of people who were born before 1951, there was no official way to verify ancestry. Birth certificates existed but were not standardized, and it was also not clear whether the race on the birth certificate captured the race of the father or the mother, nor whether both parents themselves were of the same race. Thus, for the people born before the 1951 Census, the main criteria used for classification were just the two that were observable; appearance and social acceptance.

As time progressed, more and more people obtained an official racial classification. For children born after the 1951 Census, there was an increased ability to use the official racial classification of the two parents to classify the child. Thus, two officially White parents would have children who would also be classified as White, two officially Native parents would have children who would also be classified as Native, and all other children would be classified as Coloured. The idea was that, at some point, the appearance of the child would cease to be relevant and the ancestry of the child would be sufficiently well known from official records to generate a classification. This was formalized by an Amendment to the Population Registration Act (1967)[11] which was enacted on the 19th of May 1967 and applied retroactively to 7th July 1950.[12]

There are two additional characteristics about the apartheid racial classification process that are worth discussing. First, in other contexts such as Brazil (Francis and Tannuri-Pianto, 2013) and India (Cassan, 2015), racial or caste identities have been shaped or manipulated in response to economic incentives. In the South African case, this would have been extremely difficult to achieve officially, as the process was controlled by the Race Classification Boards. The best that an individual could do would be to appeal their classification, but we know that historically only a tiny fraction of the total population were ever reclassified.[13]

A second consideration is whether a person's official racial category mattered very much, conditional on their appearance. For example, would a very fair-skinned person who was officially Coloured be able to 'pass for White'? There must surely have been some margins where 'passing for White' would have been possible, but these would have been restricted to social settings and informal economic activities. Any point of formal interaction with the state; such as registering a property, opening a business, registering for taxes, starting a new formal sector job, signing a lease contract, registering a motor vehicle, obtaining a driver's license, enrolling at an educational institution, or registering a marriage or the birth of a child; would have required that a person presents their official identity document which contained their (official) racial classification in it. Thus, to the extent that there were some individuals for whom the laws were not strictly enforced, these 'freedoms' would have manifest only for (relatively) minor aspects of their lives.

3.2. Racial classification and year of birth

The objective of our research is to quantify the magnitude of economic advantage that racial classification conferred on an individual in South Africa during apartheid. Data limitations notwithstanding, the correlation between an individual's racial classification and their parents' racial classification, which in turn would imply a correlation between an individual's classification and their parents' socioeconomic standing, would lead to an endogeneity problem that confounds an OLS regression analysis.

For a specific subset of people born around the 1951 Census, however, we have variation in classification that would occur purely due to the relative change in the salience of appearance and social acceptability for classification on the one hand, as compared to the salience of ancestry on the other. In a society with a long history of genetic mixing, children's appearances will not be fully determined by their parents' appearances, and this was relevant for the classification process. Thus, it is possible that two White parents had a dark-skinned child, or that two Coloured parents had a very fair-skinned child.[14] The distribution of appearance amongst children of mixed race couples would probably have an even wider variance.

The extent of ambiguity in the classification process is well documented by reports by the "Survey of Race Relations", an annual

[10] The Act was officially repealed in 1991, along with a number of other Apartheid statutes.

[11] The relevant section is the new section 5(5) which states:

(5) In the application of this section — (a) a person shall be classified as a white person if his natural parents have both been classified as white persons;

(b) a person shall be classified as a coloured person if his natural parents have both been classified as coloured persons or one of his natural parents has been classified as a white person and the other natural parent has been classified as a coloured person or a Bantu;

(c) a coloured person whose natural parents have both been classified as members of the same ethnic or other group, shall be classified as a member of that group;

(d) a person shall be classified as a Bantu if his natural parents have both been classified as Bantus.

[12] It is not coincidental that the shift in criteria for implementation occurred in 1967. South Africans are eligible to apply for an adult ID number at age 16. The passage of this Amendment was stimulated by the first cohort of post-1951 Census babies reaching 16 years of age in 1967.

[13] Du Pré (1994) notes that between 1 January 1983 and 31 December 1990 a total of 9150 people were reclassified. The South African total population was over 30 million people in 1983.

[14] This paper was partly inspired by a story shared by our friend and former colleague Catherine Kannemeyer. Her maternal grandmother, Mabel Canterbury née Slatem, was the relatively dark-skinned child in an otherwise all-White immediate family. Her grandmother attended a different school to that of her siblings, was officially classified as Coloured, and married a Coloured man. She and her husband were forced to move out of Goodwood when it was declared 'Whites Only'. As an adult, she became estranged from all members of her immediate biological family, even though some members lived less than 10 km away, and only reconnected with some of them much later in life. She died in 2001 without reconciling with some of her siblings. Catherine's mother, Jennifer, only saw her maternal grandmother once, and has only ever met one of her numerous cousins.

publication that monitored government policies. In 1955, while the classification of the population born before 1951 was still in process, the report states that "there were already 90,000 border-line cases. There might be many more in the long run" (Horrell, 1956, p. 35). In the 1966/67 issue more detail is provided: "The Minister said that in some cases investigations had proved necessary because there was a measure of doubt: of those classified, 48,000 Whites were involved, almost 179,000 Coloureds, 14,000 Malays, 27 Indians, 14 Chinese, and 26,500 Africans". (Horrell, 1967, p. 19)

We expect that individuals born immediately after 1951 would be less likely to be classified as White than individuals born just before 1951. The ancestry based criterion for classification required both parents to be classified as White in order for the child to be classified as White. Children of inter-racial couples could have been classified as White if those children were fair-skinned and were born before 1951, but those same fair-skinned children would have been classified as Coloured if they were born after 1951. Children of "racially ambiguous" people might have been classified as White if they were born before 1951, but would have been classified as Coloured if they were born after 1951 and at least one of the parents had already been classified as Coloured on the basis of the Census.

As an illustrative example, consider a couple where one partner was classified as White and the other classified as Coloured, who were married in 1945. This couple had four children, 2 born before 1951 and two born after 1951. Of the two older children, one had darker skin and was classified as Coloured and the other one had lighter skin and was classified as White, based on their appearances.[15] The two younger children had similar variation in appearances as their two older siblings, but since they are classified based on their parents' classifications, which is multi-racial, they are both classified as Coloured. The existence of people whose appearances are racially ambiguous thus enables us to identify the causal effect of being assigned to a different racial category, for the subset of people who might have been affected by this change in classification systems.

In principle, changes in racial classification due to this policy change could have applied to any margin: Coloured/White, African/Coloured, or African/White. In practice, most changes were likely to involve Coloureds. The reason is that the change would have mainly affected those people with a degree of racial ambiguity in terms of their appearance. These were particularly likely to involve Coloureds, as is clear from the 1966/67 Survey of Race Relations quote provided above.[16]

The two most relevant margins affected by the change in the racial classification process are thus likely to be the Coloured/White margin, and the African/Coloured margin. Our analysis will focus on the Coloured/White margin. This is mainly due to data limitations, as we explain in the next section. However, the Coloured/White margin is also likely to have been particularly relevant in practice. From 1983 to 1990 there were 5622 applications for reclassification from Coloured to White. This was close to double the number of applications for reclassification from African to Coloured (3207), and there were no applications for reclassification from African to White (Du Pré, 1994).

4. Data

The data for our analysis comes from the 1980, 1991 and 1996 Censuses.[17] For 1980 and 1991 the publicly available data includes the entire dataset, whereas for 1996 only a 10% sample is available. We restrict our sample to Coloured and White South African citizens who were born in South Africa, and who, at the time of the relevant Census, were residing in areas that currently constitute the Western Cape or Northern Cape provinces.

The restriction to only consider the White and Coloured race groups is a substantial limitation in our study, but it is unavoidable. This is mainly because the 1980 and 1991 Censuses excluded certain former "Homeland" areas, and thus did not cover the entire South African population. The exclusion of Homelands is especially problematic for us because a large proportion of the African population were forcibly removed to the former Homelands (Abel, 2019). In addition, influx control in areas outside of the Homelands was such that employment was a condition for most Africans to be granted a Pass to reside in 'White' South Africa. This restriction on mobility would generate a sample selection issue if we were to include the Africans who were residing in the Northern or Western Cape at the time of the relevant Census.[18]

The geographic restriction to the Western Cape and Northern Cape provinces is imposed because these are the areas where the overwhelming majority of the Coloured population, who are central to our analysis, lived. In 1996, these provinces accounted for only 12% of the total population in South Africa, but accounted for 72% of the total Coloured population.

The geographical restriction is based on place of residence rather than the place of birth because place of birth is only available for one census year (1980). One potential disadvantage of using place of residence to select our sample is that migration decisions may be endogenous to an individual's racial classification. This is particularly true in the context of South Africa under apartheid, where African and Coloured people were subject to "forced removals" because of their racial classification. However, unlike the case of Africans, Coloureds were always relocated within the same city or region. This implies that most Coloureds who were forced to migrate are likely to remain in our sample. Because our identification relies on cohort variation rather than spatial variation, as long as migrants remain in our sample, this type of migration should not substantially affect our estimates.

Finally, we further restrict our sample to cohorts born in a window around 1951, and focus primarily on those born between 1931 and 1961.

The variables that we use are *year of birth*, *race*, *education*, *employment* and *income*. The processing of these variables is straightforward. Education is processed into a numerical variable of school grades completed. The only noteworthy issue is that there is a small proportion of people in the 1996 Census with missing values for the race variable (3%). The income variable for 1991 and 1996 is reported in brackets; we impute a value using the midpoint of the bracket.[19] We adjust incomes for inflation using the Statistics South Africa's historical CPI series, with 2010 as base year. Approximately 2% of respondents have extremely low income levels (less that 0.1 rand per month in 2010 rands); we code these as missing.

Table 1 contains the descriptive statistics from our sample, reported separately by year and by sex. Around 30% of the sample is classified as White and this number is similar across the three waves. Years of education are also fairly constant across waves, although they are

[15] There are several documented cases in which families and siblings were indeed classified differently, with devastating implications for families and social cohesion.

[16] Indeed, there is evidence that the current Coloured population is highly genetically diverse, including a substantial share of European ancestry: "the CMA [Cape Mixed Ancestry] population shows the highest levels of intercontinental admixture of any global population, with nearly equal high levels of SAK [Southern African Khoesan] ancestry, Niger-Kordofanian ancestry, Indian ancestry, and European ancestry" (Tishkoff et al., 2009, p. 1043).

[17] These data are publicly available at https://www.datafirst.uct.ac.za/.

[18] The interaction between residency in these regions and employment was further complicated by the Coloured Labour Preference Policy, which reserved certain types of jobs in the Cape province for Coloureds. This, combined with the pass laws, meant that most Africans could not legally live in the Cape Province.

[19] The top bracket is open ended. We thus use as the endpoint of the topmost bracket three times the lower limit of that bracket. This choice is arbitrary but is unlikely to have a strong effect on our estimates since our analysis uses income in logs and there are relatively few observations in those categories (0.01% in 1996 and less than 0.001% in 1991).

Table 1
Descriptive statistics of cohorts born in 1931–1961.

	1980			1991			1996		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
Male									
White	0.32	0.46	510961	0.31	0.46	414779	0.32	0.47	38514
Years of education	7.77	4.09	506724	8.24	4.14	408723	8.34	4.21	36708
Employed	0.88	0.33	510961	0.84	0.36	414779	0.73	0.44	38514
Log income	3.65	1.04	446576	3.72	1.24	367654	3.71	1.19	32169
Female									
White	0.31	0.46	519234	0.30	0.46	454676	0.31	0.46	43942
Years of education	7.51	3.89	514645	8.00	3.88	447928	8.05	3.92	42363
Employed	0.49	0.50	519234	0.49	0.50	454676	0.45	0.50	43942
Log income	2.97	1.05	265861	3.12	1.14	245243	3.16	1.10	25154

Means, standard deviations and number of observations of the variables used in the analysis by census year and gender. The sample is restricted to cohorts used in the benchmark analysis (born between 1931 and 1961). Statistics are based on the individual level data. The 1996 census has considerably lower sample size because it is based on the publicly available 10% sample.

slightly lower in 1980. Women are much less likely to be employed than men. Even the income variable, which is typically measured with the most noise, shows a fairly consistent pattern across waves. Among those with positive income values, women earn less than men, but for both groups income rises slightly across waves. Overall, the patterns in the data seem plausible and this provides us with confidence about the quality of the data.

To illustrate just how large the differences in economic outcomes across racial categories are, Fig. 1 shows the densities of log income in 1980, 1991 and 1996. These are presented separately for men and women aged between 20 and 65. The income distribution for Whites lies clearly to the right of the corresponding distribution for Coloureds. In fact, there is only limited overlap between the two distributions, particularly for men. This indicates that relatively low income White men still earned more than relatively highly paid Coloured men. These differences become slightly smaller over time and are somewhat less pronounced for women, although they remain large.

5. Empirical approach

The race classification law that we use changed the official racial composition of the population for cohorts born after 1951 in a discrete way. We use this change to identify the effect of one's official race on labour market outcomes using a fuzzy regression discontinuity approach.

5.1. Threats to identification

There are three potential *a priori* threats to our identification strategy. First, outcomes such as employment and income have a strong non-linear life-cycle profile. For a given census year, different birth cohorts are observed at different moments in their life-cycle. Non-linear life-cycle patterns translate into non-linear patterns in outcomes across cohorts. These non-linearities can make it harder to cleanly identify potential jumps in our outcome variables. Non-linearities are likely to be particularly strong for the 1980 census, where cohorts born at the 1951 threshold are in their late twenties, a period of strong life-cycle transition. To deal with this problem we take advantage of the three census years that we have and control for life-cycle patterns using a full set of age dummies. This accounts for the non-linearities in outcomes across cohorts induced by life-cycle considerations.

Second, there is the problem of age heaping and year of birth heaping where an implausibly large share of people use round figures for these variables (see Table A1 in the online appendix).[20] This can be problematic because such heaping is correlated with race and education: Those more likely to report being aged and born in a round year tend to be Coloured and have fewer years of education. Moreover, the threshold that we use, 1951, falls just after a round number. Since people reporting to be born in 1950 are less likely to be White, and are more likely to display relatively low levels of education, this can generate an artificial discontinuity in outcomes after 1950 that confounds our approach. We address these problems in the following way. The problem of age heaping is partially addressed by the age dummies that we use to deal with the life-cycle problems. These dummies absorb all age effects, and therefore also absorb those effects that arise due to age heaping. We deal with the problem of year of birth heaping using the "donut" estimator suggested in Barreca et al. (2016). This estimator simply removes the observations with years of birth where most heaping occurs. We apply this approach by removing all years of birth ending in zero. Below we check the robustness of our results to including the years of birth ending in zero.[21]

The third potential threat to our identification strategy is to consider how changes in the marriage market pre-1951 might affect our estimates. For example, the Prohibition of Mixed Marriages Act was passed in 1949, and would have led to a substantial decrease in inter-racial marriages together with a corresponding increase in same-race marriages. If we assume that fertility patterns change in response to these changes in the marriage market, then we might observe a change in the racial shares of new cohorts born from 1950 onwards. We have no data to empirically test for this possibility, but even if the conjecture is indeed true, then the new couples would only contribute a relatively small share of new births in 1951. Thus the impact of marriage market changes on racial shares amongst new cohorts, even if it is real, is highly unlikely to generate a discontinuity in the relevant time period, and is therefore also unlikely to pose a serious threat to our identification strategy.

5.2. Data processing and related matters

We aggregate our data by census year and year of birth and conduct the analysis separately for men and women. Thus, our data points are averages of census-year x year-of-birth x sex cells. In our analyses below we use weights, where the weights are the number of observations in each cell. Since the 1996 data is a 10% sample, the cells corresponding to this year are 10 times smaller and weight ten times less in the analysis. In our benchmark specification we leave these weights, but

[20] The reason why there is both age heaping and year of birth heaping is that in the 1991 and the 1996 censuses respondents were asked for both their age and their year of birth. These two variables were then combined by the census agency to report a single age variable.

[21] The "donut" approach is effective in our case to the extent that individuals mistakenly rounding their year of birth to 1950 are similarly drawn from the 1949 and the 1951 cohorts. In Table A2 in the online appendix, we show that there is no indication of asymmetry in the size of the 1949 and 1951 birth cohorts.

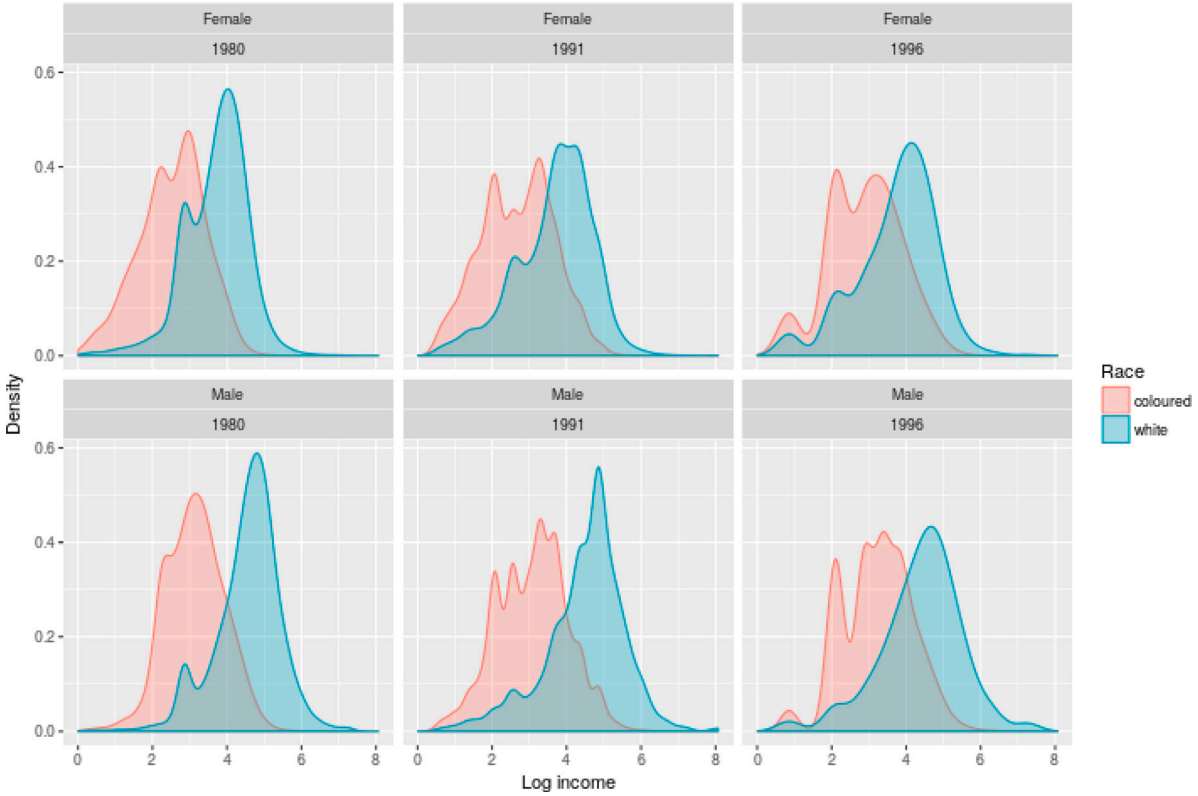

Fig. 1. Distribution of log income of Coloureds and Whites, by census year and gender.
Income is monthly and has been adjusted for CPI using 2010 as base year. Sample includes individuals between 20 and 65 years of age. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

we also show the robustness of results to two ways of dealing with the issue: we inflate the 1996 cell-based weights tenfold; and we use individual level data with weights equal to 1 for 1980 and 1991, and to 10 for 1996, clustering standard errors by year of birth. Overall, the results from these specifications yield qualitatively similar estimates to those obtained from the benchmark specification.

The first stage is:

$$White_{yac} = \alpha_{1y} + \alpha_{2a} + \alpha_3 yob_c + \alpha_4 D51_c + \alpha_5 yob_c D51_c + u_{yac}$$

where $White_{yac}$ is the fraction of Whites in each census year, age, and cohort cell, α_{1y} and α_{2a} are census year and age fixed effects, yob_c is year of birth (centred in 1951), and $D51_c$ is an indicator variable for cohorts born during or after 1951. The variables $D51_c$ and $yob_c D51_c$ capture the change in the level and trend in official race classification for cohorts born after 1951.

The second stage is:

$$Y_{yac} = \theta_{1y} + \theta_{2a} + \theta_3 yob_c + \theta_4 yob_c D51_c + \rho White_{yac} + \upsilon_{yac}$$

The second stage controls for all of the fixed effects in the first stage, for year of birth and for the interaction of year of birth and the indicator of being born after 1951. The endogenous variable is $White_c$, which is instrumented by $D51_c$, and the coefficient of interest is therefore ρ. Including the interaction of year of birth and the indicator of being born after 1951 in the second stage implies that the identification of the effect of racial classification is given by the discontinuity in the share of Whites for the cohort born in 1951.

We conduct the analysis separately for men and women because labour market outcomes differ markedly between them. We estimate these regressions using 2SLS with heteroskedasiticity robust standard errors.

We restrict the sample to cohorts affected by the policy change in 1951. Given that our focus is on labour market outcomes, it makes sense to restrict the sample to individuals who are at least 20 years old. Since our earliest census is from 1980, this puts an upper bound on the window to the right of the threshold of 10 years. For the boundary to the left of 1951, we do not have this problem and we use 20 years. Our benchmark cohorts are thus those born between 1931 and 1961. Throughout the paper we also show the results for a specification with a 3rd order polynomial in year of birth and no spline. We also check whether our main results are robust to using other windows and specifications.

5.3. Validity

The key identification assumption for our approach to be valid is that the cohorts born just before 1951 and just after 1951 are similar in all respects except in their racial classification and its consequences. The conventional way to check whether this assumption is plausible or not is to test whether pre-classification variables exhibit a jump at the specified threshold. In our case, this is difficult to implement. Racial classification under Apartheid impacted on all aspects of life so strongly, that there is probably no individual level variable that would be unaffected by one's classification. This would include health outcomes, mortality risks, educational outcomes, marital status, linguistic background, and even probably religious affiliations. An alternative would be to use family background variables. Unfortunately, members of the same family cannot be linked in the relevant census unless they live together, which would not generally be the case for the ages of the "children" considered.[22]

[22] There are earlier censuses available, from 1960 and 1970 where the people of the relevant cohorts would still be children living with their parents. However, in those censuses there is no household or family indicator.

Table 2
Similarity of pre-treatment variables around the year of birth cut-off.

	1	2	3
Cohort Size			
Born after 1951	0.059*	−0.01	0.017
	(0.033)	(0.042)	(0.024)
Share of men in cohort			
Born after 1951	0.001	−0.004	0
	(0.003)	(0.005)	(0.003)
Poly.order	1	3	1
Spline	Yes	No	Yes
Subset	Benchmark	Polynomial 3	War birth-years dummy
Cohorts	1931–61	1931–61	1931–61
N	84	84	84

Robust standard errors in parenthesis. Signif. codes: 0.1 *** 0.01 ** 0.05 *. Coefficients from regressions of log population size and share of men in the cohort on a dummy for cohorts born after 1951, year of birth and the interaction between the two, with age and census year dummies. Birth-years ending in zero are removed to partially deal with heaping. Data are aggregated by year of birth, census year and gender; regressions use cell size weights. The first column is the benchmark specification. The second column uses a 3rd degree polynomial on birth year with no spline. The third column controls also for war birth-years with a dummy for 1942 and 1943, where cohort sizes were unusually low.

In our case, there are two variables that we can use to assess the plausibility of this assumption: The overall size of the different birth cohorts and the gender distribution within these cohorts. These two variables are likely to be exogenous to the process of racial classification.[23] Our assumption would require that both variables do not experience a jump in 1951. The test is particularly relevant for the cohort size variable: If we find no change in the overall size of the population, then any jump that we find in racial shares would be a strong indication that people were indeed classified differently to earlier birth cohorts. This would then be fully consistent with our interpretation of the estimates as the effects of the racial classification policy changes. The effects could still be driven by other reasons, for example by a change in the relative fertility rates of Coloureds and Whites, but such a change would need to be concentrated in 1951 in order to drive our results below.

Table 2 shows the results of these tests. The table shows estimates from reduced form equations such as the first stage regression model described above, where the outcome variable is the log of the size of the cohort in each year of birth/census year cell. The table shows coefficients for the dummy variable identifying cohorts born after 1951, thus capturing the jump in population size for the cohort born in 1951. The first column corresponds to the benchmark specification which is linear in the running variable and includes a spline. Column 2 shows the basic robustness specification with a 3rd order polynomial specification.

The coefficients in Table 2 are generally small and statistically insignificant, implying that there is no substantial change in cohort size or in the gender distribution of the cohorts after 1951. One coefficient is marginally statistically significant (for cohort size in the benchmark specification), and this could be considered a threat to the validity of our approach. It turns out that this small effect is mainly driven by the particularly small size of cohorts born during World War II. The left panel in Fig. 2 shows the residuals from regressions of the log of cohort size on census year and age dummies, as a function of the year of birth. The figure also adds the fitted values from a regression of these residuals on the jump variable, allowing for a spline. This is the counterpart of the reduced form estimate in column 1 of Table 2. The dots do not show a particularly strong jump at 0, which corresponds to the 1951 cohort. Instead, there is quite a clear trough in the years that correspond to 1942 and 1943. These are the World War II years, where many men where abroad, and fewer children were born.

To address the extent to which these unusual years are responsible for the positive jump coefficient in Table 2, column 3 re-estimates the benchmark specification with a dummy variable with a value of one for birth-years 1942 and 1943. The jump coefficient becomes almost zero. The F-statistic for the jump coefficient being zero is small, at 0.96. This is confirmed by the right panel in Fig. 2, which shows the same residuals as the left panel, but including the 1942 and 1943 birth-year dummy in the regression: no clear change in 1951 is observed. It appears that, once we account for the war years, there is basically no jump in the size of the population in our sample born after 1951. This provides some assurances regarding the validity of our approach. For the rest of the analysis, all of our analyses include the war years dummy variable.[24]

6. Results

6.1. First stage

Table 3 shows the first stage results for men and for women separately. The structure of the table is the same as in Table 2, showing the coefficients for the jump at 1951, using the benchmark specification and the 3rd order polynomial specification. There are now two panels, the top one for men and the bottom one for women. The outcome variable is now the proportion of people classified as White (as compared to being classified as Coloured).

All coefficients in the table are negative, implying that racial shares changed abruptly in 1951. Our estimates indicate a drop in the share of Whites in 1951 of between 3 and 4 percentage points, depending on the specification. This implies that racial shares changed substantially after

[23] For cohort size, this will be the case as long as the change in racial classification that we exploit did not lead to migration.

[24] The smoothness of the cohort size variable also addresses a second potential threat to the regression discontinuity approach validity: the possibility that there is manipulation of the assignment variable, in our case the (stated) year of birth. While the cohort size results in Table 2 suggests that this is not a problem, we nevertheless perform two additional tests. First, we check that the extent of heaping is not particularly acute in 1950 relative to other years ending at zero (see second column of Table A1 in the online appendix). If that were the case, our "donut" approach might have hidden a possible "manipulation" of the running variable. Second, we run the McCrary (2008) test on the individual level data. This test is rather stringent, since it needs to include zero-ending years of birth; otherwise the density on these years is computed at zero and discontinuities emerge artificially. Nevertheless, using the bandwidth selection in McCrary (2008), the p-value of the test is 0.11, and using a bandwidth of 10 years of birth the p-value is 0.14.

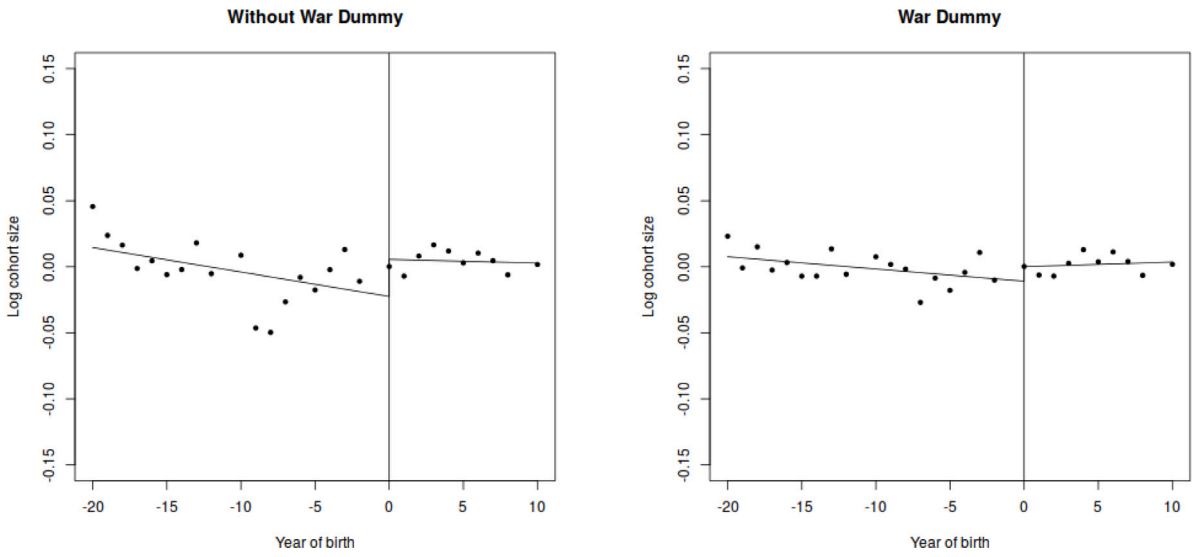

Fig. 2. No jump in overall population size for cohorts born after 1951.
Year of birth centred at year 1951. The dots are residuals from regressions of share of log size of a year of birth cohort on age and census year dummies as a function of year of birth. The line is the fitted value of a regression of these residuals on year of birth, a dummy for cohorts born after 1951, and the interaction between the two. The right panel adds to the regressions a war birth-year dummy: a dummy with value one for cohorts born in 1942 or 1943.

Table 3
First stage: Effect of instruments on being classified as White.

	1	2
Male		
Born after 1951	−0.031***	−0.039***
	(0.009)	(0.01)
Female		
Born after 1951	−0.031***	−0.038***
	(0.008)	(0.009)
Subset	Benchmark	Polynomial 3
Cohorts	1931–61	1931–61
N	84	84

Robust standard errors in parenthesis. Signif. codes: 0.1 *** 0.01 ** 0.05 *. Coefficients from regressions of share of Whites on a dummy for cohorts born after 1951, year of birth and the interaction between the two, with age and census year dummies. Birth-years ending in zero are removed to partially deal with heaping. Data are aggregated by year of birth, census year and gender; regressions use cell size weights. The first column is the benchmark specification. The second column uses a 3rd degree polynomial on birth year with no spline. The third column controls also for war birth-years with a dummy for 1942 and 1943, where cohort sizes were unusually low.

1951 even though, from the previous table, the aggregate population size did not.

Fig. 3 depicts the graphical illustration of the first stage, separately for men and women. It shows the residuals of a regression of the share of Whites on census year, age dummies, and the war birth-years dummy, as a function of year of birth. The figure shows quite clearly that after 1951, the share of Whites decreased abruptly.

6.2. Regression discontinuity results

Table 4 shows the Regression Discontinuity (RD) results. Each row corresponds to an outcome variable and each column to a different specification. Column 1 shows the OLS estimate for comparison. The OLS specification is a regression of the respective outcome on the variable White, controlling for age dummies and census year dummies. The RD regressions identify the effect of interest locally for cohorts around the 1951 threshold. We thus restrict the sample for the OLS regression to cohorts born between 1948 and 1953. The results are shown separately for men (above) and women (below).

Our instrument identifies effects for those affected by the change in racial classification: People who, had they been born before 1951 would have been classified as White, but had they been born after 1951 would have been classified as Coloured. The treatment effect for this population is unlikely to be the same as the Average Treatment Effect. Therefore, the RD estimates cannot be directly compared to the OLS estimates. On the one hand, the 'compliers' of our instrument are people with a relatively light skin tone and with more homogeneous characteristics in general than the whole population of Whites and Coloureds combined. For this reason, if this group could be identified and racial categories could be attributed to each individual, we would probably observe smaller raw racial differences for this sub-population than those shown in the OLS estimates for the whole population.

On the other hand, racial classification for these 'compliers' might have been particularly traumatic in the sense that they may have suffered particular disruption from the implementation of apartheid laws: They would have been living in more integrated neighbourhoods if/when classified as White and therefore would have certainly been uprooted by apartheid's forced removals when classified as Coloured. Over the years, they would have experienced particular tensions in terms of identity, belonging, and social acceptance. In this sense, the effect of racial classification could be stronger than a simple comparison of means between population groups might suggest.

The OLS results show very large racial differences in socioeconomic outcomes. White men and women have more than 5 additional years of

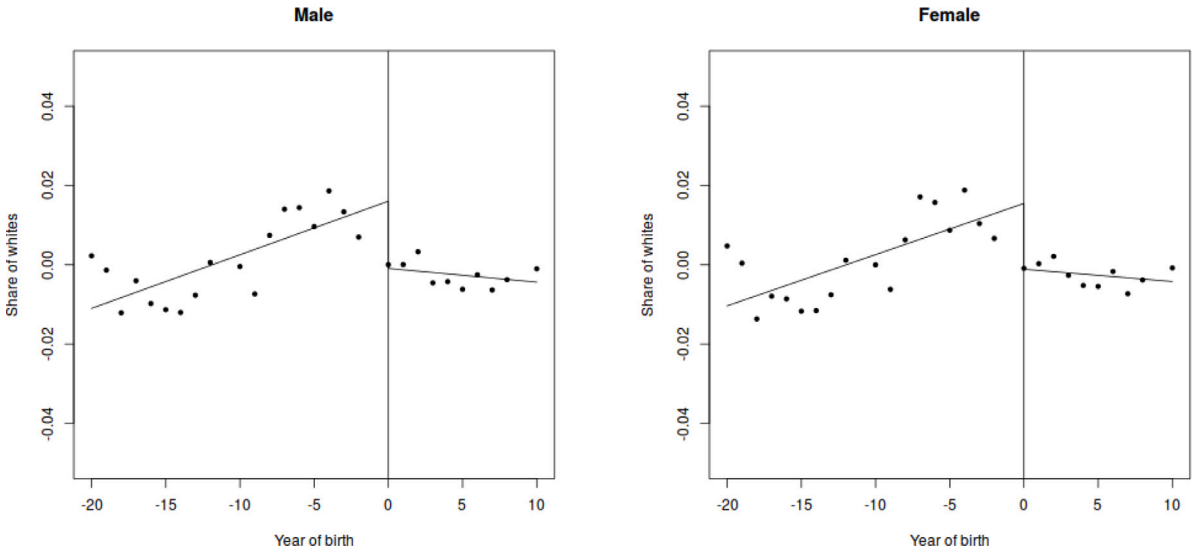

Fig. 3. First stage: Jump in share of Whites for cohorts born after 1951.
Year of birth centred at year 1951. The dots are residuals from regressions of share of Whites on census year, age dummies, and the war birth-years dummy, as a function of year of birth. The line is the fitted value of a regression of these residuals on year of birth, a dummy for cohorts born after 1951, and the interaction between the two.

Table 4
OLS and RD results: The effect of being classified White on economic outcomes.

	1	2	3
Male			
Years of education	5.213***	9.319***	8.265***
	(0.012)	(1.827)	(1.907)
Employed	0.096***	0.245	0.587
	(0.001)	(0.324)	(0.364)
Log income	1.537***	1.437***	1.888***
	(0.003)	(0.437)	(0.415)
Female			
Years of education	5.114***	7.675***	6.878***
	(0.011)	(1.508)	(1.408)
Employed	−0.003	−0.59**	−0.108
	(0.002)	(0.253)	(0.203)
Log income	1.245***	0.208	1.575***
	(0.005)	(0.736)	(0.436)
Estimation	OLS	RD	RD
Poly.order	1	1	3
Spline	Yes	Yes	No
Subset	Born close to 1951	Benchmark	Polynomial 3
Cohorts	1948–54	1931–61	1931–61
N	150852	84	84

Robust standard errors in parenthesis. Signif. codes: 0.1 *** 0.01 ** 0.05 *. Coefficients from OLS and 2SLS regressions of education, employment and log income on being classified as White, controlling for year of birth, age and census year dummies, and the interaction between year of birth and a dummy for cohorts born after 1951. Being classified as White is instrumented by a dummy for cohorts born after 1951. Data are aggregated by year of birth, census year and gender; regressions use cell size weights. Birth-years ending in zero are removed to partially deal with heaping. Each column corresponds to a different specification. Column 1 uses the OLS estimator for comparison. This is estimated using cohorts born close to the year 1951. Columns 2 and 3 use the fuzzy regression discontinuity approach (RD). Column 2 is the benchmark specification. Column 3 uses a 3rd order polynomial with no spline. RD specifications control for war birth-years with a dummy for 1942 and 1943, where cohort sizes were unusually low.

education than their Coloured counterparts. White men have over 1.5 more log points in income, while White women have over 1.2 more log points in income, relative to Coloured men and Coloured women respectively. For men, this is approximately equal to the difference in log income between White men at the 70th income percentile and those at the 30th income percentile. Differences in employment rates are high for men at 10 percentage points, but are negligible for women.

Columns 2 and 3 show our RD estimates with the benchmark window and the 3rd order polynomial specification. The effective F-statistics of Olea and Pflueger (2013) in all specifications are very high (higher than 45), indicating that the instrument that we use is strong enough to not concern ourselves with the problems that arise with using weak instruments.[25]

The benchmark specification with years of education as the outcome shows a coefficient of 9.3 for men and 7.6 for women. This implies that being classified as Coloured as opposed to White implied a very large loss in educational attainment for men and women according to our

[25] The effective F-statistics tests were carried out using the individual level data because the Stata implementation of the test does not allow for analytic weights.

estimates. The regression discontinuity estimates are higher than the OLS ones, which might suggest that the 'compliers' of our instrument experienced particularly strong disruption with the implementation of apartheid laws. At the same time, the estimates are very imprecise, with fairly large standard errors. The lower bound for men, based on the 95% confidence interval from the 3rd degree polynomial specification, would be 5.2, which is similar to the OLS estimate, and for women the corresponding lower bound would be 4.3.

The results for employment are less clear. Generally, the standard errors are too large to draw definite conclusions. For women, the benchmark specification delivers a surprising large, negative, and statistically significant coefficient. We believe that the reason for this result lies in the changing life-cycle patterns of labour force participation amongst women during the period under consideration, which generate non-linearities that confound our estimate. This conclusion is discussed in the online appendix B and is reinforced by the results of the non-linear specification (polynomial of order 3) in column 3, which yields a much smaller and more sensible coefficient.

Our most striking and statistically significant results are those relating to income for men. The RD coefficient in the benchmark specification is 1.44. This implies that the effect of racial classification on income is very large. On average, being classified as a White man as opposed to a Coloured man would have *more than quadrupled* a person's income. This coefficient is slightly smaller than the OLS coefficient. The lower bound, on the basis of the 95% confidence interval, is 0.66, which still implies a doubling of income upon being classified as a White man, as opposed to Coloured. The coefficients for female incomes are imprecise and unstable across specifications, possibly reflecting the non-linearities in labour force participation mentioned above. Again, the non-linear specification in column 3 shows the most sensible results, with a coefficient closest to the OLS coefficient and to the benchmark RD coefficient for men.

Fig. 4 shows the graphical representations of the reduced form associated with the RD results in Table 4.

6.3. Robustness

Our most remarkable results correspond to the effect of racial classification on income for men. We discuss the robustness of this particular result to different specifications. Table 5 presents the coefficients of the first stage (top panel), the reduced form coefficients (middle panel), and the fuzzy RD (thus IV) coefficient (bottom panel), under different specifications. Column 1 depicts the benchmark specification, which shows a negative jump in the White racial classification and the income variable, and the corresponding positive RD coefficient.

Columns 2 and 3 consider robustness to different windows, using the Imbens and Kalyanaraman (2012) (IK) and the Calonico et al. (2014) (CCT) procedures, as implemented in Calonico et al. (2017).[26] The pattern of results in both specifications are similar to the benchmark. In both cases, the RD coefficient is positive and statistically significant. The coefficient using the CCT window is somewhat smaller than the one using the benchmark specification, but still shows a very large effect of 1.2 log points. The coefficient using the IK window is substantially larger than the benchmark, but in this case the effective F-statistic is considerably smaller suggesting that the instrument in this specification is weak.

Column 4 considers the implications of ignoring the potential year of birth heaping problem unaddressed, by leaving the years of birth ending in zero in the analysis. Relative to the benchmark specification, the coefficient for the 1951 jump becomes smaller in both the first stage and in the reduced form. This was as expected because people who report being born in a zero-ending year of birth (including 1950) are more likely to be Coloured and have lower incomes; and this makes the reduction in Whites and the reduction in income for those born after 1951 less marked. The RD coefficient is smaller than in the benchmark, although still economically important and statistically significant.

Columns 5 and 6 check the robustness of our results to different ways of handling the fact that the 1996 data includes only a 10% sample. Column 5 uses aggregate data but inflates our cell-size weights in 1996 observations by a factor of 10. Column 6 uses individual data while weighting 1996 individuals by a factor of 10. Both procedures generate similar point estimates. The coefficients remain strongly significant, although they are slightly larger than in the benchmark specification.[27]

Overall, our main result appears to be qualitatively robust. In all specifications, a decrease in Whites after 1951 is accompanied by a decrease in income, leading to a positive RD coefficient. However, we are not able to pinpoint the size of the effect with confidence. Among the specifications with fairly large effective F-statistics, the size of the RD coefficient varies from around 1 in the specifications that keep years of birth ending in zero, to 1.7 in the specifications that inflate the 1996 data. The benchmark specification of 1.43 lies between these two sets of estimates.

7. Concluding remarks

In this research have obtained the first causal estimate of the effect of racial classification on labour market outcomes in South Africa during apartheid. We used a change in the way that people were classified to address the endogeneity problems common in most empirical studies on discrimination, thus identifying the effects of being White for a group of marginal people on the Coloured-White margin.

Being White had a large and statistically significantly positive effect on educational attainment, regardless of sex. For employment, our RD results did not allow us to reach any clear conclusions for the sample being analysed. For earnings, being a White male resulted in an exceptionally large racial earnings premium. Whereas our estimated effect differs across specifications, our benchmark specification suggests that differences in income due to racial classification for the population of compliers correspond to about 94% of the raw income gap between White and Coloured men.[28]

It is also important to note that our study is only focusing on a very narrow set of welfare outcomes and a relatively short time horizon. The effects of racial discrimination in this setting would almost surely be bigger if we were to include other widely accepted measures of welfare, such as health outcomes, life expectancy, or psychological well-being. We also do not consider any of the longer run effects that would be manifest through the inter-generational transmission of privilege or disadvantage. These would also probably amplify the effects of racial classification, but are beyond the scope of this study.

The main limitation in our study is that we have no clear way to estimate the effect of racial classification for Africans. Since this group is the largest demographic group in the country, and since this group was clearly the most disadvantaged in terms of violence, neglect, and restrictions; it would be desirable to have a similar measure for the

[26] We compute the optimal bandwidth using as outcome variable in the procedure the residuals from a regression of income on a full set of age dummies, census year dummies, and the war dummy. We do this because of the marked age profile of income.

[27] We do not report effective F-statistics in these specifications because they require the use of weights, which is not supported in the Stata implementation.

[28] We conducted a simple back-of-the envelop calculation to estimate the extent to which the effects of racial classification on income are mediated by education. Our estimate suggests that 90% of the effect of income is via education. We obtain this rather simple estimate by multiplying the estimated effect of racial classification on education in the benchmark specification (9.3) times the coefficient of a regression of income on education, controlling for racial classification (0.14). This yields a "mediated effect" of 1.3, which is 90% of the estimated effect of racial classification on income.

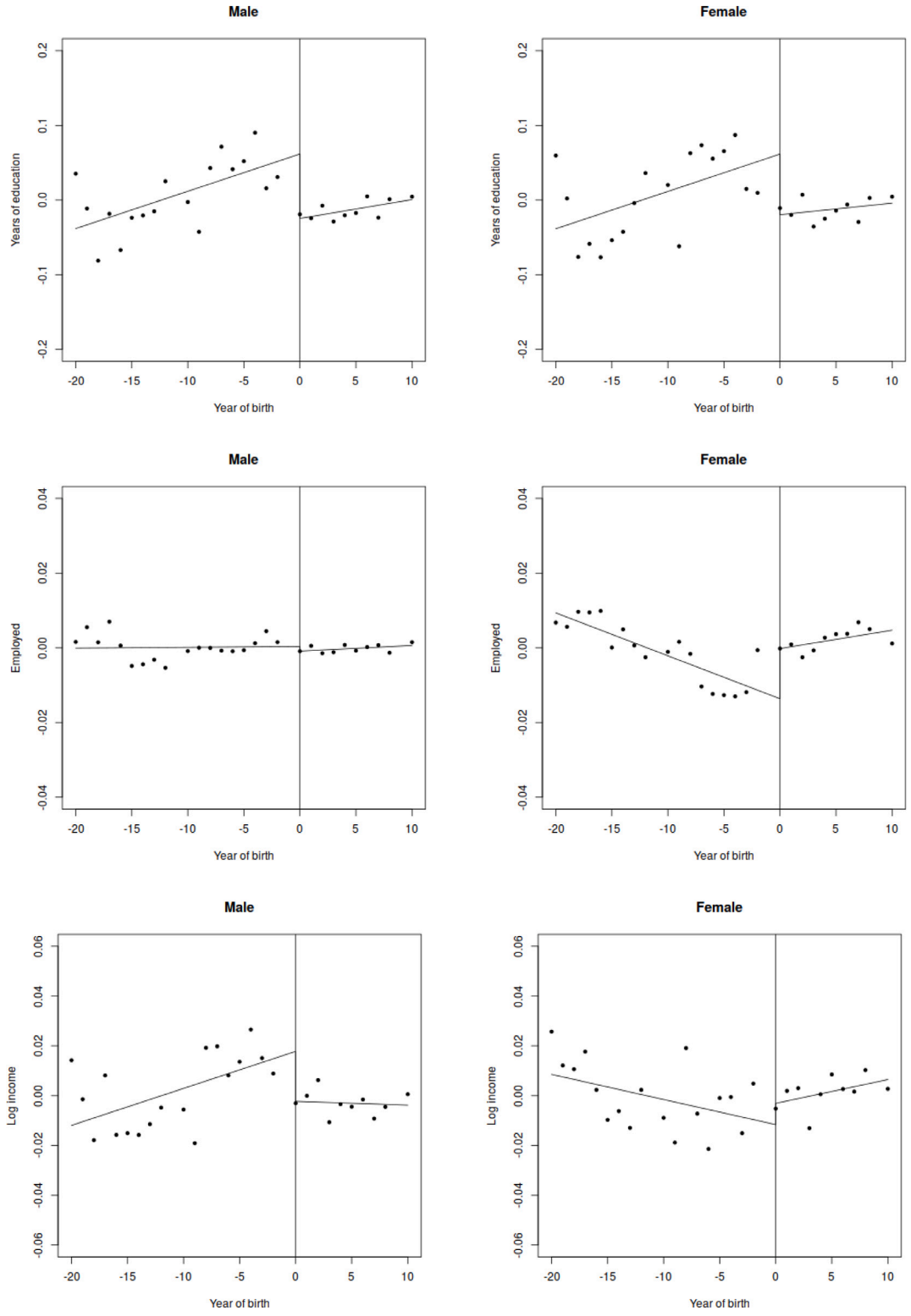

Fig. 4. Reduced form results: Jump in education, employment, and log income for cohorts born after 1951.
Year of birth centred at year 1951. The dots are residuals from regressions of share of the corresponding outcome variable on census year, age dummies, and the war birth-years dummy as a function of year of birth. The line is the fitted value of a regression of these residuals on year of birth, a dummy for cohorts born after 1951, and the interaction between the two.

African-White racial premium. This was not possible due to data limitations, the requirement that there be a sufficiently large marginal group, and the imposition of much stricter geographic residency restrictions for Africans.

Overall, the approach that we used highlights a novel method that may prove to be useful in other contexts where discrimination or affirmative action need to be evaluated. Some groups and places where this might be useful would include Scheduled Castes in India,

Table 5
Robustness checks for male log income results: First stage, reduced form, and RD estimates for different specifications.

	1	2	3	4	5	6
White (First Stage)						
Born after 1951	−0.031***	−0.029	−0.028**	−0.018*	−0.026***	−0.026***
	(0.009)	(0.017)	(0.012)	(0.01)	(0.009)	(0.005)
Log income (Reduced Form)						
Born after 1951	−0.045*	−0.067	−0.033	−0.018	−0.043*	−0.044***
	(0.023)	(0.04)	(0.027)	(0.017)	(0.021)	(0.012)
Log income (IV)						
White	1.437***	2.294***	1.19*	1*	1.693***	1.717***
	(0.437)	(0.768)	(0.665)	(0.545)	(0.463)	(0.289)
Subset	Benchmark	IK window	CCT window	With zero-ending birth-years	Weights 1996 × 10	Individual data
Cohorts	1931–61	1941–61	1941–62	1931–61	1931–61	1931–61
Bandwidth left	20	10	11	20	20	20
Bandwidth right	10	10	11	10	10	10
N	84	57	60	93	84	807995
Eff.Fstats	51.1	12.5	21.9	26.1		

Robust standard errors in parenthesis. Signif. codes: 0.1 *** 0.01 ** 0.05 *. Top Panel: Coefficients from OLS regressions of share of Whites on a dummy for cohorts born after 1951, year of birth and the interaction between the two, with age and census year dummies. Middle Panel: Coefficients from OLS regressions of male log income on the same variables as the first stage. Bottom Panel: Coefficients from 2SLS regressions of male log income on being classified as white, controlling for year of birth, age and census year dummies, and the interaction between year of birth and a dummy for cohorts born after 1951. Being classified as white is instrumented by a dummy for cohorts born after 1951. Unless otherwise stated, birth-years ending in zero are removed to partially deal with heaping. Unless otherwise stated, data is aggregated by year of birth, census year and gender, and regressions use cell size weights. Column 1 is the benchmark specification. Columns 2 and 3 use an optimal window: the Imbens and Kalyanaraman (IK) procedure in column 2 and the Calonico, Cattaneo, and Titiunik (CCT) procedure in column 3. In both procedures male log income is used as outcome variable in the procedure. Column 4 leaves the birth years ending in zero in the analysis. Columns 5 and 6 address the issue that the 1996 data includes only a 10% sample. Column 5 uses aggregate data but inflates cell-size weights in 1996 observations by a factor of 10. Column 6 uses individual data weighting 1996 individuals tenfold and clustering standard errors at the year of birth level. All specifications control for war birth-years with a dummy for 1942 and 1943, where cohort sizes were unusually low.

Indigenous people in Brazil, Native Americans in the USA, First Nations people in Canada, and Malays in Malaysia. It may also be feasible to use this method to estimate the effects of citizenship in contexts where governments change the criteria for determining citizenship amongst resident non-citizens.

The requirements for using this method for econometric identification include the need to classify people into mutually exclusive categories for administrative purposes, combined with an exogenous change in the rules that determine an individual's classification. If there exists a set of people whose classification would be altered by this change in the rules, then there exists the opportunity for the empirical estimation of a more holistic concept of discrimination.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jdeveco.2022.102998.

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