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MILES TO METERS

AN EXAMINATION OF PUBLIC ATTITUDES TOWARDS METRIC CONVERSION:
THE 1977 FHWA HIGHWAY METRICATION PROPOSAL

A Thesis
Presented in
Partial Fulfillment of the
Requirements for the Degree of
Master of Public Administration

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Abstract

Using letters written to the federal government in opposition to conversion to the metric system, this paper examines the phenomenon of fierce opposition to standards change, focusing on the types of reasoning used. I evaluate the presence of both economic and normative reasoning and identify six core themes of argument that describe the overall nature of the opposition. The influence of path dependence and historical context are also examined, but yield inconclusive results. I also compare letters to the federal government to a sample of newspaper items to conclude that complaints to the government represented a disproportionately vocal segment of the population. My findings identify directions for future research in the study of standards, including the study of standards as cultural symbols.

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Introduction

The metric system is the tool of the devil! My car gets forty rods to the hogshead and that's the way I likes it.

-Abe Simpson, The Simpsons

Standards are important and standards are everywhere. Standards of language enable communication and standardized computer languages are *sine qua non* for a functioning internet. On a more concrete scale, standards allow our cars to use gasoline from different gas stations, our washing machines to use different detergents, and our remote controls to accept different brands of batteries.

Yet standards, like most things, change from time to time. Since most standards are largely invisible, most changes in standards are barely perceptible. Observe, for example, stock prices. Today, most stock prices are precise to the cent, but until 1997, stock prices were precise only to the eighth of a dollar. For most of us, the transition to the present system of stock pricing, was either unnoticed or insignificant.

Other times, standards change in a very visible way, but the change is widely accepted as progress. The advent of the CD as the replacement for the vinyl record, for example, was a market driven change that was accepted by all but a dwindling number of audiophile purists.

In rare circumstances, however, attempts to change standards meet stubborn, public opposition. The abandonment of the gold standard, forty years ago, for instance, is a subject that still arouses controversy. Likewise, the people of Indiana have fought over the adoption of daylight savings time for nearly a century.

The phenomenon of strong public opposition is intriguing, yet it has received minimal attention in the study of standards. This paper seeks to explore this phenomenon, specifically for the

purposes of gaining insight about the reasons offered in opposition to change. To do this, we will focus on a very simple instance of opposition: that of the opposition to the US efforts to adopt the metric system in the 1970's.

The US metrication effort is an ideal case for study for many reasons, not the least of which is that it is perhaps the most famous case of strong public opposition in recent history. Indeed, the overall attempt at metrication was such an abysmal failure, that it still resonates as a punchline in popular humor. The introductory quote above, is only one of a long running series of jabs at US metrication featured on the television show, the Simpsons. Popular comic strips *Blondie* and *Family Circus* have poked fun at the metric system as recently as 2005. And in 2009, comedian Deirdre Flint released a song entitled, "The Great Metric Threat of '75!", which offers insightful, though satirical, lyrics such as,

And in the early 80's congress knew that they'd been beat
The metric system folded it went down in defeat
Liters, meters, kilograms we'll put out on the bench
Because we won't use a system designed by the French

The US metrication effort was vast, comprised of many policy initiatives, enacted by agencies across the entire federal bureaucracy. It would be neither efficient nor productive to attempt to investigate it in its entirety. Instead, since we are interested in the nature of the public opposition to the metric system, we will examine the most heavily opposed policy initiative: the 1977 proposal by the FHWA to convert highway road signs to metric units. The FHWA proposal is ideal not only because it was so heavily opposed, but because its failure was attributed directly to the letters and comments it received from the public, and because it was a highly visible failure emblematic of the overall US metrication effort.

Literature Review

The Following section will review the relevant literature with the intent to aid our examination of the opposition to metric conversion. It will begin with a definition of terms, proceed with a brief history of the metric system, discuss the relevant economic literature on standards, and conclude with a review of similar studies.

Definition of terms

Since we are studying attempts to convert from one standard to another, we must establish what qualifies as conversion. Scholars distinguish two types of conversion: hard and soft. Smith(1995) states that this is a difference recognized by the federal government and that, “[a] soft conversion is a direct mathematical conversion from a U.S. measurement to its metric equivalent e.g., from 180 pounds to 81.65 kilograms. A hard conversion is the creation of a new, rounded, rationalized number that is easy to work with and easy to remember.”

Other authors add to the distinction between hard and soft conversion by stipulating that hard conversion obtains when people “think metric.” Thinking metric occurs when metric units become ingrained into a person’s spatial perspective. That is, when a person no longer needs to translate between metric and customary units when visualizing or estimating spatial dimensions. We might also compare the notion of thinking metric to the notion of thinking in a second language, which some claim distinguishes fluency. The overall concept then, is that thinking metric is desirable because it indicates a level of metric fluency.

For the purposes of this paper, we will discuss conversion along the lines of hard conversion in the expansive sense. Metric conversion of figures results in round figures, often ending in 0 or 5, and the policy of metric conversion obtains when people “think metric”.

Second, we must define what we mean by the metric system. Discerning scholars will note

that the metric system is ambiguous as there have been several variants of it over the years, and that the metric system is more properly referred to as the International System of Units, or SI. We will continue to refer to it as the metric system, however, because this term is more commonly understood and recognized among non-scientists.

Similarly, we should note that the system of measurement currently used in the US goes by several names. This paper will refer to it by one of three interchangeable terms: the Imperial system, the English system, or the US Customary system.

The last thing we should define is the term standard. Standards receive a good deal of attention from scholars, who agree, ironically, that the term standard lacks a precise, universal definition. Krislov (1997, 3) defines the term standard as a “term of art,” often used to “define the physical qualities required for sale and use of industrial or commercial products, sometimes for regulatory social social protection purposes.” He explicitly includes among these, standards of weight and measure as well as the metric system. Weitzel provides a more restrictive definition to “refer to any technology or product[...] incorporating technological specifications that provide for *compatibility*” (2004, 8). Other economists, such as North (1990), and Werle (2001) either adopt these definitions or subtle variants thereof. These definitions refer to standards as objects or products instead of normative behavior. Thus, to say that that the US uses the metric system only requires that our products are designed using metric standards, not that US citizens actually incorporate the metric system into their perception of the world. This contradicts our notion of hard conversion and is therefore unacceptable, for our purposes, as a definition for the term standard.

Abbott and Snidal (2001, 345) use a much more expansive definition of the term: “a *standard* is a *guide for behavior and for judging behavior*”. This definition would easily accommodate our notion of hard conversion. Further, since we will only be dealing with one type of standard(standards for weight and measure), we will also adopt this expansive definition.

Background

As with any study of an historical event, it is important to understand the events that preceded it. The following provides a brief overview of the history of the metric system.

One of the defining aspects of the metric system is that it is a decimalized, or base-ten

positional, system. Pre-decimal numeral systems did not acknowledge the number zero as its own digit. Thus, the Roman numeral system, for example, begins with *I*, and represents powers of ten as single digits such as *X*, *C*, and *M*. The rudiments of the decimal system, where zero occupies its own digit, were introduced to the west in the form of the Hindu-Arabic numeral system between the ninth and tenth centuries (Sarton 1935; Cajori 1928). The use of these numbers took several centuries to gain widespread acceptance, eventually entering into common usage by the beginning of the sixteenth century. Despite the use of a base-ten numeral system, decimalized fractions were relatively unknown until 1585, with the publication of Simon Stevin's *De Thiende*¹. The concepts detailed in *De Thiende* unleashed a powerful concept that we probably take for granted today: to display the quotient of a number divided by ten, simply move the number's decimal point to the left by one decimal place; to display the product of any number and ten, simply move the number's decimal point to the right by one decimal place.

Scholars capitalized on the decimal arithmetic detailed in *De Thiende*, producing advances in trigonometry and logarithms (Sarton 1935, 181-182). Then, in 1668, John Wilkins developed a decimalized system of standard weights and measures². Two years later, Gabriel Mouton proposed a similar system in France. Other French scholars soon followed Mouton, proposing various decimalized standards for weights and measure (Sarton 1935; Smith 1995; Smith 1998). The work of these French scholars led the 1790 proposal of the metric system to the French National Assembly, by Charles Talleyrand.

By the time of Talleyrand's proposal in 1790, scholars had been discussing the need for a decimalized system of standards based on natural phenomena for at least 122 years in both England and France. Influenced by these discussions, Thomas Jefferson proposed a national, decimalized currency in 1784. This proposal was adopted into law in 1792, and helped popularize decimal arithmetic in the US (Garson 2001). To accompany the decimalized currency, in 1790 (prior to his knowledge of Talleyrand's proposal), Jefferson proposed a national, decimalized system of weights and measures. This proposal was not adopted (Hellman 1931; Sarton 1935; Smith 1995; Smith 1998). In the same year, George Washington pressured Congress to establish a uniform system of weights and measures in his annual address to Congress. Madison reiterated these

¹Republished in English under the name *Disme: the Art of Tenths* (Sarton 1935, 158)

²He discusses this only briefly in the context of a much broader proposal for a universal language. See Wilkins (1668), pages 191-192.

requests in his 1816 State of the Union address(Smith 1998, 421).

The Senate responded to Madison and requested a report on the issue of weights and measures from the Secretary of State, John Quincy Adams. This report, delivered to Congress in 1821, warmly praised the metric system for its advantages, but concluded “[Congress should] attempt no present change whatever in our existing weights and measures; to let the standards remain precisely as they are”(Adams 1821, 92)³. Despite its conclusion, some(Seymour 2001; Smith 1995; Smith 1998) read Adams’ report as an overall endorsement of the metric system, urging its adoption, but only after its adoption by other nations. Nevertheless, the report has had a long-term impact on the debate over the metric system in the US. Smith(1998, 420) in particular, notes the long-term significance of the report, suggesting that several federal agencies appear to use this report as their sole source of historical information about the Metric system.

Following Adams’ report, in 1840, the metric system was fully implemented in France, and subsequently spread throughout Europe and to various countries around the world. Metrication in the US also made slow but significant progress. In 1866, Congress passed the Kasson Act⁴, allowing for legal, voluntary use of the metric system. This was soon followed by the signing of the Treaty of the Meter in 1875. At the close of the century, in 1893, the US Coast and Geodetic Survey, which then responsible for regulating the standards of weights and measures, issued an order defining all English units by reference to their metric equivalent. Thus, by the close of the nineteenth century, the US had achieved a very soft form of conversion to the metric system.

There was relatively little progress towards US metrication during the first half of the twentieth century. A congressional attempt to make hard conversion to the metric system compulsory failed in 1901, and anti-metric sentiment began to grow among the public. Opposition to the metric system was especially strong among machinists and skilled laborers, many of whom made extensive use of weights and measures as a part of their profession and who viewed the costs associated with conversion as a threat to their livelihood. By 1917, an interest group dedicated

³Adams’ argued that the English system’s use of conversion ratios based on two(binary), three(ternary), twelve(duodecimal) and sixteen(sexagesimal) are convenient in the practical use of weights and measures. He formed a number of other arguments against the metric system, most of which rested upon circumstances of the time that are now irrelevant. For example, Adams argues that the metric system compromises certain naturally convenient proportions in the English system, such as the proportionality of a cubic foot of spring water to the avoirdupois ounce. This is now irrelevant because, pursuant to the Mendenhall Order(1893), avoirdupois weights are defined by their metric equivalent(in this case, the ounce is defined as 28.35 grams).

⁴More formally known as the Metric Act of 1866

solely to the preservation of the English system had formed under the leadership of Fredrick Halsey(1920), called the American Institute of Weights and Measures. Through this group Halsey and a co-author, Samuel Dale, published a book detailing the problems with proposals to convert to the metric system. The book is more than 230 pages long, and takes a scatter-shot approach to attacking the metric system, with complaints ranging from the logistical complications of conversion to wild conspiracy theories involving the World Trade Club. Various other publications on the costs and benefits of conversion to the metric system were published during the first thirty years of the twentieth century, several of which are styled as research reports or scholarly texts. Largely, these publications offer arguments against the metric system that center around the costs of conversion, the external economic impact to a particular industry, or the perceived mathematical advantages of non-decimal fractions in practical application.

The movement towards conversion to the metric system slowed considerably after 1933(Smith 1998), but the US regained interest in conversion in the late 1950's and early 1960's. Smith connects this renewed interest with the launch of the Russian satellite, Sputnik, the race to the moon, and the ensuing national emphasis on scientific and technological discovery(1998, 422). In 1968, Congress authorized a three year study to "appraise the desirability and practicability of increasing the use of metric weights and measures in the United States"(Metric Study Act of 1968), and in 1971, the National Bureau of Standards delivered the report, entitled: "A Metric America: A Decision Whose Time Has Come".

Congress passed the Metric Conversion Act four years after this report, in 1975. The act states:

The United States was an original signatory party to the 1875 Treaty of the Meter (20 Stat. 709), which established the General Conference of Weights and Measures, the International Committee of Weights and Measures and the International Bureau of Weights and Measures.

Although the use of metric measurement standards in the United States has been authorized by law since 1866 (Act of July 28, 1866; 14 Stat. 339), this Nation today is the only industrially developed nation which has not established a national policy of committing itself and taking steps to facilitate conversion to the metric system.

[...]

It is therefore declared that the policy of the United States shall be to coordinate and

plan the increasing use of the metric system in the United States and to establish a United States Metric Board to coordinate the voluntary conversion to the metric system. (sec. 205a-205b)

This law served as the legislative authority through which several federal programs undertook to convert to the metric system. By 1980, the Bureau of Alcohol Tobacco and Firearms mandated that liquor and wine display metric units, the National Weather Service attempted to convert its reports to Celsius and the National Park Service added metric units to trail signs and brochures.

The most visible and well known of these attempts, however was the Federal Highway Administration's (herein: FHWA) proposal of new federal rules converting highway traffic control devices (e.g. speed limit signs) to metric units⁵. More than five thousand people wrote letters in response to this proposal, and it was mentioned prominently (relative to other stories on the metric system) in the news. Accordingly, it is an ideal case to study to determine the nature of the opposition to the metric system, and shall be the focus of this study.

Of course, the FHWA's proposal did not occur in a vacuum, and we should consider the historical context. The proposal took place during the late 1970's amidst cold war tension, economic stagflation, and energy shortages. In fact, on April 18, 1977, just nine days prior to the FHWA's proposal, Carter delivered a televised address on energy policy that began, "Good evening, tonight I want to have an unpleasant talk with you," and called for increased energy conservation. This period of time is also remembered as a time of grave mistrust of the government in the aftermath of the Watergate scandal⁶, and political inefficacy brought about by early missteps of the Carter administration.

As we conclude this section, we note at least three important aspects of the history of the metric system that may help explain why the FHWA's proposal was so heavily opposed. First, that the prior to the popular use of the decimal system, fractions were used in dealing with non-whole numbers. Without the use of decimal arithmetic, the most easily manageable fractions are those with denominators of two, three, four, or low common multiples thereof. Accordingly, pre-metric standards were developed based on these conversion factors. Thus we might expect the combination of both the entrenchment of this arithmetic and the broad incompatibilities of

⁵Technically, the proposed rule did not address signs directly, but revisions to the document that governs their design: the Manual on Uniform Traffic Control Devices, or MUTCD).

⁶The FHWA's proposal was officially made just eight days prior to the famous Frost-Nixon television interviews.

it with the number ten, to provide some basis for the resistance to convert to the metric system.

Second, that the English Imperial standards have evolved from origins that stretch back at least a thousand years. The metric system represents a stark break in that evolution, making almost no reference to the English system. The conversion from the English system to the metric system therefore represents the abandonment of long-established institutions that might provide a cultural basis for opposition.

Third, that the FHWA's proposal, as well as the broader efforts to metricate in the late 1970's, occurred in a time of considerable controversy. These controversies might have motivated a level of opposition that would not have occurred during a more tranquil time. For example, the stagflation and energy shortages of the late 1970's likely made segments of the population more sensitive to the costs of conversion to the metric system than they would be during a time of economic prosperity.

Economics

The metric system receives the greatest amount of attention in the field of economics, where it is discussed in the broader context of standards and institutions. The following section provides a brief overview of this discussion, providing insight into the economic properties of the metric system.

The primary value of standards, especially standards of weights and measure, is that they reduce transaction costs. North indicates that the costliness of measurement represents a significant transaction cost and therefore is an impediment to realizing gains from trade(1990, 28-32). If a pound were not a set, standardized weight, for example, the amount of uncertainty in any purchase of an item priced by the pound would be great and the cost of measurement required to mitigate that uncertainty would be significant. Accordingly, to reduce measurement costs(along with other transaction costs) sophisticated societies are inclined to establish and enforce standards of weights and measure as part of the formal rules of society(North 1990, 46). Verman provides a similar argument, referring to the ability of standards to work as a "criteria for judgement" that can be used "in different places, by different operators at different times"(Verman 1973, 188). Krislov also makes a similar claim, but adds that the standardization of weights and

measure helped enforce honest trades by enabling easier detection of fraud and counterfeit⁷(1997, 9).

Systems of weight and measure, however, can only reduce transaction costs when all parties to a transaction are using compatible systems of measurement. Increasing levels of compatibility correspond with decreasing transaction costs. In a transaction, it is therefore often desirable for parties to use standards of weight and measure that are maximally compatible, which occurs when each party to a transaction uses the same system of weight and measure. Here, the reduced transaction costs are a collective benefit conferred to all parties of the transaction. This collective benefit makes standards subject to what economists call network effects(Katz and Shapiro 1985; Weiss and Cargill 1992; Weitzel 2004).

Put simply, network effects refer to the increase in a good's value as it is consumed or used by an increasing number of people. Telephones are a classic example of this. The value of a telephone derives from its use to communicate with others. The more people that a telephone owner can call, the more useful his telephone becomes. Thus, the telephone owner's telephone gains value as more people purchase telephones(Katz and Shapiro 1985; Liebowitz and Margolis 1994). This concept translates to languages as well as compatibility standards and standards of weights and measure(Kindleberger 1983).

The literature on the economics of standards and network effects theory suggests that network effects have the potential to produce lock-in(Weitzel 2004; David and Greenstein 1990; David 1985; Arthur 1989). As the term suggests, lock-in refers to a condition in which a standard has emerged and the potential for it to be supplanted by a competing standard is unlikely if not impossible. The classic example of this is the emergence of VHS as the *de facto* standard format for video cassettes(Arthur 1990; Cusumano, Mylonadis, and Rosenbloom 1992; David and Greenstein 1990).

Several economists use the effect of network effects and lock-in⁸ to conclude that standards are path dependent(Arthur 1990; David 1985; David and Greenstein 1990; Weitzel 2004). Specific definitions of path dependence vary, but a suitable definition for our purposes is provided by

⁷For example, in an economy that runs on coins minted from precious metals, standards of weight and measure enable the easy detection of shaved coins, or coins cut with impurities.

⁸Scholars often refer to a variety of factors when arguing that something is path dependent, but increasing returns(network effects) and lock-in are among the most prominent. See Pierson (2000).

Margaret Levi(1997, 28):

[P]ath dependence has to mean, if it is to mean anything, that once [an actor or set of actors such as a company, market or nation] has started down a track, the costs of reversal are very high. There will be other choice points, but the entrenchments of certain institutional arrangements obstruct the easy reversal of the initial choice.

It is easy to see how the concepts of network effects, lock-in and path dependence might apply specifically to standards of weight and measure⁹. In early US history, the common usage of the English system among the US colonies and by its largest trading partner, England, provided network effects. The benefits conferred by these network effects, along with other events in early US history, such as John Quincy Adams' 1821 report on the metric system, locked the US into the English system. As a result, the standards of weights and measure in the US are path dependent: the English system will grow continually entrenched in US society as will the attendant costs of conversion.

The economic literature on standards thus leads us to two conclusions:(1)that the US's historical use of the US Customary system encourages its continued use and (2) the conversion to the metric system in the US will be prohibitively costly. If we assume, as most economists do, that people are value-maximizing, then we would expect objections to the conversion to the metric system to center around these two conclusions.

Finally, we should note that the economic literature tends to focus very narrowly on the value of standards in and of themselves. That is, it typically does not typically delve into broader issues that we might naturally expect to arise in reaction the FHWA's proposal such as nationalism or trust in government.

Similar studies

While much has been written on the metric system in the last two hundred years, relatively little has been written specifically about the recent attempts at conversion or the public reaction to those attempts. This lack of literature is especially noticeable since the last forty years have

⁹Admittedly, standards of weights and measure are an issue of policy that occur in a context somewhat removed from the free market context in which economists typically discuss standards. This is less of an issue than it may seem. Peirson(2000) provides an overview of how theories of network effects and path dependence are applicable to politics and policy. The application of economic theory to government set(*de jure*) standards is also discussed by Abbott and Snidal (2001), Kindleberger (1983), North (1990), David and Greenstein (1990), and Weitzel (2004).

seen repeated attempts to integrate the metric system into US culture. There are four studies that merit review: Fasbender's 1977 study of the citizens of Sparta Wisconsin, a 1997 study of California residents by Chang and Buchanan, a case study comparison by Turner, Lindly et al., and a study by Meacham and the Ohio Department of Transportation in 1974.

Each of these studies concerns itself primarily with the opinions of the general public towards the conversion to the metric system. The Turner, Lindly et al. study focuses on the public reaction to the conversion in several countries, while the other studies focus on populations in a given area (Ohio, California and Wisconsin). These studies suggest that between half and slightly more than half of the public oppose conversion to the metric system. An exception is Buchanan and Chang's (1997) study which found only 40% of its respondents opposed metric conversion¹⁰.

Each of the four studies propose various lines of reasoning driving the opposition to the metric system. All of the studies refer to a natural resistance to change as a part of the motivation behind resistance to metric conversion. Fasbender primarily addresses the impact of demographic factors such as gender and income on attitudes towards the metric system, he does not provide meaningful insight into the lines of reasoning one might use to argue against the metric system. Turner, Lindly et al. identified cost as a major issue. And both Turner, Lindly et al., as well as the Ohio DOT suggest that acceptance of the metric system is related to one's ability to use the metric system and understand its value, but both studies provide limited evidence to substantiate their claims.

Of the four studies, however, only Buchanan and Chang focused primarily on the reasons one might oppose conversion to the metric system. Reviewing the existing literature in sociology and communications, they posit three likely reasons that an individual would be expected to object to conversion to the metric system: perceptual confusion, cost and ethnocentrism (Buchanan and Chang 1997, 151). They then test for the presence of these reasons using a survey instrument. They find that each are obstacles to conversion to some degree.

While these studies are a helpful assessment of public sentiment towards metric conversion, they do not take into account the unequal impact that different people have on the public policy process. Those people who demonstrate extreme attitudes such as ethnocentrism are likely to

¹⁰Buchanan and Chang's sample was drawn from a private university and areas of California subject to influences that could make participants more familiar with the metric system. (1997, 153)

have a greater influence since, as Buchanan and Chang state, “They are the type who write letters to the editor and to members of Congress expressing their displeasure. They will be heard above all others because those who do not oppose the change to the metric system have no reason to raise their voices” (1997, 154). Thus, investigating the general public will not help us understand the opposition faced by policymakers and therefore will not help us understand why policies of metric conversion failed. Instead, to understand why policies to convert to the metric system failed, we must investigate the vocal minority that actively communicated their views to the government.

Further, the studies mentioned here provide an incomplete picture of the reasoning that drives opposition to the metric system. Even Buchanan and Chang’s study does not provide an exhaustive list of reasons why one might oppose metric conversion. It is possible that there are other common reasons driving opposition to the metric system that arise outside of the areas of perceptual confusion, cost and ethnocentrism.

Methods

Research Objectives

The following section will outline the research objectives of this study. The research questions will be divided into two phases of study. RQ_1 through RQ_2 will be addressed in phase 1 of the study, while RQ_3 will be addressed in phase 2.

RQ_1 : To what extent were the arguments against the metrication of the MUTCD based on economic and non-economic reasons?

The economic literature, as well as the Turner, Lindly, and Chester (1996) study gives us reason to expect letters will present arguments based upon factors pertaining specifically to the value of the standards and the cost of conversion. Consideration of the historical context, the unique cultural attitudes of Americans and the findings presented by Buchanan and Chang(1997) suggest that letters might also include arguments based on factors external to standards of weights and measure and more normative in scope such as the author's attitude towards foreigners, fear of communism, or ideological beliefs about government regulation.

Operationalization

To answer RQ_1 , letters of complaint were examined and coded on two dichotomous variables. One variable indicated the presence of reasoning based on factors external to the value and costs of conversion and more normative in scope(herein: normative reasoning). The other reflected the presence of arguments focused specifically on the value and costs of conversion(herein: economic reasoning). These variables are not mutually exclusive.

Hypotheses

If we follow the logic presented in the economic literature, we arrive at the following hypothesis:

H₁: The number of letters coded for economic reasoning will far outnumber the number of letters coded for normative reasoning.

Alternatively, if we consider the findings of Buchanan and Chang (1997), we expect the following:

H₂: The letters coded for normative reasoning will represent a substantial portion of the overall sample

RQ_{1.1}: To what extent does the reasoning used in arguments against the metric system reflect the nature of the standards of weights and measures in the US as path dependent?

Based upon a review of the economic literature on standards, there is reason to suspect national standards of weights and measures are path dependent and that the historical usage of the US customary system prevents transition to the metric system. If this is the case, we would expect it to be reflected in the letters that served as the principle instrument in preventing highway metrication. This reflection would occur along three dimensions: references to historical precedent, difficulty changing behavior or learning a new system, and the transition cost brought about by the embeddedness of the US customary system in tools, machinery, or various other goods.

It is also possible that, instead of reflecting path dependence, letters will argue against highway metrication based upon contextual factors unique to that point in time. We would expect these letters to prominently reference then-contemporary issues such as inflation, unemployment, or the cold war.

Operationalization

Letters reflecting path dependence were coded on three dichotomous variables corresponding to the three dimensions mentioned above: (1) references to historical precedent, (2) difficulty changing behavior or learning a new system, and (3) the transition cost brought about by the embeddedness of the US customary system. Letters that reflect then-contemporary issues were also coded into dichotomous variables. Variables were not mutually exclusive, letters could be coded as both reflecting path dependence and reflecting then-contemporary issues.

Hypotheses

Based on the operationalization above, we reach the following hypotheses:

H₃: The number of letters coded positive for any of the three variables will represent a substantial portion of the overall sample

Considering other sources of literature, as well as the historical context of the late 1970's we also reach an alternative hypothesis:

H₄: The letters reflecting then-contemporary issues, and thus not reflecting path dependence, will represent a substantial portion of the overall sample

RQ₂: What types of arguments are made against highway metrication or the metric system in general

Aside from those arguments we expect to find through investigation of RQ₁ and RQ_{1.1}, what other types of argument were offered in letters written to the FHWA? A review of literature has produced minimal information regarding the specific reasons that people resist the metric system. We can infer some of the reasons from satirical presentations in the mass media, and a small survey of Californians (Buchanan and Chang 1997), but we have no knowledge to date of the types of arguments used by the people who were effectively responsible for preventing the adoption of the metric system.

Operationalization

To satisfy RQ₂ A process of open coding was used to generate codes based upon repeated types of argument. These codes were combined and used to describe the major themes of argument.

RQ₃: To what extent do the letters written to the FHWA reflect broader public sentiment about highway metrication or the metric system in general

The letters written to the FHWA are acknowledged as the driving force behind its decision to abandon the highway metrication proposal, but we do not know if those letters reflect the broader public sentiment or the sentiment of a vocal minority. In various newspapers throughout the country, editorials and letters to the editor voiced opposition to the FHWA's proposed rule changes. Assuming that these are somewhat reflective of public sentiment, we can compare the

types of arguments offered in these newspaper items to those offered in the letters to the FHWA to determine if they are reflective of broader public sentiment. Because RQ_3 will require the collection of a second sample, it will be addressed as the second phase of the study.

Operationalization

The typology generated in RQ_2 was used to code newspaper items. This allows the two samples to be compared to one another for each type of argument.

Hypotheses

Based on the operationalization above, we reach the following hypotheses:

H₅: for each type of argument, the proportion of newspaper items espousing a type of argument will not be statistically different from the proportion of letters of complaint espousing the same type of argument

Phase 1: Public Comments

Description of the data

The first and primary phase of this study is an examination of the nature of the opposition to the metric system manifest in arguments offered in public comments solicited by the FHWA. Accordingly, the primary unit of analysis is the letter of comment

The initial solicitation of public comment came in an in an Advance Notice of Proposed Rulemaking (herein: ANPRM) titled *Metrication of the National Standards for Traffic Control Devices*, and published at published at 42 FR 21487-8 (APR 27 1977). Docket 77-7 was designated for all letters and comments pertaining to the highway metrication proposal. Custody of the docket has been transferred from the FHWA to the National Archives and Records Administration (NARA) and is currently housed at the Archives II facility in Adelphi Maryland. It can be accessed in in Record Group 406 entry 18WW, boxes 15-16.

Logs indicate that there were 5706 letters received by the FHWA in response to the ANPRM. Of these 5706 letters, 3506 are not contained in the NARA records. They are presumed to be either lost or destroyed. The sample frame, therefore is the remaining 2200 (38.5%) letters.

A review of the log suggests no obvious periodicity in the organization of the letters. Accordingly, a systematic sampling method was adopted capturing every seventh letter. This yielded

an initial sample size of 314.

Letters were rejected from the sample for various reasons. Letters in favor of the metric system, letters from governmental agencies, and letters from businesses were rejected on the basis that they were beyond the scope of this study. Several letters were short statements to the effect of, “we don’t want the metric system,” and were rejected because they offered no insights to why the author might be opposed to the metric system. One illegible, hand written letters was also rejected. Table 1 lists letters dropped from the sample by reason. During data collection, rejected letters were replaced by the either the previous or following letter in the sample frame. During the coding phase, additional letters were rejected for the same reasons listed above, but could not be replaced. The actual sample used for analysis contained 294 letters. This represents 13.4% of the sample frame and 5.2% of all public comments originally filed in docket 77-7.

Table 1: Letters dropped from the sample

Reason	Freq.	Percent	Cum.
Letter contained newspaper clippings	3	6.25	6.25
Illegible	1	2.08	8.33
Letter from an institution or business	8	16.67	25.00
Letter supported the metric system	5	10.42	35.42
Letter was too short for analysis	31	64.58	100.00
Total	48	100.00	

Coding Process

Letters were initially coded according to preformed hypotheses about the presence of economic and normative reasoning in arguments against the metric system. Codes for economic and normative arguments were not mutually exclusive; letters could be coded as expressing both economic and normative objections.

Following this, open coding and coding memos were used to identify reoccurring lines of argument. A third round of coding used content analysis to further subdivide codes based on repeated phrases and words. Content analysis was computer assisted, using a combination of regular expression (often called REGEX) algorithms and the statistics package Stata 10.

Over the coding process, 23 coding categories were generated. These categories were then

combined to form six themes of argument. These themes are discussed further in the findings chapter.

Phase 2: Newspaper Analysis

Description of the Data

The second phase of the study analyzed the public opposition to the metric system as manifest in arguments offered in newspaper editorials and letters to the editor (herein: newspaper items). This study assumes that these sources generally reflect the aggregate thoughts, beliefs, and opinions of US citizens. The primary unit of analysis is the editorial or letter to the editor, which is measured according to the presence of the themes of argument developed in phase 1.

Data collection occurred in two rounds. In the first round, sample items were drawn from large, nationally distributed newspapers selected from a list of the most circulated papers in the United States in 1977. Sample items were collected from the April 20 through July 31, 1977 issues of the following papers: The New York Times, The Chicago Tribune, The Philadelphia Inquirer, the Boston Globe, the Wall St Journal, the Washington Post, and the LA Times. Two papers, The New York Times, and the Chicago Tribune, were accessed through their respective online archives, the rest of the newspapers were reviewed on microfilm.

In the second round, newspaper items from smaller, local papers were collected using the search website Google.com and their news archive search feature¹¹. A search was performed for all occurrences of the term “metric system” in newspapers issued between April 20 and July 31, 1977.

In both rounds of collection, the goal was to obtain letters espousing a stance on the issue of highway metrication or metric conversion in general. To accomplish this, only letters to the editor or editorials (herein: newspaper items) were selected for the sample. These items were identified by the satisfaction of at least one of two criteria: (1) the item appeared on the editorial page as identified by the presence of the paper’s masthead, or (2) it was a letter to the editor, appearing in a section so labeled, or beginning with an identifying salutation such as, “to the editor.”

In total, the phase 2 sample consisted of 70 letters. Of these, 50 letters were collected in the

¹¹Google does not do a good job of advertising this service, but it is an indispensable resource. It can be found at <http://news.google.com/archivesearch>

second round, from 23 small, local papers, and 20 were collected from 6 national newspapers¹². A listing of papers used for this study, and the number of newspaper items from each paper can be found in Appendix A.

Coding

Newspapers were initially coded according to the themes of argument derived from RQ_2 in the first phase of the study.

¹²There were no relevant newspaper items found in the Wall Street Journal between April 20 and July 31, 1977.

Findings

Phase 1

Description of the Data and Demographics

The sample collected for analysis can be described demographically as follows.

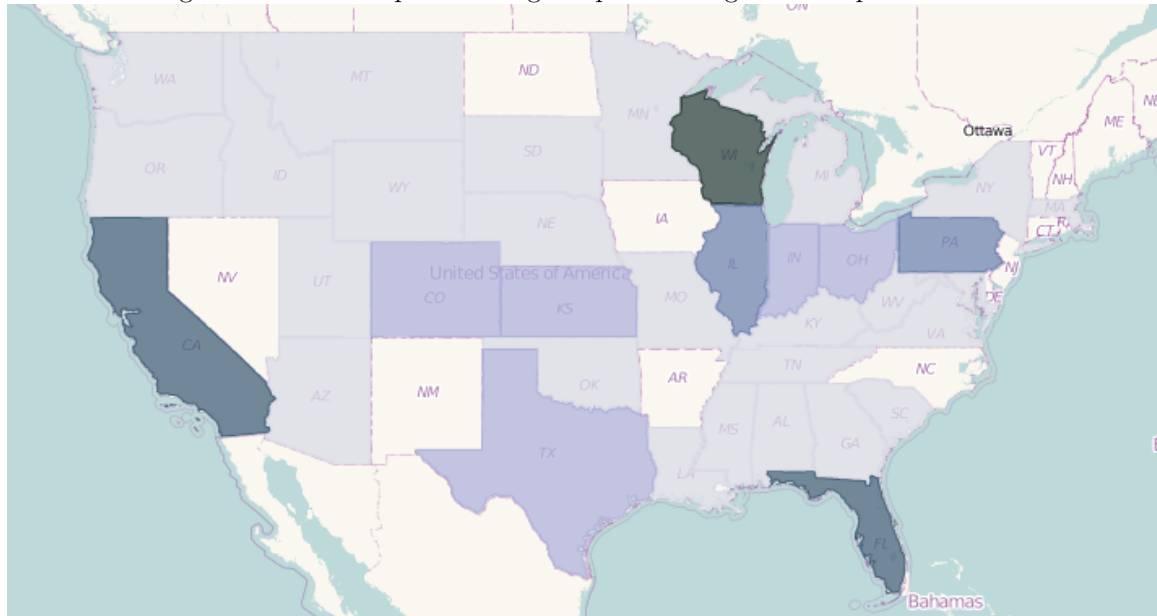
Significantly more letters were submitted by women than by men. For 268 letters in the sample, the signed name was used to identify the author's gender. Of these letters, 44% were authored by individual women, 31% were authored by individual men, and 25% of the letters were signed by more than one author. Note that when we compare only the 200 letters signed by individuals, individual women wrote 43% more letters than men.

Table 2: letters by gender without groups

Gender	Freq.	Percent	Cum.
male	82	41	41
female	118	59	100
Total	200	100	

The FHWA received letters from throughout the country, but many letters originated from a few key areas. Figure 1 shows a shaded map of the US; darker states indicate a greater number of letters originating from that state. As is visible, California, Florida, Illinois and Wisconsin were the most common states of origin. While we might expect Florida, Illinois and California, because of their large populations, to be common places of origin, the number of letters sent from Wisconsin is quite surprising.

Figure 1: A heat map of showing the place of origin for sample letters



Letters varied widely in scope. Not all the letters received to docket 77-7 specifically addressed the FHWA's proposed rule changes. A number of them were letters of protest to the Metric Conversion Act of 1975. Others were letters about the general overreach of the federal government into the private lives of its citizens. This is not entirely unexpected as the initial selection of the highway metrication proposal as the object of study was based upon the likelihood that they would reflect the overall anti-metric sentiment.

RQ₁: Use of Economic and Normative Reasoning

Almost every letter used economic reasoning, many letters used both economic and normative reasoning. Each letter was coded according to the presence of arguments based on economic and normative reasoning. Letters that made some use of economic reasoning comprised 90.48% of the sample, while 57.82% of the sample letters used normative reasoning. As Table 3 shows, most uses of normative reasoning were combined with uses of economic reasoning and, just over half of the uses of economic reasoning were accompanied by uses of normative reasoning.

Table 3: Economic and Normative Reasoning

	Freq.	Percent	Cum.
Normative only	28	9.52	9.52
Econ-only	124	42.18	51.70
Both economic and normative reasoning	142	48.30	100.00
Total	294	100.00	

*RQ*_{1.1} Path dependence

Path dependence is reflected in a sizable number of letters, though not the majority. Three variables were used to determine the extent to which path dependence was reflected in the reasoning used in sample letters. These variables were combined to generate a composite indicator for letters reflecting path dependence. Path dependence was reflected in 22.45% of the letters in the sample.

Arguments reflecting path dependence are more prevalent than those reflecting then-contemporary issues. Open coding resulted in the identification of several then-contemporary economic problems such as inflation, high unemployment, and the energy crisis of the mid to late 1970's. These arguments suggest the opposite of path dependence: that the US ought to reject metrication because of present circumstances, not previous decisions about standards of weights and measure. These economic issues are only referenced in about 13% of the sample, reflecting between 9% and 17% of all letters in docket 77-7. If we incorporate references to the cold war and communism¹³, then-contemporary issues are reflected in 27.2% of sampled letters.

Arguments reflecting path dependence and non-path dependence are not statistically different. When mention of communism and the cold war are taken into account, the estimated proportion of letters referencing then-contemporary issues comes within the margin of error of the proportion of letters reflecting path dependence. A test of the significance of the difference between proportions (a z-test of proportions) confirms that the proportion of letters referencing path-dependence is not significantly different from the proportion of letter referencing then-contemporary issues.

¹³These are not economic issues *per se*, but they are relevant then-contemporary issues because of their influence on the attitudes and arguments of the authors

Additionally, several letters both reflect path dependence and reference then-contemporary issues.

RQ₂ Major Themes

This study undertook to identify the reasoning behind the opposition to the metric system. Through open coding, six major themes were identified: (1) objections against the method, (2) fear of structural or ideological change in government, (3) American exceptionalism, (4) fiscal objections, (5) logistical objections, and (6) value puzzlement. These themes are not mutually exclusive; many sample letters reflected more than one theme. Every letter sampled is described by at least one theme.

The remainder of this section will describe each theme in turn and provide statements from sample letters that reflect that theme. The statements from sample letters reflect a mixture of typical and extreme instances each theme. Consecutive statements separated by a blank line are from different letters.

Objections Against the Method

A number of letters voiced dissatisfaction with the method by which the policy for metric conversion had developed. Several authors suggested that the way the metric conversion had been handled represented a subversion of the will of the people by the government. Authors were upset that the decision to metricate had not been put to a national vote, but had been decided by Congress in 1975. Other letters voiced objection to the FHWA's interpretation of the 1975 Metric Conversion Act, and accused the FHWA of bureaucratic over-reach. In the same line of argument, several letters accused either congress or the FHWA of acting illegally and/or unconstitutionally. In total, 24.83% of letters made comments that could be classified as objections against the method.

This must be stopped before it is too late. I have many reasons for my opposition to this. First of all, wouldn't it take a constitutional amendment to do this to our country? Let's leave well enough alone, and stop this insanity! Why are we being forced down our throats what our ancestors came here on a rowboat to get away from

I am a concerned driver of public highways and feel that the federal bureaucracy is not really concerned about the American people but more interested in the special interest groups and in my opinion this group would be the One Worlders. I would like to get the answer to one question. When you give some people authority in

government why do they think they are so superior that they think they know best what is good for all the people all the time?

It seems that most of the decisions and actions of our Federal agencies do not at all conform to the wishes of the taxpayers who furnish the money.

I also protest the way you are doing it, government by decree. I'll have to blame congress and presidents in the past for giving you the power, but I can blame you for using it! Looks like you'd see how similar actions by other agencies are affecting your private lives and see that you are doing the same thing.

I don't remember voting for anyone in the FHWA last November. Why are you forcing metric highway signs down our throats? My congressmen will hear from me and explain how some bureaucrats presume to dictate laws to the American public.

We're against changing to the Metric System, especially on our highways. Many people feel as we do. They're angry & feel they're loosing their right to vote on issues that will affect their lives.

Fear of Structural or Ideological Change in Government

Several letters objected based upon suspicions that conversion to the metric system portended a severe structural or ideological change in government. For example, some authors suggested that the conversion to the metric system represented a move towards one world government. Other authors suggested that the conversion to the metric system marked a move towards communism or socialism. In total, 18% of sample letters made objections based on these suspicions.

I think this is another One World thing that is being forced on us by the same ones that are trying(and succeeding) to make us a slave nation. Couple of hundred years ago we had a war to stop England's slavery; later we had a war to end slavery for the blacks. Now we ho-hum and turn on channel nine and forget it. Where have all the men gone? Who runs the government, anyhow? Retreat, retreat, retreat! We've been backing up for twenty years and only a handful care.

Now, suddenly, Americans must conform to a "world system" for foreigners and you "one worlders".

I do not want to be a "world citizen", but an "*American citizen*"

International metric measurements is a stepping stone for world government, eventually merging all facets of U.S. society into international standards.[...]This is the United States and I see no need to mimic or join socialistic and communistic countries

It isn't the unnecessary expense that worries me most. It is the speed at which we seem to be heading toward a world-wide, uniform system of government. [...] these

are just some of the ways I believe we are being prepared for the coming one-world government. It will be so much easier for uniformity if we all have a number and the same system of measurement.[...]I am a believer in God and in the truths of the Bible and I can say that by forcing us to use the metric system, which isn't any easier or better than our own, is only hastening us toward the time when the world will be ruled by one dictator. I ask of you - don't do it!

You are all trying to make us into a Dictatorship. Our forefathers gave us a free country, now lets keep it that way.

American Exceptionalism

Many letters viewed the adoption of the metric system as an act of conformity to foreign standards and the abandonment of an American institution. Accordingly, authors wrote letters expressing pride in their nation and advising against copying the standards of others. This theme occurred in 35.7% of sampled letters.

Leave the metric system over in Europe where it belongs

The U.S. produces more products than any other country. Why do we change [to] their ways? Why not let them change to ours.

This is the greatest country on earth and now we are supposed to bow to the other countrys because they are all metric. I say *NO*

The U.S.A. and the rest of the Anglo-Saxon countries have made greater scientific, engineering, economic and civilizing achievements with their inches-foot-yard-mile-pound measuring system than all the rest of the world combined with their metric system.

I don't understand why we should convert to this system. Its our country and we've already given up enough to the foreigners.

A booming *NO* to metric highway signs.[...] Only the Communist Third World Idiots promote this kind of crap. Stand up for America!!

Why should the greatest Nation on earth go on the metric system. There would not even be other nations if the U.S. hadn't pitched in and saved them.

Fiscal Objections

Many letters voiced objection to the conversion to the metric system because they perceived it to be wasteful government spending, or a misuse of tax revenues. Others complained of the transition costs incurred by non-governmental actors(e.g. the costs incurred by a carpenter's

purchase of new, metric tools). Letters that made fiscal objections cited widely varying estimates for the cost of conversion, ranging in magnitude from millions to trillions. The theme of fiscal objection was the most prominent theme, present in 68.4% of all letters sampled.

Any loyal US citizen that considers the welfare of our country in any way should be against this unnecessary and drastic action. Have you considered the billions, and probably trillions of taxpayer's money this will cost

It is the most outlandish thing we ever heard of. Just how does the government intend to pay for the change-over? The government is the same as Bankrupt now.[...] If an individual ran their business like the Government runs theirs, we would all be out of business immediately.

The cost of labor and materials that would be required to change the many thousands of signs appears on the surface to be an absolute unnecessary expenditure of the taxpayers dollars. Certainly, the unemployment situation, better housing for the poor and handicapped, and underprivileged seem to us to have a higher priority in the over-all scheme of things.

All through industry cost would be incalculable as tools and machines would require complete replacement! Inevitably many firms would fail, go out of business; larger and more affluent firms would be in serious difficulty; those surviving forced to greatly increased prices of their products to continue.

Under these circumstances, the already too bad employment situation becomes infinitely worse, causing a really terrible general depression involving everyone and everything which our Country simply cannot afford!

Logistical Objections

Authors argued against the metric system because of logistical concerns. These concerns manifested themselves primarily in the form of concerns about the general confusion that would be caused by the conversion. Other authors argued that specific logistical problems would emerge from the confusion. Many of these authors pointed to the problem of educating the public about the metric system. Several authors referred to the specific challenges of re-educating the elderly and the illiterate. A small number of authors wrote about the various arithmetical disadvantages of the decimal-based metric system. Logistical objections occur in 39.1% of sampled letters.

It is a fouled up system from the start. The number 10, the fundamental metric measurement—is divisible by only 2 and 5, whereas 12, the basic measurement of our more practical English system, is divisible by 2 5, 4, and 6—twice as many whole numbers. Note that the clock is divided into 12 and 24—not 10 and 20. The compass is divided into 360 degrees, not 100. Our calendar has 12 months—not 10.

Common fractions under the metric system become cumbersome. $\frac{1}{8}$ is 0.125. $\frac{1}{4}$ is 0.250, $\frac{1}{6}$ is .16666 to infinity, and one third is 0.3333 to infinity.

Stop and figure out how many illiterates there are who can't even figure out or read English signs, so what do you expect with your idiotic metric, which will so confuse the motorists (not to mention everyone else) that the Carter energy plan won't need to be unveiled at all.

The greater portion of our drivers will not know what the metric numbers mean with respect to the English system, and traffic violations are bound to increase

I protest the "Metric System" most emphatically.
This will cause much havoc and many deaths.

You are inviting accidents. I am adamantly opposed to metric in every form to begin with[...] But starting on our highways is crude. May the extra blood spilled be on your hands.

Ye gods - have you any idea what will happen on all Freeways when these signs go up?

I am sure you are aware that thousands of drivers will then drive 88 MILES Per Hr. instead of the 55[miles per hour].

It will be slaughter.

Is it possible that before this happens that all filling stations be given some sort of a disc in the metric figures that will fit over all the present speedometers. This may help in part, to solve the reckless driving.

American thinking is not equipped for metric usage in relationship to automobiles. Even if a conversion chart were used confusion would be rampant.[...] Even if cars do have metric indicators on them the American public will still calculate mileage not kilometers.

What about the illiterates who do drive and just know enough to get by now on the signs - don't say there are no such things I personally know 6 people who can't read and drive, they take oral tests.

Value Puzzlement

A common theme of argument was that the author failed to understand the value of conversion to the metric system or to the metrication of the Highways. This usually occurred through either rhetorical questions asking, "why change" or through simple statements that the author could not see the value of conversion. This theme does not apply to letters expressing preference for alternative uses of the money allocated for the conversion, nor does it apply to statements that the conversion is worthless or unnecessary as those statements suggest that the author apprehends

the proposed value of the conversion and rejects it. Value Puzzlement objections occur when the author expresses confusion over the seemingly random and meaningless decision to change. In total, value puzzlement was expressed in roughly 17.4% of sample letters.

I would like to have someone explain why this system is so desirable over the decimal system

On converting Mile and Speed Signs to the metric system; what possible advantage is there for the citizen? None that I can figure out.

What benefit is the program supposed to produce and what is the overall cost estimate to effect this change?

Why change? All these years we have used our present system and gotten along very well. [...] The biggest portion of people benefit from this system, so why change?

Phase 2

Description of the sample

As mentioned in the methodology chapter, the sample for the second phase of the study was collected from both national and local newspapers, consisting of 63 newspaper items. Of these, 50 were from local newspapers, and 13 were from nationally distributed newspapers. The names of the newspapers used, and the number of items from each can be located in Appendix A.

A large proportion of the sample consisted of newspaper items that supported the adoption of the metric system, or regretted the FHWA's decision to withdraw its proposal. Of the 63 newspaper items in the sample, 26 favored of metrication, comprising 41.27% of the sample. Conversely, 37 items, or 58.73% objected either to the FHWA's proposal or to metrication in general. Comparatively, only 5 letters from the initial sample of phase 1 supported metrication, representing only 1.67% of the sample¹⁴.

The following will discuss findings that both include and exclude the supportive items. Findings that omit the supportive items will be said to be from the controlled sample, while findings that include the supportive items shall be said to be from the full sample.

Letters to the editor comprised the largest proportion of the sample. There were 51 letters in total, and 30 opposing letters, accounting for 72.86% of the full sample and 73.17% of the

¹⁴For these purposes, the sample size was adjusted to admit the 5 positive letters, yielding a sample size of 299.

controlled sample. In contrast, there were 19 editorials in total, and 11 opposing editorials, accounting for 26.83% of the controlled sample, and 27.14% of the full sample.

*RQ*₃: Sample Comparison

Phase 1 and Phase 2 samples were compared using a z-test¹⁵ of proportions along each of the six themes of argument outlined above. The tests initially used the full samples for phase 1 and phase 2. Results showed statistically significant differences for the themes of fiscal objections, American exceptionalism and fear of structural or governmental change. Each of these themes occurred in a greater proportion of the phase 1 sample than the phase 2 sample when the supportive sample items are taken into account. The z-test comparison of proportions across all themes is reported on Table 4.

Table 4: Comparison of Samples Across Themes of Argument (Full Sample)

	Docket 77-7	Newspaper Items	Difference
Value Puzzlement	17.05%	14.29%	0.5618
Fiscal Objections	67.22%	25.71%	6.3647*
Logistical Objections	38.46%	32.86%	0.8723
American Exceptionalism	35.12%	24.29%	1.730**
Fear of Structural or Governmental Change	17.72%	5.71%	2.5031*
Objections to the Method	24.41%	22.86%	0.2742

^a Z-test conducted by subtracting Docket proportions from Newspaper proportions, Positive numbers indicate a greater prevalence in the Phase 1 sample (Letters from Docket 77-7), while negative numbers indicate greater prevalence in the Phase 2 sample (Newspaper Items).

* Indicates two-tailed significance at the 95% confidence level($\alpha = .05$)

** Indicates one-tailed significance at 95% confidence level($\alpha = .05$)

Since we are concerned with comparing the nature of the *opposition* to metric conversion, the prevalence of positive letters in the phase 2 sample produced, for our purposes, a skewed comparison. The z-tests were re-run using the controlled sample. Results showed statistically

¹⁵Fisher's Exact Test was also performed, but produced identical results. Results of the z-test are discussed here because they indicate which sample had the greater number of items reflecting the theme in question(directionality).

significant differences for the themes of logistical objections, fiscal objections and objections to the method. Fiscal objections occurred in a greater proportion of the phase 1 sample than the phase 2 sample. Logistical objections and objections against the method occurred in a greater proportion of the phase 2 sample than the phase 1 sample. The results across all themes are displayed in Table 5.

Table 5: Comparison of Samples Across Themes of Argument(Controlled Sample)

	Docket 77-7	Newspaper Items	Difference
Value Puzzlement	17.34%	14.29%	0.56
Fiscal Objections	68.36%	43.90%	3.08 *
Logistical Objections	39.12%	56.10%	-2.07 *
American Exceptionalism	35.71%	41.46%	-0.72
Fear of Structural or Governmental Change	18.03%	9.76%	1.32
Objections to the Method	24.83%	39.02%	-1.93 **

^a Z-test conducted by subtracting Docket proportions from Newspaper proportions, Positive numbers indicate a greater prevalence in the Phase 1 sample (Letters from Docket 77-7), while negative numbers indicate greater prevalence in the Phase 2 sample (Newspaper Items).

* Indicates two-tailed significance at the 95% confidence level($\alpha = .05$)

** Indicates one-tailed significance at 95% confidence level($\alpha = .05$)

Examples of Major Themes

The remainder of this section will describe each theme in turn and provide statements from sample newspaper items that reflect that theme. The statements from sample letters reflect a mixture of typical and extreme instances each theme. Consecutive statements separated by a blank line are from different newspaper items.

Objections Against the Method

Though more prevalent in the phase 2 sample, objections against the method were rhetorically the same in both samples.

If I were ever asked during a “man on the street” survey what I thought of the US changing to the metric system, I would give my opinion in loud “man on the street” terms. “ But nobody asks me. Nobody interviews me. Just a bunch of congressmen interviewed themselves. Then they passed the 1975 Metric Conversion Act

Now that the Federal Highway Administration has imperialistically decreed that highway speed-limit signs shall read in kilometers per hour instead of miles per hour, most American motorists thinking they can judge speed are about to discover they can't if the Federal bureaucrats prevail.[...][these] perverted rulings purport to be sanc-

tioned by the 1975 Congressional metric bill(P.L. 94-168) despite the fact that such decrees contravene the Federal law. It clearly and expressly provides that any metric conversion shall be voluntarily voluntary, not voluntary at gunpoint.

If this were brought before the American people for approval by vote, the metric system would not be besetting us now.

”Government of the people, by the people, and for the people“ has become strictly humbug. It should be revised to substitute ”bureaucrats“ for ”people.“

[T]he character and texture of our society is passing into the hands of the unaccountable. How was the authority given to alter our heritage?[...] Who voted for the technicians who have decided that similarity and interchangeability with foreign countries is more important than an irreparable loss to our culture?

Fear of Structural or Ideological Change in Government

Arguments that expressed fear of structural or ideological change in government occurred at similar rates in both samples. In the phase 2 sample, however, uses of this theme were slightly less apoplectic.

Think about it. The communist manifesto is one world-one language-one weights and measurements system-one weights and measurements system-one monetary system. All communist! Stand up for your rights to disagree.

The change to the metric system is part of a conspiracy to create a world government.

Will the conversion over to the metric system also include our money? If your answer is yes, do you know if that will involve our adoption of the Polish zloty and the Brazilian cruzeiro as our basic unit of monetary exchange replacing the dime and the plugged nickel? Was the metric system invented by Napoleon Bonaparte or Fidel Castro and, if so, why would they do such a thing?

American Exceptionalism

Arguments that employed American exceptionalism were very similar to those seen in the phase 1 sample.

Congress seems to be throwing the metric system at us to put us in line with the prevailing practice in other countries; poor reason for doing it, indeed. Instead we should be encouraged to adhere to and treasure our own customs and traditions.

We are living in America yet we are copying the standards from foreign countries. I'm speaking of the nonsensical metric system[...] Let the other countries have it, but let's stay American!

This year, someone is selling us a system that will change everything we ever knew as American as apple pie, it is the metric system. [...] America is great because she is different, not because she copied all the other systems in the world[...] Where is anyone who will say Whoa! Back up, we like it as it is. Who will be our Paul Revere to cry “The metrics are coming.”

[Nothing is supposed to be said] about the fact our own United States hasn't been too unsuccessful with our own measurements in feet, pounds, quarts, etc. All we have done with our allegedly antiquated system is become the world's greatest industrial nation with the highest standard of living. Maybe some of the other countries should switch to our plan instead of our surrendering to theirs.

This is the United States of America and our system is the greatest system in the world. The leaders that started our country did wonders. I think it is stupid for anyone to say the metric system is better than ours. I feel it is the greatest crime ever being committed against the people of our country.

Fiscal Objections

Fiscal objections were similar to the phase 1 sample, though less prevalent; they tended to emphasize cost and wasteful government spending. Fiscal objections in the phase 2 sample contained noticeably less hyperbolic claims about tax increases or inflation.

And it would have affected more than just our method of measuring distances. Estimates for the cost of the proposed conversion ran around \$100 million. That's \$20,000 per negative letter; not a bad contribution for a handful of citizens.

President Carter can countermand these nonsensical decrees and forbid further ones, for the benefit of the 91 percent who don't want more needless troubles or expense, including wasting the estimated \$200 million on converting speed limit signs.

I am not sure I am convinced by the arguments that the cost of change in Britain and Canada has been “much less than expected;” their sources are understandably vague and on one point they are incorrect or misleading at best: the change has not been completed in Great Britain.

The government has not told us what this will cost. They can't. The cost is not even comprehensible. One thing we know for sure is you and I will pay for it and I can't afford it.

Logistical Objections

Logistical objections in the phase 2 were much more tame than in the phase 1 sample, which repeatedly suggested that the chaos of the conversion would be a “bloodbath” or “mass slaughter.” The various arithmetical advantages of the US customary system were more frequently

discussed in the phase 2 sample.

How many people are there in Florida and the other 49 states that have the ultimate education to grasp your metric system? We have $16\frac{1}{2}$ feet to a rod or pole. How would I survey a hectare($2\frac{1}{2}$)?

I realize that compared to my parents I have been using the present English system for a short time – but it still amounts to my whole life. I know what the system is – I know the units and the conversions. But how long it will take until the system is a functional working part of me (and everyone else over the age of eight), I have no way of knowing. It's just like changing to any new way of doing anything – the new way will gradually become a part of you, but there will be a lot of things you will still be tempted to do the old way because it's familiar.

As a sports writer I fear the change for the simple fact that the sports will be in absolute chaos until the year 2000 trying to read stat sheets and determine records. Consider that all the football fields will be 91.44 meters long. That means a team will have four downs to move the ball 9.144 meters or 914.40 centimeters for the first down.[...] The changes in the sports measurements will create a problem with the record books in that either the current records will have to be converted (O.J. Simpson will no longer have a 2003-yard season but a 1831.5432 meter year) or two record books will have to be kept. More woes for the printer.

The metric system may seem easy to calculate by moving decimal points around but in actual use it is very awkward. The unit 10 upon which it is based can only be divided into halves and fifths. However, 16 ounces can be divided into halves, quarters and eighths. And 12 inches can be divided into halves, thirds, quarters and sixths. The yard can easily be divided into halves, thirds, quarters, sixths, ninths, twelfths and eighteenths.

When the state changes the street and freeway signs from miles per hour to kilometers per hour who is going to change the odometer to coincide? I can foresee many accidents when some driver will think the speed sign has been raised from 55 M.P.H. to 90 M.P.H.

Value Puzzlement

Value puzzlement objections were frequent in the phase 2 sample and were expressed in a wider variety of ways. Nevertheless, they convey the same confusion about the value of conversion.

I have yet to hear advanced any compelling reasons for burdening the ordinary citizens with the metric system.

Changing at this point in time, to me is the biggest crock of fish of which I've ever heard. If I could see one bit of use out of switching then I would be all for it.

I wonder if any of your readers can tell me why we need the metric system!

Besides the waste of money. I don't see any gain for the American people by forcing us to abandon our system of measurement in favor of the metric system.

Discussion

*RQ*₁&*RQ*_{1.1}: Economic Reasoning and Path Dependence

Considering the findings presented above, we affirm H_1 : the majority of letters written to the FHWA employed economic reasoning. As expected by the economic literature, issues of the cost of transition from one standard to another featured prominently in arguments against conversion, as did skepticism about the value of conversion, and general opposition to government spending.

At the same time, our findings also support H_2 : external issues such as nationalism featured prominently in the letters written in protest of the conversion to the metric system. In most letters, external and economic reasoning were used to object to the metric system. This implies that future discussions of conversion should take both lines of reasoning into account when considering the reaction of the public.

With regard to *RQ*_{1.1}, we found substantial, though inconclusive support for H_3 and H_4 . Though neither path dependence nor then-contemporary issues are reflected in a majority of cases, they represent a combined 42% of the phase 1 sample. At the very least, this suggests that both historical and contextual issues play an important role in decisions about standards. These findings do not, however resolve whether the metric system, or standards in general adhere to theories of path dependence as outlined in the economic literature.

*RQ*₂: Themes of Argument

Though the findings presented under *RQ*₂ do not test specific hypotheses, they do lend themselves to interpretation, and may serve as the basis for future research.

Our findings appear to confirm Buchanan and Chang's(1997), findings that cost, ethnocentrism¹⁶, and confusion are significant sources of objection. We expand upon their findings in

¹⁶Buchanan and Chang use terminology slightly different from ours. Their use of ethnocentrism and cost are

developing other sources of objection such as fear of structural or ideological change in government, and value puzzlement.

The prominence of logistical objections is unsurprising. It is expected by previous studies on the metric system, and discussed as a transition cost in the economic literature. The frequent mention of illiterates as posing a logistical obstacle, however, is something of a puzzle. This may be associated with the use of “new math” and phonics as education techniques introduced in the 1960’s. While phonics are not mentioned directly in any sampled letter, the “new math” method is mentioned several times in conjunction with the problem of young graduates who cannot perform basic arithmetic. It seems unlikely that illiteracy as a logistical obstacle is a line of argument that would continue to be used today. General confusion and other logistical concerns, however, would likely continue to be a theme of objection if conversion were attempted today.

The presence of method-based objections, fiscal objections and fear of structural or ideological change in government all conform to politically conservative ideologies in their implicit advocacy for small government. Indeed, these themes of argument seem to occur perennially, any time new government programs or regulations are introduced. The recent healthcare debate, for example was replete with claims that the US government was navigating us towards communism, that the legislation would bankrupt the country, and that the legislation was passed against the will of the people.

The theme of American exceptionalism is expected by Buchanan and Chang’s study and reflects a degree of brazen truculence towards any attempt to accommodate foreign nations or the broader global community. The suggestion, frequently offered in letters espousing American exceptionalism, that the rest of the world should abandon an otherwise universal standard to adopt ours reflects an excessively nationalist attitude that borders on jingoism. At the same time, the theme of American exceptionalism occurs frequently with the theme of fear of structural or ideological change and in a way that reflects the long-running fear of American decline also frequently espoused by the political right.

roughly analogous to our use of the terms American exceptionalism and fiscal objections

Additional Comments

Given our findings for the use of normative reasoning and the themes that emerge from *RQ*₂, it seems that much of the opposition to the metric system lies not in any genuine concern about our system of weights and measures, but in the symbolism of the metrication effort as a concrete manifestation of more troubling, broader trends or ideological concerns. Specifically, the metrication effort is an ideal symbol for ambiguous trends or complex issues.

Consider, for example, the long-running claims about the decline of US dominance in the world. For the average person, evidence of these claims seems lacking. Most ways of indicating a decline in power seem to reference issues that are either broad, or far removed from daily US life. Further, many ways of indicating a decline in power seem to require reference to extremely complex issues such as inflation or trade imbalances that have no clear cut solution. The metric system, however, is comparatively simple, and the metrication of US highways would have a direct, easily observable effect on the lives of US citizens. When viewed from a perspective that emphasizes the metric system as a foreign standard, then highway metrication becomes an ideal symbol for encroaching foreign influence and thus a decline in US power.

Viewing the metric system in this way, as a symbol, also helps us to understand the anger that pervades the sample letters. Specifically, it would seem that, using this view, the anger espoused by so many letters is not anger at the proposed metrication in and of itself, but rather it is the culmination of anger towards broader issues such as government spending or globalism.

Similarly, viewing the metric system as a symbol helps us understand some of the overly irrational claims prevalent in the letters. When viewed as a symbol, claims such as, “the conversion will bankrupt the country,” seem to reflect objections to the overall increase in government spending and government deficits, not the actual cost incurred by the conversion to the metric system. The same logic seems to apply to other irrational claims about tax increases, inflation, or big government in general.

***RQ*₃: Sample Comparison**

With regard to phase 2, we should note a couple interesting findings. First, the number of items supporting the metric system was much higher than in phase 1, and is similar to the rates of support found in similar studies on the metric system. The similarity of the proportion

of supportive items to the rates of support found in other studies on the metric conversion support our working assumption that newspaper letters to the editor and editorials function as a barometer of public sentiment. Further, the difference in the rates of support between the phase 1 and phase 2 samples affirms our earlier suspicion that the letters written to the FHWA represent a disproportionately vocal, though majority, segment of the population.

Based on the comparison of themes using the controlled sample, we conclude that in terms of the opposition to metric conversion, issues of cost were over-represented in the letters written to the FHWA. More surprising, however, is that there was no significant difference in the representation of the theme of American exceptionalism. This suggests that, among the opponents of metric conversion, American exceptionalism is a very real issue that requires careful consideration by policy-makers.

Limitations Biases and Error

An initial look at the geographical distribution of letters by state suggests a potential source of error. The sample contained relatively few letters from densely populated states in New England, suggesting that these letters had been omitted from the sampling frame. Closer examination of the logbooks of Docket 77-7 indicates that letters from new England states were present but infrequent both among letters received to Docket 77-7 and within the sample frame specifically. It is possible that geography is a factor in determining a person's propensity to write letters of complaint or resist the metric system, but that is beyond the scope of this study.

Also, we must acknowledge that our findings for RQ_3 rest upon a potentially fragile assumption: that editorials and letters to the editor are an accurate representation of public sentiment. We must acknowledge that items that appear in print are subject to an editorial filter and that it is possible that some papers may have received letters that they chose not to print for a variety of reasons. Depending on the severity of this filter, our results for the phase 2 sample may be somewhat biased. Given the similarity between the level of support for the metric system in the phase 2 sample and the level of support reported in other studies on the metric system, it seems reasonable to assume that the newspaper items collected in the phase 2 sample do represent public sentiment. Further investigation into this potential source of bias is, however, warranted.

Conclusion

At the present time, US metrication is essentially a dead issue. Hopes of robust hard conversion died in the early 1980's when Ronald Reagan disbanded the United States Metric Board. This does not mean, however, that other policy makers cannot learn from its example.

As we have shown, the metric system in the US was contentious not only because of economic issues, but because of normative and ideological issues as well. Policy makers considering changes in other highly visible standards are well advised to take the normative impact of those changes into account. Policy makers might also take some comfort in our finding that those who wrote letters to the FHWA represented a disproportionately vocal portion of the public. If they do not already do so, policy makers may wish to take public comments with a grain of salt.

For scholars, our study raises a number of questions that require further research. This study points to a potential link between political ideology and resistance to standards change that merits further investigation. Additionally, further research is needed to evaluate the theory posited earlier, that the intense reaction to the highway metrication proposal is explained by a theory of the symbolic nature of standards change.

It is important that we continue to study standards and their meaning, for as we move towards a more globalized society, standards will continue to develop as an important issue. The likelihood of vocal and stubborn opposition is foreseeable in at least two areas. The first is the area of computer software, where efforts to turn proprietary software and protocols into both *de facto* and *de jure* standards have met fierce and growing resistance from proponents of open-source standards. The other area is currency, where recent events in the euro zone portend the abandonment of the euro by some countries and the delayed adoption of it by others. In either case, it is likely that the debate will reach beyond the confines of economic benefit and require analysis in terms of cultural impact and significance.

Appendix A: Phase 2 Sample Information

Table 6: Phase 2 Sample Information

Newspaper Name	State of Origin	Number of Items	Percent of Sample
Argus-Press	Michigan	1	1.43
Bangor Daily News	Maine	5	7.14
Beaver County Times	Pennsylvania	1	1.43
Boca Raton News	Florida	1	1.43
Boston Globe ^a	Massachusetts	1	1.43
Chicago Tribune ^a	Illinois	5	7.14
Daily Collegian	Pennsylvania	1	1.43
Daily News	Tennessee	2	2.86
Eugene Register-Guard	Oregon	1	1.43
Florence Times-Daily	Alabama	1	1.43
Fort Scott Tribune	Kansas	1	1.43
Gadsden Times	Alabama	1	1.43
Kentucky New Era	Kentucky	3	4.29
Lawrence Journal World	Kansas	1	1.43
Lodi News Sentinel	California	4	5.71
Los Angeles Times ^a	California	7	10.00
Milwaukee Journal	Wisconsin	5	7.14
Modesto Bee	California	1	1.43
New York Times ^a	New York	2	2.86
News and Courier	South Carolina	1	1.43
Ocala Star-Banner	Florida	3	4.29
Philadelphia Inquirer ^a	Pennsylvania	4	5.71
Pittsburgh Press	Pennsylvania	7	10.00
Rome News Tribune	Georgia	1	1.43
Sarasota Journal	Florida	1	1.43
Spokesman-Review	Washington	6	8.57
Star-News	North Carolina	1	1.43
Victoria Advocate	Texas	1	1.43
Wall Street Journal ^a	New York	0	0
Washington Post ^a	Washington DC	1	1.43
Total		70	100

^a Denotes nationally distributed paper. Items from national papers collected by inspection via microfilm

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