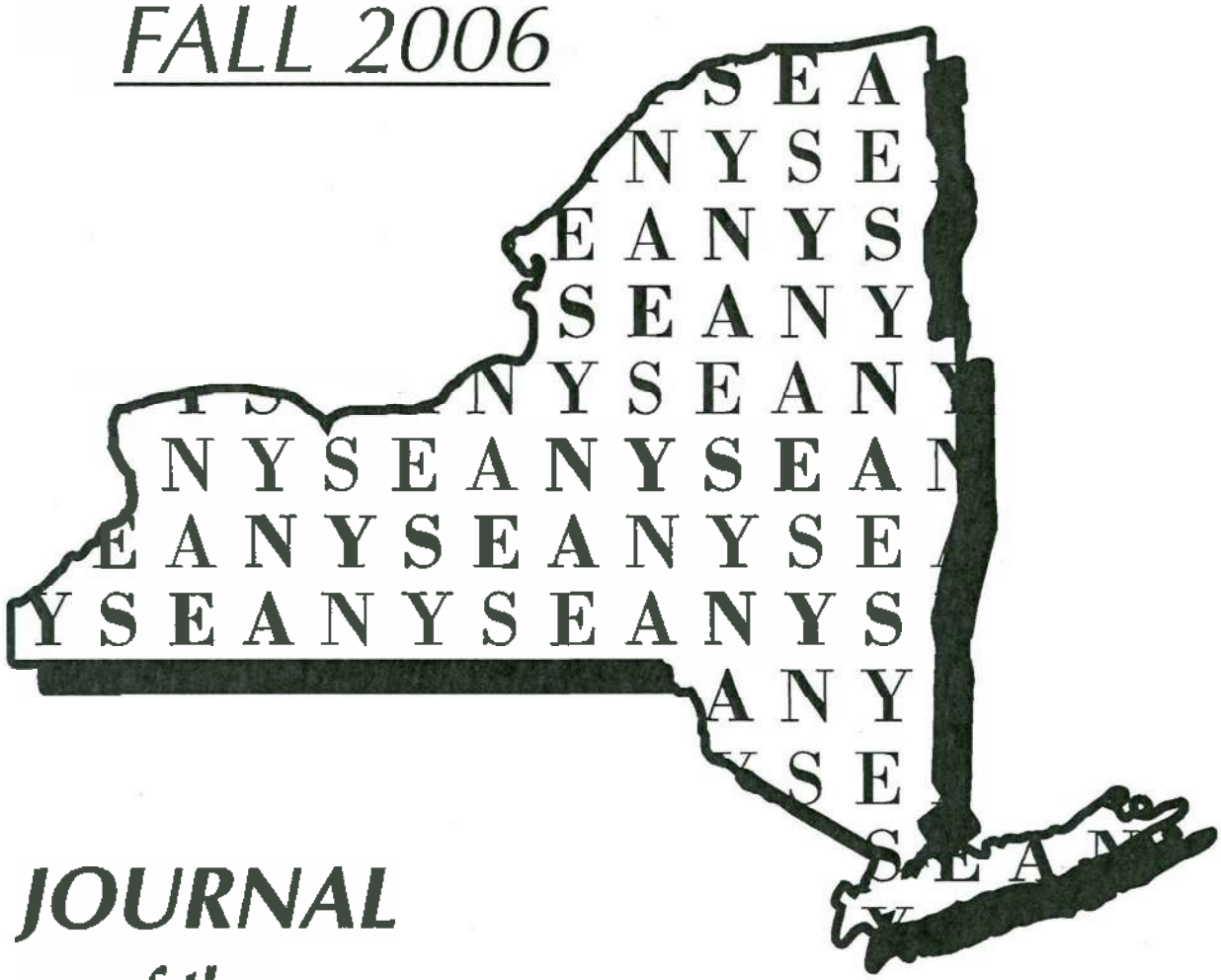
# NEW YORK ECONOMIC REVIEW

FALL 2006



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# CONTENTS

## ARTICLES

**Determinants of Alcohol Consumption By College Students**
*Elia Kacapyr and Samira Choudhury*……..…….....3

**Usining Panel Data to Estimate the Effect of the North American Free Trade Agreement on Employment and Wages at the State Level**
*Mark Gius*…….....21

**An Under Bias in the Football Betting Market: Fact or Fiction?: A Note**
*Ladd Kochman and Randy Goodwin*…….....33

**Referees**…….....38

**Final Program (58th Annual Convention – October 7 & 8, 2005)**……...39

FALL 2006

# EDITORIAL

The *New York Economic Review* is an annual journal, published in the Fall. The *Review* publishes theoretical and empirical articles, and also interpretive reviews of the literature. We also encourage short articles. The *Review's* policy is to have less than a three month turnaround time for reviewing articles for publication.

# MANUSCRIPT GUIDELINES

1. Please submit three copies of a manuscript.

2. All manuscripts are to be typed, double spaced and proofread. Prepared on a IBM PC/compatible computer in Microsoft Word format, the computer disk should be submitted in addition to the three hard copies.

3. All charts and graphs *must* be reproduction quality (Microsoft Word or Excel).

4. Footnotes should appear at the end of the article under the heading of "Endnotes."

5. Citations in the text should include the author and year of publication, as found in the references, in brackets. For instance (Marshall, 1980).

6. A compilation of bibliographic entries should appear at the very end of the manuscript under the heading "References."

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# DETERMINANTS OF ALCOHOL CONSUMPTION BY COLLEGE STUDENTS

**Elia Kacapyr* and Samira Choudhury****

**ABSTRACT**

This paper exploits a random survey of 704 Ithaca College students regarding their demographics and alcohol consumption. Regression analysis is used to explore a variety of issues including:

gender differences in alcohol consumption

whether marijuana and alcohol are complements or substitutes

underage drinking

the drinking habits of athletes

family history and alcohol abuse

the efficacy of specific policies designed to curb alcohol consumption by students.

A separate logistic regression is used to explore the determinants of binge drinking. The main finding is that the "social norms" approach to addressing alcohol abuse on campus is based on a false premise. Perceptions of the typical amount of alcohol consumption on campus have no impact on personal consumption behavior.

**INTRODUCTION**

The factors affecting the consumption and abuse of alcohol by college students have been widely researched. Summaries of this literature can be found in Engs and Hanson (1990), Prendergast (1994), Baer (2002), Knight et al. (2002), Perkins (2002a), and Ham and Hope (2003). A related, but distinct,

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(Revised in accordance with the comments of the reviewer and editor of the New York Economic Review, August 11, 2006.)

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area of research considers how perceived social norms affect alcohol consumption by college students. This vein of research is reviewed by Borsari and Carey (1999), Perkins (2002b), Berkowitz (2004), and Berkowitz (2005).

The basic idea behind social norms theory as it applies to alcohol consumption by students is that most college students overestimate the amount of alcohol consumed by their peers. This misperception induces college students to drink more than they would if they knew the true norm.

Many colleges and universities have used, and are using, the social norms approach to address alcohol abuse. The strategy involves educating students about the true norms with regard to drinking. The attractiveness of this approach is readily apparent. It is simple, easy to administer, and involves something institutions of higher learning do well – educate. Moreover, the social norms approach to alcohol policy is not patronizing and involves no moralizing.

This paper will briefly review some of the literature on the social norms approach to alcohol policy in higher education. Then a survey of 695 students at Ithaca College will be analyzed to determine the important determinants of alcohol consumption. It turns out that students' perceptions about how much alcohol is consumed by their peers have no impact on their own consumption. Therefore, the social norms approach is likely to be ineffective.

**THE SOCIAL NORMS APPROACH**

There is ample evidence supporting the efficacy of the social norms approach for controlling alcohol consumption on campus. Berkowitz (2005) cites Haines (1996), Haines and Spear (1996), Johannessen et al. (1999), Glider et al. (2001), Perkins and Craig (2002), Johannessen and Glider (2003), Haines and Barker (2003), Fabiano (2003), and Jeffrey et al. (2003). All these studies report positive results from actual social norms campaigns on various campuses.

However, all of these studies can be criticized on various grounds. Haines and Spear, for instance, showed a decrease in drinking levels as a result of social norms marketing methods. But the study did not take into account the demographic disparities between students. A greater number of women and younger students participated in the study and they turned out to be the ones who drank less alcohol to begin with. This contributed to the perceived reduction in drinking levels. It is problematic to accept these findings without controls for demographic factors.

The study carried out by Glider et al. (2001) showed that changes in perceptions regarding the intake of alcohol lowered alcohol use and problems arising from alcohol. The result was from a random sample. However, fewer than 30 percent of the students surveyed responded. From the sample that was categorized as high risk, fewer than 20 percent responded. At the same time the social norms methods were being applied, the college implemented stricter policies regarding the use of alcohol and raised the

number of social events on campus where non-alcoholic beverages were provided. Therefore, it is unclear whether the reduction in alcohol consumption was the result of social norms marketing or other factors.

A study by Werch (2000) used a random sample and controlled for demographic differences among students. The results indicated no change in drinking levels despite a vigorous social norms campaign. Along the same lines, Clapp et al. (2003) report on a failed social norms marketing campaign.

A critical blow to the social norms approach was delivered by Wechsler et al. (2003). Using data from the College Alcohol Study collected under the auspices of the Harvard School of Public Health, this study attempted to verify whether there were any decreases in drinking levels when colleges implemented social norms marketing interventions. The study looked at 118 schools of which 57 implemented the method and the remaining 61 did not. Surprisingly, no changes in the quantity, frequency, or volume of student alcohol use were detected in schools where the social norms marketing method was carried out. Five different measures of alcohol consumption were considered. The results strongly suggested that social norms programs did not affect drinking habits in a positive way. Indeed, significant increases in two of the five drinking measures were observed at schools that adopted the social norms approach. No evidence of increased alcohol consumption was found at the schools that did not adopt social norms programs. The authors of this study concluded that college administrators should "base their prevention programs on scientific evidence instead of the perception of promise." (Wechsler et al., 2003, pg. 494.)

The National Social Norms Resource Center disputed the results of Wechsler et al. and fired back with Perkins et al. (2005), which criticized Wechlser et al. for not considering the quality and the duration of the social norms programs at the 57 institutions. The National Social Norms Resource Center also suggested that Wechsler et al. were biased against the social norms approach and conveyed that bias to participants in the study, thus tainting the results.

**THE DATA**

The "Core Alcohol and Drug Survey" was developed in the late 1980s under the auspices of the U.S. Department of Education. The project is now housed at the CORE Institute at Southern Illinois University. The long form of the survey was administered to a random sample of 721 Ithaca College students in 2004. Surveys that were not complete were omitted as were surveys from graduate students, married students, and part-time students. This left a sample of 695 students.

For many of the survey questions, the responses were transformed to make more practical variables. For instance, one question on the survey asked students if anyone in their family had alcohol or other drug problems (mark all that apply): Mother/Father/Stepmother/Stepfather/Brothers/ Sisters/Mother's parents/Father's parents/Aunts/Uncles/Spouse/Children/None. For this study, this

information was transformed into the dichotomous variable HIST which is equal to 1 if the student responded by marking mother, father, or grandparents and 0 otherwise.

All of the variables that were gleaned from the survey are reported in Table 1. Table 2 gives the descriptive statistics for each variable. The "typical" Ithaca College student consumed 7.6 alcoholic drinks per week. The standard deviation was 9.3. The high was 70 drinks per week reported by one student. The mode was zero drinks per week reported by 140 students. Almost half of the sample consumed 4 or fewer drinks per week.

Another way to look at alcohol consumption is through binge drinking, defined as having 5 or more drinks at one sitting. 437 students, or 62.9 percent of the sample survey, said they had at least one episode of binge drinking over the last two weeks. In other words, well over half of all students abused alcohol within the last two weeks. This is certainly a cause for concern.

**Table 1 Variables in the data set**

| VARIABLE | DESCRIPTION |
|---|---|
| drinks | number of alcoholic drinks consumed per week |
| binge | 1 if the student had 5 or more drinks at a sitting in the last 2 weeks; 0 otherwise |
| grades | 1 if GPA=F; 2 if GPA=D-; 3 if GPA=D; 4 if GPA=D+; 5 if GPA=C-; …13 if GPA=A+ |
| gradessq | grades squared |
| male | 1 if the student is male; 0 otherwise |
| ofage | 1 if the student is 21 or older; 0 otherwise |
| cig | 1 if the student uses tobacco; 0 otherwise |
| pot | 1 if the student uses marijuana; 0 otherwise |
| working | 0 if the student does not work; 0.5 part-time; 1 full-time |
| athl | 1 if the student participates in varsity athletics; 0 otherwise |
| intra | 1 if the student participates in intramural athletics; 0 otherwise |
| pcampus | 1 if the student perceives Ithaca College to be a "party" campus; 0 otherwise |
| concern | 1 if the student feels that IC is concerned about alcohol use; 0 otherwise |
| percep | 1 if the student perceives that the typical IC student NEVER uses alcohol<br>2 if the student perceives that the typical IC student uses alcohol once a year<br>3 if the student perceives that the typical IC student uses alcohol 6 times a year<br>4 if the student perceives that the typical IC student uses alcohol once a month<br>5 if the student perceives that the typical IC student uses alcohol twice a month<br>6 if the student perceives that the typical IC student uses alcohol once a week<br>7 if the student perceives that the typical IC student uses alcohol 3 times a week<br>8 if the student perceives that the typical IC student uses alcohol 5 times a week<br>9 if the student perceives that the typical IC student uses alcohol every day |
| white | 1 if the student is white (non-hispanic); 0 otherwise |
| hist | 1 if mother, father, or grandparents had alcohol problems; 0 otherwise |
| inter | 1 if the student's permanent residence is outside the USA; 0 otherwise |
| oncampus | 1 if the student resides on campus; 0 otherwise |
| class | 1 if first year student; 2 if sophomore; 3 if junior; 4 if senior |

Perceptions about drinking on campus are measured in two ways. The variable "PERCEP" ranges from 1 to 9 with 1 meaning the particular student believes the typical student consumes no alcohol. In the survey, two students held that perception. When PERCEP equals 9, the particular student believes the typical student uses alcohol everyday. In the survey of 695 Ithaca College students, 20 of them responded with a "9". The mean of PERCEP is 6.7. Almost half of the respondents thought the typical Ithaca College student used alcohol 3 times a week.

**Table 2 Descriptive Statistics**

| VARIABLE | MEAN | MEDIAN | MAX | MIN | ST. DEV. |
|---|---|---|---|---|---|
| **drinks** | 7.57 | 5 | 70 | 0 | 9.26 |
| **binge** | 0.63 | 1 | 1 | 0 | 0.48 |
| **grades** | 10.30 | 10 | 13 | 2 | 1.59 |
| **gradessq** | 108.54 | 100 | 169 | 4 | 30.74 |
| **male** | 0.45 | 0 | 1 | 0 | 0.50 |
| **ofage** | 0.35 | 0 | 1 | 0 | 0.48 |
| **cig** | 0.49 | 0 | 1 | 0 | 0.50 |
| **pot** | 0.56 | 1 | 1 | 0 | 0.50 |
| **working** | 0.30 | 0.5 | 1 | 0 | 0.27 |
| **athl** | 0.16 | 0 | 1 | 0 | 0.37 |
| **intra** | 0.33 | 0 | 1 | 0 | 0.47 |
| **pcampus** | 0.10 | 0 | 1 | 0 | 0.30 |
| **concern** | 0.82 | 1 | 1 | 0 | 0.39 |
| **percep** | 6.67 | 7 | 9 | 1 | 0.92 |
| **white** | 0.88 | 1 | 1 | 0 | 0.32 |
| **hist** | 0.32 | 0 | 1 | 0 | 0.47 |
| **inter** | 0.02 | 0 | 1 | 0 | 0.15 |
| **oncampus** | 0.73 | 1 | 1 | 0 | 0.44 |
| **class** | 2.40 | 2 | 7 | 1 | 1.16 |

By this measure (PERCEP), the perception of alcohol consumption on the Ithaca College campus is fairly close to the reality of 7.6 drinks per week. Most students (82 percent) believe the typical student uses alcohol 1 - 3 times a week. If this perception is correct, then the typical student would consume 2.5 – 7.6 drinks per sitting. This range seems realistic. Perhaps it is an underestimate considering the data on binge drinking.

Another measure of student perceptions about alcohol consumption is "PCAMPUS". On the survey, students were asked to finish this sentence:

> "Compared to other campuses with which you are familiar, this campus' use of alcohol is…(mark one)
> Greater than other campuses……. O
> Less than other campuses……O
> About the same as other campuses……O

If the student responded by marking "Greater than other campuses", then PCAMPUS equals 1; 0 otherwise. Only 69 students responded with a "1". By this measure, the perception of alcohol use on campus is, again, moderate and fairly close to reality if not a slight underestimate.

Another variable that will be given special consideration is "CONCERN". This variable is equal to 1 if the respondent felt that the Ithaca College administration is concerned about the prevention of drug and alcohol use; 0 otherwise. In a sense, CONCERN measures the perception of how seriously the campus considers the issues surrounding substance use and abuse. The overwhelming majority of Ithaca College students (81.9 percent) felt that their campus was concerned about the prevention of drug and alcohol use.

It would be interesting to test the hypothesis that students who participate in Greek organizations consume more or less alcohol than students who do not. This was not possible because Ithaca College has no official Greek organizations.

**DATA ANALYSIS OF ALCOHOL CONSUMPTION**

From the casual examination of the summary statistics given above, it is difficult to discern if the perceptions surrounding alcohol use on the Ithaca College campus underestimate the reality or not. However, this point is not crucial for an assessment of the social norms approach to alcohol policy. The analysis in this section shows that students' perceptions about the normal amount of alcohol consumed on campus have no bearing on the amount that they actually consume.

This conclusion is the result of a regression analysis. As a first pass, a linear regression with drinks as the dependent variable and all the remaining variables except BINGE and GRADESSQ was considered. These results are shown in Table 3.

**Table 3 Preliminary regression analysis**

Dependent Variable: DRINKS

Method: Least Squares

Sample: 695

Included observations: 695

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 4.280606 | 3.603544 | 1.187888 | 0.2353 |
| ATHL | 1.955796 | 0.818694 | 2.388920 * | 0.0172 |
| CIG | 2.682547 | 0.704227 | 3.809205 ** | 0.0002 |
| CLASS | 0.223968 | 0.438300 | 0.510993 | 0.6095 |
| CONCERN | 1.526256 | 0.788550 | 1.935521 | 0.0533 |
| GRADES | -0.865844 | 0.195708 | -4.424166 ** | 0.0000 |
| HIST | -0.508088 | 0.647085 | -0.785195 | 0.4326 |
| INTER | -1.794914 | 2.138156 | -0.839468 | 0.4015 |
| INTRA | 2.249785 | 0.638625 | 3.522858 ** | 0.0005 |
| MALE | 4.799663 | 0.611792 | 7.845257 ** | 0.0000 |
| OFAGE | 0.736147 | 0.988567 | 0.744661 | 0.4567 |
| ONCAMPUS | -0.977509 | 0.887675 | -1.101201 | 0.2712 |
| PERCEP | 0.542401 | 0.327360 | 1.656897 | 0.0980 |
| POT | 4.462002 | 0.706063 | 6.319553 ** | 0.0000 |
| WHITE | 1.423699 | 0.972718 | 1.463629 | 0.1438 |
| WORKING | -2.710187 | 1.155182 | -2.346112 * | 0.0193 |

| | | | |
|---|---|---|---|
| R-squared | 0.311941 | Mean dependent var | 7.569784 |
| Adjusted R-squared | 0.296740 | S.D. dependent var | 9.260897 |
| S.E. of regression | 7.766241 | Akaike info criterion | 6.960202 |
| Sum squared resid | 40953.55 | Schwarz criterion | 7.064810 |
| Log likelihood | -2402.670 | F-statistic | 20.52223 |
| Durbin-Watson stat | 1.944252 | Prob(F-statistic) | 0.000000 |

** significant at the 1 percent critical level

* significant at the 5 percent critical level

This preliminary regression was undoubtedly overspecified. Some explanatory variables may have been redundant. For instance, CLASS and OFAGE are highly correlated (r = 0.77). CIG and POT were less correlated than expected (r = 0.52). Surprisingly, PERCEP and PCAMPUS were not correlated (r = 0.08).

Many of the variables in the preliminary regression are statistically insignificant at the 5 percent critical level (CLASS, CONCERN, HIST, INTER, OFAGE, ONCAMPUS, PERCEP, and WHITE). Two variables, CONCERN and HIST, have unexpected signs. Perhaps it is not unexpected that students who felt their campus was concerned with drug and alcohol use drank more. However, it is well documented that students with a family history of drug and alcohol abuse drink more. (See, for instance, Weitzman et al. 2003.) In any event, neither variable is statistically significant.

As a second pass, the preliminary regression was re-run without CLASS since it was highly collinear with OFAGE. OFAGE remained insignificant and the results of this second pass were not substantially different from the first regression. More specifications with multifarious variable combinations were considered as were alternate functional forms. In the end, the following specification was settled on:

**Table 4 Final regression analysis**

Dependent Variable: DRINKS
Method: Least Squares
Sample: 695
Included observations: 695

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 28.31965 | 6.542528 | 4.328548** | 0.0000 |
| GRADES | -4.934542 | 1.352311 | -3.648971** | 0.0003 |
| GRADESSQ | 0.212136 | 0.069859 | 3.036650** | 0.0025 |
| MALE | 4.522718 | 0.601804 | 7.515268** | 0.0000 |
| OFAGE | 1.947880 | 0.632799 | 3.078198** | 0.0022 |
| CIG | 2.641322 | 0.695943 | 3.795313** | 0.0002 |
| POT | 4.790316 | 0.703772 | 6.806634** | 0.0000 |
| WORKING | -2.455481 | 1.136537 | -2.160495* | 0.0311 |
| ATHL | 2.156151 | 0.813714 | 2.649764** | 0.0082 |
| INTRA | 2.291202 | 0.634786 | 3.609410** | 0.0003 |

| | | | |
|---|---|---|---|
| R-squared | 0.309008 | Mean dependent var | 7.569784 |
| Adjusted R-squared | 0.299929 | S.D. dependent var | 9.260897 |
| S.E. of regression | 7.748616 | Akaike info criterion | 6.947189 |
| Sum squared resid | 41128.12 | Schwarz criterion | 7.012569 |
| Log likelihood | -2404.148 | F-statistic | 34.03644 |
| Durbin-Watson stat | 1.958128 | Prob(F-statistic) | 0.000000 |

** significant at the 1 percent critical level
* significant at the 5 percent critical level

All of the explanatory variables are statistically significant at the 5 percent critical level. This specification has low multicollinearity among the explanatory variables. When any of the unincluded variables are added to this specification they turn out to be insignificant. This regression tests positively for heteroskedasticity using White's (1980) test. However, applying White's heteroskedasticity-corrected

standard errors does not change the statistical significance of any variable. Thus, the ordinary least-squares standard errors are reported in Table 4.

**GRADES**

Alcohol consumption and grade point average are inversely related. However, GRADES are used an explanatory variable here so that one is faced with explaining why high grades cause low alcohol consumption. One is tempted to say that smart students know better and drink less. Or conversely, low grades cause students to try to drink their troubles away. The most appealing explanation is that high grades require a time commitment that cuts into party time.

It was found that the polynomial functional form on GRADES fit best. The Negative coefficient on GRADES combined with the positive coefficient on GRADESSQ can be interpreted to mean that as GRADES increase drinking declines until grade point average reaches 3.5. Then further increases in GRADES leads to an increase in drinking. The conclusion is that students with very high GPAs drink slightly more than other students, ceteris paribus.

**MALE**

It is well established that male students drink more than female students, ceteris paribus. The magnitude of the coefficient on MALE in this regression is in line with previous studies such as Trainor (2003) and Turrisi et al. (2000). The strict interpretation is that a male student consumes 4.5 more drinks than a female student, ceteris paribus.

**OFAGE**

Our regressions results suggest that being younger than 21 years old lowers alcohol consumption by 1.9 drinks per week. This result is supported by Wechsler et al., (1997) who found that underage students drank less alcohol but drank excessively when they did.

**CIG**

Tobacco and alcohol are complements according to these regression results. Students who smoke are expected to consume 2.6 more drinks per week. Jones et al., (2001) found that students who reported current use of cigarettes were more likely to binge drink than students who were non-smokers. In addition, Jones et al. found a strong correlation between drinking and cigarette use.

**POT**

Marijuana and alcohol are compliments as well. These results suggest that a student who uses marijuana is expected to consume 4.8 more drinks per week than a student who does not, all other variables being equal. Zhao and Harris (2004) support this finding.

**WORKING**

A student with a full-time job consumes 2.5 drinks per week less than a student who does not work for income.

**ATHL**

There is a large literature investigating the relationship between participation in varsity athletics and alcohol use. We find that varsity athletes consumed 2.2 more drinks per week on average than other students with the same demographics. This finding is consistent with evidence from other researchers. Wechsler et al. (1997) found that intercollegiate athletes tend to be involved in heavy drinking. Leichliter et al. (1998) discovered that intercollegiate athletes had more drinks per week on average and participated in more binge drinking sessions compared to nonathletes.

**INTRA**

There is a connection between intramural athletes and alcohol consumption as well. Lindsey and Chen (2004) reported that 54.85 percent of intramural sports participants were involved in binge drinking compared to 39.91 percent of the non-intramural sports participants. Besides this, intramural sport participants were the higher consumers of alcohol per week. The results of this regression analysis confirm that finding: A student who participates in intramural sports is expected to consume 2.3 more drinks per week than a non participant with the same demographics.

**PERCEP, PCAMPUS, and CONCERN**

Table 5 shows that PERCEP and PCAMPUS are each insignificant when added to the specification from Table 4. The interpretation of these results is that perceptions about the normal amount of alcohol consumption on campus do not have an impact on the amount of alcohol a particular student actually consumes. Even if students overestimate the actual amount of drinking on campus, they would not drink more themselves because of that misperception.

Table 5 also shows that students who perceive their administrations to be concerned with drug and alcohol abuse do not drink less because of that perception. This is an important result for college administrators. Creating a sense of caring and concern about alcohol use on campus, by itself, does nothing to reduce the number of drinks a student has per week.

**TABLE 5 Comparative regression results**

$DRINKS_i = \beta_0 + \beta_1 X1_i + \beta_2 X2_i + \ldots + \beta_k Xk_i + \varepsilon_i$

| Variable | Coefficient | Coefficient | Coefficient | Coefficient |
|---|---|---|---|---|
| Constant term | 28.31965** | 25.47000** | 28.09243** | 27.17226** |
| GRADES | -4.934542** | -4.876509** | -4.901710** | -4.924437** |
| GRADESSQ | 0.212136** | 0.209879** | 0.210609** | 0.212031** |
| MALE | 4.522718** | 4.532494** | 4.474511** | 4.594226** |
| OFAGE | 1.947880** | 1.900421** | 1.933505** | 1.837946** |
| CIG | 2.641322** | 2.703632** | 2.665122** | 2.598298** |
| POT | 4.790316** | 4.760006** | 4.832623** | 4.730380** |
| WORKING | -2.455481* | -2.447162* | -2.521923* | -2.529141* |
| ATHL | 2.156151** | 2.153792** | 2.177174** | 2.142968** |
| INTRA | 2.291202** | 2.296011** | 2.293923** | 2.239745** |
| PERCEP | | 0.373438 | | |
| PCAMPUS | | | 0.619618 | |
| CONCERN | | | | 1.412414 |
| **Adjusted R-squared** | 0.299929 | 0.300282 | 0.299291 | 0.302325 |

n = 695
** significant at the 1 percent critical level
* significant at the 5 percent critical level

The analysis of the data from Ithaca College sharply contradicts the social norms method of alcohol reduction. It is not clear whether Ithaca College students overestimate the typical amount of alcohol consumed on campus, but that point is irrelevant. The amount of alcohol an Ithaca College student consumes is not affected by his or her perceptions of the campus norm. Thus, adjusting student perceptions would have no effect on actual behavior.

**DATA ANALYSIS OF BINGE DRINKING**

The CORE Alcohol and Drug survey also asked students if they had consumed 5 or more drinks in one sitting over the last two weeks. The variable BINGE is equal to 1 if the student responded affirmatively to this question; 0 otherwise. Logistic regressions were then considered in order to determine the important factors determining BINGE.

As a first pass, all of the variables except DRINKS were used to explain BINGE. Many of the explanatory variables were insignificant in this preliminary regression. After experimenting with many combinations of variables the regression specified in Table 6 was selected as having the best fit with no insignificant variables.

**Table 6 Final logistic regression results**

Dependent Variable: BINGE

Method: ML - Binary Logit (Quadratic hill climbing)

Sample: 695

Included observations: 695

Convergence achieved after 4 iterations

Covariance matrix computed using second derivatives

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -2.478816 | 0.376267 | -6.587925 | 0.0000 |
| MALE | 0.698083 | 0.191147 | 3.652079 | 0.0003 |
| CIG | 0.907406 | 0.207680 | 4.369247 | 0.0000 |
| POT | 1.611103 | 0.205433 | 7.842459 | 0.0000 |
| INTRA | 0.607585 | 0.201538 | 3.014747 | 0.0026 |
| CLASS | 0.309515 | 0.080718 | 3.834523 | 0.0001 |
| WHITE | 0.663876 | 0.292058 | 2.273095 | 0.0230 |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.628777 | S.D. dependent var | 0.483480 |
| S.E. of regression | 0.409807 | Akaike info criterion | 1.040134 |
| Sum squared resid | 115.5438 | Schwarz criterion | 1.085900 |
| Log likelihood | -354.4466 | Hannan-Quinn criter. | 1.057831 |
| Restr. log likelihood | -458.4244 | Avg. log likelihood | -0.509995 |
| LR statistic (6 df) | 207.9555 | McFadden R-squared | 0.226815 |
| Probability(LR stat) | 0.000000 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 258 | Total obs | 695 |
| Obs with Dep=1 | 437 | | |

When any variable from those available is added to this specification it is not statistically significant. The results indicate that males were more likely to binge than females. Tobacco use and marijuana use were strong indicators of binge drinking. Intramural athletes were more likely to binge than others. Interestingly, varsity athletes were not. Juniors and seniors were more likely to binge drink than

underclass students. The variable CLASS performed better than OFAGE in this respect. Finally, white students were more likely to binge drink than students of color.

It is disturbing to realize that a white, male, senior, who does not smoke cigarettes or marijuana, and particpates in intramural sports probably binged in the last two weeks. The probability, according to these results, is 67 percent.

Table 7 delineates how the regression results are altered when PERCEP, PCAMPUS, and CONCERN are each added separately as explanatory variables.

**Table 7 Comparative logistic regression results**

$$\ln\left(\frac{BINGE_i}{1-BINGE_i}\right) = \beta_0 + \beta_1 X1_i + \beta_2 X2_i + \ldots + \beta_k Xk_i + \varepsilon_i$$

| **Variable** | **Coefficient** | **Coefficient** | **Coefficient** | **Coefficient** |
|---|---|---|---|---|
| Constant term | -2.478816** | -3.322515** | -2.458542** | -2.679203** |
| MALE | 0.698083** | 0.700001** | 0.718836** | 0.706650** |
| CIG | 0.907406** | 0.926558** | 0.903585** | 0.899662** |
| POT | 1.611103** | 1.603674** | 1.595446** | 1.599584** |
| INTRA | 0.607585** | 0.608450** | 0.606731** | 0.602097** |
| CLASS | 0.309515** | 0.305944** | 0.312627** | 0.294173** |
| WHITE | 0.663876** | 0.687868** | 0.660575** | 0.664063** |
| PERCEP | | 0.123537 | | |
| PCAMPUS | | | -0.228518 | |
| CONCERN | | | | 0.298683 |
| **McFadden R-squared** | 0.226815 | 0.228396 | 0.227424 | 0.228503 |

n = 695
** significant at the 1 percent critical level
* significant at the 5 percent critical level

PERCEP is statistically insignificant. Students' perceptions about how much the typical Ithaca College student drinks have no effect on whether or not they binge drink.

PCAMPUS has the incorrect sign according to the social norms approach to alcohol control. The negative sign indicates that students who said the use of alcohol at Ithaca College is greater than other campuses were less likely to binge. However, the coefficient on PCAMPUS is not statistically significant.

The coefficients on CONCERN is disconcerting because it implies that students who feel their administration is concerned about drug and alcohol use are more likely to binge drink. But again, the coefficient is not statistically significantly different from zero. Still, this means that administrative concerns about substance abuse have no impact on binge drinking.

Table 8 shows the in-sample success rates for our logistic regression in predicting binge drinking behavior. Overall, the regression had a success rate of 77.99 percent.

Of the 695 students surveyed, 437 identified themselves as binge drinkers. The logistic regression correctly predicted that 381 of these students would be binge drinkers based on their demographics. The regression incorrectly predicted that 56 of these students would not be binge drinkers.

**Table 8 Success rates for the final logistic regression**

| | **Actual** | | |
|---|---|---|---|
| **Predicted ↓** | No Binge | Binge | Total |
| No Binge | 161 | 56 | 217 |
| Binge | 97 | 381 | 478 |
| Total | 258 | 437 | 695 |
| Correct | 161 | 381 | 542 |
| % Correct | 62.40 | 87.19 | 77.99 |
| % Incorrect | 37.60 | 12.81 | 22.01 |

On the other side of the coin, 258 students said they had not binged in the last two weeks. The logistic regression identified 161 of these students correctly based on their demographics. The other 97 students who were not binge drinkers were incorrectly predicted to be bingers by the regression.

**CONCLUSION**

Drinking among college students has been a matter of concern ever since the earliest colleges were established in the United States. A local sheriff leads Harvard University's graduation procession today. This is a tradition that goes back to Colonial days when disruptive drunk students had to be restrained.

It is critical for college administrators to address this serious issue. Alcohol is highly correlated with negative consequences for college students. High rates of heavy drinking have led to numerous problems such as unintentional injuries, assaults, vandalism, noise disruptions, and property damage. In

reaction to these problems, the Department of Health and Human Services pressed the need to have a 50 percent reduction in heavy drinking among college students by the year 2010.

Much effort has gone into discerning the factors that effect drinking by college students. Binge drinking is a special concern. The hope is that this research will lead to better policies to address alcohol consumption by students.

Social norms policies became popular in the late 1980s and remain so today. These policies strive to educate students about the typical behaviors regarding alcohol on campus. The rationale is that students over-estimate the degree to which alcohol is used and abused. Once students become aware of the true campus norms they will adjust their own behavior appropriately.

The empirical evidence on the efficacy of social norms policies is mixed and hotly debated. This paper adds to that debate. A 2004 survey of 695 students at Ithaca College reveals that students may or may not over-estimate the amount of alcohol consumed by their peers. A statistical analysis of the survey data shows that students' perceptions about alcohol use does not factor into their own decisions about how much to drink. Moreover, knowing students' perceptions does not help to predict whether or not they binge drink. All this implies that social norms policies are not likely to succeed.

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# USING PANEL DATA TO ESTIMATE THE EFFECT OF THE NORTH AMERICAN FREE TRADE AGREEMENT ON EMPLOYMENT AND WAGES AT THE STATE LEVEL

**Mark Gius***

*I determine the effect of NAFTA on employment and wages in the United States. I use a panel-data set of 50 states for 1980-2000, and a two-stage least squares, fixed effects model. I estimate equations for employment and wages. Empirical results indicate that NAFTA had a negative effect on employment and a positive effect on wages. Chow Test results suggest that there is a break in both the employment and wage relationships in 1994, the year NAFTA became effective.*

## I. INTRODUCTION

On January 1, 1994, the North American Free Trade Agreement (NAFTA), a trilateral agreement between Canada, the U. S., and Mexico that established a free-trade area in North America, took effect. Many tariffs were eliminated on January 1, 1994, while others were scheduled to be reduced over a 5, 10, or 15-year period. Quotas and import licenses were also eliminated. In addition to trade liberalization, there were side agreements that dealt with such topics as environmental safeguards and child labor.

NAFTA is one of the most controversial trade agreements ever ratified by Congress. Since it was first proposed in the early 1990s, organized labor, environmentalists, and even self-made billionaires have rallied against NAFTA. Ross Perot, the Texas billionaire Presidential Candidate in 1992, urged Congress to defeat NAFTA; he believed that all that would be heard after the passage of NAFTA would be a "giant sucking sound," which would be the sound of thousands, if not millions, of U.S. jobs moving to Mexico. In addition, environmentalists believed that NAFTA would loosen environmental regulations throughout North America and would shift production of goods to Mexico, where environmental safeguards are less stringent than in the U.S.

Most of the existing research on NAFTA has dealt with anecdotal evidence or sectoral studies; few studies have used robust statistical analyses to determine how NAFTA has affected the U.S. economy. I

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attempt to fill that void and focus on how NAFTA affects employment and wages at the state level. I use data from 50 states over the period 1980-2000 and a two-stage least squares, fixed effects model to determine if, after controlling for all other factors, NAFTA has positively or negatively affected employment and wages at the state level. My study differs from prior research in that it focuses on state-level data. Since most prior research has focused on sectoral studies, my work is unique in this regard. Finally, I use the most recent data set of any study on this topic.

## II. LITERATURE REVIEW

As noted previously, most prior research has not employed rigorous statistical analysis to assess how NAFTA affects employment and wages. Most prior research has either been produced by self-interested lobbyist groups and think tanks or has focused on very narrow issues, such as the Maquiladora Program or on NAFTA's sectoral effects.

Imada-Iboshi and McCleery (1994) used a general equilibrium model with 1988 trade data to determine if NAFTA would affect production, trade, or employment in the three signatory countries. Results suggested that low-technology industries should experience slower growth in the U.S., although no industries are expected to contract. Trade would increase, and production in Mexico and Canada would increase in some industries.

Martin (1995), in an article in *Challenge*, examined Mexican-U.S. migration and attempted to determine how NAFTA would affect this migration. Using anecdotal evidence and relying primarily on the results of other studies, he stated that it is very difficult to determine how NAFTA affects labor migration. Nonetheless, he claimed that, based on the results of other studies, Mexican immigration to the U.S. would initially increase after the passage of NAFTA and would then decline.

Dorantes and Huang (1997) used a panel-data set from 10 major industries over the period 1983-1994 in a random effects model to ascertain the determinants of the unemployment rate at the sectoral level. Using explanatory variables such as interest rates and unionization rates, they found that unemployment rates are explained by a number of factors at the industry level, chiefly the extent of unemployment insurance coverage and interest rates. As an afterthought, the authors used a Chow Test to determine if NAFTA affected unemployment rates; they reported that there was no statistically significant difference in the regression coefficients between the periods 1983-1993 and 1994. Hence, Dorantes and Huang concluded that NAFTA did not affect sectoral unemployment rates.

Hashemzadeh (1997) reviewed the literature on NAFTA and job losses and described bilateral trade flows between the U.S. and Mexico. He found that almost all economic studies of NAFTA showed that the relaxation of trade barriers between the U.S. and Mexico should increase economic growth for both countries, but that the effect on labor in the first two years of NAFTA would be minimal.

Silvers (2000) studied the Maquiladora Program and attempted to determine whether NAFTA

affected trade linkages between Arizona and Sonora, Mexico. He found a limited linkage between these two areas, with most of the trade going one way, from Arizona to Sonora. NAFTA was expected to have a positive effect on the Mexican demand for U.S. goods but little, if any, effect on U.S. demand for Mexican goods.

Two studies by the Economic Policy Institute (Schott, 2001a; Schott, 2001b) unequivocally claimed that NAFTA cost the U.S. jobs; according to both studies, the U.S. lost over 766,000 jobs from 1994 to 2000 due to NAFTA. These estimates were calculated by examining the effects of trade on employment at the 3-digit SIC industry level. The studies used industry-specific, chain-weighted price indices to deflate trade data and extrapolated trade effects on employment using a 1992 U.S. input-output table.

Yoskowitz et al.(2002) analyzed the impact of NAFTA on employment, per capita income, and the unemployment rate. Looking at the Texas-Mexico border region, they used data from the Department of Commerce and the Texas Workforce Commission; their latest data were from 1998. Using nonparametric tests, they reported that employment and per capita income were lower in the post-NAFTA period but that the unemployment rate was not statistically significantly different between the two periods; these results are only applicable to the South Texas region.

Thorbecke and Eigen-Zucchi (2002) examined the economic effects of NAFTA using a descriptive statistics approach. Extrapolating potential changes in employment from trade data, they asserted that NAFTA had little, if any, effect on U.S. employment. NAFTA's largest impact on the U.S. economy has been in trade between the U.S. and Mexico.

Klein, Schuh, and Triest (2003) looked at the effect of NAFTA on job flows and trade for three industries: textile and apparel, chemical, and automobile. Using descriptive statistics, the authors found that NAFTA had little, if any, effect on employment and gross job flows in these three industries. In addition, the authors state that NAFTA did not affect either net or gross job flows in the United States as a whole. However, they concede this conclusion is tentative.

A more recent study by Hufbauer and Schott (2003) for the Institute for International Economics, reviewed various prior NAFTA studies and found that NAFTA has had a limited effect on both U.S. employment and wages. Although they do not statistically show NAFTA's effect, if any, on employment and wages, their primary contention is that, given the enormous size of the U.S. labor market and the relative insignificance of foreign trade for the U.S. economy, even if NAFTA negatively affected employment and wages, it would be so minor in the aggregate that it would be statistically insignificant.

Finally, Trefler (2004) examined the effect of NAFTA on Canadian industries. For those industries that experienced the largest Canadian tariff cuts, low-productivity plants reduced employment by 12 percent, while overall industry productivity increased by 15 percent. For those Canadian industries that experienced the largest US tariff cuts, productivity increased by 14 percent. Hence, high productivity

plants clearly gain from free trade.

**III. EMPIRICAL MODEL**

Trade theory suggests that free and open trade increases a nation's welfare. Regarding employment and wages, the relative prices of goods in which a nation has a comparative advantage will increase; this price increase, in turn, increases employment and wages for the export sectors. However, the relative prices of goods in which the nation has a comparative disadvantage will fall; this price decrease, in turn, lowers employment and wages for the import sectors. Consumers benefit because trade increases their consumption possibilities. The overall gain to those who benefit from trade (the exporting sectors and consumers) should more than outweigh the losses of the importing sectors. Hence, nations benefit from free and open trade.

Theory thus dictates that the U.S. and its trading partners gain from NAFTA. Note, however, that the gains from trade include both the benefit to the exporting sectors and to consumers. My work is important because it specifically examines employment and wages and thus attempts to determine if free trade is beneficial to labor. In addition, it is important to note that removal of trade barriers does not confer immediate benefits on a nation and especially on its labor force. Rather, there may be several painful adjustment periods in the labor market as import-competing sectors shrink and export sectors expand. Terminated workers in the import-competing sectors may not find new positions quickly; hence, the gains or benefits from free trade cannot be seen as occurring instantaneously after the removal of trade barriers.

To construct a model that examines the effect of NAFTA on employment and wages, I use labor market theory. Theory suggests that employment and wages are affected by product prices, marginal products, and worker's preferences with regards to trade-offs between leisure and work (substitution and income effects). Because wages and employment are determined simultaneously, I use two-stage least squares. For employment, I estimate the following two regressions:

First Stage:

$$\begin{aligned} LOG(WAGE) = {} & a_1 NAFTA + a_2 LOG(WHITE) + a_3 LOG(RURAL) + a_4 T \\ & + a_5 LOG(COLLEGE) + a_6 LOG(ROADS) + a_7 NAFTAC + a_8 NAFTAM \\ & + a_9 LOG(NCOLLEGE) + a_{10} LOG(EDUC) + u \end{aligned} \qquad (1)$$

Second Stage:

$$\begin{aligned} LOG(EMPLOY) = {} & a_1 NAFTA + a_2 LOG(WHITE) + a_3 LOG(RURAL) + a_4 T \\ & + a_5 LOG(COLLEGE) + a_6 LOG(ROADS) + a_7 NAFTAC + a_8 NAFTAM \\ & + a_9 LOG(WAGE) + u \end{aligned} \qquad (2)$$

For wages, I estimate the following two equations:

First Stage:

$$LOG(EMPLOY) = a_1NAFTA + a_2LOG(WHITE) + a_3LOG(RURAL) + a_4T + a_5LOG(COLLEGE) + a_6LOG(ROADS) + a_7NAFTAC + a_8NAFTAM + a_9LOG(NCOLLEGE) + a_{10}LOG(EDUC) + a_{11}LOG(AGE65) + u \quad (3)$$

Second Stage:

$$LOG(WAGE) = a_1NAFTA + a_2LOG(WHITE) + a_3LOG(RURAL) + a_4LOG(COLLEGE) + a_5LOG(ROADS) + a_6NAFTAC + a_7NAFTAM + a_8LOG(NCOLLEGE) + a_9LOG(EDUC) + a_{10}LOG(EMPLOY) + u \quad (4)$$

In the above regressions, *WAGE* and *EMPLOY* are endogenous variables.

Variables are defined as follows: *EMPLOY* is the ratio of employment to the total adult population in the state; employment is the total number of employees in non-agricultural establishments; *NAFTA* is a dummy variable equal to one for 1994-2000 the period when NAFTA was in effect, and zero otherwise; *WHITE* is the percentage of the state's population that is white; *RURAL* is the percentage of state's population that lives in rural areas; *ROADS* is the ratio of total highway mileage in the state to total area of the state; *COLLEGE* is the share of the state's population age 25 and older with a college degree; *NAFTAC* equals one if a state borders Canada and the year is 1994 or later; *NAFTAM* equals one if a state borders Mexico and the year is 1994 or later; *T* is a time trend variable; *WAGE* is the average hourly wage; *NCOLLEGE* is an interactive variable between *NAFTA* and *COLLEGE*; *EDUC* is the per capita amount spent on primary and secondary education at the state level; and u is a normally distributed random error term.

Regarding the second-stage employment equation, trade theory suggests that *NAFTA* should have a positive employment effect. *WHITE* should have a positive effect on employment, suggesting that states with large non-white populations suffer from racially discriminatory labor markets; Murphy and Hofler (1984) used a similar variable in their study of geographic unemployment rates. *RURAL* should have a negative effect, suggesting fewer job opportunities in rural states; Blackley (1989) used a similar variable in his study on the determination of state unemployment rates. *ROADS* is a proxy for government fixed assets. Labor theory suggests that states with more government fixed assets per capita would have a more productive labor force, so firms would be more willing to locate there, thus increasing employment. *COLLEGE* should have a positive effect. Blackley (1989) also included this variable in his study. If individuals with more education are more productive, firms would be more willing to locate in states where the workforce is better educated and hence increase employment. *WAGE* should have a negative effect. I include *T* to capture any possible employment changes due to productivity increases, immigration, or other unspecified factors.

*NAFTAC* should have a positive effect, suggesting that states bordering Canada would experience an employment increase after NAFTA. *NAFTAM* should have a negative effect, suggesting that states bordering Mexico should experience either an employment decrease or less of an employment increase than other regions after NAFTA. *NAFTAC* should have a positive effect because Canada is an inviting market for U.S. goods, and given the relatively minor wage differences between the U.S. and Canada, U.S. firms will have little incentive to relocate to Canada. *NAFTAM* should have a negative effect because factories located in states adjacent to Mexico would move south to take advantage of lower wages and less stringent environmental and safety regulations.

Regarding the second-stage wage regression, theory suggests that *NAFTA* should have a positive effect on wages, assuming that the wages gains in the export sectors outweighs the wage losses in the import-competing sectors. *WHITE* should be positive, once again suggesting the discriminatory nature of the labor markets. *RURAL* should have a negative effect on wages, suggesting that employers do not have to pay their workers as much in rural areas given lower costs of living. *EDUC* and *COLLEGE* should be positive; those states with more educated laborers will have more productive laborers and hence higher wages. *NAFTAC* should have a positive effect on wages, suggesting that an increase in the demand for workers in states bordering Canada will increase wages. *NAFTAM* should be negative since there will be a decrease in demand for workers in states bordering Mexico. *ROADS* will have a positive effect on wages, suggesting that those states with more government fixed assets will have more productive workers and hence higher wages. *EMPLOY* should have a negative effect on wages since the greater the supply of workers, the lower will wages be. *NCOLLEGE* will have a positive effect on wages. Regarding this effect, the Heckscher-Ohlin Theory states that when a nation opens up to trade, the goods that use the nation's relatively abundant factor will see an increase in its price, and the Stolper-Samuelson Theory states that a nation's relatively abundant factor will see an increase in its compensation. Hence, those states that have a relative abundance of college-educated individuals, our nation's relatively abundant factor, will see their average wages increase when trade opens.

As an additional test of the effect of NAFTA on employment and wages, I use a Chow Test to determine if NAFTA altered the employment and wage relationships. This procedure detects whether there is a significant difference between two sets of regression parameters, one set pre-NAFTA and one set post-NAFTA; the variables must be identical in the compared equations. Rejecting a null hypothesis of equality would indicate that the employment and wage relationships differ between the two time periods; this would suggest that NAFTA had an effect on these relationships.

The Chow Test statistic used in the present study is as follows:

$$F = [(SSE_t - (SSE_b + SSE_a))/k] / [(SSE_b + SSE_a)/(t-2k)] \qquad (5)$$

where SSE is the sum of squared residuals, b denotes before NAFTA (pre-1994), a denotes after NAFTA (post-1994), t denotes the entire period (1980-2000), and k is the number of parameters estimated in the model.

## IV. DATA AND RESULTS

I obtained all data from various issues of the *Statistical Abstract of the US*, Census Bureau reports, the Bureau of Economic Analysis, and Bureau of Labor Statistics reports. All data were available at the state level and are for the years 1980-2000. I deflated all dollar figures using the Bureau of Labor Statistics' Consumer Price Index, base year 1982-1984. Descriptive statistics are presented on Table 1.

Table 1
Descriptive Statistics

| Variable | Mean | Standard Deviation |
|---|---|---|
| WAGE (dollars; hourly wage) | 8.26 | 1.2 |
| EDUC (dollars; per capita amount spent on primary and secondary education) | 613 | 165 |
| WHITE (% of population that is white) | 0.82 | 0.133 |
| RURAL (% of population that lives in rural areas) | 0.347 | 0.217 |
| ROADS (miles of roads per square mile) | 1.77 | 1.14 |
| COLLEGE (% of population that has a college degree) | 0.206 | 0.045 |
| EMPLOY (employment-population ratio) | 0.762 | 0.165 |
| N = 1050 | | |

I used a two-stage least squares, fixed effects model to estimate equations (2) and (4). This model is superior to both cross-sectional and time series models for three reasons. First, panel data models control for potentially important but unobservable state-level effects that may be correlated with other employment and wage determinants. If I did not use panel data where appropriate, state-level effects might have been omitted, and omitted variable bias may have resulted. Second, panel data increase the degrees of freedom. Third, I used two-stage least squares because wages and employment are simultaneously determined.

Table 2

First-Stage Regression for EMPLOY

Dependent Variable: WAGE

Functional Form of Equation: LOG-LOG

| Variable | Coefficient | T-Statistic |
|---|---|---|
| NCOLLEGE*** | 0.103 | 4.06 |
| EDUC** | 0.406 | 26.822 |
| NAFTA*** | 0.217 | 5.191 |
| WHITE*** | -0.098 | -6.681 |
| RURAL*** | -0.081 | -21.113 |
| T*** | -0.0108 | -12.216 |
| ROADS*** | 0.0166 | 4.509 |
| COLLEGE*** | -0.049 | -2.892 |
| NAFTAC | 0.0036 | 0.313 |
| NAFTAM | -0.0356 | -2.024 |

$R^2$ = .61
N = 1050
*** = Significant at 1% level
** = Significant at 5% level
* = Significant at 10% level

Table 3

Second-Stage Regression for EMPLOY

Dependent Variable: EMPLOY

Functional Form of Equation: LOG-LOG

| Variable | Coefficient | T-Statistic |
|---|---|---|
| WAGE** | -0.572 | -1.93 |
| NAFTA*** | -0.169 | -4.322 |
| WHITE*** | 0.09 | 4.931 |
| RURAL*** | 0.034 | 3.582 |
| T*** | 0.0078 | 25.359 |
| ROADS | -0.0095 | -0.89 |
| COLLEGE*** | -0.019 | -3.01 |
| NAFTAC* | 0.0093 | 1.846 |
| NAFTAM | -0.0075 | -0.987 |

$R^2$ = .86
N = 1050
*** = Significant at 1% level
** = Significant at 5% level
* = Significant at 10% level

Empirical results for equations (1) and (2) are presented on Tables 2 and 3. According to these results, *NAFTA* negatively affected employment; in fact, holding all other factors constant, NAFTA reduced the employment-population ratio by 16.9 percent, on average. For those states bordering Canada, the reduction was less severe; the employment-population ratio fell by 15.9 percent. Restating these results in terms of jobs lost, holding all else constant, every state not bordering Canada lost, on average, 370,279 jobs due to NAFTA. For states bordering Canada, the average state lost 348,514 jobs.

Given that the present study examines only six years of post-NAFTA employment experience, it may be possible that the job dislocations and employment adjustments that occur when trade restrictions are removed are still occurring. In addition, since some tariffs and trade restrictions are still in existence in North America, the interim benefits will clearly not be as large in magnitude nor as significant as when all trade barriers are removed. Regarding the significance and signs of the other variables, *WHITE, RURAL,* and *T* had a positive effect on employment, and *COLLEGE* had a negative effect on employment.

Table 4
First-Stage Regression for WAGE
Dependent Variable: EMPLOY
Functional Form of Equation: LOG-LOG

| Variable | Coefficient | T-Statistic |
|---|---|---|
| AGE65*** | 0.131 | 9.124 |
| NAFTA*** | -0.086 | -5.712 |
| WHITE*** | 0.0818 | 4.666 |
| RURAL*** | 0.0335 | 4.144 |
| T*** | 0.0049 | 10.279 |
| ROADS* | -0.0168 | -1.651 |
| COLLEGE | 0.0098 | 1.296 |
| NCOLLEGE*** | -0.0485 | -5.35 |
| NAFTAC** | 0.0107 | 2.263 |
| NAFTAM | -0.0103 | -1.408 |
| EDUC*** | 0.0426 | 3.985 |

$R^2$ = .863
N = 1050
*** = Significant at 1% level
** = Significant at 5% level
* = Significant at 10% level

Table 5
Second-Stage Regression for WAGE
Dependent Variable: WAGE
Functional Form of Equation: LOG-LOG

| Variable | Coefficient | T-Statistic |
|---|---|---|
| NAFTA*** | 0.1806 | 6.916 |
| WHITE | 0.0147 | 0.475 |
| RURAL*** | -0.0563 | -4.045 |
| EMPLOY*** | -0.914 | -9.795 |
| ROADS | -0.0059 | -0.329 |
| COLLEGE*** | -0.0762 | -5.679 |
| NCOLLEGE*** | 0.092 | 5.668 |
| NAFTAC | -0.005 | -0.637 |
| NAFTAM | -0.0116 | -0.908 |
| EDUC*** | 0.254 | 13.45 |

$R^2$ = .861
N = 1050
*** = Significant at 1% level
** = Significant at 5% level
* = Significant at 10% level

Empirical results for equations (3) and (4) are presented on Tables 4 and 5. *NAFTA* had a positive and statistically-significant effect on wages; due to NAFTA and holding all other factors constant, hourly wages increased by 18 percent. This increase is even greater for those states that have a greater share of college-educated individuals; for those states, the increase is 27.2 percent. Restating these results in terms of gained income, the hourly wage in those states not having large shares of college-educated individuals went up by $1.46, on average, due to the passage of NAFTA. For states with substantial numbers of college-educated individuals, the hourly wage went up by $2.21, on average. These results corroborate trade theory. In addition, *EDUC* positively affected wages, whereas *EMPLOY* and *RURAL* negatively affected wages; all of these results corroborate theory.

It is important to note that, although it appears that multicollinearity may be an issue in these regressions, it was not found to be statistically relevant. First, one of the primary indicators of muticollinearity is that the $R^2$ is high but few, if any, of the independent variables are significant. As was seen in the results, that is clearly not the case in the present study. Second, high pair-wise correlations among the regressors may also indicate the presence of multicollinearity. When a correlation matrix was estimated, it was found that the highest pair-wise correlation was between *RURAL* and *ROADS*; this correlation was -0.516. Most of the others were considerably lower, usually below 0.25. Combining these rather low pair-wise correlations with the fact that many of the independent variables were

significant supports the view that multicollinearity is not an issue in the present study. Finally, in order to eliminate any vestiges of multicollinearity from the regressions in the present study, the data were transformed by using natural logarithms. This transformation was supported by a hypothesis test of linearity versus loglinearity (Davidson and Mackinnon (1981)).

Regarding the final test of the impact of NAFTA on employment and wages, Chow Test results are as follows:

*EMPLOY Chow Test F-Statistic = 106.21*

*WAGE Chow Test F-Statistic = 72.003*

The critical value at the 5 percent level of significance for the F-distribution with (6,1038) degrees of freedom is 2.10. The critical value at the 5 percent level of significance for the F-distribution with (7,1036) degrees of freedom is 2.01. The null hypothesis that the regressions for the pre-NAFTA and post-NAFTA time periods are statistically identical is rejected. These results suggest that NAFTA had a statistically-significant effect on the employment and wage relationships; there clearly was a structural break in 1994, the year NAFTA became effective.

## V. CONCLUSION

I attempted to determine the effect of NAFTA on employment and wages in the United States. Using a panel data set of 50 states for 1980-2000 and a two-stage least squares, fixed effects model, I estimated two equations. Results indicate that NAFTA negatively affected employment and positively affected wages. Although NAFTA reduced employment for the entire nation, for those states bordering Canada, NAFTA had less of negative effect. Results also showed that NAFTA had a positive effect on wages, especially in those states with large shares of college-educated individuals. Finally, as an additional test of the effect of NAFTA on employment and wages, I used a Chow Test to determine if there was a change in these relationships after NAFTA took effect. The Chow Test result suggested that NAFTA did have a statistically-significant effect on both wages and employment. The results of the present study are significant since this study is one of the first that uses panel data to examine the effect of NAFTA on both wages and employment at the state level.

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# AN *UNDER* BIAS IN THE FOOTBALL BETTING MARKET: FACT OR FICTION?: A NOTE

**Ladd Kochman and Randy Goodwin***

**ABSTRACT**

Betting that total points in a football game will go over or under the Las Vegas number prompts the question whether that number has been inflated to adjust for the documented preference of bettors for the *over*. If bettors do overbet the over, regular profits should accrue to those betting under the total. Our investigation spanned the 1995-2004 National Football League seasons and found that betting under produced an unimpressive wins-to-bets ratio of 50.4 percent. The lone nonrandom ratio that was not year-specific was the 52.7-percent mark for National Football Conference games over the 2000-2004 years. Once again the market for wagers on football games proved to be remarkably efficient.

**BACKGROUND**

When Pankoff (1965) suggested that the efficiency of people's average economic judgments could be tested quickly and directly by examining the outcomes of imaginary bets on football games, sports-betting studies proliferated. Pankoff's analogy between investors and bettors rested on his observation that the latter were no less numerous, knowledgeable or profit-maximizing than the former. Early supporters [Vergin and Scriabin (1978), Tryfos et al. (1984), Zuber et al. (1985), Gandar et al. (1988), Russo et al. (1989), Golec and Tamarkin (1991) and Kochman and Badarinathi (1992)] focused on football while later researchers expanded into basketball [Brown and Sauer (1993) and Kochman and Goodwin (2000)], baseball [Woodland and Woodland (1994) and Kochman and Badarinathi (1997)] and hockey [Woodland and Woodland (2001) and Kochman and Goodwin (2003)]. Despite the variety of sports and statistical tests, all found little evidence of exploitable errors.

While *side* bets (betting that one side, or team, wins at the other's expense) may produce only breakeven results, *totals* betting (gambling that total points in a game will be greater or less than the Las Vegas number) has raised some doubt about the market's efficiency. Badarinathi and Kochman (1996) found no fewer than six betting rules—all based on betting under the total—that produced nonrandom wins-to-bets ratios during the 1984-1993 seasons of the National Football League. One rule (*Bet under when the visiting team is playing its second straight game on the road*.) was nonrandomly profitable at $p < 0.05$. Kochman and Badarinathi (1996) uncovered three nonrandomly profitable strategies when betting

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specific NFL teams under the total during the 1985-1994 seasons. More recently, Paul et al. (2004) reported that betting under NFL totals beat the 52.4-percent breakeven rate but failed to represent a statistically significant violation of the efficient markets concept.

**METHODOLOGY**

To understand why betting the *under* in football enjoys the empirical support, we would first have to assume that Las Vegas totals are systematically overstated—thereby creating regular profit opportunities for those betting under. Researchers [e.g., Paul and Weinbach (2005) and Paul and Weinbach (2002)] have reasoned that totals are overstated because oddsmakers anticipate the tendency of bettors to overbet the over and therefore adjust the total upward. In the absence of any explanation in the literature of why bettors behave this way, we could speculate that they have an inherent belief that totals are understated and/or they simply like to be entertained by the kinds of plays that make games go over (e.g., touchdowns, long runs and completed passes) vis-à-vis the miscues that impede scoring such as fumbles, interceptions and penalties.

While we suspect that bettors enjoy offensive displays, enough of them may have recognized an opportunity as contrarians to bet football games under and, in turn, drive out the under bias. To test that suspicion, we tracked the final scores of games in the National Football League (NFL) over the 1995-2004 seasons and compared them with their respective Las Vegas totals. By partitioning our 10-year measurement period into two five-year halves, we hoped to learn whether potential trends are historical or recent; by dividing the NFL into the National and American Football Conferences, we were looking for different scoring patterns that might be conference-specific. Equations (1) and (2) below are not unlike those in Gandar et al. (2001) and are used to identify pointwise records as nonrandom (W/B vs. 50 percent) and nonrandomly profitable (W/B vs. 52.4 percent[1]), respectively. The sources of our data were two newsstand magazines: *The Gold Sheet College and Pro Football Annual* (2005) and *Marc Lawrence's Playbook* (2002).

$$(1) \qquad Z_R = \frac{(W/B - 0.5)}{\{[(0.5)(1 - 0.5)]/B\}^{1/2}}$$

$$(2) \qquad Z_{\square} = \frac{(W/B - 0.524)}{\{[(0.524)(1 - 0.524)]/B\}^{1/2}}$$

where: $Z_R$ = statistic for testing the null hypothesis of randomness

$Z_{\square}$ = statistic for testing the breakeven null hypothesis

W = number of winning bets

B = number of total bets

**RESULTS**

Imagining that we had bet on all NFL games to go under their respective totals during the 1995-2004 seasons, we would have placed a grand total of 5001 wagers and won 2520 of them for a wins-to-bets ratio of 50.4 percent. It is also evident from Table 1 that the National Football Conference would have produced a higher success rate (51.4 percent) than that for the American Football Conference (49.3 percent). When we divided our 10-year measurement period into five-year halves, we found that the W/B ratio for under bets in NFC games improved from a breakeven rate of 50.0 percent (1995-1999) to a nonrandom mark of 52.7 percent (2000-2004). A slight improvement was also registered by the AFC: 48.9 percent (1995-1999) vs. 49.6 percent (2000-2004). The only W/B ratios that were statistically nonrandom in addition to the 52.7-percent rate for 2000-2004 were the 56.9-percent outcome for NFC contests in 2001 and the 54.4-percent mark for all NFL games in 1995[2].

**Table 1**
Wins-to-bets ratios when betting NFL games under the *total* betting line (1995-2004)

| Year | NFC | AFC | All |
|---|---|---|---|
| 2004 | 143/264 (54.2%) | 125/266 (47.0%) | 268/530 (50.6%) |
| 2003 | 138/264 (52.3%) | 138/262 (52.7%) | 276/526 (52.5%) |
| 2002 | 129/266 (48.5%) | 132/261 (50.6%) | 261/527 (49.5%) |
| 2001 | 148/260* (56.9%) | 116/250 (46.4%) | 264/510 (51.8%) |
| 2000 | 135/261 (51.7%) | 119/230 (51.7%) | 254/491 (51.7%) |
| 2000-2004 | 693/1315* (52.7%) | 630/1269 (49.6%) | 1323/2584 (51.2%) |
| 1999 | 128/263 (48.7%) | 124/230 (53.9%) | 252/493 (51.1%) |
| 1998 | 130/262 (49.6%) | 104/215 (48.4%) | 234/477 (49.1%) |
| 1997 | 139/268 (51.9%) | 111/216 (51.4%) | 250/484 (51.7%) |
| 1996 | 145/264 (54.9%) | 94/212 (44.3%) | 239/476 (50.2%) |
| 1995 | 126/278 (45.3%) | 96/209 (45.9%) | 222/487 (45.6%) |
| 1995-1999 | 668/1335 (50.0%) | 529/1082 (48.9%) | 1197/2417 (49.5%) |
| 1995-2004 | 361/2650 (51.4%) | 1159/2351 (49.3%) | 2520/5001 (50.4%) |

*nonrandom at $p < 0.05$

## CONCLUSIONS

It seems clear from our results that if betting NFL games under the Las Vegas total were a profitable strategy, it is at least a decade past its prime. Breakeven marks of 51.2 percent (2000-2004), 49.5 percent (1995-1999) and 50.4 percent (1995-2004) when betting under dismiss any notion of a recent under bias and suggest that bettors no longer overbet the over. We can also infer from our W/B ratios that unlike other biases that tend to overcorrect when discovered, no over bias has emerged. However, our most important contribution to the sports-betting literature may be that the failure to profit from totals wagers has less to do with market efficiency than with behavioral finance. Attempting to exploit totals perceived to be either understated or inflated is a good example of what behaviorists see as the folly of individuals acting on information which they regard as perfect in order to profit from mistakes committed by others acting on imperfect information. The field of behavioral finance promises new insights into the role of emotions and cognitive errors in the decision-making process of investors—and bettors!

## ENDNOTES

1. Bettors must win 11 of 21 wagers (or 52.4 percent) to break even since they risk $11 to win $10.
2. the reverse of betting under on all NFL games in 1995

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2. Richard Deitz
3. Kent Klitgaard
4. Michael McAvoy
5. William O'Dea
6. Martha Wojtowycz

New York State Economics Association
Founded 1948

# 58th Annual Meetings of the New York State Economics Association

***2005***

## Geneva, New York

**Friday October 7th**
6 – 7:30 pm Reception, Ramada Inn Geneva Lakefront

**Saturday October 8th**
8:00 – 8:30 Registration
8:30 – 10:00 Concurrent Sessions
10:15 – 11:45 Concurrent Sessions
12:00 – 1:15 Lunch
1:30 – 3:15 Concurrent Sessions
3:30 – 4:45 Concurrent Sessions
5:00 – 6:00 Business Meeting (Open to all members)

### Concurrent Sessions

### 8:30am – 10:00am

**Session: Economic Issues in New York** **Seneca Room**

Chair: Booker, James (Siena College)

| | |
|---|---|
| Palumbo, George, Canisius College<br>Shick, Richard, Canisius College<br>Zaporowski, Mark, Canisius College | The Decline of the Upstate Economies and Its Impact on the Credit Worthiness of Local Gov'ts<br>*Discussant:* Deitz, Richard (Fed Res Bank- Buffalo) |
| Yerger, David, Indiana Univ. of Penn. | Changes Over Time in New York State's Responsiveness to Monetary and Oil Price Shocks<br>*Discussant:* Froyen, Richard (U of North Carolina) |
| Hadsell, Lester, SUNY Albany | Premiums in the New York Wholesale Electricity Market<br>*Discussant:* Booker, James (Siena College) |

| | |
|---|---|
| Larry, Lichtenstein, Canisius College<br>Reiber, Ronald, Canisius College<br>Zaporowski, Mark, Canisius College | Structured Settlements in Personal Injury Cases Under New York State Article 50 B Statute: Economic Justice for the Plaintiff?<br>*Discussant:* Thomas, Wade (SUNY Oneonta) |

**Session: Student Session 1** **Geneva Room**

Chair: Jeffrey Wagner, RIT

| | |
|---|---|
| Ryan, Justin, Ithaca College | Expected Inflatin and Equity Prices<br>*Discussant:* Kopp, Thomas (Siena College) |
| Freitas Luiz, RIT<br>Wagner, Jeffrey, RIT | Capturing Moral Economic Content<br>*Discussant:* Schmidt, Ted (SUNY Buffalo) |
| Bouzaeva, Olga, SUNY Oneonta | The Roll of Intuition in Managerial Decision-Making: The United States and Russia Compared<br>*Discussant:* Meister, Patrick (Ithaca College) |
| Bushu, Riziki, SUNY Oneonta | The Political and Actual Budgets: The Error Balance and the US Experience, 1977 - 2003<br>*Discussant:* Masaya, Tendai (Ithaca College) |

## 8:30am – 10:00am

**Session: Teaching Statistics** **Blackwell Ballroom**

Chair: Florence Shu, SUNY Potsdam

| | |
|---|---|
| DePoint, Matthew, HSBC Bank | Guidelines for the Incoming Modeler<br>*Discussant:* Shu, Florence (SUNY Potsdam) |
| Fu, Ning, SUNY Potsdam | Quantitative Marketing Literature Review Report: Summer 2005 HSBC Internship<br>*Discussant:* Barker, Dean (HSBC Bank) |
| Lunt, Lora, SUNY Potsdam | International Collaboration in Teaching Statistics<br>*Discussant:* Lachaab, Mohamed (Clarkson U) |
| Lachaab, Mohamed, Clarkson U | Probit and Logit Models of Consumer Choice<br>*Discussant:* DePoint, Matthew (HSBC Bank) |
| Shu, Florence, SUNY Potsdam | Business Economics and Log-Log Regression Techniques<br>*Discussant:* Lachaab, Mohamed (Clarkson U) |

## 10:15am – 11:45am

**Session: Varied Topics** **Seneca Room**

Chair: Alfred Lubell, SUNY Oneonta

| | |
|---|---|
| Kopp, Thomas, Sienna College | Using Forecasts to Select Optimal Portfolios for Long-Term Investment<br>*Discussant:* Piccione, John |
| Hadsell, Lester, SUNY Albany | Factors Influencing Students' Choice of Business School: Some Survey Results<br>*Discussant:* Pate, David (St. John Fisher College) |
| Ganley, William, SUNY Buffalo | Veblen and Keynes on the Theory of Business Cycles<br>*Discussant:* Ring, David (SUNY Oneonta) |
| Dennis, Benjamin, Univ. of the Pacific<br>Iscan, Talan, Dalhousie University | Distortions, Structural Change, and Economic Growth<br>*Discussant:* Hinderliter, Roger (Ithaca College) |

## 10:15am – 11:45am

**Session: Quantitative Analyses** **Geneva Room**

Chair: Michael McAvoy (SUNY Oneonta)

| | |
|---|---|
| Sayginsoy, Özgen, SUNY Albany | Powerful and Serial Correlation Robust Tests of Composite Inequality Hypotheses on the Parameters of the Simple Linear Trend Model with an Application to Economic Convergence |
| Dingil, Fahrettin, SUNY Alfred | Time Series and Panel Data Analysis of Property Crimes in the States<br>*Discussant:* Sayginsoy, Özgen. (SUNY Albany) |
| Zhong, Miao, SUNY Albany | Estimation of Portfolio Value-at-Risk using GARCH, Extreme Value Theory, and Copulas<br>*Discussant:* Yerger, David (Indiana U of Penn) |

**Session: RIT Student Session** **Blackwell Ballroom**

Chair: Jeannette Mitchell, RIT

| | |
|---|---|
| Hicks, Matt, RIT | The Impact of Health Care Spending on Economic Growth: A Feder Growth Model Analysis |
| Callendar, Kyle, RIT | Trade and the Distribution of Income: The Unasked Question |
| Gordon, Gregory, RIT | Models of Investment Choice<br>*Discussants*:<br>Deitz, Richard, New York Fed – Buffalo<br>Cherry, Alexandria, RIT |

## 12:00pm – 1:15pm

**Luncheon Speaker: Kaushik Basu** — **Lakeview Ballroom**
C. Marks Professor of International Studies and Director, Program on Comparative Economic Development at Cornell University

## 1:30pm – 3:15pm

**Session: Monetary Economics** — **Seneca Room**

Chair: Roger Hinderliter, Ithaca College

| | |
|---|---|
| Schmidt, Ted, Buffalo State College | Seignniorage and Sovereignty: Measuring the Benefits of the International Reserve Currency<br>*Discussant:* Yerger, David (Indiana U of Penn) |
| Olson, Ordean, Nova Southeastern U | The Effects of Fluctuations of the Yen/Dollar Exchange Rate on the Stability of the East Asian Economies: A VECM Model Approach<br>*Discussant:* Iscan, Talan (Dalhousie University) |
| Froyen, Richard, University of North Carolina and Hakan Berumet, Bilkent University - Turkey | Monetary Policy and Long-Term Interest Rates: Is There an Excess Sensitivity Puzzle?<br>*Discussant:* Ring, David (SUNY Oneonta) |

**Session: Labor and Demographics** — **Geneva Room**

Chair: Booker, James (Siena College)

| | |
|---|---|
| Conger, Darius, Ithaca College | Family Structure and Altruism versus Reciprocity: The Role of Child Status in Human Capital Acquisition<br>*Discussant:* Eisenhauer, Joseph (Canisius College) |
| Parai, Amar, SUNY Fredonia<br>Sarbani, SUNY Buffalo<br>Parai, Rama, Niagra County CC | Computer Use and Wage Differentials: US and Banerjee, Foreign Born Male and Female Workers<br>*Discussant:* Kolberg, William (Ithaca College) |
| Cherry, Monica, St. John Fisher College<br>Pate, David, St. John Fisher College | Consequences of Unpaid Work: A Profile from the PSID<br>*Discussant:* Booker, James (Siena College) |
| Yuan, Xin, SUNY Albany<br>Yun, Kwan, SUNY Albany | Social Security Programs and Retirement Behaviors in Korean and China: A Micro Estimation<br>*Discussant:* O'Dea, William (SUNY Oneonta) |

## 1:30pm – 3:15pm

**Session: Student Session 2** — **Blackwell Ballroom**

Chair: Wade Thomas, SUNY Oneonta

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| Jimenez, Alethia, RIT | An Empirical Study of the "Day without a Car" Program in Mexico City, 1989 - 2004<br>*Discussant:* Thomas, Wade (SUNY Oneonta) |

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| Choudhury, Samira Ithaca College | Determinants of Alcohol Consumption by College Students<br>*Discussant:* McCannon, Bryan (Elmira College) |

## 3:30pm – 4:45pm

**Session: Microeconomics** **Seneca Room**

Chair: William O'Dea, SUNY Oneonta

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| Eisenhauer, Joseph, Canisius College | Measuring Aversion to Large Scale Risks<br>*Discussant:* Conger, Darius (Ithaca College) |
| Wagner, Jeffrey, RIT | Are Forecast Disclosure Rules Pareto- Improving?<br>*Discussant:* O'Dea, William (SUNY Oneonta) |
| Kolberg, William, Ithaca College | Elasticities, Cross-Elasticities, and Market Relationships Revisited |

## 3:30pm – 4:45pm

**Session: Health Economics** **Geneva Room**

Chair: Frank Musgrave, Ithaca College

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| Cheng, Joseph, Ithaca College<br>Ives, Jeffrey, Ithaca College | Two Stage Health Insurance Policies: A Proposal and a Cost Analysis<br>*Discussant:* Tussing, Dale (Syracuse U) |
| McCannon, Bryan, Elmira College | An Economic Theory of College Alcohol and Drug Policies<br>*Discussant:* Meister, Patrick (Indiana U of Penn) |
| Principe, Kris, Canisius College | Hospital Market Structure, Behavior, and Prices: An Analysis of Florida Hospital Markets<br>*Discussant:* Musgrave, Frank (Ithaca College) |

## 5:00pm – 6:00pm

**Business Meeting** (open to all members) **Seneca Room**