

Napster and its Effect on Music Industry: An Empirical Analysis

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I. **Introduction**

The global economic climate has experienced drastic changes over the last two decades as a direct result of the personal computer and increased internet connectivity. This rapid advancement of technology has created new business opportunities and allowed for vast improvements in communication. Despite the multitude of positive effects being reaped from the internet, there also exist issues that have upset many people. In the mid to late 1990s the rise of the internet led to the development of peer-to-peer networks (P2P). These networks allow for increased and rapid connectivity between individuals and made the transfer of information and files as simple as clicking a button. The ability to connect so easily with masses of individuals has had its share of positive and negative effects.

One potentially negative effect in particular has led to much controversy in our society: the Recording Industry of America (RIAA), a trade group representing the music industry, has charged that P2P networks have enabled individuals to effectively steal and share music which is concomitant with decreasing CD sales. Thus the P2P networks are illegally swallowing the profits of recording artists and the music industry as a whole.

Behind this argument lies some dispute over copyright infringement upon the rights of music artists.

Proponents of these types P2P networks that facilitate music file sharing claim that the ability to download music for free has had an innocuous effect on CD and paid electronic sales. Still others claim that the availability of free music on applications such as Napster and Kazaa, among others, has actually helped the music industry by exposing individuals to artists they might not have otherwise become aware of, or allows sampling of music prior to purchase. The purpose of our research will be to attempt measure what has been contributing to the overall decline in CD sales. Furthermore, the effects of legislature enacted against illegal file sharing and the increase in access to legal digital downloads has helped curb this issue. Before constructing a model an understanding of the recorded music industry and its history, the nature and function of P2P networks, and legislation imposed to protect intellectual property must be established.

II. A Brief History of The Recorded Music Industry

The recorded music industry consists of several groups who are involved in the creation, recording, and distribution of music. The 1800s saw the music industry being dominated by live music or the sale of sheet music. The creation of the phonograph marked the establishment of a new market: recorded music, which currently dominates the industry in this day and age. The industry saw many changes throughout time generally a result of technological innovation. Some of the groups involved in this industry include musicians, producers, A&R agents, publishers, labels, and retail music stores. This discussion will involve, principally, record companies or labels.

For most of the later part of the 20th and into the 21st century the music industry was composed primarily, on the supply side, of two major groups. These groups are major record labels which are dominated by the “big four” record groups SonyBMG, EMI, Universal, and Warner. The other group is comprised of smaller independent labels producing and distributing music on a smaller scale. These two groups spent a long period of time at odds with one another, but each played an integral role in the industry’s development and expansion. Independent labels boasted of the ability to stay true to music, serve artist interests, and not be part of the corporate “sell out” or major labels. They were able to spend time breaking new artists and genres creating and feeding expanding demand for music. Major labels were able to amass large quantities of capital that allowed them to finance the recording process and expand to have global distribution chains that served to feed global demand for recorded music. Furthermore, labels are supposed to protect the intellectual property of their clients, preventing piracy and unlicensed distribution. The 1980s led to most independent labels using major labels for their distribution and therefore, independent labels came to serve the interests of major labels (Throsby 2002).

P2P file sharing did not mark the first threat to the rights and profits of the music industry and the artists they represent. The ability to copy tapes, burn CDs, or purchase pirated music from street vendors has long plagued the music industry. However, the burning of CDs and copying of tapes took place on a relatively small scale in comparison to the online sharing. The online climate of sharing allowed for people all over the world access to a person’s music library, where burning a CD would require one to know an

individual who has the music they want who is generally in very close geographical proximity (Harrower 2005).

The digital revolution of the world and, consequently, music, appeared to happen very quickly. However, the music industry's infrastructure and legislation protecting the rights of artists in the music industry lagged far behind the innovational changes taking place in the marketplace. Before record companies could begin to put into place online marketplaces, others were already creating their own P2P software to share music free of charge.

Another issue needs to be considered here is the P2P Network. The development of P2P networks has changed the climate of the internet and has led to some excellent innovations. However, these P2P networks have also enabled online communities to connect and illegally share copyrighted music without any payment to artists. In order to understand the effects these P2P networks potentially have on the music industry, it is important to first develop an understanding of how they function.

P2P networks are online communities that are able to connect to one another's computers to search, share, and download files from computers. These P2P networks capabilities are not limited to music file sharing, but also movies, pictures, and computer programs. A defining characteristic separating P2P networks from more traditional networks is the lack of a central server or client servers, but rather shared peer nodes which provide the bandwidth. Most online business networks derive from a central server where a client would initiate a download and the server would react to satisfy the request. In most P2P networks the individual computers initiate downloads directly from one another usually through host software. Thus, as more users begin to use these P2P

networks their system capacity increases along with the number of files available for sharing.

P2P networks, despite the fact that they pose a threat to some industries, have been used to break new ground in innovation and assisted in the distribution of information. For example, many computer programmers will make their programs and program codes available on P2P networks for other individuals to test, adjust, and improve the programs. Furthermore, many colleges have become a part of online academic P2P networks that allow colleges and higher education institutions to legally share files. The largest of these academic P2P networks is the Penn State's LionShare. LionShare allows secure and legal file sharing of academic content. Another attractive feature of LionShare is its commitment to disclosure of the identity of sharing peers and movement away from anonymous sharing.

While P2P networks are responsible for enabling a majority of the illegal downloading that takes place, this does not make them bad. However, it is important to understand how P2P networks function and facilitate illegal file sharing (Oberholzer & Strumpf 2004).

III. Literature Review

A number of studies have attempted to analyze and assess the effects of illegal downloads on the sales of the music industry. Many of these studies have created models to support multiple arguments, while others have used less quantitative reasoning to propose their reasoning for decreasing CD sales. It is important to become familiar with these studies and use them as a guide to help build and construct an effective model to

assess digital pirating's effects on the music industry. These studies will be discussed as well as their findings and implications to the illegal downloading world.

Stan Liebowitz (2002) in a study, attempted to test "annihilation hypothesis" in the context of illegal downloads on the music industry. He used 30 years of music sales data in his effort to discover external influences on the sale of music in order to discover a link between mp3 downloads and music sales. Liebowitz identified factors that he believed might influence the sale of records. These factors include the change in income of potential users, changes in the prices of complements and substitutes, changes in musical tastes, and changes in recording formats. Liebowitz finds that the price of CDs and consumer income are not statistically significant in determining CD sales. Though the role of prices being insignificant may appear to violate the law of demand, he concludes that it is a result of no major changes in price. He goes on to use a qualitative analysis to link declining CD sales to illegal downloading, but does not provide an empirical study to support his claims. Liebowitz finds four other major decreases in sales over the last 30 years and attempts to see if the current decreases are of a similar nature. He concludes that this current decline in sales appears to be different in nature from previous declines. He then notes that there were three major technological changes that took place during the period he is analyzing (other than mp3s): vinyl, cassettes, and compact discs (Liebowitz 2002).

Later on Peitz and Patrick Waelbroeck (2003) conducted a survey of individuals in 16 countries who had downloaded music in the past. They have analyzed data from the years 2000 and 2001 when illegal downloading was becoming popular. The study looked at the 16 countries with the largest markets for recorded music. Peitz and

Waelbroeck use a cross-sectional analysis to control for differences in the countries and still attempt to tie downloading to the number of CD units sold. In this study, the dependent variables include a number factors. The first is downloads which is the percentage of adult internet users who downloaded unlicensed music files at least once. Other variables include GDP, the percentage of households with broadband connections, the number of cassette units sold divided by CD sales, and the number of CD players per household. The introduction of each variable attempts to explain potential changes and differences in CD consumption. GDP serves as a general indication of national wealth which influences consumer spending. The broadband internet connection variable attempts to capture possible substitution to online gaming or high-speed audio-streaming which become available with higher speed connection. The variable involving the sales of music cassettes divided by CD sales captures the effect of replacement of music libraries in out-dated formats that were being updated. Finally, the number of CD players available per household measures how easily consumers can copy and enjoy the downloaded music on portable media players. A regression analysis reveals that all of the tested variables were statistically significant with the exception of CD players. Despite the small number of explanatory variables the model reached an R^2 of 0.86. The study attributes 11% of current CD sale declines to illegal downloading (Waelbroeck & Peitz 2003).

Next , Felix Olberholzer and Koleman Strumpf (2004) tracked actual illegal downloading on a P2P server and attempted to link together downloaded songs and albums to the sales of these same songs and albums over seventeen weeks. The study observed 1.75 million file-downloads, or approximately ten downloads per minute. Their

original model involved sales as the dependent variable with downloads and specific album characteristics as independent variables. However, since downloads are likely to be correlated to immeasurable characteristics, such as a band's popularity, Olberholzer and Strumpf used the fixed effects model to control for such changes. The study reveals that downloading is heavily concentrated on a limited number of songs. Songs at the top of the Billboard Charts during the study were, generally, the most downloaded. However, their results find that downloads have no statistically significant effect on the purchases of the average album in the sample and could not possibly explain the drastic decreases in sales in the music industry (Olberholzer & Strumpf 2004).

Seung-Hyun Hong(2004) used the Bureau of Labor Statistic's Consumer Expenditure Survey (CEX) to link together expenditures on music and computer ownership. The CEX includes detailed information about how individuals spend their money, which includes spending on recorded music formats and this could possibly be tied to computer ownership. He uses a difference-in-differences approach. For those with internet access an increase or decrease in music expenditure could potentially be a result of trading illegal files on Napster. Hong considers the treatment group of computer owners' spending on music after the introduction of Napster and subtracts it from their spending before the existence of the file-sharing platform. He then takes the control group, those without access to internet, and compares their music expenditures before and after the introduction of Napster. He attempts to see if the access to the internet has significantly decreased expenditure on music which could mean that Napster has, in fact, illegally encroached upon the profits of record companies and artists. Hong attributes a \$3 decrease in music expenditure per household as a result of Napster's illegal

downloading platform. Furthermore, he finds that this downloading could be responsible for as much as 33% of sales decrease (Hong 2004).

Norbert Michel (2006) also performed an analysis attempting to capture the effects of illegal downloading on individual music consumption using the CEX. Michel took the survey and divided individuals into two groups: people who own computers in 2000, and those who do not own computers effectively creating a control group for spending on music, individuals without computers, and a test group of those with computers. This approach provides extremely clean data by avoiding self-selection and false reporting due to his attempt to externally link individual spending on music recordings and computer ownership. If file-sharing had no effect on music sales we could assume that there would be no significant change in the relationship between computer ownership and musical expenditures. Michel begins by performing a difference-in-differences model in order to directly measure the change in the relationship between computer ownership and household consumption of music. Michel divided the survey candidates into pools based on their spending on music (i.e. "above average", "below average"). He felt that any major impact on CD sales from file-sharing should be concentrated among more avid music consumers. Michel uses the dependent variable of a natural log of CD expenditure. The independent variables include a natural log of income, a dummy variable for computer ownership, an indicator variable for the year with all expenditures made in 2003 equal to one, and an interaction variable for computer ownership and year. He finds a significant negative relationship between the interaction variable between computer ownership and year. This indicates that the relationship between computer ownership and CD expenditures weakened from 1998 to 2003. Michel discovers a

statistically significant weakening relationship between computer ownership and music expenditures during the rise of P2P files-sharing networks, this was found to be especially true for the more avid music listener pooling. Furthermore, Michel concluded that changes of income could not be responsible for the decrease in musical expenditures for computer owners. Michel also discovers that the effect of income on CD expenditure became less strong once illegal downloading became a viable option in later years of the data. Michel concludes that illegal file-sharing may have reduced CD sales by as much as 13% (Michel 2003).

IV. Model Description and Data

In this section we describe the model we have used for discovering causes of decreasing CD sales using semi-annual time series data for the years 1990 through 2007. A number of variables were chosen as potential predictors of CD sales. They were selected based on both preexisting research on the topic as well as additional variables that seemed, intuitively, to influence the sale of CDs. These variables are listed below along with an explanation for their inclusion in the sample. Once the data was collected, all of the variables were run through a stepwise regression to eliminate the insignificant variables.

i. Other Media Formats

Other audio media format sales are included in the model in order to account for substitution of one format for another. These formats include cassettes and vinyl albums. It is relatively safe to assume that most individuals purchase predominantly one format of

music for the sake of consistency and to reduce the cost of different types of media players. For this reason different media formats should have a negative impact on CD sales. Furthermore, once legal downloads became available in 2004, their unit sales were included as an additional independent variable. The effects of legal downloading on CD sales will be especially interesting because arguments can be made for whether people will substitute away from CDs when purchasing online, or if legal downloading allows consumers to sample music from home before going out and purchasing the entire album in CD format.

ii. Median Income

Music consumption generally falls into the category of discretionary recreational spending coming from one's disposable income. For those with extremely limited disposable incomes, the majority of their money going to living expenses, will be able to spend very little on the consumption of music. However, individuals with larger disposable incomes will generally spend more money on recreation including recorded music consumption. We expect income to have a positive effect on the sale of CDs. For this reason inflation adjusted median income has been included in the study to account for increased spending on music resulting from increases in income.

iii. Consumer Price Index of Recorded Music

Though the price elasticity of recorded music is a relatively unexplored topic, it is safe to assume that drastic changes in the price of recorded music will have some effect on the demand and, consequently, the consumption of this good. If the CPI for recorded music

has faced any major fluctuation in recent years, this could potentially account for some of the changes in CD purchases.

iv. Consumer Price Index of DVDs and Video Games

When considering what may be influencing the sale of music, it is important to consider what substitutes are available. One substitute that quickly comes to mind is DVDs, videos, and video games which certainly compete with music sales. For this reason the CPI of DVDs and similar products have been included in the study.

v. Substitution Variable

It is believed that some of the CD sales in the 1990s were the result of individuals updating their music libraries from cassette format. In order to account for such behavior a variable has been introduced which divides cassette unit sales by CD sales. This variable is expected to be positive.

V. Analysis of the Empirical Results

The approach used for modeling changes in the music industry after the introduction of legal downloading involved using four separate steps of identifying the appropriate model. The first model involved using a stepwise regression to identify independent variables that had a significant effect on the sale of CDs. This was used to eliminate unnecessary variables that may skew the results of subsequent models. The next model used time series data and regressed a number of different independent values against the dependent variable of CD unit sales. After this regression was completed, we

have used Chow test techniques to identify the possibility of structural changes during the time that illegal downloading became prevalent. Next, regressions were run to compare differences in the estimated coefficients of independent variables for the years 1990 through the middle of 2002, and 2003 through 2007. The final regression involved regressing each individual independent variable against the dependent variables using the simple regression model technique. The results of these regressions will be discussed throughout the next several paragraphs.

Time Series Data and the Chow Test

The time series regression involving all years of the study was performed not only to gather information on the effects of selected variables over all years, but also to perform the Chow test to assess whether or not structural changes took place in the music industry at some point throughout the duration of the study. The regression passes the global F-test to test for overall fitness of the model. Furthermore, the regression yielded an r^2 value of .8186, meaning that the variables used in the study can account for about 82% of changes in CD sales. Though this r^2 value is relatively high, it appears that there are other things effecting the sale of CDs that are not accounted for in this study. The independent variables used include median income, vinyl single sales, time, and the substitution variable. A Chow test was then performed to assess whether or not major structural changes took place around the time that Napster was introduced. The breakpoints used in the analysis included the first and second halves of 1998 and 1999, around the time Napster was introduced and when it began to be widely used by music listeners. Hypothesis tests of all these breakpoints reveal that there were, in fact,

structural changes taking place during the course of all of these four periods. The actual breakpoint was at the end on 1999, or the twentieth data line. This, as seen in appendix 2, has the largest F value. Since no other literature has come up with an explanation for potential structural changes in the music industry during this time, we can attribute the change to the increase in Napster downloading.

Though Napster and other illegal downloading existed prior to the later part of 1999, it does take time for awareness of such new technologies to be disseminated to the general public. The implications of this test reveal that the effects of the independent variables are not constant and may be changing over the course of these years as a result of a rise in the prevalence of downloading. This result is to be expected because the introduction of P2P networks for downloading music illegally certainly changed the climate of the music industry as a whole, and for the years following its introduction, more and more people began to utilize these networks. Furthermore, the attempts by record companies and law makers to curb this illegal downloading trend only serves to make the industry more volatile and the effects of these different independent variables more unpredictable over the course of several years.

Time Series using Different Time Intervals

Another set of models was then used to assess whether or not the coefficients of independent values varied significantly after the introduction of legal downloading when compared to years leading up to the introduction of illegal downloads. The first model included the semi-annual data for the years 1990 through 2002. The model revealed parameter estimates that would coincide with intuitive conclusions about the independent

variables' effects on the dependent. Median Income showed had a small positive effect on the sales of CDs. It makes sense that as a person's income rises, they would generally increase their expenditures on discretionary goods based on their individual interests which, for many, includes music. A hypothesis test of this variable proved the effects of income to have a significant impact on CD sales during this time period. The sale of vinyl singles, which became more popular in the late nineties with the rise of DJ culture, had major significant negative effects on the sale of CDs. As the grass roots movement towards more traditional vinyl formats increases there is a substitution effect away from the purchase of CDs. The substitution variable adjusting for the updating of cassette media libraries to CD libraries had an expected negative impact on CDs which we would not expect. Finally, the time variable had a significantly negative effect on the sale of CDs which indicates some sort of movement away from the CD media format that is not accounted for in our study. Furthermore, a test for multicollinearity using variance inflation factors revealed relatively low values (all below ten with the exception of the time variable) indicating that multicollinearity is not a major issue in this study.

The second time period, involving the years after the introduction of legal downloading (after 2002), was then run. The model yielded some unexpected results and may have some underlying issues that need to be looked at for further adjustments to the model. First, median income was found to have a significant negative effect on CD sales, which is certainly contrary to intuitive analysis and our results for other models. CDs are not an inferior good and, thus, its consumption should increase with income. The only possible explanation is that as a nation's median income increases, the availability of internet becomes more widespread. As more individuals are able to access the internet,

they will also have increased access to illegal downloading platforms. Legal downloads appear to have no significant effect on the sale of CDs. This can be explained by the purchase of a single song via the internet resulting in increased interest in a music group which may lead an individual to go out and purchase a copy of the CD while others chose to substitute away from CDs altogether for the new electronic media format. Vinyl singles continue to have a significantly negative impact on CD sales, but the effects of these vinyl purchases have a greater negative impact on CDs during the later time interval than in the earlier time interval.

This may be a result of the fact that DJs and individual movement back to vinyl became more prevalent in the first decade of the twenty-first century than in the late 1990s (Maerin 2009). Substitution was found to have a significantly positive effect on CD sales for the later time interval which is consistent with our original hypothesis. The time variable was also found to be statistically insignificant for this model. An assessment of variance inflation factors revealed the high likelihood of multicollinearity with factors generally ranging between 20 and 80. Due to the threat of multicollinearity in this particular model, further modeling is required to truly test the effects of each variable on CD sales. Furthermore, the fact that legal downloading has been around for only a few years, making our sample extremely small, makes the results far less reliable than a large sample.

Individual Variable Models

In an attempt to correct some issues from the models involving different time intervals regressions were run using models of only one of the independent variable.

This was done to eliminate the effects of multicollinearity and discover the actual effect of each variable on the sale of CD units without interaction with other variables.

Global F-tests of each model proved the models' overall fitness in predicting CD unit sales. The results provide a much clearer picture of the effects of the independent variables on CD sales. Vinyl singles had a very significant negative impact on the sale of CDs. This, again, is explained by the movement away from CDs to vinyl formatted media. The substitution variable resulted in a significantly negative effect on CD sales. This is contrary to our expectations that the updating of libraries from cassette format would increase the sale of CDs. Median income was found to have a small significantly positive effect on sale of CDs, which is congruent with our belief that spending on music will increase proportionally to one's income increases. Finally, the variable of time was found to have a significantly positive effect on CD sales. This can be explained by the fact that as the 1990s progressed, CDs use became more and more widespread.

VI. Conclusion

Testing for illegal downloading's actual effects on CD sales is a near impossibility due to the fact that data about what has been downloaded is largely unavailable. This black market activity has been blamed for much of the decline in CD sales, but based on the results of this study illegal downloading is not the only culprit. There appears to be a number of factors driving down the sale of CDs, the largest of which is the sale of vinyl singles. Vinyl singles act, essentially, as a substitute for CD formats and tend to drive down the sale of CDs as more and more vinyl units are purchased in a given year. However, it appears that there are forces driving down the

sale of CDs in the music industry that are not accounted for in the study. Though some of this could potentially be explained by a lack of interest in the music that is available or other qualitative factors. The other side of this argument is that there is more music than ever available and the communication age we live in makes it extremely easy to search for and find a plethora of different types of music. The obvious fact that there is something missing from the model that is contributing to the decrease in CD sales makes illegal downloading a very likely suspect. Furthermore, the existence of structural changes in the music around the time of Napster's height of popularity makes an even stronger case for the RIAA's belief that illegal downloading has been swallowing up profits from the industry.

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Appendix 1: Summary Statistics

	CD sales	Vinyl	DL	MedInc	Subs
n	36	36	8	36	36
Mean	348.7	4.5	365.5	47652	152.7
St. Dev.	110.5	3.8	212.7	2363	350
Max	568.8	13.8	629.7	50641	1284
Min	143.8	.3	58.6	44034	.94
Skewness	-.26	1.2	.45	-.041	2.6

Appendix 2: Time Series with Chow Test

Dependent Variable CD

Ordinary Least Squares Estimates

SSE	77443.5342	DFE	31
MSE	2498	Root MSE	49.98178
SBC	396.337444	AIC	388.41985
Regress R-Square	0.8186	Total R-Square	0.8186
Durbin-Watson	2.2279		

Structural Change Test

Test	Break				
	Point	Num DF	Den DF	F Value	Pr > F
Chow	17	5	26	2.15	0.0915
Chow	18	5	26	2.55	0.0523
Chow	19	5	26	2.36	0.0678
Chow	20	5	26	4.18	0.0064

Estimate of the Paarmeters

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > t
Intercept	1	71.5414	339.8811	0.21	0.8347
Medinc	1	0.0176	0.007013	2.51	0.0177
VSu	1	-49.6446	5.5182	-9.00	<.0001
Subs	1	-88.5464	47.8358	-1.85	0.0737
t	1	-17.0073	2.2246	-7.65	<.0001

Table3: Time Series Data 1990 - 2002

Model: MODEL1
Dependent Variable: CD

Number of Observations Read 26
Number of Observations Used 26

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	354965	88741	69.54	<.0001
Error	21	26800	1276.17116		
Corrected Total	25	381765			

Root MSE 35.72354 R-Square 0.9298
Dependent Mean 353.22692 Adj R-Sq 0.9164
Coeff Var 10.11348

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Variance Tolerance	Inflation
Intercept	1	85.51041	257.07749	0.33	0.7427	.	0
Medinc	1	0.01321	0.00583	2.27	0.0342	0.24264	4.12135
VSu	1	-38.40151	5.49712	-6.99	<.0001	0.12368	8.08514
Subs	1	-54.45172	35.08851	-1.55	0.1356	0.37766	2.64786
t	1	-8.36368	3.45198	-2.42	0.0245	0.07323	13.65600

Table 4: Time Series Data 2003 – 2007

The REG Procedure

Model: MODEL1
Dependent Variable: CD

Number of Observations Read	10
Number of Observations Used	9
Number of Observations with Missing Values	1

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	39512	7902.32226	6.96	0.0706
Error	3	3405.85368	1135.28456		
Corrected Total	8	42917			

Root MSE	33.69398	R-Square	0.9206
Dependent Mean	338.80000	Adj R-Sq	0.7884
Coeff Var	9.94510		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Tolerance	Variance Inflation
Intercept	1	16331	5209.89897	3.13	0.0519	.	0
Medinc	1	-0.32429	0.12038	-2.69	0.0742	0.02700	37.04308
DL	1	0.13875	0.25608	0.54	0.6256	0.04191	23.86328
VSu	1	-231.16533	114.1039	-2.03	0.1359	0.02701	37.02968
Subs	1	10742	5171.63793	2.08	0.1294	0.12407	8.05995
t	1	5.27826	38.66862	0.14	0.9001	0.01265	79.02490

Appendix 5: Individual Variable Regressions

The REG Procedure

Model: MODEL1
Dependent Variable: CD

Number of Observations Read 36
Number of Observations Used 36

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	201486	201486	30.38	<.0001
Error	34	225529	6633.22041		
Corrected Total	35	427015			

Root MSE	81.44458	R-Square	0.4718
Dependent Mean	348.65278	Adj R-Sq	0.4563
Coeff Var	23.35980		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	438.79952	21.25537	20.64	<.0001
VSu	1	-20.14452	3.65508	-5.51	<.0001

The SAS System

The REG Procedure

Model: MODEL1

Dependent Variable: CD

Number of Observations Read 36
Number of Observations Used 36

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	116832	116832	12.81	0.0011
Error	34	310183	9123.03714		
Corrected Total	35	427015			

Root MSE 95.51459 R-Square 0.2736
Dependent Mean 348.65278 Adj R-Sq 0.2522
Coeff Var 27.39533

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	395.89878	20.68144	19.14	<.0001
Subs	1	-178.61742	49.91290	-3.58	0.0011

The SAS System
The REG Procedure
Model: MODEL1
Dependent Variable: CD

Number of Observations Read 36
Number of Observations Used 36

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	78158	78158	7.62	0.0092
Error	34	348857	10260		
Corrected Total	35	427015			

Root MSE 101.29412 R-Square 0.1830
Dependent Mean 348.65278 Adj R-Sq 0.1590
Coeff Var 29.05301

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	265.67468	34.48065	7.71	<.0001
t	1	4.48530	1.62513	2.76	0.0092

The SAS System
The REG Procedure
Model: MODEL1
Dependent Variable: CD

Number of Observations Read 36
Number of Observations Used 36

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	138643	138643	16.35	0.0003
Error	34	288372	8481.52827		
Corrected Total	35	427015			

Root MSE 92.09521 R-Square 0.3247
Dependent Mean 348.65278 Adj R-Sq 0.3048
Coeff Var 26.41459

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	-920.52731	314.28927	-2.93	0.0060
Medinc	1	0.02663	0.00659	4.04	0.0003