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Occupational gender segregation in post-apartheid South Africa

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Motivation

- South Africa: dysfunctional labor market with **low employment rates** among women and black Africans.
- Apartheid left South Africa with large **racial inequalities** with blacks facing:
  - Higher poverty and deprivation (Gradín, 2013)
  - Lower employment rates and wages (e.g. Rospabé, 2002)
  - Lower occupational attainment (e.g. Treiman et al., 1996)
  - Occupational segregation of blacks into low-paying occupations (Gradín, 2017b).
- … but also affected **gender equality**, temporary migration of black men (Gelb, 2004):
  - Disruption of family life: Women had to fulfil the role of both breadwinner and care giver in challenging circumstances of high unemployment and HIV/AIDS prevalence, with very limited economic opportunities (Budlender and Lund, 2011).

Previous literature on gender inequality

- Growing **feminization** of the labor force after apartheid, with **higher unemployment/self-employment** (Casale and Posel, 2002; Posel, 2014)
  - lower marriage rates, higher education, non-discriminatory legislation;
- **Compared with men**, South African women face:
  - lower employment rates (e.g. Leibbrandt et al., 2010)
  - lower earnings (e.g. Burger and Yu, 2007; Wittenberg, 2014)
  - and none of them is fully explained by their different endowments.
  - Women also tend to be over-represented at both, the **bottom** (e.g. domestic service) and **top** (e.g. professionals) of skills categories (Winter, 1999; Rospabé, 2001).

Previous literature on gender inequality

- Much less about gender **occupational segregation** or **stratification**:
  - Occupational attainment (Rospabé, 2001); Occupational segregation (Parashar, 2008).
- Occupational **segregation** by **race**:
  - The labor market is still strongly stratified by race with blacks systematically overrepresented at the lowest-paying occupations,
  - … even after controlling for the differences by population group in education and other observed characteristics of workers (Gradín, 2017b).
- **Aim:** To **extend the analysis** of **segregation and stratification** of occupations to **gender** in post-apartheid South Africa.

Data

- **Census:** 1996 and 2001 Census, and 2007 Community Survey from **IPUMS-I** (MPC, U. Minnesota)

- **Labor force surveys:** South Africa - Post Apartheid Labour Market Series (**PALMS**, DataFirst-UCT) 1994-2015, combining different StatsSA surveys.

Sample: 16-65 employed workers (not in the Armed Forces).
Occupations: 3-digit ISCO-1988 (In census: IPUMS version).
Earnings: income before taxes (midpoint interval) in census; real earnings in LFS.
Worker characteristics: province, area of residence, marital status, race, age, attained education, disability, immigration.

Relevant issues regarding the codification of jobs by occupations, reporting of earnings, or the % of domestic help workers.

	2007			2015		
Population group	Male	Female	Total	Male	Female	Total
African/Black	69	68	69	72	73	72
White	16	17	16	14	14	14
Coloured	10	12	11	10	11	11
Indian/Asian	4	3	4	3	3	3
Total	100	100	100	100	100	100

Gender, race, and occupations

Table 1a. Occupation by gender (ISCO88, 1-digit) Census

	1996			2001			2007		
	W	M	Diff.	W	M	Diff.	W	M	Diff.
Legislators, senior officials and managers	2.8	5.1	-2.3	3.8	6.9	-3.1	7.7	9.5	-1.8
Professionals and Technicians	20.5	13.2	7.4	20.1	14.8	5.3	19.5	14.4	5.1
Clerks	13.5	4.3	9.2	17.2	7.1	10.1	11.6	4.4	7.2
Service workers and shop and market sales	7.9	10.1	-2.2	8.7	11.5	-2.8	8.3	10.1	-1.9
Skilled agricultural and fishery workers	1.9	5.4	-3.5	1.5	3.5	-2.0	3.0	4.6	-1.6
Crafts and related trades workers	4.6	20.1	-15.5	4.4	17.5	-13.1	4.3	17.3	-13.0
Plant and machine operators and assemblers	2.9	11.5	-8.6	2.8	12.8	-10.1	2.0	12.6	-10.6
Elementary occupations	40.0	22.0	18.0	34.6	19.7	14.9	26.8	12.3	14.5
Unknown	5.9	8.3	-2.4	7.0	6.2	0.8	16.9	14.8	2.1
Total	100	100	0	100	100	0	100	100	0

Table 1b. Occupation by gender (ISCO88, 1-digit) LFS

	1994			2015		
	W	M	Diff.	W	M	Diff.
Legislators, senior officials and managers	3.2	7.1	-3.9	5.8	10.3	-4.4
Professionals and Technicians	18.8	11.8	7.0	17.6	11.8	5.8
Clerks	18.7	7.0	11.7	17.6	5.1	12.5
Service workers and shop and market sales	11.9	9.7	2.2	17.0	14.1	2.9
Skilled agricultural and fishery workers	0.4	1.9	-1.5	0.4	0.9	-0.5
Crafts and related trades workers	4.5	16.6	-12.1	3.0	19.8	-16.9
Plant and machine operators and assemblers	4.9	16.5	-11.6	2.5	12.7	-10.3
Elementary occupations	37.8	29.5	8.3	36.3	25.4	10.9
Total	100	100	0	100	100	0

Women tend to be largely **overrepresented** among elementary low-paying occupations, especially as domestic helpers and cleaners, street vendors, or housekeepers (all with average income below 50% of the 2007 median).

However, women are also overrepresented at the middle of the occupational distribution (50-150% of the median) in clerk occupations (e.g. tellers, office or client information clerks) and at the top (above 150% of the median) employed as professionals or technicians (i.e. teachers, nurses, …).

Table 2. Occupation by gender (ISCO88, 3-digit)

10 occupations with largest overrepresentation of women in 2007 CS
(Difference between %women and %men)

Code	Census	1996	2001	2007
913	Domestic and related helpers, cleaners and launderers	25.4	20.9	15.2
233	Primary and pre-primary education teaching professionals	2.9	1.1	2.6
421	Cashiers, tellers and related clerks	2.2	2.7	2.4
223	Nursing and midwifery professionals	2.4	0.5	2.1
911	Street vendors and related workers	0.4	0.4	1.8
411	Secretaries and keyboard-operating clerks	3.5	2.2	1.6
512	Housekeeping and restaurant services workers	1.1	1.3	1.3
419	Other office clerks	1.0	3.2	1.2
422	Client information clerks	1.3	1.3	1.1
232	Secondary education teaching professionals	0.7	0.1	1.1

Table 3. Occupation by gender (ISCO88, 3-digit) in LFS

10 occupations with largest overrepresentation of women in 2015
(Difference between %women and %men)

Code		1994	2015
913+919	Domestic and related helpers, cleaners and launderers	22.5	17.9
419	Other office clerks	4.0	4.5
513	Personal care and related workers	2.4	3.7
421	Cashiers, tellers and related clerks	2.5	3.7
512	Housekeeping and restaurant services workers	1.7	3.0
911	Street vendors and related workers	0.1	2.5
323	Nursing and midwifery associate professionals	2.2	1.9
331	Primary education teaching associate professionals	1.7	1.7
422	Client information clerks	1.0	1.7
411	Secretaries and keyboard-operating clerks	3.8	1.6

The largest **underrepresentation** of women occurs among mid-paying jobs such as drivers, building, protective services, or mining, and at the top of the earnings distribution in managerial positions, as well as among physicists or engineers.

Table 2. Occupation by gender (ISCO88, 3-digit)

10 occupations with largest underrepresentation of women in 2007 CS
(Difference between %women and %men)

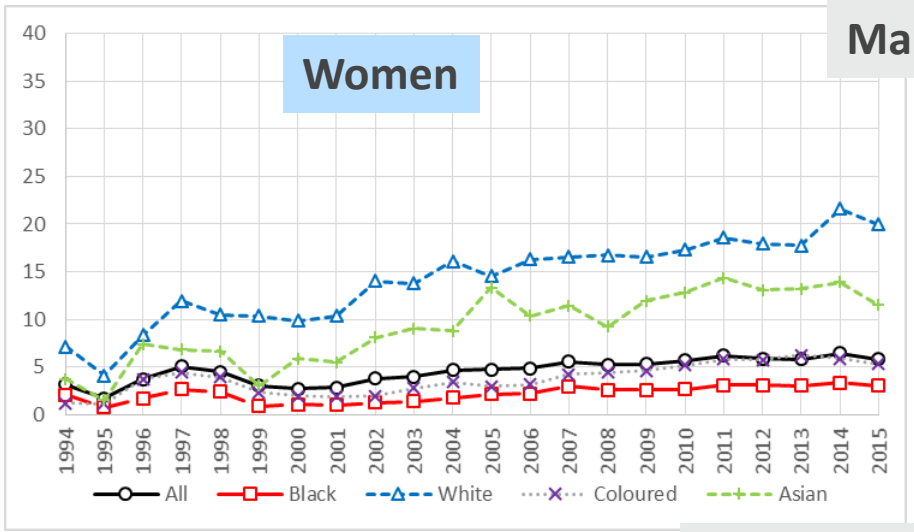
Code	Census	1996	2001	2007
931	Mining and construction labourers	-1.8	-2.4	-1.3
311	Physical and engineering science technicians	-0.6	-1.2	-1.4
131	General managers	-1.0	-1.6	-1.4
811	Mining- and mineral-processing-plant operators	-0.2	-0.2	-1.5
721	Metal moulders, welders, sheet-metal workers, structural- metal preparers	-1.6	-1.4	-1.6
723	Machinery mechanics and fitters	-2.6	-2.1	-1.8
713	Building finishers and related trades workers	-4.2	-2.2	-2.3
516	Protective services workers	-4.4	-4.9	-4.1
712	Building frame and related trades workers	-4.5	-3.3	-4.5
832	Motor-vehicle drivers	-5.2	-7.3	-6.5

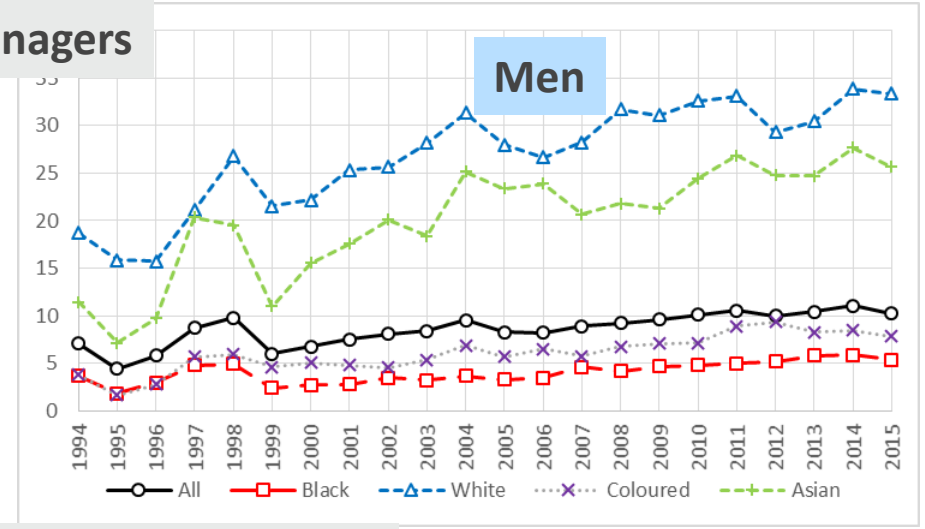
Table 3. Occupation by gender (ISCO88, 3-digit) in LFS

10 occupations with largest underrepresentation of women in 2015
(Difference between %women and %men)

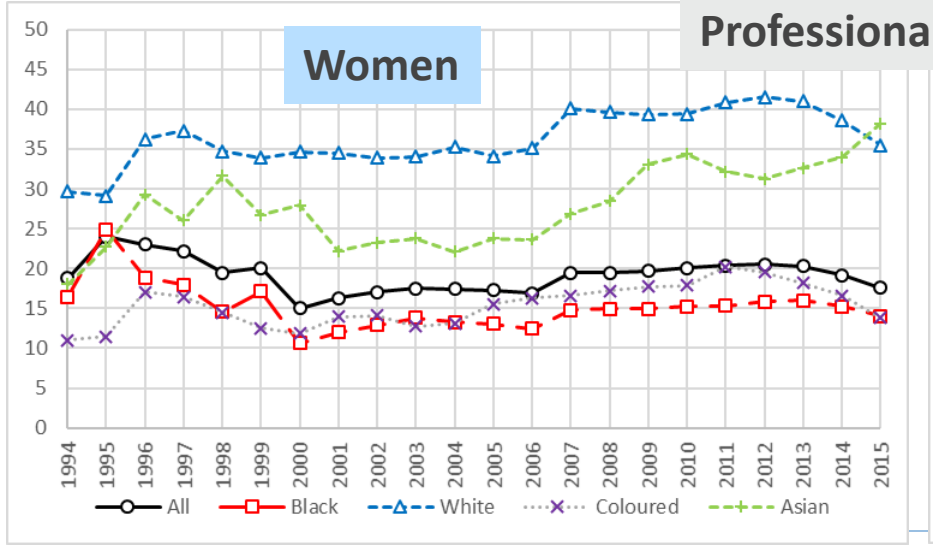
Code		1994	2015
131	General managers	-1.9	-2.1
833	Mining and construction labourers	-2.2	-2.2
721	Metal moulders, welders, sheet-metal workers, structural- metal preparers	-1.9	-2.4
723	Machinery mechanics and fitters	-3.3	-3.1
931	Mining and construction labourers	-3.3	-3.2
713	Building finishers and related trades workers	-2.0	-3.2
921	Agricultural, fishery and related labourers	-8.0	-4.7
516	Protective services workers	-4.4	-4.8
712	Building frame and related trades workers	-2.9	-5.2
832	Motor-vehicle drivers	-7.3	-6.3

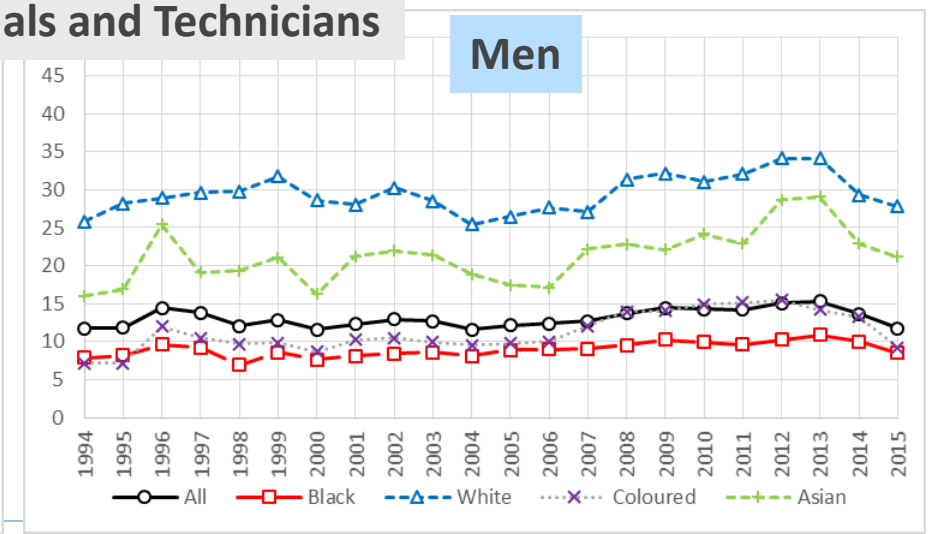
Managers





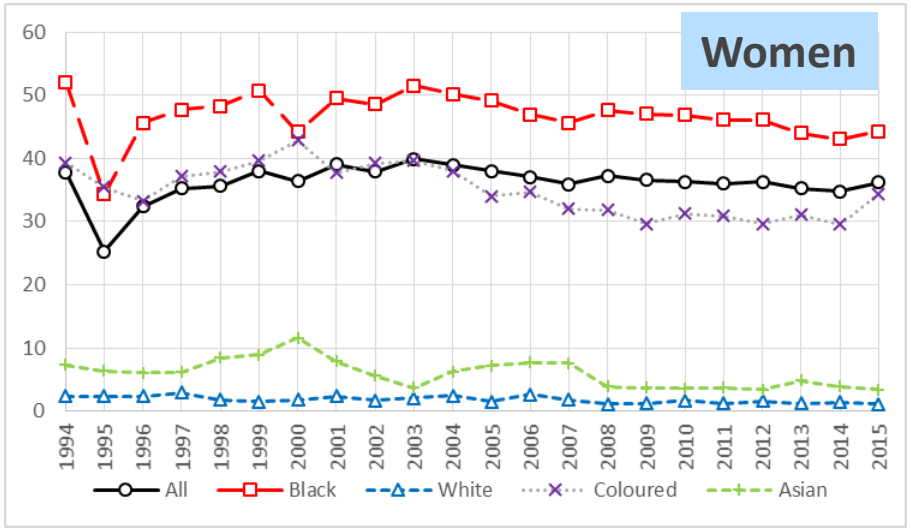
Professionals and Technicians

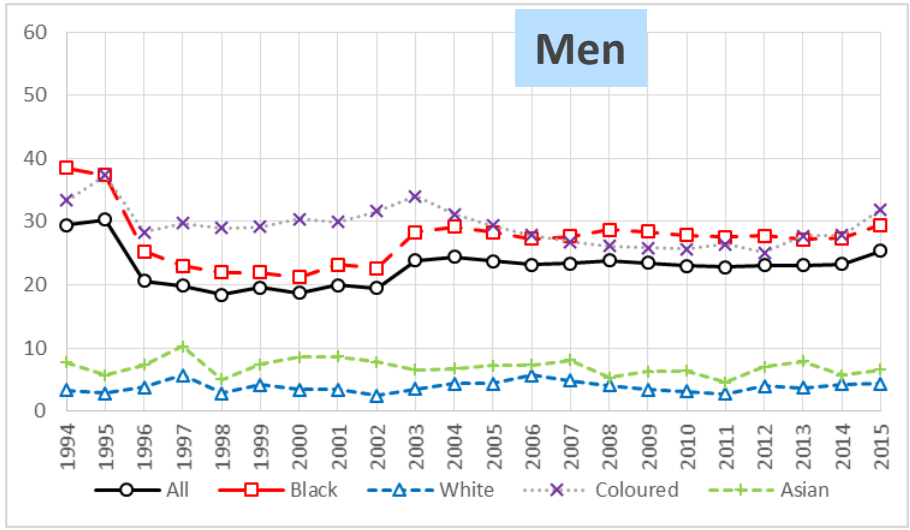




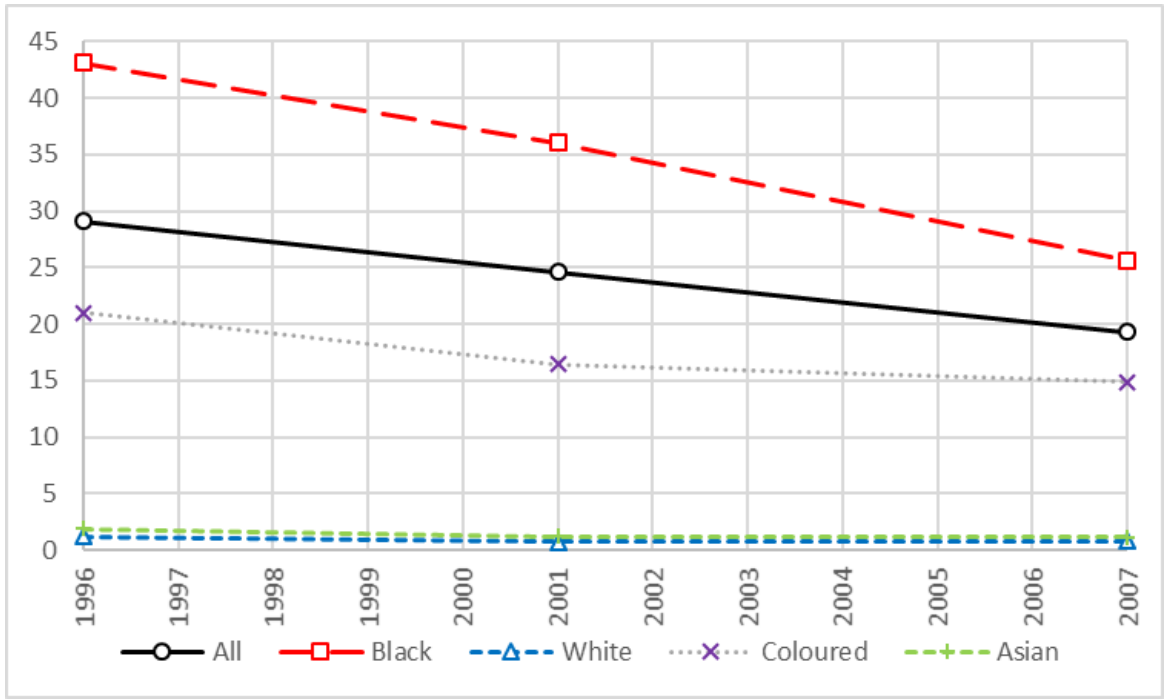
Elementary occupations

Labor Force Surveys (PALMS)





% women in domestic service



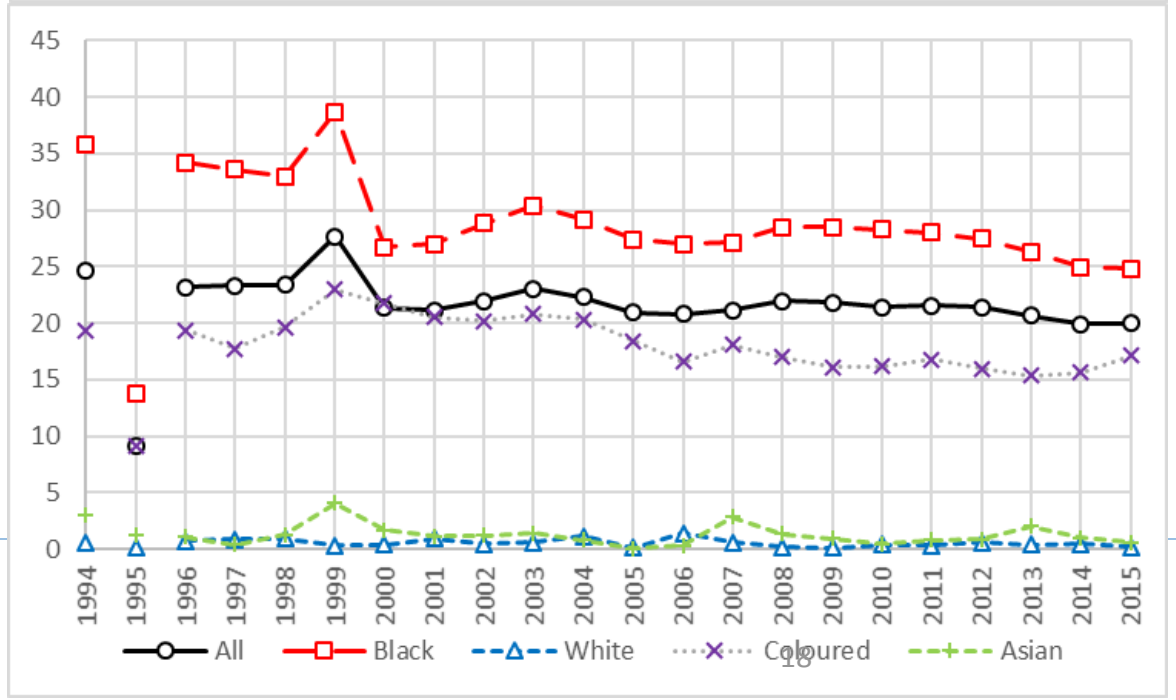


Table 5. Workers' characteristics by gender

	Women			Men		
	1996	2001	2007	1996	2001	2007
Rural	24.1	22.7	26.1	27.5	25.8	24.3
Urban	75.9	77.3	74.0	72.5	74.2	75.7
No schooling	10.2	9.2	5.3	11.6	10.0	5.3
Some primary	8.3	8.3	8.0	9.6	9.9	9.9
Primary	20.0	16.6	14.6	20.1	17.2	16.3
Lower secondary	21.0	20.1	20.4	20.9	21.4	22.1
Secondary	31.2	39.6	41.9	28.1	35.5	38.0
University	4.2	6.3	8.6	4.2	6.1	7.4
Other education	3.9	0.0	1.3	4.1	0.0	1.1
Unknown education	1.3	0.0	0.0	1.5	0.0	0.0
15-24 years old						
25-34 years old						
35-44 years old						
45-54 years old						
55-65 years old						
White						
African/Black						
Indian/Asian						
Coloured						
Other						
Single/never marrie						
Married/in union						
Separated/divorced/						
Widowed						
Disabled						
Native						
National immigrant	7.9	5.4	4.4	9.5	6.4	6.2
Immigrant from abroad	0.9	0.5	0.7	1.7	0.9	1.4

Women working in 2007 tend to be less likely than men to be married (49% versus 61%), Indian/Asian or black, and generally have attained higher education (42% with secondary school and 9% with a university degree, compared with 38% and 7% of men).

More working women are in middle-aged groups and live in rural areas or in provinces such as Eastern and Western Cape or KwaZulu-Natal (and a lower proportion in Gauteng or North West).

These differences result from the combination of gender differences in the working-age population and a strong sorting of women into employment.

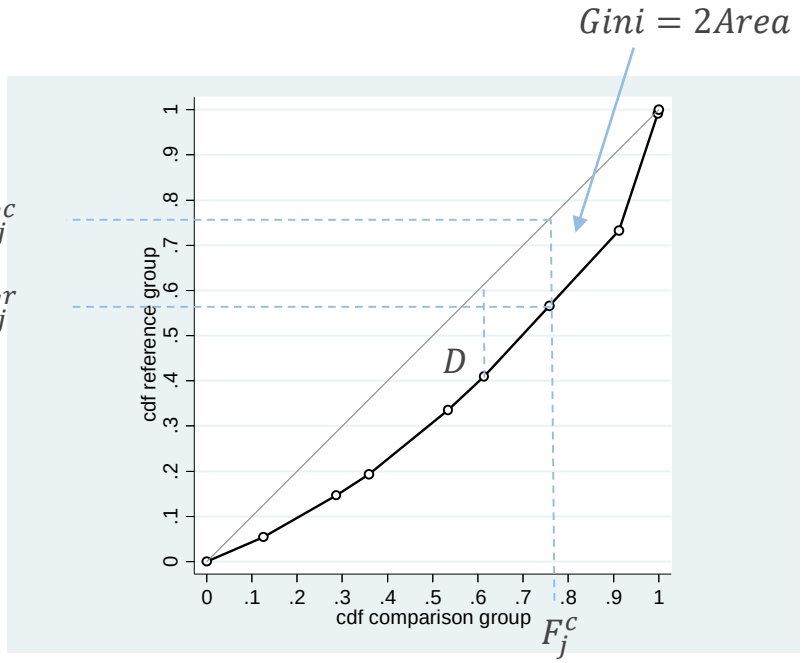
2007 census	All		Black		White		Coloured		Indian	
	M	F	M	F	M	F	M	F	M	F
no schooling	5	5	7	7	0	0	3	3	1	1
some primary	10	8	13	10	0	0	8	7	1	2
primary	16	15	19	17	3	2	21	20	7	6
lower secondary	22	20	24	22	12	10	29	26	18	13
secondary	38	42	32	36	60	65	34	39	58	61
university	7	9	4	6	24	22	3	3	14	18
Total	100	100	100	100	100	100	100	100	100	100

2015 LFS	All		Black		White		Coloured		Indian	
	M	F	M	F	M	F	M	F	M	F
no schooling	4	4	5	5	1	1	3	3	1	1
some primary	6	5	7	6	0	0	5	3	0	0
primary	7	6	8	7	0	0	9	8	0	0
lower secondary	35	31	39	35	12	8	39	37	12	8
secondary	42	45	37	41	63	63	39	44	63	63
university	7	9	4	6	24	28	4	5	24	28
Total	100	100	100	100	100	100	100	100	100	100

Occupational segregation by sex

The approach

Segregation curve



Occupations sorted by male/female ratio

Segregation indices $S(f^c, f^r)$

Dissimilarity:

$$D(f^c, f^r) = \frac{1}{2}\sum_{j=1}^{T}\left|f_j^c - f_j^r\right| = \max_{j\in[1,T]}\left\{F_j^c - F_j^r\right\}.$$

Gini:

$$Gini(f^c, f^r) = 2\sum_{j=1}^{T}\left(\hat{F}_j^c - \hat{F}_j^r\right) f_j^c;$$

where $\hat{F}_j^i = \frac{1}{2}\left(F_{j-1}^i + F_j^i\right) = F_{j-1}^i + \frac{1}{2}f_j^i$

Segregation conditional on worker characteristics

- **Aggregate decomposition** of segregation into explained and unexplained terms, Gradín (2013) (based on DiNardo et al., 1996 and Gradín, 2014).

$$S(f^c, f^r) = \underbrace{[S(f^c, f^r) - S(f^\gamma, f^r)]}_{\text{Explained}} + \underbrace{S(f^\gamma, f^r)}_{\text{Unexplained}}.$$

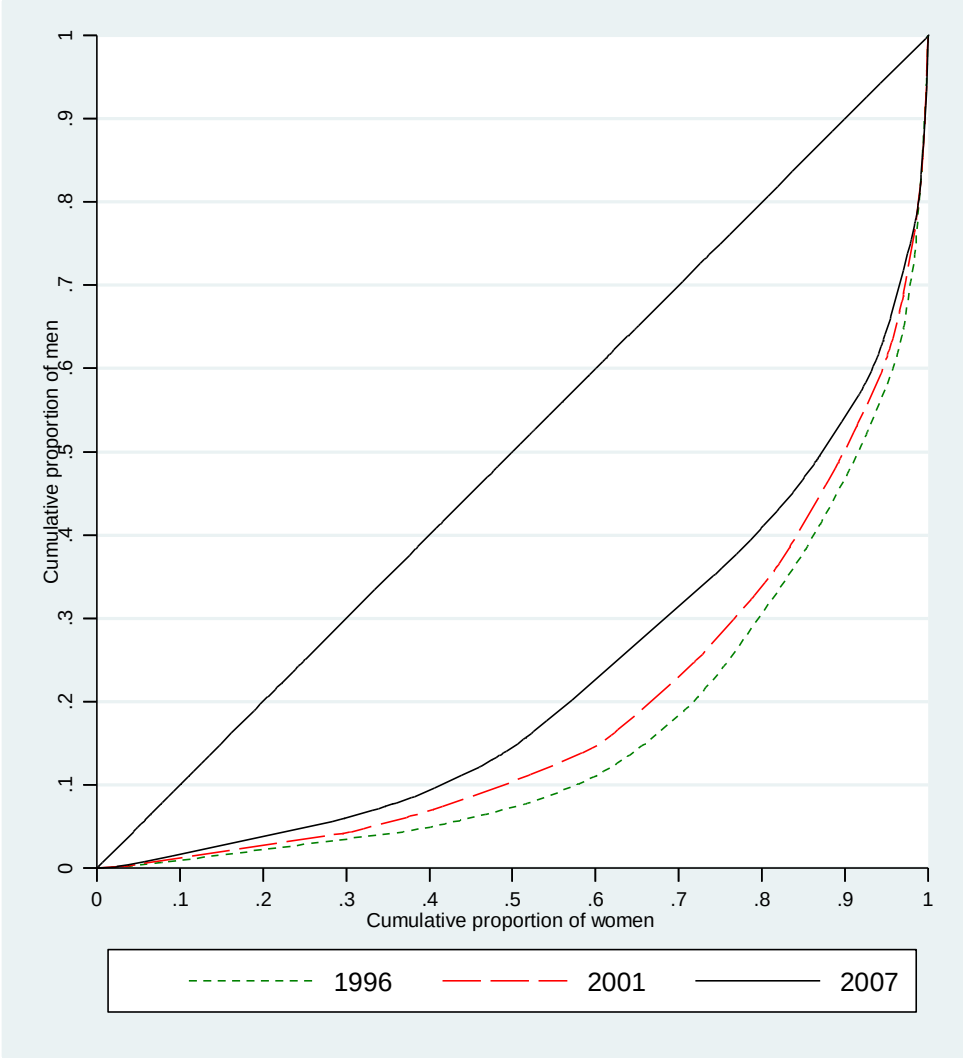
- f^γ: **Counterfactual** with c reweighted (propensity score) → distribution of characteristics (X) of r: $f_j^i(X) = \int_{X \in \Omega_X} f_j^i(X = x) f^i(x) dx$

$$f_j^\gamma = \int_{X \in \Omega_X} f_j^c(X = x) f^r(x) dx = \int_{X \in \Omega_X} f_j^c(X = x) f^c(x) \Psi_x dx;$$

$$\Psi_x = \frac{f^r(x)}{f^c(x)} = \frac{f^c}{f^r} \frac{Pr(i{=}r|x)}{Pr(i{=}c|x)}.$$

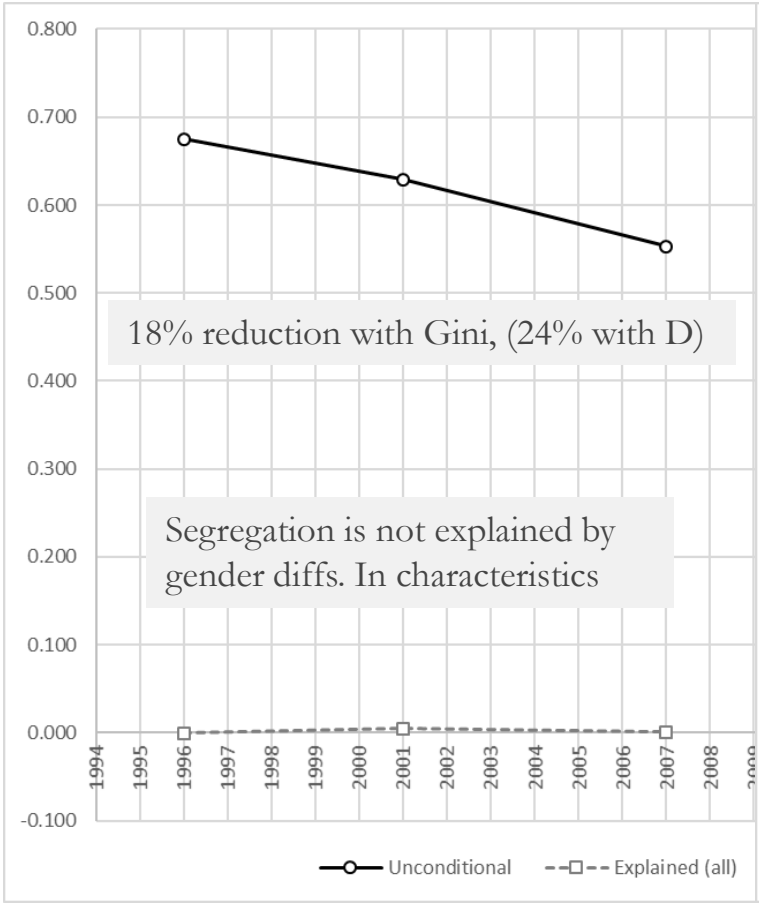
- **Detailed decomposition of the explained term** (Shapley).

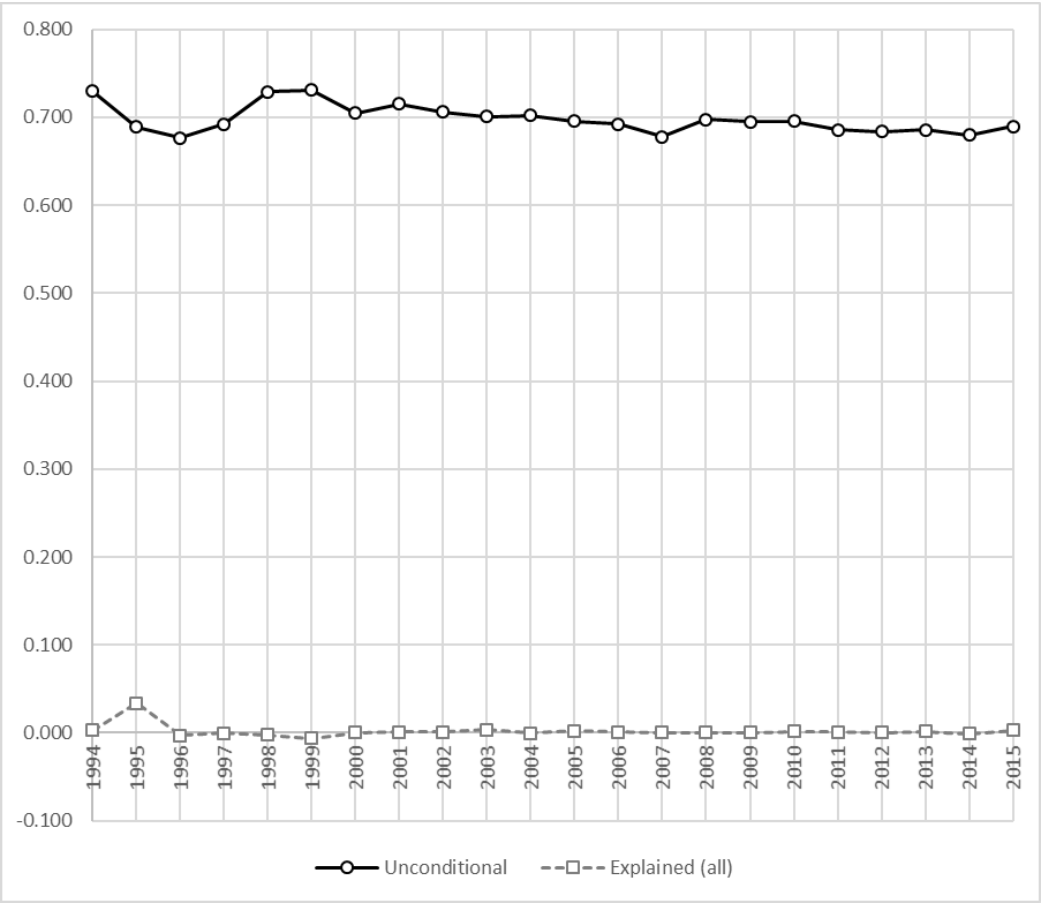
Gender segregation curves



Decline in gender segregation in the census is robust to the choice of indices because it is corroborated by the segregation curves getting closer to the diagonal over time.

Gender occupational segregation indices (Gini)





- Substantial increase in % women and men entering occupations initially dominated by the other gender (the unknown category excluded) between 1996 and 2001: from 22.7% to 25.6% (women) and from 19.7% to 23.8% (men).
- Modest increase for women (to 26.5%) and a decline for men (20.8%) between 2001 and 2007.
- No reduction over time in the Gini within the sets of occupations dominated by one gender (Gini - D).

Table 4. Robustness in the evolution of segregation

Treatment of workers with unknown occupation

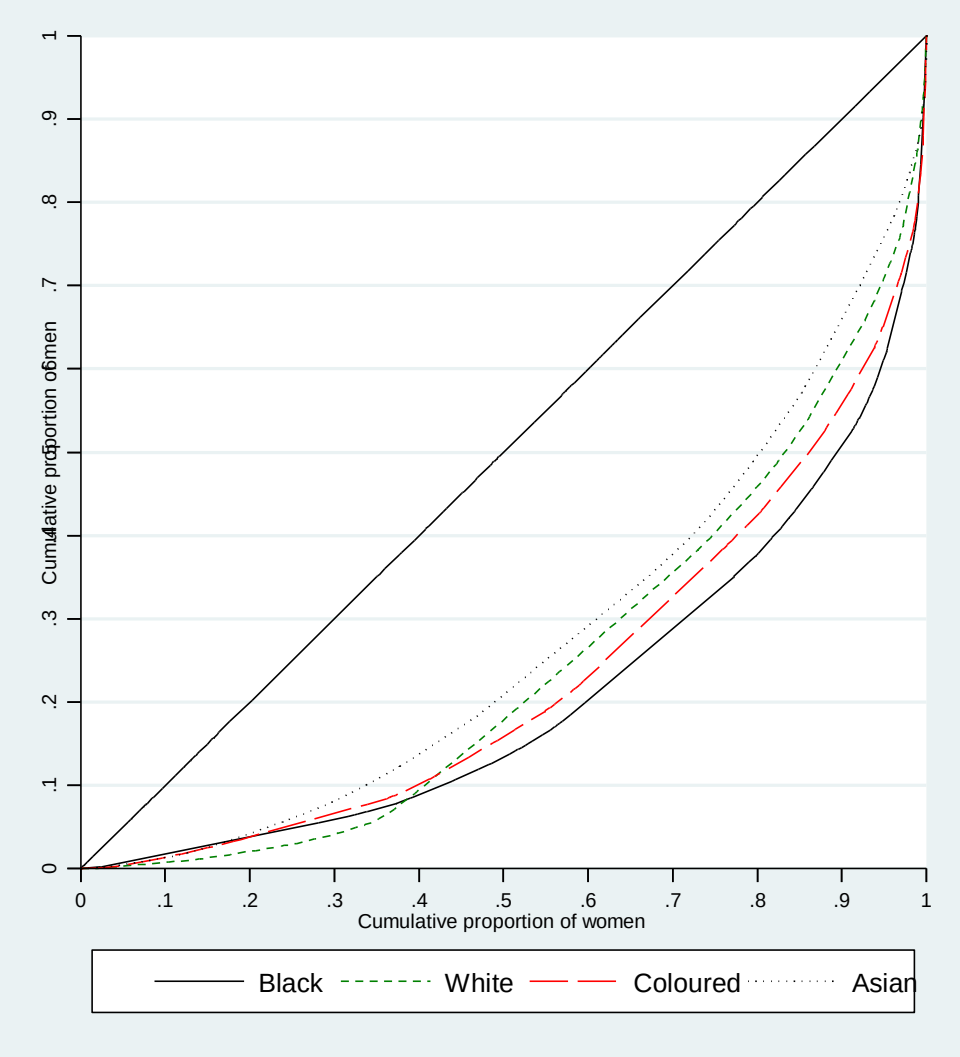
	Gini			D		
	1996	2001	2007	1996	2001	2007
Base Scenario. One occupation	0.675	0.629	0.553	0.517	0.472	0.393
Alternative 1. Removed	0.698	0.650	0.609	0.544	0.501	0.454
Alternative 2. 1996 %	0.675	0.628	0.589	0.517	0.476	0.434
Alternative 3. 2 segregated occupations	0.740	0.694	0.723	0.576	0.534	0.541

The decline in segregation between 1996 and 2001 (or 2007) is robust.

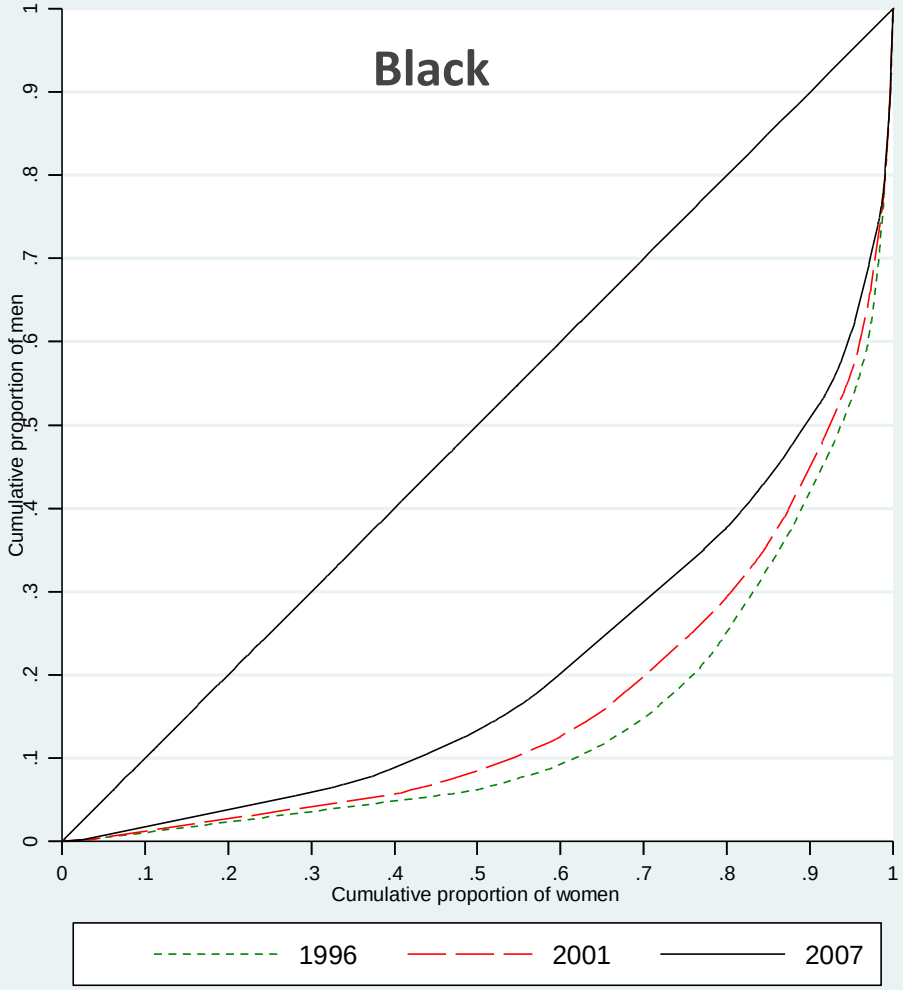
The decline between 2001 and 2007 is substantially smaller if the distribution of occupations in the unknown category (or its changes over time) did not differ much from the rest.

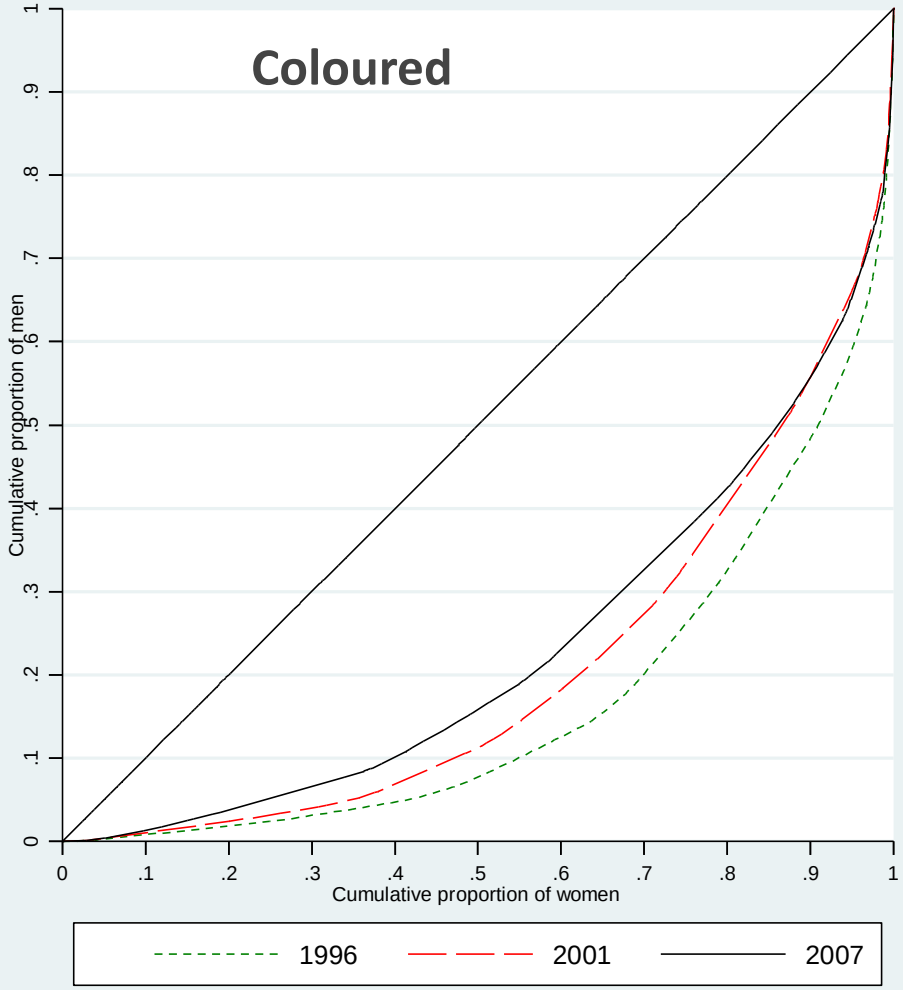
If these occupations or changes over time are highly segregated, instead, it could be that segregation would have been constant or even increased between 2001 and 2007.

Gender segregation curves by race: 2007



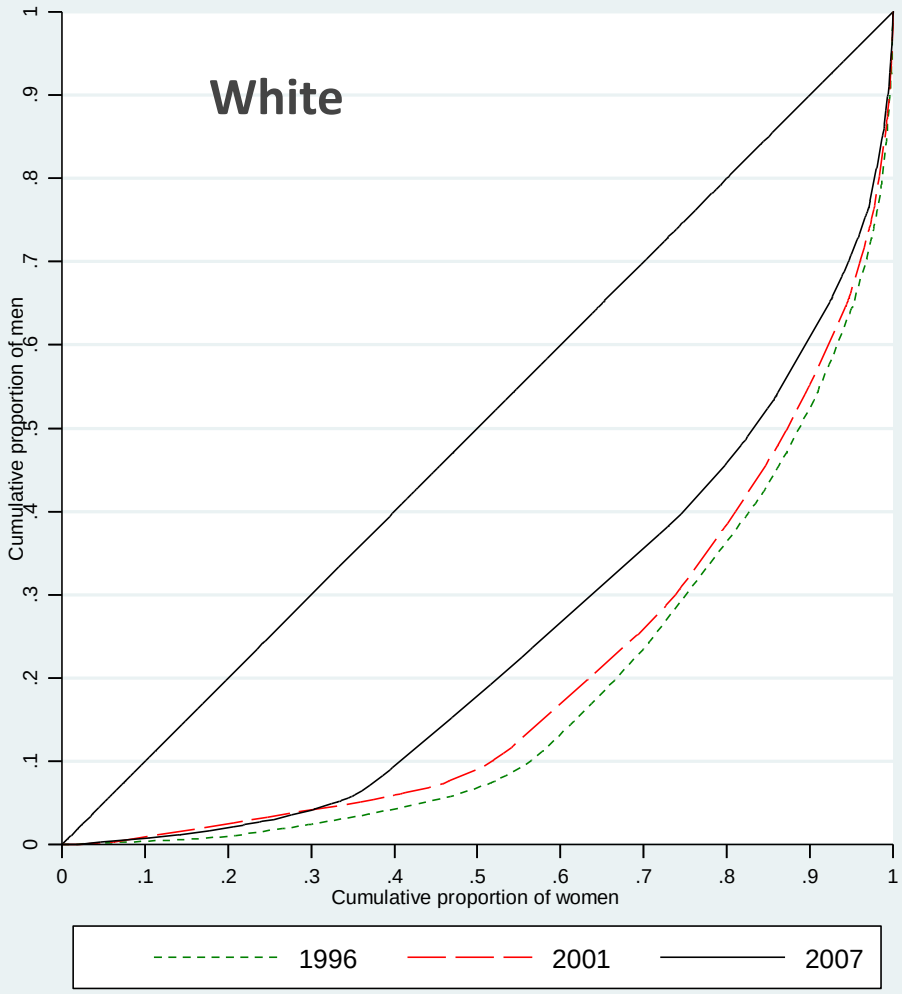
Gender segregation curves

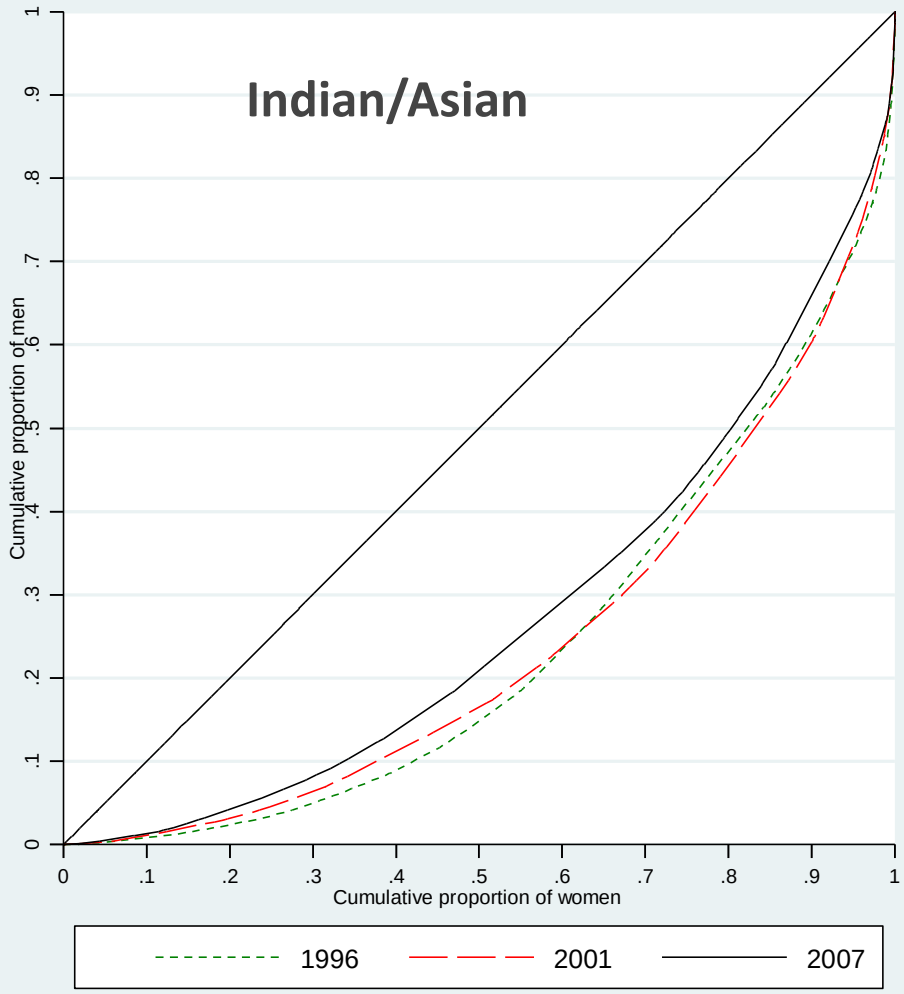




Segregation curves over time do not overlap for blacks (and Coloured 2001-2007).

Gender segregation curves



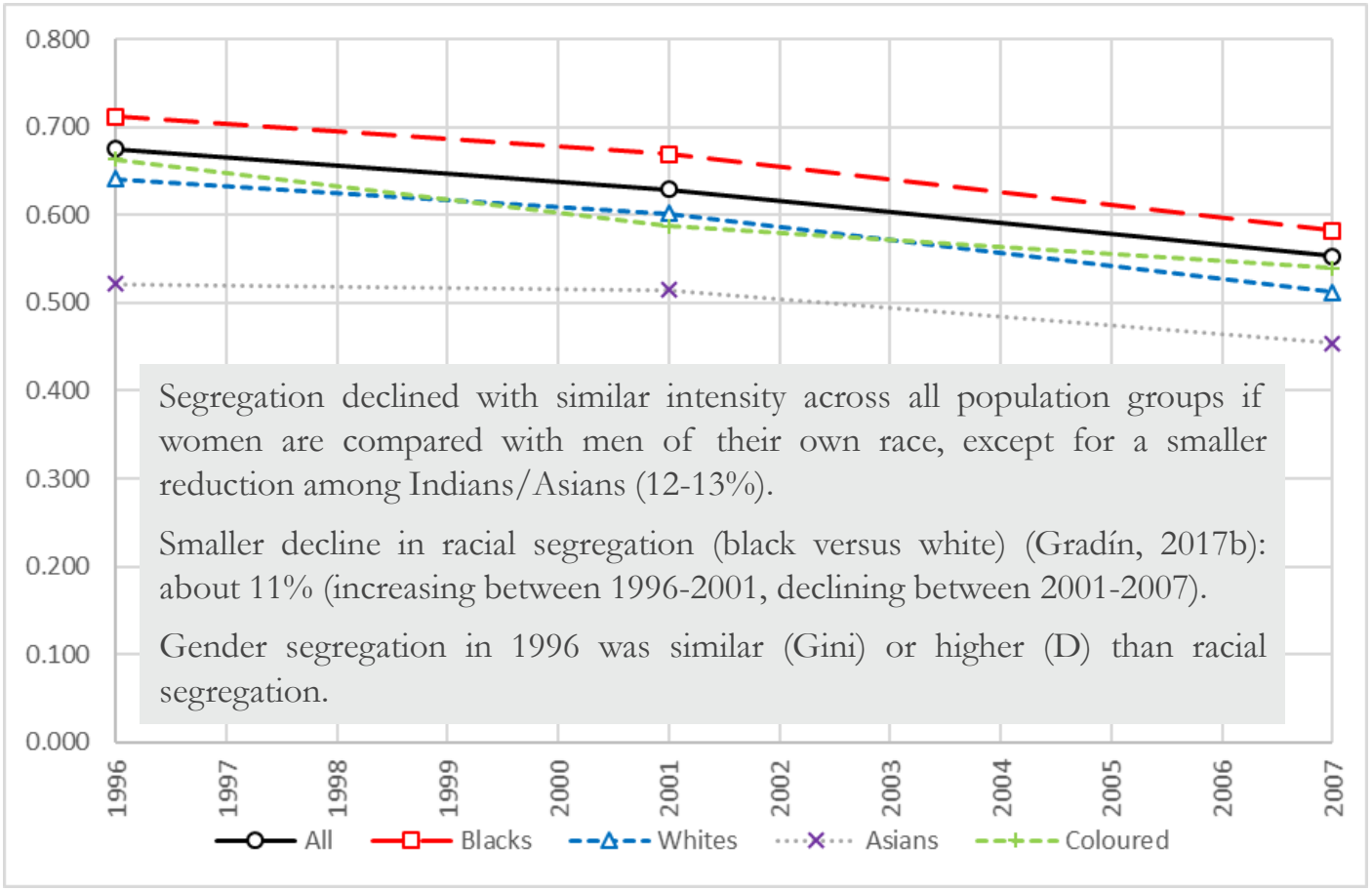


Segregation curves cross at the bottom for whites between 2001 and 2007 (indices more sensitive to occupations in which men are more strongly underrepresented could point at an increase in segregation).

Several crossings for Indians/Asians 1996-2001.

Gender occupational segregation indices by race (Gini)

Census



Segregation declined with similar intensity across all population groups if women are compared with men of their own race, except for a smaller reduction among Indians/Asians (12-13%).

Smaller decline in racial segregation (black versus white) (Gradín, 2017b): about 11% (increasing between 1996-2001, declining between 2001-2007).

Gender segregation in 1996 was similar (Gini) or higher (D) than racial segregation.

Table 6. Segregation indices (Gini)

	1996			2001			2007		
	Unc.	Unexp.	%E	Unc.	Unexp.	%E	Unc.	Unexp.	%E
All	0.675	0.671	0.7	0.629	0.624	0.8	0.553	0.553	0.1
	(0.001)	(0.001)		(0.001)	(0.001)		(0.002)	(0.002)	
Black	0.712	0.704	1.1	0.669	0.660	1.4	0.582	0.581	0.2
	(0.001)	(0.001)		(0.001)	(0.001)		(0.002)	(0.002)	
White	0.641	0.636	0.8	0.602	0.596	0.9	0.512	0.509	0.5
	(0.002)	(0.002)		(0.002)	(0.002)		(0.005)	(0.005)	
Coloured	0.663	0.656	1.1	0.587	0.582	0.8	0.540	0.535	0.9
	(0.003)	(0.003)		(0.003)	(0.003)		(0.006)	(0.006)	
Indian/Asian	0.522	0.516	1.0	0.514	0.506	1.6	0.454	0.446	1.9
	(0.005)	(0.005)		(0.005)	(0.006)		(0.011)	(0.012)	

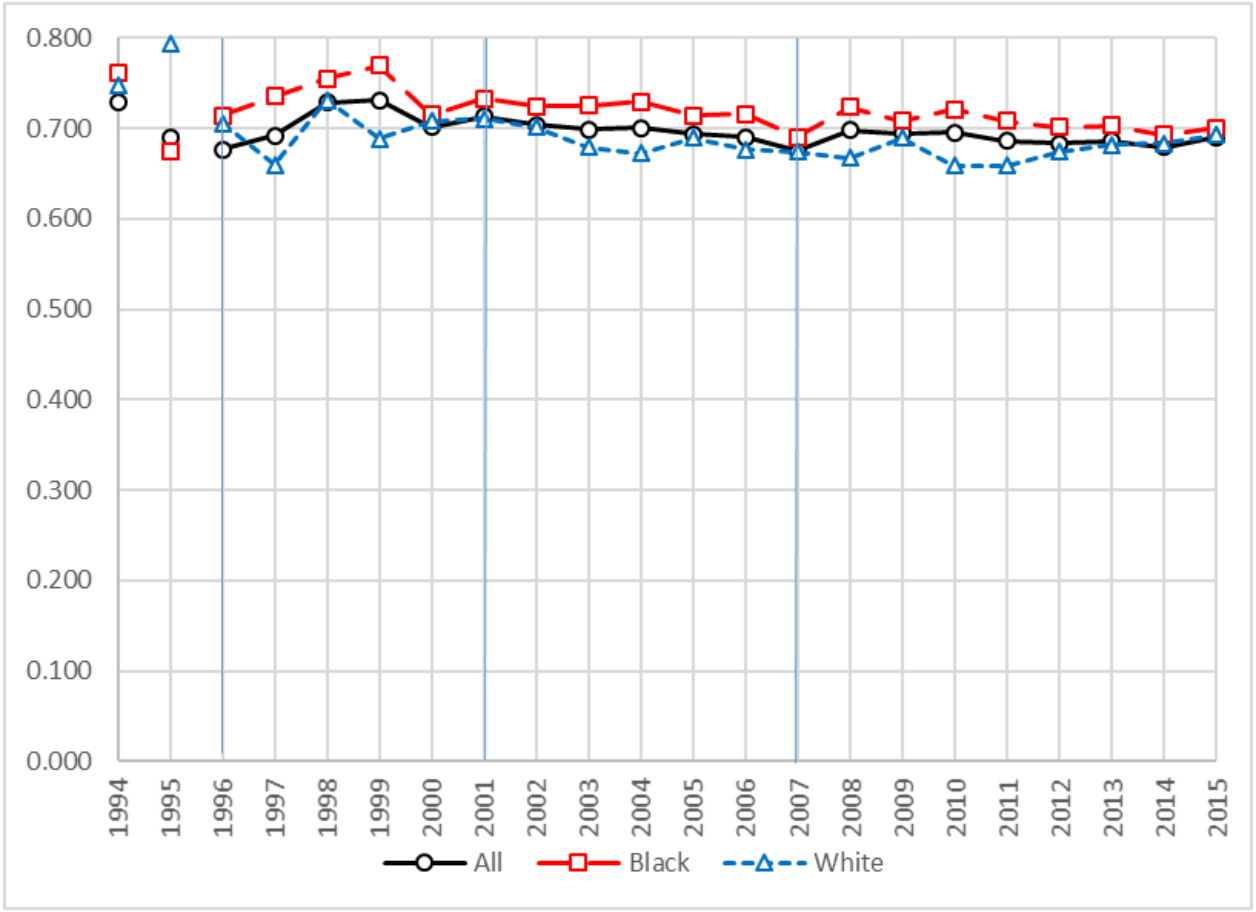
Differences in characteristics by gender explained virtually nothing of their occupational segregation in any year and population group (between 0-2%).

About 29% of black vs white racial segregation in 2007 in South Africa (Gradín, 2017b).

Explained gender segregation rose from 1.7 to 7.1% after including field of degree in the US (Gradín, 2017a).

Gender occupational segregation indices by race (Gini)

LFS



Gender occupational segregation indices by race (Gini)

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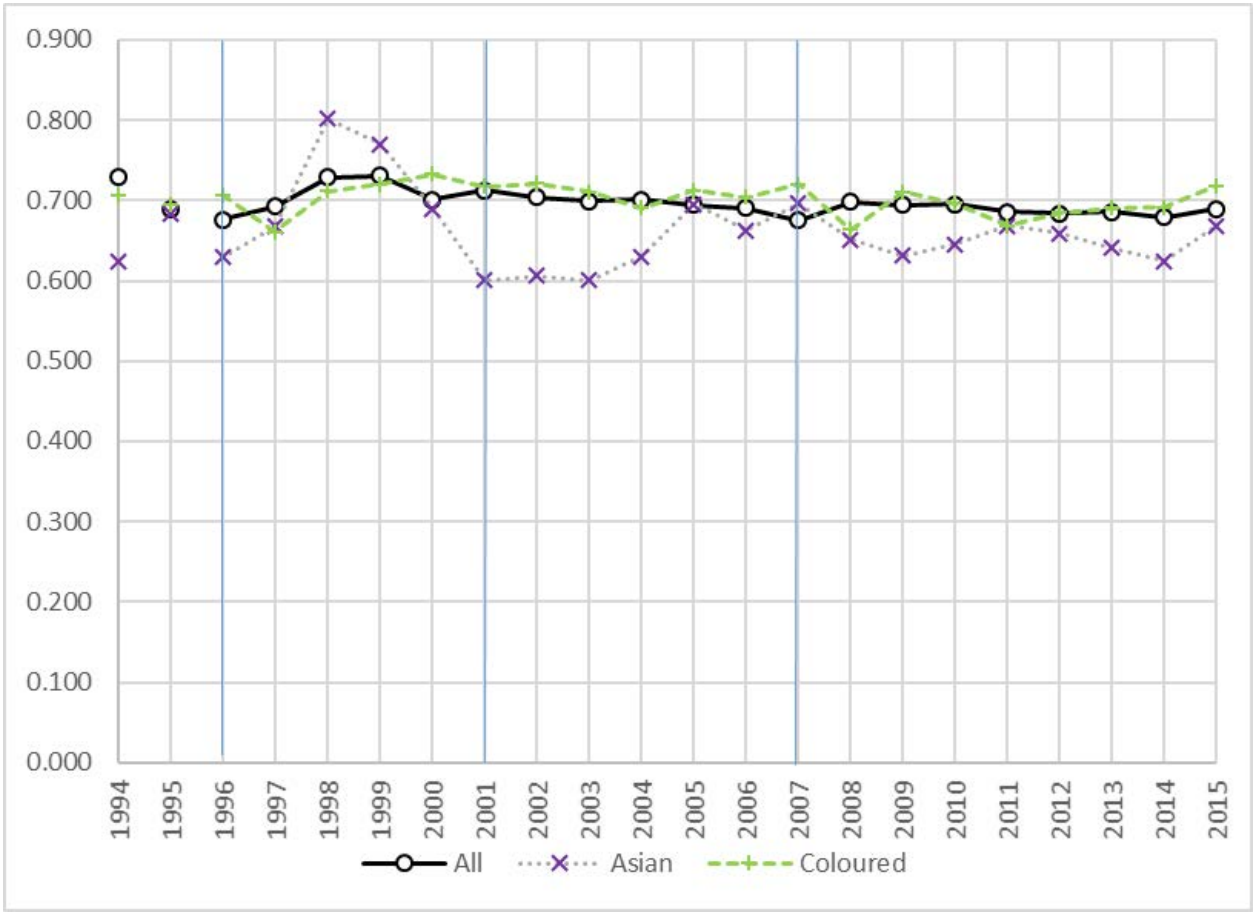
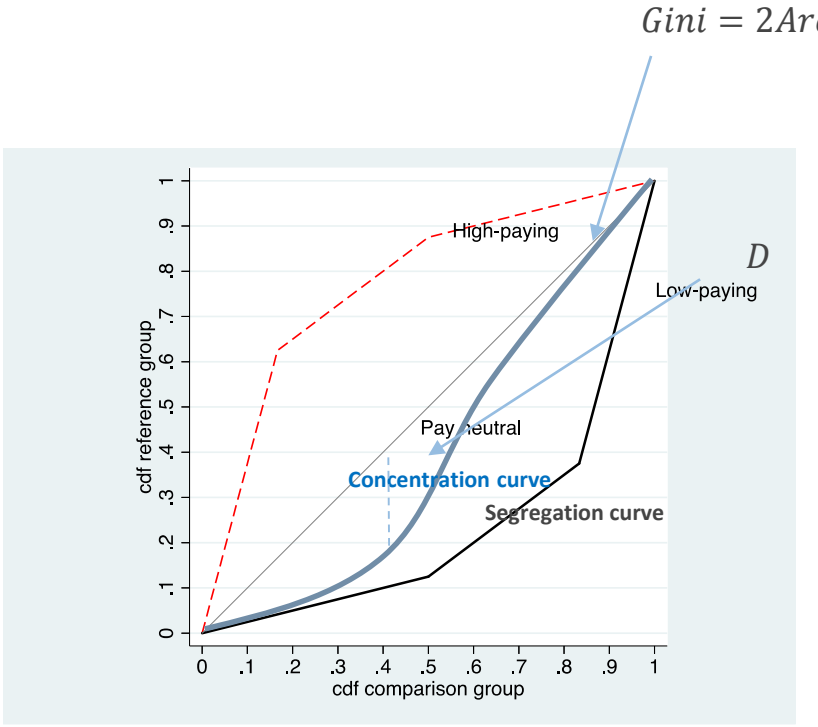


Occupational stratification by sex

Stratification (low-pay segregation)

Concentration curve



Occupations sorted by earnings

Concentration indices: $S(g^c, g^r)$

Dissimilarity:

$$D(g^c, g^r) = G_s^c - G_s^r,$$

where $|G_s^c - G_s^r| = \max_{j \in [1,J]} \{|G_j^c - G_j^r|\}.$

Gini:

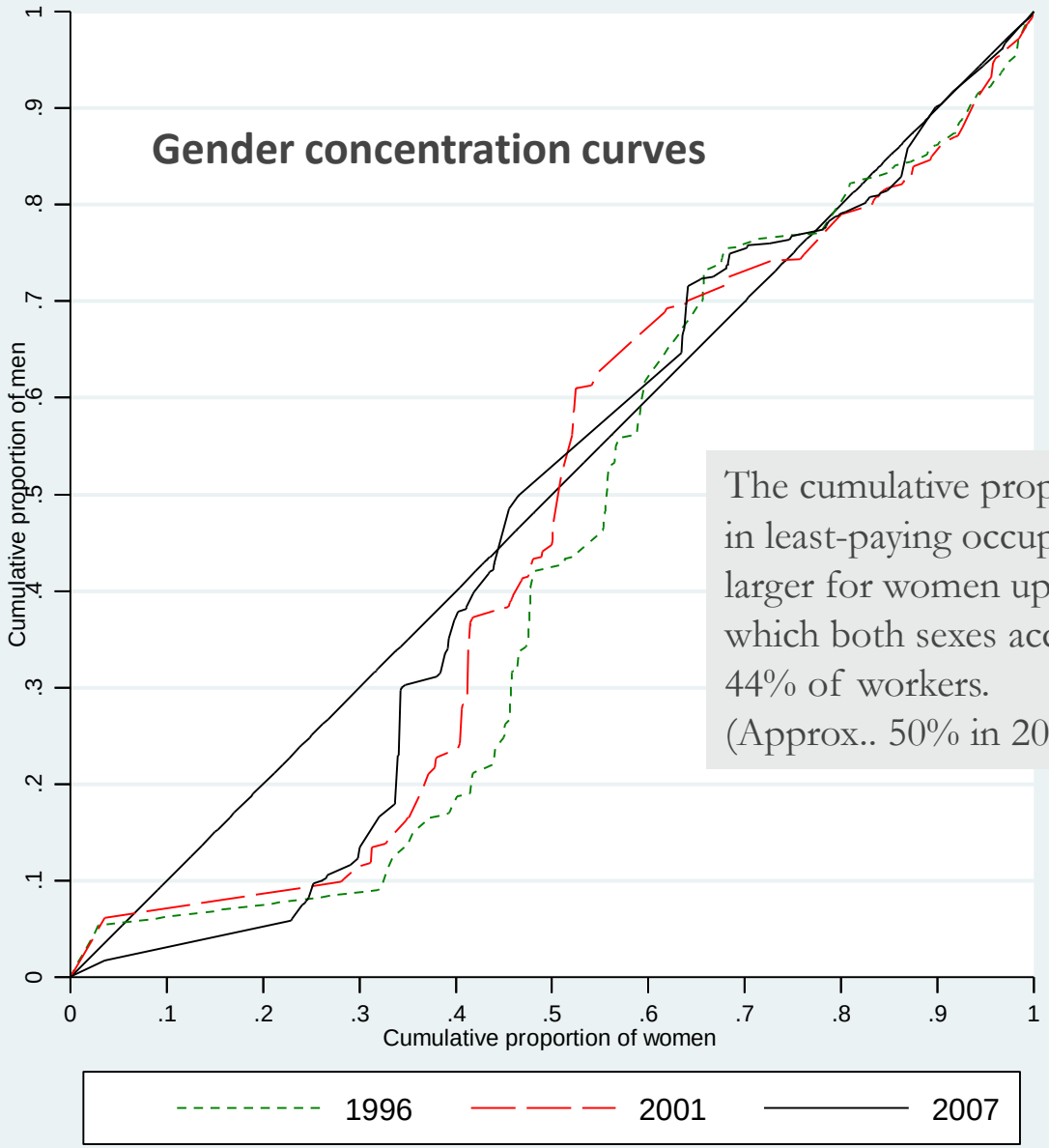
$$Gini(g^c, g^r) = 2\sum_{j=1}^{T} (\hat{G}_j^c - \hat{G}_j^r) g_j^c$$

where $\hat{G}_j^i = \frac{1}{2}(G_{j-1}^i + G_j^i)$

Concentration (low-pay ratio)

$$r_S = \frac{S(g^c, g^r)}{S(f^c, f^r)}$$

Same conditional analysis as with segregation



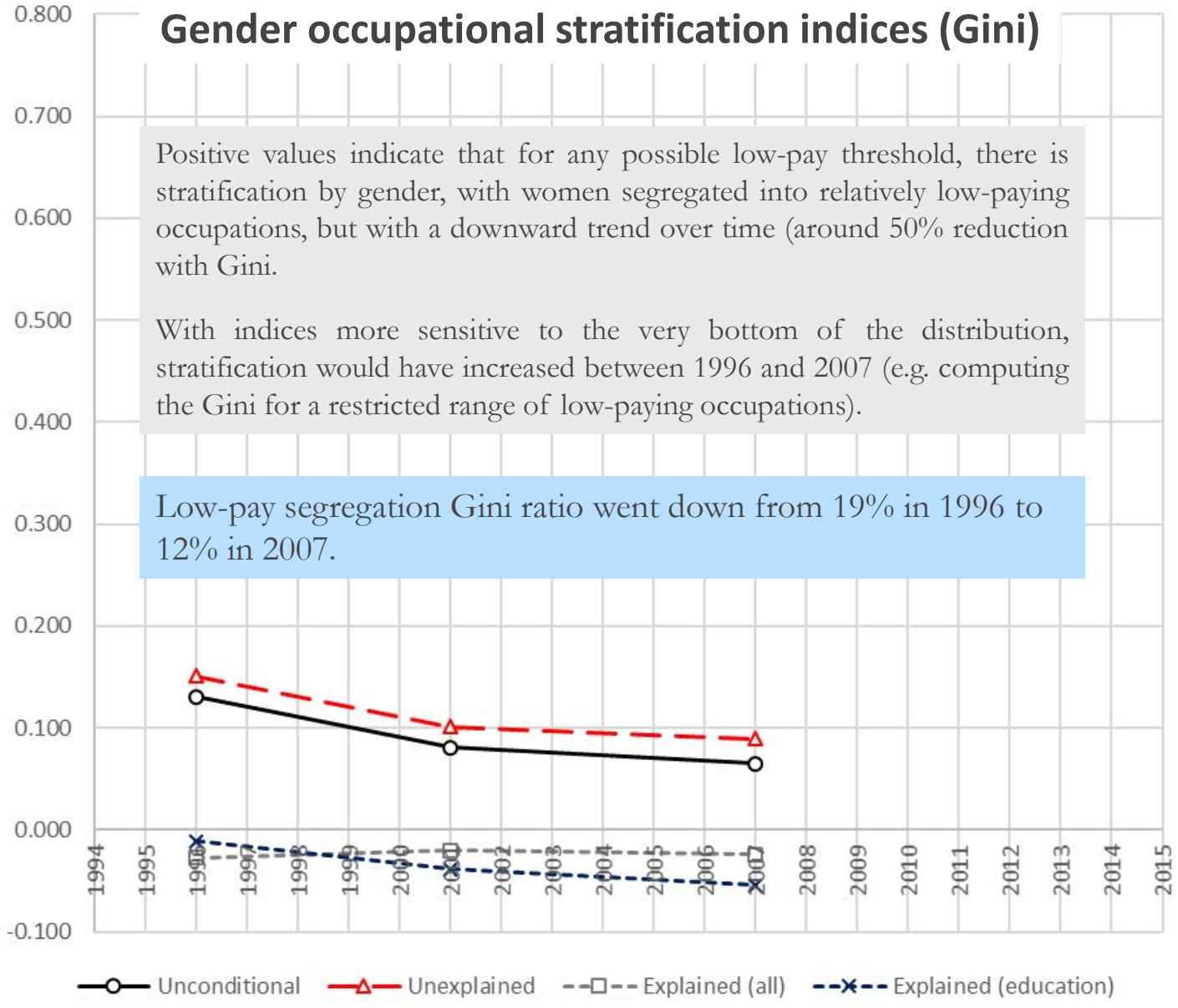
The cumulative proportion of workers in least-paying occupations in 2007 is larger for women up to the level in which both sexes accumulate about 44% of workers.
(Approx.. 50% in 2001; 60% in 1996)

Gender occupational stratification indices (Gini)

Positive values indicate that for any possible low-pay threshold, there is stratification by gender, with women segregated into relatively low-paying occupations, but with a downward trend over time (around 50% reduction with Gini.

With indices more sensitive to the very bottom of the distribution, stratification would have increased between 1996 and 2007 (e.g. computing the Gini for a restricted range of low-paying occupations).

Low-pay segregation Gini ratio went down from 19% in 1996 to 12% in 2007.



Much smaller stratification by sex than by race (Gradín, 2017b)

Table 7. Robustness in the evolution of low-pay segregation

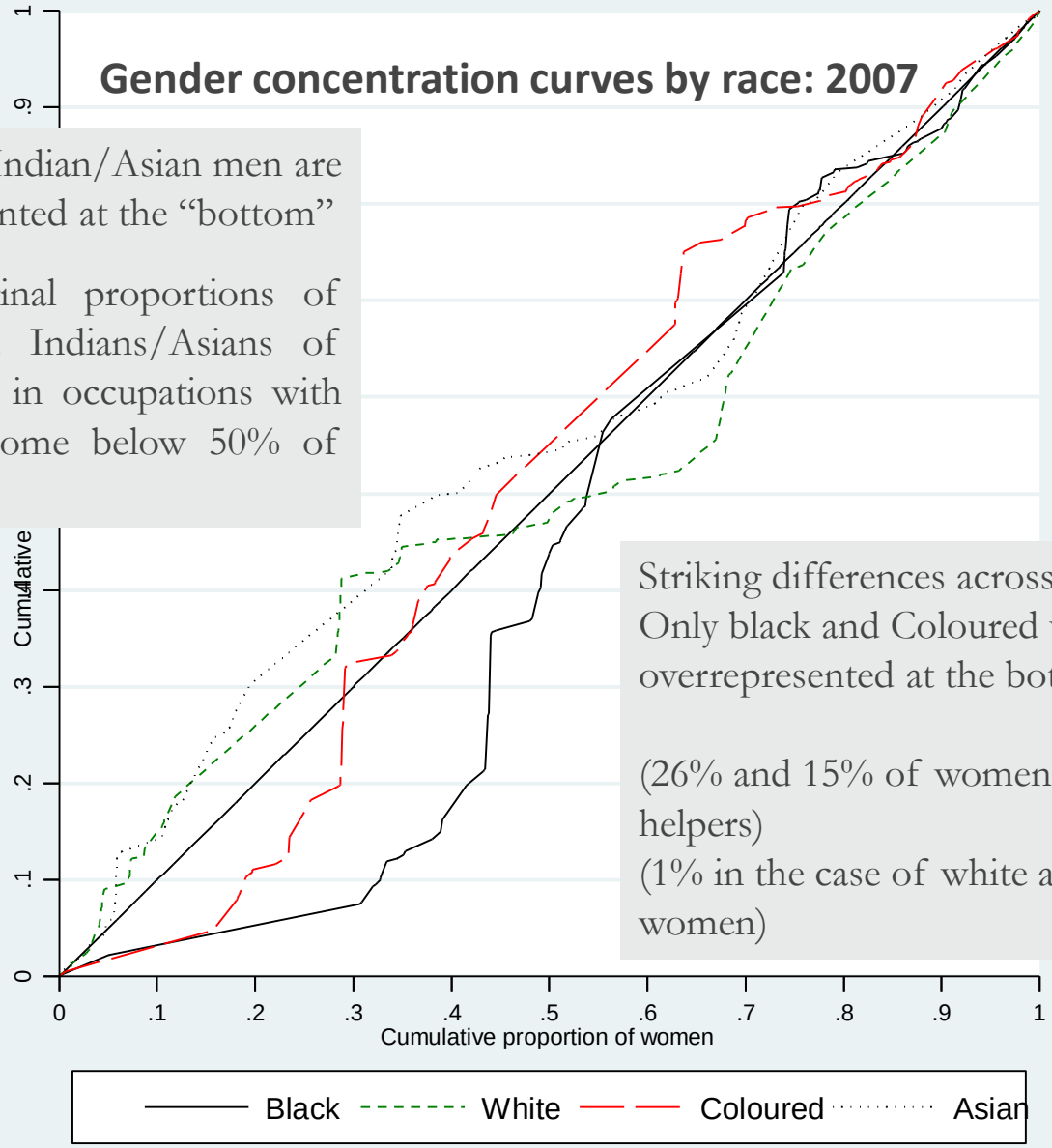
Treatment of workers with unknown occupation

	Gini			D		
	1996	**2001**	**2007**	**1996**	**2001**	**2007**
Base Scenario. One occupation	0.131	0.081	0.065	0.229	0.193	0,175
Alternative 1. Removed	0.149	0.106	0.106	0.241	0.208	0.214
Alternative 3. 2 segregated occupations	0.174	0.117	0.103	0.229	0.193	0.175

Gender concentration curves by race: 2007

White and Indian/Asian men are overrepresented at the "bottom"

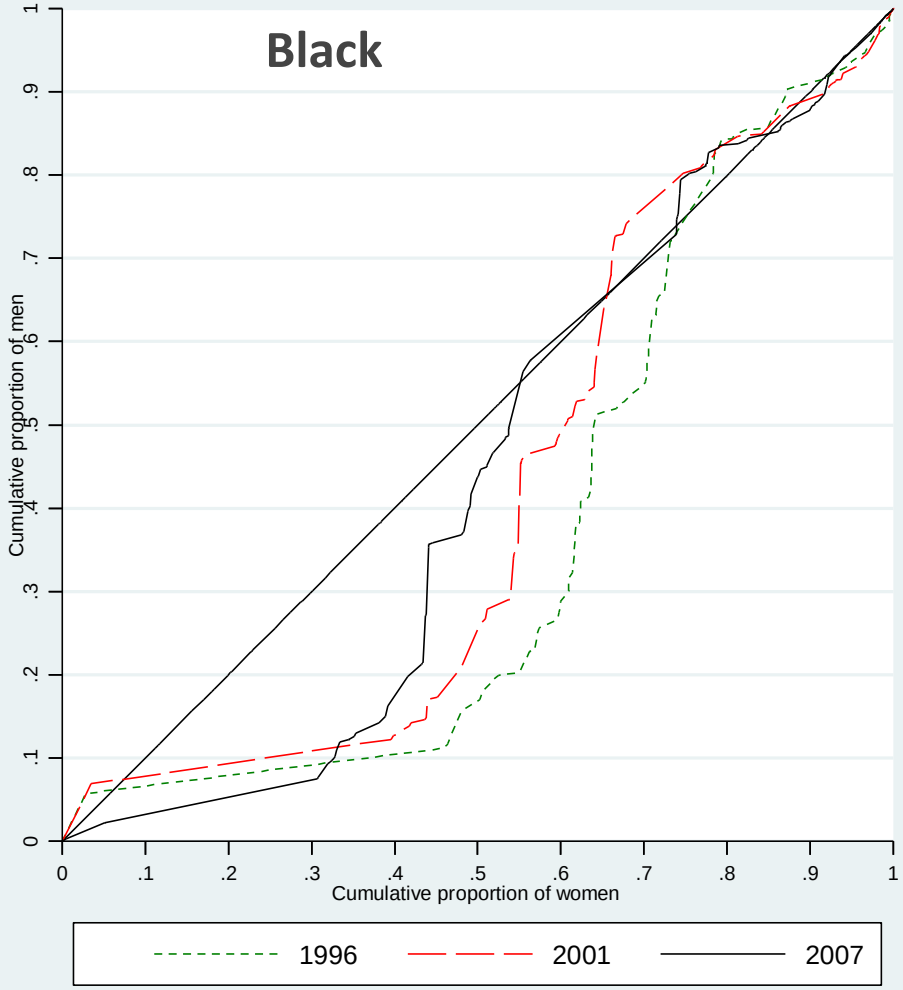
Only marginal proportions of whites and Indians/Asians of any gender in occupations with average income below 50% of the median.

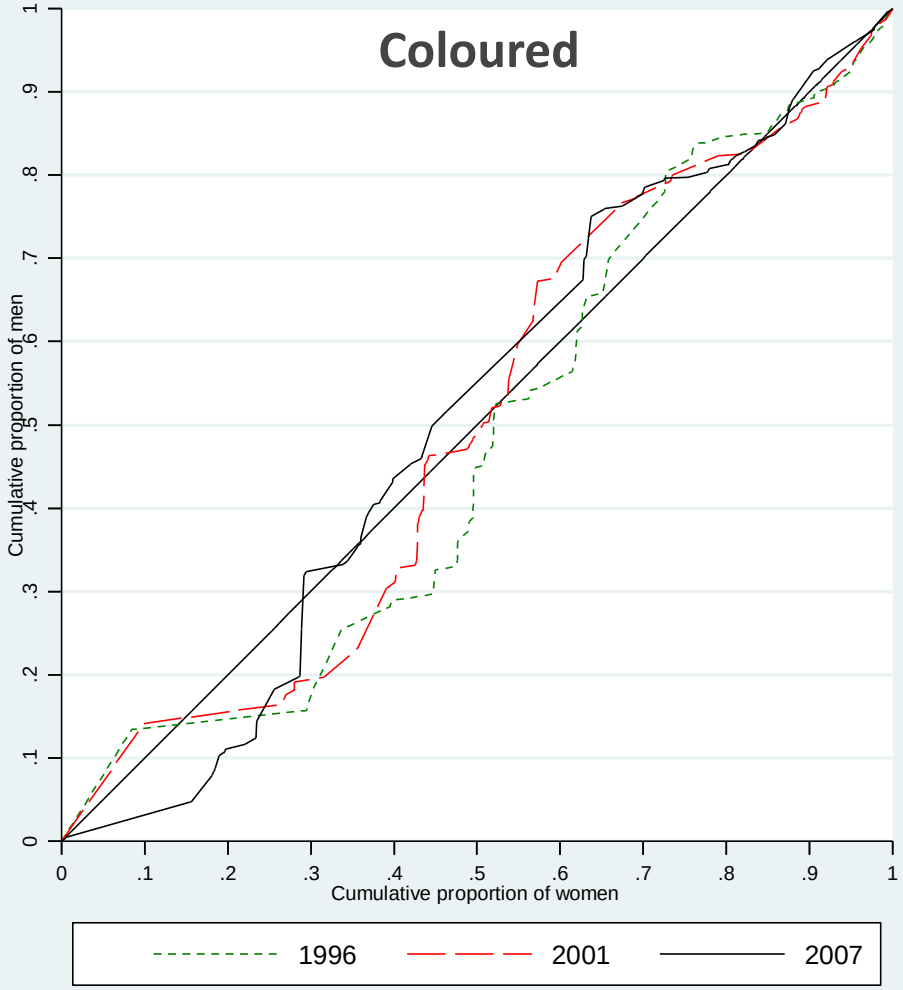


Striking differences across population groups. Only black and Coloured women are overrepresented at the bottom.

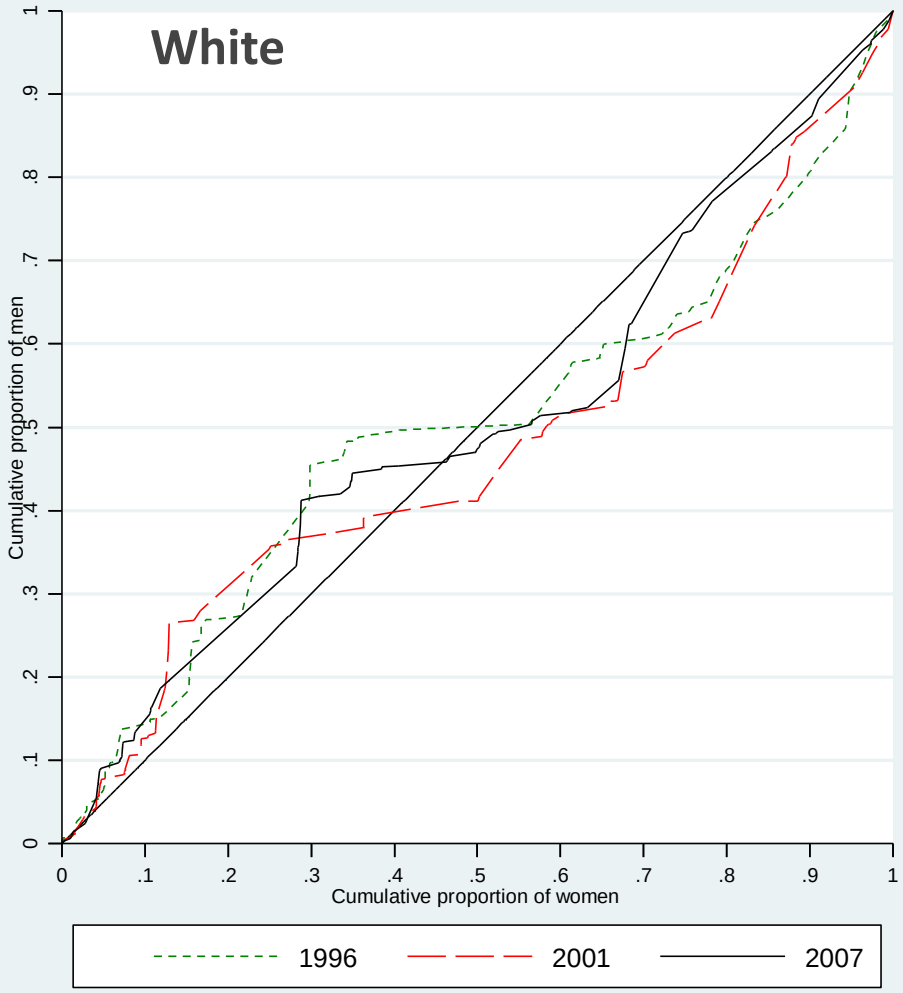
(26% and 15% of women are domestic helpers)
(1% in the case of white and Indian/Asian women)

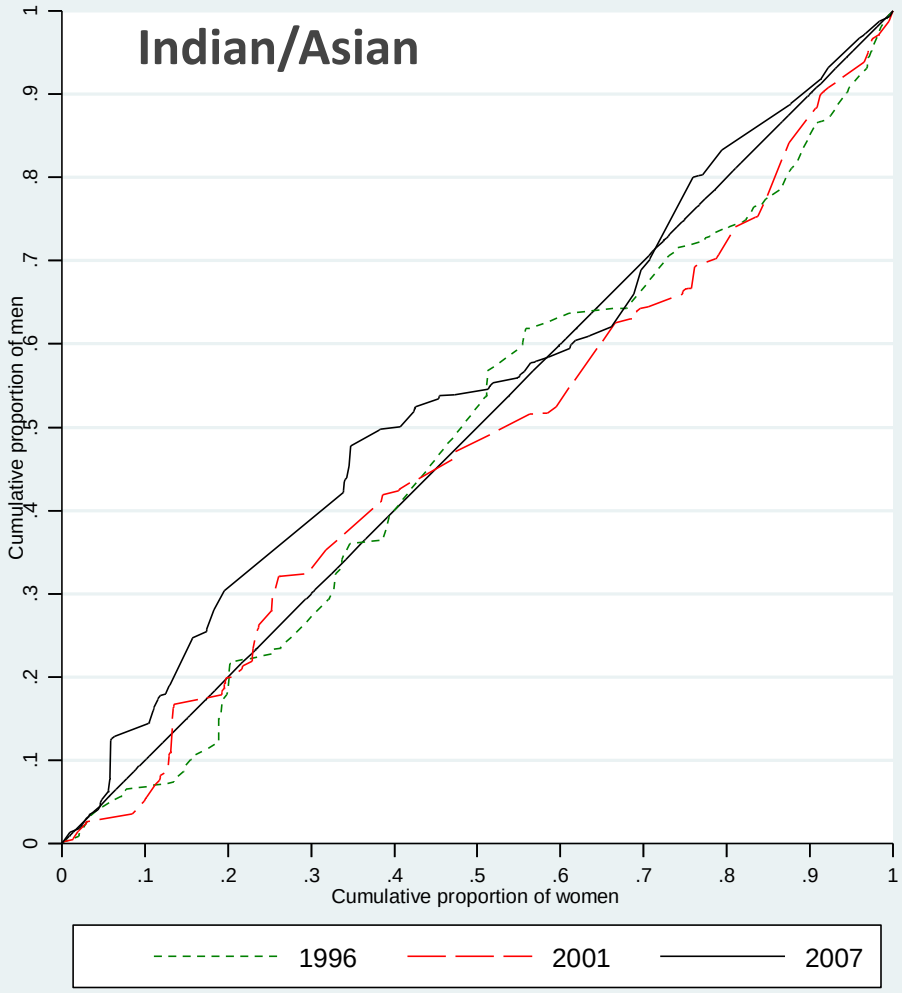
Gender concentration curves





Gender concentration curves

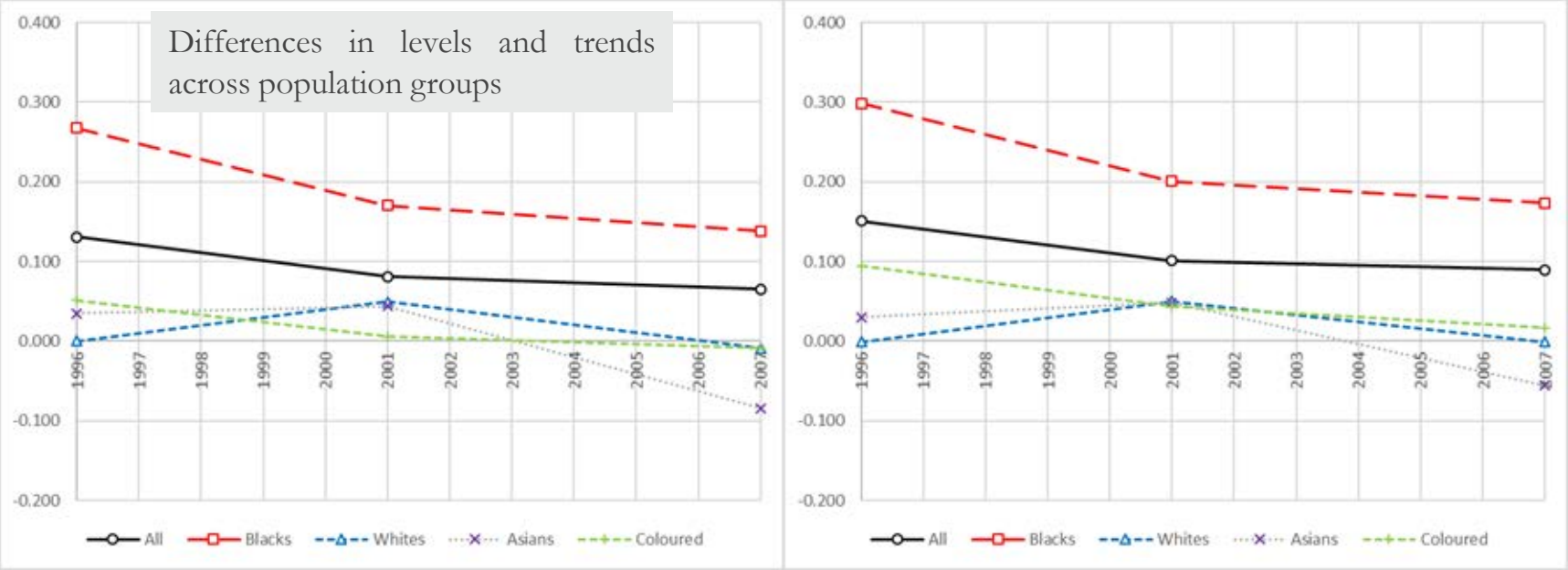




Gini low-pay segregation of women (Census)

a. Unconditional

b. Conditional



Concentration index is positive only for blacks.

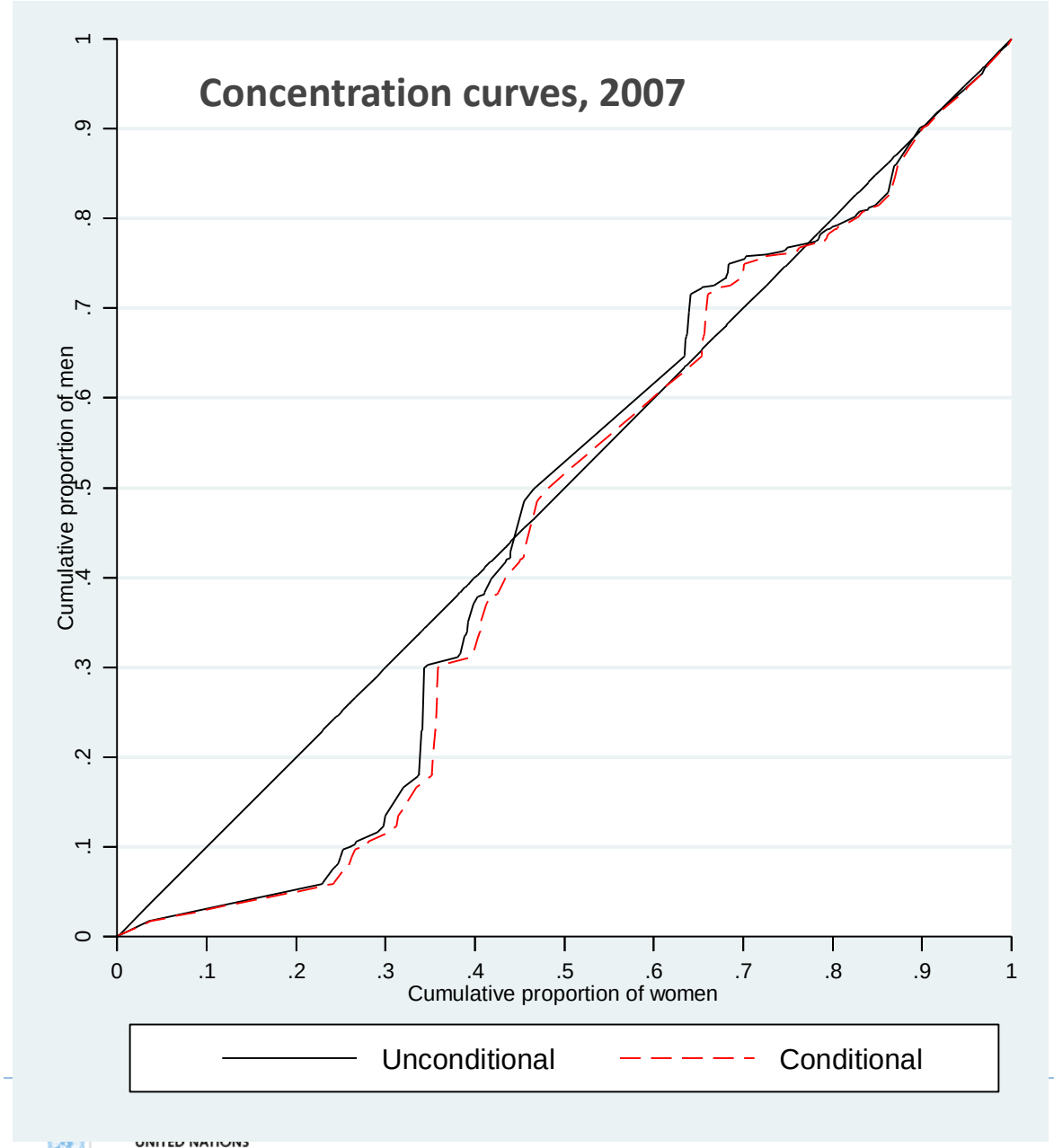
Coloured women are segregated at low-paying occupations along black women if we restrict the measure to the bottom 30% of women in worst-paying occupations.

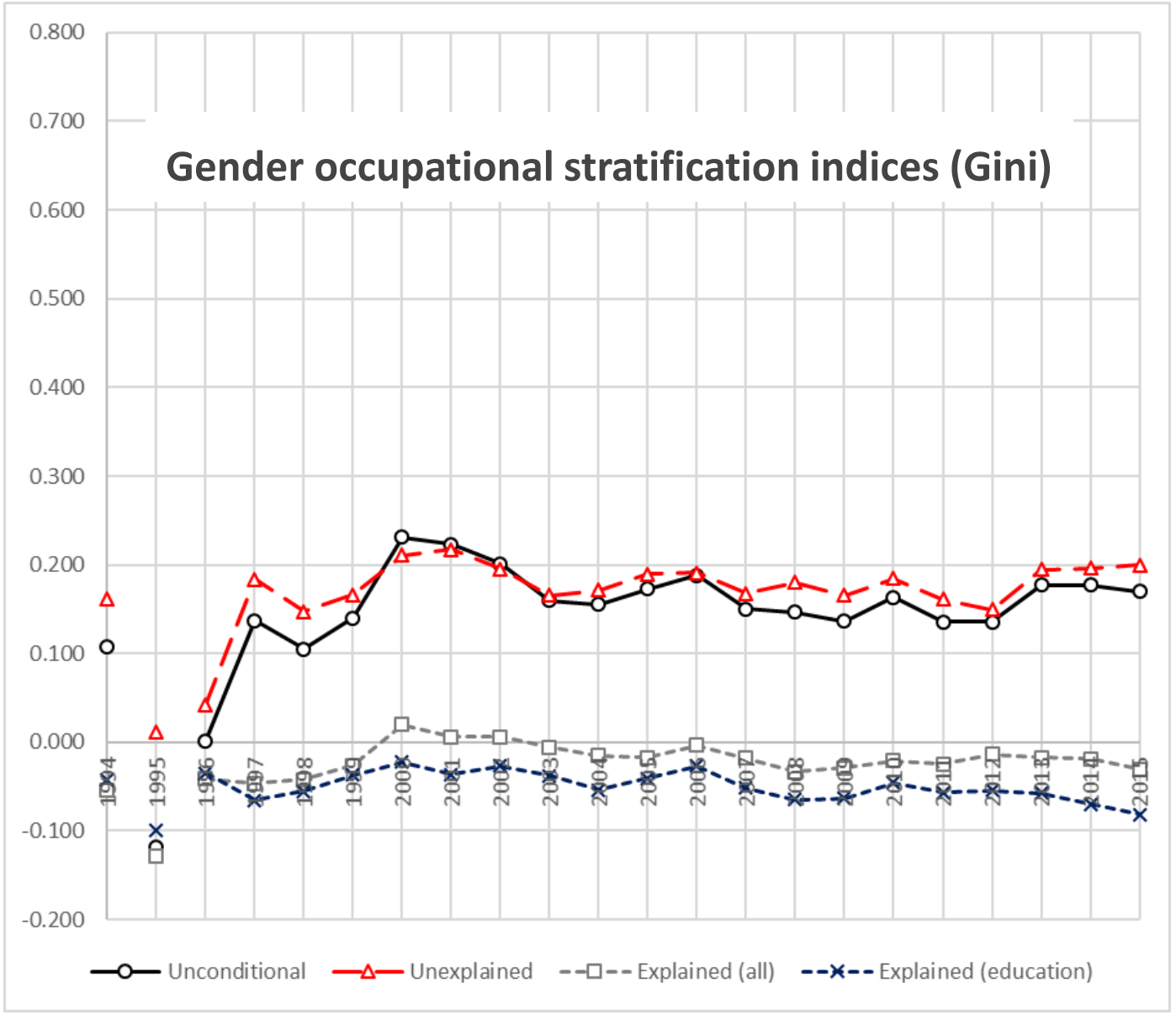
The value of Gini would be positive (0.041) although still below the corresponding value for blacks (0.066) and in contrast with the negative levels obtained for whites (-0.030) and Indians/Asians (-0.039) in that case.

Table 8. Low-pay Gini segregation index

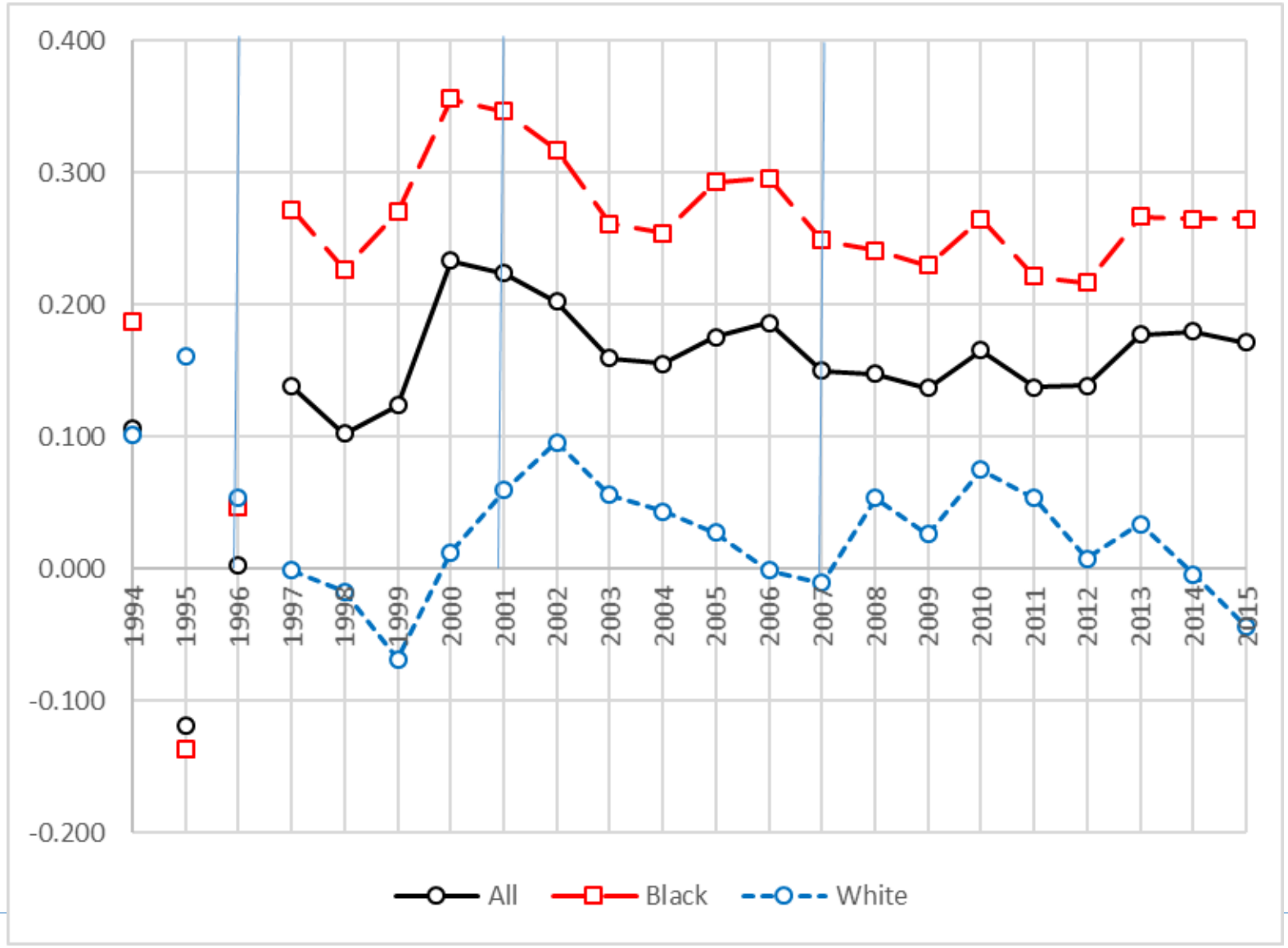
	2007				
	All	Black	White	Coloured	Indian/Asian
Unconditional	0.065	0.138	-0.009	-0.009	-0.085
Ratio	11.8%	23.6%	-1.8%	-1.7%	-18.6%
Unexplained	0.090	0.173	-0.001	0.017	-0.056
Explained	-0.024	-0.036	-0.008	-0.026	-0.029
Area	0.006	0.003	-0.001	-0.004	-0.003
Province	0.000	-0.001	-0.001	-0.002	-0.002
Education	-0.054	-0.057	-0.004	-0.028	-0.027
Age	0.002	0.008	0.001	-0.001	-0.008
Race	-0.002				
Marital	0.023	0.013	-0.002	0.009	0.010
Disability	0.000	0.000	0.000	0.000	-0.001
Immigration	0.002	-0.001	0.000	0.001	0.002

The effect of education might be overestimated given the lack of information about field of college degree (Gradín, 2017a for the US), although only 9% of women and 7% of men had university degree in 2007. The advantage of women is larger in secondary education (42% versus 38%).


Concentration curves, 2007
Cumulative proportion of men
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1
Cumulative proportion of women
Unconditional
Conditional


Gender occupational stratification indices (Gini)
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
Unconditional
Unexplained
Explained (all)
Explained (education)

Gender occupational stratification indices (Gini)



Concluding remarks

- I have analyzed gender inequalities in the **distribution of occupations** in post-apartheid South Africa.
  - Limited available data, contributing to the understanding of segregation in developing countries.
- **Long-term** trend (census):
  - Substantial decline; women persistently holding lower-paying jobs (especially black and Coloured women), but at the same time increasingly filling higher paying positions (especially true for Indian/Asian and white women, also for Coloured).
- Most **recent** trend (LFS):
  - More persistent segregation and, to a lesser extent, stratification

Concluding remarks (Cont.)

- This phenomena are not the result of the distinctive **characteristics** of male and female workers.
  - No segregation can be justified on these terms.
  - Only the over-representation of women in some higher-paying professional positions may be justified on their higher education and other attributes, but not their over-representation at the bottom of the pay scale.
- That is, **men and women with similar characteristics tend to work in different occupations, with a tendency for (black/Coloured) women to work in lower-paying jobs.**
  - Relatively higher education of women has mitigated this.