2004

Empirical Study of Expenditures Models

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Abstract
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Degree Type
Open Access Senior Honors Thesis

Department
Economics

First Advisor
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Keywords
Economics, Mathematical, Economics Mathematical models

Senior Honors Thesis

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Department: Economics
Area: Economics
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Title: Empirical Analysis of Expenditures Models
Length: 36 pp.
Completion Date: 09-02-03
Special Features: Tables of empirical results

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Empirical Analysis of Expenditures Models

By

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A Senior Thesis Submitted to the

Eastern Michigan University

Honors Program

In Partial Fulfillment of the Requirements for Graduation

With Honors in Economics

In this paper we examine four expenditure models: Residential Construction, Medical Services, Consumption of Motor Vehicles, and Investment in Motor Vehicles. For each expenditure model we examine a number of functional forms, all having components with and without a lagged dependent variable; Level, Double Log, Change, and an Error Correction Model. In level form the data is left alone and regressions are run. In the Double Log Form we take the natural log of the dependent variable, and the independent variables (excluding rates i.e. mortgages rates, inflation) so we may examine the coefficients as elasticity's, or the percent change of the dependent variable as the result of a 1% change in the given independent variable.

In the change form we take the data and examine the amount it changes by as opposed to looking at its value. Taking the natural log of the variables current value divided by its value in the previous quarter does this. Many of the variables, over time, have an upward trend (i.e. Disposable Income), while other variables fluctuate between some given value. By examining changes in the data, we remove these upward trends and we may better see if changes in the variable actually have some effect on the expenditure model in question.

Each specification is done twice, once without a lagged dependent variable, and once with a lagged dependent variable. This helps to capture the effects of those variables that may be highly correlated with other variables, thus correcting for serial correlation.

As a final specification, called the Error Correction Model, we use change variables as well as variables in level form to see the effect of changes in the variable as well as the effects of level variables. Included in this specification are variables for the ratio of expenditures, and capital stock over real disposable income. These are mean reversion variables that deviate towards the mean, and are expected to be negative.

Residential Construction

Variables (expected sign)

RFYCW – Real Consumer Net Worth (+)
XPOP – Population (+)
RMORT – Mortgage Rates (-)
KIR – Capital Stock in Residential (-)
RPIR – Relative Price (-)
XPDPC – per capita Real Disposable Income (+)
INFL – Inflation (-)
RU – Unemployment Rate (-)

For this model we expect RFYCW, XPOP, and XPDPC to have positive coefficients. We expect consumers to spend more on housing if their net worth, and disposable income is higher because they have more money, as well as the assets to borrow more money. We expect residential construction to increase as population increases as the need for more housing increases as the population increases.

We expect the variables RMORT, RPIR, INFL, KIR, and RU to have negative coefficients in this model. We expect mortgage rates to have a negative effect on residential construction because in order to buy a house most people borrow money and are charged interest at the mortgage rate, so if the mortgage rate goes up the cost to borrow that money increases, making people less likely to borrow money. We expect relative price to have a negative effect on residential construction because if the price of housing increases relative to other goods people are less likely to spend money on housing, and will spend money on other goods. We expect inflation to have a negative effect on residential construction because if the inflation rate increases peoples money is worth less and they will be less likely to spend it on housing. We expect the unemployment rate to have a negative effect on housing because if more people are out of work they are less likely to buy a new home as the uncertainty of having a steady income increases. We expect capital stock in housing to have a negative effect on residential construction because an increase in capital stock in housing causes less need for housing now.

Empirical results for residential structures model are as follows:

Level Form Model

Dependent Variable: XIR
Method: Least Squares
Date: 08/27/03 Time: 14:41
Sample(adjusted): 1955:1 2002:3
Included observations: 191 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
XPOP***	2.422943	0.201272	12.03816	0.0000
RMORT(-1)**	-1.772639	0.871750	-2.033427	0.0435
RMORT(-2)***	-2.382345	0.852780	-2.793623	0.0058
KIR(-1)***	-0.055415	0.004563	-12.14397	0.0000
RPIR***	196.2840	14.96942	13.11233	0.0000
XPDPC***	1022.730	262.5314	3.895648	0.0001
XPDPC(-1)	377.4202	318.4666	1.185117	0.2375
XPDPC(-2)*	-454.5056	269.9033	-1.683957	0.0939
INFL***	-0.919262	0.247157	-3.719349	0.0003
C	-468.5997	35.69768	-13.12689	0.0000

R-squared	0.956159	Mean dependent var	73.26272
Adjusted R-squared	0.953979	S.D. dependent var	23.60430
S.E. of regression	5.063695	Akaike info criterion	6.133006
Sum squared resid	4641.023	Schwarz criterion	6.303282
Log likelihood	-575.7020	F-statistic	438.6200
Durbin-Watson stat	0.437784	Prob(F-statistic)	0.000000

* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

The Durbin-Watson statistic of .437784 suggests there is positive first order autocorrelation. This problem is addressed in other models. An adjusted r-squared of 0.953979 suggests the model explains 95.4% of the variations. The standard error of 5.063695 suggests that 95% of predicted values are 10 billion dollars of the actual value. In this model the variables RFYCW(-1) and RU were insignificant, so they were dropped. The variables XPOP, RMORT(-2), KIR(-1), RPIR, XPDPC, and INFL were significant at the 1% level. RMORT(-1) was significant at the 5% level. Like expectations this model shows that as XPOP, and XPDPC increase, residential construction increases. Also the model shows that as RMORT(-1), RMORT(-2), KIR(-1), and INFL increase, residential construction decreases. Unlike expectations, RPIR was shown to have a positive effect on residential construction. XPDPC(-2) was significant at the 10% level. Unlike what we'd expect, the model shows that XPDPC(-2) has a negative effect on residential construction. The variable XPDPC(-1) had a high p-value but was left in the model because it had

a t-statistic greater than one. This model shows that XPDPC(-1), like expectations, has a positive effect on residential construction.

Level Form with Two-Quarter Lagged Dependent Variable

Dependent Variable: XIR
Method: Least Squares
Date: 08/27/03 Time: 14:46
Sample(adjusted): 1955:1 2002:3
Included observations: 191 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
XIR(-1)***	1.192473	0.061451	19.40519	0.0000
XIR(-2)***	-0.327139	0.056846	-5.754795	0.0000
XPOP***	0.488683	0.103062	4.741615	0.0000
RMORT(-1)***	-2.553485	0.361317	-7.067151	0.0000
RMORT(-2)***	1.773961	0.398750	4.448806	0.0000
KIR(-1)***	-0.010294	0.002365	-4.352080	0.0000
RPIR***	32.46497	8.109442	4.003354	0.0001
XPDPC***	411.0533	105.0675	3.912277	0.0001
XPDPC(-1)**	-284.9604	110.2493	-2.584692	0.0105
INFL**	-0.229693	0.100077	-2.295160	0.0229
RU**	0.396140	0.171166	2.314359	0.0218
C	-89.76527	19.06803	-4.707631	0.0000

R-squared	0.992845	Mean dependent var	73.26272
Adjusted R-squared	0.992405	S.D. dependent var	23.60430
S.E. of regression	2.057110	Akaike info criterion	4.341248
Sum squared resid	757.4743	Schwarz criterion	4.545579
Log likelihood	-402.5891	F-statistic	2257.926
Durbin-Watson stat	2.317176	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin Watson statistic 2.317176 suggests there is no serial correlation in the data. An adjusted r-squared of 0.992405, suggests that the model explains 99.2% of the variations. A standard error of 2.057110 suggests that 95% of predicted values are within 4 billion dollars of the actual value. In this model the variables RFYCW and XPDPC(-2) were insignificant, thus were dropped. The variables XPOP, RMORT(-1), RMORT(-2), KIR(-1), RPIR, and XPDPC were significant at the 1% level. The variables XPDPC(-1), INFL, and RU are significant at the 5% level. Like expectations the variables XPOP, and XPDPC have a positive effect on residential construction, and the variables RMORT(-1), KIR(-1) and INFL have a negative effect. Unlike

expectations the variables RMORT(-2), RPIR, and RU have positive effects on residential construction, while XPDPC(-1) has a negative effect on residential construction.

Double Log Form

Dependent Variable: LNXIR
Method: Least Squares
Date: 08/27/03 Time: 15:07
Sample(adjusted): 1954:4 2002:3
Included observations: 192 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRFYCW(-1)***	0.231174	0.072355	3.194996	0.0016
RMORT(-1)***	-0.028674	0.004157	-6.898514	0.0000
LNKIR(-1)	0.324722	0.263088	1.234269	0.2187
LNRPIR***	0.731617	0.193547	3.780040	0.0002
LNXPDPC***	4.224593	0.603366	7.001708	0.0000
LNXPDPC(-2)***	-3.244337	0.657884	-4.931474	0.0000
INFL*	0.007818	0.004219	1.853050	0.0655
C	4.060360	2.794764	1.452846	0.1480

R-squared	0.915925	Mean dependent var	4.237724
Adjusted R-squared	0.912727	S.D. dependent var	0.333829
S.E. of regression	0.098620	Akaike info criterion	-1.754313
Sum squared resid	1.789564	Schwarz criterion	-1.618584
Log likelihood	176.4141	F-statistic	286.3611
Durbin-Watson stat	0.318506	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin Watson statistic of 0.318506 suggests positive first order serial correlation in this model. This problem is resolved in the following models. An adjusted r-squared of 0.912727 suggests the model explains 91.3% of the variations. A standard error of 0.098620 suggests that 95% of predicted values are within 9.9 billon dollars of the actual value. The variables LNXPOP, RMORT(-2), LNXPDPC(-1), and RU were insignificant in this model, and were dropped. The variables LNRFYCW, RMORT(-1), LNRPIR, LNXPDPC, and LNXPDPC(-2) had significance at the 1% level. Like expectations the variables LNRFYCW(-1), LNXPDPC have a positive effect on residential construction, while the variables RMORT(-1) has a negative effect. The variable INFL had significance at the 10% level. Unlike expectations this variable had a positive effect on residential construction. Though the variable LNKIR(-1) had a high p-value, it was left in the model because it had a t-statistic greater than 1. Like INFL, unlike expectations this variable had a positive effect on residential construction.

Double Log form with Lagged Dependent Variable

Dependent Variable: LNXIR
Method: Least Squares
Date: 08/27/03 Time: 15:18
Sample(adjusted): 1955:1 2002:3
Included observations: 191 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNXIR(-1)***	1.277038	0.059538	21.44922	0.0000
LNXIR(-2)***	-0.365315	0.059319	-6.158431	0.0000
LNRFYCW(-1)**	0.049487	0.022653	2.184565	0.0302
RMORT(-1)***	-0.036480	0.005611	-6.501792	0.0000
RMORT(-2)***	0.031707	0.005956	5.323338	0.0000
LNXPDPC***	1.055100	0.279346	3.777037	0.0002
LNXPDPC(-1)	-0.441372	0.377158	-1.170255	0.2434
LNXPDPC(-2)	-0.425644	0.286953	-1.483320	0.1397
RU***	0.009534	0.002933	3.250239	0.0014
C	0.824286	0.218417	3.773907	0.0002

R-squared	0.990323	Mean dependent var	4.240515
Adjusted R-squared	0.989842	S.D. dependent var	0.332452
S.E. of regression	0.033507	Akaike info criterion	-3.903183
Sum squared resid	0.203213	Schwarz criterion	-3.732907
Log likelihood	382.7540	F-statistic	2058.122
Durbin-Watson stat	2.229465	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 2.229465 suggests there is no serial correlation in the model. An adjusted r-squared of 0.989842 suggests the model explains 98.9 percent of the variations. A standard error of 0.033507 suggests that 95% of the predicted values were within 6.8 billion dollars of the actual values. In this model the variables LNXPOP, LNKIR(-1), LNRPIR, and INFL were insignificant, and were dropped.

The variables RMORT(-1), RMORT(-2), LNXPDPC, and RU were significant at the 1% level. Like expectations the variable RMORT(-1) was shown to have a negative effect on residential construction, while LNXPDPC was shown to have a positive effect. Unlike expectations the variable RMORT(-2) and RU were both shown to have a negative effect on residential construction.

The variable LNRFYCW(-1) was significant at the 5% level. Like expectations, the model shows that this variable has a positive effect on residential construction.

Though LNXPDPC(-1) and LNXPDPC(-2) had high p-values they had t-statistics greater than one, so they were left in the equation. Unlike expectations these variables were shown to have a negative effect on residential construction.

Change Form

Dependent Variable: DXIR
Method: Least Squares
Date: 09/01/03 Time: 20:51
Sample(adjusted): 1955:2 2002:3
Included observations: 190 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DRFYCW(-1)**	0.250033	0.131944	1.894986	0.0597
DRMORT(-1)***	-0.351311	0.063448	-5.536966	0.0000
DRMORT(-2)***	-0.254251	0.061774	-4.115847	0.0001
DXPDPC**	0.707409	0.322953	2.190436	0.0298
DXPDPC(-1)	0.427937	0.324707	1.317919	0.1892
DKIR(-1)*	-2.655451	1.523708	-1.742755	0.0831
DRPIR**	-0.747174	0.319520	-2.338427	0.0205
DRU***	-0.204300	0.054049	-3.779887	0.0002
C	0.022671	0.010979	2.064896	0.0404

R-squared	0.468104	Mean dependent var	0.005453
Adjusted R-squared	0.444595	S.D. dependent var	0.047631
S.E. of regression	0.035497	Akaike info criterion	-3.792529
Sum squared resid	0.228066	Schwarz criterion	-3.638722
Log likelihood	369.2902	F-statistic	19.91154
Durbin-Watson stat	1.356528	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 1.356528, suggests that there may be serial correlation between the variables, which is dealt with in alternate specifications below. An adjusted R-squared of 0.444595 suggests the model explains 44.5 percent of the variations. A standard error of 0.035497 suggests that 95% of the predicted values are within 7 billion dollars of the actual values. In this model the variables DXPOP, DXPDPC(-2), and DINFL were insignificant, and were dropped.

The variables DRMORT(-1), DRMORT(-2), and DRU were significant at the 1% level. Like expectations the variables DRMORT(-1), DRMORT(-2), and DRU have a negative effect on residential construction.

The variables DRFYCW(-1), DXPDPC, and DRPIR were significant at the 5% level. Like expectations the variables DRFYCW(-1), DXPDPC have positive effect on residential construction, while the variable DRPIR has a negative effect.

DKIR(-1) was significant at the 10% level. Like expectations, the model shows that this variable has a negative effect on residential construction. Though the variable DXPDPC(-1) had a high p-value, it was left in the model because it had a t-statistic greater than 1. Like expectations this variable is shown by the model to have a positive effect on residential construction.

Change Form with Lagged Dependent Variable

Dependent Variable: DXIR
Method: Least Squares
Date: 09/01/03 Time: 20:57
Sample(adjusted): 1955:2 2002:3
Included observations: 190 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXIR(-1)***	0.304777	0.071727	4.249101	0.0000
DXIR(-2)	0.072384	0.062853	1.151640	0.2510
DRFYCW(-1)**	0.235329	0.120879	1.946824	0.0531
DXPOP	3.504203	3.448824	1.016058	0.3110
DRMORT(-1)***	-0.340973	0.060133	-5.670336	0.0000
DRMORT(-2)*	-0.109302	0.065444	-1.670159	0.0966
DXPDPC**	0.666779	0.302922	2.201157	0.0290
DXPDPC(-2)	-0.313701	0.286825	-1.093704	0.2756
DKIR(-1)**	-3.604124	1.587201	-2.270742	0.0244
DRPIR***	-0.834052	0.309919	-2.691189	0.0078
DRU**	-0.131041	0.051612	-2.538956	0.0120
C	0.020833	0.012406	1.679316	0.0948

R-squared	0.537395	Mean dependent var	0.005453
Adjusted R-squared	0.508807	S.D. dependent var	0.047631
S.E. of regression	0.033382	Akaike info criterion	-3.900523
Sum squared resid	0.198356	Schwarz criterion	-3.695448
Log likelihood	382.5497	F-statistic	18.79794
Durbin-Watson stat	1.915912	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 1.915912 suggests there is no serial correlation in the model. An adjusted r-squared of 0.508807 suggests the model explains 50.9% of the variations. A standard error of 0.033382 suggests that 95% of predicted values were with in 6.6 billon dollars of the actual values. In this model the variables DXPDPC(-1), and DINFL were insignificant and were dropped.

The variables DXIR(-1), DRMORT(-1), and DRPIR were significant at the 1% level. Like expectations the variables DRMORT(-1), and DRPIR are shown to have a negative effect on residential construction by this model. The variables DRFYCW(-1), DXPDPC, DKIR(-1), and DRU were significant at the 5% level. Like expectations the variables DRFYCW(-1) and DXPDPC were shown to have a positive effect on residential construction, while DKIR(-1), and DRU were shown to have a negative effect. The variable DRMORT(-2) was significant at the 10% level. Like expectations, this variable was shown to have a negative effect on residential construction. Though the variables DXIR(-2), DXPOP, and DXPDPC(-2) high p-values they were left in the model because they had t-statistics greater than 1. Like expectations, the variable DXPOP was shown to have a positive effect on residential construction. Unlike expectations, though, the variable DXPDPC(-2) was shown to have a negative effect.

Error Correction Model

Dependent Variable: DXIR
Method: Least Squares
Date: 09/01/03 Time: 21:15
Sample(adjusted): 1955:2 2002:3
Included observations: 190 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DRFYCW(-1)**	0.237828	0.118532	2.006445	0.0463
DRMORT(-1)***	-0.258414	0.064083	-4.032489	0.0001
DRMORT(-2)***	-0.171737	0.060914	-2.819312	0.0054
DXPDPC***	0.770515	0.292973	2.629983	0.0093
DKIR(-1)***	-32.16743	11.86166	-2.711882	0.0074
DRPIR**	-0.734286	0.305138	-2.406406	0.0171
DRU***	-0.188140	0.049059	-3.834964	0.0002
LNRXIR(-1)**	0.267682	0.129008	2.074918	0.0394
LNRKIR(-1)***	-1.051660	0.216124	-4.866004	0.0000
RU(-1)***	0.014298	0.002997	4.770624	0.0000
LNXPDPC(-1)***	-0.228779	0.048773	-4.690656	0.0000
RMORT(-1)***	-0.005537	0.001496	-3.700747	0.0003
C	4.862753	1.000844	4.858653	0.0000

R-squared	0.572808	Mean dependent var	0.005453
Adjusted R-squared	0.543845	S.D. dependent var	0.047631
S.E. of regression	0.032169	Akaike info criterion	-3.969636
Sum squared resid	0.183172	Schwarz criterion	-3.747471
Log likelihood	390.1154	F-statistic	19.77777
Durbin-Watson stat	1.547899	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 1.547899 suggests that there is autocorrelation in the model, which was dealt with in alternate specifications previous to this. An adjusted r-squared of 0.543845 suggests the model explains 54.4% of the variations. A standard error of 0.032169 suggests that 95% of predicted values are within 6.4 billion dollars of actual values.

In this model we added two variables, LNRXIR, and LNRKIR. This variables are the natural log of the ratio of residential construction expenditures and capital stock in residential over real personal disposable income. These are mean reversion variables that is that when this ratio is greater than the mean of previous ratios it will be negative, and when it is less than mean it will be positive. Normally we'd expect theses variables to both be negative but as this model shows LNRKIR(-1) is negative while LNRXIR(-1) is positive. LNRKIR(-1) is significant at the 1% level, while LNRXIR(-1) is significant at the 5% level.

The coefficient of the variable LNXPDPC(-1) show the long run income elasticity of residential construction expenditures. In the model this variable was significant at the 1% level and has been show to have a negative effect on residential construction expenditures. That is to say that in the long run as per capita real disposable income increases, the percentage of their income people spend on housing decreases.

In this model the variables DRMORT(-1), DRMORT(-2), DXPDPC, DKIR(-1), DRU, RU(-1), and RMORT(-1) are significant at the 1% level. Like expectations, the variables DRMORT(-1), DRMORT(-2), DKIR(-1), DRU, RMORT(-1) have negative effect on residential construction, while the variable DXPDPC has a positive effect. Unlike expectations, the variable RU(-1) is shown to have a positive effect on residential construction.

The variables DRFYCW(-1), DRPIR were significant at the 5% level. Like expectations, DRFYCW(-1) has a positive effect on residential construction, while the variable DRPIR has a negative effect.

Medical Service Regressions

Variables (expected sign)

RPCSM – Relative Price of Medical Services (-)
RFYCW – Real Consumer Net Worth (+)
XPOP – Population (+)
XPDPC – per capita Real Disposable Income (+)
INFL – Inflation Rate (-)
RU – Unemployment Rate (-)

We expect the variables RFYCW, XPOP and XPDPC to have a direct relationship with Medical Service consumption. If consumer net worth, and disposable income increases we expect people's ability to spend money on medical services will increase. If population increases we'd expect people's need for medical services to increase.

We expect the variables RPCSM, INFL, and RU to have an indirect relationship with medical service consumption. If the relative price of medical services increases we expect people spend more money on other goods and less on medical services. We expect inflation to have a negative effect on medical services because if the inflation rate increases peoples money is worth less and they will be less likely to spend it on medical supplies. We expect the unemployment rate to have a negative effect on medical service consumption because if more people are out of work they are less likely to spend money on medical services as the uncertainty of having a steady income increases.

Empirical results for medical services model are as follows:

Level Form

Dependent Variable: XCSM
Method: Least Squares
Date: 08/20/03 Time: 14:11
Sample(adjusted): 1954:3 2002:3
Included observations: 193 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RPCSM***	78.90337	5.099781	15.47191	0.0000
RFYCW(-1)***	75.46138	11.30840	6.673036	0.0000
XPDPC	107.5444	82.15369	1.309064	0.1921
XPDPC(-1)	113.3655	103.3611	1.096791	0.2742
XPDPC(-2)***	244.7566	82.67813	2.960355	0.0035
INFL**	0.210315	0.086849	2.421614	0.0164
RU***	1.455865	0.148506	9.803380	0.0000
C	-89.12679	4.871251	-18.29649	0.0000

R-squared	0.997413	Mean dependent var	58.56083
Adjusted R-squared	0.997315	S.D. dependent var	31.77532
S.E. of regression	1.646360	Akaike info criterion	3.875577
Sum squared resid	501.4424	Schwarz criterion	4.010818
Log likelihood	-365.9932	F-statistic	10190.82
Durbin-Watson stat	0.205592	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

In this model a Durbin-Watson statistic of 0.205592 suggests there is positive first order autocorrelation in the data. This is dealt with in alternate specifications below. An adjusted r-squared of 0.997315 suggests the model explains 99.7% of the variations. A standard error of 1.646360 suggests 95% of predicted values are within 3.2 billion dollars of the actual values.

In this model the variables RPCSM, RFYCW(-1), XPDPC(-2), and RU are significant at the 1% level. Like expectations, the variable RFYCW, and XPDPC(-2) have positive effects on medical service expenditures. Unlike expectations the variables RPCSM, and RU also have a positive effect on medical service expenditures. The variable INFL has significance at the 5% level, but unlike expectations it is shown to have a positive effect on medical service expenditures.

Though XPDPC, and XPDPC(-1) had high p-values, they were left in the equation because they have t-statistics greater than 1. Like expectations these variables are shown to have a positive effect on medical service consumption.

Level Form with Lagged Dependent Variable

Dependent Variable: XCSM
Method: Least Squares
Date: 08/20/03 Time: 14:11
Sample(adjusted): 1954:3 2002:3
Included observations: 193 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RPCSM***	78.90337	5.099781	15.47191	0.0000
RFYCW(-1)***	75.46138	11.30840	6.673036	0.0000
XPDPC	107.5444	82.15369	1.309064	0.1921
XPDPC(-1)	113.3655	103.3611	1.096791	0.2742
XPDPC(-2)***	244.7566	82.67813	2.960355	0.0035
INFL**	0.210315	0.086849	2.421614	0.0164
RU***	1.455865	0.148506	9.803380	0.0000
C	-89.12679	4.871251	-18.29649	0.0000

R-squared	0.997413	Mean dependent var	58.56083
Adjusted R-squared	0.997315	S.D. dependent var	31.77532
S.E. of regression	1.646360	Akaike info criterion	3.875577
Sum squared resid	501.4424	Schwarz criterion	4.010818
Log likelihood	-365.9932	F-statistic	10190.82
Durbin-Watson stat	0.205592	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 2.042193 suggest that there is no serial correlation in the data. An adjusted r-squared of 0.999896 suggests the model explains 99.9% of the variations. A standard error of 0.324819 suggest that 95% of predicted values are within .32 billion dollars of the actual values.

In this model all variables had significance at the 1% level. This model suggests that RFYCW(-1), and XPDPC(-2) have positive effects. Also, like the level form without a lagged dependent variable, show that RU has a positive effect on medical service expenditures, unlike expectations.

Double Log Form

Dependent Variable: LNXCSM
Method: Least Squares
Date: 08/21/03 Time: 14:09
Sample(adjusted): 1954:3 2002:3
Included observations: 193 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNXPOP***	1.578130	0.114174	13.82220	0.0000
LNXPDPC***	1.186440	0.056110	21.14499	0.0000
INFL***	0.007948	0.000999	7.954444	0.0000
RU***	0.023384	0.001512	15.46977	0.0000
C	-2.536087	0.724878	-3.498641	0.0006

R-squared	0.997875	Mean dependent var	3.891740
Adjusted R-squared	0.997830	S.D. dependent var	0.634548
S.E. of regression	0.029558	Akaike info criterion	-4.179391
Sum squared resid	0.164246	Schwarz criterion	-4.094865
Log likelihood	408.3112	F-statistic	22075.47
Durbin-Watson stat	0.274897	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 0.274897 suggests that there is serial correlation in the data, which is dealt with in alternate specifications below. An adjusted r-squared of 0.997830 suggests the model explains 99.8% of the variations. A standard error of 0.029558 suggest that 95% of predicted values are within 5.8 billion dollars of actual values.

In this model all variables have significance at the 1% level. Like the Level Form, and Level Form with the Lagged Dependent Variable, but unlike expectations, this model suggests that RU has a positive effect on medical services expenditures. Also, like the Level Form, the model suggests that INFL has a positive effect on medical services expenditures. Like expectations, LNXPOP and LNXPDPC have a positive effect on medical service consumption, according to this model.

Double Log with Lagged Dependent Variable

Dependent Variable: LNXCSM
Method: Least Squares
Date: 09/09/03 Time: 02:21
Sample(adjusted): 1952:2 2002:3
Included observations: 202 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNXCSM(-1)***	1.137596	0.069087	16.46605	0.0000
LNXCSM(-2)***	-0.192136	0.069649	-2.758625	0.0064
LNRFYCW(-1)***	0.015290	0.005320	2.874059	0.0045
LNXPOP	0.052776	0.036361	1.451468	0.1483
LNXPDPC(-2)***	0.101261	0.032372	3.128025	0.0020
RU***	0.002097	0.000705	2.974992	0.0033
C	0.151938	0.185802	0.817740	0.4145

R-squared	0.999826	Mean dependent var	3.834075
Adjusted R-squared	0.999821	S.D. dependent var	0.675527
S.E. of regression	0.009041	Akaike info criterion	-6.540002
Sum squared resid	0.015940	Schwarz criterion	-6.425359
Log likelihood	667.5402	F-statistic	186981.6
Durbin-Watson stat	1.990640	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin Watson statistic of 1.990640 suggests that there is no serial correlation in the data. An adjusted r-squared of 0.999821 suggest the model explains 99.9 percent of the variations. A standard error of 0.009041 suggests that 95% of predicted values are within 1.8 billion dollars of actual values.

In this model the variables LNRFUCW(-1), LNXPDPC(-2) and RU are significant at the 1% level. Like expectations the variables LNRFYCW(-1) and LNXPDPC(-2) have a positive effect of medical service consumption. Unlike expectations, but like previous forms, the model show that RU has a positive effect on medical service consumption. Though the variable LNXPOP had a high p-value it was left in the model because it had a t-statistic greater than one. This variable, like expectations, was shown to have a positive effect on medical service consumption.

Change Form

Dependent Variable: DXCSM

Method: Least Squares
Date: 08/21/03 Time: 14:32
Sample(adjusted): 1952:3 2002:3
Included observations: 201 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DRFYCW(-1)*	-0.056263	0.032472	-1.732655	0.0847
DRPCSM*	-0.254629	0.139595	-1.824060	0.0697
DXPOP	1.345407	0.835304	1.610679	0.1089
DXPDPC**	0.156144	0.078246	1.995565	0.0474
C	0.006965	0.002803	2.484788	0.0138

R-squared	0.046598	Mean dependent var	0.011234
Adjusted R-squared	0.027140	S.D. dependent var	0.009851
S.E. of regression	0.009716	Akaike info criterion	-6.405539
Sum squared resid	0.018502	Schwarz criterion	-6.323367
Log likelihood	648.7567	F-statistic	2.394879
Durbin-Watson stat	1.524008	Prob(F-statistic)	0.051839

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 1.524008 suggests that there is positive autocorrelation in the data, which is dealt with in alternate specifications. An adjusted r-squared of 0.027140 suggest the model explains 2.7% of the variations. A standard error of 0.009716 suggest that 95% of predicted values are within 1.9 billion dollars of actual values.

In this model the variable DXPDPC is significant at the 5% level. Like expectations, this variable is shown to have a positive effect on medical service consumption. The variables DRFYCW(-1) and DRPCSM are significant at the 10% level. Like expectations the variable DRPCSM has a negative effect on medical service expenditures, but unlike expectations the variable DRFYCW(-1) has a negative effect also.

Though the variable LNXPOP had a high p-value it was left in the model because it had a t-statistic greater than one. Like expectations this variable has a positive effect on medical service consumption.

Change Form with Lagged Dependent Variable

Dependent Variable: DXCSM
Method: Least Squares
Date: 09/09/03 Time: 12:22
Sample(adjusted): 1952:3 2002:3
Included observations: 201 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXCSM(-1)***	0.253997	0.068628	3.701091	0.0003
DRFYCW(-1)	-0.043786	0.031383	-1.395235	0.1645
DRPCSM**	-0.278355	0.136008	-2.046612	0.0420
DXPDPC	0.105942	0.076611	1.382856	0.1683
C	0.008669	0.001224	7.082632	0.0000
R-squared	0.097082	Mean dependent var		0.011234
Adjusted R-squared	0.078655	S.D. dependent var		0.009851
S.E. of regression	0.009455	Akaike info criterion		-6.459944
Sum squared resid	0.017523	Schwarz criterion		-6.377772
Log likelihood	654.2244	F-statistic		5.268466
Durbin-Watson stat	1.991539	Prob(F-statistic)		0.000474

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 1.991539 suggests there is no serial correlation in the data. An adjusted r-squared of 0.078655 suggests the model explains 7.9% of the variations. A standard error of 0.009455 suggest that 95% of predicted values are within 1.8 billion dollars of actual values.

In this model the two-quarter lagged dependent variable was insignificant, and therefore dropped. The variable DRPCSM was significant at the 5% level, and like expectations it was shown to have a negative effect on medical service consumption. Though the variables DRFYCW(-1) and DXPDPC had high p-values they were left in the equation because they had t-statistics greater than one. Like the change form without a lagged dependent variable, DRFYCW is shown to have a negative effect on medical services, despite expectations. Like expectations DXPDPC has a positive effect on medical service consumption.

Error Correction Model

Dependent Variable: DXCSM
Method: Least Squares
Date: 08/27/03 Time: 14:24
Sample(adjusted): 1952:3 2002:3
Included observations: 201 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXCSM(-1)***	0.204425	0.068968	2.964061	0.0034
DRFYCW(-1)	-0.042998	0.035581	-1.208450	0.2284
DRPCSM	-0.211692	0.139272	-1.519992	0.1302
DXPOP	-1.686189	1.139284	-1.480042	0.1405
DXPDPC	0.104768	0.074625	1.403927	0.1620
DXPDPC(-1)	-0.082610	0.079342	-1.041186	0.2991
LNRXCSM(-1)***	-0.076147	0.022809	-3.338458	0.0010
RU(-1)***	0.001769	0.000666	2.655812	0.0086
INFL(-1)	0.000538	0.000424	1.269999	0.2056
LNXPOP(-1)**	0.053738	0.022467	2.391875	0.0177
C	-0.258039	0.116849	-2.208310	0.0284

R-squared	0.205930	Mean dependent var	0.011234
Adjusted R-squared	0.164137	S.D. dependent var	0.009851
S.E. of regression	0.009006	Akaike info criterion	-6.528703
Sum squared resid	0.015410	Schwarz criterion	-6.347925
Log likelihood	667.1347	F-statistic	4.927367
Durbin-Watson stat	1.976498	Prob(F-statistic)	0.000002

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 1.976498 suggest that there is no serial correlation in the model. An adjusted r-squared of 0.164137 suggest the model explains 16.4 percent of the variations. A standard error of 0.009006 suggest that 95% of the predicted values are with in 1.8 billion dollars of the actual values.

Two quarter lagged dependent variable become highly insignificant and is dropped from the equation. The variables LNRXCSM(-1), and RU(-1) are significant at the 1% level. Like expectations the variable LNRXCSM(-1) has a negative effect. Unlike expectations the variable RU(-1) has a positive effect. The variable LNXPOP(-1) was significant at the 5% level. Like expectations it has a positive effect on medical services. Though the variables DRFYCW(-1),

DRPCSM, DXPOP, DXPDPC, DXPDPC(-1), and INFL(-1) had high p-values they were left in the model because they had t-statistics greater than one. Like expectations the variable DXPDPC was shown to have a positive effect, while RPCSM was shown to have a negative effect. Unlike expectations the variables DRFYCW(-1), DXPOP, DXPDPC(-1) were shown to have a negative effect, while the variable INFL(-1) was shown to have a positive effect.

Consumption of Motor Vehicles

Variables (Expected Sign)

KCDV – Capital Stock in Motor Vehicle consumption (-)
RPCDV- Relative Price of Motor Vehicles (-)
RFYCW – Real Consumer Net Worth (+)
RU - Unemployment Rate (-)
XPOP – Population (+)
XPDPC – per capita Real Disposable Income (+)
PCNG – Gasoline Price (-)
INFL – Inflation (-)

We expect the variables RFYCW, XPOP, XPDPC, to have a direct relationship with the consumption of motor vehicles. If consumer net worth, and disposable income increase the ability of consumer to spend on motor vehicles increases, thus they will spend more on motor vehicles. We expect that an increase in population, will increase the need for more vehicles thus increasing consumption.

We expect the variables KCDV, RPCDV, RU, PCNG, and INFL to all have an indirect relationship with the consumption of motor vehicles. If the relative price of motor vehicles were to increase we'd expect people to spend less money on motor vehicles and more money on other goods. With an increase in the unemployment rate we'd expect people to be less likely to spend there money on a new car as they don't have a regular income. If the price of gasoline rises, the cost to maintain a motor vehicle rises thus causing a decrease in the consumption of motor vehicles. We expect inflation to have a negative effect on the consumption of motor vehicles, because an increase in inflation means people's money is worth less thus they will spend money less of it on motor vehicles. Also, and increase in capital stock of motor vehicles will have a negative effect because the more stock of motor vehicles there is the less new cars are needed.

Empirical results for consumption of motor vehicles model are as follows:

Level Form

Dependent Variable: XCDV
Method: Least Squares
Date: 09/02/03 Time: 01:38
Sample(adjusted): 1952:2 2002:3
Included observations: 202 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
KCDV(-1)***	-0.059032	0.017244	-3.423346	0.0008
RPCDV***	54.71981	13.25482	4.128294	0.0001
RFYCW(-1)***	239.1360	39.23718	6.094628	0.0000
RU***	1.544668	0.495340	3.118402	0.0021
XPOP***	-0.946003	0.119487	-7.917225	0.0000
XPDPC***	1375.864	270.8316	5.080147	0.0000
XPDPC(-1)***	876.6859	298.0670	2.941238	0.0037
PCNG	-0.047152	0.034170	-1.379925	0.1692
INFL***	-0.688351	0.209571	-3.284576	0.0012
C	-146.2418	23.91495	-6.115079	0.0000

R-squared	0.977829	Mean dependent var	64.40005
Adjusted R-squared	0.976790	S.D. dependent var	35.21766
S.E. of regression	5.365384	Akaike info criterion	6.246050
Sum squared resid	5527.170	Schwarz criterion	6.409826
Log likelihood	-620.8511	F-statistic	940.8836
Durbin-Watson stat	0.794546	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 0.794546 suggest there is positive first order serial correlation in the model which is dealt with in alternate specifications below. An adjusted r-squared of 0.976790 suggests the model explains 97.7% of the variations. A standard error of 5.365384 suggest that 95% of the predicted values are within 10.7 billion dollars of the actual values.

The variables KCDV(-1), RPCDV, RFYCW(-1), RU, XPOP, XPDPC, XPDPC(-1), and INFL are significant at the 1% level. Like expectations the variable RFYCW(-1), XPDPC, and XPDPC(-1) are shown to have a positive effect on motor vehicle consumption, while the variables KCDV(-1) and INFL have a negative effect. Unlike expectations the variable XPOP was shown to

have a negative effect on motor vehicle consumption, while RPCDV and RU were shown to have a positive effect.

Level Form with Lagged Dependent Variable

Dependent Variable: DXCSM
Method: Least Squares
Date: 08/27/03 Time: 14:24
Sample(adjusted): 1952:3 2002:3
Included observations: 201 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXCSM(-1)***	0.204425	0.068968	2.964061	0.0034
DRFYCW(-1)	-0.042998	0.035581	-1.208450	0.2284
DRPCSM	-0.211692	0.139272	-1.519992	0.1302
DXPOP	-1.686189	1.139284	-1.480042	0.1405
DXPDPC	0.104768	0.074625	1.403927	0.1620
DXPDPC(-1)	-0.082610	0.079342	-1.041186	0.2991
LNRXCSM(-1)***	-0.076147	0.022809	-3.338458	0.0010
RU(-1)***	0.001769	0.000666	2.655812	0.0086
INFL(-1)	0.000538	0.000424	1.269999	0.2056
LNXPOP(-1)**	0.053738	0.022467	2.391875	0.0177
C	-0.258039	0.116849	-2.208310	0.0284

R-squared	0.205930	Mean dependent var	0.011234
Adjusted R-squared	0.164137	S.D. dependent var	0.009851
S.E. of regression	0.009006	Akaike info criterion	-6.528703
Sum squared resid	0.015410	Schwarz criterion	-6.347925
Log likelihood	667.1347	F-statistic	4.927367
Durbin-Watson stat	1.976498	Prob(F-statistic)	0.000002

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 2.086199 suggest there is no serial correlation in the model. An adjusted r-squared of 0.988436 suggests the model explains 98.8% of the variations. A standard error of 3.787108 suggests that 95% of predicted values are within 7.5 billion dollars of the actual values.

In the model the variables KCDV(-1) and INFL were significant at the 1% level. Like expectations these variables are shown to have a negative effect on motor vehicle consumption. The variables RFYCW(-1) and XPOP were significant at the 5% level. Like expectations the variable RFYCW(-1) was shown to have a positive effect on the consumption of motor vehicles, but unlike expectations XPOP was shown to have negative effect. The variables RU, XPDPC,

and XPDPC(-1) were significant at the 10% level. Like expectations XPDPC and XPDPC(-1) were shown to have a positive effect on the consumption of motor vehicles. Unlike expectations the variable RU was shown to have a positive effect as well. Though the variable XPDPC(-2) had a high p-value it was left in the model because it had a t-statistic greater than one. Unlike expectations this variable was shown to have a negative effect on motor vehicle consumption.

Double Log Form

Dependent Variable: LNXCDV
Method: Least Squares
Date: 09/02/03 Time: 01:49
Sample(adjusted): 1952:2 2002:3
Included observations: 202 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFL***	-0.015139	0.003046	-4.970140	0.0000
LNRFYCW(-1)***	0.228557	0.046288	4.937664	0.0000
LNRPCDV*	0.390750	0.208698	1.872323	0.0627
LNXPDPC***	2.845088	0.657849	4.324835	0.0000
LNXPDPC(-1)**	2.011431	0.903803	2.225520	0.0272
LNXPDPC(-2)**	-1.651215	0.668638	-2.469520	0.0144
LNXPOP***	-1.667360	0.328767	-5.071550	0.0000
C	19.66360	2.209078	8.901273	0.0000

R-squared	0.982363	Mean dependent var	3.996494
Adjusted R-squared	0.981727	S.D. dependent var	0.607627
S.E. of regression	0.082138	Akaike info criterion	-2.122041
Sum squared resid	1.308840	Schwarz criterion	-1.991021
Log likelihood	222.3262	F-statistic	1543.687
Durbin-Watson stat	0.841175	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 0.841175 suggests that there is positive first order autocorrelation in the model, which is dealt with in alternate specifications below. An adjusted r-squared of 0.981727 suggests the model explains 98.2% of the variations. A standard error of 0.082138 suggest that 95% of predicted values are within 16.4 billion dollars of the actual values.

The variables INFL, LNRFYCW(-1), LNXPDPC, LNXPOP are significant at the 1% level in this model. Like expectations the variables LNRFYCW(-1) and LNXPDPC are shown to have a positive effect on motor vehicle consumption, while INFL is shown to have a negative effect. Unlike expectations LNXPOP is shown to have a negative effect on motor vehicle consumption in this model.

The variables LNXPDPC(-1), and LNXPDPC(-2) are significant at the 5% level in this model. Like expectations LNXPDPC(-1) is shown to have a positive effect on motor vehicle consumption, but unlike what we'd expect, LNXPDPC(-2) is shown to have a negative effect. The variable LNRPCDV is significant at the 10% level in this model, but unlike expectations it is shown to have a positive effect on motor vehicle consumption.

Double Log Form with Lagged Dependent Variable

Dependent Variable: LNXCDV
Method: Least Squares
Date: 09/02/03 Time: 01:57
Sample(adjusted): 1947:3 2002:3
Included observations: 221 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNXCDV(-1)***	0.669022	0.067429	9.921863	0.0000
LNXCDV(-2)	0.091373	0.066362	1.376898	0.1700
INFL**	-0.004084	0.001714	-2.382577	0.0181
LNXPDPC***	1.661622	0.343840	4.832540	0.0000
LNXPDPC(-2)***	-1.226934	0.328143	-3.739026	0.0002
C	1.806894	0.341753	5.287141	0.0000

R-squared	0.990205	Mean dependent var	3.892756
Adjusted R-squared	0.989977	S.D. dependent var	0.675595
S.E. of regression	0.067636	Akaike info criterion	-2.522567
Sum squared resid	0.983557	Schwarz criterion	-2.430309
Log likelihood	284.7436	F-statistic	4346.998
Durbin-Watson stat	2.068305	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 2.068305 suggest there is no serial correlation in the model. An adjusted r-squared of 0.989977 suggests the model explains 98.9 percent of the variations. A standard error of 0.067636 suggests that 95% of the predicted values are within 13.4 billion dollars of the actual values.

In this model the variables LNXPDPC, and LNXPDPC(-2) are significant at eh 1% level. Like expectations LNXPDPC is shown to have a positive effect on motor vehicle consumption. Unlike expectations but like previous models LNXPDPC(-2) is shown to have a negative effect on motor vehicle consumption. The variable INFL is significant at the 5% level, and like expectations has a negative effect on motor vehicle consumption.

Change Form

Dependent Variable: DXCDV
Method: Least Squares
Date: 09/09/03 Time: 23:57
Sample(adjusted): 1948:1 2002:3
Included observations: 219 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DKCDV(-1)**	-0.528569	0.257855	-2.049868	0.0416
DRPCDV**	-0.981611	0.408576	-2.402518	0.0171
DRU*	-0.123599	0.072740	-1.699196	0.0907
DXPDPC**	1.152363	0.517396	2.227235	0.0270
DXPDPC(-1)	0.590573	0.492273	1.199685	0.2316
DXPDPC(-2)*	0.934009	0.474292	1.969268	0.0502
C	0.003313	0.007453	0.444489	0.6571

R-squared	0.113643	Mean dependent var	0.011641
Adjusted R-squared	0.088557	S.D. dependent var	0.074602
S.E. of regression	0.071222	Akaike info criterion	-2.414582
Sum squared resid	1.075393	Schwarz criterion	-2.306255
Log likelihood	271.3967	F-statistic	4.530206
Durbin-Watson stat	2.220564	Prob(F-statistic)	0.000241

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 2.220564 suggests there is no serial correlation in the model. An adjusted r-squared of 0.088557 suggests the model explains 8.9% of the variations. A standard error of 0.071222 suggests that 95% of predicted values are within 14.2 billion dollars of the actual values.

In this model the variables DKCDV(-1), DRPCDV, DXPDPC are significant at the 5% level. Like expectations the variables DKCDV(-1), and DRPCDV have a negative effect on motor vehicle consumption, while the variable DXPDPC has a positive effect. The variables DRU and DXPDPC(-2) are significant at the 10% level. Like expectations DRU has a negative effect on motor vehicle consumption, and DXPDPC(-2) has a positive effect. Though the variable DXPDPC(-1) had a high p-value it was left in the model because it had a t-statistic greater than

one. This variable, like expectations, was shown to have a positive effect on motor vehicle consumption.

Change Form with Lagged Dependent Variable

Dependent Variable: DXCDV
Method: Least Squares
Date: 09/10/03 Time: 03:36
Sample(adjusted): 1948:1 2002:3
Included observations: 219 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXCDV(-1)**	-0.152652	0.071128	-2.146154	0.0330
DKCDV(-1)	-0.307897	0.273429	-1.126055	0.2614
DRPCDV**	-1.001955	0.412515	-2.428896	0.0160
DRU*	-0.131301	0.071923	-1.825573	0.0693
DXPDPC**	1.108616	0.515003	2.152638	0.0325
DXPDPC(-1)	0.721119	0.489699	1.472576	0.1424
DXPDPC(-2)**	0.994256	0.468958	2.120140	0.0352
DPCNG*	-0.204594	0.113985	-1.794916	0.0741
C	0.002584	0.007515	0.343765	0.7314
R-squared	0.143575	Mean dependent var		0.011641
Adjusted R-squared	0.110949	S.D. dependent var		0.074602
S.E. of regression	0.070342	Akaike info criterion		-2.430670
Sum squared resid	1.039077	Schwarz criterion		-2.291393
Log likelihood	275.1584	F-statistic		4.400671
Durbin-Watson stat	1.995393	Prob(F-statistic)		0.000061

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 1.995393 suggests there is no serial correlation in the model. An adjusted r-squared of 0.110949 suggests the model explains 11% of the variations. A standard error of 0.070342 suggests that 95% of predicted values are within 14 billion dollars of the actual values.

In this model DXCDV(-2) was insignificant, thus was dropped. The variables DRPCDV, DXPDPC, and DXPDPC(-2) were significant at the 5% level. Like expectations DRPCDV was shown to have a negative effect on motor vehicle consumption, while DXPDPC and DXPDPC(-2) were shown to have a negative effect. The variable DPCNG was significant at the 10% level and like expectations was shown to have a negative effect on motor vehicle consumption. Thought

the variables DKCDV(-1) and DXPDPC(-1) had high p-values they were left in the model because they have t-statistics greater than one. Like expectations, DKCDV(-1) was shown to have a negative effect on motor vehicle consumption, while DXPDPC(-1) was shown to have a positive effect.

Error Correction Model

Dependent Variable: DXCDV
Method: Least Squares
Date: 09/10/03 Time: 13:59
Sample(adjusted): 1948:1 2002:3
Included observations: 219 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXCDV(-1)	-0.089154	0.063014	-1.414822	0.1586
DRU**	-0.139096	0.065411	-2.126500	0.0346
DRPCDV***	-1.286735	0.375839	-3.423634	0.0007
DXPDPC**	1.133185	0.466372	2.429788	0.0160
DXPDPC(-1)	0.693403	0.455348	1.522799	0.1293
DXPDPC(-2)***	1.321515	0.431261	3.064307	0.0025
DXPOP**	-17.14129	7.307005	-2.345871	0.0199
LNRXCDV(-1)***	-0.285252	0.043287	-6.589824	0.0000
LNRPCDV(-1)***	-0.136074	0.044729	-3.042161	0.0027
INFL(-1)***	-0.005658	0.001785	-3.170310	0.0018
C	0.237955	0.039523	6.020692	0.0000

R-squared	0.305091	Mean dependent var	0.011641
Adjusted R-squared	0.271682	S.D. dependent var	0.074602
S.E. of regression	0.063667	Akaike info criterion	-2.621391
Sum squared resid	0.843114	Schwarz criterion	-2.451164
Log likelihood	298.0423	F-statistic	9.131973
Durbin-Watson stat	2.067012	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 2.067012 suggests that there is no serial correlation in the model. An adjusted r-squared of 0.271682 suggest the model explains 27.2% of the variations. A standard error of 0.063667 suggests that 95% of the predicted values are within 12.6 billion dollars of the actual values.

In this model the variables DRPCDV, DXPDPC(-2), LNRXCDV(-1), LNRPCDV(-1), and INFL(-1) are significant at the 1% level. Like expectations the variables DRPCDV, LNRXCDV(-1) and LNRPCDV(-1) have a negative effect while DXPDPC(-2) has a positive effect. The variables

DRU, DXPDPC, and DXPOP were significant at the 5% level. Like expectations the variable DRU has a negative effect on motor vehicle consumption while DXPDPC has a positive. Unlike expectations though, DXPOP is shown to have a negative effect on motor vehicle consumption. Though the variable DXPDPC(-1) has a high p-value it was left in the model because it had a t-statistic greater than one. Like expectations it was shown to have a positive effect on motor vehicle consumption.

Motor Vehicles Investment

Variables (Expected Sign)

KIEV – Capital Stock in Motor Vehicle Investment (+)
RFF – Federal Funds Rate (-)
RPIEV – Relative Price (-)
RFYCW – Real Consumer Net Worth (+)
INFL – Inflation (-)
RU – Unemployment Rate (-)
XPOP – Population (+)
XPDPC – per capita Real Disposable Income
PCNG – Gasoline Prices (-)

We expect the variables RFYCW, XPOP, and XPDPC to have a direct relationship with motor vehicle investment. We'd expect an increase in consumer net worth and disposable income to cause motor vehicle investment spending to increase as these give people a greater ability to buy. We expect and increase in population to cause a greater need for motor vehicles and thus an increase in motor vehicle investment spending.

In this model we use the Federal Funds Rate as the interest rate at which firms borrow to invest in motor vehicles. We expect the federal funds rate to have a negative effect on motor vehicle investment because as the federal funds rate increases the cost to borrow money increases making firms decrease the amount of money they borrow to invest in motor vehicles.

Also we expect the variables KIEV, RPIEV, INFL, RU, and PCNG to be indirectly related to motor vehicle investment. An increase in the relative price would cause people to invest less money on motor vehicles and more on other goods. An increase in gasoline prices would increase the cost of maintaining motor vehicles and thus decrease investment in motor vehicles. An increase in the unemployment rate will cause people to be less likely to invest in motor

vehicles, as they can't maintain a regular income. Also an increase in capital stock will decrease the need for new motor vehicles.

Empirical results for motor vehicle investment are as follows:

Level Form

Dependent Variable: XIEV
Method: Least Squares
Date: 09/01/03 Time: 21:34
Sample(adjusted): 1967:2 2002:3
Included observations: 142 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
KIEV(-1)***	0.220467	0.024303	9.071513	0.0000
RPIEV***	-98.26850	22.91885	-4.287672	0.0000
RFYCW(-1)***	-582.5948	62.48716	-9.323431	0.0000
INFL	-0.431967	0.309729	-1.394662	0.1655
RU***	-7.825363	0.706940	-11.06935	0.0000
XPOP***	1.155035	0.211095	5.471638	0.0000
XPDPC(-1)*	-590.3966	321.5834	-1.835905	0.0686
XPDPC(-2)***	-1148.088	301.1760	-3.812019	0.0002
PCNG***	-0.232231	0.046251	-5.021067	0.0000
C	258.7727	64.77978	3.994652	0.0001

R-squared	0.959878	Mean dependent var	62.72585
Adjusted R-squared	0.957143	S.D. dependent var	28.67069
S.E. of regression	5.935402	Akaike info criterion	6.467567
Sum squared resid	4650.228	Schwarz criterion	6.675723
Log likelihood	-449.1972	F-statistic	350.8882
Durbin-Watson stat	0.536167	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 0.536167 suggests there is positive first order autocorrelation in the model, which is dealt with in alternate specifications below. An adjusted r-squared of 0.957143 suggests the model explains 95.7% of the variations. A standard error of 5.935402 suggests that 95% of predicted values are within 12 billion dollars of the actual values.

In this model the variables KIEV(-1), RPIEV, RFYCW(-1), RU, XPOP, XPDPC(-2) and PCNG are significant at the 1% level. Like expectations the variables RPIEV, RU, and PCNG have a negative effect on motor vehicle investment, while XPOP has a positive effect. Unlike expectations the variables RFYCW(-1) and XPDPC(-2) were shown to have a negative effect, while KIEV(-1) has a positive effect. The variable XPDPC(-1) is significant at the 10% level and unlike expectations is shown to have a negative effect on motor vehicle investment. Though the

variable INFL had a high p-value it was left in the equation because it had a t-statistic greater then one, and like expectations was shown to have a negative effect on inflation.

Level Form with Lagged Dependent Variable

Dependent Variable: XIEV
Method: Least Squares
Date: 09/01/03 Time: 21:40
Sample(adjusted): 1967:3 2002:3
Included observations: 141 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
XIEV(-1)***	0.667735	0.084278	7.923035	0.0000
XIEV(-2)**	0.190181	0.080341	2.367165	0.0194
RFF*	-0.281587	0.161130	-1.747579	0.0829
RPIEV***	-33.25506	12.59950	-2.639396	0.0093
RFYCW(-1)***	-149.4745	29.96871	-4.987687	0.0000
RU***	-1.907522	0.437396	-4.361092	0.0000
XPOP***	0.592551	0.123268	4.806995	0.0000
XPDPC(-2)***	-589.6673	95.76529	-6.157422	0.0000
PCNG	-0.041625	0.036078	-1.153748	0.2507
C	37.72227	30.12237	1.252301	0.2127

R-squared	0.987069	Mean dependent var	62.99369
Adjusted R-squared	0.986180	S.D. dependent var	28.59406
S.E. of regression	3.361420	Akaike info criterion	5.330885
Sum squared resid	1480.188	Schwarz criterion	5.540017
Log likelihood	-365.8274	F-statistic	1111.064
Durbin-Watson stat	1.976239	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 1.976239 suggests there is no serial correlation in the model. An adjusted r-squared of 0.986180 suggest the model explains 98.6% of the variations. A standard error of 3.361420 suggest that 95% of the predicted values are within 6.7 billion dollars of the actual values.

In this model the variables RPIEV, RFYCW(-1), RU, XPOP, and XPDPC(-2) were significant at the 1% level. Like expectations the variables RPIEV, RU were shown to have a negative effect on motor vehicle investment while the variable XPOP was shown to have a positive effect. Unlike expectations the variables RFYVW(-1), and XPDPC(-2) were shown to have a negative effect.

Meanwhile, the variable RFF was significant at the 10% level, and like expectations was shown to have a negative effect. Though the variable PCNG had a high p-value it was left in the model because it had a t-statistic greater than one.

In this functional form the variables RFF, RPIEV, RU, and PCNG have negative effect on motor vehicle investment, while the variable XPOP has a positive effect. Unlike expectations the variables RFYCW(-1), and XPDPC(-2) have negative effect on motor vehicle investment. Although PCNG had a high p-value it was left in the model because it had a t-statistic greater than one.

Double Log Form

Dependent Variable: LNXIEV
Method: Least Squares
Date: 09/01/03 Time: 22:04
Sample(adjusted): 1967:2 2002:3
Included observations: 142 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RU***	-0.069719	0.011372	-6.130937	0.0000
LNKIEV(-1)***	1.467065	0.197937	7.411775	0.0000
LNRFYCW(-1)***	-0.841158	0.183206	-4.591325	0.0000
LNPCNG***	-0.352273	0.078992	-4.459588	0.0000
LNRPIEV**	-0.976898	0.475094	-2.056218	0.0417
LNXPDPC*	1.485436	0.812573	1.828064	0.0698
LNXPDPC(-2)***	-3.641716	0.791367	-4.601803	0.0000
LNXPOP	-1.296412	0.849275	-1.526493	0.1293
C	-0.870832	4.117854	-0.211477	0.8328

R-squared	0.941184	Mean dependent var	4.041349
Adjusted R-squared	0.937646	S.D. dependent var	0.439961
S.E. of regression	0.109861	Akaike info criterion	-1.517915
Sum squared resid	1.605241	Schwarz criterion	-1.330574
Log likelihood	116.7720	F-statistic	266.0373
Durbin-Watson stat	0.486834	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 0.486834 suggests that there is positive first order serial correlation in the model. This is dealt with in alternate specifications. An adjusted r-squared of 0.937646 suggests that the model explains 93.8% of the variations. A standard error of 0.109861 suggests that 95% of predicted values are within 20 billion dollars of the actual values.

In this model the variables RU, LNKIEV(-1), LNRFYCW(-1), LNPCNG, and LNXPDPC(-2) were significant at the 1% level. Like expectations the variables RU and LNPCNG were shown to have a negative effect on motor vehicle investment. Unlike expectations LNRFYCW(-1) and LNXPDPC(-2) were shown to have a negative effect on motor vehicle investment, while LNKIEV(-1) was shown to have a positive effect. The variable LNRPIEV has significance at the 5% level, and like expectations it has a negative effect on motor vehicle investment. The variable LNXPDPC has significance at the 10% level and is shown to have a positive effect on motor vehicle investment. Though XPOP had a high p-value, it was left in the model because it had a t-statistic greater than one, but unlike expectations it was shown to have a negative effect.

Double Log Form with Lagged Dependent Variable

Dependent Variable: LNXIEV
Method: Least Squares
Date: 09/01/03 Time: 22:11
Sample(adjusted): 1967:3 2002:3
Included observations: 141 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNXIEV(-1)***	0.778350	0.083596	9.310864	0.0000
LNXIEV(-2)	0.108941	0.084704	1.286134	0.2006
RFF**	-0.005234	0.002112	-2.478397	0.0145
RU	-0.009044	0.005978	-1.512770	0.1327
LNRFYCW(-1)**	-0.134147	0.065466	-2.049111	0.0424
LNXPDPC***	1.380537	0.454882	3.034935	0.0029
LNXPDPC(-2)***	-1.814625	0.461023	-3.936087	0.0001
LNXPOP*	0.649440	0.366349	1.772735	0.0786
C	-4.113722	2.318453	-1.774339	0.0783

R-squared	0.979813	Mean dependent var	4.047194
Adjusted R-squared	0.978589	S.D. dependent var	0.435962
S.E. of regression	0.063792	Akaike info criterion	-2.604687
Sum squared resid	0.537157	Schwarz criterion	-2.416469
Log likelihood	192.6305	F-statistic	800.8491
Durbin-Watson stat	2.057432	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 2.057432 suggests there is no serial correlation in the model. An adjusted r-squared of 0.978589 suggests the model explains 97.8% of the variations. A standard error of 0.063792 suggests that 95% of the predicted values are within 12.6 billion dollars of the actual values.

In this model the variables LNXPDPC, and LNXPDPC(-2) were significant at the 1% level. Like expectations the variable LNXPDPC had a positive effect on motor vehicle investment, but unlike expectations and like previous models the variable LNXPDPC(-2) has a negative effect. The variables RFF and LNRFYCW(-1) were significant at the 5% level. Like expectations RFF has a negative effect on motor vehicle investment. Unlike expectations but like previous models LNRFYCW(-1) is shown to have a negative effect. The variable LNXPOP was significant at the 10% level, and like expectations it is shown to have a positive effect on motor vehicle investment. Though the variable RU had a high p-value it was left in the model because it had a t-statistic greater than one. Like expectations the model shows that RU has a negative effect on motor vehicle investment.

Change Form

Dependent Variable: DXIEV
Method: Least Squares
Date: 09/02/03 Time: 01:18
Sample(adjusted): 1967:3 2002:3
Included observations: 141 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DKIEV(-1)*	-0.968039	0.525491	-1.842160	0.0676
DRPIEV***	-1.582135	0.556550	-2.842758	0.0052
DRU***	-0.538622	0.101327	-5.315682	0.0000
DXPDPC**	1.060801	0.548132	1.935303	0.0550
C	0.014140	0.008919	1.585451	0.1152

R-squared	0.262354	Mean dependent var	0.010328
Adjusted R-squared	0.240659	S.D. dependent var	0.069903
S.E. of regression	0.060913	Akaike info criterion	-2.723913
Sum squared resid	0.504618	Schwarz criterion	-2.619347
Log likelihood	197.0359	F-statistic	12.09257
Durbin-Watson stat	2.398870	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 2.398870 suggests there is no serial correlation in the model. An adjusted r-squared of 0.240659 suggests the model explains 24% of the variations. A standard error of 0.060913 suggests 95% of predicted values are within 12 billion of actual values.

In this model the variables DRPIEV, DRU, and DXPDPC are significant at the 1% level. Like expectations DRPIEV, and DRU have a negative effect on motor vehicle investment, while DXPDPC has a positive effect. The variable DKIEV(-1) is significant at the 10% level and like expectations has a negative effect on motor vehicle investment.

Change Form with Lagged Dependent Variable

Dependent Variable: DXIEV
Method: Least Squares
Date: 09/10/03 Time: 15:35
Sample(adjusted): 1967:4 2002:3
Included observations: 140 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXIEV(-2)	0.127878	0.080293	1.592635	0.1136
DKIEV(-1)**	-1.206269	0.558865	-2.158426	0.0327
DRPIEV***	-1.697876	0.588716	-2.884031	0.0046
DRU***	-0.515253	0.102249	-5.039186	0.0000
DXPDPC*	0.929860	0.555376	1.674289	0.0964
DPCNG	-0.107201	0.105090	-1.020087	0.3095
C	0.017220	0.009098	1.892717	0.0606

R-squared	0.280714	Mean dependent var	0.010279
Adjusted R-squared	0.248265	S.D. dependent var	0.070151
S.E. of regression	0.060823	Akaike info criterion	-2.712990
Sum squared resid	0.492026	Schwarz criterion	-2.565908
Log likelihood	196.9093	F-statistic	8.650925
Durbin-Watson stat	2.370842	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 2.370842 suggests there is no serial correlation in the model. An adjusted r-squared of 0.248265 suggests the model explains 24.8% of the variations. A standard error of 0.060823 suggests that 95% of predicted values are within 12 billion dollars of actual values.

In this functional form the one-quarter lagged dependent variable is insignificant and dropped from the equation. Though DPCNG had a high p-value, it was left in the equation because it had a t-statistic greater than one. Like expectations this variable is shown to have a negative effect on motor vehicle investment. The variables DRPIEV and DRU were significant at the 1% level, both of these were shown to have a negative effect on motor vehicle investment.

The variable DKIEV(-1) was significant at the 5% level, and like expectations, was shown to have a negative effect on motor vehicle investment. The variable DXPDPC was significant at the 10% level and was shown to have a positive effect.

Error Correction Model

Dependent Variable: DXIEV
Method: Least Squares
Date: 09/12/03 Time: 15:06
Sample(adjusted): 1967:3 2002:3
Included observations: 141 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DXIEV(-1)**	-0.206654	0.084794	-2.437123	0.0162
DKIEV(-1)**	3.960795	1.833041	2.160778	0.0326
DRFF	0.063879	0.047798	1.336436	0.1838
DRPIEV***	-1.615120	0.563012	-2.868712	0.0048
DRU***	-0.505197	0.108254	-4.666784	0.0000
DXPDPC	0.659872	0.566549	1.164722	0.2463
LNRXIEV(-1)***	-0.373669	0.130033	-2.873647	0.0047
DRKIEV(-1)*	0.246812	0.143362	1.721591	0.0875
LNXPDPC(-1)*	-0.213361	0.120405	-1.772033	0.0787
LNRPIEV(-1)	-0.346004	0.221788	-1.560068	0.1212
INFL(-1)*	-0.005196	0.002960	-1.755289	0.0816
C	-0.683257	0.375377	-1.820187	0.0710

R-squared	0.364617	Mean dependent var	0.010328
Adjusted R-squared	0.310438	S.D. dependent var	0.069903
S.E. of regression	0.058047	Akaike info criterion	-2.773859
Sum squared resid	0.434661	Schwarz criterion	-2.522901
Log likelihood	207.5571	F-statistic	6.729754
Durbin-Watson stat	2.265883	Prob(F-statistic)	0.000000

* Significant at 1% level
** Significant at 5% level
*** Significant at 10% level

A Durbin-Watson statistic of 2.265883 suggests there is no serial correlation in the data. An adjusted r-squared of 0.310438 suggests the model explains 31% of the variations. A standard error of 0.058047 suggests that 95% of predicted values were within 10 billion dollars of the actual values.

The two quarter lagged dependent variable was insignificant and thus dropped from the model. The variables DRPIEV and LNRXIEV(-1) were significant at the 1% level, both of these like expectations, have negative effect on motor vehicle investment. The variables DKIEV was

significant at the 5% level, but, unlike expectations, was shown to have a positive effect on motor vehicle investment. The variables DRKIEV(-1), LNXPDPC(-1), and INFL(-1) were significant at the 10% level. Like expectations the variables INFL(-1) was shown to have a negative effect. Unlike expectations the variable LNXPDPC(-1) has a negative coefficient which suggests in the long run a change in disposable income will lead to a decrease in motor vehicle investment. Also, the variable DRKIEV(-1) has a positive coefficient, unlike what we'd expect. Though the variables DRFF, DXPDPC, and LNRPIEV(-1) had high p-values they were left in the model because they had t-statistics greater than one. Like expectations the variable DXPDPC has a positive effect on motor vehicle investment, while LNRPIEV(-1) has a negative effect. Unlike expectations the model suggests DRFF has a positive effect on motor vehicle investment.

In these models variables such as lagged real disposable income and real consumer net worth have been shown to have a negative effect on motor vehicle investment. This may be due to people's tastes changing from leasing a car to buying a car as they have more income to spend. This model also shows that the long run income elasticity for motor vehicle investment is less than one, probably due to the previous reason.

Conclusions

In conclusion, the use of more sophisticated models tended to improve the empirical results by showing us relationships between the variables that we expected as well as improving the standard error. This can be best seen in the residential construction model. For the level and double log forms of the residential construction model, the variable relative price, which is expected to have a negative effect on residential construction, was shown to have a positive effect in these models. In the change and error correction model's, this variable was shown to have a negative effect, like we'd expect. The more sophisticate models also produced the lowest standard errors in the residential construction model.

In the final forms of these expenditures model we see some interesting results. The long run income elasticity is negative for residential construction and motor vehicle investment models. This means that if income increases it will have a negative impact on residential construction and motor vehicle investment in the future. In the motor vehicle investment model the variable

XPDPC(-2) was shown to have a negative effect, thus reinforcing our suspicion that income has a negative effect on motor vehicle investment in the long run.

Also, in the residential construction model, the mean reversion variable LNRXIR has a positive coefficient when we'd expect it to be negative. In the long run unemployment seems to have a positive effect on residential construction, this may be closely tied to the long run effect income has on residential construction.

In the medical services model, the unemployment and inflation was shown to have a positive effect in the long run. This may be explained by the thought that being unemployed causes an unusual amount of stress on the body. This may in turn lead to higher rate of illness and thus more need for medical services. In many of the medical services models, unemployment rate was shown to have a positive effect as well. The unemployment rate did something similar in the residential construction model. In other forms unemployment rate was shown to have a positive effect, until we did the model in change form when it became negative. Unemployment rate did the same thing in the medical services model, except it became insignificant in the change form, as opposed to negative.