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Do Public Health Insurance Participants Have Different Preferences Toward Work?: The State Children's Health Insurance Program

Ho Jin Lee* and Akinori Tomohara**

Abstract

This paper studies the effects of the State Children's Health Insurance Program (SCHIP) on the labor supply decisions of married women. Specifically, we examine whether the program's participants have inherently different preferences toward work when compared to non-participants. The analysis shows that SCHIP participants are not self-dependent. Mothers who participate in the program are willing to decrease their labor supply and to accept a lower income, in order to become eligible for public health insurance. Non-program participants do not have this tendency; they would rather keep working.

I. Introduction

Medicaid, a public health insurance program created in 1965, provides health services benefits to the poor. During the 1980s, Medicaid went through several reforms. The federal government expanded the income eligibility for Medicaid to provide health insurance coverage to uninsured children in higher income families. In spite of the change, the percentage of uninsured children stayed relatively constant from 1988 to 1997. To address this issue, Congress implemented the State Children's Health Insurance Program (SCHIP) in October of 1997. SCHIP aims to provide health insurance coverage to near-poor children not eligible for Medicaid.[1]

This paper studies the effects of SCHIP on the labor supply decisions of married women. We examine whether SCHIP participants' preferences toward work are different from non-participants' preferences toward work. The relationship between health insurance and the labor supply of women has been thoroughly explored in the literature. Nevertheless, little attention has been given to the effects of offering public health insurance on the labor supply decisions of married women. Previous work focused on the effects of providing public health insurance on the decisions of single mothers [Blank, 1989; Moffitt and Wolfe, 1992; Winkler, 1991; Yelowitz, 1995, 1998, 2000; Mongomery and Navin, 2000; Meyer and Rosenbaum, 2000a, 2000b, 2001]. This is because the majority of public assistance program participants are poor, single, female-headed families.[2] More recently, the literature has increasingly focused on married women.

* Staff Economist, PricewaterhouseCoopers, 2020 Main Street Suite 400, Irvine CA 92614. Email: ho.j.lee@us.pwc.com.

** Assistant Professor, Department of Economics, Queens College, The City University of New York, 65-30 Kissena Blvd., Flushing, NY 11367. E-mail: at7@qc.edu.

[1] Near poor families are usually defined as those with income between 100 to 200 percent of Federal Poverty Level (FPL). In 2003, 200 percent of FPL was approximately $30,520 for a family of three.

[2] "Medicaid eligibility for non-disabled children was originally limited to single-parent families receiving cash assistance under the Aid to families with Dependent Children (AFDC)" [Card and Shore-Sheppard, 2002, p.4].

Studies have explored the effects of husbands' employer-sponsored health insurance on the labor supply of married women [Olson, 1998; Buchmueller and Valletta, 1999; Chou and Staiger, 2001].

Our analysis examines relationships previously unexplored in the literature. We focus on the effects of offering public health insurance on the labor decisions of married women. The literature reveals that health insurance is a significant factor in the labor supply decisions of married women, but is not for low-income single mothers [see the survey of Gruber and Madrian, 2002]. We explore whether some married women decrease their labor supply after SCHIP implementation. Children would become eligible for SCHIP if their mothers accepted lower income via reduced work hours. However, not all mothers would choose to decrease labor supply in order to join the program. This is possibly due to a motivation to work and/or the stigma associated with participation in a public assistance program. This paper introduces a self-selection problem into the analysis and examines the possibility that SCHIP participants may have different working habits than non-participants. SCHIP participants may tend not to work (or not be motivated to work) by nature.

We use Heckman's two-step regression for the analysis [Heckman, 1990]. Assuming decisions regarding hours worked and public health insurance coverage are jointly normally distributed, we examine whether married women adjusted their work hours in response to the implementation of SCHIP. In the first step, we use a Probit model for health insurance decisions. From this model, we obtain a variable to control for the characteristics of married women whose families chose public health insurance coverage. In the second step, we compare work hours decisions of married women before and after the enactment of SCHIP, having controlled for the characteristics of SCHIP participants.

The analysis shows that mothers who participate in SCHIP are willing to decrease working hours, although, on average, SCHIP does not affect hours worked by mothers. The results indicate that SCHIP participants are not self-dependent. Participants are willing to accept lower income in order to be eligible for public health insurance. Non-participant mothers prefer to keep working, forfeiting public health insurance benefits. We conclude that the work preferences of SCHIP participants are inherently different from the work preferences of non-participants.

The paper proceeds as follows. We discuss theoretical implications of the enactment of SCHIP in Section 2. After summarizing the data used in the analysis in Section 3, Section 4 describes an empirical model for studying changes in married women's labor supply after SCHIP implementation. Results of the analysis are presented in Section 5.

II. Theoretical Implications

The standard theoretical model of labor force participation does not give a clear prediction regarding the direction of the average labor force participation of married women in response to the introduction of SCHIP. The following simple framework illustrates this concept.

Given a maximum allocation of time, T, a married woman maximizes a twice differentiable, strictly quasi-concave utility function of two goods, leisure, L and total family income, Y. Total family income includes the woman's net after-tax asset and transfer income as well as the husband's net earned income. A woman is assumed to take the husband's labor supply decision as given when making her labor supply decisions. This is consistent with the literature [e.g., Triest, 1990]. This assumption is reasonable given the findings of Buchmueller and Valletta [1999]. They find that husbands' work hours have insignificant effects on wives' hours worked. We monetize the net value of health insurance (i.e., the gross value minus the cost) [Blank, 1989; Winkler, 1991; Buchmueller and Valletta, 1999]. Assuming public health insurance provides benefits regardless of utilization, we value the insurance at its equivalent variation within Y.

Figure 1 depicts a budget constraint for a married woman with children as a bold line. *UINC* denotes her unearned income and *VAL* denotes the cash value of health insurance. The slope of the budget constraint is the net after-tax wage rate. Suppose the husband's employer does not sponsor dependent health insurance coverage and the married woman works to provide health insurance for her children. Note two distinct labor hours thresholds, H^I and $H^{Medicaid}$. If a woman works above some fixed level of hours, H^I, she may be able to obtain employer-sponsored dependent health insurance. Similarly, if she works below some level of hours, $H^{Medicaid}$, the family can obtain public health insurance for the children. For the range of labor hours between H^I and $H^{Medicaid}$, the family cannot obtain subsidized health insurance from either the government or employer, consequently incurring the full cost. Implementing SCHIP reduces this range by shifting the threshold of $H^{Medicaid}$ to H^{SCHIP}. A dotted line represents a new budget constraint post-SCHIP implementation. Lastly, $H^{Welfare}$ is the threshold below which the family can receive health insurance coverage through the cash assistance program. Note that the *VAL* of $H^{Medicaid}$ is smaller than that of H^I or $H^{Welfare}$. This is because the welfare program provides health insurance coverage for the whole family. Medicaid and SCHIP coverage is generally only available for children.[3] The figure depicts the case where employer-sponsored benefits provide health insurance coverage for the family. The length of vertical jump at H^I varies depending on the coverage.

This figure also presents one possible labor response by a married woman to SCHIP implementation. Increasing generosity allows a married woman to reduce labor supply in order to obtain subsidized health insurance coverage for her children (i.e., shift her indifference curve from u^1 to u^2). This is true if the net gain in utility from the increase in leisure and time spent with her children plus the gain from subsidized public health insurance is greater than the loss in the utility from reduced total family income and the stigma associated with participating in a public assistance program.[4] For example, suppose a married woman has worked for an employer that provides dependent health insurance coverage for children. With the increased income eligibility threshold, she now chooses to work less (or leave the labor force) in order to provide SCHIP coverage for children. Similarly, some married women previously on Medicaid may

[3] Recently states have expanded their public health insurance coverage to working adults. Nevertheless, the income eligibility thresholds are generally far below the thresholds for children's eligibility.
[4] Another possible monetary gain from not working is the decrease in daycare expenditures.

increase their labor hours or labor force participation. Families can now increase their income and still maintain public health insurance coverage for their children. Thus, the effects of enacting SCHIP on married women's labor supply decisions are theoretically ambiguous. In the following section, we empirically examine these effects.

III. Data

We use the March Current Population Survey (CPS) from 1996 to 2002. The CPS provides national health insurance data for families as well as detailed demographic characteristics for the years 1995 through 2001. The survey is commonly used in the literature to study relationships between health insurance and female labor supply decisions [e.g., Yelowitz, 1995; Olson, 1998; Buchmueller and Valletta, 1999; Meyer and Rosenbaum, 2000a, 2000b, 2001]. The survey is also commonly used in the literature to examine the possibility that public health insurance crowds out private health insurance [Cutler and Gruber, 1996; Dubay and Kenny, 1996, 1997; Shore-Sheppard, 1997, 2000; Kronick and Gilmer, 2001; LoSasso and Buchmueller, 2002]. The data for the 1995 through 2001 period use the 1996 redesign of the CPS. LoSasso and Buchmueller [2002] extract similar time periods to study the effects of SCHIP expansions on take-up (i.e., effectiveness to reduce uninsured) and crowd-out (for private health insurance). Additionally, we obtained data on state level provision of dependent health insurance coverage via correspondence with the state offices and the Centers for Medicare and Medicaid Services.

There are advantages and disadvantages associated with using the CPS as opposed to other data sets. Longitudinal data sets such as the SIPP and NLSY are preferable when the objective is to capture dynamic changes in labor supply. However, the sample sizes in the SIPP and NLSY are much smaller than in cross-sectional data sets such as the CPS. Blumberg et al. [2000] admit, "The small sample size and complex sampling design of the SIPP reduce our statistical power..." Additionally, the SIPP suffers from "seam bias" [Young, 1989; Marquis and Moore, 1990] and does not have information about residents of nine low population states. The CPS does not suffer from these particular problems. One advantage of the SIPP is the information's accuracy. Data collected is close to the time of interview (cf. the CPS asks questions pertaining to last year's information in interviews) [Ham and Shore-Sheppard, 2001]. The NLSY also has some problems.

> Since the NLSY is composed of one cohort of mothers who are aging over the time period of the expansions, trends in insurance coverage for children in the NLSY are different from the trends in the general population…. Consequently, estimated effects of the expansions from the NLSY may not be generalized to the entire population of children. [Ham and Shore-Sheppard, 2001, p.10].

The CPS data are nationally representative and are less likely to suffer from such attrition. We use the CPS that most previous works use, enabling us to contrast our results with those in the literature.[5]

The summary statistics from our sample are presented in Table 1. We extract a sample of 160,471 children ages 0 to 18. Our sample does not include children who are reported as the head of a household, the spouse of the head, or a parent of another child. We restrict our sample to children in families with married mothers whose husbands earn income. Although some literature uses targeted samples (i.e., they consider only people who are more likely affected by health policy changes such as children from families with incomes between 100% and 133% of the poverty line), we include all children. Some mothers previously in the non-targeted sample may experience a change in their status, becoming members of the targeted sample, if they reduce work hours or quit working altogether.

The table also shows that health insurance coverage of children can be affected by demographic characteristics. For example, white children are more likely to be covered by private insurance. Black children are more likely to be covered by public insurance. Children born in a foreign country tend to be uninsured. We also observe that children with parents working for larger firms and of higher educational achievement tend to be covered by private insurance.

The CPS does not collect data on the same children year after year, and thus, does not track changes in the health insurance coverage of the same children before and after SCHIP. The analysis employs an identification strategy similar to the one used in Chou and Staiger [2001].[6] We contrast a treatment group and a control group during the implementation of SCHIP. The treatment group consists of children with married women in families, where both the husband and wife are working in the private sector. This group also includes non-working married women, whose husbands work in the private sector.[7] The control group consists of children of married women, who work for or have a husband working for the federal or state government.[8] We exclude local government employees from the sample. It would be difficult to determine the treatment of children of local employees (county and city level), since most states do not collect data on their health benefits.

The identification strategy (public vs. private) is valid since children of government employees are effectively ineligible for the public health insurance program. In October of 1997,

[5] Ham and Shore-Sheppard [2001] estimate the same model by using both the SIPP and the CPS. They conclude that differences in estimates come from the different nature of each data set, i.e., monthly data or annual data. They find similar estimates using either data once they correct for the differences.

[6] The authors study the effects of a new health insurance program on the labor supply of wives in Taiwan.

[7] We exclude self-employed women from the sample as in the literature. Chou and Staiger [2001] point out that "their labor force status is often ambiguous (e.g., there is less distinction between housekeeper, employed, and self-employed)." Self-employed husbands are included in the sample, and are classified as private sector employees.

[8] The control group excludes married women who work for or have a husband working for the state of Mississippi or North Carolina.

Congress endowed $40 billion over ten years to provide public health insurance coverage to near poor children not eligible for Medicaid. The states may use these funds to either expand the Medicaid program (M-SCHIP), establish a separate state program (S-SCHIP), or a combination of both (COMBO). While the introduction of SCHIP increased the income eligibility threshold for free or subsidized public health insurance coverage for children, a federal mandate excludes all children of government employees from S-SCHIP. Children of federal employees are effectively ineligible for M-SCHIP because all full-time federal employees, along with their children, are offered Federal Employees Health Benefits. Similarly, all states (except Mississippi and North Carolina) provide health benefits for children of full-time state employees. Thus, children of state employees do not qualify for M-SCHIP coverage.

The identification strategy is employed to analyze the possibility that families adjust their incomes to take advantage of new legislation. Eligibility status will change when family income changes. Family incomes will change if SCHIP implementation affects the labor supply decisions of family members. Specifically, we suspect that mothers change their labor supply decisions after the introduction of SCHIP. In testing the hypothesis, we find it difficult to identify (or stratify) the sample that became eligible for the program via voluntary reduction of labor supply in the current data set. We have only ex post income. Thus, we classify children who are potentially able to benefit from SCHIP if their mothers reduce hours worked as a treatment group. Children who are classified as "Private" can be made eligible for SCHIP if their mothers reduce their labor supply. Children who are classified as "Government" are not eligible for SCHIP, even if their mothers reduce their labor supply. The previous work does not include the possibility that families adjust their incomes to take advantage of new legislation.

Table 2 presents the summary statistics of each category. We classified the treatment group as "Private" and the control group as "Government." The table shows that the demographic characteristics of these two groups are quite similar. For example, the mean age of married mothers is 37.8 years old for the Private group and 39.1 years old for Government. The ratio of races and the number of children are similar between the two groups. The two groups are relatively comparable, considering this is a quasi-natural experiment. We control for differences in observed characteristics (e.g., "Government" contains more married women with advanced degrees) and other macroeconomic factors in our regression analysis.

IV. Empirical Models

We use Heckman's two-step model to examine the effect of expanding public health insurance on the labor supply decisions of married women. As is typical in the literature, the husband's work decisions are treated as given in the analysis. One interpretation of this assumption is that a married woman is a secondary earner, so her labor supply is more flexible than her husband's. In this sense, a married woman's labor supply decision will depend on other income available to the household, such as their husband's income. However, instead of using the husband's income directly, we use the husband's observable characteristics such as age, age squared, and education (which are correlated with husband's income levels) in our empirical

analysis. This helps to avoid an endogeneity problem, which occurs when both husband and wife decide labor supply simultaneously [Chou and Staiger, 2001].

Using Heckman's two-step regression, and assuming that the decisions of both hours worked and public health insurance coverage are jointly normally distributed, we examine whether married women adjusted their work hours upon SCHIP's implementation. In the first step, we perform the following Probit analysis for health insurance decisions. We obtain a control variable for married women whose families chose public health insurance coverage.

$$(1) \quad Coverage_{ist} = \gamma_0 + Z_{ist}\gamma_1 + \gamma_2 PRIVT_{ist} + \gamma_3 SCHIP_{st} + \gamma_4 PRIVT_{ist} * SCHIP_{st} + \delta_s + \delta_t + trends_{st} + e_{ist},$$

where $Coverage_{ist} = 1$ for a i^{th} child, who has public health insurance coverage in state *s*, for year *t*,; otherwise $Coverage_{ist} = 0$. We classify that a child as being covered by public health insurance if the child is reported as a Medicaid, SCHIP, or other government program beneficiary. $PRIVT_{ist}$ is an indicator for the treatment group. This controls for characteristics of government employment such as other fringe benefits. $SCHIP_{st}$ is an indicator for the implementation of SCHIP (the treatment). The index takes a value of one if the program is in effect for more than six months in year *t*, and a value of zero otherwise [Lo Sasso and Buchmueller, 2002]. Some states with COMBO implemented M-SCHIP and S-SCHIP in different years. Since we study SCHIP as a whole, we use the date that any SCHIP was first implemented in a particular state for the treatment.

The vector Z_{ist} is the set of observable characteristics that may influence decisions regarding health insurance coverage. This vector includes the children's age, race, and gender, and place of birth (foreign or not), the size of the household, the size of the city of residence, the health conditions of household members, the size of workplace, and the level of the parents' education. The vector controls for observed differences between the two groups. This vector also controls for changes in welfare and cash assistance programs prior to SCHIP. SCHIP was passed one year after the Personal Responsibility and Works Opportunity Reconciliation Act (PRWORA) of 1996, which transformed AFDC to TANF. TANF was implemented to promote work by ending the dependence on public assistance. TANF was successful in reducing welfare workloads. This may affect public health insurance take-up in the following years. Due to the implementation of TANF, we use a deflated value of the maximum welfare guarantees for a family of three.

We control for other possible unobserved variables that may influence health insurance coverage decisions. The δ_s and δ_t are state and year fixed effects, respectively. Year fixed effects control for time varying elements that affect all states in a given year. Examples include changes to the Federal Earned Income Tax Credit (EITC) during this sample period [see CES, 1997]. State fixed effects capture time invariant elements that differ across states. For instance, the term controls for the inherent relative generosity of public assistance in one state compared to

another. We also control for unobserved variables that change over time and across states. In particular, the analysis includes $urate_{st}$, the unemployment rate, to capture the differences in labor market conditions in each state as well as in each year. However, accurate results are not guaranteed. The model may yield inconsistent estimates if time-varying unobserved variables across states influence health insurance coverage decisions. We use linear state-specific *trends*, as in the literature such as CEA [1997], [1999], Moffitt [1999], and Schoeni and Blank [2000].[9]

In the second step, we compare work hours decisions of married women before and after the enactment of SCHIP, controlling for the characteristics of SCHIP participants.

$$(2) \qquad H^*_{ist} = \beta_0 + X_{ist}\alpha + \beta_1 PRIVT_{ist} + \beta_2 SCHIP_{st} + \beta_3 PRIVT_{ist} * SCHIP_{st} + \beta_4 \lambda + urate_{st} + \delta_s + \delta_t + trends_{st} + \varepsilon_{ist}$$

$$H_{ist} = H^*_{ist} \text{ if } H^*_{ist} > 0 \text{; else } H_{ist} = 0$$

where H^*_{ist} is the desired hours, and H_{ist} is the reported hours worked of the i^{th} married woman in state *s* in year *t*. The variable λ is $\phi(\gamma'\omega)/\Phi(\gamma'\omega)$, where ϕ is the density function, Φ is its cumulative distribution function, and $\gamma'\omega = \gamma_0 + Z_{ist}\gamma_1 + \gamma_2 PRIVT_{ist} + \gamma_3 SCHIP_{st} + \gamma_4 PRIVT_{ist} * SCHIP_{st} + \delta_s + \delta_t + trends_{st}$. This variable controls for the characteristics of SCHIP participants. We assume that (e, ε) has a bivariate normal distribution with $[0,0,1,\sigma_\varepsilon,\rho]$.

The coefficient of interest, β_3, captures the effect of implementing SCHIP on married women's hours worked decisions. If $\beta_3 > 0$, then on average, expanding public health insurance for children increases hours worked of the treatment group over the control group. If $\beta_3 < 0$, then on average, SCHIP reduces hours worked implying that married women dropped out of the labor force in order to provide subsidized public health insurance coverage to their children.

The vector X_{ist} is the set of observable characteristics that may influence employment decisions. The vector controls for the observed differences between the two groups. This vector includes the woman's age, age squared, race, health status, and education. Similarly, we include the husband's age, age squared, race, health status, and education. This vector also includes family level characteristics, such as the number of children under age 6, number of children under age 18, and family non-wage income. Furthermore, we control for other possible unobserved variables that may be correlated with the enactment of SCHIP and the labor supply decisions of married women. As in the literature, the model uses state and year fixed effects, the unemployment rate, and linear state-specific trends.

[9] Grogger [2002] uses linear and quadratic state-specific trends and Ziliak et al. [2000] uses cubic state-specific trends in their regressions. Aizer and Grogger [2003] add a full set of state-year interactions; however, this is not commonly used compared to linear state-specific trends, due to the degree of freedom drawback.

We consider the relationship between the labor supply decisions of married women and the age of the family's children, specifically, the youngest child and the oldest child in the family. The literature on the effects of Medicaid expansions on single mothers' employment [Yelowitz, 1995 and those which extend his work] treats the youngest child in the family as a crucial factor for the employment decisions of single mothers. Younger children face higher risk of being sick than do older children. Considering the high opportunity costs of preparing for medical expenses, the assumption seems plausible. Furthermore, Medicare provides more coverage for young children than older children. However, the argument may not be applicable to the SCHIP case, since the two policies target different groups of children. Table 3 presents the SCHIP implementation dates and the variation in income eligibility thresholds for an infant (age 0) and an 18 year-old in June of 1996, 1998, and 2001. The SCHIP program increased the eligibility thresholds for 18 year-olds considerably while yielding only slight changes in eligibility for infants. The gap between the income eligibility for infants and 18 year-olds is reduced or eliminated after SCHIP (see Table 1 in LoSasso and Buchmueller [2002] for similar information). Since the legislation targets older children, the oldest child in the family will play an important role in married women's labor supply decisions.

We divide the sample into four sub-samples: oldest own child in the family, youngest own child in the family, oldest child in the family, and youngest child in the family. The sample, oldest own child in the family, includes only married women with their own children. If a woman was a caregiver for grandchild, child sibling, or child cousin, etc., then that woman is not included into the oldest own child sub-sample. The child level information for this regression is that of the oldest own child in the family. Similarly, the sample, youngest own child in the family, includes only married women with their own children. The child level information for this regression is that of the youngest own child in the family. We also consider other scenarios. The sample, oldest child in the family, includes a woman who is a caregiver for any child considered her dependent. The oldest dependent, age 18 or younger, of any family relation (sister, cousin, grandchild, etc.), is the data we use for the child level data in the regression. Similarly, the sample, youngest child in the family, includes a woman who is a caregiver for any child who is considered her dependent. The youngest dependent, age 18 or younger, of any family relation is the data we use for the child level data in the regression.

V. Results of Analysis

We conduct two different analyses regarding the labor supply decisions of married women. One is the analysis controlling for selection bias and the other is the analysis without controlling for selection bias. We compare the results in order to characterize SCHIP participants. The comparison clarifies the difference in attitudes towards work between SCHIP participants and non-participants. The analysis indicates that SCHIP participants decrease their labor supply in order to be eligible for public health insurance.

Let us begin with the analysis that does not control for selection bias. The results are summarized in Table 4. Column (1) is the most parsimonious model, and Column (2) is a model with the demographic controls, state and time fixed effects, state unemployment rate, and state specific trends. Table 4 shows that implementing SCHIP reduces labor hours of married women

by about 1 hour, 0.899, for a typical workweek. This effect is of consequence. Suppose there are 100 married women who work 40 hours per week (i.e., 8 hours times 5 days). After implementing SCHIP, the average hours worked would reduce to 39 hours, which is equivalent to 2.5 workers leaving the labor force. The drop out rate of 2.5% may be considered large. The decrease in labor supply could be explained by a mother's motivation for her children to be eligible for public health insurance.

Table 5 summarizes the results after controlling for the characteristics of SCHIP participants using Heckman's two-step regression. Using the four different samples, we ran three regressions. Column (1) is the simplest model with a set of demographic controls and the state unemployment rate. Column (2) is a model with a set of demographic controls, the state unemployment rate, as well as both state and year fixed effects. Column (3) includes state-specific trends in addition to the specifications of the model in Column (2).

The results in Table 5 are different from those in Table 4. Table 5 shows that implementing SCHIP does not affect the number of hours worked by married women. The difference arises from a self-selection problem: whether we have or have not controlled for characteristics of SCHIP participants.

Comparing the two results implies that after SCHIP implementation non-program participants do not change their hours worked, while program participants do. SCHIP participants have different work habits than non-participants. The program participants are mothers who are willing to curtail their labor supply and accept lower income in order to be eligible for public health insurance. Non-participants have a different attitude towards work. Some children would be eligible for the program if their mothers reduced work hours. However, the mothers of these children may choose not to work less. Their behavior may be explained using reasoning similar to that which explains a lower take-up of public assistance programs: a motivation to work, including accomplishment and social responsibility, and/or the stigma associated with participating in a public assistance program.

This raises questions regarding SCHIP participants' backgrounds. Using the CPS data, we examine participants' backgrounds in terms of race and educational attainment. Table 6 summarizes the results. The current data set shows that 2.81% of mothers are SCHIP participants. The ratio increases to 5.22% (or 5.90%) when considering SCHIP participation among Black and Hispanic mothers (or mothers with less than high school education). The increase is more significant if both race and education are interacted. 7.58% of Black and Hispanic mothers with less than high school education join SCHIP. The SCHIP participation rate is more than double that of the overall SCHIP participation rate.

The analysis suggests that expanding public health insurance through SCHIP is more likely to affect certain groups of married women, specifically, Black and Hispanic mothers with a lower education level. Given the economic prospects of low educational attainment, these mothers may have less motivation to work and may be willing to rely more on public assistance programs. Educational attainment can be interpreted as an indicator for patience. Patience is

required to achieve academic and/or professional success. The identification of non-diligent (or impatient) workers remains as a matter to be discussed further. A formal analysis is beyond the scope of this paper.

The results of this study have important policy implications. Governments may want to develop an incentive compatible mechanism that promotes work by targeting specific groups. This reduces the dependence on public assistance. Considering the current large public deficits, it is a pressing problem for state governments to reduce their public health insurance program expenditures [e.g., Gill and Guyer, 2003]. Clearly, this is a politically sensitive issue and is not an easy task. However, the analysis suggests that if it is feasible to develop a public assistance system compatible with an incentive to work, the goal of welfare reform will be attained through two different channels. The first result would be a decrease in government expenditures. Second, an increase in tax revenues would accompany increases in labor supply. Providing constructive policy suggestions is one potential future line of research.

VI. Conclusions

Congress implemented the State Children's Health Insurance Program (SCHIP) in October of 1997. This paper studies the effect of SCHIP on the labor supply decisions of married women whose husbands are earning income. The relationships between health insurance and the labor supply of women have been thoroughly explored in the literature. Nevertheless, little attention has been given to the effects of offering public health insurance on the labor supply decisions of married women. This paper is distinct; we focus on the effects of offering public health insurance on the labor decisions of married women. Specifically, we introduce a self-selection problem in the analysis. The current analysis shows that, on average, SCHIP does not have any impact on the hours worked of married women, but, that those mothers who do participate in the program are willing to decrease working hours. The results indicate that SCHIP participants are not self-dependent. The program participants' preferences toward work are inherently different from the preferences of non-participants. Mothers participating in the program curtail their labor supply and accept lower income in order to become eligible for public health insurance. We conclude that SCHIP causes efficiency losses through distorted labor supply decisions.

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Figure 1

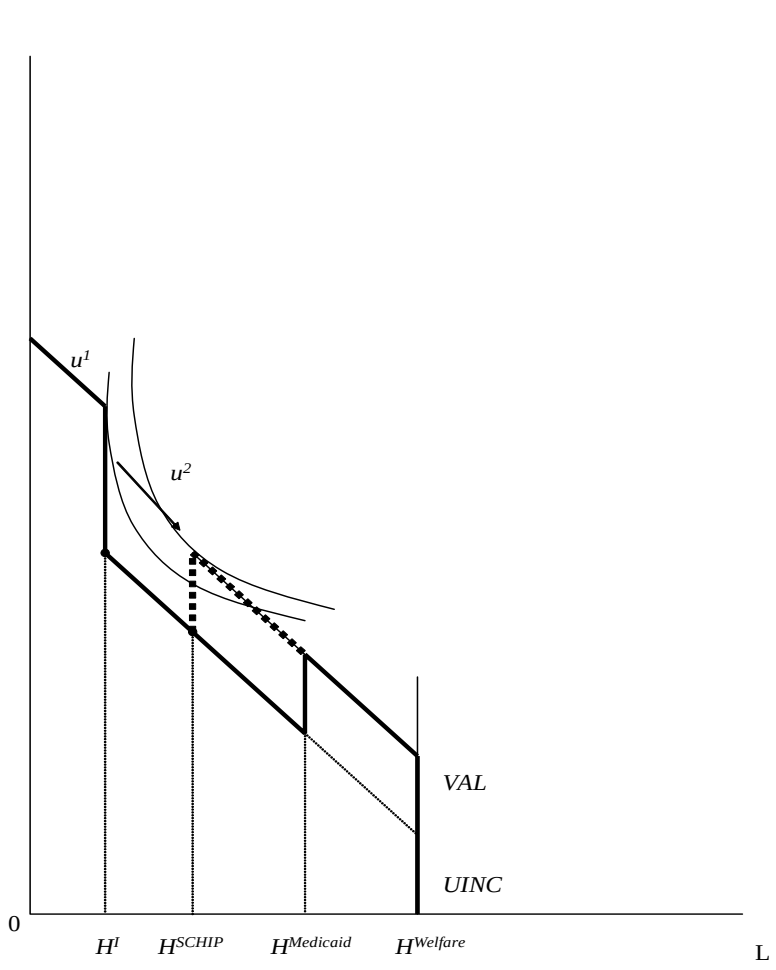

Table 1. Summary Statistics of the Sample of Children

Variable	All		Public		Private		Uninsured	
	Mean	Std.Dev.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Age of Child	8.270	5.457	6.571	5.149	8.465	5.449	8.403	5.495
Male	0.512	0.500	0.513	0.500	0.511	0.500	0.518	0.500
Race								
White	0.884		0.849		0.891		0.863	
Black	0.062		0.085		0.058		0.073	
Other	0.054		0.066		0.051		0.064	
Foreign Born Child	0.063		0.081		0.041		0.164	
Workers in Household								
1 Worker in Household	0.265		0.409		0.231		0.337	
2+ Workers in Household	0.735		0.591		0.769		0.663	
Number of People in Household (HH)	4.731	1.386	5.241	1.709	4.586	1.224	5.138	1.718
# of People in HH with Fair or Poor Health	0.732	0.443	0.555	0.497	0.792	0.406	0.556	0.497
At least one worker works in a large firm	0.188		0.449		0.143		0.269	
Education of Parents								
Father								
Less than High School	0.158		0.371		0.088		0.359	
High School Graduate	0.321		0.350		0.318		0.330	
Some College	0.291		0.213		0.319		0.210	
College Degree	0.175		0.054		0.208		0.082	
Master and Higher Degree	0.054		0.012		0.066		0.019	
Mother								
Less than High School	0.164		0.371		0.097		0.359	
High School Graduate	0.310		0.360		0.306		0.311	
Some College	0.250		0.184		0.271		0.198	
College Degree	0.177		0.060		0.210		0.084	
Master and Higher Degree	0.099		0.024		0.117		0.048	
MSA Residence	0.777		0.731		0.782		0.770	
Sample Size	160471		18927		123981		23151	
Percentage of Health Insurance Coverage			12%		77%		14%	

Source: The 1996-2002 March CPS.
Note: The sum of the sub-samples sizes is not equal to the total sample size since a child can be observed with multiple coverage options. The first column presents the descriptive statistics for the full sample of children. The next three columns present the descriptive statistics for children observed in each coverage option. Also, the sample size in Table 2 is smaller than the one in Table 1 since some children share the same parents.

Table 2. Summary Statistics – Married Mothers & Husbands

	Private		Government	
Variable	**Mean**	**Std-Dev**	**Mean**	**Std-Dev**
Age	37.77	8.74	39.05	8.65
Husband's age	40.17	9.40	41.38	9.46
The number of children under age 6	0.46	0.73	0.36	0.66
The number of children under age 18	1.32	1.22	1.18	1.14
Husband earnings	46756.53	51198.1	42899.4	33637.71
Family non-wage income	4382.66	12305.2	5202.69	12740.58
Race	**Frequency**	**Percent**	**Frequency**	**Percent**
White	75995	76.34	12042	76.83
Black	4948	4.97	1413	9.02
American Indian, Aleut Eskimo	832	0.84	205	1.31
Asian or Pacific Islander	4337	4.36	917	5.85
Hispanic	13432	13.49	1096	6.99
Education	**Frequency**	**Percent**	**Frequency**	**Percent**
<High School	13797	13.86	534	3.41
High School graduate	34376	34.53	4284	27.33
Some College	28558	28.69	5077	32.39
Bachelor's Degree	17666	17.75	3743	23.88
More than Bachelor's Degree	5147	5.17	2035	12.98
Husbands' education	**Frequency**	**Percent**	**Frequency**	**Percent**
<High School	14955	15.02	593	3.78
High School graduate	32695	32.84	3999	25.52
Some College	25059	25.17	4894	31.23
Bachelor's Degree	17989	18.07	3492	22.28
More than Bachelor's Degree	8846	8.89	2695	17.2
Health status	**Frequency**	**Percent**	**Frequency**	**Percent**
Excellent or Very good	69016	69.33	11580	73.89
Good	23202	23.31	3239	20.67
Fair or Poor	7326	7.36	854	5.45
Husbands' health status	**Frequency**	**Percent**	**Frequency**	**Percent**
Excellent or Very good	71811	72.14	11898	75.91
Good	22173	22.27	3043	19.42
Fair or Poor	5560	5.59	732	4.67
Labor Supply	**Frequency**	**Percent**	**Frequency**	**Percent**
Participation	71088	71.41	13370	85.37
	Mean	**Std-Dev**	**Mean**	**Std-Dev**
Hours per week	25.98	18.74	31.8	16.23
Sample size	99544		15673	

Table 3. Implementation Dates and Maximum Income Thresholds

State	Date Implemented	Infants (age 0)			age 18		
		1996	1998	2001	1996	1998	2001
Alabama	Feb-98	185	133	200	0	100	200
Alaska	Mar-99	133	133	200	0	59	200
Arizona	Jul-98	250	140	200	0	32	200
Arkansas	Oct-98	133	200	200	0	200	200
California	Mar-98	200	200	250	0	100	200
Colorado	Apr-98	133	185	185	0	185	185
Connecticut	Oct-97	185	185	300	0	185	300
Delaware	Feb-99	185	185	200	100	100	200
Dist. of Col.	Oct-98	185	185	200	0	36	200
Florida	Apr-98	185	185	200	100	185	200
Georgia	Sep-98	185	185	235	100	100	235
Hawaii	Jan-00	300	185	200	300	100	200
Idaho	Oct-97	133	160	150	0	160	150
Illinois	Jan-98	133	133	200	0	133	185
Indiana	Oct-97	150	150	200	0	100	200
Iowa	Jul-98	185	185	200	0	37	200
Kansas	Jul-98	150	150	200	0	100	200
Kentucky	Jul-98	185	185	200	100	33	200
Louisiana	Nov-98	133	133	200	0	12	200
Maine	Jul-98	185	185	200	125	125	200
Maryland	Jul-98	185	185	200	0	100	200
Massachusetts	Oct-97	185	200	200	0	200	200
Michigan	Apr-98	185	200	200	0	200	200
Minnesota	Sep-98	275	275	280	0	275	275
Mississippi	Jul-98	185	185	200	0	34	200
Missouri	Oct-97	185	300	300	0	300	300
Montana	Jan-98	133	150	150	0	150	150
Nebraska	Apr-98	150	150	185	0	100	185
Nevada	Oct-98	133	133	200	0	34	200
New Hampshire	May-98	185	365	365	185	185	365
New Jersey	Feb-98	300	200	350	0	200	350
New Mexico	Mar-99	185	185	235	185	185	235

Table 3 (Continued)

New York	Apr-98	185	185	250	0	185	250
North Carolina	Oct-98	185	185	200	0	100	200
North Dakota	Oct-98	133	133	140	0	48	140
Ohio	Jan-98	133	150	200	0	150	200
Oklahoma	Dec-97	185	185	185	0	28	100
Oregon	Jul-98	133	133	170	100	100	170
Pennsylvania	Jun-98	185	185	235	0	39	235
Rhode Island	Oct-97	185	250	250	0	250	250
South Carolina	Aug-97	185	185	185	0	150	150
South Dakota	Jul-98	133	133	200	100	100	200
Tennessee	Oct-97	185	200	200	0	200	200
Texas	Jul-98	185	185	200	0	47	200
Utah	Aug-98	133	133	200	0	100	200
Vermont	Oct-98	225	225	300	0	225	300
Virginia	Oct-98	133	133	200	100	100	200
Washington	Jan-00	200	200	250	200	200	250
West Virginia	Jul-98	150	150	200	150	100	200
Wisconsin	Apr-99	185	185	185	0	54	185
Wyoming	Apr-99	133	133	133	0	57	133

Source: The dates of implementation are from the Centers for Medicare and Medicaid Services. The figures for 1996 are from Aaron Yelowitz's dataset. The figures in 1998 and 2001 are extracted from the Centers for Medicare and Medicaid Services and various State Level Offices.

Note: This table provides the month and year in which SCHIP was first implemented. If a state implemented M-SCHIP and S-SCHIP at different times, we provide the earlier date. Also, the numbers presented are the income eligibility thresholds of the public health insurance program (Medicaid and SCHIP) in terms of the percentage of the federal poverty level for infants and children who are age 18. The 1996 figures represent the Medicaid income eligibility thresholds, and the 1998 and 2001 figures represent the highest income eligibility thresholds for Medicaid or SCHIP.

Table 4. The Effects of SCHIP on Married Women's Hours Worked
(without controlling for selection bias**)**

Tobit Models of Hours Decision		
	(1)	(2)
Private	-7.250	-4.835
	(0.505)***	(0.356)***
SCHIP	1.051	1.98
	(0.418)**	(0.542)***
Private x SCHIP	-1.152	-0.899
	(0.630)*	(0.483)*
Loglikelihood	-421653.72	-413518.49
Demographic Controls	No	Yes
Unemployment Rate	No	Yes
State Dummies	No	Yes
Year Dummies	No	Yes
State Specific Trends	No	Yes

Note: The standard errors are presented in parentheses. The standard errors for the tobit models are corrected for clustering within state-year cells. The number of observations is 115217.

* Statistically significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. The Effects of SCHIP on Married Women's Hours Worked

	Oldest Own Children			Youngest Own Children		
	(1)	(2)	(3)	(1)	(2)	(3)
Private	-0.48	0.41	0.35	-0.60	0.61	0.50
SCHIP	3.10*	0.82	1.05	1.82	0.13	0.03
Private X SCHIP	1.10	1.80	1.81	1.53	2.00	2.07
lambda	36.05***	38.26***	38.13***	35.19***	37.35***	37.20***
Wald chi-square	3710	4215	4466	3961	4457	4717
State Dummies	No	Yes	Yes	No	Yes	Yes
Year Dummies	No	Yes	Yes	No	Yes	Yes
State Specific Trends	No	No	Yes	No	No	Yes
Sample size	78553	78553	78553	78565	78565	78565
	Oldest Children			Youngest Children		
	(1)	(2)	(3)	(1)	(2)	(3)
Private	-1.70	-0.89	-0.98	-1.66	-0.58	-0.66
SCHIP	2.65	0.28	0.53	1.47	-0.23	-0.26
Private X SCHIP	1.48	2.17	2.19	1.90	2.42	2.45
lambda	34.48***	36.48***	36.33***	34.03***	36.06***	35.88***
Wald chi-square	3827	4358	4625	4069	4597	4871
State Dummies	No	Yes	Yes	No	Yes	Yes
Year Dummies	No	Yes	Yes	No	Yes	Yes
State Specific Trends	No	No	Yes	No	No	Yes
Sample size	82869	82869	82869	82873	82873	82873

Note: * Statistically significant at 10%; ** at 5%; *** at 1%.

Table 6. SCHIP Participants' Backgrounds

	Freq.	Percent
No SCHIP	76,138	97.19
SCHIP	2,198	2.81
Total	78,336	100
Among Black & Hispanic		
No SCHIP	11,443	94.78
SCHIP	630	5.22
Total	12,073	100
Among less than high school graduates		
No SCHIP	10,368	94.1
SCHIP	650	5.9
Total	11,018	100
Among Black & Hispanic w/ less than high school education		
No SCHIP	3,635	92.42
SCHIP	298	7.58
Total	3,933	100

Source: CPS YEAR 2001 and 2002

THE DETERMINANTS OF MUNICIPAL SOLID WASTE

David A. Anderson*

Abstract

The virtues of conservation are much touted; the underlying determinants of waste are less clear. Individuals adopt a broad spectrum of resource-use strategies from sustenance to disregard. Varying local needs and priorities influence a similarly broad set of conservation paradigms in government and industry. The influence of demographics including education, age, land per capita, farming culture, and income are of particular interest as their composition is on course for worldwide change. This study examines the determinants of municipal solid waste generation and anticipates the effects of current demographic trends on resource allocation over the coming decades. Municipal solid waste levels are found to increase with variables including per capita income levels and crime rates (a proxy for moral climate) and to decrease with the percent of college graduates and farms per capita.

I. Introduction

With the new century came the "age of excess" and the "generation of materialism."[1] The economy was growing and inflation was in check. Rapid technological advancement led to the obsolescence of old equipment, and falling agricultural prices threatened the livelihood of those living off the land [Ginger, 1965, 61]. That was the dawning of the *twentieth* century and the so-called excesses were tempered by subsequent world war and depression. The twenty-first century began under parallel circumstances, with continuing growth projected in wealth and education, a dwindling farm population, and hope for relative amity despite ongoing conflicts. If social choice, rather than war or Malthusian famine, is to compensate for the externalities of excess, societal attitudes towards the expenditure of natural resources are of interest.

At present, residents of the United States, Europe, and Japan--representing a relatively wealthy 16 percent of the world population--are responsible for an estimated 80 percent of natural resource consumption on an annual basis. The average American is responsible for the consumption of about 25 tons of raw materials, and the four percent of the world population living in the U.S. operates one-third of the world's automobiles and consumes one-quarter of the global energy supply [Utley, 1999]. Consumption begets waste. In 1986 the EPA estimated that the U.S. generated over 160 million tons of municipal solid waste (MSW), or 3.6 pounds per

*Paul G. Blazer Associate Professor, Department of Economics, Centre College, 600 West Walnut Street, Danville, KY 40422. E-mail: David@Centre.edu

[1] See the books with these titles by Ginger [1965] and Hays [1941]. Strasser [2000] is among many recent books in this vein.

person per day. At that time they also predicted that the rate of waste generation would increase by about 1 percent per year, to reach 3.9 pounds per capita by the year 2000. This prediction turned out to be conservative, and MSW per capita reached 4.5 pounds by the mid-1990's [EPA, 2005].

The U.S. currently generates more municipal solid waste per capita than any other OECD country [U.S. Bureau of Census, 2004, t. 1332]. The relevance of the determinants of MSW is heightened by the potential for developing countries to follow the U.S. example. For instance, Nie et al. [2002, p. 1] state that "with the rapid urbanization of China's population, the management of municipal solid wastes is fast becoming one of the most important issues facing the country." Given global resource constraints, the advancement of developing countries will necessitate a renewed focus among developed countries on the issues of conservation and municipal solid waste.[2] The results of this study will inform those efforts.

Rising trends in municipal solid waste precipitate three categories of problems: resource depletion, waste storage, and external costs. As an illustration of the resources in the balance, Table 1 specifies the make-up of the 236 million tons of MSW generated in 2003, one-quarter of which originated from non-renewable resources. About 31 percent of MSW is recovered for recycling or composting, 15 percent is incinerated, and the remaining 54 percent is placed in landfills [EPA, 2001, 1]. The problem of waste storage grows inversely with the areas available for disposal. In 2002 there were 1,767 landfills in the U.S., down from 8,000 in 1988 [EPA, 2005], although the average landfill capacity has increased substantially. As the most convenient dumpsites reach capacity and urban sprawl makes new sites within close proximity to urban centers less viable, the direct and external costs of transporting and disposing of MSW increase. The external costs also include groundwater contamination from landfills and ash toxicity from MSW incineration facilities. An EPA-sponsored study of 167 nationally representative landfills found groundwater contamination or adverse trends at 90 percent of the sites, and toxic levels of fly or bottom ash at many of the landfills receiving the 17 percent of MSW that is incinerated [Denison and Ruston, 1990].

The creation and fate of municipal waste may reflect broader attitudes toward the environment and social responsibility. Coincidentally or not, per-capita MSW generation increased by only 13 percent during the decade of the 1970's that spawned the EPA and Earth Day, by 23 percent during the "me" decade of the 1980's, and by 3 percent during the 1990's under the influence of Generation X [EPA, 2001, 4]. Groups and individuals who prioritize the reduction of waste may place similar emphases on recycling, pollution control, and related humanitarian pursuits. The existence of ties between solid waste generation and broader attitudes toward political platforms is tested using a political party variable in this study.

Ongoing problems with municipal solid waste and demographic trends that may shape MSW generation motivate study of the determinants of MSW levels. In this article I empirically investigate the relationship between MSW creation and county-level demographic

[2] For discussions of the problems with solid waste generation and corresponding resource depletion, see Neal and Schubel [1986] or Anderson [2003].

characteristics. Section II reviews the existing literature. Section III identifies the trends that may influence the generation of MSW. Section IV provides an overview of the empirical data. Section V describes the model and hypotheses. Section VI presents and discusses the results. Section VII concludes the paper.

II. Previous Research

In his classic article, Lackman [1976] models solid waste production with a household consumption model that incorporates material inputs, time inputs valued at the wage rate, waste, and external effects. Assuming that external effects are indeed paid externally, his model predicts that higher wages and correspondingly higher opportunity costs of time will increase solid waste production as consumers switch to higher-priced time-saving products. Lackman provides TV dinners and non-returnable bottles as examples.

Over the past decade there have been several empirical investigations of the conceptual uncertainties regarding income and pollution abatement. Grossman and Krueger [1995] found inverted-U-shaped Kuznets relationships[3] between per capita income and fecal contamination, oxygen depletion, heavy metals in rivers, and urban air pollution. Related studies have found Kuznets relationships between income and deforestation, particulates, nitrogen oxides, carbon monoxide, and automotive lead emissions.[4] MSW is among the problems that appear to buck the Kuznets up-and-down scenario.[5] Shafik and Bandyopadhyay [1992] found a monotonic, positive relationship between income per capita and municipal solid waste per capita on the basis of 1985 city-level information from 39 countries. The present study includes an examination of the same relationship using data from over 1000 counties in the U.S.

Citing the importance of waste generation influences to waste policy planning, Annegrete Bruvoll [2001] used state-level U.S. data to analyze the effect of waste management fees, income, and population density on waste management techniques and the amount of waste generated. Her primary results suggest that landfill fees are effective in promoting recycling and incineration over landfill use. She also found a positive relationship between population per square mile and per capita solid waste levels. She did not, however, find a statistically significant effect from landfill fees or income on MSW generation at the state level.

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[3] Named after Simon Kuznets [1955], who found an inverted-U-shaped relationship between income and income inequality.

[4] See, for example, Hilton and Levinson [1998]. Andreoni and Levinson [2001] present a model that explains the environmental Kuznets relationship on the basis of increasing returns to pollution abatement technology.

[5] As an example of other environmental problems that do not adhere to the Kuznets relationship, Harbaugh, Levinson, and Wilson [2002] found varying relationships between sulfur dioxide emissions and per capita income depending on the assumptions made and the areas and years studied. Many of the curves in their results begin as an inverted U and then spring back up at incomes above $15,000 per year (in 2003 dollars).

Sterner and Bartelings [1999] studied the determinants of waste disposal for a residential area of southwest Sweden. Their household-level data came from a mail questionnaire and information from a weight-based waste disposal billing system. Their explanatory variables included age, income, and education as in the current study. The nature of their sample did not provide variation in race, region, or any of the other variables included in the current study. Sterner and Bartelings concluded that the most important positive influences on waste disposal at the household level were home size and practical difficulties with recycling, and the most important negative influences were the composting of kitchen waste and advancing age.

Beede and Blom [1995] analyzed country-level panel data to consider the influence of income on waste. They found that MSW generation is positively related to per capita income, but does not vary with population size among countries with comparable per capita income. Beede and Blom project that levels of MSW will increase at a rate of 2.7 percent per year through 2010. The county-level dataset used in the present study provides a check on the robustness of past findings regarding income and population as determinants of MSW levels. At the same time, this study examines the influence of an expanded set of relevant variables on the demand for solid waste disposal.

A number of related studies have examined the determinants of recycling and the effects of "pay-as-you-throw" market-based incentives for MSW reduction. For example, Callan and Thomas [1997] examined city-level recycling rates for communities in Massachusetts. Their explanatory variables included income, education, and population density. Inasmuch as increases in recycling correspond with decreases in MSW production,[6] the coefficients on those variables in the current study can be expected to have the opposite sign of those in Callan and Thomas' results. They found that income and education had positive coefficients and population density had a negative coefficient.

Miranda et al. [1994] studied market-based incentives to reduce MSW with data from phone and mail surveys in 21 U.S. cities. They found that pay-per-throw programs offered significant reductions in solid waste generation. Similarly, Reschovsky and Stone [1994] studied the probability of recycling using survey data from an upstate New York county. They found that recycling rates increased significantly when curbside pickup was combined with mandatory recycling, pay-per-throw incentives, or both.

Since most MSW is a byproduct of consumption, and consumption patterns influence the translation of income into waste, there is a bridge between this study and a broad array of research on consumption. Dunlap, Buttel, Dickens, and Gijswijt [2002] describe the role of consumption as a staple concern of environmental sociology. And Shove and Warde [2002] suggest that despite the attention to materialism and the environment, to date there have been only modest efforts to link societal variables with consumption and environmental harm.

[6] Wenger, Thyner, and Wagoner [1997] address this issue.

III. Notable Trends[7]

Of particular interest are several variables expected to change significantly over the coming decades. Real median incomes are steadily increasing in every region of the country, and mean incomes are on the rise for each income quintile. The relationship between income and MSW is theoretically ambiguous. Although consumption levels generally increase with income, so do expenditures on more-durable consumer goods, recycling infrastructure, education, and other goods and services that may have a negative influence on waste generation. Education levels are on the rise. Between 1970 and 1998 the percentage of the adult population with less than a high school diploma decreased from 44 percent to 17 percent, while the percentage with at least some college education more than doubled, from 22 percent to 58 percent.

The U.S. Census Bureau projects that the U.S. population will continue to migrate south and west over the next century, making regional influences of interest. Age may also play an important role in resource management. Between 1970 and 1999, the under-18 population increased by only 0.8 percent while the 18-64 population increased by 48 percent and the over-65 population increased by 72 percent. Over the next 25 years, the under-20 and 20-64 populations are projected to decrease by 1-2 percent, and the over-65 population is projected to increase by 40-56 percent.

The racial and ethnic composition of the U.S. is expected to change as well. Over the next 25 years, the Hispanic population is projected to increase from 11.5% to 17.6% of the U.S. population. The African-American population is projected to increase from 12.1% to 13.0%, the white population is projected to decrease from 71.9% to 62.4%, and the Asian, American Indian, Eskimo, Aleutian, and Pacific Islander population is expected to increase from 4.5% to 7%. This study will examine the relationship between these and other demographic and socio-economic variables and the generation of waste.

IV. Data

The U.S. Census Bureau defines municipal waste as "that which is collected and treated by or for municipalities: household waste and bulky waste as well as comparable waste from small communities or industrial enterprises; and market and garden residue" [U.S. Census Bureau, 2001, 838]. Annual data on municipal solid waste were obtained by this author from unpublished reports via correspondence with Environmental Protection Agency regional solid waste managers for 1055 U.S. counties in 17 states.[8] States were omitted only because they did not provide county-level data. In most cases the omitted states collected data by landfill or region rather than by county.[9] Alaska was omitted because it has no counties. All of the data obtained for this study are from the 1990s: Population figures are from 1995, waste data are from 1995-98, employment, income, and industry data are from 1992-94, voting data are from the 1992 presidential election, and some of the demographic data are from the 1990 census.

[7] Data on trends were obtained from the U.S. Census Bureau (www.census.gov) and the Population Reference Bureau (www.ameristat.org).

While some states collect data on both waste generated and waste disposed of (the difference being waste recycled), the MSW variable used in this study is in every case the measure of waste disposed of.

Variable definitions appear in Table 2. The dependent variable is the natural log of WASTE, which measures the annual tons of municipal solid waste per capita at the county level. The explanatory variables include education, region, income, age, and race. Land, farms, and business establishments are measured on a per capita basis. The analysis includes a variable for the percentage of firms in the service industries because customers of hotels, sporting events, hospitals, entertainment venues and the like deposit much of their waste on site. In contrast, retail, wholesale, and manufacturing industries, among others, involve products that become waste elsewhere. The rate of serious crimes is included as a proxy for moral climate, and the political party variable may capture other social priorities.

Table 3 provides sample means and standard deviations. The sample is broadly representative of the population at large. For example, 83 percent of the sample completed four years of high school or more, 40 percent voted for the Republican presidential candidate in 1992, and 15 percent were 65 years old or older. The analogous figures for the entire U.S. population during the same time period were 82 percent, 37 percent, and 13 percent respectively. Although every region of the country is represented, only four percent of the counties for which MSW levels were available reside in the East. Thus, the findings for the EAST dummy variable may not be representative of the larger region. The other three regions of the country receive approximately equal representation within the sample. Adults between 22 and 64 years of age represented 53 percent of the residents in the sampled counties on average. Hispanic citizens and African American citizens composed about seven percent of county population on average, and there was an average of one non-farm establishment for every 43 individuals in the counties studied.

V. The Model and Hypotheses

Following Sterner and Bartelings [1999], this analysis involves log-linear specifications that do not combine income and strong determinants of income (e.g., education) in the same equation. The model can be interpreted as a demand function for waste disposal services. The first specification involves all of the variables except income:

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[8] The sample includes data from California, Delaware, Florida, Hawaii, Illinois, Indiana, Kansas, Kentucky, Maryland, Michigan, Montana, New Jersey, New Mexico, North Carolina, South Carolina, Texas, and West Virginia. Contact information for the regional managers was obtained from the EPA at: http://www.epa.gov/epaoswer/non-hw/muncpl/factbook/internet/intro/epa3.htm.

[9] It is assumed that a state's unit of observation for MSW data collection is independent of the relationships tested in this paper. Violations of this assumption could potentially bias the results.

$$\ln WASTE = \alpha_0 + \alpha_1 HIGH\ SCHOOL + \alpha_2 COLLEGE + \alpha_3 ESTABLISHMENTS + \alpha_4 SERVICE\ INDUSTRY + \alpha_5 LAND + \alpha_6 FARMS + \alpha_7 SERIOUS\ CRIME + \alpha_8 NORTH + \alpha_9 EAST + \alpha_{10} SOUTH + \alpha_{11} ESKIMO/ALEUTIAN + \alpha_{12} ASIAN/PACIFIC\ ISLANDER + \alpha_{13} AFRICAN\ AMERICAN + \alpha_{14} HISPANIC + \alpha_{15} ADULTS + \alpha_{16} SENIORS + \alpha_{17} POLITICAL\ PARTY + \varepsilon.$$

Previous studies (e.g., Anderson, 1994, 653) have demonstrated strong relationships between income and education, race, service occupations, and business centers. For this reason, the second specification includes income and omits the variables most likely to correlate with income (HIGH SCHOOL, COLLEGE, ESTABLISHMENTS, SERVICE INDUSTRY, and the race variables):[10]

$$\ln WASTE = \alpha_0 + \alpha_1 INCOME + \alpha_2 LAND + \alpha_3 FARMS + \alpha_4 NORTH + \alpha_5 EAST + \alpha_6 SOUTH + \alpha_7 ADULTS + \alpha_8 SENIORS + \alpha_9 POLITICAL\ PARTY + \varepsilon.$$

In these equations ε_i is a stochastic error term and *i* subscripts are dropped for simplicity. These equations can be estimated using ordinary least squares given the appropriate assumptions about the normality of the error term. On the basis of a White test performed using the SAS SPEC procedure, the joint null hypothesis of independent and homoskedastic errors and valid model specification is accepted for both models at any conventional level of significance.

The models do not include variables for pay-per-throw programs or gender. Pay-per-throw programs provide incentives for waste reduction by charging per-unit fees for disposal. These programs typically exist at the city level, whereas the unit of observation in this study is the county. A small proportion of the counties in the sample contained cities with pay-per-throw programs, but it was unknown what proportion of those counties' populations the programs affected. Test regressions that included a dummy variable for counties with at least one pay-per-throw program produced no significant results.

Gender distribution was not included in the sample. Variation in a gender variable at the county level may have been limited, and previous studies by Sterner and Bartelings [1999] and Reschovsky and Stone [1994] found no significant gender effect on waste disposal, newspaper recycling, composting, or waste incineration. Furthermore, in contrast to the above variables, there has been very little change in gender representation. Between 1970 and 1999, the male

[10] For example, SAS collinearity diagnostics indicate a proportion of variation of 0.875 between income and the HISPANIC variable.

population of the U.S. increased from 48.7% to 48.9% of the overall population. The female population decreased from 51.3% to 51.1%. No significant trends in regard to gender are anticipated. For these reasons, this study does not focus on gender.

Education and income have theoretically indeterminate effects on MSW generation. Both may foster relatively immodest lifestyles and the pursuit of material possessions. Education may also be environmentally enlightening, and conservation may behave as a luxury good. Composters, recycling bins, and products made from recycled materials all cost more than their less ecological alternatives. Lackman [1976] suggests that individuals with higher incomes will generate relatively more solid waste. Given the higher opportunity cost of their time, he reasons that high-income groups will prefer to spend money on disposable items rather than time on repairable or returnable goods. The results will speak to this hypothesis.

Beyond the income effects of advanced schooling, education may convey the repercussions of waste and teach alternatives to resource exploitation. Some secondary school curricula require students to construct solar water heaters and learn conservation techniques. Some college level courses provide exposure to more advanced conservation methods. And some college campuses bring students into contact with recycling bins and outspoken environmentalists. Thus, education may have a negative effect on waste. In support of this hypothesis, Callan and Thomas [1997] estimated that education had a positive but not statistically significant effect on recycling, and Sterner and Bartelings [1999] found education to have a negative but not statistically significant effect on waste disposal demand.

Establishments represent sources of consumption and subsequent waste generation, suggesting a positive effect. Service industries in particular use a smaller volume of resources than manufacturing, retail, and wholesale industries. However, the latter ship their products to customers around the country, while the waste that service industries do generate is more likely to remain within the county in such forms as medical waste, office waste, and food containers from sporting events, hotels and amusements. For these reasons, the percentage of service industries is expected to have a positive effect on county-level MSW.

Rural areas offer improved opportunities for composting, the use of food waste as animal feed, storage for re-use, and on-site disposal. They also offer inferior access to retail shopping venues, perhaps reducing the temptation to dispose of assets that are maintainable or reusable. The LAND per capita variable will pick up some of the influences of urbanization, and the FARM variable will test related stereotypes of frugality in agrarian culture. Anecdotal evidence includes quilts made from old clothing and tractors built from old parts. Cailas et al. [1996] find a positive correlation between population density and waste, and Callan and Thomas [1997] provide related evidence that population density has a negative and significant effect on recycling levels.

As a gauge of morality, SERIOUS CRIMES is expected to correspond with higher rates of waste. The POLITICAL PARTY variable, a proxy for pro-business versus pro-environment priorities, is hypothesized to have a positive effect on waste. The East and North have relatively more bottle recycling bills, pay-per-throw trash programs, and curbside recycling programs. If

these are indications of more aggressive attitudes towards waste reduction, EAST and NORTH should have negative coefficients. Eskimo and Aleutian cultures practice reverence for the animals that sustained their communities,[11] and the concomitant mentality that no flesh or bone should go to waste. If this attitude carries over to resource use more generally, these groups can be expected to produce less waste. African Americans and Hispanics are expected to dispose of more waste as the result of disproportionate representation in relatively poor areas where the quality of education is inferior for any given level of education. Seniors, who lived through the imposed frugality of the depression (or were closer to the generation that did), are expected to dispose of less waste than adults or children.

VI. Findings and Discussion

Table 4 presents the results of the first equation. The findings suggest that education has a different effect on waste disposal at different levels of schooling. Relative to no high school, the completion of high school had a positive effect that was not statistically significant ($t = 1.02$), and the completion of college had a statistically significant negative effect. The income effects of a college education are apparently compensated for, perhaps by increased environmental awareness and a willingness to spend some of the added income on conservation efforts. As hypothesized, the number of establishments per capita had a highly significant positive effect, as did the percentage of firms in the service industry.

Land per capita had a significant negative coefficient.[12] As the amount of undeveloped land decreases and fewer property owners can dispose of waste *locus rei sitae*, there will be greater needs for landfills and other disposal methods. The LAND variable picks up the increased options for composting, disposal of food waste in livestock feed, and informal dumpsites in rural areas, all of which allow lower rates of solid waste disposal by the municipality with or without lower rates of solid waste generation. Evidence of the relative frugality and resourcefulness of rural agrarian populations comes from the negative coefficient on FARMS, which is significant at the 1-percent level. Controlling for land per capita, a decrease in the number of farms constitutes a decrease in the number of farmers. These estimates suggest that current trends toward larger farms and fewer farmers will coincide with increasing resource expenditure.

The findings suggest that moral decay as signified by crime rates is reflected in MSW levels. The coefficient on SERIOUS CRIMES was positive and significant at the 5-percent level. This may result from differing moral values among the citizens that lead some to care less

[11] For example, whaling ship captain Burton "Atqann" Rexford wrote: “The bowhead [whale] is our brother. Our elders tell us that the whales present themselves to us so that we may continue to live. If we dishonor our brother or disturb his home, he will not come to us anymore.” See the *World Council of Whalers News*, http://www.worldcouncilofwhalers.com/Newsletter/NL93.html, accessed October 18, 2001.

[12] These regressions were also run with population per acre in place of land per capita. The results were substantially the same, although the R-squared values were lower and the statistical significance was slightly weaker for the majority of variables in each regression.

about the environment, or from differing priorities in high-crime areas that commit resources to security that might elsewhere be allocated to conservation. The hypothesized negative coefficient on EAST was significant at the 5-percent level, although the other regions did not have significant effects.

As expected, ESKIMO / ALEUTIAN had a negative effect, although it was only significant at the 15-percent level. The highly significant positive coefficient on AFRICAN AMERICAN may reflect the quality of schooling in predominantly African American counties more so than any cultural phenomenon. It might be safe to assume that conservation is a learned behavior, and under-funded urban school systems may place less emphasis on recycling than suburban schools. HISPANIC was expected to have a positive coefficient for the same reasons, although this value was only significant at the 25-percent level. ASIAN / PACIFIC ISLANDER had no statistically significant effect on the level of waste disposal.

The hypothesized frugality of senior citizens is suggested by the weak (t = -0.84) negative coefficient on the SENIORS variable, but the variable was not significant. The influences of the adult and senior age levels are measured relative to the effect of youth, and the weak (t = 1.39) positive effect of the ADULT variable compared with the negative SENIORS coefficient may indicate a meaningful difference between adults and seniors. As a unique contribution to the literature, and as expected, POLITICAL PARTY had a positive and significant coefficient.

As indicated in Table 5, the inclusion of income in the second model yielded a positive and statistically significant coefficient. As incomes increase worldwide, the amount of waste is likely to increase. Among the variables that appeared in both models, each of those found to have significant effects in the first model were again found to have significant effects of the same sign in the second model. As one would expect with a decrease in the number of explanatory variables, several of the variables appeared more significant in the second model. For example, the proportion of adults again had a positive effect, this time at the 10-percent level of significance.

VII. Conclusion

Over the next century, the population of the United States will become older, wealthier, more diverse, and better educated. The overall population will double, and regions in the South and West will experience even more substantial increases in population. These and related socio-economic trends are echoed throughout the world, and involve influences on the environment including resource depletion and subsequent expansion in municipal solid waste production. With per-capita municipal solid waste levels rising by over one percent annually and a concurrent decrease in the number of available landfills, the objective of this project is to examine the relationship between demographics and the amount of waste generated but not recycled.

The findings suggest that municipal solid waste disposal at the county level decreases with the number of farms per capita, the amount of land per capita, and the percent of the

population with a college education. The number of establishments, the percent of firms in the service industry, per-capita income, the percent of republican voters, the percent of African Americans, and the serious crime rate all exhibit significant positive coefficients. An understanding of these relationships may permit the anticipation of future solid waste crises, and the targeting of policy initiatives toward the most profligate groups. Further research could determine the most effective ways of introducing, for example, the resourceful values of farming culture to inner-city youth, and policies that address the particular solid waste issues of service establishments.

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Table 1

Composition of U.S. Municipal Solid Waste, 2003

Material	Percent
Paper / Paperboard	35.2
Yard Trimmings	12.1
Food Scraps	11.7
Plastic	11.3
Metals	8.0
Rubber / Leather / Textiles	7.4
Wood	5.8
Glass	5.3
Other Waste	3.4

Source: EPA [2005]

Table 2

Variable Definitions

WASTE	Annual tons of municipal solid waste disposed of per capita in county
HIGH SCHOOL	Percent high school graduates, but not college graduates
COLLEGE	Percent college graduates
ESTABLISHMENTS	Private non-farm establishments per capita
SERVICE INDUSTRY	Percent of firms that are in service industries
LAND	Land area in square miles per capita
FARMS	Number of farms per capita
SERIOUS CRIMES	Serious crimes per 100,000 population
NORTH	Regional dummy variable: 1 if county resides in northern U.S., 0 otherwise
EAST	Regional dummy variable: 1 if county resides in eastern U.S., 0 otherwise
SOUTH	Regional dummy variable: 1 if county resides in southern U.S., 0 otherwise
ESKIMO / ALEUTIAN	Percent of population that is American Eskimo or American Aleutian
ASIAN / PACIFIC ISLANDER	Percent of population that is Asian or Pacific Islander
AFRICAN AMERICAN	Percent of population that is African American
HISPANIC	Percent of population that is of Hispanic origin
ADULTS	Percent of population between the ages of 22 and 64 inclusive
SENIORS	Percent of population 65 and over
POLITICAL PARTY	Percent of Republican votes in presidential election
INCOME	Income per capita in dollars

Table 3

Sample Means and Standard Deviations (N=1055)

Variable	Mean	Standard Deviation
WASTE	1.33	5.78
HIGH SCHOOL	69.31	10.22
COLLEGE	13.49	6.62
ESTABLISHMENTS	0.023	0.0068
SERVICE INDUSTRY	31.27	4.81
LAND	0.079	0.22
FARMS	0.030	0.034
SERIOUS CRIMES	2,892.01	2,549.22
NORTH	0.31	0.46
EAST	0.04	0.20
SOUTH	0.31	0.46
ESKIMO / ALEUTIAN	1.06	4.39
AFRICAN AMERICAN	7.48	11.94
ASIAN / PACIFIC ISLANDER	0.92	3.59
HISPANIC	7.03	14.69
ADULTS	53.07	3.21
SENIORS	14.75	4.50
POLITICAL PARTY	40.31	8.71
INCOME	17,171.79	4076.70

Table 4

Estimate of Log Waste Equation*

Variable	Coefficient	t – ratio
INTERCEPT	-2.72[a]	-3.31
HIGH SCHOOL	0.0048	1.02
COLLEGE	-0.012[c]	-1.78
ESTABLISHMENTS	17.15[a]	3.38
SERVICE INDUSTRY	0.021[a]	3.11
LAND	-0.30[b]	-2.02
FARMS	-3.77[a]	-3.03
SERIOUS CRIMES	0.000028[b]	1.98
NORTH	0.059	0.67
EAST	-0.32[b]	-2.04
SOUTH	-0.0089	-0.08
ESKIMO / ALEUTIAN	-0.0090	-1.42
ASIAN / PACIFIC ISLANDER	0.0045	0.58
AFRICAN AMERICAN	0.0059[b]	2.04
HISPANIC	0.0032	1.18
ADULTS	0.019	1.39
SENIORS	-0.0076	-0.84
POLITICAL PARTY	0.0075[b]	2.24

* R-square = 0.15, adjusted R-square = 0.14.
[a] Significant at the .01 level.
[b] Significant at the .05 level.
[c] Significant at the .10 level.

Table 5

Estimate of Log Waste Equation with Income Variable*

Variable	Coefficient	t – ratio
INTERCEPT	-1.71[b]	-2.46
INCOME	0.000017[b]	2.13
LAND	-0.32[b]	-2.24
FARMS	-7.19[a]	-6.67
NORTH	-0.096	-1.32
EAST	-0.41[a]	-2.70
SOUTH	-0.057	-0.71
ADULTS	0.022[c]	1.71
SENIORS	0.0014	0.17
POLITICAL PARTY	0.0067[b]	2.06

*R-square = 0.119, Adjusted R-square = 0.111
[a] Significant at the .01 level.
[b] Significant at the .05 level.
[c] Significant at the .10 level.

How to Pass Down Ideas Via the National Pastime Or Teaching Cliometrics Using Baseball Statistics

Brian K. Strow and Claudia W. Strow*

Abstract

Recent research has emphasized the value of active learning techniques for improving student comprehension and retention of economic concepts. In order to help students better understand the statistical findings presented in American economic history, we propose a group project that requires students to analyze historical baseball statistics. This paper explains the impetus of the class project, details the framework of the project, and examines the implementation thereof. While this project is especially useful for courses in American economic history, this project is applicable to a variety of other courses including statistics, econometrics, and sports economics.

I. Introduction

As enrollments in economics courses dropped in the early 1990's, researchers began to emphasize the importance of using alternatives to traditional lecturing methods in order to captivate and interest students in economics (e.g., Becker and Watts 2001, and Becker 1997). Although enrollments are now on the rise, the need for attracting students and keeping them interested in economics still exists (Siegfried, 2004).

Keeping students' attention while discussing statistical analysis can be particularly challenging. Yet, statistical analysis is vital to the understanding of most upper level economics courses. The purpose of this paper is to introduce a group project that requires students to analyze historical baseball statistics so that they may better understand the processes used to model and analyze historical economic data. While we have found this project to be useful for a course in American economic history and will focus our discussion on courses of this nature, this project is applicable to a variety of other courses including statistics, econometrics, and sports economics.

In the next section, we briefly describe the project and explain its role in an American economic history course. We then illustrate how to conduct the project over the course of the semester and describe our experience with the project. Finally, we discuss extensions of this project for other courses.

*Assistant Professors of Economics, Department of Economics, Western Kentucky University, 1906 College Heights Blvd., Bowling Green, KY 42101. E-mail: brian.strow@eku.edu and claudia.strow@wku.edu.

II. Impetus for the Class Project

Cliometrics, the statistical analysis of economic history, has revolutionized the field of economic history. Economic historians such as Nobel Prize winners Robert Fogel and Douglas North have recently been recognized for their use of cliometrics (Goldin, 1995). By infusing statistical methods into the study of economic history, cliometricians have altered fundamental assertions made by previous economic historians.

The primary objective of our American economic history course is to help students better understand causes and consequences of past economic phenomena and equip them with the analytical tools necessary to evaluate historical events from an economist's perspective. Such study facilitates an individual's ability to learn from past economic triumphs and tragedies in order to avoid repeating the same mistakes in the future. Since the major findings in economic history have all been the result of cliometrics, economic history instructors are remiss if they fail to communicate to students the value added from using quantitative methods to study economic history.

One way to do this is to have the students read quantitative works such as Robert W. Fogel's (1964) work on railroads so they will gain a better understanding of how to conduct research in economic history. Another way for instructors to expose students to cliometrics is by introducing a hands-on project. At the undergraduate level, the choice of projects is key. One could assign historical data sets and have students conduct original research using the data sets. These data sets may or may not be of much interest to students. Such a project may be best served in a graduate course where the selection of students is biased in favor of those interested in economic history.

In order to attract more students to economic history, the project must cast a larger net. Ideally, history majors, economics majors, and other business majors who are looking to add an elective course would find an interest in American economic history. The inclusion of a project that involves analyzing historical baseball statistics potentially attracts more students to the course.

There are both pros and cons to using baseball as the topic for a research project in American economic history. On the positive side, a large and detailed data set is readily available for baseball. Observers of Major League Baseball have done an excellent job of collecting player and team data since its inception via box scores. This data set is easily available at the baseball archive (www.baseball1.com). Because of its size, the data set can be split up and used by many different groups in a class without having an overlap in the statistics. Secondly, this data set is easy to model, as most students can easily identify and measure inputs and outputs in baseball. Thirdly, anecdotal evidence suggests that students enjoy studying baseball in an academic context. The level of students' effort and achievement appears to be directly correlated with their interest in the topic, and baseball is interesting to most students.

The major downside to using baseball as the data set of choice is the opportunity cost of forgoing the empirical study of topics more directly related to economic history, such as the profitability of slavery or railroads, the economic costs of the US Civil War, or the impact of protectionist tariffs on the infant manufacturing sector during the early 1800's. While these topics can still be studied in conjunction with the following baseball project, students will not have the time to do original empirical work on these topics.

Our university's American economic history course is structured in such a fashion as to highlight the developmental process of the American economy along with explaining past economic phenomena and the role institutions play in these events. Our baseball project targets our objective of familiarizing students with the tools and process involved in conducting statistical research on historical data sets. Furthermore, we find that the extra interest generated in the American economic history course as a result of this project outweighs the opportunity cost of forgoing the study of a more purely economic topic.

The main goal of the statistical project is to better acquaint students with the statistical and econometric tools that make the study of economic history worthwhile. Sabermetricians attempt to use historical baseball statistics to predict future baseball results, just as cliometricians attempt to use historical economic statistics to forecast future economic trends. The method used by both sabermetricians and cliometricians is the same, so students can learn to do cliometrics by doing sabermetrics. In this way, examining historical baseball statistics exposes students to the application of statistical analysis to historical data sets.[1]

A unique way to incorporate sabermetrics into the course is by using "ESPN Classic Fantasy Baseball". This option allows hands on learning throughout the semester. The competitive spirit in students comes to the forefront as they compete against each other for baseball supremacy and ultimately, a higher grade. Multiple students have commented that this was their favorite project in college … and to think, it was in an economic history class!

This project requires only about 15 to 20 minutes of class time for explanation, and so takes up very little class time. Outside of class, each group collected their baseball data and decided which variables they wanted to use for their estimations. The groups each scheduled a time to meet with the instructor to discuss their data and run their estimations. During this meeting we discussed both the meaning of their numbers and how they could improve upon their estimations. In the next section of this paper, we will explain how to conduct this project in class.

[1] Ideally, we would quantitatively measure and compare student performance, enrollments, and interest in cliometrics in courses using the project with courses that do not. Unfortunately, this course is taught every other year with few factors held constant. Further problems with empirical measures of such activities are discussed in Becker (1997). Consequently, at the present time the project's effectiveness cannot be quantitatively measured and reported.

III. The Project

Students are divided into 11 groups (12 if the professor does not participate in the project)[2]. The project is broken down into three papers and the baseball simulation with a project grading scheme such as the following: Paper #1 is worth 50%, Paper #2 is worth 25%, Paper #3 is worth 15%, and Team Standing is worth 10%.

In our class, the project as a whole was worth 24% of the students' final grade. Three exams based on class readings and lecture were worth 66% of the grade, while the completion of reading assignments in American Economic History made up 10% of the final grade.

IV. Paper #1 (10-15 pages)

The initial paper has three parts. The first is a brief literature review of baseball production functions. Numerous researchers have examined such production functions (see, for example, Scully (1974), Thorn and Palmer (1989), Ryan (1991), and Zimblast (1992)). In part two, students are to model a baseball production function. The dependent variable is team wins. Wins are a function of runs scored and runs allowed. Therefore, a production function for runs scored and runs allowed should be tested.

A production function for runs scored may include, but is not limited to, independent variables such as the team's ballpark, batting average, on-base percentage, slugging percentage, stolen base percentage, and the overall number of singles, doubles, triples, home runs, stolen bases, sacrifice hits, strikeouts, and double plays grounded into. A production function for runs allowed may include, but is not limited to, the team's fielding percentage, a park factor, and the total number of double plays, allowed walks, strikeouts, allowed hits, and allowed home runs.

In the third part of the paper, students empirically test their model. Each group chooses one major league franchise with which to test their model empirically and determine which factors influence runs scored and runs allowed.[3] Students should choose a franchise with at least 60 years of observations. Sixteen teams fit this criterion. Data is available for each franchise at http://www.baseball-reference.com/. To avoid duplication of franchises, the professor may wish to clear franchise selection.

While this paper involves empirically analyzing the characteristics of a successful baseball team, the knowledge gained from doing a literature review, building a testable model, and doing empirical analysis is of value to all economics students, especially students of economic history. In examining and creating a production function, students learn how to build and test an economic model and should then better understand how

[2] If the class is larger than 45 students, then one may want to double the number of groups.

[3] The purpose of choosing only one team per group is to ensure that groups work independently of each other. Alternatively, players for a variety of teams could be chosen, but this may result in some overlap between groups.

economic historians use this same process when analyzing historical data. In that vein, the next step in the project is to apply the theory to reality. This is done with the help of "ESPN Classic Fantasy Baseball".

V. Paper #2 (5-10 pages)

The goal of this paper is for students to apply and test the theoretical and empirical work from their first paper. Each group purchases a team from ESPN Classic Fantasy Baseball at http://games.espn.go.com/legends. Each team costs $49.95, and group members can split this cost.

The instructor first sets up a private league for the teams to join. The instructor can take his or her team, create a private league with a password, and give this information to the groups. Each group then joins the private league. Once groups have formed their teams, they will play each other with the help of ESPN computer simulations.

Each team drafts thirty players: twenty-five players for the major league roster and five for the minor league. The player pool consists of all baseball players who have been retired for at least five years. Each player has a market value attached to him. The demand for each player over time determines his price. Teams face a budget constraint, as the total value of the players on their initial roster cannot exceed $50 million. Following each of the first seven weeks of play, teams are allotted an extra $1 million with which to improve their team. Once the season begins, players can be cashed in at 80% of their value. This aspect of the simulation challenges students to maximize production given a budget constraint.

There are two ways to handle the drafting of players. In the first option, all teams can draft from the entire player pool. This increases the research costs (in time) to the students. It also opens up the possibility that students may draft some of the same players that other groups draft. Since only one group can actually have the player, some teams may be left with their second best choice.

In the second option, groups can draft only players that played a majority of their career for a specific team. For instance, if group A chooses to test their model empirically on the Chicago Cubs, then their player pool will be limited to former Chicago Cubs. This option lowers the research time of player histories. It also solves the problem of more than one team drafting the same player. Given the salary constraint by all teams, there should be no advantage to having selected one specific franchise (like the Yankees). Having used the first option previously, we recommend the second option to avoid conflicts in the draft. It also lowers the research time needed, which is important given early deadlines.

Upon completion of the draft, each group must turn in a paper explaining why it chose its particular players. Terms that may be included are average, variance, probability, and opportunity cost. Team selection should follow the empirical evidence students discovered in their first paper. Groups are also to choose the park in which they are going to play their home games. Once this process is completed, league play can begin.

VI. Paper #3 (3-6 pages)

The final paper of this project has two parts. The first part is to include reasoning behind each roster move the group made during the course of the season. Why were certain players turned in? Why were others purchased? Because the simulation records all transactions, the instructor and students can easily view them. The second part is for students to reflect on what went right or wrong with their team and why.

VII. Timing Issues

Once teams are drafted, the season takes 9 weeks to run. Three games are played six days a week. The games are played on ESPN computers in the middle of the night while all students (or most given that we are talking about college students) are asleep. The playoffs and World Series are in week 10. Therefore, the first two papers must be due fairly quickly in the semester. The great advantage to this is that typically students' other courses will concentrate a majority of their projects at the end of the semester. This course will gain more of the student's attention by being counter-cyclical in workload. Given that many students in an upper level course such as this are seniors, front loading the work is advantageous to seeing it accomplished.

VIII. Reflection on the Implementation

Some summary results of the league conducted in a prior class appear at the end of this paper. In our experience, students appreciate the instructor's participation in the league, and love to rub it in when they beat the instructor. Students and alumni have shared how much they thoroughly enjoyed the project. They typically spend a lot of time outside of class talking about it.

The remainder of our course involves readings and lectures in American Economic History. We have found that when discussing others' econometric findings, students appear to better appreciate how economic historians arrived at their conclusions when they themselves have participated in this project and run their own estimations.

Also important is that students who were not in the course found out about the project and have expressed interest in taking the course because of the project. The project serves both as a "hook" to get students to take an economic history class and as a method to expose them to cliometrics. For some non-economics majors, it is their only exposure to econometrics of any form. Furthermore, this "hook" involves students creating and examining models using a historical data set. Such an analysis allows them to better understand the process used in the more traditional economic history research covered in class. This enriches their study of economics generally and economic history specifically.

As surprising as it sounds, not all students are interested in baseball. This is inevitable for any topic. There are two ways to solve this problem. The first is to make sure that people who don't care much about baseball are grouped with those who do. Then, the non-baseball lovers can focus more on the general research and model building while the other group members can specialize in team formation.

The second option is to create an alternative project that does not involve baseball. This option has been used at our university. Three out of twenty-eight students in one particular class opted for this choice. Two of those three students were female. The other seven females in the class gladly participated in the baseball project. We were concerned at the outset that the project may be too "male biased", but what we found was that many of the women in the course had a general interest in sports, if not in baseball itself.

The project helps students reinforce such economic concepts such as opportunity cost, production functions, budget constraints, and maximization. It also gives students econometric practice in a historical context. From this project, students gain experience with literature reviews, model building, and model testing. In this vein they learn how economic historians build and test models in order to interpret historical events. All that, and they learn more about the national pastime as well. Now that's education.

IX. Conclusion

Economic history is a valuable area of study for those who want to know why economic phenomena occur and what effect these events have on our economy. Economic historians have revolutionized the study of economic history by using econometric analysis to aid in their explanation of economic phenomena. In applying such analysis, economic historians have corrected earlier faulty conclusions arrived at without the aid of econometrics. For those instructors who wish to increase the popularity of their economic history course while exposing more students to econometrics, we suggest incorporating a project using "ESPN Classic Fantasy Baseball" into the course. This has increased the popularity of our university's American economic history course while exposing students to the study of historical statistics. Although quantitative evidence of the effectiveness of such a project in improving students' understanding of economic history is not yet available, anecdotal evidence suggests that incorporating a topic as popular as baseball does just that. Furthermore, such a project could also be a useful tool in other economics courses such as econometrics, statistics, and sports economics.

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Econ 467 League Standings

TEAM	W-L	%	GB	HM	1 Run	L WK	2 WK	3 WK	Extra Innings
Eastern Division									
Free Market Enforcers	91-71	.562	-	47-34	24-22	0-0	10-8	21-15	6-5
Undervalued Externalities	85-77	.525	6	46-35	20-28	0-0	9-9	23-13	10-3
Hopeless Nine	81-81	.500	10	46-35	21-21	0-0	7-11	16-20	1-7
Springfield Ice-O-Topes	72-90	.444	19	41-40	23-16	0-0	10-8	19-17	9-8
Central Division									
Team Modlin	94-68	.580	-	47-34	21-21	0-0	10-8	20-16	4-4
Team Summers	91-71	.562	3	46-35	28-24	0-0	10-8	24-12	10-6
bowling green econgeeks	73-89	.451	21	43-38	25-25	0-0	5-13	13-23	8-7
Scottsville Supply	69-93	.426	25	37-44	28-26	0-0	11-7	15-21	10-10
Western Division									
Team Glover	85-77	.525	-	43-38	30-19	0-0	11-7	19-17	4-4
pennant or bust	79-83	.488	6	42-39	15-26	0-0	8-10	15-21	4-9
Bangkok Hoodrats	76-86	.469	9	42-39	19-25	0-0	10-8	15-21	7-9
Demand Curvballs	76-86	.469	9	38-43	19-20	0-0	7-11	16-20	7-8

Econ 467 League Batting Totals

	AVG	AB	R	H	2B	3B	HR	RBI	BB	SB	OBP	SLG
Eastern Division												
Free Market Enforcers	**.283**	**5680**	**840**	**1607**	**314**	**54**	**136**	**808**	**547**	**156**	**.348**	**.429**
Undervalued Externalities	.265	5542	771	1469	239	57	118	727	608	105	.340	.393
Springfield Ice-O-Topes	.254	5598	806	1424	277	54	131	761	648	52	.337	.393
Hopeless Nine	.252	5506	748	1386	258	21	168	715	632	48	.330	.398
Central Division												
Team Modlin	.275	5597	810	1541	273	40	96	778	669	182	.353	.390
Team Summers	.258	5557	759	1434	245	28	128	725	514	144	.322	.381
Scottsville Supply	.254	5608	630	1422	228	24	81	596	488	56	.314	.346
bowling green econgeeks	.251	5552	695	1393	224	47	117	665	553	116	.320	.371
Western Division												
Bangkok Hoodrats	.253	5496	641	1392	247	45	83	607	526	145	.320	.360
Demand Curvballs	.250	5558	656	1390	239	27	110	622	546	100	.320	.362
Team Glover	.243	5488	665	1334	207	36	126	628	509	48	.311	.363
pennant or bust	.243	5559	709	1351	251	49	133	676	592	114	.317	.378

Econ 467 League Pitching Totals

	ERA	W-L	SV	SVOP	IP	H	HR	R	ER	BB	K
Eastern Division											
Free Market Enforcers	3.92	91-71	24	36	1454.0	1424	112	689	634	512	745
Undervalued Externalities	4.17	85-77	24	41	1444.2	1443	133	731	669	557	891
Hopeless Nine	4.45	81-81	33	42	1435.0	1463	140	769	710	579	1018
Springfield Ice-O-Topes	4.89	72-90	26	40	1443.0	1649	134	894	784	602	964
Central Division											
Team Modlin	3.64	94-68	36	48	1440.2	1256	103	643	582	591	874
Team Summers	3.67	91-71	37	48	1453.0	1415	109	665	592	532	723
bowling green econgeeks	4.01	73-89	27	51	1446.0	1487	122	748	645	531	921
Scottsville Supply	4.12	69-93	28	33	1459.2	1326	135	753	668	680	1086
Western Division											
Bangkok Hoodrats	3.47	76-86	22	29	1451.1	1371	109	666	559	483	1007
pennant or bust	3.90	79-83	27	39	1452.2	1442	103	698	629	562	1009
Team Glover	3.93	85-77	31	45	1448.2	1412	101	700	633	579	1030
Demand Curvballs	4.20	76-86	29	34	1454.2	1455	126	774	679	624	1001

Econ 467 League Fielding Totals

	Pct	G	PO	A	E	TC	DP	PB
Eastern Division								
Free Market Enforcers	.986	162	4362	1762	89	6213	177	8
Hopeless Nine	.983	162	4305	1491	102	5898	152	8
Undervalued Externalities	.981	162	4334	1465	112	5911	141	5
Springfield Ice-O-Topes	.974	162	4329	1444	154	5927	139	7
Central Division								
Team Summers	.984	162	4359	1819	99	6277	172	12
Team Modlin	.983	162	4322	1853	105	6280	126	8
Scottsville Supply	.978	162	4379	1627	132	6138	121	9
bowling green econgeeks	.974	162	4338	1577	160	6075	136	11
Western Division								
Team Glover	.983	162	4346	1656	105	6107	140	6
pennant or bust	.982	162	4358	1656	109	6123	167	16
Demand Curvballs	.978	162	4364	1517	134	6015	117	11
Bangkok Hoodrats	.972	162	4354	1539	172	6065	157	6

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