Exam No. 3 on Topics from Chapters 2 through 7 (1.5 hours)

Using quarterly data for 15 years (60 observations), the following double-log model was estimated.

$$(R) \qquad LQ = a + b\,LY + g\,LP + d\,Lr + u$$

where Q is per capita new car sales (in thousands), Y is disposable personal income per capita in real terms (in thousands of dollars), P is a real price index for cars, and r is the prime interest rate in percent. The prefix "L" refers to the logarithm so that the parameters (excluding the constant term) are all elasticities.

You suspect that the Greek letters in the above model all depend on seasonal dummy variables and define three dummies; d2 = 1 for the Spring quarter, 0 otherwise, d3 = 1 for the Summer quarter, 0 otherwise, d4= 1 for the Fall quarter, 0 otherwise.

1. (5 points) What is the control period and why is there not a dummy variable for it?

2. (10 points)
Derive a general model that can test the suspicion stated above. Be sure to state what new variables will have to be created.

3. (5 points) State the null hypothesis that none of the dummy variables have any effect.

To test the null hypothesis, the variable LQ was regressed against a constant, LY, Lp, and Lr, and the residuals saved as ut. Then an auxiliary regression was run with ut as the dependent variable and the results are as follows (LXdi = LX $\times$ di for X = Y, P, and r, and i = 2, 3, 4 .

	VARIABLE	COEFFICIENT	STDERROR	T STAT	2Prob(t > |T|)	
0)	const	-0.7178	1.0151	-0.707	0.483243	
14)	d2	0.7653	1.4431	0.530	0.598548	
15)	d3	-0.1326	1.4517	-0.091	0.927648	
16)	d4	2.3866	1.4602	1.634	0.109309	
9)	LY	0.5902	1.0475	0.563	0.576028	
10)	LP	-0.2247	0.4366	-0.515	0.609356	
11)	Lr	0.1445	0.1067	1.354	0.182662	
17)	Lpd2	0.2994	0.6214	0.482	0.632357	
18)	Lpd3	0.6185	0.6153	1.005	0.320287	
19)	Lpd4	0.1392	0.6009	0.232	0.817948	
20)	LYd2	-0.5829	1.4741	-0.395	0.694454	
21)	LYd3	-0.9452	1.4550	-0.650	0.519315	
22)	LYd4	-1.1344	1.4314	-0.793	0.432318	
23)	Lrd2	-0.2781	0.1596	-1.743	0.088395	*
24)	Lrd3	-0.2036	0.1718	-1.185	0.242358	
25)	Lrd4	-0.1625	0.1605	-1.013	0.316745	

Unadjusted R-squared 0.369

4. (10 points)
Compute the LM test statistic, state its distribution including degrees of freedom, and carry out the test at the 5 percent level. What do you conclude?

5. (10 points)
Regardless of your answer to (4), explain how you can use the above auxiliary regression to select variables that are candidates for adding to Model(R) and write down the model implied by it. Note that the model must be in symbolic terms and not involve any estimates.

6. (10 points)
Using the data-based model reduction procedure, the following final model was estimated (dependent variable is LQ)

	VARIABLE	COEFFICIENT	STDERROR	T STAT	2Prob(t > |T|)	
0)	const	2.9347	0.5072	5.786	0.000000	***
14)	d2	0.7284	0.2204	3.305	0.001726	***
16)	d4	2.7189	1.0748	2.530	0.014484	**
9)	LY	2.0192	0.4481	4.506	0.000038	***
10)	LP	-1.2291	0.1818	-6.759	0.000000	***
22)	LYd4	-0.9914	0.4310	-2.300	0.025492	**
23)	Lrd2	-0.2624	0.0929	-2.825	0.006697	***
25)	Lrd4	-0.1753	0.1044	-1.679	0.099141	*

For each season, write down the estimated model making sure that your answer does not contain any of the dummy variables. Without formal testing, state whether in each season the coefficients for log income, price, and interest rate, exhibit elastic demand, inelastic demand, or unitary elasticity (ignore the sign). Do the signs agree with your intuition? Fully justify your answers.