Econ 753 HW2

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Part 1 - Berndt Exercises

In part 1, we analyze a hedonic price model constructed by Gregory Chow in the rental market for computers. Chow constructs a quality-controlled model of price indices using memory time, multiplication time, and access time as the set of qualitative characteristics. We are asked to replicate Chow's results and perform further analysis.

Question 3a

In question 3a, we construct a correlation matrix for the regession variables, both for the 1954-1959 and 1960-1965 time periods.

Table 1: Correlation Matrix for 1954-1959

	lnrent	lnmult	lnaccess	lnadd	lnmem
lnrent	1.0000000	-0.8673364	-0.8450792	-0.8397468	0.8756174
lnmult	-0.8673364	1.0000000	0.8626912	0.9771873	-0.7371050
lnaccess	-0.8450792	0.8626912	1.0000000	0.8457563	-0.6129908
lnadd	-0.8397468	0.9771873	0.8457563	1.0000000	-0.7295567
lnmem	0.8756174	-0.7371050	-0.6129908	-0.7295567	1.0000000

Table 2: Correlation Matrix for 1960-1965

	lnrent	lnmult	lnaccess	lnadd	lnmem
lnrent	1.0000000	-0.6331708	-0.5849575	-0.6316314	0.8825522
lnmult	-0.6331708	1.0000000	0.7739316	0.9405762	-0.5707293
lnaccess	-0.5849575	0.7739316	1.0000000	0.8064029	-0.4648790
lnadd	-0.6316314	0.9405762	0.8064029	1.0000000	-0.5633702
lnmem	0.8825522	-0.5707293	-0.4648790	-0.5633702	1.0000000

We can see that the variables are all highly correlated with each other, with many of the correlation coefficients coming close to 1. This indicates that Chow's concern over collinearity was a valid concern, as several of the independent variables maintained high correlation coefficients (e.g. the correlation between lnmult and lnaccess is 0.863 in the 1954-1959 range and 0.774 in the 1960-1965 range).

The correlation coefficients maintained the same signs throughout the two periods, but changed somewhat significantly in values, with the change in magnitudes of some of the correlation coefficients changing by as much as 30%. Therefore, it was correct for Chow to perform separate regressions for the two time periods,

as the relation between qualitative characteristics changed somewhat significantly between the two price periods.

Question 3b

In part b, we run a regression for the years 1960-1965 of lnrent on lnmult, lnmem, lnaccess, and a list of dummy variables indicating if the observation takes place in a particular year (excluding the year 1960).

Table 3: Quality-Controlled Regression of lnrent on Quality-Variables

term	estimate	std.error	statistic	p.value
(Intercept)	-0.1044553	0.3149422	-0.3316651	0.7410925
d61	-0.1397971	0.1664674	-0.8397866	0.4037700
d62	-0.4891062	0.1737704	-2.8146686	0.0062723
d63	-0.5938483	0.1660955	-3.5753430	0.0006250
d64	-0.9248183	0.1662993	-5.5611664	0.0000004
d65	-1.1631690	0.1661051	-7.0026088	0.0000000
lnmult	-0.0653663	0.0284110	-2.3007353	0.0242650
lnmem	0.5793301	0.0353914	16.3692440	0.0000000
lnaccess	-0.1406043	0.0293269	-4.7943871	0.0000084

Figure 1: Chow's Original Regression

The regression successfully replicated Chow's results. Each of the qualitative variables result in the correctly predicted signs; multiplication time and access time both correlate negatively with computer rental price (the longer the multiplication times and access times, the slower the computer and thus the lower the price), while memory correlates positively with rental price (more memory means higher quality computer). Furthermore, each of the qualitative variables are statistically significant.

The coefficients on the year dummy variables decrease as the year increases, which corresponds to the rental price of computers lowering over time. This intuitively makes sense, as computers have consistently improved in quality while lowering in price for the past 50 years. After running the regression, a list of price indices for the years 1960-1965 is generated by taking the antilogarithm of the dummy variable coefficients. Since the regression was run on the natural logarithm of the rental price, and since the coefficients are relatively small, the antilogarithm of the dummy variable coefficients approximately equals the percent change in the rental price from the year 1960 to the year of the dummy variable. The resulting price indices are identical to Chow's price indices, located in the middle column of the screenshot of the Berndt textbook.

Table 4: Replicated Price Indices

Year	Estimated_Coefficient	Price_Index
1960	-0.1044553	1.0000000
1961	-0.1397971	0.8695346
1962	-0.4891062	0.6131742
1963	-0.5938483	0.5521982
1964	-0.9248183	0.3966035
1965	-1.1631690	0.3124943

Table 4.2 Quality-Adjusted Price Indexes for Computers, 1960–1965. Based on Chow's Dummy Variable Coefficient Estimates and on Chow's Arithmetic-Weighted Procedure

Year	Estimated Coefficient	Price Index (Antilogarithm)	Price Index* (Arithmetic-Weighted)
1960		1.0000	1.0000
1961	−0.1398	0.8695	0.8438
1962	−0.4891	0.6132	0.6414
1963	−0.5938	0.5522	0.5330
1964	−0.9248	0.3966	0.3906
1965	−1.163	0.3125	0.3188

*Entries in the final column are taken from Chow [1967, Table 2, p. 1124], normalized to unity in 1960.

Figure 2: Chow's Original Price Indices

Part 3 - Replication Paper Topic

Clark LP, Millet DB, Marshall JD (2014). National Patterns in Environmental Injustice and Inequality: Outdoor NO_2 Air Pollution in the United States. PLoS ONE 9(4): e94431. doi:10.1371/journal.pone.0094431

For my replication paper, I will replicate the paper titled "National Patterns in Environmental Injustice and Inequality: Outdoor NO_2 Air Pollution in the United States" by Clark et al. The paper describes spatial patterns in environmental injustice and inequality for nitrogen dioxide (NO_2) concentrations in the United States. It uses Census demographic data and a recently published dataset of outdoor (NO_2) concentrations. It compares (NO_2) concentrations in populations of different demographics and in different locations (e.g. urban vs rural).

There are three tables and two figures. Table 1 provides data on (NO_2) concentration for different populations. Table 2 offers comparisons of specific populations. Table 3 provides "environmental justice" and "environmental inequality" indices for different areas. Figure 1 plots a regression of (NO_2) concentration on household income for different regions. Figure 2 projects the environmental justice and inequality indices onto a map of the United states. I am interested in replicating all tables and figures, although I will likely be unable to replicate the figure of the US map. Finally, I am interested in taking a deeper look at the data and offer any other revelations I come across.