Comment

Reconsidering Racial Bias in Motor Vehicle Searches: Theory and Evidence

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I. Introduction

In an influential paper in the February 2001 *Journal of Political Economy*, Knowles, Persico, and Todd present a model of police and motorist behavior in the context of vehicle searches and test it using data from Maryland.[1] Their work marked a resurgence in interest on how to interpret purported evidence of statistical and racial discrimination. (For recent studies, see Hernández-Murillo and Knowles [2004], Levitt [2004], Anwar and Fang [2006], Dominitz and Knowles [2006], and Persico and Todd [2006].)

The main implication of the Knowles et al. model is that in the absence of racial discrimination, the proportion of searches yielding drugs (or "hit rate") will be equated across races. A relatively low hit rate for any group suggests that police may improve their overall hit rate by shifting resources away from that group and is thus evidence toward discrimination. Using data on vehicle searches by the Maryland State Police (MSP), they find no bias against blacks relative to whites but significant bias against white females and particularly Hispanics (though both groups had limited observations: 41 white females and 97 Hispanics).

An important feature of the data used by Knowles et al. is that they are limited to searches occurring on Interstate 95, which was also the focus of the racial profiling lawsuit filed against the MSP in 1993. Since

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[1] See also their 1999 working paper.

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TABLE 1
HIT RATES AND *t*-TESTS OF SIGNIFICANT DIFFERENCE

Sample	White (1)	Black (2)	Hispanic (3)	Black−White (4)	Hispanic−White (5)	Observations (6)
1995–99:						
1. Original	.32	.34	.11	.02	−.21[a]	1,570
2. Best replication	.326	.349	.124	.022	−.202	1,570
	(.022)	(.015)	(.034)	(.027)	(.040)**	
3. Best replication (no doubles)	.329	.351	.124	.022	−.205	1,554
	(.022)	(.015)	(.034)	(.027)	(.040)**	
4. All Maryland	.352	.294	.102	−.058	−.249	5,306
	(.009)	(.010)	(.019)	(.013)**	(.021)**	
1995–2006:						
5. All Maryland	.380	.279	.083	−.102	−.297	18,927
	(.005)	(.005)	(.007)	(.007)**	(.009)**	
6. I-95 only	.277	.261	.077	−.016	−.200	6,577
	(.010)	(.007)	(.008)	(.012)	(.013)**	
7. Non-I-95 only	.408	.293	.095	−.114	−.312	12,346
	(.006)	(.007)	(.014)	(.009)**	(.015)**	
84% subsample with matched location, 1995–2006:						
8. All Maryland						
a. Without location fixed effects	.373	.275	.080	−.098	−.293	15,907
	(.005)	(.006)	(.013)	(.008)**	(.013)**	
b. With location fixed effects				−.077	−.255	15,907
				(.008)**	(.014)**	
c. row *b* − row *a*				.021	.037	
				(.011)*	(.019)*	

NOTE.—Standard errors are listed in parentheses.
[a] This is not explicitly tested in Knowles et al.'s paper, although their table 3 suggests that it would be significantly different from zero.
* Statistically significantly different from zero at 90 percent confidence.
** Statistically significantly different from zero at 99 percent confidence.

the MSP started collecting data on vehicle searches in 1995 (as part of the settlement of the case), there is no way of empirically verifying the grounds for the suit (i.e., if there was racial bias before 1993).

However, while the suit focused on I-95 searches, the settlement required the MSP to record all vehicle searches, of which I-95 searches constitute about one-third.[2] In this paper, I reconsider the Knowles et al. analysis using all MSP searches, both for the time period studied in their paper (1995–99) and in more recent years (1995–2006).

II. Results

Table 1 lists the results. For each sample, columns 1–3 list the hit rates for whites, blacks, and Hispanics, respectively, with standard errors in parentheses. Column 4 lists the difference between blacks and whites, and similarly for Hispanics and whites in column 5. By the Knowles et

[2] More specifically, the settlement required the MSP to record all searches conducted by one of the 24 barracks that constitute the MSP.

al. model, I interpret statistically significant negative values in these two columns as evidence toward racial discrimination against blacks and Hispanics. Column 6 reports the total number of vehicle searches involving black, white, and Hispanic drivers.

The first row lists the original results from Knowles et al.'s paper (their tables 2 and 3). In the second row, I successfully replicate their results, though the estimates differ slightly. This is most likely due to minor differences in the precise definition of a successful search.[3] The third row excludes double entries that, to the best of my knowledge, were not removed in the original study. Again, I find no significant differences.

The next two rows include all MSP searches. Row 4 includes only searches occurring during the time period considered in Knowles et al.'s paper (on or before January 29, 1999). The sample size is now about 3.5 times the original, and I naturally obtain more precise estimates. Black and Hispanic hit rates are approximately 6 and 25 percentage points lower than those for whites, suggesting racial bias against these two groups, particularly Hispanics.[4] When I use the full sample (all Maryland, 1995–2006), the disparity increases by about 4 percentage points for both groups, suggesting that the bias has increased in recent years.

Rows 6 and 7 separate by on and off I-95. Row 6 confirms Knowles et al.'s result: when I consider searches along I-95, I find no significant difference between black and white hit rates. However, the disparity is large and significant for non-I-95 searches. Also, the Hispanic/white difference, while large and significant both on and off I-95, is substantially larger off I-95. Both statistics suggest that police may have responded to the lawsuit, which primarily concerned racial profiling on I-95. Finally, the relatively low hit rates for all searches on I-95 suggest that police are oversearching I-95 motorists. It may be that police are oversearching I-95 because of its reputation for drug trafficking and/or that drug traffickers have responded to police behavior.[5] Alternatively, officers may place a higher value on I-95 finds because, for example, they yield larger quantities on average.[6]

[3] A small number of drugs, such as Valium, were excluded from the definition of a positive search. However, there may be differences in coding schemes that arise from borderline cases of excluded drugs, such as discovery of Valium in the driver's shoe by a police canine.

[4] When the data are restricted to the relatively small sample of females, there is bias against whites relative to blacks in the Knowles et al. sample (searches on I-95, 1995–99). When all MSP searches are used, there is no significant female black/white difference for the years of their sample. Finally, the black female hit rate is statistically significantly lower than the white female hit rate when the full sample is used (about 7 percentage points).

[5] The I-95 and non-I-95 hit rates were similar until around 2002, when I-95 hit rates dropped considerably, reaching a low of 8.7 percent in 2004.

[6] I thank an anonymous referee for this insight.

Finally, consider the effect of heterogeneous search costs. In Knowles et al.'s original model, an important assumption is that the cost of a search is constant. However, if police allocated their resources strategically across time and space, this may not hold. For example, suppose that high-crime areas (for reasons other than drugs) are areas of both high police and minority presence. Then one might expect higher search intensity and therefore lower hit rates across all races in such areas. Since, in this example, these areas are also areas of high minority presence, the unconditional hit rate gap between whites and minorities may be different from zero even in the absence of racial discrimination. I thank an anonymous referee for this example.

To address this issue, I control for location by including location fixed effects in a linear regression of an indicator for a positive drug search on indicators for each race. Location was observed for each search but was unfortunately not recorded in a systematic way. I therefore used an algorithm to search for keywords of highways, road names, and mile markers (and misspelled versions of these). The algorithm then assigned each observation to a neighborhood on the basis of the results of the search. The neighborhoods roughly correspond to either a major road or an actual neighborhood (usually near a major road). Interstate 95 searches were split into seven neighborhoods on the basis of mile markers. The algorithm was able to assign a location to about 84 percent of searches. Neighborhood size varied considerably as searches were usually conducted along a few major roads. The "typical" neighborhood contained about 50–500 or 1,000–2,000 searches. The details of the algorithm are available on request.

The last three rows of table 1 list the results. In row 8*a*, I regress an indicator for a positive drug search on indicators for each race, including only the 84 percent subsample that was matched to a location. The unconditional hit rates are similar to those for the full sample (row 5). Next, I include a full set of location fixed effects, while excluding the indicator for white to prevent collinearity between the race and location indicators. The qualitative results remain, in that significant black/white and Hispanic/white hit rate gaps are observed. However, the magnitude of these gaps shrinks slightly for both, and these differences, reported in the last row, are different from zero at 90 percent confidence.

The addition of location fixed effects explains about 20 percent of the hit rate gap for blacks and 10 percent for Hispanics. This suggests that heterogeneity in search cost could be an important factor in the hit rate gap. However, the results should be interpreted with caution, since they concern only a nonrandomly selected subsample (the 84 percent of searches to which the algorithm successfully assigned a location). Furthermore, this strategy would underestimate the importance of heterogeneous search costs inasmuch as location is a noisy indicator

of search cost, and the location variable itself is subject to measurement error from the assignment algorithm. Alternatively, the analysis may overestimate the importance of search cost heterogeneity if, for example, racial discrimination existed in higher levels of police management and managers discriminated against minorities by instructing officers to search minority neighborhoods at a greater than optimal level of intensity.[7]

III. Conclusion

Knowles et al. test for racial bias in the Maryland State Police using vehicle search data along Interstate 95—a very interesting strip of road considering its connection to the racial profiling lawsuit filed against the MSP. In this paper, I reconsidered their analysis using all MSP searches. My results largely confirm theirs: searches along I-95 suggest a significant and large bias against Hispanics but no black/white disparity. When considering all MSP searches, though, I find evidence toward racial discrimination against blacks and especially Hispanics, and that these disparities have increased in recent years.

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[7] I repeat the analysis with location × time fixed effects and find little difference from the specification that includes only location fixed effects. Results are not reported here but are available on request.