

A Value-Added Education

Research by Ray Kluender
Written by Taylor Kostal

The Great Smog of China
Testing NBA Gambling Models
Ananth Seshadri's Macroeconomy
David Samson & the New Marlins
Hidden Costs of Concealed Carry



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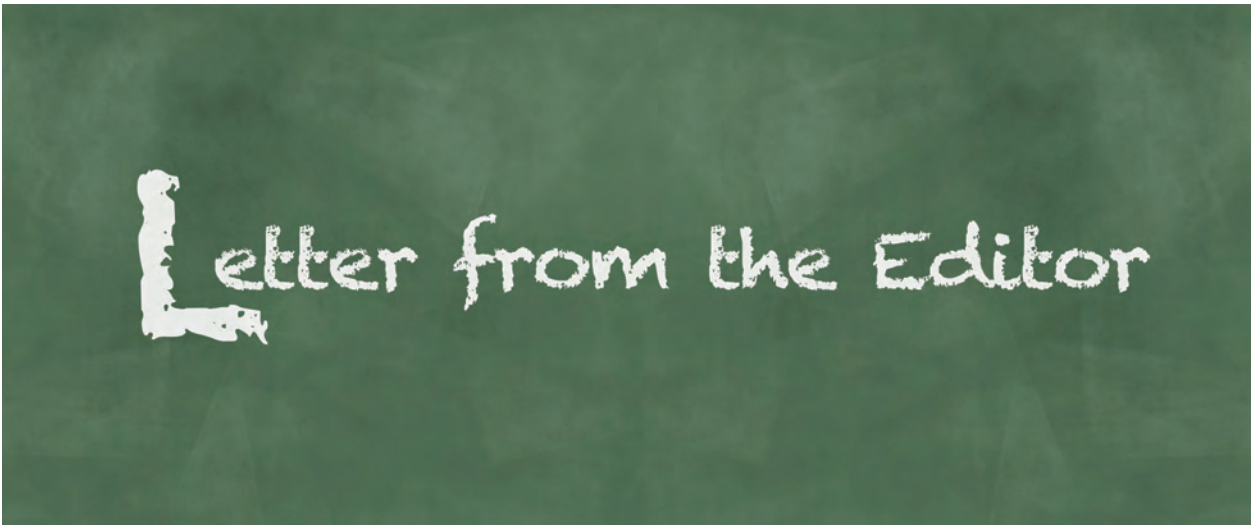
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Letter from the Editor

Dear Reader,

The Economics Department and I are very excited to introduce the third volume of *Equilibrium*. This journal truly exemplifies the talents of the Department's students, the guidance of its faculty, and the exceptionalism of its alumni.

The significance of *Equilibrium* cannot be understated. This journal provides a window into the laboratories that are the minds of the Department's brightest students. It also gives professors the chance to see much of their teachings and influence in action, and gives Alumni a view of the astounding effect of their support. Most importantly, it presents underclassman the occasion to learn more about the world of economics and the opportunities that exist for its students through the work of their peers.

Bobby Kennedy famously said, "Some men see things as they are, and ask why, I dream of things that never were, and ask why not." The students, whose work is highlighted in this journal, have certainly internalized this philosophy. They deserve enormous praise for their accomplishments, and some of them have already received it in the form of acceptance letters to the nation's top Economics PhD programs. Each began in Econ 101 in their freshman year, and by their fourth year, they dreamt up unanswered questions and then transcended expectations to perform original research and discover new truths.

Through *Equilibrium* these students' work as well as the careers and accomplishments of notable alumni and professors will certainly have an impact at Wisconsin. There is a common misunderstanding among many college students that an Economics degree is simply a pathway to a career in finance. I hope that this journal can provide a different perspective to underclassman who are making the decision of declaring a major as well as to seasoned economics students who are speaking with advisors to determine a career path. The student, alumni, and professor accomplishments in this journal encompass the theoretical, the practical, and the human, and cover topics of sociology, politics, sports, law, pollution, education and equality. Through their accomplishments, they have proved the expansiveness and endlessness of an education in Economics.

I would like to thank all those who contributed to the journal and give a special thank you to Sam Clegg '11 who fathered *Equilibrium*, and to Evan Mast '12 who produced a fantastic second volume.

Onward and Upward,
Alexander K Rosenthal
Editor-in-Chief



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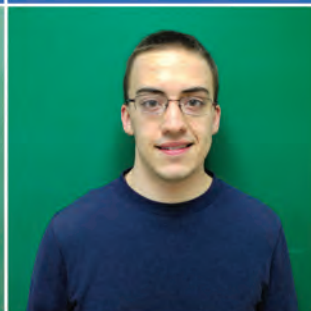
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BRAINS AND BRAWN

Determinants of Global and Physical Development in Argentina

Research by Evan Mast
Written by Wendy Yeong
Art by Kate Nikles

IN AN ARGENTINEAN TRASH dump, a three year old child picks up a mostly empty bag of potato chips and a piece of molding sausage. He carefully cleans the food, as this process now becomes a daily routine. Elena Durón Miranda, founder of a non-profit that fights against child labor, witnessed this scene eleven years ago in Bariloche, Argentina. She estimated that there were about two hundred children at this dump rummaging through garbage and hoping to find a morsel of food or something to sell. Because of extreme poverty like this, a vast majority of these children are forced to drop out of school. Their daily struggle for survival perpetually keeps them struggling in the labor market as they grow older.

Since then, the Argentinean government implemented a conditional cash transfer program to help remedy this crisis. A cash subsidy of 220 pesos (or \$55) per child is conditioned on school attendance, regular medical check-ups and vaccinations. The program emphasizes the importance of building a solid foundation for impoverished children's future economic success.

Currently, the Argentinean Health Ministry reports that 750,000 children and teenagers under the age of 18 are

malnourished. Furthermore, around 7% of children ages 5 to 14 perform regular manual labor to help provide for their families. Recent economic literature has shown that improving the income and education levels of mothers has positive effects on children's physical development. However, not much research has been done on the connection between the mothers' situation and children's global development. In this context, global development is defined as a measure of the child's coordination and cognitive development, and physical development is defined as overall health and well-being.

Evan Mast, a recent University of Wisconsin-Madison graduate, pursued this topic in his senior thesis "Brains and Brawn: Determinants of Global and

Physical Development in Argentina." He based his study on data from the 2004-2005 Argentinean National Survey on Health and Nutrition. Through econometric analysis, Mast found that mothers' income and education have disproportionate effects on children's global development.

Correspondingly, Mast made two conclusions about the data he collected. Firstly, a mother's education is more important to a child's cognitive development, whereas a child's physical

development is more dependent on her income. His second discovery was that children in complete poverty (do not have the most basic necessities to living) benefit more from income increases than education reform.

Mast believes that these outcomes have important implications for public policy. His research suggests that global (cognitive) development and physical development should be evaluated separately. He also reinforced the notion that children from low-education families have lower levels of cognitive development. All in all, this implies that income subsidies may be more effective in improving both the physical and global development of the child. Simply put, for children living in extreme poverty,



monetary interventions are likely to create better results than educational interventions.

The data from the aforementioned survey contained physical and biochemical measures for over 35,000 children ages six months to five years old and their families. In terms of the sample composition, the sample population was evenly distributed geographically across Argentina and all sample observations contain weight, height, and basic family characteristics. Additionally, roughly half of the subjects studied also had the results for their PRUNAPE scores

included. In order to measure developmental delay among children, the Argentinean government designed the PRUNAPE test. An example of a typical question in the test is, "Can the child walk heel-to-toe along a line?" This data was crucial for Mast's analysis of global development because it provided a metric for cognitive, gross motor, fine motor, and social development.

The PRUNAPE test also afforded Mast an extra level of detail because it uses two subsets to distinguish between global development levels of 6-23 month old children and 2-5 year old children.

The subsets are unique in so far as the questions are tailored to the age of the child surveyed. Through advanced statistical analysis, Mast surmised that among older children, a mother's education level strongly correlates with positive global development, but not so for the youngest in the study.

Mast also employed regression analysis to analyze the different effects the variables had on physical development.

When physical development was the outcome, he learned that income has a t -statistic (the amount that a coefficient differs from its standard error) roughly twice the size of mother's education ($t = 4.1$; $t = 2.5$). When the relationship was reversed and cognitive development was the outcome of interest, he ascertained that education had a larger t statistic ($t = 3.5$; $t = 7.7$). In terms of global (cognitive) development, a one-year increase in mother's education was associated with a .04-point improvement on

the PRUNAPE test, while a 10% increase in average family income was only associated with a .008-point improvement.

This analysis supported Mast's hypothesis that a mother's education is more important to global (cognitive) development. Consequentially, this is economically good news because research shows funding cognitive development programs is less expensive than their physical development counterpart programs.

Despite these optimistic results, the study still did offer concrete conclusions on how to isolate the global development crisis. The collinear relationship between mothers' income and her education suggests there is not a sufficient amount of variation to differentiate between their causative effects. That being said, Mast affirms that this does not affect his results too significantly because of the subsequent variation in the each income segment. Going along with that point, the variation in income among each segment of mothers' education also helps minimize the risk of bias.

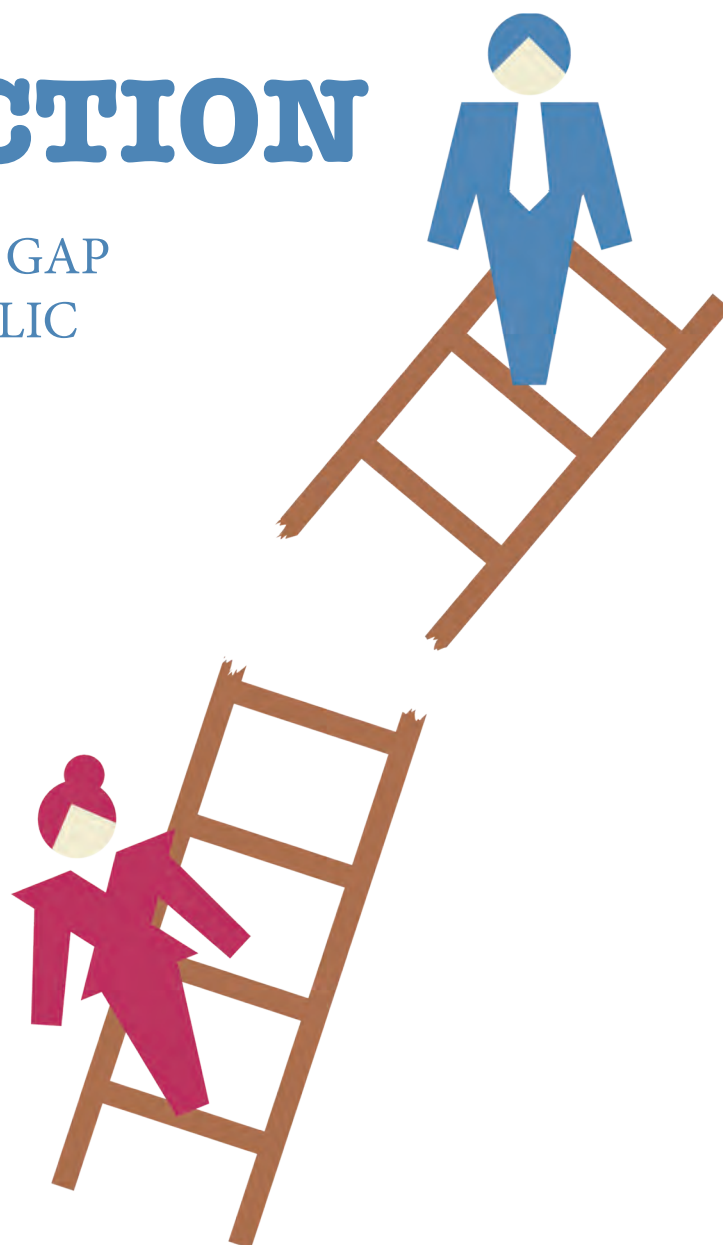
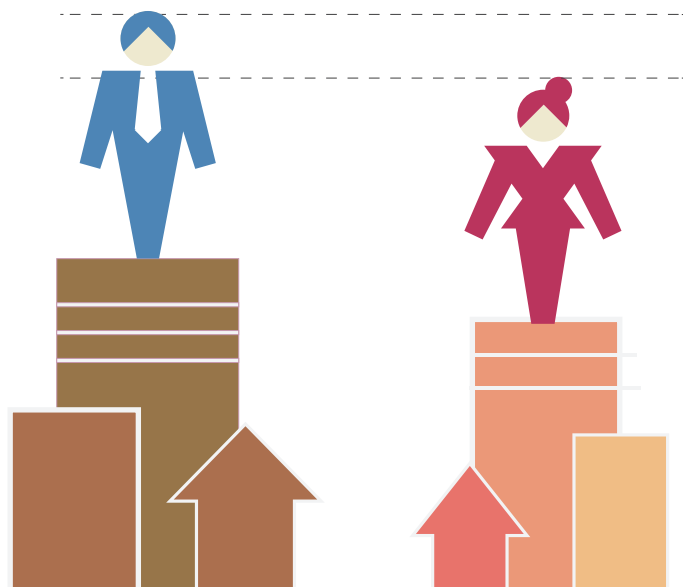
Mast's study will help further the debate on the ideal and most economical methods for fighting poverty. There is a lot of foreign aid flowing into developing nations from developed economies, but there is questioning as to how much of these contributions actually have a measurable effect and change the facts of life for the poor. This is where the value of Mast's research is most apparent; he is trying to isolate which cash flows have the greatest multiplier effect on benefiting impoverished children. Through analysis such as this, nations can make better decisions on where and how to allocate funding and structure assistance programs.



FEMALEFACTION

THE GENDER COMPENSATION GAP AMONG EXECUTIVES OF PUBLIC COMPANIES

Research by Sam Schreiber
Written by Jonathan Schellenberg
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IN THE UNITED STATES, women have fought in the legislature, in the streets, and in the office place for decades to win equal pay. Despite notable successes, a 1999 study by the National Committee on Pay Equity found that women on average earn only 72 cents for every dollar earned by men. Granted, however, some women certainly have reached powerful positions. Notable examples who have been recently making their names both in Technology and in Finance, are the current CEO of Yahoo Marissa Mayer and the COO of Facebook Sheryl Sandberg.

So how far have we come in eliminating gender discrimination in the modern workplace? Although equal pay was one of the most talked about and debated topics in the recent Presidential Election, and the Equal Pay Act has been in force for nearly half a century, a noticeable gap in earnings exists among men and women in a variety of occupations. According to the US Census Bureau, the average woman earns just 77% of the average man's annual salary. At the time of this writing, there were only eighteen female CEOs at Fortune 500 companies or less than 4 percent. Furthermore, according to the Institute for Women's Policy Research, publicly traded companies have one of the highest average wage differences between men and women, despite the fact that they are constantly in the public spotlight.

Sam Schreiber, a senior from the

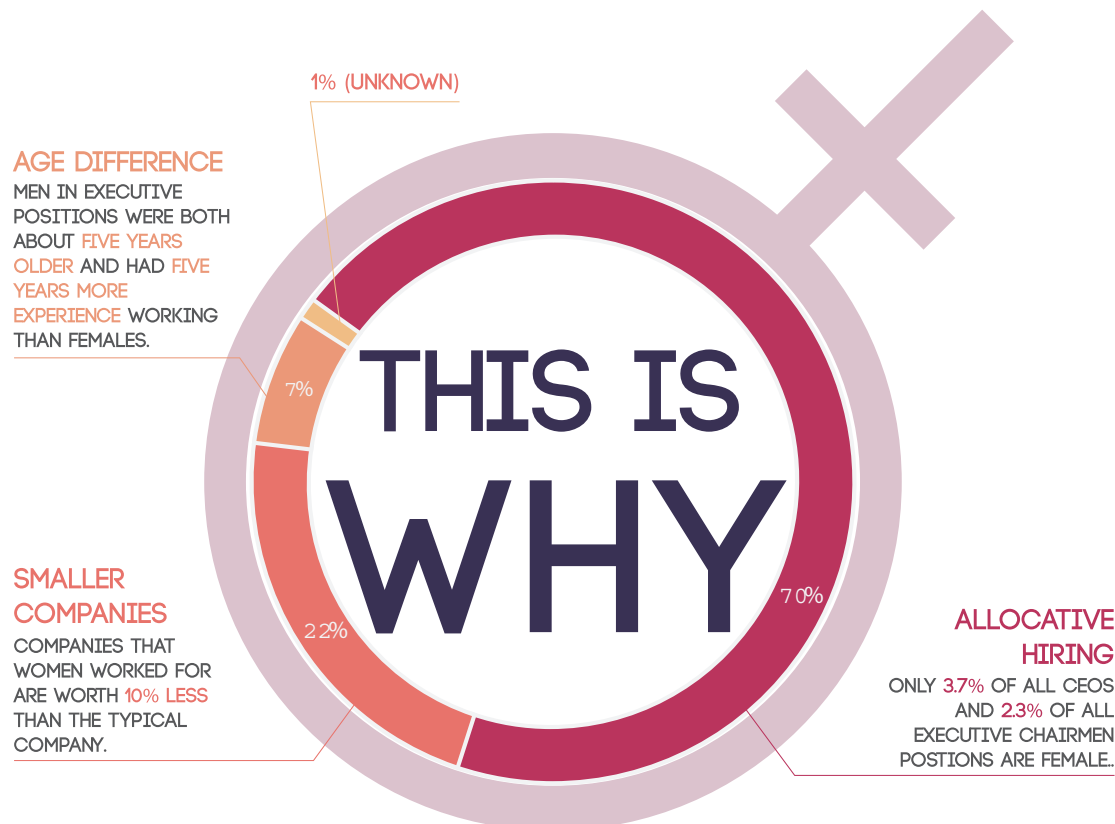
University of Wisconsin-Madison, decided to investigate how and why this inequality continues to persist. Schreiber segments gender wage discrimination into three categories: within-job discrimination, allocative discrimination, and valutive discrimination. Within-job discrimination is a term describing the situation where women and men have the same job, but men are paid more. The Equal Pay Act made this discrimination explicitly illegal and although its occurrence has declined in recent decades, this type of discrimination still has not completely disappeared from practice. Only four years ago, Sterling Jewelers was brought to court for paying several of its female workers less than their male colleagues, even though they were doing the exact same jobs. The United States Equal Employment Opportunity Commission (EEOC) received approximately 25,000 discrimination complaints from women

WOMEN IN EXECUTIVE POSITIONS EARN 18% LESS THAN THE AVERAGE MALE EXECUTIVE.

in 2007—an increase of 7% from the prior year.

All of these statistics indicate that gender discrimination is almost as rampant as racial discrimination in today's workplace, and that 68% of women believe discrimination is a real threat to their career advancement. Moreover, the EEOC found that due to gender wage discrimination, the average female college graduate loses \$1.2 million over the course of her career, while a woman with professional school qualifications has \$2.2 million taken right out of her pocket. When put into monetary terms, these numbers seem all the more powerful.

As groups such as the EEOC expose these blatant cases of job discrimination, more subtle forms persist. In allocative discrimination, women are recruited specifically for lower paying jobs and solely because they are women, instead of a difference in a skill set or level of experience. Similarly, in valutive discrimination, jobs that are predominately performed by women pay less than jobs predomi-



nately performed by men.

In the 2001 report, “The Gender Gap in Top Corporate Jobs,” economists Marianne Bertrand at the University of Chicago’s Booth School of Business and Kevin Hallock at Cornell University investigated the gender wage gap specifically in executive positions of public companies. Bertrand and Hallock

When Schreiber looked at the types of executive positions women tended to fill, they appeared especially under-represented in the CEO and Chairman positions. Only 6.5% of executives are female, and only 3.7% of all CEOs and 2.3% of all chairmen are female. While these rates are better than the 2001 levels, women still occupy less than 1% of all executive positions. Additionally, most women in executive positions tend

This discovery leads Schreiber to conclude that reducing the experience differential between men and women is a possible solution to eliminating pay inequality.

Interestingly enough, the proportion of female executives in the workplace has actually been steadily decreasing for the last five years, following a substantial increase in the 1990s. It will

Only 6.5% of executives overall are women, and only 3.7% of all CEOs and 2.3% of all executive chairmen are female.

discovered that allocative discrimination made up about 45% of the wage differential between male and female executives. It appears that the vast majority of corporate America still is not willing to embrace female leadership in their companies. Despite this notable discrimination, they also found that female election to top management positions tripled and the ratio of female-to-male compensation rose by 40% in the 1990s. Schreiber continues this line of research to learn how the discriminatory landscape has changed for female executives.

She finds that female executives are paid approximately 18% less than the average male executive. This gap is substantially less than the 45% difference observed by Bertrand and Hallock, thus giving signs that gender discrimination is loosening its grip on corporate America. Schreiber’s research also examines the gender wage gap in terms of job position, firm size, and age.

to work for smaller companies that pay executives less. To illustrate this point, the stocks of companies that women work for in this study are worth about 10% less than the typical company. Schreiber finds that the number of women working in small market-share companies accounts for about 22% of gender wage discrimination.

Schreiber’s last variable of interest is the difference in age and experience between male and female executives. Bertrand and Hallock found that on average, men in executive positions were about five years older and approximately five years more experienced than their female counterparts. However, Schreiber finds that age does not play a major role in contemporary gender wage discrimination. Today, the average women are just two years younger than their male counterparts. Furthermore, female executives tend to gain more experience over time as they become more numerous in executive positions.

be important for future researchers to examine ulterior reasons that could be responsible for this. Some studies have found that the current generation of female professionals has fundamentally different values than the previous one, thus accounting for the sudden drop in female executives.

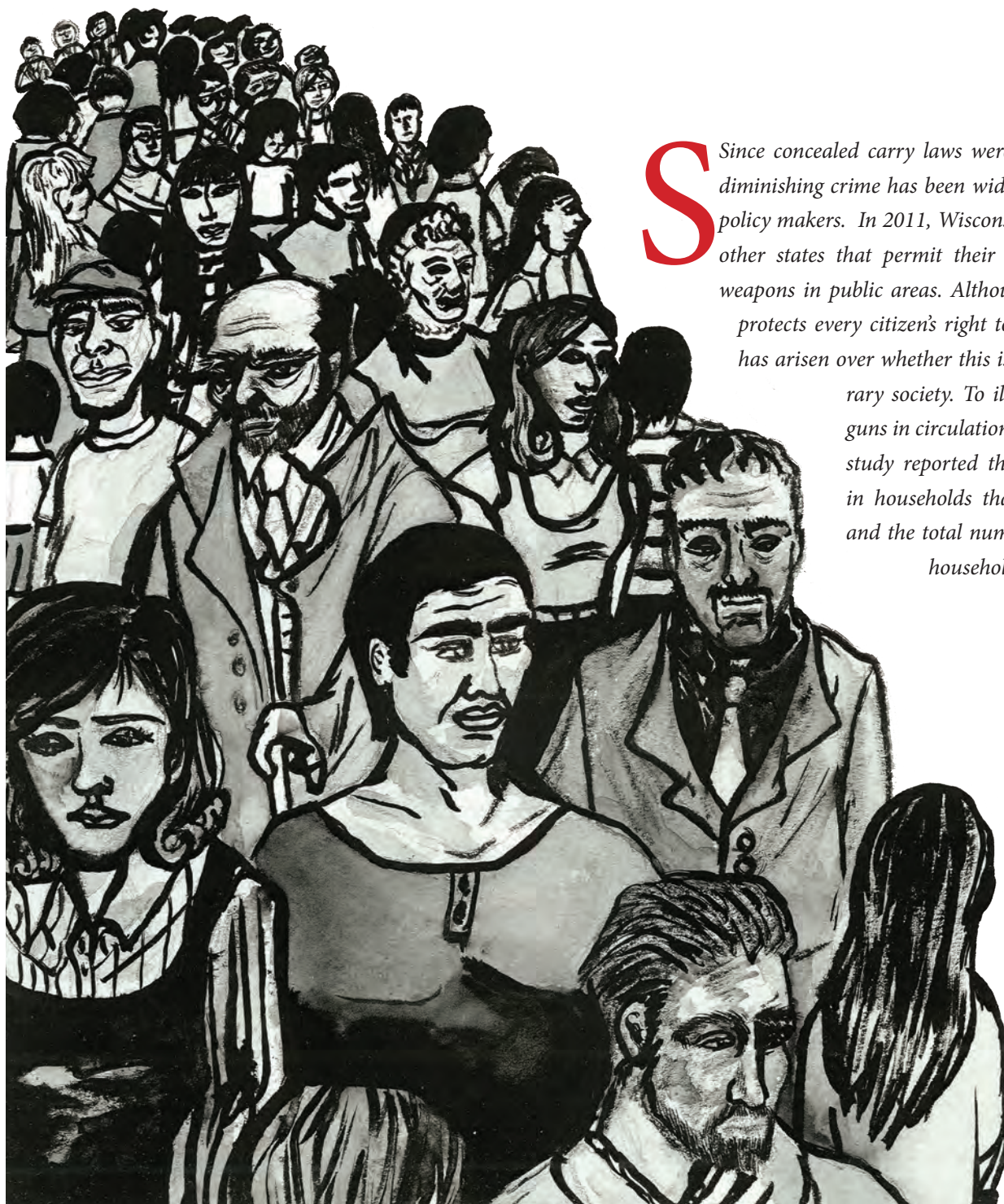
However, as Schreiber notes, major strides have been made in the last decade to minimize the gender wage gap. Sheryl Sandberg, COO of Facebook, made a particularly interesting comment on the female presence in executive positions in a recent interview with the Harvard Business Review. She said, “There’s a great quote from Alice Walker: ‘The most common way people give up their power is by thinking they don’t have any.’ I am not blaming women; I’m helping them see the power they’ve got and encouraging them to use it.”

Where's the Gun?

Concealed Carry and Changing Crime

Research by Brandon Williams
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Since concealed carry laws were first enacted, their role in diminishing crime has been widely contested by experts and policy makers. In 2011, Wisconsin joined the ranks of many other states that permit their citizens to carry concealed weapons in public areas. Although the Second Amendment protects every citizen's right to bear arms, a fierce debate has arisen over whether this is still practical in contemporary society. To illustrate the sheer volume of guns in circulation in the United States, a 2009 study reported that 124 million people lived in households that owned at least one gun, and the total number of guns owned by those households was roughly 270 million.

In his senior thesis, "Concealed Carry and Changing Crime: A brief look at the deterrent and substitution effects of conceal carry laws", Brandon Williams, a recent graduate of the University of Wisconsin-Madison's Economics Department, investigates the validity of the arguments for and against concealed carry laws. By "deterrent effect," Williams refers to the argument that would-be criminals are less likely to commit crimes because of the increased risk that their intended victims are carrying a concealed weapon. Correspondingly, the "substitution effect" purports that these laws will encourage criminals to participate in alternative types of crime, such as fraud, that avoid physical encounters with their victims.

While the media debates the consequences of such laws, there are many more variations of concealed carry laws that further complicate the issue. For instance, nondiscretionary laws, also known as "shall-issue" laws, allow law enforcement agencies to issue concealed carry permits at their discretion, provided applicants meet certain criteria. Some states do not even require permits—prohibiting only people with a criminal record from owning guns. "May-issue" states issue permits solely based on necessity, which is in turn determined by criteria established by that state. A lone holdout against the concealed carry trend, Illinois, does not allow its citizens to carry concealed weapons. It is interesting to note that with the increased adoption of concealed carry laws between 1946 and 2004, the number of guns owned per person in the United States has also increased from 0.36 to 1. However, state-by-state these figures have a much different composition. For example, compared to Nebraska, Delaware has a much lower level of gun ownership per



household. Researchers have also found that gun ownership tends to vary based on race, age, gender, and political views.

To explore how concealed carry laws affected crime rates in states that passed these laws, Williams examines seven primary categories: murder and non-negligent manslaughter, rape, aggravated assault, robbery, auto theft, burglary, and larceny. While these categories are not completely exhaustive, they are a suitable measure of the potential deterrent and substitutive effects of the concealed carry laws.

In "Crime, Deterrence, and Right-to-carry Concealed Handguns", published in 1997, economists John Lott and David Mustard concluded that allowing citizens to carry concealed weapons does deter violent crimes without increasing accidental deaths. Williams takes a

look at these conclusions from a modern perspective to see if they still hold true. Rather than assume the distribution of gun owners was even among all states, Lott and Mustard used county-based data from 1977-1992 to determine which areas were most affected by concealed carry laws. According to Lott and Mustard's data on "shall-issue" laws, murder, rape and aggravated assault rates fell while property crimes, larceny, and auto theft increased. The murder rate changed most, showing a 7.6% decrease. It was also found that violent crime rates dropped dramatically in the years following the implementation of shall-issue laws. Lott and Mustard thereby concluded that it was economically beneficial for states to adopt concealed carry laws.

When Lott and Mustard published their research, experts were divided on

how to interpret their findings. In 2003, Ian Ayres and John Donohue took a closer look at their methods to see if the conclusions were appropriate. By expanding the data set and examining different variables, they concluded that gun-related violence actually increased after concealed carry laws were enacted.

Ayres and Donohue believed that the Lott and Mustard study was compromised by their narrow focus on states' data. By limiting their analysis to a state-by-state approach, Lott and Mustard missed out on identifying national trends in crime. Ayres and Donohue also concluded that Lott and Mustard's model was based on population demographics, which means that more populated states skewed the data to show crime had decreased. Ayres and Donohue concluded that concealed carry laws do not equate to decreases in violent crime, based on the fact that violent crime rates in some states actually increased after laws were enacted.

To start resolving the disparities between these two studies, Williams examines a third report by Florenz Plassman and John Whitely which refuted Ayres and Donohue's conclusions. By adding a few more years of data to the study, Plassman found that annual murder rates did indeed drop as Lott and Mustard had determined. The study shows that crime levels decreased by 1.5% to 2.3% for each additional year added after the concealed carry laws were implemented. Ayres' restricted timeframe skewed the results of the data in favor of higher crime rates, thus leading to their different conclusions.

A final study Williams inspects used the fluctuation in murder rates as the basis for its conclusion. In "Victim Characterization and Offender Choice," Michael

Maltz and David Olsen broke down homicides by weapon type, victim characteristics, and victim-offender relationships. They found an overall decrease in the homicide rate, just as Lott and Mustard concluded. However, by conducting this more detailed analysis, they were able to see how some demographics were impacted more than others. They determined that women were more often the targets of violent crime and accounted for more of total homicides, despite the fact that the total number of homicides decreased for both men and women. Maltz and Olsen also found an increase in the murder rate for non-firearm homicides, even though the firearm-related homicides decreased.

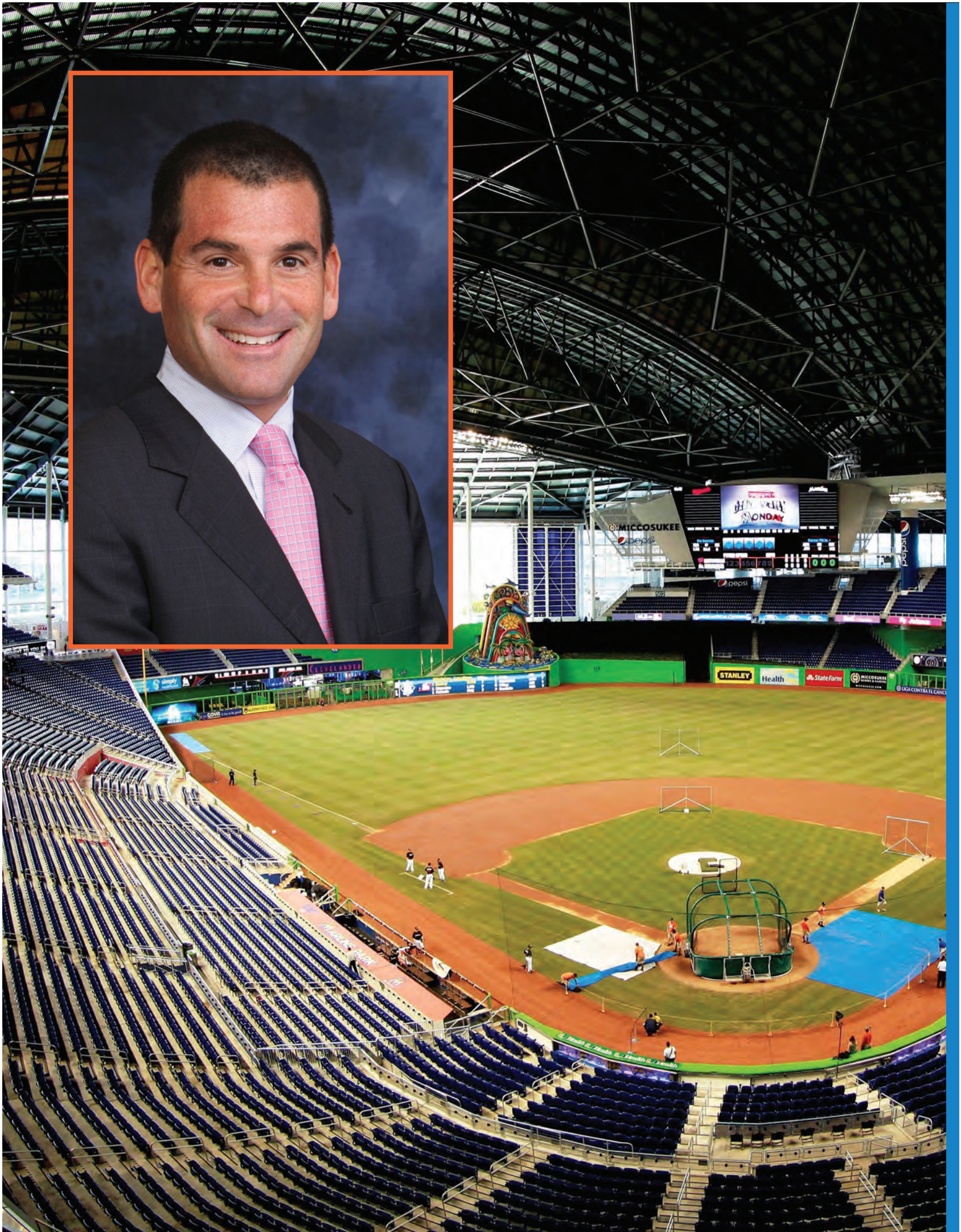
More importantly, Maltz and Olsen found a statistically significant drop in the murder rate when the victims were strangers to the perpetrators. This supports the theory of the deterrent effect of uncertainty, which states that criminals will not be deterred from violently engaging someone they know, but they are probably less likely to attack a stranger who could be armed. This also helps explain how the substitution effect of concealed carry laws changes the patterns of crime.

The traditional economic definition of the substitution effect indicates that individuals will change their preferences based on the relative costs of their choices. If one good becomes cheaper, the consumer gains more utility from switching to the cheaper one. In the case of concealed carry laws, criminals face a similar choice regarding the types of crime they decide to engage in. According to Lott, "When potential victims are able to arm themselves, some criminals turn away from crimes like robbery that require direct attacks and turn instead to such crimes as auto theft, where the

probability of direct contact with victims is small." This switch to physically distanced crimes reduces the risk while maintaining the same potential gains.

Williams concludes that the many differing results of studies on concealed carry laws and their effects make ascertaining a single conclusion challenging; however, it is his belief that there is strong evidence of a deterrent effect produced by concealed carry laws. It is generally agreed upon by academics that violence has not spiked as a direct result of shall-issue laws, but the deterrent effect is still ambiguous due to incomplete data. Conversely, the substitution effect of concealed carry laws has been well proven. The evidence suggests that criminals do pursue less risky crimes when life and limb are at stake – beacons of rationality, as it were, in an otherwise outlandish shouting match.





OUR PRODUCT IS BASEBALL

David Samson, President and CEO of the Miami Marlins, gave us an inside look at how big the business of baseball actually is.

Interview by Alex Rosenthal
Written by the Equilibrium Staff

DAVID SAMSON'S JOURNEY BEGAN AS A STUDENT at the University of Wisconsin, Madison, graduating in 1990 with a B.A. in Economics and a minor in Philosophy. Even as a student, Samson was already thinking like an executive. When planning his class schedule, he went as far as plotting out exactly where he would be (the Equilibrium staff learned that in the old days, students had to physically visit the department in order to enroll for each course) and how long he would wait in line for each enrollment, in order to make the most of his time. "That's part of being a type 'A' personality," he said. "There is no way anyone can do it as well as you can." Samson summed up his time in Madison by saying, "There was never one thing I did that I didn't love."

“I am waiting for someone to show me the statistic of the heart.”

CELEBRITY STATUS INVESTORS make the front page of the business section, but many people overlook sports franchises that also transcend the sports column and dominate the business world. David Samson, President and CEO of the Miami Marlins, gave us an inside look at how big the business of baseball actually is.

During our interview Samson said, “I feel like what we are doing is running a large company. Our product is baseball. Other people make whatever product they are making, or service they are providing. We are an entertainment company. Baseball is our entertainment.”

Samson’s journey began as a student at the University of Wisconsin-Madison, graduating in 1990 with a B.A. in Economics and a minor in Philosophy. Even as a student, Samson was already thinking like an executive. When planning his class schedule, he went as far as plotting out exactly where he would be and how long he would be there in order to make the most of his time. “That’s part of being a type ‘A’ personality,” he said. “There is no way anyone can do it as well as you can.”

Samson summed up his time in Madison by saying, “There was never one thing I did that I didn’t love.”

After graduation, Samson worked a brief stint as a Morgan Stanley investment advisor, but was soon enticed to the world of sports business. He began his career as the Executive Vice President of the Montreal Expos before taking his talents to South Beach. In 2002, he became President of the Marlins after successfully negotiating the transfer of ownership between the two teams.

It did not take much time for Samson to find success in Miami. In just his second

season there, he helped bring the city a World Series trophy and a team they could admire.

“So many things have to go right to win the World Series; so many little things, so many little signings that you make, or a free agent pick-up during the regular season, or a ball has to bounce a certain way,” Samson said. “It is crazy what happens during the course of the season and even during the course of the playoffs.”

After a grueling series against the Chicago Cubs, the Marlins went on to beat the New York Yankees in six games to win the World Series. Because this was the last game in old Yankee Stadium, it was an especially meaningful moment for Samson, a former resident of the Big Apple.

The Marlins were able to take down the Bronx Bombers with just a third of the Yankee’s famous ultra-high payroll. Samson believes that when it comes to building a championship team, you cannot put a price on the intangibles.

The absence of a salary cap in baseball creates a competitive imbalance. Large franchises have the advantage of larger revenue streams, which allows them to spend more on players and bring in more fans.

Samson says that the difference in large market teams’ payroll helps in two ways: “One, it enables you to cover your mistakes. So if you sign someone who isn’t good, you can find someone else, and [two], it enables your window of competitiveness to be longer.”

In an effort to keep overhead low, Samson made the decision to cut some of the stars from the championship team. When we asked him how he dealt with the ensuing

criticism, he simply said, “You can’t please everybody.” This in combination with his “type A” personality helps him navigate the challenges of a small-market baseball club. He further added, “There are a lot of talented players and I think fans want to see people they can relate to, and it is really tricky because no one can relate to someone making twenty million a year. You cannot comprehend that kind of life. That’s why the players who are beloved are ones that can relate to fans somehow in some other way, via Twitter, via charity, via whatever they do.”

When locating new talent, teams are turning to analytics and specialized sta



tistics, which have revolutionized the scouting world. The movie "Moneyball" provides fans with an insider view of baseball front offices, but Samson said that this kind of hard data neglects many key variables. "There are a whole lot of people in our industry who do only analytics," Samson said. "They, frankly, don't go to baseball games, they don't know what a baseball player is, and they don't know what it means to play 162 games a year in 180 days. They don't

"My rule is, after a loss, I allow myself 25 minutes to be angry. And then it's gone."



know what a clubhouse is; they just know numbers on a piece of paper."

He finally added, "I can find a statistic for anything now. I am waiting for someone to show me the statistic of the heart." However, even if you do manage to create the perfect team, you cannot take losing out of the equation.

Out of thirty ball clubs, there can only be one winner. Samson said, "You have to have a very short memory. After a loss, I allow myself twenty-five minutes to be angry, and then it is gone. I forget about it. You wake up the next day and start again." This attitude has helped the Marlins achieve a winning record at least five times in his tenure as President.

Recently, Samson relocated the team to a new stadium in Little Havana. He changed the club's identity, which includes its new name, merchandise, and logo. One of Samson's major achievements was working with Miami-Dade County and the city of Miami to obtain tax revenues to pay for over 80% of the total expenses.

The move resulted in a huge boost of sales for the Marlins. Rebranding the

team helped the Marlins reach a new market of baseball fans. They recorded a 208% increase in overall merchandise sales, and a 700% increase in merchandise sales inside the stadium. Samson said, "There is no one way to market to everyone. You have to do it separately. You have to do promotions that appeal to different people in different ways. There is a constant internal discussion on how to do it right, and it is difficult."

That being said, Samson is hesitant to declare victory too quickly. "This year, I think it is going to be a struggle. I think that over time, it is definitely going to work. Like with any project, you have to let it percolate. It is a bad idea to make economic decisions based on a very small sample size. A sample size of one or two seasons is nothing when the building could be here for fifty or sixty years."

Since his days as a badger, Samson always set himself up for success. Despite his vision and organizational prowess, he realizes that when it comes to economics, irrational behavior will always be a factor. Samson said, "The most important thing to remember is that you can't please everybody. The minute you try is your last day as a good executive."

TEACHERS ON STRIKE!



A Value Added Education

High School Teacher Value-Added Models

Research by Ray Kluender
Written by Taylor Kostal

Graphics by Sher Minn Chong
schong7@wisc.edu

On Monday September 10, 2012, approximately 350,000 Chicago public school students did not have to set their alarm clocks to the usual time. Unfortunately, instead of a scheduled holiday, this day-off was due to a citywide strike by the Chicago Teachers Union (CTU). Although the strike was somewhat instigated by salary concerns, it was also largely driven by protests against Chicago Mayor Rahm Emanuel's vision for reforming Chicago's public schools.

This vision, which has been embraced by the Obama Administration, is often described as an attempt to emphasize outcomes-based accountability for teachers by relying on value-added estimates of teacher effectiveness.

A value-added model of teacher effectiveness compares expected student performance on standardized tests to their actual performance. The amount by which the student exceeds the expected

scores is the added educational value that a good teacher brings into a classroom. Economists hope that these models will create an objective way to evaluate teacher quality and effectiveness.

Many consider the addition of value-added models to be an extension of No Child Left Behind (NCLB), an initiative implemented by President Bush in 2001, which attempted to hold states

and schools more accountable for the success of their students. This reform has been largely bipartisan in nature. In addition to No Child Left Behind, the Bush Administration introduced the Teacher Incentive Fund, which provides \$1.2 billion in grants to districts that introduce pay for performance programs. More recently, President Obama's version of NCLB, Race to the Top, supported a \$4.35 billion Department of Education contest, which awards grants to states that pledge to employ performance-based standards

for teachers and principals among other criteria.

This system of merit pay, in which teacher salaries are linked to performance instead of seniority, was heavily opposed by the CTU. CTU President Karen Lewis has protested the proposed loss of \$34 million dollars in TIF funding due to poor implementation, and proclaimed that "we're not interested in merit pay." While the CTU ended their strike on September 18, some feel the resulting contract did little to solve the issues at the heart of the strike, such as merit pay and teacher evaluation methods. Furthermore, questions remain surrounding the ability of a value-based model to measure teacher effectiveness.

In his senior honors thesis, Raymond Kluender examined the challenges of introducing value-added models to high schools, and proposed new models of his own. Value-added models of teacher evaluation are implemented to produce a measure of teacher productivity based

on student test scores. While these models all use a student's pretests as a control, they also include variables for socioeconomic status, gender, race, and English language proficiency. Furthermore, the metrics they produce are not just idle numbers. In his 2012 State of the Union address, President Obama quoted Chetty, Friedman, and Rockoff's (2011) findings that replacing a teacher who is in the bottom 5% of the distribution, using a value-added score, with an average-rated teacher, increases the lifetime income of the classroom by more than \$250,000.

The Value-Added Research Center (VARC) at the Wisconsin Center of Education Research is currently working with districts across the United States to design similar evaluations. While VARC has implemented many models at the elementary level, insufficient research exists to determine if a value-added approach is effective at the high school level, where testing is not federally mandated. This is primarily due to a lack of available data; however, testing within

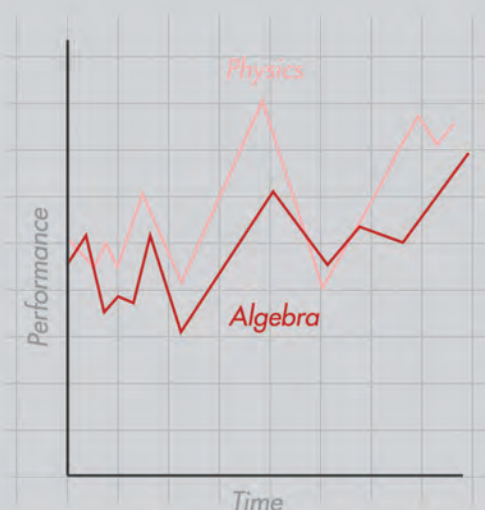


\$1.2 billion of grant funding allocated

\$34 million was lost due to poor implementation

1. Potential waste of funds

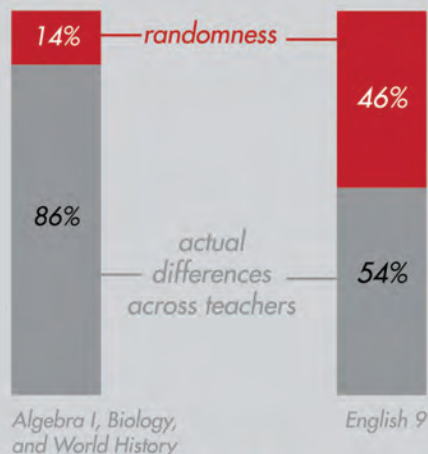
In 2010, the **Teacher Incentive Fund** was introduced which provides grants for districts that introduce pay for performance programs.



2. Track treatment effect

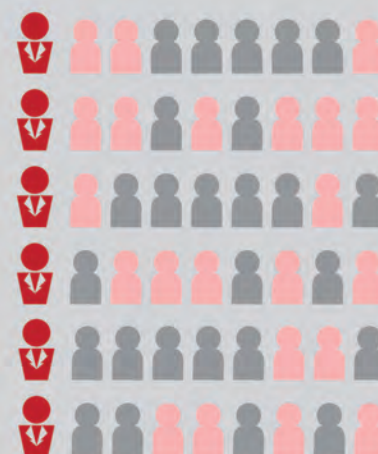
There may be a spillover effect between classes in seemingly unrelated subjects, e.g. a student's physics teacher may significantly impact the scores of an algebra class.

Percentage of Variance in Estimates Attributable to Differences Across Teachers or Randomness



3. Reliability issues

Measures in teacher performances have much lower reliabilities for subjects like English 9 compared to other subjects.



4. Sorting bias

Students may be nonrandomly assigned to teachers within schools, biasing teacher value-added estimates.



high schools is becoming increasingly common. Kluender focused on the viability of expanding value-added models to the high school level. There are key differences, however, between high schools and elementary schools, including the magnitude of teachers' effects on student achievement. On one hand, teachers could have a larger impact on their students at the high school level because of the challenging and specialized nature of the subjects, however, teachers could also have a lesser impact since high school students have already developed a tremendous amount and there is less opportunity for incremental development.

Kluender's primary concern was whether Value-added evaluation models could be applied to high schools. A good model must measure teacher

effectiveness using year-end test scores while also balancing the objectives of stability, reliability, predictive power, and including as many students as possible. If a model fails to include a large number of students or teachers, it becomes less effective for policy use. Another key research question concerns the magnitude of teachers' effects on student achievement at the high school level. Finally, Kluender also looked to evaluate the potential biases in value-added models. While the presence of a "sorting bias" has been discussed in relation to elementary school models, the existence of a "track treatment bias," specific to high schools, has been posited.

The idea of a sorting bias first arose in a paper by Jesse Rothstein in 2009, which suggested that students are non-randomly assigned to teachers within

schools, biasing teacher value-added estimates in the process. At the high school level, this might operate differently due to the larger number of teachers. However, students may still self-sort themselves into differing levels of courses. A paper by Jackson in 2012 studied student sorting in high school classrooms using North Carolina state data. He found that actual test score dispersion is within 88 and 100 percent of that observed under random assignment in schools. This indicates that sorting bias has a minimal effect within high schools. However, Jackson's paper introduced the idea of a "track treatment effect" that would upwardly bias teacher effectiveness estimates. This effect focuses on the idea that there may be a spillover effect between classes in seemingly unrelated subjects. For example, the quality of a student's physics teacher may significantly impact

On September 10, 2012, the Chicago Teachers Union (CTU) held a city-wide strike against Chicago mayor Rahm Emanuel's reformist vision for Chicago public schools.

The protest was largely driven by the opposition of the merit pay system, where teacher salary is linked to their performance instead of seniority.

the student's scores in his or her algebra class. Thus, a student's track, or his set of classes, could bias the estimation of teacher value.

In his paper, Kluender attempts to account for these biases, while providing a model that is inclusive enough for policy use. By including prior year-end test scores, Kluender is able to control for prior course history. If prior course history is correlated with current course enrollment, this also serves the purpose of controlling for track treatment effects. Kluender's paper attempts to further control for track treatment effects by following Jackson's method of school-track variables. By Jackson's definition, a school-track consists of students who take the same number and set of courses at the same school. Kluender finds that including the school-track variable significantly decreases the magnitude of teacher effects. While the inclusion of school fixed effects has been shown to limit bias in value-added models, it restricts the model to only comparing teachers within the same school. Kluender chooses not to include school fixed effects, because in order for the model to be viable in policy use, it must be able to compare teachers in different schools.

Kluender uses data for high school students in the Los Angeles Unified School District. His analysis focuses

on end-year exams for students within the district, and uses three years of data to reduce biases and enable testing for track treatment effects. In addition to estimating models for Math (Algebra I) and English, Kluender analyzes Biology and World History, two areas for which value-added models have not been previously published. As he explains, these models serve as insight into the effectiveness of expanding the value-added system outside the traditional areas of Math and English. While there may be overlap between skill areas, certain unique skills may not be captured in Math and English, such as the long-term retention unique to World History reading. Kluender tests the impact of pretests in Science and Social Studies by evaluating the usefulness of their inclusion in his model versus an alternative one. He finds that there is only a marginal difference in the model which includes Science and Social Studies. In other words, while tests in Science and Social Studies may account for some additional student abilities, the overall benefit is low. This conforms to the somewhat intuitive notion that standardized tests are a better measure of general aptitude than of subject specific knowledge.

One of Kluender's most interesting findings addresses Value-added models in high school English classes. He finds that a large part of the variance in English achievement can be explained

by the past performance of students and student characteristics. Therefore, it is possible that English teachers have a more difficult time influencing student achievement. Furthermore, students are exposed to much more English outside the classroom than other subjects. Kluender argues that value-added estimates can and should take a cautious approach to evaluating English teachers, as they may only have a marginal influence on the success of their students.

In his paper, Kluender advocates an evaluation of students comprised of value-added estimates, principal, peer, and third-party evaluations, and student surveys. Research has shown a positive relationship between value-added methods and other estimates of teacher quality, and therefore a comprehensive evaluation technique would be the most effective approach.

Central to the discussion of value-added models is the larger conversation about the usefulness of statistics in everyday life. While statistics can always be manipulated, properly wielded statistics can have a truly powerful impact on society. If economists can create models that successfully measure the value added by teachers, they can have a large impact on the education system. With more accurate models and standardized tests, schools can move towards providing children with better teachers, better schools, and ultimately, better communities. Despite this, however, there are significant hurdles that must be cleared before this dream is realized. Inaccurate models and policies that incentivize inefficient or ineffective teaching will have the opposite effect on education. The strike in Chicago was ultimately not an argument over whether or not education should be improved, but over the methods by which it should be done.

A Student Interview

RAY KLUENDER GRADUATED from UW-Madison in 2012 with a triple-major in Economics, Mathematics and Political Science. He interned at the Value Added Research Center in Madison, where he was exposed to Education Economics and where he found inspiration for his thesis, “High School Teacher Value-Added Models”. We asked him about it.



Ray Kluender (Left) receiving the Economic Academic Excellence Award from Department Chair Karl Scholz

RAY KLUENDER

EQ: Your thesis is about the Economics of Education. How did you first get interested in education research and in the politics of education reform?

Kluender: Economics of Education is a fascinating field to study because at some point everyone has thought about it. Whether it was a less than inspiring teacher or an assignment that was a waste of time, we all have firsthand experiences and ideas for reform. I got my start doing more serious work at the Value-Added Research Center (VARC) right here on campus. VARC was founded in 2004 and has been at the frontier researching, developing, and implementing value-added models to assess school and teacher performance. They work with some of the biggest school districts in the country and have played a critical role in the movement toward responsible assessment and accountability in public education.

EQ: Could you tell us more about the process of conducting your research and writing your thesis? Who did you work with on it?

Kluender: I was lucky to have a fantastic group of advisers for my senior thesis. I worked with Professors Andrew Rice and Robert Meyer. The process actually began the summer before my senior year, when VARC was developing a high school value-added model for Los Angeles, so I used a large dataset from Los Angeles Unified School District (LAUSD) for my thesis. Since these models have almost never been done at the high school level because of the dearth in standardized testing there, it was a new and exciting undertaking. I worked on my thesis from September to April of my senior year (though I spent most of the fall bouncing ideas and around and started in earnest around January).

I was also advised on my thesis by our wonderful chair Professor John Karl Scholz, who passed along a paper in January that ended up providing some valuable direction. I received some additional advisement from Political Science Professor Emeritus John Witte who himself was an education expert. Looking back, Wisconsin is awash with opportunities for research and professors willing to share their expertise and help students take advantage of them.

EQ: If you were President, what would your version of No Child Left Behind or Race to the Top include? What about if you were the Principal of your middle school or high school?

Kluender: Public education is moving inexorably toward more accountability and better incentives. No Child Left Behind, with its mandated testing for grades 3-8, has provided schools with a ton of data that is ever increasing

and improving. The success of ongoing reform will hinge entirely on how responsibly we use the new data available to us. Moving away from misguided measures like “percent proficient,” which punishes schools and teachers who teach tougher students, as well as poorly defined ones like “adequate yearly progress,” is a huge first step. This is where research and implementation of value-added models can do some legwork for public administrators. That being said, value-added and other growth models (like quantile regression) should simply be one tool in an administrator’s arsenal. We need to be careful to avoid over-testing and limiting teachers’ creative freedoms. This requires writing better tests that can probe deeper understanding instead of how well students can regurgitate facts.

Value-added measures and test scores can provide a valuable snapshot of how well a given school or classroom is doing. These measures should be used first to identify struggling schools and teachers. Administrators should make use of observation and knowledge of best practices to provide professional development to these teachers as the primary response. If these measures prove ineffective, then other options can be brought to the table.

EQ: What are you doing now?

Kluender: I am currently working at the National Bureau of Economic Research (NBER) in Cambridge, MA as a research assistant to MIT Professor Amy Finkelstein. Seeking advice from a few of my professors last year (this is the best way to get jobs everyone!) on whether to work or go straight to graduate school, they suggested taking a year to work as a research assistant. Taking this job over other offers in consulting is hands down the best decision I could have made. Amy is an amazing boss and one of the

top health economists in the world. I’m also taking graduate courses at Harvard and MIT to prepare for graduate school. Working at NBER has exceeded all of my expectations.

EQ: Tell us a little about the day to day of your current job. What classes have helped prepare you the most for your current work?

Kluender: I essentially live my entire workday in STATA working with Medicare, hospital, and financial datasets. Statistical programming is far and away the most valuable skill I developed at Wisconsin and has gotten me every single job and internship since my sophomore year. I highly recommend taking the opportunities to learn STATA in econometrics seriously. Professor Charles Franklin in the Political Science department also offers a fantastic and fascinating course in Political Numbers, which is all about the effective exploitation of data.

EQ: You want to get your PhD in Economics, what sort of an experience are you looking for afterwards? What type of research do you see yourself doing?

Kluender: Like anyone who pursues a Ph.D., I love research. While an undergraduate degree endows you with a valuable foundation and initial skillset, to contribute in a meaningful way you definitely need more education and expertise. Starting in Political Science, I am most fascinated by subjects with immediate and substantial policy implications. I took a class this fall with Harvard Professor Raj Chetty on Public Economics and Fiscal Policy which I absolutely loved. I am also enamored with politics, elections, and legislating so researching Political Economy would be really cool.

EQ: Who was your favorite professor at UW and why?

Kluender: I took Economics 311 with (now Emeritus) Professor Brock, which was 100%, the class that convinced me to commit to a career in Economics. When a couple friends and I did some freelance market research and data consulting for a start-up in Madison, we actually named our “company” after Professor Brock. Economics 580 with Professor West was a great introduction to research and gave me a community of students who I am still in close contact with after graduation. Economics 711 with Professors Kennan and Sandholm challenged and taught me more than I previously thought was possible in a semester. It’s hard to limit it even to a few; I enjoyed all of my courses in Economics at Wisconsin. I also had a few really great TAs (Carly Urban, Enrique Pinzón García, Mike Batty).

EQ: This is your final chance to give a Shoutout to anyone or anything on campus, go for it.

Kluender: I miss the city and everyone in Madison (unavoidable post-graduation nostalgia—enjoy it your undergrad while it lasts!). It really is an incredible to go to school; I work with graduates from Harvard, MIT, Columbia, Berkeley, Chicago, Stanford, and Brown and there is not a single one of those schools I would attend instead of Wisconsin if I had to do it over again.

Also, shoutouts to everyone making Equilibrium happen for its third year, Alex Rosenthal for his editorial commitment and huge praise to Sam Clegg and Evan Mast for shepherding it through its first two years.

Beat The Bookie

Testing Systematic Market Biases in
the NBA Wagering Market

Research by Ben Stenhaus
Cartoon and Written by
Andrew Tapper

SOMETHING AS SIMPLE as shooting a basketball involves the careful coordination of the shooter's entire body, and one variation can throw everything off. Likewise, the millions of factors that effect global markets are constantly in flux and challenging investors as they try to make the right decisions.

Late in 2011, the former Federal Reserve chairman Paul Volcker stated that, "among the causes of the recent financial crisis was an unjustified faith in rational expectations [and] market efficiencies." The comment was just one of many criticisms of the efficient market hypothesis (EMH) incited by the Great Recession and the bursting of multiple speculative bubbles. The EMH dictates that markets will accurately use all available knowledge to appropriately assign value to goods and services. Assuming everyone invests rationally and assigns value accurately, it should be impossible for an investor to consistently beat the market. However, irrational and unpredictable human behaviors are rampant in the real world, creating very interesting and complicated markets.

While the EMH is most often considered in the context of financial markets, the complexity of such markets makes empirical testing difficult within them. This is where the NBA comes in. Recent research has endeavored to overcome this obstacle by testing the EMH within professional sports wagering markets, which contain relatively few variables and factors. The EMH implies that in an efficient market it is impossible for one to consistently receive a return in excess of

the average market returns. A study by Gray and Gray in 1997 formalizes this proposition for sports wagering—a market is inefficient if and only if there is a systematic way of turning a profit in excess of commission fees.

Ben Stenhaus, a recent UW-Madison graduate, wanted to investigate how the law of efficient markets worked in Las Vegas and he set out to put his Economics degree to use trying to discover a strategy to beat the NBA sports gambling market. In his paper, Stenhaus sets out to test the efficiency of NBA wagering markets by searching for a profit-producing model. He analyzes wagers made against a spread, which are the most common type of sports betting. To illustrate the concept of a spread, suppose the Boston Celtics expected to



win by 3 points against the Los Angeles Lakers, then the spread would read: Boston -3, Los Angeles +3. If you place a bet on Boston, they must win the game by four points or more in order for you to win money. Factoring in commissions, a bettor must be able to correctly predict higher than 52.38% of game outcomes against the spread in order to turn a positive profit—i.e., to prove inefficiency.

A study by Steven Levitt puts forth two alternatives for how Las Vegas sets the spread line: either the casino seeks to earn a risk-free profit off commission alone by setting the line so that half of the total value of bets are placed on side of the spread, or Vegas can move the spread line just far enough to one side to encourage enough bets on slightly less likely outcomes. Stenhaug remarks that either way, finding a market-beating strategy is a matter of finding factors on which other bettors over-bet and then betting the alternative.

Stenhaug searches for these factors using a probit model to analyze nearly twenty years of NBA data. Such a model gives a binary response of “home team wins against the spread” or “otherwise”, making it appropriate for gamblers who see the same gain or loss regardless of the margin by which the outcome is achieved.

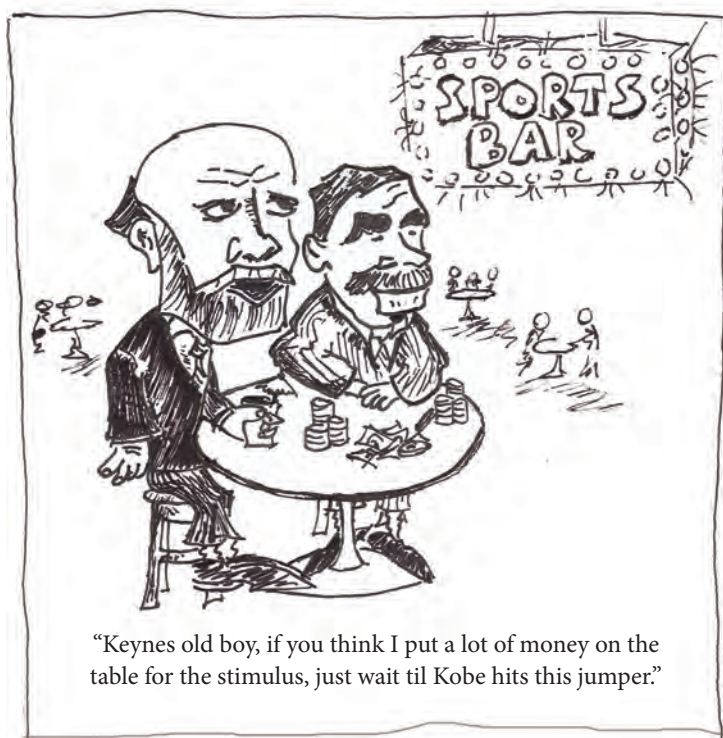
Consistent with similar studies, Stenhaug finds that wagering markets tend to overvalue hot streaks of the away team. If the away team has won each of its last five games against the spread, he estimates the probability of the home team winning against the spread in the current game is 15% greater.

Stenhaug also examines the impact of a team possessing a superstar. He finds that while markets tend to overvalue superstar players on the road during the regular season, these same players are often undervalued in the postseason. Some believe this is due to the common

perception that superstars are lazier during the regular seasons, and increase their intensity in the postseason. This explanation is undermined, however, by the fact that the same results fail to hold for home team superstars, a variable Stenhaug finds insignificant in every model considered.

Using both in-sample and out-of-sample testing for regular and postseason games, Stenhaug successfully specifies strategies that generate positive profits with statistical significance. But don't quit your day job and break out your STATA software just yet—this profit does not come easily. Stenhaug's results entail extreme patience and produce only a small margin of gain, implying such efforts require an enormous time commitment. Moreover, a market beating strategy may still lead to rather harsh short-term financial losses. Hence, while there is evidence of inefficiency in NBA wagering markets, it is not overly obvious or easy to capitalize on.

As is often the case when economic models are applied directly to the real world, the question of whether markets are efficient likely does not have a yes or no answer. Stenhaug presents research that peers into the spectrum between extremes. Such research is shedding a new light on how we view the marketplace, and may potentially have an impact on how we attempt to manage our economy. Betting on the spread is not unique to sports. In the global financial markets, investors everywhere are betting on the spreads of derivatives and other financial instruments. However, it is clear that the same type of bets we enjoy making on a big basketball game during our weekend in Vegas, are not so harmless when we are instead trading huge portions of the global economy.





A Conversation with Richard Meese UW-Madison PhD '79.

EQUILIBRIUM SAT DOWN WITH RICHARD MEESE, Managing Director at Barclays Global Investors. *Meese has led an impressive career in Economics, working in both the public and private sectors, and as a Professor in the Haas School of Business at the University of California Berkeley, or “Bezerkely”. A supporter of the Economics Department and a member of the Alumni Advisory Board, Meese discusses interest rate forecasting and wine-making.*

EQ: What led you to choose Wisconsin for your PhD in Economics?

Meese: The Department had a good reputation back then as it does now, and I was offered four years of support for my studies. In those days, my graduate support took the form of teaching or research assistant-ships, much as it does today. The guaranteed offer of support was the deciding factor in my decision to study at UW. It was also the primary reason that I endowed a UW professorship in applied econometrics—my way of saying thanks for the support when I needed it.

EQ: What do you feel distinguishes UW-Madison's Economics Department from others?

Meese: As long as I can remember, the Department at UW has been strong in econometrics, and I was very interested in statistics when I finished my undergraduate degree at the University of Michigan in 1974. The Department also has a long history of policy research, and (in my day) placed many of its graduate students in policy positions. My first job out of graduate school was in the International Finance Division of the Federal Reserve Board in Washington, D.C.

EQ: Was there one course or professor who had a particularly profound impact on you as a student?

Meese: There were several individuals, but the most important mentor I had as a graduate student was Professor John Geweke. He studied under Nobel Prize winners Tom Sargent and Chris Sims, then of the University of Minnesota. I believe John was a professor at UW between

1975 and 1983. He introduced me to time series econometrics, and helped to get me up to speed on the then new breed of macroeconomic research that looked at the effects of economic agents' expectations on macroeconomic outcomes. He also served as my thesis advisor. I have lost track of him, but believe he is still on the faculty of the economics and statistics departments at the University of Iowa. John was a great influence, and was generous with his time.

EQ: Could you tell us more about your experience working at the Federal Reserve?

Meese: I worked in the International Finance Division (IFD) of the Fed. This experience engendered my interest in international finance, and exchange rates in particular. For every Federal Open Market Committee round, the IFD had to put together forecasts of US international accounts that fed into the Fed's model/view of the overall US economy. Forecasts of major exchange rates were a part of that process. My colleague in the IFD, Ken Rogoff, and I decided to examine the IFD's forecasting ability, along with the forecast accuracy of the then state of the art monetary models of exchange rate behavior. However, neither the Fed nor these monetary models were particularly good at

forecasting bi-lateral exchange rates.

EQ: What did you do after working at the Federal Reserve?

Meese: First, I left the Fed and joined the Haas School faculty at UC Berkeley in 1982. I had always planned to return to academia, but felt I should take that best job out of graduate school that I was offered, and my best offer turned out to be the Fed position. I had managed to get a number of papers published while at the International Finance Division, and this opened the door to better academic positions than I had access to coming straight out of graduate school. I still remember my recruiting visit to UC Berkeley and my wife Liz telling me not to come home to Washington, D.C. if I didn't get the job!

EQ: I have heard people call Madison the Berkeley of the Midwest. Would you agree?

Meese: Yes, Madtown and Bezerkeley!

EQ: What did you do at Barclays? How was your work in Finance different from your research in Economics?

Meese: I left UC Berkeley in 1998, after 16+ years in the Haas School of Business. I knew the life of an academic well, but was looking for a new challenge, a chance to participate in business and not just talk about it. I was one of the founding members of a macro-hedge fund group at Barclays Global Investors, now a part of BlackRock. Among other things we were taking positions on major currency exchange rates, something that my earlier academic work was quite skeptical of! We also took long and short positions



Barclay's Global Headquarters

in international stock markets, government bond markets and major commodity markets, using both futures and forward positions. There were a number of former academics in the group (dubbed “recovering academics”). I used to refer to us as “closet” efficient market types. Skepticism that you can beat the markets is a good discipline to bring to research on asset markets. While econometric and statistical analysis were crucial to our model building, one must be very careful of statistical findings generated from non-experimental (asset return) data. If you torture the data long enough, it will tell you things that aren’t true.

EQ: How has your background in economics applied differently to each of your career paths?

Meese: Actually, there is an important common thread here. Each of these jobs required strong research skills. While we were encouraged to publish our research at the Fed, and publications are the “coin of the realm” in academic positions, I stopped publishing any interesting results once I started trading on my research. Another interesting observation is that my research was never more scrutinized than when I was a hedge fund manager. We needed to be absolutely sure of our ideas and their implementation before risking our clients’ money on the strategy.

EQ: You own a vineyard in Napa Valley. What’s the wine business like these days?

Meese: Liz and I live on a seven-acre parcel in Napa Valley, and about three acres are planted in grapes. We grow mostly syrah (red grape), but a little viognier (white), and malbec (red) as well. We sell most of the grapes to professional wine makers to cover our farming expenses, but we make a barrel (about 24 cases) of our own wine each year. It’s great fun, and I’ve always loved to drink wine.



London's Canary Wharf

China's Economy vs. Environment

A Simultaneous Estimation of Environmental Kuznets Curve in China

中国的环境污染对经济的影响



Research by Yanpei Lu
Written by Will Strinz

Art by Kate Nikles
recycledrhinos@gmail.com

TODAY, A FAMILY LIVING IN Beijing has more reasons to be optimistic about their future than they would have had twenty or thirty years ago. Subsidized childcare and education are enabling more and more Chinese citizens to break into the middle class as the economy continues to grow at around 8-10% a year.

中国的环境污染对经济的影响

However, despite the economic advantages of urbanization and rapid industrialization, the hazy skies above Beijing have begun grounding airplanes. China has exceeded its capacity for polluting and inefficiency, and its citizens are demanding a resolution. Cancer, the leading cause of death in China, is three times more common in cities than in rural areas. A 2007 World Bank report found that as many as 760,000 Chinese citizens die prematurely each year due to pollution related health problems—half of which are city dwellers exposed to extreme air pollution. The Chinese Ministry of Health blames these phenomena on the level of industrial pollution in the country.

Reformists have had success in convincing China to curb its rapid deforestation and improve water quality standards. That being said, air quality has continued to deteriorate in economic development zones like Tianjin and Beijing. In his speech to the 18th Party Congress, outgoing General Secretary Hu Jintao said, "Promoting ecological progress is a long-term task of vital importance to the people's well-being and China's future." Ironically, the current government led by Xi Jinping has been frequently issuing emergency orders for Beijing's twenty million plus inhabitants to stay indoors. While political corruption and a low level of environmental awareness amongst the population contribute to China's poor attention to air pollution, it is clear that the regulation-free environment for manufacturers and other business is largely responsible. Despite China's renewed promise to protect its ecology, they are not likely to abandon breakneck growth any time soon, especially as they look to transition from an exporter to a consumption-based economy. A closer look at the connection between growth and pollution paints a more complicated and perhaps more optimistic picture.

The relationship between a country's wealth and its environmental integrity is a perennial subject of inquiry for economists. Conventional wisdom suggests that as a result of industrialization, the level of pollution in a country will rise as it exploits its natural resources. Since the environment cannot demand compensation for being exploited in this manner, the cost of pollution is effectively nonexistent from the firms' perspective—a phenomenon referred to as the tragedy of the commons.

As we already know, a real cost exists in the form of damage to public health and ecological diversity. Companies' irresponsible pollution practices are increasingly scrutinized as we question whether or not our Earth can tolerate the trends of current consumption and waste.

However, the story is not all gloom and doom. One particular phenomenon that should give environmentalists cause for optimism was the subject of a recent paper by Yanpei Lu, a graduate of the University of Wisconsin-Madison. Lu's study focused on the Environmental Kuznets Curve (EKC), developed by economist Simon Kuznets in the 1950s. Kuznets focused on the relationship between economic growth and inequality, particularly in the developing world. He noticed when economic activity was predominately centered on agriculture, income inequality was low. In contrast, as industrialization began, a rift grew between those who were well positioned to exploit the new economy and those who were not.

After a certain point, however, the trend reversed. Mass education and technological innovation gave people the opportunity to lift themselves out of poverty, and inequality gradually decreased. Kuznets' ideas were foundational in the field of development economics, and are still used by many economists. Still, like any model, not all his predictions were

accurate.

Forty years later, Gene Grossman and Alan Krueger adapted his model to the relationship between economic growth and pollution. Similar to the growth-inequality curve, pollution tends to be lower in poor agrarian societies because the value of pollution heavy activities is not greater than its cost. As the society industrializes though, common ownership of the environment by firms and people encourages pollution as a short-term cost-saving practice. However, once pollution reaches a certain level, it no longer becomes profitable for companies to continue to behave this way.

Accordingly, as wealth increases and individuals move beyond subsistence levels of income they are able to afford being environmentally conscious and progressive. Many of the same factors that benefit low-income earners, such as widespread education, also allow them to exert more influence on politicians to increase regulation of polluters. As nations grow wealthier they typically abandon industrial production as the primary driver of growth, and focus resources on less energy intensive and service based business models.

Measuring the accuracy for the EKC can prove to be difficult because there is no single metric that perfectly captures pollution or environmental health. It is not clear whether waste products such as lead, ozone, and carbon dioxide should be the determining statistics, or if energy use and resource extraction should be the primary focus. Compounding the problem of measuring these different variables is also the difficulty involved with aggregating them in a way to be able to infer appropriate conclusions about pollution in general. For example, even pollutants that belong to the same category can be hard to compare. Heavy

中国的环境污染对经济的影响

metals are much easier to regulate than carbon dioxide because their points of origin and affected areas are easier to ascertain.

These troublesome relationships between variables have spurred a large amount of research in the EKC field. Results have widely varied depending on the choice of pollutants, location, time period, and controlled external variables. For some variables, the relationship has proved surprisingly strong. For instance, the United States GDP and miles traveled by cars and trucks demonstrated paralleled surges over the last forty years. Likewise, carbon monoxide and sulfur emissions fell equally due to technological advancement and regulatory intervention.

Recent studies have found evidence for a "turning point" where pollution starts to decrease in a developing country, but economists are not in unanimous agreement. Lu's thesis builds on work by economist Junyi Shen to try and resolve these uncertainties.

Shen applied the EKC model to the current situation in China to see if those predictions would hold true. Whether or not China follows the inverted U-shaped pattern seen in other countries is of particular concern to environmentalists, because China is on track to surpass the United States as the nation with the biggest carbon footprint. Furthermore, the data on environmental health in China has, until recently, been unavailable or of dubious quality. It is for this reason that Shen's work is particularly groundbreaking in the field of environmental economics.

Lu's investigation is unique in the way she uses the statistical method known as the Simultaneous Estimation Model, which

Shen also adapted for studying the EKC phenomenon. Traditional econometric analysis rests on the assumption that the dependent variable is not one of the deter-

mining factors for the independent variables. Although it makes modeling easier, this assumption is not applicable in many real world contexts. Economic growth may create more pollution, but pollution may in turn have a negative effect on growth by harming the health of the labor force. In situations such as these, standard statistical inferences are no longer reliable, so something must be done to account for the feedback loops.

Lu's solution was to set up her model using three special equations. In addition to the standard equation with pollution as the dependent variable and income as the independent variable, she also features the opposite, making income the dependent variable and pollution the independent variable. The third and final equation defines abatement expenditure as a function. Pollution can of course be affected by other factors, and Lu attempts to control for them by including measures of industrialization, unemployment, and physical capital.

Lu chose to examine eight regions across China that represent a range of economic development, from major metropolitan centers such as Beijing, to primarily agrarian provinces such as Xinjiang. As a final touch, Lu's dataset includes separate numbers for air and water pollution, as well as the mitigation costs of each. This filtering allows for finer examination of which combinations of pollution are affected by certain variables.

Her results paint a mixed picture of China's environmental future. They are not statistically significant and do not present a clear Kuznets Curve trend until

the province of Xinjiang is excluded from the study. Xinjiang is the least developed region in the study, and therefore shows few of the characteristics of an EKC model. According to the EKC model, water pollution will continue to fall, while air pollution will continue to grow until China obtains a higher level of development. Lu also found that a 1% increase in air and water pollution was correlated with a 2% decline in GDP. These results provide strong economic justification for China to redouble its efforts to reign in its pollution.

Nonetheless, correlation does not imply causation. The variables explained only 25% of the change in pollution over the time period studied, leaving room for other factors to be investigated. Furthermore, the estimated turning points were almost twice those found in earlier analyses. While this may reflect different choices of regions or modeling techniques, a constantly increasing pollution level is a disturbing prospect to contemplate.

Despite these concerns, results presented by Lu offer hope to those who believe economic growth and environmental health can coexist. However, economic models and statistics can only take you so far. As Henry David Thoreau said, "It's not what you look at that matters, it's what you see."





Ananth Seshadri recently completed a three-year term as Chair of the Economics Department. He is generally regarded by students as one of the best and most engaging teachers around. Seshadri specializes in macroeconomics and public finance and this article discusses a couple of his most recent works: “Health and Wealth in a Life-cycle Model”, 2012, with co-author John Karl Scholz; and “Lifetime Labor Supply and Human Capital Investment”, 2012.

A Professor Profile

Written by Alexander K Rosenthal

Ananth Seshadri – Professor, former Chair and one of the most popular teachers in the Economics Department – is perhaps most famous among students for his propensity to interrupt lectures to ask questions. Why, he demands of macroeconomics classes, do poorer families tend to be larger than rich ones? And while he has generated an internationally acclaimed body of research into macroeconomic puzzles just like this one, Seshadri often prefers to hear the answer from his audience.

Seshadri's research uses what is known in economics as the life-cycle model in order to analyze linkages between health and wealth accumulation as well as how tax and retirement policy changes influence the number of hours people

choose to work.

In “Health and Wealth In a Life-cycle Model” Seshadri, along with co-author University of Wisconsin Professor Karl Scholz, develops a model that looks at the effect that one's overall health has on their lifetime wealth accumulation. “What we wanted to do in this paper is to further understand the intricate connections between health and wealth accumulation by allowing individuals to make choices on how healthy they could be.” The life-cycle model, which was originally designed by Franco Modigliani who won the Nobel Prize in Economics for his work in 1985, is a model that assumes that the typical household works for about 40 years and then is in retirement for 15-20 years. In

order to save for their retirement (and be prepared for any health shocks or issues that arise as they get older) they “smooth” or spread their consumption and utility across the two periods. This shifting of consumption and investment across ages is known as the life-cycle model.

As many have experienced in their lifetime, numerous bonds exist between medical expenses, health status, consumption, and wealth. On the one hand, unexpected changes in health or in medical costs can have a severe effect on a households' ability to work and generate income, but the effect that health changes have on income are certainly not the only ways that this relationship appears. Changes in con-

sumption, such as eating or exercise, undoubtedly have an effect on both short and long term health, and, rather unfortunately, a household's income has a direct influence on its ability to seek medical care and the quality of that care.

Seshadri approaches the life-cycle model

view, households might make decisions that have the opposite effect, and may even have a negative effect on their long term health. For example, a household that was adversely affected by a change in an assistance program might decide to get a second job, save money by eating fast food instead of home-cooked meals,

when considering health expenditures and retirement. Since high-income households have more resources to make sound health decisions, such as working less, eating healthier and exercising more, these households experience much lower out of pocket medical expenses when entering into their later

“The net result is that individuals will both consume less and die earlier in a world without Medicare.”

in quite a different way than economists had in the past, modeling health in such a way that it affects life expectancy, as well as utility, the total satisfaction received from consumption. Seshadri explains that while most previous papers view health and consumption separately, he finds that “consumption and health are complements [and] important to understanding the evolution of health and wealth as individuals age.” This difference is important because Seshadri's life-cycle model will swing consumption to earlier parts of a person's life cycle since consumption declines in old age as health deteriorates, while many previous models ignore this relationship entirely.

Another key difference in Seshadri's approach is that his paper studies health and consumption decisions from the beginning of a household's functioning life assuming that many people alter consumption habits and change their savings with their future health in mind.

It is important to analyze the differences between lower income households and higher income households because they are presented with very different health decisions. For example, as Seshadri notes, many previous economists have assumed that lower income households will respond to reductions in government assistance programs by increasing their current savings in order to cover for any unexpected future health issues that may arise. However, in Seshadri's

or even exercise less regularly in order to keep their level of income or consumption at their previous levels. Seshadri notes that “Over the long run, effects can be large. In a world without health-related social insurance, young forward-looking households may recognize the futility of accumulating wealth to offset expected late-in-life health shocks and simply enjoy a higher standard of living for a shorter expected lifetime.”

Seshadri and colleagues also found that Medicare has a sizeable effect on low-income households specifically in their decisions regarding health investments, shedding light on the effect of Medicare on mortality at the bottom of the income distribution. Seshadri says, “First [Medicare] provides insurance against health shocks after age 65. Second, the presence [of] Medicare motivates poor (and rich) households to invest in their health earlier on in life. After all, they need to be alive at age 65 to take advantage of Medicare.” In an experiment to remove the stylized Medicare program, Seshadri's model predicts that in the long run, households adjust to changes in the institutional environment by consuming less and saving more. In addition, private health investments decrease. “The net result is that individuals will both consume less and die earlier in a world without Medicare.”

On the other side of the income spectrum, higher income households have a very different set of outcomes

stages of life. Subsequently these households are generally healthier overall, and thus they do not need to spend as much to maintain their health.

Another paper of Seshadri's, titled “Lifetime Labor Supply and Human Capital Investment” looks at the effects that policy changes, such as in tax rates and retirement policies, have on human capital supply. Seshadri makes it a priority to define the supply in human capital as “the effective amount of labor supplied”, or the impact of an hour of work by both skilled and unskilled laborers since this definition can provide much more clarity than the simple numbers of hours worked. Seshadri further looks at the differences in labor supply between workers in the United States and workers in Europe, who are subject to vastly different tax rates.

Seshadri explains that, “Taxes and retirement policies [are] substantial, with the policies affecting both the quantity and the quality components of effective labor. These policies explain a large fraction of the gap in retirement age between European countries and the US, and almost all of their difference in schooling.” Additionally, Seshadri describes that “Lowering the distortions induced by taxation can help the economy improve its stock of human capital as well as GDP.” Lawmakers hoping for just that would do well to attend one or two of his classes.

How Many Licks Does It Take to Get to the Center of America's Obesity Problem?

Research by Molly Lloyd
Written by Equilibrium Staff

The Economic and Geographic Trends of Food Stamp Participation

In 2010, Mission: Readiness, a nonpartisan group of retired military leaders, released an outline of the demographic trends that could threaten America's ability to fight a major war. These military leaders noted a substantial segment of the recruitment pool would be unfit for service due to abysmal high-school graduation rates and a concerning number of criminal records. The greatest threat, however, was listed as obesity. The report noted that an estimated 75 percent of America's 17-24 year-olds would be excluded from serving solely because of their weight.

Obesity is a relatively new pandemic. In the 1930's, the average American ate between 80 and 100 pounds of meat per year. Today, that same generation's grandchildren annually pack away anywhere between 160 and 180 pounds of meat. While skyrocketing agricultural output and a similar increase in food security has provided an abundance of food, a host of societal factors have transformed obesity from a cosmetic threat to an apparently existential one. Unfortunately, the most common victims of this crisis have been the poor, and this has been true despite economic theory



and historical evidence indicating that frugal households would simply consume less food in times of hardship.

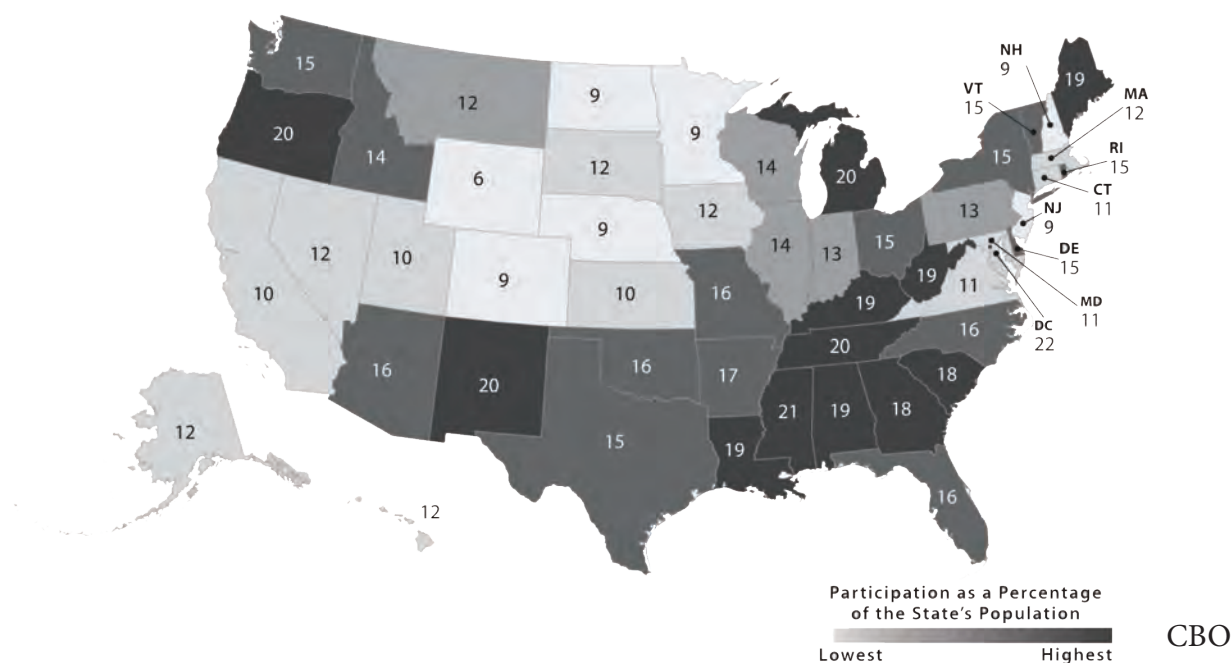
One explanation that some economists have looked at in order to explain the prevalence of obesity among the poor is the Supplemental Nutrition Assistance Program (SNAP), formerly known as the Food Stamp program. SNAP guarantees a sustained food supply to those meeting the federal poverty requirements. A host of past explanations exist as to the link between obesity and food stamp participation, including poor diet, a lack of time to prepare healthy food, and the possibility that food stamps boost food consumption beyond necessary. However, like many of us, UW-Madison graduate Molly Lloyd hypothesized that a relationship may exist between obesity and food

stamps that is influenced by geography.

To examine this relationship, Lloyd begins with the "obesity gap" which Charles Baum of Middle Tennessee State University (2001) defined as "the prevalence of obesity multiplied by the average amount by which Body Mass Index exceeds the obesity threshold." This nuance eliminates a key shortfall in any reasoned attempt to study issues of weight – obesity is a just simple ratio of weight to height, while the actual proportion by which a population is overweight is far more revealing. Baum noted in his research that this proportion reached a height as of 2010 of 30%, up from only 15% in 1985.

In order to determine the geographical impact of food stamps on obesity, Lloyd examines the impact of food deserts – areas the USDA defines as "low-income census tract[s] where a substantial share of residents have low access to a supermarket or grocery store." She divides the US into 4 distinct regions the Northeast, North Central (U.S. Midwest), the South, and the West. She uses data from the National Longitudinal Survey of Youth 1997, a national survey of 9000 Americans ages 12-16 on December 31st, 1996, that measured participants' height and weight 12 times; data that Lloyd uses to break down the subjects into categories of "overweight" and "obese" based on BMI norms. The NLSY also provided information on the subjects' income

In 2011, roughly 45 million Americans (about 1 in 7) received \$134 a month from SNAP.



and participation in government assistant programs, which identified individuals that used SNAP benefits at any point during a given year.

Lloyd uses two overlapping regressions to estimate the probability of being overweight or obese. A third and distinct regression estimates the obesity gap, which includes both the prevalence of obesity and its distribution. She also isolates any genetic dispositions that might influence a subject to weight gain by including the BMI of participants' parents. Unexpectedly, Lloyd does not find a statistically significant correlation between the location of a food stamp participant and an increase in the likelihood of obesity. Despite the prevalence of food deserts in Louisiana, Mississippi, Alabama, Kentucky and West Virginia, Lloyd finds that living in the Southern and Northeastern states were instead correlated with a decrease in obesity. However, she does find a positive corre-

lation between obesity and food stamp participation for both men and women (a link previously indicated for women only). Men on food stamps were 6.3% more likely to be obese than the rest of the population as compared to 7.1% for women.

More so than food stamp participation or geography, however, obese parents are a much larger factor in determining whether a subject is obese or not. An obese parent plays a disproportionate role by gender – women with an obese parent are 17.5% more likely to be obese, while men are only 6.8% more likely. Furthermore, Lloyd's obesity gap analysis indicates that the gap among food stamp participants is far greater than that for the rest of the population. Lloyd speculates that the greater likelihood of obesity among women with obese parents relative to their male peers is due to women's increased likelihood to have children in their households, which elongates the period of food stamp assistance. When it came to

the effect of food stamps, men do not get off the hook; Lloyd finds that male waistlines increase with their time on food stamps.

While the effect of food stamps on obesity is not overwhelming, a significant part of the United States enlisted military comes from poorer households as the military offers consistent employment and decent pay. Additionally, despite this country's impressive technological sophistication, obesity is an issue that effects many different aspects of life and society and major government programs should be cognizant of their role in obesity trends. Perhaps with more economic literature, such as Lloyd's, on the effect of food subsidies, policymakers can take a more active interest in the nutrition labels of the food they subsidize. Otherwise, the Pentagon should think hard about a cheaper material to use in the production of plus-sized camouflage.

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