

# Homework 5 Submission

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## Python

1. Using OLS, the mpg coefficient is -131.0449. This coefficient seems to be rather large and has the wrong sign.
2. The mpg coefficient would be a function of all of the other independent variables. MPG would be affected by whether the vehicle is a sedan or SUV, its weight, height, and length. Specifically, the car coefficient probably has some endogeneity itself since on average sedans tend to be lighter, smaller, and with higher MPG than their SUV counterparts.

Table 1: Two-Stage Least Squares Estimates

	Weight	Weight <sup>2</sup>	Height
Miles per gallon	150.43 (59.30)	157.06 (57.56)	10165.74 (25552.22)
Car type (=1 if sedan)	-4676.09 (548.94)	-4732.67 (537.90)	-90156.39 (218080.47)
First Stage F-statistic	256.80	257.02	203.66

I think we can see here in Table 1 that the car type has a sizable negative effect on mpg. Intuitively, this means that our instruments might not be good instruments for the reasons that we discussed in the first question.

4. The coefficient estimates are the same, but the standard errors are smaller for the IVGMM estimation. This might be because the number of instruments that we have outnumber the regressors. GMM is more accurate than 2SLS in the case of overidentification.

Table 2: Two-Stage Least Squares Estimates

	2SLS	IVGMM
Miles per gallon	150.43 (59.30)	150.43 (63.05)
=1 if car is a sedan	-4676.09 (548.94)	-4676.09 (589.70)

## Stata

1. The second stage results are below in Table 3.

Table 3: Limited Information Likelihood Estimation

VARIABLES	(1) price
mpg	150.4** (65.51)
car	-4,676*** (605.3)
Constant	17,628*** (1,849)
Observations	1,000
R-squared	0.104
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

2. The F-statistic is 37.418. The intuition of the weak instrument test is that if the F-statistic is larger than the critical value, we have a weak instrument. Our results here point to a weak instrument.