INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

Bell & Howell Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

THE ENGLISH METROLOGICAL STANDARDISATION DEBATE, 1758-1824

by

REBECCA JEMIMA ADELL, B.A.

A thesis submitted to the Faculty of Graduate Studies
in partial fulfillment of the requirements for the degree of

Master of Arts
Department of History

Carleton University
Ottawa, Canada
28 February, 2000

The undersigned recommend to the Faculty of Graduate

Studies and Research acceptance of the thesis

THE ENGLISH METROLOGICAL STANDARDISATION DEBATE, 1758-1824

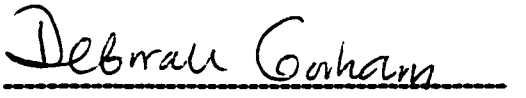
submitted by

Rebecca J. Adell, B.A.

in partial fulfilment of the requirements

for the degree of Master of Arts

Thesis Supervisor



Chair, Department of History

Carleton University

1 May 2000

Abstract

This thesis examines the English debate surrounding the standardisation of weights and measures between 1758 and the passage of the Imperial Weights and Measures Act of 1824. It is argued that the central government, the mercatorial and trades communities, and a group of individual, independently-minded members of Parliament all held distinct views concerning the nature of weights and measures and the importance of metrological reform. As these views were articulated, they contributed to a process of conflict and negotiation between the groups which shaped the standardisation debate and through which the imperial system was constituted.

Acknowledgements

I must first thank Professor David Dean for his supervision and support of my work, and Professor Robert Goheen for introducing me to a number of theoretical possibilities. I am very grateful to all the professors from the History Department who have offered me ideas and support, and to the very helpful and courteous people at the Bedfordshire County Archives who made my first experience in an overseas archive so enjoyable and worthwhile.

I must also thank Michael Holroyd and Peter Watson for suggesting I study measurement, my mother for her feedback, and Michael Billinger for not leaving home.

This thesis is dedicated to Bill Hucker.

Table of Contents

List of Abbreviations

Bedfordshire Record Office	B.R.O.
The Eighteenth Century Microfilm Collection	E.C.
The *Times* of London newspaper	*Times*

Introduction.

Eighteenth-century England was, like many parts of Europe, in many ways highly non-standardised. Weights and measures varied from county to county, and sometimes even between markets within a single county.[1] Among scientists, great innovations in the precision of measurements were made in the late eighteenth and early nineteenth centuries. In the 1770s, John Harrison solved a centuries-old problem by building a chronometer that was able to keep track of a ship's longitude at sea. More powerful refractors were also built to improve astronomical observation.[2] Near the end of the eighteenth century, Jesse Ramsden built a dividing engine that enabled the quick construction of highly precise scales, and, importantly, a market developed for such instruments of measurement as interest spread.[3] This interest in measurement went beyond the physical sciences. Statistics became increasingly popular as people sought to understand and classify the effects of industrialisation.[4] In addition to measuring objects, statistics enabled people to determine average values, which were seen to constitute normal, ideal standards, so that the notion of standardisation also grew.[5]

This period of unprecedented growth of interest in quantification and standardisation has inspired the interest of a number of historians, as well as other social scientists. What seems to have begun with an antiquarian interest in collecting and describing ancient weights and

---

[1] Even local time zones existed. For example, Julian Hoppit mentions that a twenty-eight minute difference existed between Great Yarmouth and Penzance. J. Hoppit, "Reforming Britain's Weights and Measures, 1660-1824", *English Historical Review*, vol. 108 (1993), p. 102, note 2.

[2] L. Pyenson and S. Sheets-Pyenson, *Servants of Nature: A History of Scientific Institutions, Enterprises and Sensibilities* (New York, 1999), p. 273.

[3] L. Pyenson and S. Sheets-Pyenson, *Servants of Nature*, pp. 186-187.

[4] L. Pyenson and S. Sheets-Pyenson, p. 275.

[5] For a general discussion of this phenomenon, see S. J. Gould, *Full House: The Spread of Excellence from Plato to Darwin* (New York, 1996), pp. 38-42.

measures evolved in the early twentieth century into an interest in the scientific and economic implications of the ancient metrological systems; in the technology involved in ascertaining and reproducing standards as well as what they revealed about ancient systems of exchange.[6] Further into the twentieth century, a number of economic historians studying price fluctuations began to examine units of weight and measurement from the less distant past. Again, their interest in historic units lay in what those units could tell the historians about market practices and prices.[7] Some historians of science have also studied European metrological developments, especially the scientific innovations required for the comprehensive reforms of weights and measures brought about by the creation of the metric system in France and the imperial system in Britain two decades later. As science advanced, they argue, the scientific spirit of impartiality and objectivity led men to inevitably seek transparent metrological structures based on absolute and invariable natural standards in order to remove all ambiguity and the possibility of human adulterations from the measuring process.[8]

A number of historians, sociologists and anthropologists, however, do not agree with the assertion that the development of objective metrological systems resulted solely and inevitably from impartial scientific research. Even the notion of finding a truly invariable physical standard in nature is questioned by numerous writers. Witold Kula, for example, argues that "traditional doctrines required that measures be immutable. Yet there is no immutability in life,

---

[6] F. G. Skinner, *Weights and Measures: their ancient origins and their developments in Great Britain up to AD 1855* (London, 1967), pp. 1-2.

[7] For example, see J. Thirsk, general ed., *The Agrarian History of England and Wales, vol. 6, 1750-1850,* edited by G. E. Mingay (Cambridge, 1989), especially pp. 1117-1155; H. D. Smith, *Shetland Life and Trade* 1550-1914 (Edinburgh, 1984), p. 42.

[8] For a full historiographical discussion, see chapter one.

for time wears away all things".[9] These writers have also identified the fact that not only were technical improvements required in order to create and implement new metrological systems, but a fundamental change in the conception of the purpose of weights and measures also had to occur. The pre-metric and pre-imperial mensurative systems involved accepted amounts of variation of weights and measures in order to accommodate a variety of factors, such as changes in the availability of goods, the quality of products being measured, and even the social status of those involved in commercial transactions. In contrast, the imperial and metric systems imposed uniform, constant units on all goods, which were not susceptible to any such social considerations.[10] As a result, these writers have sought to discover why it came to be believed that naturally constant standards, rather than man-made standards, could and must form the basis of metrological systems. They have examined such issues as the political contexts of the standardisation movements, the growth of interest in quantification more generally, and, especially, issues of central and local power.

This thesis will examine some of the specific historical circumstances in which the English debate surrounding the development of the imperial system of weights and measures took place leading to the adoption of the Imperial Weights and Measures Act in 1824. It will not be argued that the success of the imperial system was the result of the inevitable linear progression of science toward the ultimate goal of absolute knowledge of the physical world.

---

[9] W. Kula, *Measures and Men* (Princeton, 1986), p. 79.

[10] Bruce Curtis, a sociologist, describes this shift as a change from "synthetic-quanlitative measurement systems", in which metrological variation was common, to "abstract-quantitative measures" which "presume formal equality among parties to exchange relations". B. Curtis, "From the Moral Thermometer to Money: Metrological Reform in Pre-Confederation Canada", *Social Studies of Science*, vol. 28, no. 4 (August, 1998), pp. 547-548. See also W. Kula, *Measures and Men*, chapters 7 and 8; K. Alder, "The Metric Revolution: A Social History of the Metric System in France", *Proceedings of the Annual Meeting of the Western Society for French History*, no. 21 (1994), p. 101.

Nor will it be seen, on the other hand, as solely the result of the government's imposition of a radically new and uniform metrological system on an unwilling population in an attempt to effect radical social change or to execute a physical display of its own authority. Rather, it will be argued that several different social groups held distinct understandings of both the nature and purpose of weights and measures as well as the importance of their reform. The central government, the mercatorial and commercial communities, and a group of individual, independently-minded members of Parliament, all articulated discrete views on these subjects, and as these views were articulated they contributed to a process of conflict and negotiation between the groups which ultimately resulted in the adoption of the imperial system in 1824.

The imperial system did involve the adoption, as its basis, of invariable natural standards and it did require the shift from a traditional metrological system, in which variation was tolerated, to one of uniformity and objectivity under which "measures become indifferent to differences among persons".[11] However, unlike the French move to the metric system in 1793, British metrological reform was not part of a revolutionary social upheaval, nor did it introduce a completely new and unfamiliar system of weights and measures. Most existing units of both weight and measurement were altered slightly in order to conform to the chosen natural standards, while some units, in particular troy units of weight, remained unaltered and their dimensions were merely legally fixed in relation to the new standards. Therefore, both the fundamental conceptual changes required for the acceptance of the new structure and the conservatism of the reforms were important aspects of the imperial system. That, in the end, the system contained these two disparate elements will be seen to reflect the fact that the

---

[11] B. Curtis, "From the Moral Thermometer to Money", p. 548.

development and implementation of the system involved the interaction of the several different, and sometimes opposing, interests.

Theoretical Approach.

The historiographical debate surrounding the development and adoption of the imperial system in 1824 is characterised by arguments emphasising the objectivity of this metrological structure and with which it was developed, countered by arguments stressing the subjective forces, in particular political concerns and issues of power, influencing the nature and success of the imperial system. When this interpretive division is combined with the fact that almost all of those writing on this subject appear to agree that a fundamental conceptual shift necessarily occurred before a system such as the imperial one could be seriously considered, the adoption of a theoretical approach allowing one to explore questions of objectivity, subjectivity, and epistemology becomes essential. As a result, this thesis will explore some interpretive possibilities provided by postmodern, or linguistic turn, theory. It will be argued that discursive analysis can be very helpful in the attempt to explain the past when it is used in a constructive and open manner, and, moreover, when it is seen to add levels of meaning to different historical interpretations rather than eliminating other explanatory possibilities.

To begin with, postmodern theory allows one to seriously suggest that an ostensibly objective entity such as the imperial system can never, in fact, be objective in the sense in which this word is commonly understood. Not only is the implementation of the new metrological structure seen to have been rendered subjective by the influence of politics, economics, and any number of other factors that are not seen to be objective, but the very idea that it is possible for

humans to gain the ultimate, unimpeded access to the physical world, which underlies the arguments of historians of an empiricist persuasion, is brought into question. Instead, postmodern theorists argue that the only way in which one can understand the world is through the use of language because one's subjectivity can only develop as one uses language. As Charles Taylor explains, for postmodern theorists, "thought, that is, the clear, explicit kind of thought we need to establish new coinages, new relations of 'signifying', is itself explained from expression."[12] As a result, one cannot engage with the world without applying to it certain previously constituted notions, which implies that even when dealing with physical objects in nature one can never enjoy unmediated access to them, or be purely objective. This is perhaps most simply put by Stephen Jay Gould, who asserts that "objective nature does exist, but we can converse with her only through the structure of our taxonomic systems".[13] Therefore, the category of objectivity is no longer a useful category to apply to human activity.

This rejection of the possibility of pure human objectivity allows one to move beyond deciding whether the development of the imperial system was predominantly objective or subjective. However, what is not so clearly stated in the work of Charles Taylor, Michel Foucault, and other postmodern theorists is that just as this theory enables one to avoid the category of pure objectivity, it must also, logically, allow one to argue that nothing can be purely subjective either. The category of subjectivity must become an equally false concept according to the postmodern conception of language. If language is a fundamentally social

---

[12] C. Taylor, "Hegel's Philosophy of Mind", in C. Taylor, *Human Agency and Language: Philosophical Papers, vol. 1* (Cambridge, 1996), p. 91.
[13] S. J. Gould, *Full House*, p. 39.

phenomenon, that functions "inter-subjectively",[14] or communally, and if it functions according to a set of rules of its own, then the individual's understanding of the world must always be at least partly shaped by forces exterior to the individual. If one accepts this argument, it becomes possible to avoid narrowing one's field of study to the point at which one examines a single discursive formation since such a formation, in a manner similar to an individual subjectivity, is shaped as it comes into contact with other social phenomena.

Another important clarification that must be made regarding the use of postmodern theory in this thesis involves the ambiguous status of human agency found in many theoretical writings. In particular, Michel Foucault's ideas concerning the extent of the epistemological dislocation caused by discursive change, and concerning historical discontinuity, present serious problems for a historian attempting to identify large historical processes. Foucault argues that the historian must cease to seek a historical continuity that is based on the traditional assumption of a fixed, rational human subjectivity and a teleology driven by progress and improvements in the human condition: "Continuous history is the indispensable correlative of the founding function of the subject".[15] Instead, Foucault argues that because human subjectivity is constituted through language, and because discourses change abruptly and radically rather than developing gradually and smoothly, history itself is fundamentally discontinuous. Foucault outlines the implications of this position in a haunting passage:

> Is there not a danger that everything that has so far protected the historian in his daily journey and accompanied him until nightfall (the destiny of rationality and the teleology of the sciences, the long, continuous labour of thought from period to period, the awakening and the progress of consciousness, its perpetual

---

[14] This term is used frequently by Charles Taylor.

[15] M. Foucault, *The Archaeology of Knowledge* (London, 1972), p. 12.

> resumption of itself, the uncompleted, but uninterrupted movement of totalizations, the return to an ever-open source, and finally the historico-transcendental thematic) may disappear, leaving for analysis a blank, indifferent space, lacking in both interiority and promise?[16]

When this picture of historical discontinuity, characterised by radical discursive ruptures, is combined with the point raised above, that one's understanding of the world cannot transcend one's discursive reality, it does not appear possible that humans can either access the past in any objectively true manner, or consciously effect any real social change. At the same time, however, Foucault, as well as a number of historians who support his ideas, appear to believe that they can interpret the past in a truer, more meaningful manner than other historians. A clear example of this can be seen in the preface of Mary Poovey's book, *A History of the Modern Fact*. Poovey states that she is drawing on Foucault's theoretical position, and that she has adopted a "constructed and unconventional" approach. She claims to have done this in order to avoid the anachronism that occurs in many more theoretically traditional studies: "I want to avoid conventional histories' tendency to consolidate their objects of analysis artificially and retrospectively."[17] Therefore, while she explicitly states that her own work offers a construction of the past, she assumes the authority to categorise, and criticise, the constructions of other historians as being created "artificially". There is, arguably, a fundamental contradiction in this argument. If both her history and the histories she criticises are constructions, then the idea that one is artificial whereas the other is not is problematic.

A resolution to this problem can, arguably, be found if one adopts a new conception of

---

[16] M. Foucault, *The Order of Things: An Archaeology of the Human Sciences* (New York, 1994), p. xxii of the preface.
[17] M. Poovey, *A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society* (Chicago, 1998), p. xiii of preface.

what constitutes a real thing, in particular what constitutes a fact. If the extent of human epistemological capabilities lies in the ability to create meaning, and facts, only within the confines of a discursive framework, then the nature of a fact must include its being discursively, or socially, constructed. This means, among other things, that all histories will be constructed, since, as Charles Taylor explains, "we can often experience what it is like to be on the outside when we encounter the feeling, action, and experiential meaning language of another civilization. Here there is no translation, no way of explaining in other, more accessible concepts. We can only catch on by getting somehow into their way of life, if only in imagination."[18] In other words, to adopt Stephen Jay Gould's statement, "we should revel in our newfound status and attendant need to construct meanings by and for ourselves".[19] Consequently, this approach forces one to accept the notion that people are not capable of either creating or ascertaining anything universal, or transcendent. At the same time, however, by asserting that the possibility of creating meanings, and thereby effecting change, within one's own social environment does exist, a space for human agency within discourse opens up. If people are capable of creating social constructions with limited meaning, then they must be capable of creating facts, if facts are also seen to have meanings limited to the discursive framework in which they are created.

All of the points raised in this section will be examined in greater detail, in chapter five, in relation to the interaction between the various groups involved in the metrological standardisation debate. The question of the objectivity of the imperial system will be addressed,

---

[18] C. Taylor, "Interpretation and the Sciences of Man", in C. Taylor, *Philosophy and the Human Sciences: Philosophical Papers II* (Cambridge, 1985), p. 24.
[19] Gould, p. 18.

the problem of historical discontinuity will be weighed against the historical development of the issue of standardisation, and the issue of human agency will be examined in terms of the roles played by various groups in the creation and implementation of the imperial system.

Methodology.

The question of why the British government chose to adopt the imperial system in 1824 is very difficult to answer from the legislation or other parliamentary sources examined in this thesis. As will be seen in chapter two, the only eighteenth-century parliamentary committee appointed to look into the issue of weights and measures, and which produced reports,[20] advocated the adoption of an invariable natural standard, the length of the pendulum vibrating seconds in the latitude of London at a fixed temperature, against which to gauge the yard and on which to base a new metrological system. Legislation to this effect was not successful, however, and it was not until the second decade of the nineteenth century that another parliamentary committee investigated the possibility of such fundamental metrological change. Beginning in 1814, the committees appointed to look into weights and measures were appointed to determine which would be the best natural standard to adopt. Somewhere in the lapse of time between the appointment of committees, therefore, the decision that a new metrological system must be based on such a standard was already made. Julian Hoppit examined a wide variety of government documentation, but was no more successful in his search for unambiguous evidence, as he openly admits in his article "Reforming Britain's Weights and Measures, 1660-

[20] A second eighteenth-century committee was formed in 1790, but it never published a report, and no other records of its activities have been found.

1824": "it is very difficult to uncover the government's motives here. In theory the relevant records ought to be found among the papers of either the Treasury or the Board of Trade at the PRO, but the only documents found dealing with the question are concerned with the post-1824 problems of implementing the imperial system."[21]

As a result of this difficulty, one is required to infer possible answers to this question from a number of sources, including the parliamentary material. This explains why none of the historians who have written about metrological standardisation in England in this period is able to come to a definitive conclusion in this regard. For the same reason, this thesis will not present conclusive primary material supporting the arguments made in it. Instead, the arguments made will be constructed by engaging primary material with theoretical questions, and the use of primary materials will vary in each chapter. In chapter two, parliamentary sources, including bills, statutes, committee reports, and debates will be examined. Some inconsistencies in the government's arguments will be pointed out, in order to lead into a discussion of the government's motives for deciding to pursue metrological standardisation when, and how, it did.

One of the most frequently occurring inconsistencies in the parliamentary sources was that while many of them stated that the government sought standardisation in order to improve the country's commercial situation, the few insights into the views of merchants and tradesmen provided by the same sources suggest that metrological standardisation was not seen by these people to be as potentially beneficial to trade as the government suggested. Therefore, in chapter three, books and manuals written either by or for merchants and tradesmen are

---

[21] J. Hoppit, "Reforming Britain's Weights and Measures, 1660-1824", p. 104, note 2.

surveyed. It is revealed that these groups, which, importantly, were influential in terms of central politics despite their lack of representation in the unreformed parliament, appear to have had well established, widely known practices concerning weights and measures for the purposes of both measuring craftsmen's work and of trading goods. This literature is also contrasted with a number of scientific treatises in order to demonstrate the very different concerns held by these disparate groups, all of which were consulted and talked about by the government in its research on weights and measures. By demonstrating that the commercial communities had a unique understanding of weights and measures, these findings reinforce the suggestion made in chapter two that the government had its own set of concerns in seeking the adoption of the imperial system. Moreover, the government appears to have been faced with a lack of support for radical metrological change from this large and influential group, which most likely influenced its choice of a metrological reform with highly conservative characteristics in 1824.

Chapter two also reveals the fact that on numerous occasions before the passage of the Imperial Weights and Measures Act, the issue of standardisation was raised in Parliament by individual members. These members also served as justices of the peace in their home counties, where they dealt with problems related to weights and measures at the quarter and petty sessions. The best known of these individuals was Samuel Whitbread, a member from Bedfordshire. Chapter four explores the case of Bedfordshire in order to gain insight into the manner in which local problems with weights and measures informed these independently-minded members of Parliament. It will be argued that Whitbread's efforts to improve his county's weights and measures led him to pursue the matter in Parliament, and that his exposure to standardisation debates at Westminster influenced his activities in Bedfordshire. The

interconnection of Whitbread's local and central experiences appear to have created yet another distinct understanding of weights and measures, one in which Whitbread favoured a general standardisation but without any radical changes. Although one of the two other individual members of Parliament who repeatedly raised the issue of metrological reform in Parliament made suggestions that differed from those of Whitbread, they all had in common the fact that they each displayed significant concern for the common people whom they represented and for whom they sought standardisation. In addition, their efforts to achieve change in this area made weights and measures into an established issue in Parliament, so that when the government came to favour general standardisation in the early nineteenth century, the debate was familiar and had already been shaped by these individuals.

Finally, the issues raised over the course of the first three chapters will be drawn together in chapter five. The discrete understandings of weights and measures and the importance of metrological reform found among the groups studied will be seen to have each contributed to the development of the imperial system and the passage of the Imperial Weights and Measures Act in 1824. This last chapter will begin with the interpretation of the government's movement towards favouring the comprehensive metrological reforms involved in the adoption of the imperial system in terms of the epistemic changes which Foucault argues occurred in western Europe near the end of the eighteenth century in his book, *The Order of Things*. This interpretation will then be built upon through the argument that while such a discursive change as that described by Foucault does appear to have affected the government, the interests of the other groups studied also contributed to the imperial system's constitution. In addition, the issues raised in the previous section of this introduction concerning postmodern

theory will be examined in relation to the primary material presented in the second, third, and fourth chapters.

Chapter 1. The Historiography of English Metrology.

The historiography of English metrology in the eighteenth and early nineteenth centuries is scarce and fragmented. Very few books and articles on English metrology alone have been written, so that one must examine a variety of different types of sources. The works done on English metrology all assume different theoretical and methodological perspectives, which leads them to come to different conclusions. A number of sociological and anthropological studies concerning metrology offer possibilities of other approaches to the issue, while other historical works that look at measurement in different periods or countries also offer insights into the eighteenth- and early nineteenth-century English experience. What then emerges is a historiographical compilation that provides a large amount of information and a number of possibilities for further study on the issue, but that lacks cohesion and contains what appear to be a number of contradictions. This chapter will describe this historiography, outlining the questions raised when the historiography is considered as a whole.

To begin with, many books on the history of science do not discuss the development of the imperial system of weights and measures. Most of these books focus on the vital role played by measurement in the evolution of the scientific method of empirical experimentation, while the issue of problems in everyday weights and measures in England is not mentioned in most cases. In Stephen F. Mason's *A History of the Sciences*, for example, France's adoption of the metric system during the early stages of the French Revolution is discussed without any reference to work in this area by English scientists.[22] Other historians of science who focus more specifically on measurement do not address the political debate surrounding standardisation

[22] S. F. Mason, *A History of the Sciences* (New York, 1962). For Mason's discussion of France's adoption of the metric system, see pp. 335-338.

either. Thomas Kuhn and Ian Hacking both discuss the process by which measurement and quantitative evidence became essential components of scientific experimentation in the nineteenth century.[23] Kuhn argues that in the seventeenth and eighteenth centuries, quantitative measurement was applied to many scientific questions that had already been studied qualitatively for centuries. It was not until the nineteenth century that precise quantification assumed the prestige it now enjoys in the physical sciences because, as Kuhn explains, "most of the eighteenth century was needed for the additional exploration and instrumentation prerequisite to quantitative exploitation."[24] Hacking discusses similar advances in quantification in this period and he explicitly declines to examine the issue of standardisation of everyday weights and measures: "The everyday practice of measuring may need no explanation ... There is, however, another class of more memorable measurements that is problematic; it includes many of the great measurements of history"[25], for example Cavendish's weighing of the earth in 1798. Therefore, while these works provide the scientific context for the growth of precise measurement in general, there is little to be gained from them in terms of the problem of standardisation of everyday weights and measures used in trade.

Moving closer to the English context, a number of other historical studies that are devoted to measurement do not discuss the standardisation process in the eighteenth and early nineteenth centuries in any detail. However, many interesting facts can be ascertained from these works, which help to contextualise the issue. For example, Bruno Kisch points out, in his *Scales*

---

[23] T. Kuhn, "The Function of Measurement in Modern Physical Science", in T. Kuhn, *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago, 1977), pp. 178-224. I. Hacking, "Measurement", in I. Hacking, *Representing and Intervening* (Toronto, 1981).

[24] T. Kuhn, " The Function of Measurement in Modern Physical Science", p. 216.

[25] I. Hacking, "Measurement", p. 235.

and Weights: A Historical Outline, that into the eighteenth century and in many markets, the weighing of goods during business transactions was often done simply with one's hands.[26] This serves to remind the reader how new the notion of standardisation must have been to a very large number of people. Kisch also mentions very briefly that in 1818, Lord Castlereagh, who was at this time Foreign Secretary, collected a set of weights from all the countries with which England had political and economic ties for "practical and commercial" reasons, thus making a connection between weights and measures and high politics.[27] Similarly, in his *The World of Measurements*, M. Arthur Klein points out that "So long as there was an England there were persistent problems of units of measurement".[28] Problems concerning weights and measures were discussed at the annual meetings held by Angle and Saxon reeves and eventually, in the late tenth century, a statute was passed under King Ethelred the Unready which lists metrological abuse as one of the realm's most serious problems[29]. This suggests that the eighteenth-century system of local enforcement of legal weights and measures, complemented by somewhat vague central legislation, had very ancient roots.

Ronald E. Zupko's book, *Revolution in Measurement*, and Alfred W. Crosby's book, *The Measure of Reality*, deal with the development of the notion of standardisation of various types of measurement in Western Europe[30]. Zupko, in particular, is interested in the ultimate metrological goal of the rise to global predominance of the metric system, and he locates the movement towards standardisation and the imperial system within the rise of science, beginning

---

[26] B. Kisch, *Scales and Weights: A Historical Outline* (New Haven, 1965), p. 1.

[27] B. Kisch, *Scales and Weights*, p. xv (preface).

[28] M. A. Klein, *The World of Measurements* (New York, 1974), p. 28.

[29] M. A. Klein, *The World of Measurements*, pp. 28-29.

[30] R. E. Zupko, *Revolution in Measurement: Western European Weights and Measures Since the Age of Science* (Philadelphia, 1990). A. W. Crosby, *The Measure of Reality* (Cambridge, 1997).

in the early seventeenth century. Crosby also looks at the role of precise measurement in the emergence of "the rationalistic character of modern culture" which was closely related to the rise of science, but his study stops in the seventeenth century.[31]

The most comprehensive study of the evolution of British metrology is undoubtedly Ronald E. Zupko's book, *Revolution in Measurement*. Zupko provides a detailed chronology of the legislative developments related to weights and measures from the early seventeenth century through to the 1960s. He outlines what he believes was a determined progression, due to the emergence of the modern experimental method in the Scientific Revolution, towards the adoption of the imperial system of measurement in 1824.

According to Zupko, throughout the Middle Ages and until the beginning of the seventeenth century, "confusion reigned" in terms of weights and measures.[32] This is because there existed a huge number of units of weight and measurement, which varied greatly between regions and towns, and the physical standards needed to make accurate copies were neither kept in good shape nor reproduced as needed. Unlike the scientists of the seventeenth century who were influenced by Baconian empiricism, medieval scientists did not take an interest in "using hypothesis and experimentation;" instead they "...strove to perpetuate and disseminate the accumulated lore of the past."[33] Zupko adds that "to make matters worse, medieval philosophers and other educated persons were influenced all too often by magic, the occult, astrology, symbology, word and number associations, and an odd assortment of unnatural or supernatural beliefs."[34]

---

[31] A. W. Crosby, *The Measure of Reality* (Cambridge, 1997), p. 230.
[32] R. E. Zupko, *Revolution in Measurement*, p.28.
[33] R. E. Zupko, p.32.
[34] R. E. Zupko, p.32.

Positive change began in the early seventeenth century, as the Scientific Revolution gradually occurred. In this period of "early revision" of weights and measures, many innovations were made which, in time, played important roles in the standardisation scheme of 1824. Despite these changes which looked forward to comprehensive standardisation, Zupko claims that early revisionists mistakenly attempted to merely repair the existing, "chaotic" system, rather than to implement a completely new and uniform one. The failure on their part to envision much more radical changes, in particular changes of the nature of those implemented in 1824, doomed their reforms to failure. On this basis, he argues that the only long-term positive element attributable to the early reforming ideas was that out of them eventually came "...the inspiration for the conceptualization and implementation of a radically new program in the later eighteenth century."[35]

Zupko provides a huge amount of information. However, his book is based on two premises which prove to be problematic when his work is compared with that of other historians writing on metrology. To begin with, the unifying theme of Zupko's work is that the legislation of 1824 "was a ray of light out of a metrological tunnel" and that all preceding standardisation legislation should be judged according to it. Such an assertion leads one to question the usefulness of deciding that early seventeenth-century thinkers were mistaken because they did not attempt a complete overhaul of the metrological body. It is perhaps not enlightening to characterize the efforts of a century and a half as merely a catalogue of mistakes and missed opportunities. Zupko's assertion presumes that these seventeenth-century thinkers were capable of thinking in the same way that early nineteenth-century thinkers thought.

---

[35] R. E. Zupko, p.43.

Secondly, Zupko does not ask why it was decided that a universalisation of weights and measures was necessary, outside the context of the Scientific Revolution. The lack of other suggestions leads Zupko to imply that as people acquired more sophisticated reasoning capacities and the scientific method of observation and experimentation, they inevitably sought to improve the accuracy and universality of weights and measures. While this probably was an important factor, one becomes wary of Zupko's tendency to discount, or discuss only very briefly, the views of those who did not favour standardisation. That he does not consider it necessary to discuss opposition to standardisation in any depth has the effect of removing the metrological debate from the political, economic, and social contexts in which it occurred, and which also influenced the development and adoption of the imperial system.

While Zupko dwells exclusively on reform at the level of the central government, Richard Sheldon, Adrian Randall, Andrew Charlesworth, and David Walsh explore the issue of resistance to standardisation efforts at the local level.[36] They question the commonly accepted assertion of economic historians that a national grain market emerged in England in the eighteenth century. According to Sheldon et al., the collective resistance of the common people prevented enforcement of the legislation that made the Winchester bushel the statutory measure for corn until at least the second decade of the nineteenth century. While large landowners and farmers supported conforming to the statutory measure, corn merchants, smaller farmers and the common people who owned no land fought against the enforcement of conformity, as they felt it limited their ability to negotiate transactions in the local markets. Furthermore, the

---

[36] R. Sheldon, A. Randall, A. Charlesworth, D. Walsh, "Popular Protest and the Persistence of Customary Corn Measures: Resistance to the Winchester Bushel in the English West", in A. Randall and A. Charlesworth, eds., *Markets, Market Culture and Popular Protest in Eighteenth-Century Britain and Ireland* (Liverpool, 1996), pp. 25-45.

magistrates often did not strictly enforce complete conformity. The authors claim that this indicates support on the part of the magistrates for the lower classes: "Some might regard the failure to enforce the Winchester measure as evidence of the weakness of the magistracy. The persistence of the non-standard bushels, however, is evidence of the triumph of localism and local economic self-interest and indicative of the pragmatism of the justices."[37] This suggests the lower classes enjoyed a significant amount of agency in this regard.

This argument compares very interestingly with Zupko's work. The notion that, at the local level, the urge to standardise weights and measures was met with suspicion and animosity by many people for so long is not explored by Zupko. This leads one to believe that the issue was far more complicated, and that it evolved less smoothly, than Zupko suggests. However, Sheldon et al. do not explore the relationship between local resistance and the eventual success of central reform. They do claim to be interested in questions of power and agency when they assert that "historians need to pay more attention to the artefacts of material culture and to everyday practices, for both of these reflect and embody social relations and expressions of power."[38] But instead of returning to their initial claim that their evidence undermines the notion that a national grain market developed in eighteenth-century England, they seek to defend the actions of the lower classes from accusations of backwardness and conservatism. For this they draw on anthropological theory to conclude that,

> Given the fact that the Winchester bushel itself had a long pedigree and claim to customary usage, resistance attempts to establish this measure in place of local customary measures might be better understood, not as blind acts of hostility to the new, but as improvised defensive performances drawn from a repertoire of

---

[37] R. Sheldon et al., "Popular Protest and the Persistence of Customary Measures", p. 34.
[38] R. Sheldon et al., p. 44.

customary claims based upon a historical memory open to selective recall.[39]

When Sheldon et al. do raise the question of why local resistance ultimately failed, they provide one short paragraph alluding to aspects of national politics, ending with the claim that "while a sea change [in central politics] may well have been taking place, the reasons for the apparent collapse of sturdy localism in defence of customary measures are much harder to account for."[40] Therefore, while their article raises many very interesting questions regarding market relations and the reasons informing local resistance to metrological reform, and thus provides a new dimension to the issue of weights and measures standardisation, one is left with a sense that, between their work and that of Zupko, there is a large space still to be explored. Were parliamentarians drafting metrological legislation aware of local resistance to standardisation? Did they take this resistance into account, or was its ultimate failure the result of Parliament simply imposing rules to be followed? What was the real purpose of standardising legislation if the lower classes were correct in their suspicion of it?

Avril D. Leadley's article, "Some Villains of the Eighteenth-Century Market Place", provides another interesting dimension to the issue of metrology at the local level.[41] Her work focuses on the abuses and frauds committed during transactions at local markets, which she characterises as some of "the less dramatic criminal practices which were a major feature of market town life."[42] She argues that part of this crime was the result of the confusion surrounding weights and measures, rather than deliberate criminal activity. At the same time,

---

[39] R. Sheldon et al., p.44.
[40] R. Sheldon et al., p. 43.
[41] A. D. Leadley, "Some Villains of the Eighteenth-Century Market Place", in J. Rule, ed., *Outside the Law: Studies in Crime and Order 1650-1850* (Exeter, 1982), pp. 21-34.
[42] A. D. Leadley, "Some Villains of the Eighteenth-Century Market Place", p. 22.

she points out that while a certain amount of metrological fraud was tolerated by the people trading at the markets, if the incidence of fraud rose significantly the local authorities were often urged by the local population to take action. Her study suggests that there was more involved in the problem of weights and measures at the local level than the conflict between "sturdy localism" and central reform, and leads one to ask why a certain amount of abuse was allowed to continue into the nineteenth century. Did the local authorities neglect their duties in this regard? Was any substantial action on the part of the authorities even possible?

The work of Julian Hoppit attempts to explain the local metrological situation in eighteenth- and early nineteenth-century Britain in terms of the standardisation process at the governmental level. In his article, "Reforming Britain's Weights and Measures, 1688-1824"[43], Hoppit outlines the extent of metrological fraud occurring in various places in the country. He attributes this continued fraud in part to the decline of the power of the Clerks of the Market, who were responsible for verifying weights and measures in the marketplace and whose authority was eventually taken over by justices of the peace. Furthermore, he warns that it is easy to overestimate the amount of abuse that took place, because "divergence from the norm was always likely to attract comments."[44]

Hoppit then discusses possible reasons for the drive to reform weights and measures. He emphasises the fact that the government was not involved in this process until the end of the wars with France in 1814-15; before this, reports and bills were introduced by individual Members of Parliament who conducted the required research on their own. Hoppitt argues

---

[43] J. Hoppit, "Reforming Britain's Weights and Measures, 1688-1824", *English Historical Review*, vol. 108 (1993), pp. 82-104.

[44] J. Hoppit,"Reforming Britain's Weights and Measures, 1688-1824", p. 85.

that, in this earlier period, the parliamentarians who supported these efforts were motivated by a sense of moral obligation combined with their firsthand experience of the problem encountered in their duties as justices of the peace: "it would appear that a number of those most concerned with weights and measures issues were liberal in politics and activated by a desire that the market-place be 'just' – though those concerns may have been more the product of their activities as justices than political idealism."[45] In this way, Hoppit makes a direct link between the local situation and central reform.

After 1814, when the government began to appoint committees to investigate the various possibilities for reform offered by the individual members (Lord Carysfort in 1758-9, Sir John Riggs Miller in 1790, and Samuel Whitbread in 1814), it was the scientific community that assumed control of the debate and shaped it according to current scientific practice as well as their "thirst for knowledge and the search for perfectibility."[46] Hoppit argues that the scientific community's desire for reform fits well with other reforming impulses in this period, such as the reform of the calendar, improvements in a number of different kinds of measurement, including longitude, time, pressure, and temperature, the development of mean time (1792), the Ordnance Survey (1791), and the establishment of the census (1801).[47] Once the technology required for metrological standardisation was perfected, which Hoppit claims occurred by around 1820, more radical legislation could be seriously considered. As he observes, "it is striking that the government appears to have played so little part at this juncture."[48]

---

[45] J. Hoppit, p. 97.
[46] J. Hoppit, p. 103.
[47] J. Hoppit, p. 104.
[48] J. Hoppit, p. 104.

Hoppit concludes by emphasising the fact that metrological standardisation did not occur as naturally, or inevitably, as other historians suggest. It was, rather, the repeated efforts of concerned individual members of Parliament who had seen for themselves the sustained problems and abuses surrounding everyday weights and measures that brought the matter to the attention of the central government. The government was able to deal more fully with the problem once the wars with revolutionary France finally ended, at which point the scientific community had perfected a programme of standardisation and was willing to play an active role in its implementation. This fortunate coincidence produced the imperial system in 1824.

Both Sheldon et al. and Hoppit allude to a pre-industrial "moral" economy, which led the lower classes to believe they enjoyed certain fundamental rights concerning the purchase of agricultural produce. In many instances of food rioting, for example, rather than simply taking food from farmers or dealers, the rioters often demanded to buy the food at a fair price and according to a fair measure. E. P. Thompson also explores this "old paternalist moral economy"[49], and he argues that "In urban and rural communities alike, a consumer-consciousness preceded other forms of political or industrial antagonism."[50] By the end of the eighteenth century, most legislation protecting buyers from sellers attempting to manipulate the market, such as forestallers and regraters, had been repealed; however, notions of fair trading remained a strong element in the people's collective mentality. This consciousness centred on "just" prices of agricultural products, in particular of bread. As sellers increasingly attempted to manipulate food prices, due to the growth of capitalistic notions of supply and demand, and

[49] E. P. Thompson, *The Making of the English Working Class* (London, 1980 edition), p. 72.
[50] E. P. Thompson, *The Making of the English Working Class*, p. 68.

the number of labourers dependent solely on money wages resulting from enclosure and industrialisation increased, the people fought against what they considered to be an encroachment upon their rights. Therefore, resistance to metrological reform, including the imposition of the Winchester bushel that Sheldon et al. discuss, constituted part of the struggle of the common people against the impersonal forces of capitalism that threatened not just their way of life but their livelihood as well.

Peter Linebaugh, like Thompson, offers a Marxist interpretation of the purpose behind metrological development, placing it in the context of a history characterised by class struggle and material necessity. In his book, *The London Hanged*, Linebaugh argues that over the course of the eighteenth century the development of capitalism necessitated standardization: "As things were answered by money they became commodities and must, therefore, have quantifiable standards of measure. The standardization of these...is what gives the period its mercantile characterization."[51] He examines conflicts in eighteenth-century English labour relations which involved the problem of the ruling class forcing new metrological configurations on traditional labour processes.

Metrology has also been the subject of a significant amount of anthropological and sociological research, which focuses on similar issues involved in the imposition of new political systems by governments on populations, and local resistance to such impositions. Bronislaw Malinowski, considered to be one of the founders of anthropology, studied the imposition of the metric system on the Mexican population (which was used to pre-metric Spanish units), and

---

[51] P. Linebaugh, *The London Hanged: Crime and Civil Society in the Eighteenth Century* (Harmondsworth, 1991), pp.115-116.

the consequent popular opposition.[52] Bruce Curtis, a sociologist, argues that "the stabilization of metrological chains across defined territories is closely connected to the formation of state power, and that science and politics have been closely connected in metrological reform."[53] Although he focuses on the development of Canadian metrology, he describes the general philosophical climate, in North America and Europe at the beginning of the nineteenth century, which inspired the urge to standardise on the part of a wide array of people, including Jeremy Bentham, Thomas Jefferson, and the marquis de Condorcet: "These metrological projects were perfectly contiguous in the understandings of their promoters, part and parcel of attempts to configure a rationally calculable universe, and they typically sought to draw upon, extend and reconfigure powers of state."[54] Similarly, Witold Kula distinguishes between older systems of measurement, in which such factors as who was buying and selling and the quality of the goods for sale influenced the actual measurement of the goods, and the newer, "abstract-quantitative" systems of measurement (like the imperial and metric systems) in which goods are objectively measured against units based on invariable standards taken from nature. Kula argues that these newer systems are, in fact, as subjective as the older ones, and that they too develop in response to political, social, and economic factors.[55]

The argument that systems of measurement which are supposedly based on invariable natural standards are not actually purely objective, impersonal systems has been made by a number of historians as well. Michel Foucault argues, in *The Order of Things*, that the idea of

---

[52] B. Malinowski and J. de la Fuente (edited by S. Drucker-Brown), *Malinowski in Mexico: The Economics of a Mexican Market System* (London, 1982).

[53] B. Curtis, "From the Moral Thermometer to Money: Metrological Reform in Pre-Confederation Canada", *Social Studies of Science*, vol. 28, no. 4 (August 1998), p.550.

[54] B. Curtis, "From the Moral Thermometer to Money", p.550.

[55] W. Kula, *Measures and Men* (Princeton, 1986).

precise, objective measurement was a feature of the "Classical *episteme*", or the epistemological status quo of the seventeenth and eighteenth centuries. Scientific knowledge became separated from other forms of knowledge because it alone was considered to be exact,[56] and a new method of ordering the world came into being, one based on quantitative measurement, called "*mathesis*", and more complex, qualitative measurement called "*taxinomia*".[57] The notion of accurate measurement is therefore characterised by Foucault as a product of a discursive construct, lacking any objective reality.

In a work that appears to be heavily influenced by Foucault, Simon Schaffer makes some very similar arguments.[58] Schaffer examines the belief among many eighteenth-century philosophers and scientists that they formed an intellectual community which was capable of detaching itself from political, economic, or any other biases that might encroach upon the autonomy of their subject matter, and that the empirical facts of nature revealed themselves to these thinkers directly and objectively. He argues, however, that "models of the speculative autonomy and international communality of philosophers were themselves the result, rather than the unproblematic cause, of enlightened philosophical projects and their social formation."[59] According to this view, the philosophers and scientists convinced themselves that their work was completely impartial, and that this belief has become accepted as truth. But Schaffer argues their work was not of this nature, and that measurement itself had hidden motivations: "Different measurement schemes are different social practices. Each scheme needs defending

---

[56] M. Foucault, *The Order of Things: An Archaeology of the Human Sciences* (New York, 1994), p.56.

[57] M. Foucault, *The Order of Things*, p.55.

[58] S. Schaffer, "A social history of plausibility: country, city and calculation in Augustan Britain", in A. Wilson, ed., *Rethinking Social History: English society 1570-1920 and its interpretation* (Manchester, 1993).

[59] S. Schaffer, "A social history of plausibility", p. 134.

against rivals." This process could not only give validity to certain types of measurement, but it could also exclude others:

> Standardisation, for example, works by stipulating the right places where calculation should be performed, such as the Mint and the Exchange, and disqualifying others, such as the field or the hearth. Metrology, which sets up local standards as universal values, was a crucial eighteenth century accomplishment in the social work which made a stable zone of operations for natural philosophers.[60]

Overall, this body of anthropological, sociological, and historical work presents a number of very interesting issues concerning the nature of the Imperial system itself, the purposes behind standardisation, and the ability of humans to act in a completely autonomous and objective manner.

When the historiography is considered as a whole, a number of questions arise, stemming mostly from Zupko's interpretation, since his is by far the most comprehensive work on English metrology. To begin with, Kuhn's and Hacking's articles suggest that the issue of everyday weights and measures did not figure prominently in the work of the eighteenth-century scientific community, calling into question Zupko's view of the process of standardisation as a natural manifestation of the scientific spirit that emerged in the seventeenth century. This view is further problematised by the extensive research revealing substantial local resistance to standardisation well into the nineteenth century. Were the suspicions of the people opposing reform, that the government had motives other than the improvement of the situation in local and overseas trade, well founded? The work of Thompson and Linebaugh offers the possibility that capitalistic economic motives informed the ruling class's desire for standardisation, while Leadley's research demonstrates that the legislation passed does not appear to have had a

[60] S. Schaffer, p. 143.

considerable effect on the local situation until the mid-nineteenth century. All of these works suggest that the issue of metrological standardisation was far more complex than Zupko claims.

Furthermore, the philosophical and scientific backgrounds provided, in particular, by Kuhn, Hacking, Curtis, Foucault, and Schaffer, help define the dimensions of the space in which the notion of metrological standardisation was conceived and debated. This allows one to avoid excessively teleological judgements such as Zupko makes and helps to explain a number of differences of interpretation. For example, Hoppit's suggestion that the government did not hold much of the initiative when it came to standardisation clashes with the picture presented by Zupko. While both do point out that it was initially individual members of Parliament who introduced legislation, their interpretations of that legislation differ. Zupko sees their reform efforts as crude initial attempts at establishing a uniform system, whereas Hoppit argues that these individuals sought to enforce the status quo based on their direct experience of local problems, and that a fundamental shift occurred in the nature and purpose of reform when the scientific community assumed the initiative and introduced an altogether new system. When one considers the philosophical context informing the choices of those involved in the standardisation debate, it becomes increasingly possible to avoid interpreting their actions in terms of epistemological views to which they did not necessarily adhere.

At the same time, however, one must be wary of stopping once one identifies the epistemological context of the standardisation debate. To historicise the issue in this way, in order to avoid unfair judgement, is, arguably, to define its outermost extremities, its domain of possibility. While this domain will be one for every branch of thought in any discursive period, as Foucault and other like-minded intellectuals would argue, the standardisation debate itself

must also be seen in terms of the multitude of other forces affecting it during and after its discursive constitution. As mentioned above, Schaffer claims that the eighteenth-century notion of the impartial, apolitical scientist or philosopher was constituted by the dominant eighteenth-century discursive milieu. Once this notion became established, however, there remains the very large question of how it was understood and used by the various groups involved. The same can, arguably, be said for the standardisation debate, and the work of Sheldon et al., Leadley, and Hoppit reinforces this fact by suggesting factors specific to this issue that they feel affected its development.

Overall, it appears that an examination of English metrological standardisation in the eighteenth and early nineteenth centuries requires the inclusion of the respective roles of the central government, the mercatorial class, the scientific community, local governments, and the common people. In addition, this topic touches upon issues of human cognitive capacities, agency, and social relations. An attempt to juxtapose the causal factors offered by various theoretical positions should be effected in order to offer a more broadly based interpretation of the English metrological debate that explores all of these options.

Chapter 2: Legislation.

In the preceding chapter, it was seen that both R. E. Zupko and Julian Hoppit examined the issue of English metrological standardisation in the eighteenth and early nineteenth centuries in terms of the central government's involvement therein. This chapter will examine the evidence provided by parliamentary reports, bills, statutes, and debates concerning weights and measures between 1758 and 1824, with particular reference to Zupko's and Hoppit's arguments. The purpose of such an examination is to suggest that when this body of evidence is assessed as a whole, the possibility arises of offering an interpretation of the government's views regarding, and involvement in, the metrological debate that draws on those offered by Zupko and Hoppit, but then diverges from them. By questioning the arguments made by Zupko and Hoppit concerning, respectively, the development of the necessary conceptual changes that enabled the government to conceive, and implement, the imperial system in 1824, as well as who was involved in the metrological debate and for what reasons, this chapter will open up a space for a different interpretation of the larger issue of the causes that led the standardisation debate in the direction it ultimately went in 1824. This chapter will not, however, discuss such a new interpretation in any detail. Rather, it provides important aspects of the background that must be established before attempting to present a new explanation of the factors leading to the passage of the Imperial Weights and Measures Act in 1824 and in the form it finally assumed.

To begin with, Zupko points out that a fundamental shift was required in order for the

government to stop attempting to enforce an archaic metrological body of law, which involved what appear to have been somewhat arbitrarily created standards that were difficult to copy as well as innumerable exceptions and exemptions to the laws. A new, enlightened scientific spirit was needed before the government could radically alter the system so that it came to be based on what were considered to be invariable standards taken from nature, which could be easily reproduced without recourse to any existing models of them. In this way, the nature of the official standards kept by the government would change. They would now only be models, or representations, of an absolute value observed in nature, whereas previously they themselves were the standards, without recourse to anything outside them. The claim that such a conceptual change was needed before a new basis of the metrological system could be conceived of will not be disputed in this thesis. The problem arises, however, when Zupko argues that this philosophical change can be seen to have occurred by 1758, when a committee appointed to look into metrological problems presented a report in the House of Commons. If one examines the conceptual basis of the legislation between 1758 and 1824 as a whole, it becomes evident that the 1758 report, along with that of 1759, and indeed all the bills and acts until 1815, are in fact highly conservative in nature. Although radical proposals were made before 1814, including a plan for Britain's adoption of a decimal system very close to the French metric system, the majority of the documents covering the period between 1758 and 1814 are based on ancient historical precedents, which are continually restated in the legislation. As a result, it will be argued that traditional notions of how a system of weights and measures worked, and in particular the nature of the standards themselves, continued to inform many of those involved in the lengthy process of negotiation that went into the creation of the imperial

system until only a few years before its enactment.

Julian Hoppit provides a very different interpretation of the earlier legislation (1758-c.1815). He argues that this legislation was introduced, and lobbied for, by individual members of Parliament, without significant government involvement either in the drafting of the legislation, or even in the extensive research that was required prior to its initiation. His argument that these individual members were motivated by a sense of moral obligation to the people they represented, and governed in their capacity as local magistrates, is supported by the presence of the theme of alleviating the burden of losses sustained through metrological abuse by the poor in the legislation throughout the eighteenth and early nineteenth centuries. However, Hoppit's claim that the government remained surprisingly uninvolved in the creation of metrological legislation is brought into question when, once again, this body of evidence is considered as a whole, especially when other legislation not discussed by Hoppit is taken into account. Instead, a picture of keen governmental interest, if not initiative, in certain areas of standardisation emerges.

In May, 1758, the Carysfort Committee presented a report to the House of Commons, the purpose of which was "to inquire into the original standards of weights and measures in this Kingdom, and to consider the laws relating thereto."[1]. In the first half of the eighteenth century, problems affecting Britain's weights and measures were frequently alluded to in legislation concerning matters of trade, taxation, and the assize of bread. However, the Carysfort Committee was the first committee in the eighteenth century devoted exclusively to the issue

[1] "Report from the Committee, Appointed to Inquire into the Original Standards of Weights and Measures in this Kingdom, and to Consider the Laws relating thereto" (26 May, 1758). *Reports from Committees of the House of Commons, 1715-1801, vol. 2, p. 411.*

of British metrological uncertainty, in particular to the problem of confusion about standard weights and measures themselves and the government's continued inability to enforce substantial conformity to the legally sanctioned units of weight and measurement. Zupko argues that with the 1758 report, the government proved itself to no longer be interested in what Zupko calls "revisionism", meaning the repeated attempts merely to improve the existing situation. Instead, he argues that the scientific and philosophical bases of the imperial system were espoused for the first time, namely, the conception of a system based on an empirically verifiable constant from nature. As a result, he argues that it is evident from the committee's recommendations that "a revolution was on the horizon."[2] Such an assertion suggests that the report warrants a closer examination than Zupko undertakes.

To begin with, the committee members compiled a list of all existing legislation dealing with weights and measures. The statutes were divided into two sections, the first outlining the historical development of the existing system, and the second describing methods of enforcement. Their list begins with Magna Carta, in which it was declared that there shall be "one wine measure, one ale measure, and one corn measure ... And it shall be of Weights as it is of Measures."[3] The first specific description of metrological units appeared in 1266, in an act of 51 Henry III. The English penny, or "sterling", was declared to have originally been measured according to thirty-two grains of wheat, "well dried, and gathered out of the Middle of the Ear". Twenty such pennies were to constitute an ounce and the pound was to contain twelve ounces. Measures of capacity were linked to these units of weight in that eight pounds

---

[2] R. E. Zupko, *Revolution in Measurement* (Philadephia, 1990), p. 69.

[3] *Reports from Committees of the House of Commons, 1715-1801, vol. 2, p. 413.*

were declared to equal a gallon of wine, eight of which form a "bushel of London."[4] The committee concluded, from this description, that the grain was the unit upon which the entire system was originally based, which it felt was too small and uncertain a unit to play such an important role in the metrological system.

The committee discovered that the practice of stamping or sealing weights and measures after they were examined by an officer appointed for this purpose, which was still done in the eighteenth century, became mandatory in the reign of Edward I. By the 1350s, however, it was clear that this method of ensuring uniformity was not effective. Instead, official copies of the standards kept in London were ordered to be sent to the sheriffs of England. Moreover, by this time a divergence had developed between the standards kept at the Exchequer, and the "King's Standards" kept at the Treasury, and by the reign of Henry V, the enforcement of one standard bushel for corn was becoming increasingly difficult. Finally, to make matters even worse, the committee discovered that many exemptions of goods, and parts of the country, were made over the centuries, an example being a statute of 1389 which declared that there was to be a single weight and measure for the entire country except Lancaster, where "it hath always been used to have greater Measure than in any other Part of the Kingdom".[5] Therefore, not only were the units used in the eighteenth century of ancient lineage, but the various problems and abuses which so disturbed the committee members can also been seen to have arisen centuries earlier.

In terms of the enforcement of uniformity, it was discovered that, as early as 1325, legislators became aware that a reactive system of enforcement, which relied on presentments of offenders by members of the community, was not expedient due to the fact that "the Person

---

[4] *Reports from Committees of the House of Commons, 1715-1801, vol. 2, p. 414.*

[5] Ibid, pp. 415-416.

presentable for false Measures must not only be proved to have them in his Custody, but must also be proved to have used them both in buying and selling".[6] As a result, a more preventive approach was attempted in 1340, when it was ordered that at least "two good and sufficient Persons" be appointed in each County to inspect weights and measures and punish offenders. They were also required to submit annual reports of their activities to the Exchequer, thereby increasing the information available to the central government.

The necessary conditions for another issue that hindered effectual enforcement by the eighteenth century were also created in 1340 when the appointment of the new inspectors was declared not to alter the powers of Clerks of the Market or franchises of Lords, both of which were empowered to enforce the use of legal weights and measures. This created an overlap of jurisdictions, which served to complicate matters of enforcement. The situation was further complicated in 1360, when justices of the peace were also empowered "to inquire of Measures and Weights". This jurisdictional complexity appears to have led some local authorities not to fulfil their responsibilities, as can be seen in a statute of Richard II in which penalties were imposed for Clerks of the Market and "any other of the King's Liege People" who did not use weights and measures that agreed with the Exchequer standards.[7]

All of these problems involved in ascertaining a single set of standards and enforcing their use across the country continued to exist, and worsen, and in fact were found by the Carysfort Committee to be worse than ever in the 1750s. The powers vested in the justices of the peace grew until they became a disincentive for local gentlemen to assume the responsibility of being a justice of the peace, which led to less than satisfactory enforcement in many areas.

---

[6] Ibid, pp. 421-422.

[7] Ibid, p. 423.

The proliferation of accepted standards, which were not all the same, occurred as the Companies of Coopers, Founders, and Plumbers were granted charters, in the early seventeenth century, allowing them to inspect soap and beer casks, brass standards, and lead standards, respectively, in and around London. At the same time, unequal standards continued to be kept at the Exchequer, the Treasury, the Mint, and the Customs. It is easy to imagine, from this information, the chaotic nature that must have characterised parts of the eighteenth-century metrological system.

The committee decided that, overall, the poor quality of the standards, which led to inaccuracies, combined with the vast array of statutes concerning weights and measures, had allowed the problems to reach such a level of severity. To rectify the situation, they argued, in their 1758 report, that one single set of units of weight and measurement must be established as the sole body of legal standards. They accepted the recommendation of the Assay Master of the Mint to adopt a yard bar that would be made by John Bird, a well known inventor, as the standard of length. From this, all measures of capacity could be gauged according to the cubic inches they contained, and one single legal gallon of 282 cubic inches could be designated to replace the wine, ale, and corn gallons, all of which were different sizes.[8] The troy pound (as described in the act of 51 Henry III, but now with twenty-four grains to the pennyweight rather than thirty-two) was recommended as the legal standard of weight. Other resolutions included the recommendations that a licence should be required for anyone wanting to make weights or measures, that all measures of capacity be stamped with the name of the maker and the initials

[8] In the 1750s, the corn gallon, which was derived from the ancient Winchester bushel, was supposed to contain 268.835 cubic inches, the Exchequer ale gallon contained 282 cubic inches, and the wine gallon had become only 231 cubic inches.

of the official examiner, that it be a penal offence for anyone to possess illegal units, and that all commercial transactions must be undertaken according to the legal, standard units.

If one considers these recommendations in relation to the committee's findings, it appears that they were, in fact, highly conservative. They were all based on well established historical precedents, the one important exception being the new yard bar the committee ordered to be built by Bird (although even this was designed to resemble the existing Elizabethan yard bar from the Exchequer, as closely as possible). Furthermore, some recommendations, for example the stamping of all weights and measures, were made despite the fact that the committee had found them to be ineffectual in the past. A second report issued by the same committee in April, 1759, emphasised the conservative nature of the resolutions when it stated that "there seems little to be expected from reviving Means, which Experience has shewn to be inadequate; and yet it is very difficult to devise any thing intirely unattempted by former Parliaments."[9] This lack of innovation brings into question Zupko's assertion that this report represents the turning point, after which the imperial system became possible philosophically and scientifically.

Most important of all, however, is the fact that the yard bar built by Bird, which was submitted to the Commons by Lord Carysfort himself upon presentation of the committee's findings,[10] was gauged according to the length of a pendulum vibrating seconds in the latitude of London.[11] This means that the yard was measured against a standard that was considered

---

[9] "Report from the Committee Appointed (Upon the 1st Day of December 1758) to Enquire into the Original Standards of Weights and Measures in this Kingdom, and to Consider the Laws Relating Thereto" (11 April, 1759). *Reports from Committees of the House of Commons, 1715-1801, vol. 2, p. 460.*

[10] "A Report from the Committee Appointed (Upon the 1st Day of December 1758) to Enquire into the Original Standards of Weights and Measures in this Kingdom, and to Consider the Laws Relating Thereto. With Proceedings of the House thereupon" (London, 1759). *E.C., reel 341, no. 3, p. 4.*

[11] Zupko, *Revolution in Measurement*, p. 73.

to be an absolute, invariable standard taken from nature because the pendulum was believed to always vibrate, or oscillate, the same distance at a constant latitude. In this way, the units themselves would be completely invariable, rather than being subject to manmade standards that could be arbitrarily changed, and the standards could be easily reproduced in case the official standards were lost, damaged, or if people were unable to come to Westminster to use them.

At first glance, this appears to contradict the assertion, made above, that the committee was functioning according to a thoroughly conservative outlook. However, the fact that Bird's standard yard bar was created according to a supposedly absolute natural standard was never mentioned in either the 1758 or 1759 report. Nor was it mentioned in the two bills, introduced in 1765, that were based on the committee's resolutions. Both of these bills focused on issues of enforcement and the protection of government revenues. The first bill contained very strict rules concerning the use of the new standards to be adopted, such as a £50 fine for anyone conducting a commercial transaction in illegal units, a £10 fine for anyone making false weights or measures, and a sentence of death as a felon, without benefit of clergy, for anyone caught counterfeiting the stamps required on all weights and measures.[12] All existing standards were to be destroyed and existing legislation abolished, and conversion charts were to be designed for the Customs so that taxes might still be collected, since "the Alteration of such Measures, may, without due Care had therein, greatly affect his Majesty's Revenue, and to the diminishing of the same."[13] The second bill reinforced much of the preceding bill, adding a preamble which stated that metrological uniformity was necessary "for the Security of Commerce, and for the

---

[12] "A Bill (With the Amendments) for enforcing Uniformity of Weights and Measures, to the Standards thereof, by Law to be established". *British Sessional Papers. House of Commons, 1731-1800. Bills, vol. IV, no. 135h (1765), pp. 2-7.*

[13] *British Sessional Papers. House of Commons, 1731-1800. Bills, vol. IV, no. 135h (1765), p. 16.*

good of the Community", and a set of conversion charts for taxation purposes. It also legalised a second system of weights that was very widely used but had never been legally described, called avoirdupois weights, which were fixed in relation to troy weights. Two complete sets of standards were to be made, one of which was to be kept by commissioners appointed to examine and stamp weights and measures for the public, and the other of which was to be kept by the Chancellor and Chief Barons of the Exchequer to use periodically in order to adjust the first set.[14]

Neither bill discussed the merits of ascertaining a standard based on a natural constant, or revealed that this was the basis of the newly proposed system. Both bills were also lost when Parliament recessed, and it would not be until 1815 that the attempt to legislate such comprehensive change was made again. Therefore, the committee does not appear to have been interested in the actual method involved in ascertaining the standard yard, and the idea that Bird's yard bar only represented a standard length obtained from nature, and did not inherently constitute that length, was not addressed. Furthermore, the fact that both bills which were based on the committee's recommendation failed, and that the issue of general uniformity was not raised again by such a committee until fifty years later suggests that Parliament was not ready to accept such large scale change in the 1750s and 1760s. This argument undermines Zupko's assumption that the adoption of the imperial system had been inevitable since 1758.

At this point, it is timely to consider Hoppit's argument, that once the bills failed, the issue of weights and measures failed to be of interest to the government until another

---

[14] "A Bill for ascertaining and establishing uniform and certain Standards of Weights and Measures throughout the kingdom of Great Britain, and for the assizing and adjusting of Weights and Measures, agreeable to the said Standards." *British Sessional Papers. House of Commons, 1731-1800. Bills, vol. 5, no. 146 (1765).*

independent member of Parliament, Sir John Riggs Miller, forced the issue on the government in 1789 and 1790. Although no legislation was enacted in 1765, standards did continue to be constructed, as can be seen from a photograph, provided by Zupko, of a set of standard avoirdupois weights dated 1773.[15] Only a year after the construction of these weights, an act to regulate the weights used to weigh gold and silver currency, which neither Zupko nor Hoppit mentions, became law.[16] The act directed the warden, master, and comptroller of the Mint to have a set of money weights made. In a manner almost identical to that proposed in the 1765 bills, copies of the standards were to be made and given to a person appointed to run an inspection office to which anyone who made coins must come to have his or her weights examined and stamped. The original set was to be kept safely by the warden, master, and comptroller of the Mint, so that they might be used to adjust the second set (which would be used by the examiner) annually. The fact that Parliament would enact such legislation suggests that there was more governmental interest in the issue of weights and measures than Hoppit acknowledges, in particular in terms of issues involving money.

The government's choice in the appointment of the officer to run the public examination office, furthermore, reveals an intriguing relationship between those whom Hoppit characterises as independent, disinterested scientists and the government. John Whitehurst, a well known and very highly respected clock maker and inventor from Derby, who also conducted numerous experiments in aid of later research that led to the development of the imperial system, was chosen to be the "Keeper of the Duplicates of the Standard Weights at the Royal Mint".

---

[15] Zupko, *Revolution in Measurement*, p. 78. Zupko does not, unfortunately, say anything about these weights.

[16] "An act for regulating and ascertaining the weights to be made use of in weighing the gold and silver coin of this kingdom." *Statutes at Large, 24 George III, cap. 92 (1774), pp. 588-591.*

Whitehurst was appointed at the request of the Duke of Newcastle, because he had designed an intricate and highly successful plumbing system for the Duke's house in Nottinghamshire. By 1782, he had become the "Stamper of the Money Weights", and the house allocated to him in Westminster to use as an office had become a meeting place for inventors and scientists from all over the country.[17] This connection between such important members of the government as the Duke of Newcastle and members of the scientific community raises questions about the impetus behind the movement for standardisation, and these questions become more complicated as one considers that the 1774 act only related to weights, and a very specific type of weights. It seems likely that the government was in fact interested in standardisation, although not as an end in itself (not in terms of a complete system of uniformity), but in as far as it helped the government to do things such as regulating the money supply.

The possibility that the government could have been interested only in certain types of standardisation of weights and measures is supported by an act of 1791 regulating the import and export of corn, which is also not mentioned by either Hoppit or Zupko.[18] This act ordered that juries were to be convened monthly in every Scottish county in order to set the price of various grains. Although they were to operate officially according to the statutory Winchester bushel, and only this measure was to be used for taxation purposes, the juries were also directed to post lists of comparisons between the Winchester bushel and the customary measures in use. This allowed people to trade according to customary measures, and to be taxed according to

---

[17] M. Craven, *John Whitehurst of Derby: Clockmaker and Scientist 1713-88* (Mayfield, Derbyshire, 1996), pp. 82-106.

[18] "An act for regulating the importation and exportation of corn, and the payment of the duty on corn imported, and of the bounty of British corn exported." *Statutes at Large, 31 George III, cap. 30 (1791), pp. 233-289* (The page numbers are inconsistent).

a standard measure. The list of comparisons was to be "hung up in some conspicuous place in the market and town-hall of such city or town, and from time to time renew[ed] ... if it shall become defaced or illegible". It does not appear, from this statement, that the juries were only to produce the list of comparisons once in order to enable people to convert their measures, after which conformity to the Winchester bushel would become mandatory. Furthermore, the act listed the weights of a Winchester bushel of eleven different types of grains, in case they were sold by weight. This clause directly contravened the recommendation of the Carysfort Committee, that measures of capacity of the same denomination should in no circumstances be allowed any variation.[19] Therefore, while careful attention was paid to the weights used to make the currency in 1774, this act, passed seventeen years later, perpetuated the use of customary corn bushels and allowed bushels of different weights to all be called Winchester bushels, suggesting that the level of interest in weights and measures on the part of the government could vary widely.

Shortly before the act regulating the sale of corn was passed, Sir John Riggs Miller, a member of Parliament who was "intensely interested in mercantile matters", presented a proposal for a radically new metrology, based on a decimal system similar to the new French metric system, in the House of Commons in April, 1790.[20] This is seen by Zupko as further evidence that Parliament was interested in a new system of uniformity. Miller's proposal openly discussed the merits of the pendulum method for gauging the standard yard for the first time in Parliament. Although he was not a scientist, he had received information from numerous British

---

[19] The main target of this recommendation, in 1758, was the gallon, of which there were three legally recognised. See p. 38 above.

[20] Zupko, *Revolution in Measurement*, p. 79.

scientists (including John Whitehurst), as well as from the French Bishop of Autun (Talleyrand), who also proposed the metric system in the revolutionary Assemblée Nationale in April, 1790. Miller complained to the Commons that due to metrological uncertainties, "the poor thresh out corn and other grain by the largest customary bushel, and buy their bread by the smallest."[21]

Despite this compassionate appeal, Miller's proposal does not appear to have been seriously considered, something Zupko attributes to the temporary set-back caused by the fear of any radical change inspired in England by the onset of the French Revolution. This lack of popularity is reflected in a letter from the Duke of Leeds, the English Secretary of State for foreign affairs, to the Duc de Luzerne, the French ambassador in London. Leeds reported to Luzerne that,

> J'ai l'Honneur d'informer Votre Excellence qu'aiant, par Ordre du Roi, fait faire des Perquisitions à ce Sujet, il paroit que l'Affaire a été agitée dans la Chambre des Communes vers la Fin du dernier Parlement, mais qu'aucune Proposition de la Chambre n'a été faite en Consequence .... Il a souvent été question d'un tel arrangement parmi Nos Economistes publics mais le Projet a paru expose à tant de Difficultés que son Accomplissement, tout desireable qu'il pourroit etre, a été regardé comme presque impracticable.[22]

A similar disdain for Miller's proposal is very clear in the coverage given to it in the *Times*. The reporters described how Miller spoke at length about the benefits that would result from a permanent and uniform system. "Sir John in describing the attributes of a perfect standard kept both the House and Gallery in excellent humour." They continued in this uncomplimentary manner, by saying that "We shall not enter into a minute detail on this subject,

---

[21] Cited in Hoppit, "Reforming Britain's Weights and Measures, 1660-1824", *English Historical Review*, vol. 108 (1993), p. 84.

[22] A. Favre, *Les Origines du Syèstme Métrique* (Paris, 1931), pp. 226-227.

lest we should offend the ears of our delicate readers. We shall only observe that Sir John thought that a standard ought to be taken from something in nature that was permanent and invariable... We will not go more particularly into this business, and perhaps it would be charity to suppose that Sir John himself understood everything he said."[23]

Miller ended his proposal by moving that a new committee be appointed to consider his information gathered from around the country, and this was agreed to. However, no minutes of the proceedings of this committee were ever recorded, and an 1814 committee report on weights and measures stated that "they do not appear to have made any progress."[24] Later on in that same year, Miller suffered electoral defeat and left the Commons.

Interestingly, in December, 1791, as fears of domestic unrest caused by the French Revolution increased among the English upper classes, the *Times* issued a warning to the government concerning problems of metrological abuses and their effects on the poor: "Well may the poor complain of the high rate of taxes when in every necessary of life they are most shamefully cheated by every chandler's shop in and around London." The article pointed out that the poor must buy their food and goods at such shops, but that so many of the weights and measures used by the owners of the shops were false that the poor pay "at least twenty per cent. more than Justice requires them to do." The reporters concluded that "This is a very serious grievance – it is permitting a system of oppression to exist, which must at last come so home to the feelings of the poor that they may remonstrate, in an alarming manner, and ascribe that to Government which lies at the door of the cheating and usurious individual."[25]

---

[23] *Times*, Wednesday, April 14, 1790, p. 2, cols. 2-3.

[24] "Report from the Select Committee of Weights and Measures. 1 July 1814." *British Sessional Papers. House of Commons, 1813-1814. Reports, vol. 3, pp. 136.*

[25] *Times*, 30 December, 1791, p. 4b.

However, following this unsettling report, the need for radical metrological reform appears to have been forgotten once again and an article criticising the metric system was printed in 1798.[26] The article began with a criticism of the French: "The Republicans, resolved on a thorough innovation, were not satisfied with reforming the Calendar, but have introduced a system of weights and measures. They even have the vanity to look forward to the adoption of it by the rest of the world...". It then ended with an anecdote which thoroughly ridiculed various recent French innovations. In it, a woman attempts to buy an ell of fabric (a pre-metric unit), but is given a metre, which is smaller. When she approaches a justice of the peace, the following conversation ensues:

The Woman.- Monsieur.
Delorme [the Justice] *(interrupting her)* – What is that you say? I am no Monsieur.
The Woman. – I ask pardon, Citizen. Last Sunday.
Delorme. – What do you call Sunday? We have no such thing now.
The Woman. – Well, the Quintidi of the week.
The Justice, (with impatience) – You tire me with your nonsense. I know nothing of weeks.
The Woman. – But Monsieur Citizen, I mean to say the decade, in the month of April.
The Justice. – Again, your nonsense, April!
The Woman. – Of Floreal, I would say, I bought an ell.
The Justice (in a passion.) – I'll hear no more – you mean a metre – go your way. You still have your Sundays, your weeks, your months of April, your ells, and Monsieurs; get out. You are an *Aristocrate.*
The poor woman retired in confusion, and kept her *metrical* purchase, without any more complaining.[27]

Therefore, while it does appear that weights and measures were a matter of concern to many members of the ruling class, throughout the 1790s they do not appear to have been capable of accepting a proposal as radical, and that would involve as much change, as the proposal introduced by Miller.

---

[26] *Times*, 1 October, 1798, p. 4b.
[27] Ibid.

Between the failure of Miller's proposal in 1790 and 1814 , two acts were passed, in 1795 and 1797.[28] In 1795, a bill was introduced in Parliament, the preamble of which stated that the existing laws concerning weights "have been found ineffectual for that Purpose; and divers Frauds are committed by Persons using deficient Weights, and false or unequal Balances".[29] By the time the bill became law, a clause was added onto this sentence, which contained the words "by which the poor in particular are much injured."[30] No mention of a general standardisation was made, and the two acts concerned only issues of enforcement. As in the 1765 bills, harsh penalties are imposed for the construction or use of false weights or scales. All attempts at any large-scale change appear to have disappeared by this point.

The tension between the recognition of the need for change, and hostility towards any change considered radical that became apparent in the debate over Miller's proposals resurfaced however in 1814-1815, when the issue of a general standardisation was once again brought up in Parliament. Sir George Clerk, a member of the Commons from Edinburghshire, who is described by R. G. Thorne as someone who "could be counted on to support government",[31] requested that a Select Committee of Weights and Measures be appointed to examine the reports from the Carysfort Committee, and to make recommendations concerning the possibility

---

[28] "An act for the more effectual prevention of the use of defective weights, and of false and unequal balances. June 22, 1795." *Statutes at Large, 35 George III, cap. 102 (1795), pp. 363-365 ;* "An Act to explain and amend an Act, made the thirty-fifth Year of the Reign of His present Majesty, intituled, An Act for the more effectual Prevention of the Use of defective Weights, and of false and unequal Balances (20th July 1797)." *Statutes at Large, 37 George III , cap. 143 (1797), pp. 677-679.*

[29] "A Bill for the more effectual Prevention of the Use of defective Weights, and of false and unequal Balances."*British Sessional Papers. House of Commons, 1731-1800. Bills, vol.25, no. 756 (1795).*

[30] "An act for the more effectual prevention of the use of defective weights, and of false and unequal balances. June 22, 1795." *Statutes at Large, 35 George III, cap. 102 (1795), pp. 363.*

[31] R. G. Thorne, *The History of Parliament: The House of Commons 1790-1820, Vol. 3, Members A-F* (London, 1986), p.449.

of metrological standardisation. The committee's findings were presented to the Commons on July 1, 1814.[32]

The report began by citing the two main reasons held in 1758 to be responsible for the lack of uniformity: the poor quality of craftsmanship resulting in the construction of inaccurate standards, and the excessive legislation still in force concerning weights and measures. While the report stated that the new committee agreed that these factors, more than any others, had hindered the widespread adoption of uniform units, its members did not agree with the 1758 plan to adopt the troy pound and a standard gallon measuring 282 cubic inches. Instead, they recommended a system developed by Dr. William Hyde Wollaston, the Secretary of the Royal Society. Wollaston's plan changed the order in which the standards would be determined, so that rather than beginning with a standard yard, from which would be gauged measures of capacity in terms of the number of cubic inches they contained (such as with a gallon of 282 cubic inches), one would gauge a standard of weight according to a standard length, and the weight of the contents of measures of capacity would determine their dimensions. This change was recommended because the avoirdupois pound had been discovered to contain,"by a very remarkable coincidence, a cubic foot of pure water"at 56 ½ degrees Fahrenheit, thus rendering it possible to calculate without using decimals. This meant that a the gallon could be set at the size needed to hold 10 pounds avoirdupois of pure water, so that the quart, pint, and bushel might all be expressed in integers.

Therefore, if the avoirdupois pound containing sixteen ounces were adopted as the

---

[32] "Report from the Select Committee of Weights and Measures. 1 July 1814." *British Sessional Papers. House of Commons, 1813-1814. Reports, vol. 3, pp. 131-153.*

standard of weight, rather than the troy pound, measures of capacity could be very easily determined. The conversion to such a system would also require few difficult changes because the gallon of ten pounds avoirdupois of water was only three per cent larger than the Winchester measure. As the committee explained, "in this manner, the standard of length is kept invariable, by means of the pendulum; the standard of weight, by the standard of length, and the standard of capacity, by that of weight."[33] All weights and measures would, therefore, be reproducible according to the invariable standard provided by the length of a pendulum vibrating seconds in the latitude of London at a given temperature.

It is interesting to note that the committee recommended allowing goldsmiths to continue using troy weights when dealing with the currency, because "considering the connection of this branch of trade with the standard of the Coin, it appears advisable that gold and silver be sold by Troy Weight."[34] As in 1774, therefore, money weights were once again dealt with differently than everyday weights and measures. Apart from this clause, however, the rest of the committee's recommendations were very similar to those from 1758 and 1759, concerning licences for making weights and measures and the official stamping thereof, heavy penalties for the use or construction of false units, and the requirement to conduct all business transactions according to the legal standards alone. The important difference between this report and earlier proposals lies in the fact that with this report, the idea that a uniform metrological system must be based on an absolute natural standard was openly discussed and was considered to be essential.

---

[33] Ibid, p. 138.
[34] Ibid, p. 138.

After the committee's findings were presented, interviews with Professor Playfair of Edinburgh, a renown metrologist, Wollaston, and John Warner, a brass founder from Cripplegate, London, who made brass standards for county corporations, were reported. Wollaston, naturally, agreed with the committee's recommendations. Professor Playfair, on the other hand, said that the length of the pendulum did constitute an invariable standard, but that it had not yet been calculated with sufficient accuracy. He also proposed a different system, under which a bushel would contain 1 ¼ cubic feet, which would make it so close to the Winchester bushel that hardly any change at all would be needed. John Warner complained at length about the different dimensions of the standards at the Exchequer and those at Guildhall (the standards used by the Founders and Plumbers Companies were kept at Guildhall). As a result, when rural magistrates ordered standards from London, and if some were made according to the Exchequer standards and others according to the Guildhall standards, upon comparison by a local inspector the standards would be found not to be equal and innocent people stood to be convicted for possessing false weights or measures. Warner presented as an example the parish of Biggleswade, Bedfordshire, where by order of Samuel Whitbread (a Bedford magistrate as well as a radical member of the Commons) a huge number of containers based on inconsistent measures of capacity and that could not be adjusted were destroyed.

The committee appears to have been influenced more by Warner's complaints and urging that some immediate action be taken, than by Playfair's warning concerning the inaccuracy of the existing pendulum measurements. In November, 1814, a bill was introduced by Samuel Whitbread that would have extended the provisions of the 1795 and 1797 acts

concerning weights to include measures as well.[35] After it failed to pass in the House of Lords, Whitbread introduced another bill in March, 1815, which did become law, entitled "A Bill for the more effectual Prevention of the Use of false and deficient Measures."[36] This act was designed to accomplish the same thing as the bill he had introduced in November, 1814, since its purpose was to empower justices of the peace to appoint inspectors of measures in a manner very similar to their power to appoint inspectors of weights, which was established in the 1795 and 1797 acts. Also like the earlier acts, the county justices were required to purchase a set of measures to be kept by the Clerk of the Peace for the use of the inspector. Despite the comprehensive changes advocated in the committee report, however, neither bill contained either Wollaston's proposal or a discussion of the use of the pendulum. Once again, the issue of a radical metrological change was raised, only to be quickly dropped.

The issue did not disappear for long, however, and following the passage of Whitbread's second Act in May, 1815,[37] a bill which did espouse the 1814 committee's recommendations was introduced in the Commons by Sir George Clerk. This was the first act, since the two 1765 bills were unsuccessfully presented in Parliament, that would have created a system of general metrological uniformity based on the objective, invariable length of the pendulum vibrating seconds in the latitude of London. This similarity to the proposed legislation of 1765 is reflected in the fact that the preamble of the 1815 bill was taken nearly word for word from the preamble of the second bill introduced in 1765 entitled "A Bill for ascertaining and establishing uniform

---

[35] "A Bill to extend the Provisions of Two Act of the Thirty-fifth and Thirty-seventh years of His present Majesty, relative to defective Weights and false and unequal Balances, to false and defective Measures." 23 November, 1814. *British Sessional Papers. House of Commons, 1814-1815. Vol. 1, pp. 19-20.*

[36] *British Sessional Papers. House of Commons, 1814-1815. Vol. 1, pp. 21-25.*

[37] "An Act for the more effectual Prevention of the Use of false and deficient Measures.2 May, 1815." *Statutes at Large, 55 George III, cap. 43 (1815), pp. 76-78.*

and certain Standards of Weights and Measures throughout the kingdom of Great Britain, and for the assizing and adjusting of Weights and Measures, agreeable to the said Standards", [38] which read as follows:

> Whereas it is necessary, for the security of Commerce, and for the good of the Community, that Weights and Measures should be just and uniform: And whereas notwithstanding it is provided in the Great Charter, that there shall be but One Measure and One Weight throughout the Realm; and, by the Treaty of Union between England and Scotland, that the same Weights and Measures should be used throughout the United Kingdom, as were then established in England; yet different Weights and Measures, some larger and some less, are sill in use in various places, and the true Measure of the present Standards is not verily known, which is the cause of great Confusion and of Manifest Frauds...[39]

The bill then differed from that of 1765 when it went on to describe the manner in which the standard yard had been determined, and the purpose of deriving it from the length of the pendulum was stated to be that "it is expedient that the Standard Yard, if lost, destroyed, defaced or otherwise injured, should be restored of the same length, by reference to some invariable natural Standard".[40] At this point the bill broke further with the 1765 bills in that it adopted the system suggested by Wollaston, which included making the avoirdupois pound the legal standard, whereas the 1765 bills had chosen the troy pound. The pound was declared to be what Wollaston calculated, 27.648 cubic inches of pure water at 56 ½ degrees Fahrenheit. Accordingly, the adoption of this avoirdupois pound allowed measures of capacity to be easily calculated by weight. The set of units based on the gallon consisting of ten pounds of water, as

---

[38] *British Sessional Papers. House of Commons, 1731-1800. Bills, vol. 5, no. 146 (1765).*

[39] "An Act for the more effectual Prevention of the Use of false and deficient Measures." 2 May, 1815. *Statutes of the United Kingdom, 55 George III, cap. 43, vol. 6 (1815-1816), p. 76.*

[40] Ibid, p. 28.

described in the 1814 report, was to be legally established.

The 1815 bill also included clauses that are familiar by this point: models of the standard yard and gallon were to be kept in the Exchequer in the joint custody of the Chancellor, Chief Baron, and Chamberlains of the Exchequer, justices of the peace were required to procure sets of standards and grant licences to local inhabitants appointed to make weights and measures according to those standards, heavy penalties were proposed for offenders against the legislation, all statutes beginning in the reign of Henry III, leading up to and including Whitbread's successful 1815 act (55 George III, cap. 43) were to be repealed, and conversion tables were to be prepared to facilitate an easy transition to the new units for the purposes of taxation and formal commercial transactions such as contracts and rents payable in goods.

Despite the fact that this bill was introduced very shortly after Whitbread's successful bill, it failed. Therefore, while the matter of creating an all-encompassing, uniform metrological system, the stability of which would be assured by centring it on an absolute natural standard, appears to have become a matter of serious discussion by 1814, Parliament was only prepared to accept Whitbread's conservative, reactive legislation. The issue continued to be discussed periodically in Parliament, however. On March 13, 1818, in the House of Commons, Sir George Clerk brought up the fact that a committee composed with the help of the Royal Society was supposed to have been established following the failure of the 1816 bill. Since this had not yet been done, Clerk requested that the Chancellor of the Exchequer rectify the matter "since he could not bring in a bill on the subject, with any chance of success, till that previous step had

been taken."[41]

Clerk's request appears to have been taken seriously, as on May 23 of that year the new committee presented what information they had until that point gathered about experiments conducted on pendulums with the purpose of adopting the pendulum as the invariable metrological standard now believed to be needed.[42] The report began with a letter written by J. Pond, Esquire, who was conducting experiments on the pendulum at the Royal Observatory. His letter revealed that the Prince Regent had requested that a pendulum be built in 1816, and that this had been done by Captain Henry Kater, a member of the Royal Society. Pond reported that Kater used "a principle long known to mathematicians (but I believe never before carried into execution for any useful or practical purpose)" in creating his pendulum.[43] Following Pond's letter was an essay by Kater himself, in which he described the experiments he had conducted both on the pendulum method and on the comparison of the English yard with the French metre. In working on the pendulum, he adopted a theorem developed by Christian Huygens concerning the relationship between a pendulum's axis of suspension and its axis of oscillation (or vibration). However, both Pond and Kater emphasised the fact that there was still much work to be done before they could make a full report to the House of Commons. It appears that they were asked to submit a full report earlier than they felt they could.

The subject was raised once again the following year, when in February, 1819, Henry Sumner, a member of the Commons for Surrey, requested that the Chancellor of the Exchequer

---

[41] *Hansard's Debates. First Series, vol. 37 (1818), col. 1080. House of Commons, March 13, 1818.*

[42] "Experiments Relating to the Pendulum Vibrating Seconds of Time in the Latitude of London" (23 May, 1818). *British Sessional Papers. House of Commons, 1818, vol. 15, pp. 31-71.*

[43] Ibid, p. 33.

reveal what the Committee had accomplished so far.[44] The Chancellor responded that progress was being made, but "not sufficient to encourage a hope that they would be able to present a report during the present session." Sumner then complained that although magistrates were required, by the 1815 Act, to procure sets of standards according to the Exchequer standards, these standards were only the bushel, peck, and gallon, with no subdivisions of the gallon for smaller quantities. The city of London therefore had subdivisions made, and magistrates made convictions using these subdivisions, but the convictions "could not be sustained, because they were founded on measures that did not issue from the exchequer." He argued that a bill was necessary to legalise such subdivisions of the Exchequer standards.

Five months after Sumner's appeal to the Commons, a special group of Commissioners, made up Sir George Clerk and four members of the Royal Society, Davies Gilbert, William Hyde Wollaston, Thomas Young, and Henry Kater, was appointed by the Commons Select Committee on Weights and Measures. The Commissioners issued their first official report on July 7, 1819.[45] The first half of the report consisted of recommendations for the adoption of a system that, once again, used Wollaston's plan in order to establish complete uniformity based on a natural, reproducible standard, but that would alter the existing system as little as possible. The committee members argued that while it was essential that a natural standard, in this case the length of the pendulum, be available so that anyone with watch or clock making skills might easily create new standards in case of loss or damage of the standards in use, the adoption of

---

[44] *Hansard's Debates. First Series, vol. 39 (1819), cols. 332-333. House of Commons, February 5, 1819.*

[45] "First Report of the Commissioners Appointed to Consider the Subject of Weights and Measures." (7 July, 1819). *British Sessional Papers. House of Commons, 1819, vol. 11, pp. 307-323.*

a system as radical as the metric one was not expedient because,

> There is no practical advantage, in having a quantity commensurable to any original quantity, existing, or which may be imagined to exist, in nature, except as affording some little encouragement to its common adoption by neighbouring nations. But it is scarcely possible, that from the departure from a Standard, once universally established in a great Country, should not produce much more labour and inconvenience in its internal relations, than it could ever be expected to save in the operations of foreign commerce and correspondence, which always are and always must be conducted by persons, to whom the difficulty of calculation is comparatively inconsiderable, and who are also remunerated for their trouble, either by the profits of their commercial concerns, or by the credit of their scientific acquirements.[46]

Their concern, in this passage, clearly appears to have been with the common man or woman conducting the basic, everyday commercial transactions necessary for subsistence, rather than with traders and merchants engaging in international trade and who must regularly have converted units of weight and measurement of other countries into English ones. This evident concern is reflected in the rest of this section, which emphasised the need to establish Bird's standard yard and the avoirdupois pound suggested by Wollaston in 1814, (from which was derived the 10 pound gallon that very closely resembled the Winchester bushel and the standard ale gallon in size), as well as the need to retain all the various subdivisions of existing weights and measures.

The only problem encountered by the committee was that the fixing of the gallon at one sole capacity for all goods measured required the abolition of the wine gallon. The change from the other commonly used gallons would be relatively easy, given their proximity to the 10 pound gallon; however, the wine gallon was significantly smaller, at 231 cubic inches, and would require substantial adjustment. The Commissioners openly acknowledged their reservations in

[46] Ibid, pp. 309-310.

this regard, and they admitted that they could "only suggest, that there would be a manifest advantage in the identification of all measures of the same name, provided that the change could be made without practical inconvenience: but how far the inconvenience might be more felt than the advantage, we must leave to the wisdom of His Majesty's Government to decide."[47]

The Commissioner's second report was presented to the Commons on September 18, 1820, four months after Henry Sumner appealed a second time to Parliament to rectify the metrological situation. Sumner's frustration is apparent in his address to the Commons, since his county (Surrey) had made copies of the subdivisions made by the city of London from the Exchequer standards, only to be "immediately convicted for having so done, and now laboured under the state of one using weights and measures no longer established by law".[48] This second report reaffirmed the Commissioners' support for the adoption of the standard yard made by Bird at the request of the Carysfort Committee as the legal standard of length, and the length of the pendulum vibrating seconds in the latitude of London at 62 degrees Fahrenheit, measured at 39.13929 inches, was proposed as the natural standard from which to calculate the yard. This very short report was followed by an appendix of over twenty pages, which listed all the local units of weight and measurement the Commissioners were able to discover.[49]

A third and final report from the Commissioners was published on March 31, 1821, in which it was suggested, for the first time, that Bird's yard be called "the authentic legal Standard of the British Empire", and that the gallon containing 10lb. avoirdupois of water

---

[47] Ibid, p. 312.

[48] *Hansard's Debates. Second Series, vol. 1 (1820). House of Commons, September 18, 1820, cols. 47-48 (quote from col. 48).*

[49] "Second Report of the Commissioners Appointed by His Majesty to Consider the Subject of Weights and Measures" (18 September, 1820). *British Sessional Papers. House of Commons, 1820, vol. 7, pp. 473-503.*

should become the "Imperial Gallon". The fixing of a standard of weight was more ambiguous; the standard troy pound presented to the Commons in 1759 by Lord Carysfort was to "remain unaltered", and 7000 troy grains were declared to constitute one pound avoirdupois, thereby necessitating the legalisation of both the troy and avoirdupois systems. The Commissioners concluded their observations by stating that "Whether any further Legislative enactments are required, for enforcing a uniformity of practice throughout the British Empire, we do not feel ourselves competent to determine." However, they did make one last appeal for simple, conservative changes to the metrological system: "But it appears to us, that nothing would be more conducive to the attainment of this end [uniformity], than to increase, as far as possible, the facility of a ready recurrence to the legal Standards, which we apprehend to be in a great measure attainable by the means that we have recommended".[50]

The final Commissioners' report was followed by a report from the Select Committee on Weights and Measures, printed May 28, 1821.[51] The members of the committee stated very clearly that they supported all of the Commissioners' proposals: "Your Committee concur entirely in opinion with the Commissioners on Weights and Measures, as to the inexpediency of changing any Standard, either of Length, Superficies, Capacity, or of Weight, which already exists in a state of acknowledged accuracy; and where discrepancies are found between models equally authentic, they deem it right that such a selection should be made as will prove most accordant with generally received usage, and with such analogies as may connect the different quantities in the most simple ratios."[52] Furthermore, the committee recommended that if the

[50] Both quotes from Ibid, p. 300.

[51] "Third Report of the Commissioners Appointed by His Majesty to Consider the Subject of Weights and Measures" (18 September, 1820). *British Sessional Papers. House of Commons, 1821, vol. 4, pp. 297-302.*

[52] Ibid, p. 291.

Commissioners' suggestions received the affirmation of the Commons, a bill should be introduced "declaring these Standards of Length, of Capacity, and of Weight, to be the imperial Standards for Great Britain and Ireland, and for its colonies and dependencies".[53]

At this point, the shape that the imperial system was to take had finally been fully articulated, the one remaining obstacle being Parliamentary approval. Accordingly, legislation, once again entitled "A Bill for ascertaining and establishing Uniformity of Weights and Measures", based on the recommendations of the Commissioners and the Select Committee (i.e. the adoption of Wollaston's plan in conjunction with Bird's standard yard), was introduced in the Commons on February 28, 1823.[54] An unexpected development occurred, however, when the Glasgow Chamber of Commerce sent a petition to the House of Lords shortly after the bill's introduction. The members of the Chamber of Commerce objected to the proposed imperial system, and urged that the metric system be adopted in order to facilitate trade with France and to encourage other countries to change over to the French scheme.[55]

The Lords delayed the passage of the bill in order to convene a Select Committee to look into the matter, and while the Glaswegian proposal did not cause any changes to be made to the legislation in the end, the report from the Lords' Committee raises some very interesting questions concerning the motivations of those seeking to enact the imperial system. The report began with a statement from Davies Gilbert, claiming that in the course of the research done on this issue, interviews were conducted with "persons practically skilled in the construction of measures of Capacity" as well as "mathematical instrument makers, and ... other persons in

---

[53] Ibid, pp. 292-293.

[54] *British Sessional Papers. House of Commons, 1823, vol. 3, pp. 663-668.*

[55] J. Hoppit, "Reforming Britain's Weights and Measures, 1688-1824", p. 99.

their [the Commissioners'] judgement competent to give Information".[56] Gilbert was then asked why "the Commission did not examine any practical tradesmen, merchants, or others, relative to the practical effect of the enactment now before Parliament", and he responded that "It did not occur to the Commission that it was possible for them to derive any useful information from such an examination. It is manifest that in establishing one uniform system of measures, there must be more or less of inconvenience experienced by those who have been in the habit of using such as are about to be abolished; and that seems to be unavoidable in all cases where an uniformity of measure is effected."[57]

Gilbert's response to this question is startling, if one recalls the continual placement of emphasis on the security of trade and the need for simplicity when altering the metrological system in the three Commissioners' reports (and, indeed, long before). His apparent lack of concern for the trouble caused to merchants by metrological changes appears particularly contradictory if one considers the first clause of the preamble to the 1823 bill, which was identical to the beginnings of the second bill introduced in 1765, the bill of May 24, 1815, and the 1823 bill: "Whereas it is necessary for the security of commerce, and for the good of the community, that Weights and Measures should be just and uniform". Gilbert's claim that none of the Commissioners thought that merchants or tradesmen could provide "any useful information" sits very uneasily with the legislation's proposed purpose of facilitating trade.

The rest of the Lords' report supported the suspicion that other motivating factors might have played an important part in the development of the imperial system. Gilbert also

---

[56] "Report from the Select Committee of the House of Lords Appointed to consider of the Petition of the Chamber of Commerce and Manufactures ... in the City of *Glasgow* ..." *British Sessional Papers. House of Commons, 1824, vol. 7, p. 437.*

[57] Ibid.

argued that the new system will be easy for "ignorant persons" to understand, since weighing a given amount of water is much more easily done than gauging the contents of measures of capacity.[58] However, apparently not satisfied with Gilbert's response to the question of interviewing merchants and tradesmen, the Lords Committee questioned two very prosperous merchants, two tradesmen, and two Customs officers. Only the wealthy merchants claimed not to be worried about the proposed changes. All the others complained that the shift to a new system would cause them a substantial degree of inconvenience, calling into question Gilbert's claim that the lower classes who were less skilled in mathematics, as was likely the case with the tradesmen interviewed, would be the least affected by the legislation.

Perhaps the most incriminating testimony of all, however, was that of Patrick Kelly, whom Zupko describes as "one of the most brilliant metrologists of the nineteenth century".[59] Kelly began in an apparently conventional manner, by asserting that he believed the proposed standards of weight and length to be "very correct", but that the measures of capacity were "not so uniformly established."[60] He was then asked, in regard to determining the yard according to the length of a pendulum, "is there not great difficulty in obtaining standards formed on observations from nature?" Kelly replied that "yes, Nature seems to refuse invariable standards; for, as Science advances, difficulties are found to multiply...", and he listed five significant problems he saw with the pendulum method. Finally, when asked if the existing weights and measures did cause as many problems as the Commissioners claimed, Kelly answered that "I

---

[58] Ibid, p. 436.

[59] Zupko, *Revolution in Measurement*, p. 112.

[60] "Report from the Select Committee of the House of Lords Appointed to consider of the Petition of the Chamber of Commerce and Manufactures ... in the City of *Glasgow* ..." *British Sessional Papers. House of Commons, 1824, vol. 7, p.444.*

believe it is more an imaginary than a real evil; more felt by philosophers than by farmers, or others interested in the practice. For, as the contents of customary measures are generally known to all persons concerned in their use, the prices are regulated accordingly."[61] That such an eminent metrologist as Patrick Kelly would state so bluntly that the good of the people was perhaps not the primary concern of those appointed to develop the imperial system suggests that it is definitely worthwhile examining other possible factors motivating standardisation.

Despite the new information provided by the Lords' report, the controversy caused by the petition from the Glasgow Chamber of Commerce subsided, and in February, 1824, a bill identical to the 1823 bill was introduced in the Commons by Sir George Clerk and seconded by Davies Gilbert. The bill became law on June 17, 1824, and, after one delay due to the time required to prepare for the new laws, the imperial system came into effect on January 1, 1826. The new system incorporated both Wollaston's proposal and Bird's standard yard. The imperial system therefore became, in the end, a system of general metrological uniformity, shaped by its determination from an observable constant in nature, but also one of a highly conservative nature regarding the amount of change required. Its purpose was once again asserted (in the preamble) to be "the Security of Commerce, and ... the Good of the Community".[62]

In conclusion, this examination of the standardisation debate as it unfolded in Parliament, as seen through the evidence provided in Parliamentary reports, bills, acts, and debates, as well as supporting evidence from the *Times* and secondary literature, presents a picture of a complicated and protracted process of negotiation between various points of view

---

[61] Ibid, p. 446.

[62] "An Act for ascertaining and establishing Uniformity of Weights and Measures" (17 June, 1824). *Statutes of the United Kingdom, 5 George IV, cap. 74, vol. 9 (1823-1824), pp. 759-766.*

concerning weights and measures. This process appears to have included the involvement of the scientific community, independent members of Parliament, and the government. The scientific community had been interested in the movements of the pendulum for generations, as evidenced by Kater's adoption of a theorem developed by Huygens, although Pond's comment in 1818 that Kater was working on a principle that had been known to scientists for a very long time but had never been put to any "useful or practical purpose" suggests that scientists such as Kater do not appear to have been interested in applying their knowledge to the issue of everyday weights and measures. The government, on the other hand, appears to have become interested in the standardisation of certain specific types of weights and measures, for example money weights, and its interest in the scientific basis of the system of standardisation that the scientific community was able to offer developed much more slowly. Finally, the initiative of individual members of Parliament, in particular George Clerk and John Riggs Miller, seems to have helped forge a connection between the government and the scientific community as their interests grew closer together until they became synthesised in the second decade of the nineteenth century, as reflected in the Prince Regent's request that a pendulum be built for the purposes of metrological research in 1816.

Furthermore, the fact that both radically new, and highly conservative, ideas continued to be advocated until as late as the early 1820s suggests that the shape the imperial system ultimately assumed had by no means become inevitable by 1758, as Zupko argues. Rather than viewing the period between 1758 and 1824 as one of anticipation of a foregone conclusion, therefore, this chapter has demonstrated the need to examine the manner in which the views of the various groups involved in the standardisation debate developed, came into contact and

conflict with one another, and, ultimately, how agreement on the form the imperial system finally assumed was reached.

Chapter 3: Merchants, Tradesmen, and Scientists.

The previous chapter revealed that successive British governments in the eighteenth and early nineteenth centuries were concerned with the state of England's metrological system. In 1758, with the presentation of a report from the Carysfort Committee in the House of Commons, the government revealed that it considered Britain's (and especially England's) lack of metrological uniformity to be a serious problem. From this point until the passage of the Imperial Weights and Measures Act in 1824, variations in weights and measures continued to be seen as a national problem at the level of the central government. Two distinct approaches to the issue are discernible. Comparatively conservative legislation simply proposed stricter enforcement of the existing standards, as in Samuel Whitbread's bill of 1815 which became law in the same year. In contrast, more radical proposals, calling for a fundamental overhaul of the metrological system, included the plans articulated by Sir John Riggs Miller and the unsuccessful 1815 bill to establish uniformity of weights and measures. The varying customary weights and measures which were in use throughout England were obviously thought to be a matter in need of urgent attention by many members of Parliament..

It was also suggested that the government's claim to be attempting to standardise weights and measures in order to benefit trade, or for "the Security of Commerce, and ... the Good of the Community" as stated in the preambles of the bills of 1765, 1815, 1823, and 1824 as well as the Imperial Weights and Measures Act of 1824, is questionable. The Lords'

committee report in 1824 revealed that members of the most recent Commons' committee to recommend passage of the imperial system had not interviewed any merchants or tradesmen while conducting their research. Instead, they had interviewed scientists who were able to discuss the accuracy of the method but not practical issues of implementation. When the Lords interviewed some merchants, various tradesmen, and Customs officers, they were told that only the large, very wealthy merchants would not be inconvenienced by the proposed changes. Furthermore, the renowned metrologist, Patrick Kelly, stated directly that he believed the metrological problems the government so badly wanted to change were "more an imaginary than a real evil".[1] This accusation, with its implication that other motivating factors played a role in the government's standardisation plans, will now be investigated by attempting to discover how the mercatorial community viewed the issue of metrological uncertainty. This will be done by examining a variety of books written for people who used weights and measures on a daily basis in their work, and which were intended to educate those aspiring to enter these areas of employment. They include books on gauging, measuring, mathematics, bookkeeping, and trading.

It is first necessary to consider more specifically what should be looked for in the sources studied in this chapter. Sheldon et al., in their article, "Popular Protest and the Persistence of Customary Corn Measures", claimed that their work points to a conscious rejection of quantification in local market places: "The purpose of this chapter is ... to examine the sources and values of the stubborn resistance to the implementation of the Winchester

[1] "Report from the Select Committee of the House of Lords Appointed to consider of the Petition of the Chamber of Commerce and Manufactures ... in the City of *Glasgow* ..." *British Sessional Papers. House of Commons, 1824, vol. 7, p.446.*

bushel in the eighteenth century with particular reference to the West of England as a case study in what might be termed the 'anti-quantifying' spirit."[2] This "spirit" was common among pre-industrial societies of many different kinds.

On the same page, however, the authors emphasise the importance of the routine functioning of the market in the lives of the common people, and the prominent role played by enforcement of proper weights and measures:

> ... the market place, as a site for economic and extra-economic activities, occupied a crucial role in the plebeian conscousness. The market place was not merely a centre of economic exchange. It was also a theatre and one of its regular performances was the public regulation of commercial transactions: the assize of bread, the testing of weights and measures by the clerk of the market, and the public burning of those measures found to be deficient. A key prop was the corn bushel itself.[3]

They reinforce this argument by asserting that an understanding of the "just measure" was an integral aspect of "the moral economy of the crowd."[4] It appears, therefore, that the "anti-quantifying spirit" that is revealed by Sheldon et al. to have existed among the "plebeians" was directed towards certain types of quantification only, in particular the imposition of metrological change by the central government. In terms of local consensus regarding the proper units to be used in local markets, and the enforcement thereof, such resistance to

---

[2] R. Sheldon, A. Randall, A. Charlesworth, D. Walsh, "Popular Protest and the Persistence of Customary Corn Measures: Resistance to the Winchester Bushel in the English West", in A. Randall and A. Charlesworth, eds., *Markets, Market Culture and Popular Protest in Eighteenth-Century Britain and Ireland* (Liverpool, 1996), p. 27.
[3] R. Sheldon, et al., "Popular Protest and the Persistence of Customary Corn Measures", p. 27.
[4] Ibid.

quantification is conspicuously absent in their work. Furthermore, Sheldon et al. imply that the public nature of weights and measures testing was part also of another public ritual, an assertion of authority, with the market place characterised as a theatre, and the testing of weights and measures as a performance. This is a very interesting notion; however, one is left wondering specifically what power relationships were manifested in these events.

Avril D. Leadley's work reinforces the importance of local enforcement of weights and measures. She argues that while fraud was relatively common, and that some incidents of "fraud" in fact resulted from confusion concerning exactly what units were allowed, there were definitely limits as to the amount of fraud the public would accept, at which point legal action was taken. Other local institutions participated in the attempt to enforce a level of uniformity too. Local newspapers, in particular, often named (and thereby embarrassed) offenders, as well as publishing articles criticising lack of enforcement if this became excessive.[5]

When considered together, the work of Sheldon et al. and Leadley suggests that while there was substantial local resistance to the imposition of legally sanctioned standards by the government, this does not necessarily imply that there was widespread reaction against quantification of any kind. This raises the possibility that groups outside the government might have understood the nature and purpose of weights and measures differently than their contemporaries in the government. This chapter explores this idea in relation to merchants and tradesmen in an attempt to ascertain how these groups, for whom the government purported to be instigating metrological reform, appear to have viewed the issue of metrological variation.

---

[5] A. D. Leadley, "Some Villains of the Eighteenth-Century Market Place" in J. Rule, ed., *Outside the Law: Studies in Crime and Order 1650-1850* (Exeter, 1982).

Upon examination, the literature reveals evidence that many members of these groups did not share the level of concern shown by the government over regional metrological variation. There appear to have been established methods and units of measurement within different industries that were widely recognised and remained constant throughout the eighteenth century. These characteristics contrast markedly with the scientific treatises found concerning metrology, which strengthens the suspicion raised in the previous chapter that the scientific community did not engage with everyday weights and measures in a manner in any way similar to the business communities.

One must begin by admitting that it is difficult to define and describe the merchant and trades communities. Although contemporary books that deal with weights and measures refer quite specifically to which trades and businesses, builders and craftsmen they were directed, the distinction between individual craftsmen and larger businessmen that is made in current historical works was not made in this period. As David Barnett explains, "no contemporary source of industrial data from the late eighteenth and early nineteenth centuries ever distinguished between occupation or craft on the one hand, and industry or trade on the other."[6] He gives an example of an owner of a large insurance company specialising in insuring the shipping industry, who was categorised as a "shipwright" in a trade directory.[7] Therefore, it is possible that overlap existed between the two groups which are treated as largely distinct entities in this chapter.

Furthermore, as one might expect, the various communities were not entirely homogeneous. Substantial differences of political opinion existed among the London merchants,

[6] D. Barnett, *London, Hub of the Industrial Revolution* (London, 1998), p. 26.
[7] D. Barnett, *London, Hub of the Industrial Revolution*, pp. 28-29.

for example. George Rudé argues that while the merchants of the City often joined together to oppose specific government initiatives, there were serious political divisions between those who worked in the very large "moneyed" companies, such as the Bank of England, the largest trading companies, and national insurance firms, and other more independent merchants who worked in smaller ventures. These divisions also manifested themselves in the numerous administrative bodies that governed London.[8] However, this chapter seeks to examine the views of those who lived and worked outside the immediate circles of the central government, and who would have had considerable experience with England's weights and measures, especially because this is the group alluded to repeatedly in the legislation. Therefore, for the purposes of this chapter, it is argued that the apparent cohesiveness of these groups in terms of occupation and exclusion from government warrants positing them as distinct communities.

The books most immediately concerned with the dimensions of everyday measures were works on gauging, which was also often called "stereometry". All except one of these books appear to have been written by members of the Excise collection service, and their dedications reveal that they were written for other Excisemen. These books were directed towards the officers of Excise who travelled the country in order to enter business premises or households and gauge the vessels used by the inhabitants and charge the required domestic tax, or excise, on the goods or produce sold according to those measures.

The importance of officers of Excise in this period is reflected in the fact that the number of them employed by the government grew significantly over the eighteenth century, from 1000

[8] G. Rudé, *Hanoverian London 1714-1808* (London, 1971), pp. 145-147.

in 1690 to 2800 in 1780.[9] John Brewer attributes this growth to the crucial role played by officers of Excise in the development of a steady system of taxation for the purposes of funding long-term government debt, due in large part to the almost continual war waged in this period. He argues that between 1660 and 1760, England's financial system was revolutionised as the need to support foreign wars consistently increased. Unlike other historians who emphasise the fact that these financial changes were led by the introduction of large-scale, publicly funded government debt through the Bank of England, Brewer argues that the government's ability to meet its debt or interest payments was equally important, since it is unlikely that any great number of people would have invested in government securities if it did not appear that these would be secure. A formidable system of tax collection was developed, and the officers of Excise, who actually travelled the countryside to gauge and charge excise on containers of goods in almost every household, played a very important role in this system. One can argue, from this information, that it is likely these field officers would have been among the most knowledgeable people in the country concerning the state of English weights and measures.

Of all the works surveyed in this chapter, these books do indeed provide the most comprehensive outline of the standard measures in use. Their publication dates range from 1704 to 1799, and the information they provide concerning the legal, standard measures of capacity in use reveals both the consistency of some of the units used by the Excise, and the arbitrariness employed in fixing the bushel that became the standard Winchester bushel for most of the eighteenth century and until 1824. First, each author lists the standard ale (or beer) and wine gallons as containing 282 and 231 cubic inches respectively. These values did not change,

[9] J. Brewer, *The Sinews of Power: War, money and the English state, 1688-1783* (London, 1989), p. 102.

despite the fact that the legal status of the standards upon which they were based was uncertain. The wine gallon of 231 cubic inches was held in the Guildhall, while the ale and beer gallon of 282 cubic inches was to be found in the Exchequer. In spite also of this ambiguity concerning which of the two locations held the "original" standard, which was a prominent point of discussion in the 1758 Committee Report, there seems to have been a widespread consensus that these were the two measures for liquids to be used for such official things as taxation.

In contrast to the standard measures of capacity for liquids, the values given for the corn bushel, also called "dry measure" and used for almost all dry goods and produce except coal, evolved over the first quarter of the eighteenth century. In 1704, George Ward stated that the corn or dry gallon "now in use" contained 272 ¼ cubic inches.[10] This would create a bushel that contained 2178 cubic inches (or 8 gallons), which is not an amount discussed in any of the reports or legislation examined in the previous chapter. The following year, Thomas Everard listed the corn gallon as holding 272 ½ cubic inches in his *Stereometry, or, The Art of Gauging Made easie*. He also added a new gallon, used for gauging malt, because a tax on malt was imposed in 1701. The new malt measure was to be derived from the Winchester bushel, but Everard mentions that when the malt tax bill was first introduced in the House of Commons in 1696, numerous Members requested that the standard Winchester bushel held in the Exchequer be gauged so that the exact number of cubic inches could be written into the legislation. Such an examination was performed, and it was discovered that the Exchequer bushel (which was made in the reign of Henry VII) held 2145.6 cubic inches. This was considered to be an

[10] G. Ward, *The Gauger's Practice: Or, A Compendious Way of Gauging Brewers Tuns; and the Gauging of Casks, according to the true Rules of Art* (London, 1704), *E.C.* reel 302, no. 9, p. 21.

inconvenient size, however, so that, as Everard explains,

> to settle the Dimensions for a Bushel to answer the said Standard, these were agreed upon as most convenient, *viz.* 18.5 Inches Diameter, and 8 Inches deep; for a Cylindrical Vessel of these Diamensions will contain 2150.42 solid Inches, which exceeds the Content of the Standard Bushel but 4.82 Inches, and there being no other convenient Dimensions, without counting to the hundredth part of an Inch, that would come so near as these. It was therefore Enacted in the Act for laying Duty upon Malt.[11]

Once agreed upon in this manner, the new Winchester bushel became the legal standard for measuring malt in 1701. By 1729, when the "philomath" E. Hatton wrote *The Gauger's Guide; or, Excise-Officer Instructed*, the division between the corn bushel and the new malt bushel made by Everard in 1705, had disappeared. Hatton refers to only one "malt or corn measure" which appears to be of the dimensions specified in the act of 1701. In 1766, Thomas Moss included only the newly calculated Winchester bushel as the "malt bushel" in his *A Treatise of Gauging*,[12] and in 1799, William Symons's *The Practical Gauger*[13] refers to the Winchester bushel as the "standard bushel" for dry goods and both its dimensions and weight are listed. Therefore, the new Winchester bushel of 2150.42 cubic inches appears to have been decided on because of its mathematical simplicity rather than its basis in any historical precedent. Within a few years of the passage of the malt tax act in 1701, it was generally adopted by the officers of Excise as the standard dry measure of capacity, and like the liquid measures, it then remained in constant use until 1824.

However, while there seems to have been little confusion among government gaugers

---

[11] T. Everard, *Stereometry, or, The Art of Gauging Made easie, by the Help of a Sliding-Rule* (London, 1705), *E.C.* reel 2188, no. 19, pp. 190-191.
[12] T. Moss, *A Treatise of Gauging* (London, 1766), *E.C.* reel 309, no. 8, p. 67.
[13] W. Symons, *The Practical Gauger: Or, The Young Gauger's Assistant* (London, 1799), *E.C.* reel 309, no. 4, pp. 180-181.

concerning weights and measures, this does not mean that there was little or no regional variation in units used by the general population. The one gauging book to discuss such variation is George Ward's book, *The Gauger's Practice* (1704), which includes a table of commonly used wine, beer, and ale vessels.[14] Furthermore, the purpose of employing Excise officers who were skilled gaugers was to convert these local vessels into either wine, ale and beer, or dry gallons. The sample problems presented in the books reflect this purpose. For example, in Thomas Moss's *A Treatise of Gauging* (1766), one is taught how to find the superficial measurement of geometric figures in units of ale and wine gallons, and malt bushels. A triangle with a base of 84 inches and a height of 56 inches is shown to measure, superficially, 2352 square inches (the base multiplied by half the height), equalling 8.34 ale gallons (2352 divided by 282), 10.18 wine gallons (231 cubic inches), or 1.09 malt bushels (2150 cubic inches). Every sample problem given is calculated three times, so that any quantity of goods found in this shape could be quickly converted into any of the different sized legal measures of capacity. It is, arguably, not particularly surprising that the Excise collection involved an established set of units with which gaugers who collected the Excise would have been familiar, or that the officers would not have displayed great concern over regional metrological variation since they would have been prepared to deal with any type of customary measure.

This picture of relative consistency among the standard legal units of measurement and weight becomes more striking, however, when it can be seen in books dealing with measurement more generally, in addition to the specialised books on gauging. The nine books

[14] G. Ward, *The Gauger's Practice*, p. 24.

found on general measurement were written by a wider variety of authors, and although not all of the authors state their professions, there are at least four mathematics teachers, one of whom was also the librarian of the Royal Society, and two "philomaths". The instructive nature of the books that do not state the author's occupation suggests that their authors were probably also involved in teaching. All of the books are directed towards people involved in trade, and many of them begin with prefaces extolling the virtuous union between trade and mathematics, such as that included by Isaac Overley in his *Measuring Made Easy* (1739): "By help of Arithmetic, the industrious Merchant transacts a great deal of Business, without oppressing the Memory: By help of Geometry, the skilful Builder truly delineates the Proportion of every Part of that most beautiful Vehicle a Ship; so that those two, may be justly esteem'd the Supporters of Commerce."[15] They appear to have been directed in particular towards craftsmen and young gentlemen in schools who would eventually engage in trade, as they focus on applied measurement for building and various trades, and also appear to have been used in schools in a number of cases. For example, *Hawney's Complete Measurer* (1798) was stated to be for "the use of schools, and persons concerned in measuring, gauging, surveying, &c.",[16] while the title of William Pain's book, *The Practical Measurer, or Youth's Instructor* (1783) reveals its purpose.[17]

These works are, in general, considerably longer than the books on gauging. They begin with theoretical sections that provide basic mathematical instruction, as was seen in the gauging treatises, followed by various types of applied measurement used in different trades. Each book

[15] I. Overley, *Measuring Made Easy* (London, 1739), *E.C.* reel 337, no. 6, preface.
[16] T. Ketih, ed., *Hawney's Complete Measurer: Or, The Whole Art of Measuring* (London ,1798), *E.C.* reel 2824, no. 1.
[17] W. Pain, *The Practical Measurer, or Youth's Instructor* (London, 1783), *E.C.* reel 2283, no. 6.

either lists or uses the legal wine, ale or beer, and dry measures, as well as the respective denominations of the troy and avoirdupoids pounds and some measures of length and superficies. However, these definitions do not tend to figure prominently in any of the works, and they can often be found either close to the end or in an appendix, as in William Hawney's earlier edition of his *The Compleat Measurer* (1721).[18] Furthermore, the standard units described by the authors show no sign of having changed from the early 1720s until the very end of the century. The earliest book, Hawney's 1721 edition of *The Compleat Measurer*, states that "the several Measures now used in England" were the ale gallon of 282 cubic inches, the wine gallon of 231 cubic inches, and the corn gallon of 268.8 cubic inches, with its derivative bushel of 2150.42 cubic inches.[19] These are the same values listed in the earlier treatises on gauging, and the corn measure listed here conforms with the statutory Winchester bushel enacted for levying the new malt tax in 1701 after the House of Commons decided 2150.42 cubic inches was the most convenient size. This bushel was seen, in the gauging books, to have become the capacity measure for dry goods in general by the 1720s, after which it did not change until 1824. These values also remain constant up to the latest book on measurement examined, which is a 1798 edition of Hawney's work, revised and adapted for greater school use by a mathematics teacher.[20] In it, the only difference lies in the fact that the statutory Winchester bushel is called the "malt bushel" rather than the "corn bushel", although its use continues to be for measuring almost all dry goods. In terms of the legal standard units of

---

[18] W. Hawney, *The Compleat Measurer; or, the Whole Art of Measuring* (London, 1721), *E.C.* reel 2642, no. 2.
[19] W. Hawney, *The Compleat Measurer*, p. 309.
[20] See footnote 13.

measurement, therefore, the consensus and widespread use of the same units throughout most of the eighteenth century that was seen in the gauging treatises appears also to have been present in a certain capacity within many trades.

Far more prominent than the legal standards of weight and measurement in the works on measurement, however, are discussions of the ways in which different craftsmen measured their work. For instance, in his 1721 edition, Hawney described the manner in which carpenters measured flooring, partitioning, and roofing; in which bricklayers measured tiling, walling, and chimney work; and in which plasters, joiners, painters, glasiers, and masons calculated the cost of their work by measuring the product thereof. Isaac Overley provided similar information for coopers, paviers, and backmakers, in addition to most of the trades discussed by Hawney, in his *Measuring Made Easy* (1739).[21] Other authors added information concerning such topics as timber measure, ships' tonnage, the size of ammunition, and land surveying.[22] The only unit of measurement discussed in these sections that appears to have been uncertain is the pole, a superficial measure also called a rod or perch, which is listed as varying in different areas. William Hawney and Abraham Fletcher mention that bricklayers usually used the statutory pole of 16 ½ square feet to measure walling, but that in some places poles of 18 or 21 square feet were also used,[23] while J. Good mentions that in land measurement, poles of 18, 21, and even 24 square feet were used in "divers parts of England".[24] Apart from this instance of

---

[21] I. Overley, *Measuring Made Easy. Being The most Facile and Expeditious Method extant* (London, 1739), *E.C.* reel 337, no. 6.
[22] For example, see J. Bonnycastle, *An Introduction to Mensuration, and Practical Geometry* (London, 1782), *E.C.* reel 1666, no.4, pp. 208-274. Abraham Fletcher discusses land surveying in his *The Universal Measurer, and Mechanic* (London, 1762), *E.C.* reel 308, no. 10.
[23] W. Hawney, *The Compleat Measurer*, p. 213. A. Fletcher, *The Universal Measurer*, p. 40.
[24] J. Good, *Measuring Made Easie: Or The Description and Use of Coggeshall's Sliding Rule* (London, 1724), *E.C.* reel 337, no. 8, p. 74.

metrological ambiguity, which does, admittedly, show significant variation in the value of the pole, similar methods of measurement for each trade are listed in each book, suggesting that, once again, there were a number of generally accepted systems of measurement used in industries requiring the services of the skilled craftsmen listed above. When this apparent level of uniformity among tradesmen's measurements is combined with the consistent listing of the legal standards of weight and measurement in the books on measurement, and when it is noted that none of the authors wrote about problems he encountered concerning metrological confusion, one is led to question the extent to which many people outside of the government, who worked in trades, considered metrological problems to constitute a serious and pressing issue.

A similar pattern can be seen in a set of mathematical textbooks, most of which appear to have been used in the education of members of the merchant, or business, classes. Some of them stated directly that they were written to educate the mercatorial class, an example being the full title J. Randall's book, *An Introduction to so much of the Arts and Sciences, More immediately concerned in an Excellent Education for Trade in its lower Scenes and more genteel Professions, and for Preparing Young Gentlemen in Grammar Schools to attend Lectures in the Universities.*[25] Similarly, Thomas Dilworth's *The Schoolmaster's Assistant: Being a Compendium of Arithmetic, both Practical and Theoretical* (1744) is "recommended by several eminent Mathematicians, Accomptants and Schoolmasters, as necessary to be used

[25] J. Randall, *An Introduction to so much of the Arts and Sciences, More immediately concerned in an Excellent Education for Trade* (London, [1765 ?]), *E.C.* reel 308, no. 9. After home schooling and the English public schools, grammar schools were the next most popular choice of education among the gentry in this period, whereas almost no members of the aristocracy attended them. See N. Hans, *New Trends in Education in the Eighteenth Century* (London, 1951), pp. 26-27.

in Schools by all Teachers...",[26] while Benjamin Donn's *The Accountant and Geometrician* (1765) claims to be "designed for the Use of Schools, as well as private Gentlemen."[27] Others are directed toward merchants in general, rather than specifically designed for teaching purposes. W. Hodgkin's *Short, New, and Easy Method of Working the Rule of Practice in Arithmetic* (1731) was designed "for the greater Facilitating of all Operations in Trade"[28]; John Wilson's *Introduction to Arithmetic* (1752) contains "the more necessary and useful Rules in Business".[29]

These mathematical books, which appear to have been more common than either of the more specialised types of books discussed previously,[30] all contain sections on mensuration, similar to the books on measurement, but they also provide instruction in other more specifically mercatorial areas, such as bookkeeping, calculation of interest, and foreign exchange rates. As a result, the sample problems offered to the reader deal with issues more of a mercatorial nature, rather than focusing on exercises in converting and calculating different types of weights and measures as the other types of books do. A simple example of such sample problems can be found in J. Randall's book when he asks, "Bought 10 Casks of Indigo, at 4s. per lb. Neat, the Gros and Tare being as per Margin, What have I to pay for these Goods?"[31] While each book contains either descriptions of the standard units of weight and measurement or sample problems in which weights and measures are used, just under two thirds of them do not raise

---

[26] T. Dilworth, *The Schoolmaster's Assistant: Being a Compendium of Arithmetic, both Practical and Theoretical* (London, 1744), *E.C.* reel 308, no. 4.
[27] B. Donn, *The Accountant and Geometrician* (London, 1765), *E.C.* reel 302, no. 6.
[28] Q. Hodgkin, *A Short, New, and Easy Method of Working the Rule of Practice in Arithmetic* (London, 1731), *E.C.* reel 1428, no. 2.
[29] J. Wilson, *An Introduction to Arithmetic* (Edinburgh, 1752), *E.C.* reel 1666, no. 3.
[30] Fourteen books written for the purpose of general mathematical instruction were found, compared with seven on gauging and nine on mensuration.
[31] J. Randall, *Introduction To so much of the Arts and Sciences*, p. 53.

the issue of metrological variation within England at all.[32]

The discussions of regional variation found in the rest of the books vary considerably in length and content. John Wilson, whose *Introduction to Arithmetic* (1752) was published in Edinburgh, inserts a chart of eight conversions of Scottish weights and measures into those of England between his preface and the table of contents of his book.[33] Richard Neve and Thomas Sadler include longer discussions of the uncertainty surrounding the actual size of the standard gallons. In 1708, Neve wrote that "There has been a great Controversy about the true Number of Cube-Inches in each of these Gallons; which I shall here endeavour to decide."[34] He lists the wine gallon of 231 cubic inches as that commonly used, whereas the actual standard measured 224 cubic inches. He mentions that an experiment was conducted in 1688 by several prominent men, including the Lord Mayor of London and Mr. Flamstead (the president of the Royal Society), to gauge the standard wine gallon held at the Guildhall. It was found to contain 224 cubic inches; however, it had long been thought to contain 231 cubic inches, and this discovery did not result in any change in the wine gallon in practice. Similarly, Neve says that despite the change in the size of the Winchester bushel brought about by the 1701 malt tax act, 272 ¼ cubic inches continued to be used for the gallon in some places. This conforms with the other works that included the old 272 ½ cubic inch gallon, considering its very early date. Sadler says almost the exact same thing about the wine gallon in 1773: there was "an experiment tried at Guild-Hall before the Lord Mayor &c. when the old standard wine gallon was found to contain exactly but

[32] Eight of the fourteen books contain no mention of metrological confusion or variation in England.
[33] J. Wilson, *An Introduction to Arithmetic* (Edinburgh, 1752), *E.C.* reel 1666, no. 3, p. xv.
[34] R. Neve, *Mathematicks made Plain, In the Solution of a Variety of Useful Propositions* (London, 1708), *E.C.* reel 2230, no. 9.

224 cubical inches, yet for all that the supposed content of 231 inches are continued."[35] This depiction of both the legal wine gallon and the powerful force exerted by custom in terms of the general acceptance and use of an incorrect gallon is very similar to what was said in the 1758 report concerning the wine gallon, the importance difference being that neither Neve nor Sadler voice any concern about this legally ambiguous situation.

A more interesting aspect of specific regional metrological variation is raised in two other mathematical books. In his *Arithmetick in the Plainest and Most Concise Methods hitherto Extant* (1748), George Fisher mentions that the unit used in land measurement is the statute pole (also 'rod' or 'perch'), which consisted of 16 ½ square feet. He adds, however, that "there are some customary Measures which are more; as for Fens and Wood Lands, there are reckoned 18 Foot to the Pole; and for Forests 21 to the Pole."[36] An anonymous book entitled *The Four First Rules of Arithmetic* (1787) gives the same explanation for regional variation in the size of the pole: "though a statute Pole, Rod or Perch is 5 Yards and ½, or 16 Feet and ½, yet in fenny and barren Lands they generally allow 18 Feet, and 21 Feet to the Pole in the Forest Mensuration."[37] It will be remembered that two books on measurement mention that some bricklayers used the larger, customary poles, and that J. Good lists poles of 18, 21, and even 24 square feet in his section on land measurement.[38] Without any contextualisation, these instances of variation at first appeared to simply have been symptoms of the nation-wide metrological confusion complained of repeatedly by the government beginning with the 1758

---

[35] T. Sadler, *A Complete System of Practical Arithmetic (Both Vulgar and Decimal) On an entire new Plan* (Shrewsbury, 1773), *E.C.* reel 309, no. 2.

[36] G. Fisher, *Arithmetick in the Plainest and Most Concise Methods hitherto Extant* (London, 1748), *E.C.* reel 302, no. 1.

[37] *The Four First Rules of Arithmetic, With a Useful Collection of Tables, of Weights and Measure* (London, 1787), *E.C.* reel 1428, no. 10.

[38] See p. 78 above.

Committee Report. However, the explanation provided by George Fisher and *The First Four Rules of Arithmetic*, that the pole increased as the land became less arable, raises the possibility that at least some differences in measures were effected deliberately and for practical reasons. Furthermore, the fact that both bricklayers and land surveyors used the larger, illegal poles suggests that these differences might have been quite widely known and accepted among different occupational groups.

A number of other books relating to trade in various capacities, which contain certain interesting points of information, were also examined. Two books on foreign trade make no mention whatsoever of problems within England concerning weights and measures.[39] John Mair's *Book-Keeping Methodiz'd* (1757) contains a "merchant's dictionary" containing "the abstruse words and terms that occur in merchandise".[40] What is striking in it is the lack of precision with which many units of weight and measurement are described, in particular British ones. For example, a cask is defined as "an uncertain quantity; of sugar, from 8 to 11 C. [hundredweight]; of almonds, about 3 C." A quarter is "in England, 8 bushels; in Scotland, 4 boils; in Spain, a quantity of about 139lb. weight of corn; and a puncheon is "of wine, 84 gallons; of prunes, from 10 to 12 C."[41] A 1773 edition of Mair's book contains identical descriptions of these measures.[42] Whether such vagueness concerning weights and measures was deliberate on the part of merchants who could manipulate it to their own financial

---

[39] B. Webb, *The Complete Negotiator: Or, Tables for the Arbitration and Combination of the Exchanges of all the Trading Countries in Europe, and for Reducing the Same to Par* (London, 1767), *E.C.* reel 338, no. 4. W. Leybourn, *Panarithmologia: Or, The Trader's Sure Guide* (London, 1769), *E.C.* reel 3423, no. 5.

[40] J. Mair, *Book-Keeping Methodiz'd: Or, A methodical treatise of Merchant Accompts, according to the Italian form* (Edinburgh, 1757), *E.C.* reel 3428, no. 4.

[41] J. Mair, *Book-Keeping Methodiz'd*, pp. 399-416.

[42] J. Mair, *Book-Keeping Moderniz'd: Or, Merchant-Accounts by Double Entry, according to the Italian form* (Edinburgh, 1773), *E.C.* reel 3428, no. 5.

advantage, as Sheldon et al. argue, is impossible to ascertain from these sources, although it is worth noting that the pint, gallon, bushel, pound, and hundredweight are not included as entries in the glossary, so that it remains unknown whether or not the statutory units were also considered to be highly flexible.

Another feature that figures prominently in Mair's "merchant's dictionary" is the inclusion of numerous allowances made in calculating the taxes to be paid on goods. For instance, a "draught" (also called a "cloff" or "clough") is listed as "a small allowance on weighable goods, made by the King to the importer, or by the seller to the buyer, to cause the weight hold out when the goods are weighed again."[43] One pound was allowed on goods weighing less than a hundredweight, two pounds for goods weighing between one and two hundredweight, and so forth. Similarly, "leakage" was "an allowance made to the merchant in liquids of 12 per cent. and to brewers of 3 in 23 barrels of beer, and 2 in 22 barrels of ale, in consideration of what leaks or runs out."[44] Cloff and tret, "an Allowance of four Pounds per Hundred for Waste, and Dust on some sort of Goods" granted to the retailer by the merchant, are also mentioned in most of the mathematical books, and they must have been an important factor for merchants to consider in their everyday business transactions.

In addition to these allowances, merchants faced the duties imposed by the English taxation system, which became very complicated by the late eighteenth century. For example, under an 1803 statute, which was intended to simplify the duties payable on goods, salt was subject to nine different duties, depending on whether it was imported or exported, the type of salt and the purpose for its purchase. At the same time, there were two different tax exemptions

[43] J. Mair, *Book-Keeping Methodiz'd*, p. 404.
[44] Ibid, p. 407.

for salt (one for use in bleaching linen and cotton in England; another for the same use but in Scotland), twelve different bounties for salt used to cure fish and meat, and three drawbacks for exported salt.[45] When this multiplicity of taxes and exemptions on specific goods is combined with the more general allowances, such as cloff, leakage, and tret, described in the mercatorial and mathematical literature, it is very difficult to imagine such a system functioning in any capacity without significant co-operation from merchants and traders on the issue of weights and measures.

A final point of interest in the miscellaneous merchants' books is the support given to John Riggs Miller's proposal of 1790 for the adoption of a radically new decimal system of weights and measures by the author of *Commercial Tables* (1790), who is identified only as "a British Merchant, formerly resident in France".[46] The merchant begins by complaining that "Measures of all denominations, viz. Liquids, Grain, Linens, Cloths, &c. ... vary so much in different Provinces and Territorial Districts, as to render the Equilization of them, to the fixed Standards both in England and France, attended with no small degree of difficulty."[47] He then praises Miller's proposal:

> The English reader may have some idea of the obstacles which intrude themselves on such an investigation, by taking a view of the cumbersome variety of different Weights and Measures now in use, in almost every County of Great Britain, which seem so much to demand the Regulating Hand of the Legislature. The Honourable Baronet [Miller] who has lately called the attention of the British Government to this Important Object, certainly merits the applause of his Countrymen, for his laudable Exertions to relieve the Internal Commerce of this Nation,, from a state of so much

[45] "An act to repeal the duties of excise payable in Great Britain, and to grant other duties in lieu thereof. July 4, 1803." *Statutes at Large, 43 George III. cap. 69 (1803), p. 374.*
[46] *Commercial Tables. By a British Merchant, formerly resident in France* (Salisbury, 1790), *E.C.* reel 311, no. 1.
[47] Ibid, p. iii.

> perplexity and embarrassment, occasioned by the use of a multitude of disproportionate Weights and Measures in the different Markets of this Kingdom, and which, for the greater part, are not subject to any fixed Regulation or Controul.[48]

This is the only display of support for Miller's, or any other, proposal for metrological reform encountered in the literature examined thus far in this chapter. The fact that it was published outside London might in part explain this great difference of perspective; otherwise, it is only possible to say that the author appears to have articulated a position that was not frequently supported (in writing at least) by other merchants in this period.

Scientific treatises dealing with metrological standardisation provide another dimension to the standardisation debate. As noted in chapter two, Commons committees of enquiry into weights and measures thought fit to interview only scientists, rather than men engaged in commerce. Scientific treatises found on measurement by scientists include John Dawes's *Pantometry; or, An Attempt to Systematize Every Branch of Admeasurement* (1797), Thomas Williams's *Method to Discover the Difference of the Earth's Diameters* (1788), which contains "a method for fixing an universal standard for weights and measures", Colonel William Roy's *Experiments and Observations Made in Britain, in Order to Obtain a Rule for Measuring Heights with the Barometer* (1778), and a letter from Sir George Schuckburgh to Colonel Roy concerning Roy's barometer experiments (1778).[49] Thomas Williams suggested dividing up the

---

[48] Ibid.

[49] T. Williams, *Method to Discover the Difference of the Earth's Diameters* (London, 1788), *E.C.* reel 1392, no. 8. J. Dawes, *Pantometry; or, an Attempt to Systematize Every Branch of Admeasurement* (London, 1797), *E.C.* reel 1428, no. 13. W. Roy, *Experiments and Observations Made in Britain, in Order to Obtain a Rule for Measuring Heights with the Barometer* (London, 1778), *E.C.* reel 2056, no. 8. G. Shuckburgh, *Comparison between Sir George Shuckburgh and Colonel Roy's Rules for the Measurement of Heights with the Barometer; in a Letter to Col. Roy, F.R.S. from Sir George Shuckburgh, Bart. F.R.S.* (London, 1778), *E.C.* reel 2056, no. 7.

52nd degree, in which London is located, in a manner similar to the French method of determining the metre,[50] expressing a similar admiration for the French metrological innovations as that implied by the author of the *Commercial Tables* in his support for John Riggs Miller's ideas. A very different approach was taken by John Dawes, who offered a completely new method with which to determine standards of cyclometry (circular measurements), chronometry (time), Grammometry (lines), Tetragonometry (land), cubometry, hydrometry (liquids), barometry (weights), numismatometry (coin), and arithmometry (numbers) according to one scientific principle involving the measurement of the circle. To a reader today, Dawes's plan sounds somewhat unrealistic. However, a long tradition of this type of research existed in Europe, with the concept of "pantometry" having emerged in the thirteenth century as quantification became a new and important aspect of Western European philosophy and science.[51]

Colonel Roy's piece was read at the Royal Society over four sessions in 1778, and in it he recounted why, based on his own experiments, he felt the barometer provided a more promising method than the pendulum for ascertaining an absolute standard in nature. He added, though, that neither method has been sufficiently researched to be used for any practical purpose. In the introduction, Roy mentioned that "ever since the discovery made by Torricelli, the barometer hath been applied, by different persons, in different countries, to the measurement of vertical heights..."[52] Evangelista Torricelli was a scientist working in the mid-seventeenth century who studied under Galileo and who worked on the effects of changes in air pressure on

[50] T. Williams, *Method to Discover the Difference of the Earth's Diameters*, pp. 72-75.
[51] A. W. Crosby, *The Measure of Reality: Quantification and Western Society, 1250-1600* (Cambridge, 1997), p. 21.
[52] W. Roy, *Experiments and Observations Made in Britain, in Order to Obtain a Rule for Measuring Heights with the Barometer*, p. 6.

suction pumps. Blaise Pascal, among others, conducted experiments which supported his theory. [53] Therefore, similarly to Dawes, Roy was working within a very well established, international scientific tradition that was not solely devoted to everyday metrological issues. This characteristic was also shared by Captain Henry Kater, who stated that he used a theorem concerning pendulums developed by another seventeenth-century scientist, Christian Huygens, in his 1818 report that was presented to the House of Commons.[54]

Overall, the sources examined in this chapter suggest that the metrological variation present within England in this period was dealt with in a variety of different ways by a number of people in different occupations. Officers of Excise prepared themselves for regional variation by becoming skilled gaugers, authors of books on general practical measurement attempted to prepare their readers for encountering different units by describing differences they were aware of, while members of the scientific community offered possibilities of systematising the metrological structure through the use of well established scientific theories and experiments. While certain individuals stand out in terms of their advocation of reform of weights and measures, such as the author of the *Commercial Tables*, the general picture to emerge from this literature is striking in terms of the lack of both complaints regarding the complicated state of England's weights and measures and calls for metrological reform among merchants and craftsmen.

This chapter certainly does not prove that little or no regional metrological variation existed or caused problems for the general public. However, it does suggest that the general picture presented in the parliamentary sources that English metrology was chaotic and

[53] S. F. Mason, *A History of the Sciences* (New York, 1962), pp. 273-274.
[54] See p. 64 above.

detrimental to commerce and the country in general should not be accepted unquestioningly. This suggests that the intricate system of local acceptance and enforcement of units that Sheldon et al. and Leadley (among others) discuss must be taken into account when attempting to understand how the government came to be able to implement the imperial system after such a long period of metrological initiatives followed by parliamentary stagnation.

Chapter 4: Bedfordshire.

An analysis of the various groups involved in the development of the imperial system has raised a number of questions up to this point. It was suggested in the second chapter that the central government's desire to reform Britain's weights and measures should not be understood solely in terms of a disinterested urge to stabilise the metrological system, an urge rendered inevitable by the great advancements made in the eighteenth century in the areas of scientific knowledge, technological capability, and human rationality. The government's characterisation of the metrological status quo as chaotic and dangerous was questioned in the third chapter, when it was argued that a number of groups outside the central government had a different understanding of weights and measures than that of the government. These merchants and tradesmen did not necessarily view national uniformity as a necessary part of the metrological structure, let alone as the fundamental purpose of that structure. In relation to the apparent difference of understanding, the third chapter also discussed some issues of local enforcement of metrological conformity raised by Sheldon et al. and Avril Leadley. These authors demonstrate that certain types of enforcement were accepted, and indeed expected, by the public. Furthermore, it was seen in the first chapter that Julian Hoppit emphasises the importance of the local metrological issues experienced by members of Parliament, acting as local justices of the peace, in their decision to advocate metrological reform in Parliament.[1]

[1] J. Hoppit, "Reforming Britain's Weights and Measures, 1660-1824", *English Historical Review*, vol. 108 (1993), pp. 82-104.

This chapter will examine one locality, the county of Bedfordshire, in an attempt to add to the information provided by these authors concerning the relationship between Parliament and county government. An examination of Bedfordshire in this context provides a number of valuable insights into the standardisation debate. To begin with, Bedfordshire was close enough to London that its ruling class could play an active role in Parliament and in the government of the county. Samuel Whitbead, who pursued metrological standardisation in Parliament in 1814 and 1815 as was seen earlier, represented the borough of Bedford and acted as a local magistrate throughout his career until his death in 1815. Whitbread, as well as many other members of the local ruling elite including the Duke of Bedford, the Duke's younger son Lord John Russell, and William Lee Antonie, was a member of the Whig party in Parliament. At the same time, Bedfordshire was at enough of a distance from London that its economy was not closely tied to the metropolis. The county's economy remained largely agricultural throughout this period, supplemented by such industries as wool-combing, straw plaiting, and pillow-lace making.[2] Therefore, the local justices of the peace were not faced with the severe social upheavals caused by heavy industrialisation, although the county did suffer from the effects of war and population increase. Despite the absence of acute social crisis, a number of local gentlemen and justices worked consistently to improve the living conditions of the common people of Bedfordshire. Whitbread in particular was renowned for the constant concern he displayed for the people he represented, and he is said to have frequently placed his own moral convictions above his loyalty to the Whig party.[3] Therefore, a strong force in the standardisation

---

[2] W. Page, ed., *The Victoria History of the Counties of England: Bedfordshire* (London, 1972),vol. 2, pp. 117-127.

[3] R. Fulford, *Samuel Whitbread 1764-1815: A Study in Opposition* (London, 1967).

debate in 1814-1815 came from a member of the Whig opposition with extensive experience in local government and concern for the poor. This presents an interesting dimension to the central standardisation debate.

This local study will identify some of the issues facing justices of the peace attempting to enforce local conformity of weights and measures in Bedfordshire. At the same time, the members of Parliament for Bedfordshire, in particular Samuel Whitbread, were exposed to the developments in the standardisation debate at Westminster. It will be argued that, in addition to the important role played by local experience in the members' activities at Westminster which Hoppit discusses, this central governmental experience appears to have influenced the justices' metrological initiatives within their county. Therefore, rather than interpreting the relationship between the local situation and the central standardisation debate as one of predominant opposition, or incompatibility, it will be suggested that the relationship contained an important element of reciprocity, as the people involved in both areas (as justices and members of Parliament) attempted to forward and reconcile a number of different interests. In this way, the link between local metrological situations and central political discourse concerning metrology will be seen to have been tighter and more formative than even Hoppit argues. This is important for the larger purpose of this thesis because the following chapter will offer an explanation for the success of the imperial system in 1824 in which this relationship plays an important role.

The question of why the Bedfordshire's ruling elite began to play a more active and positive role in the county's governance in the late eighteenth century is impossible to answer completely, and various factors have been identified by historians which could help explain their

initiatives in the area of weights and measures more specifically. To begin with, the dramatic demographic changes affecting the county form an important part of the background of the metrological issue. Joyce Godber describes the huge increase in population that occurred in the county between c.1770 and 1830 in her *History of Bedfordshire 1066-1881*. Bedford did not experience the level of industrialisation that many other counties did in this period, but its population nonetheless increased 76 per cent, or from 3,948 to 6,959, between 1801 and 1831.[4] The county's population as a whole grew at a similar rate, from 63,393 in 1801 to 83, 716 in 1821 and to 95 483 in 1831.[5] This increase began earlier than 1801, however: in 1807, the author of *Two General Views of the Agriculture of the County of Bedford* wrote that the sharp population increase began as early as to 1770.[6] As a result, many more people attended local markets, making them more impersonal and enabling frauds to be committed more easily.

Added to this population increase was the dramatic increase in the price of corn caused by the wars with France and the imposition of the Corn Law. William Page mentions, in the *Victoria History of the Counties of England*, that the average price of corn per bushel between 1796 and 1810 was 9 shillings 3 pence. This price grew to an average of 10 shillings 1 ¼ pence between 1803 and 1818, and to 10 shillings 11 pence between 1808 and 1818.[7] Most of the historians writing about metrology specifically mention the price of corn as an important factor in the rise to prominence of standardisation proposals, as stated most explicitly by Julian Hoppit: "It [metrological variation] was only a pressing problem when the agricultural economy

[4] J. Godber, *History of Bedfordshire 1066-1881* (Bedford, 1984), p. 414.
[5] *Bedfordshire Population Figures 1801-1991*. (Bedford 1994).
[6] W. Page, ed., *The Victoria History of the Counties of England: Bedford*, vol. 2, p. 98.
[7] W. Page, ed., pp. 105-106.

was in a state of confusion or chaos, whereby consumers were especially liable to suffer from exploitation."[8] In an attempt to remedy the problems of corn prices and population growth, progressive members of the local gentry, such as the Duke of Bedford, initiated numerous agricultural reforms. These included experiments with different breeds of sheep, new farming equipment, and unprecedented levels of enclosure. These too contributed to the local population's malaise and insecurity concerning their livelihoods, which could manifest themselves in a greater interest in ensuring that weights and measures were just. The late eighteenth century also saw an evangelical revival, which William Page claims affected members of both the Anglican and Dissenting churches in the county and led many local justices to be more active and vigilant in terms of law enforcement.[9] Finally, a more impersonal reason for this greater involvement is offered by Beatrice and Sidney Webb. They document the increasing responsibility imposed on justices across the country by the central government, which continued until the passage of the Municipal Corporations Act in 1835.[10] Overall, there were significant economic problems afflicting the county by the late eighteenth century, and attempts to enforce metrological conformity appear to have been part of the justices' contribution to improving these problems.

This chapter will now explore the action taken by the local justices to deal with metrological problems within this general context. It will be seen that local issues both restricted and encouraged the justices. Attempts were repeatedly made by the local justices to enforce legislation enacted by Parliament in a way that would function successfully at the local level.

---

[8] J. Hoppit, "Reforming Britain's Weights and Measures, 1660-1824", p. 103.
[9] W. Page, ed.,*The Victoria History of the Counties of England: Bedfordshire*, vol. 2, p. 101.
[10] S. and B. Webb, *English Local Government: Volume One, The Parish and the County* (London, reprinted 1963).

Further developments in the standardisation debate at Westminster also appear to have encouraged activity in Bedfordshire in the areas of procuring standards and attempting to enforce metrological conformity. The involvement of Samuel Whitbread, in particular, reflects the complexity of the relationship between Parliament and the county. He is one of the members of Parliament, mentioned by Hoppit, whose local experience as a magistrate encouraged him to advocate metrological reform in Parliament. At the same time, the influence derived from his exposure to developments in the standardisation debate in Parliament affected his actions while at work in Bedfordshire.

The documentary evidence concerning weights and measures in Bedfordshire in the eighteenth century dates almost exclusively from the third quarter of the century. There was some action taken on the part of the local elite to control fraud involving weights and measures within specific industries. For example, in 1785, an act of Parliament was passed that applied only to certain midland and eastern counties, including Bedfordshire. According to it, Inspectors were appointed to ensure that wool and yarn producers measured their products fairly when preparing them for sale. However, more general metrological action does not appear to have been taken by local justices of the peace to either ensure standards were kept in local markets or to enforce metrological uniformity within the county throughout most of the eighteenth century. For example, W. Page states, in *Victoria History of the Counties of England*, that metrological abuse "appears to have been allowed to exist unchecked" throughout this period.[11] The 1758 and 1759 reports of the Carysfort Committee do not appear to have encouraged any interest in weights and measures among Bedfordshire's elite.

[11] W. Page, ed., *The Victoria History of the Counties of England: Bedfordshire*, vol. 2, p. 105.

The first record of a purchase of weights and measures in the eighteenth century is an indenture from 1795 for a set of standards for Woburn, a small market town. The fifth Duke of Bedford, whose large estate of Woburn Abbey included the lordship of the town of Woburn, ordered sets of brass avoirdupoids and troy weights, along with one brass Winchester quart, all of which were "for the Use of the Town of Woburn in the County of Bedford to be kept and used according to the Statutes in that Case made and provided."[12] This purchase was made only six months after the passage of the 1795 act "for the more effectual prevention of the use of defective weights, and of false and unequal balances".[13] The act required justices of the peace to appoint inspectors of weights and balances, and to provide these inspectors with proper standards, which is what the Duke appears to have done. It is worth noting that the quart measure ordered by the Duke is referred to here as being the "Winchester measure", for, as seen earlier, after the Winchester bushel was set at 2150.42 cubic inches for the purposes of the new malt tax in 1701, this unit of measurement came to be used for corn in general.[14] The general adoption of the Winchester measure therefore appears to have affected Bedfordshire, or at least to have been known to the Duke.

The 1795 indenture is similar to one of 1671, which reveals that the Earl of Bedford ordered a brass quart and bushel to be made for the town and market of Woburn. The standards were "Sized and Sealed by his Majesty's measures and standards remayning in the said Receipt of Exchequer". They were "to be kept and used for the use of the said towne and market for

[12] B.R.O., X250/2 (24 December, 1795).
[13] 35 George III, cap. 102.
[14] See pp. 73-74 above.

the Commonwealth's profit and ease of all his Majesty's subjects".[15] These standards were purchased shortly after the passage of a1670 which required every market to have a standard bushel chained in a public place for all participants in the market to use.[16] Therefore, as in the case of the 1795 purchase, there appears to have been an attempt made on the part of this family to enforce the metrological laws enacted by Parliament.

Apart from these two purchases, however, the matter of procuring standards for the public's use was not dealt with by the local government until 1800. The 1795 act was brought to the attention of the county's Lord Lieutenant, Lord Ossory, in 1796, when an abstract of the act was sent from London to a Mr. Palmer, Esquire.[17] This abstract appears to have been an advertisement, as it ends with an offer from a London manufacturer of balances, scales, weights, and measures to make any "such Standard-Weights, Balances, or Scales, on the utmost reasonable and equitable Terms; and with the utmost Expedition".[18] A note filed next to the abstract states that "Lord Ossory desires Mr. Palmer will send a circular letter to all the acting justices according to the enclosed".[19] Although no record exists of any purchases of standards from the London firm, Lord Ossory's involvement in the publicisation of the issue suggests that, like the Duke of Bedford, he was interested in promoting Bedfordshire's adherence to the new

---

[15] B.R.O., X250/1 (5 January, 1671).

[16] 10 Charles II, cap. 8.

[17] Palmer does not appear to have been a Justice of the Peace since his name does not appear on the attendance lists of any of the Quarter Sessions throughout this period. However, in 1835, a Mr. Palmer is named as one of the county's High Constables. The possibility that this was the same Mr. Palmer would be consistent with the 1795 act's requirement that the Justices appoint, as weights and balances inspectors, "the high constable of a hundred, who shall have the power of examining within his hundred, or the constable and parish officers of a parish, who shall have the like power within his and their parish; or such other fit and proper persons ...". *Statutes at Large, 54 George III, cap. 102 (1795), p. 363.*

[18] "Abstract of an Act, *Anno* 35, Geo. III, Ch. 102." B.R.O., Q.S.M. 19 (1792-1796), 1796.

[19] B.R.O., Q.S.M. 19 (1792-1796), 20 September, 1796. This volume is not organised in the manner that the ones following it are.

act.

No further official action in relation to the purchase of new standard weights appears to have been taken until early 1800, when, at the Easter Quarter Sessions, the justices asked the clerk of the peace to enquire as to whether each market in the county possessed a set of standard weights and measures.[20] The Sessions were adjourned for nine days, at which point the clerk of the peace reported that not a single set of standards belonging to any of the towns was found to exist. It is unclear whether the clerk of the peace was unaware that the Duke of Bedford had bought a set of standards five years previously, or whether he was aware of this, but since those standards were not publicly owned by a market town they were not mentioned. As a result, the justices immediately ordered that "Mr. John Kilpin of Bedford Ironmonger do provide one compleat Set of Standard Weights and Measures of Brass with Proper Balances – and to be sealed at the Exchequer and Certified by Indenture And that the Name of the County be engraved Thereon." [21] Kilpin appears to have been an established inhabitant of Bedford, and the numerous bills submitted by him for work done for various public buildings at the Quarter Sessions beginning in the mid-1790s suggest that the justices knew him well.[22] It is interesting to note that the 1758 report from the Carysfort Committee cited the local manufacturing of standards as one of the most important factors contributing to regional variation of weights and measures. Therefore, in choosing to have the standards made by a familiar local inhabitant and taken to the Exchequer for sealing, rather than engaging a London firm, the justices might have in fact contributed to the national problem.

---

[20] B.R.O., Q.S.M. 20 (Easter Sessions 1800), 23 April, 1800, p. 153.
[21] Ibid, p. 156.
[22] See, for example, B.R.O., Q.S.M. 19 (1796), p. 10; Q.S.M. 20 (Epiphany Sessions 1798), p. 70.

John Kilpin was paid £56-2-7 for a brass bushel, half bushel, peck, gallon, quart, pint, and half pint; brass weights of 56, 28, 14, 7, 4, 2, and 1 pound (presumably avoirdupoids); brass weights of 8 ounces to a dram; and a set of copper scales. Kilpin himself paid £5-3-0 to have the standards sized and sealed at the Exchequer and the Westminster inspection office, and for the indenture.[23] The size of this purchase must have been considerable for the county, especially if one considers that the average day labourer's salary at this time was between 8 and 12 shillings, depending on the season.[24] The county then ordered a second set of standards from Charles Farnelli, who was described as a brazier and who was also from Bedford. In early 1802, Farnelli submitted a bill for £38-18-7 at the Quarter Sessions.[25] Like Kilpin, he provided weights ranging from 56 pounds to one dram, some Winchester measures of capacity, and he claimed to have paid £5-13-0 for the sizing, sealing, and indenture (his indenture cost £4, whereas Kilpin's only cost £3-10-0).

Once the county had these standards, the justices immediately appointed some inspectors of weights and measures. In January, 1802, Kilpin was appointed to act as both an inspector and the supervisor of the new standards, which were kept in the Shire Hall.[26] A few months later, another person appointed as inspector of weights and measures for three different hundreds, Dingley Garrard, conducted his first inspection of weights and balances. He submitted a list of offenders, and upon his information the justices fined 87 people at Petty Sessions. The

---

[23] B.R.O., Q.S.R. 1800/43 (Michaelmas Sessions 1800). See also "Bills Ordered for Payment", B.R.O., Q.S.M. 21 (Michaelmas Sessions 1800).

[24] J. Godber, *History of Bedfordshire 1066-1888* (Bedford, 1984), pp. 416-417. William Page, ed., *The Victoria History of the Counties of England: Bedfordshire* (London, reprinted 1972), vol. 2, p. 106. Godber claims labourers' wages could be as low as 8 shillings, whereas page argues they were as high as 12 shillings.

[25] B.R.O., Q.S.R. 1802/99 (Epiphany Sessions 1802), bill submitted for work done in 1801. See also B.R.O., Q.S.M. 21 (Epiphany Sessions 1802), p. 99.

[26] B.R.O., Q.S.M. 21 (Epiphany Sessions 1802), p. 98.

justices then submitted a record of these convictions to the Midsummer Quarter Sessions in September, 1802 in which they stated that they decided to impose the minimum fines possible, since it was the first such inspection. A general warning was then issued to the public, "that as it will be impossible for the Inhabitants to plead Ignorance in any future Case of Delinquency".[27]

In the fall of 1802, shortly after Garrard's inspection, a problem arose when it was discovered that the county's collection of standards was missing some units. The justices ordered "that such Standard Weights and Measures in Brass be immediately procured as shall make the Set in the Sessions House a Compleat Set for all Purposes."[28] It is uncertain what caused the justices to discover this, but the parish records indicate that immediate action appears to have been taken by one of the justices, Samuel Whitbread, who ordered a set of standards from a London founder in October, 1802. These included the usual avoirdupoids weights, but also measures of length (a yard and an ell).[29]

The parish records also contain a list from 1802 of "Standard Weights and Measures", which names brass weights of 56, 38, 14, 7, 4, 2, and 1 pound; 8, 4, 2, and 1 oz; a Winchester quart, pint, and half pint; wine measures of a quart, pint, half-pint and gill; a standard yard and ell; two copper scales with beams; wood measures of a peck, half peck, and quartern; and two "packing cases".[30] Since the list contains the yard and ell, it appears to have been compiled after Whitbread ordered the new standards in October, 1802. Notwithstanding the exact date of its compilation, the list demonstrates the increasing interest taken by the justices in the county's collection of standards. Local craftsmen also continued to be employed in the manufacture of

---

[27] B.R.O., Q.S.R. 1802/13 (Midsummer Sessions 1802).
[28] B.R.O., Q.S.M. 21 (Michaelmas Sessions 1802), p. 130.
[29] "Weights and Measures for Delivery to Samuel Whitbread", B.R.O., P64/28/3 (1802).
[30] B.R.O., P64/28/2 (1802).

weights and measures, despite Whitbread's decision to buy a set from a London founder. For example, in the fall of 1803, John Simons submitted a bill for wood supplied to the county for repairs at the county gaol. Simons also bills for "4 Larg boxes for to put the Wits and mishers in and 2 par of angls for the County".[31] These attempts to improve the country's metrological situation by the Bedfordshire justices become more noteworthy if one considers that at the same time at Westminster, the issue of metrological reform had not been addressed since 1797. At this point, the initiative appears to have come from within the county rather than from Parliament.

Between 1803 and 1814, no evidence of further action regarding the procurement of standards was found. In the meantime, however, an interesting development should be noted. In April, 1807, a list was drawn up of all the subscribers enlisted to build a public weighing machine at Woburn. Each person had bought a number of shares at five pounds per share, which suggests that only the most prosperous inhabitants were among the subscribers. Although this was not, strictly speaking, a local government initiative, it is almost certain that it would have been undertaken by the same group of local gentry and wealthy merchants who acted as justices of the peace, churchwardens, and overseers of the poor. Since the weighing machine was to be built at Woburn, the Duke of Bedford was very likely one of the instigators of the project. This type of public subscription to trusts created to build such things as bridges and turnpikes became increasingly popular by the late eighteenth century in Bedfordshire, but in the early nineteenth century the public funding of these projects from the county funds began.[32] Therefore, a weighing machine was considered important enough to build by public

[31] B.R.O., Q.S.R. 1803/82 (Michaelmas Sessions 1803).
[32] J. Godber, *History of Bedfordshire 1066-1888*, pp. 435-436.

subscription, yet it was not accepted as a county project to be built and owned publicly.

The next wave of metrological activity on the part of the Bedfordshire justices came in 1814, and appears to have been led by Samuel Whitbread, a prosperous brewer, local magistrate, and radical member of Parliament. It was already noted that he ordered a set of standards in 1802 in his capacity as a magistrate, and it was possibly at that point that he became interested in weights and measures. It will also be remembered that Whitbread presented two bills in the House of Commons to improve the enforcement of uniformity of measures. The second bill became law, bringing the enforcement of legal measures into line with the enforcement of legal weights.[33] Shortly before he presented his bills in the House of Commons in November, 1814, and March, 1815, and after the 1814 Commons committee on weights and measures presented its recommendations to the Commons in July, 1814, Whitbread was involved in the appointment of new weights and measures inspectors for Bedfordshire. He must have requested that a new inspector be appointed in the fall of 1814, because on October 26, 1814, another justice of the peace, George Cardale, wrote to Whitbread to suggest a candidate for the position.[34] Cardale did not yet know the man's address, so he promised to write again a few days later. On October 29, he did write, but to say that he and another justice felt that two inspectors should be hired instead of just one.[35] The matter stayed at that until December 12, when Cardale returned from a trip to Leicestershire. By this time, he felt the appointment should not be made until the spring because "it would be very inconvenient at this season of the year to get over the country with the proper weights".[36]

---

[33] See pp. 51-52 above.
[34] B.R.O., W.1/364 (26 October, 1814).
[35] B.R.O., W.1/365 (29 October, 1814).
[36] B.R.O., W.1/366 (12 December, 1814).

It is impossible to know how Whitbread felt about this delay, since none of his letters to George Cardale appear to have survived. The matter was not forgotten, though, and in the spring of 1815 Dr. James Pritchard was appointed as the inspector for five different hundreds. At the Easter Quarter Sessions, he was paid £45-1-0 for his work as inspector,[37] and at the Midsummer Sessions of the same year, a series of convictions for false weights and measures was made based on information reported by Pritchard. Overall, fines amounting to £53-15-0 were imposed on the offenders.[38] A substantial number of convictions must have been made, if one considers that in 1802 when Dingley Garrard's inquiries as inspector of weights and measures led to the conviction of 87 people, the total amount raised was £56-8-8 ½, even when they were fined the lowest amounts possible.[39] Despite Pritchard's success, however, at the end of 1815 he appears to have quit. At the Michaelmas Sessions, the justices reported that "At this Sessions James Pritchard the Inspector of Weights attended and It is ordered that Lord Saint John [a magistrate] be requested with the Assistance of the Clerk of the Peace to inspect his Accounts and ascertain what is due to him on Balance."[40] The Sessions were adjourned for five weeks, at which point it was decided that Pritchard would be paid 50 pounds for all his work.[41]

After Pritchard ceased working as an inspector, large-scale inspections were not recorded again until the fall of 1822. It is likely that Samuel Whitbread's death in July, 1815, affected the vigilance of the local governing elite concerning weights and measures. Overall, the local gentry of Bedfordshire in this period appear to have been dedicated administrators, and

---

[37] B.R.O., Q.S.R. 1815/279 (Easter Sessions 1815). See also B.R.O., Q.S.M. 25 (Easter Sessions 1815), p. 133.
[38] B.R.O., Q.S.M. 25 (Midsummer Sessions 1815), p. 158.
[39] B.R.O., Q.S.R. 1802/13 (Midsummer Sessions 1802).
[40] B.R.O., Q.S.M. 25 (Michaelmas Sessions 1815), p. 204.
[41] B.R.O., Q.S.M. 25 (adjourned Michaelmas Sessions 1815), p. 206.

in 1908 the *Victoria History of the Counties of England* stated that "Bedfordshire has been fortunate in having had, throughout the last century, many among the nobility and gentry of the county, and also among the leading men in the towns, who have been conspicuous for their practical sympathy with the several political, social, and intellectual progressive movements of the times."[42] However, even among this group, Samuel Whitbread stood out in terms of the amount of time he spent with the public and the variety of initiatives in which he was involved.[43] His son, William Henry Whitbread, is thought to have had "none of his father's energy and political commitment and made no mark in politics"[44], which might partly explain why Whitbread's effort to improve Bedfordshire's metrological situation were not continued after his death.

In 1822, four series of convictions were made for false weights and measures in two different hundreds of the county, resulting in the imposition of fines on 142 people. Although no act was passed in Parliament requiring the justices of the peace to conduct such inspections, by this time the issue of metrological reform was being raised regularly in Parliament. Between 1818 and 1821, five reports were presented to the House of Commons from the scientists involved in experiments on the pendulum, the special group of commissioners appointed by the Commons Select Committee on weights and measures, and from the Select Committee itself. The presentation of these reports was encouraged by individual members of Parliament, in particular Sir George Clerk and Henry Sumner, who repeatedly questioned the Chancellor of the Exchequer concerning the progress made on the metrological research requested by the

[42] W. Page, ed., *The Victoria History of the Counties of England: Bedfordshire*, vol. 2, p. 109.
[43] Among many other things, Whitbread advocated a minimum wage for labourers, he opposed slavery, and was involved in the building of schools, hospitals, and other public institutions. See R. Fulford, *Samuel Whitbread 1764 1815: a Study in Opposition*.
[44] R. G. Thorne, *History of Parliament: The House of Commons 1790-1820* (London, 1986), vol. 3, p. 545.

Prince Regent in 1816.[45] It is very likely that the Bedford justices were aware of these events, and the fact that a Commons committee was developing a new metrological system probably encouraged the justices to become more involved in the enforcement of metrological conformity within the county.

It is also interesting to note that three of the four convictions from 1822 were recorded on official forms printed specifically for this purpose. However, the forms were printed before 1820, as each one has 181_ printed where the date was to be written. Furthermore, the printed forms all contain the phrase "In Pursuance of the several Acts of Parliament made for the more effectual prevention of the Use of Defective Weights and false and unequal balances". This clause has been altered by hand on each form, so that the convictions were stated to be for false measures rather than weights.[46] Only the fourth form, which was entirely written out by hand, was for "unequal Balances, or false and deficient measures".[47] No such official records exist for the 1815 convictions made on the information provided by James Pritchard, although the forms used in 1822 might have been in print at that time. It seems likely, then, that they were printed before Samuel Whitbread died in 1815, and that their continued use confirms the possibility that efforts at enforcing metrological conformity died down immediately after his death until the early 1820s. Following this series of inspections, the county received two advertisements from London makers of weights and measures upon passage of the Imperial Weights and Measures act in 1824 that were very similar to the one sent to Mr. Palmer in 1796. One advertisement was from a mathematical instrument maker, R. B. Bale,[48] while the second

[45] See pp.53-56 above.
[46] B.R.O., Q.S.R. 1822/416-417 (Michaelmas Sessions). B.R.O., Q.S.R. 1822/420-421 (Michaelmas Sessions). B.R.O., Q.S.R. 1822/422 (Michaelmas Sessions).
[47] B.R.O., Q.S.R. 1822/422 (Michaelmas Sessions).
[48] B.R.O., B.O.R.B., F4/69/157.

one was from two brass founders, John and Robert Warner.[49] This was almost certainly the John Warner who was interviewed in 1814 by the Commons committee appointed to enquire into the possibility of establishing a new metrological system. Warner mentioned, in his testimony, that he had received information from Bedfordshire regarding Samuel Whitbread's order to destroy a great number of inappropriate standards. Warner also complained about the difficulties facing local governments that attempted to procure uniform standards.[50] It appears that a personal connection was made between Warner and Whitbread during their exchanges of information that must have taken place in (or shortly before) 1814. This would explain why the Warners were chosen over Mr. Bale by the Bedford justices to furnish the county with new imperial standards. In 1825, the Warners supplied a full set of brass imperial weights and measures, sized and sealed at the Exchequer and in accordance with the Imperial Weights and Measures Act.[51]

In addition to revealing a new interest among the justices in enforcing metrological conformity, the 1822 conviction forms also reveal that the manner in which information concerning metrological offences was collected, as well as that in which convictions were made, appears to have changed slightly by this time. Three of the conviction notices include an amount deducted from the total revenue for the purposes of "carrying [the] Act into execution". The fourth describes these expenses in greater detail, and among the items entered is an allowance to a warden. The warden appears to have replaced the office of inspector, and he was paid a commission of one-sixth, or seventeen per cent, of each fine. This could explain why there is no evidence of any payments made to weights and measures inspectors from the county budget

---

[49] B.R.O., B.O.R.B., F4/69/158.
[50] See p. 51 above.
[51] The evidence of this purchase is an indenture, recording the purchase of the standards, filed separately from the two advertisements. Q.A.V. 2/1 (1825).

in 1822, such as the payments made to James Pritchard in 1815. It is impossible to state definitively why these changes occurred; however, a system based on commission payments would offer a greater incentive to the warden to conduct searches for possible offenders. The method of paying the warden directly from the funds raised by convicting the offenders also probably made the position more attractive, if one considers that the earlier inspectors had to submit their bills to the Quarter Sessions, where they could be scrutinised by the justices.

Furthermore, these changes in the method of paying the wardens raise questions concerning the success of the inspectorate system, especially if they were effected in order to make the office of inspector, or warden, more attractive because they experienced difficulties making appointments. Before 1822, none of the inspectors of weights and measures mentioned in the county records appears to have remained in the employment of the county as an inspector for very long. John Kilpin's term of office was the longest, beginning in January, 1803, and ending upon his death in the fall of the same year.[52] Dingley Garrard and Charles Farnelli are not mentioned in the Quarter Sessions records in the capacity of inspectors after they were initially named as such. James Pritchard was appointed in the spring of 1815, and at the Michaelmas Sessions of the same year he was relieved of his duties at his own request. Some valuable insight into this lack of commitment to the position is provided in a letter written by Mrs. E. Kilpin, the widow of John Kilpin, to the justices in 1808. The bill submitted to the county by her husband's executors in 1803 was not paid immediately, and after five years Mrs. Kilpin wrote to make an appeal to the justices to pay the money owed to her. In her letter, she first defended the amounts claimed by her husband, ten shillings a day while he conducted

[52] John Kilpin appears to have died between the Midsummer and Michaelmas Quarter Sessions, 1803, as a bill from his executors for his work as inspector of weights and measures was submitted at the Michaelmas Sessions. B.R.O., Q.S.R. 1803/73.

inspections, as this amount was paid to another inspector she knew. She then described the conditions under which her husband laboured as an inspector:

> ... it was so far from being a desirable thing to Mr. Kilpin to leave his family and other Business and to be exposed to the abusive Insulting Language and rough treatment of the People to whom he was sent (not having a Magistrate with him) that after he had made the trial nothing could have Induced him to accept a fresh appointment ... except that he considered himself acting as the Servant of those Magistrates he was always proud to call his Ministers.[53]

The justices sympathised with Mrs. Kilpin, who also pointed out that she was left alone with three young children, and her husband's bill was paid in full. This image presented by Mrs. Kilpin emphasises the significant hostility faced by the inspectors from the public. Even as late as 1834, local inhabitants were convicted of mistreating inspectors. In the summer of 1834, Thomas Brewer from the parish of Everton was convicted "for that he ... did wilfully obstruct hinder and oppose one Frank Smith in viewing and examining the measures of James Brewer of Everton aforesaid Victualler the said Frank Smith being then and there duly authorized and empowered to view and examine the same ..."[54]

The public's hostility therefore appears to have been specifically directed towards the active search for metrological fraud conducted by the inspectors rather than towards a more general "quantifying spirit", as Sheldon et al. argue.[55] This is supported by the fact that while members of the public harassed people like John Kilpin, they also appear to have been willing to issue presentments at their own initiative, before the justices, of people using false weights and measures or committing other related offences. The seriousness of the offences varied

---

[53] B.R.O., Q.S.R. 1807-1810/170 (Easter Sessions 1808), 26 April, 1808.
[54] B.R.O., Q.S.M. 31 (Midsummer Session 1834), p. 416.
[55] R. Sheldon, A. Randall, Andrew Charlesworth, D. Walsh, "Popular Protest and the Persistence of Customary Corn Measures: Resistance to the Winchester Bushel in the English West" in A. Randall and A. Charlesworth, eds., *Markets, Market Culture and Popular Protest in Eighteenth-Century Britain and Ireland* (Liverpool, 1996), pp. 26-27.

considerably. For example, in 1775, a man was presented, convicted, and fined four shillings before a justice of the peace for selling bread underweight.[56] In 1786, a labourer "came before" a justice of the peace to complain about a carrier, Arthur Rork, who had brought a wagon full of goods to Dunstable for the market. Rork had to have his wagon weighed before he could unload it, but he was accused of removing goods from it before it was weighed "in order to avoid the Payment of the Duties or Tolls by Certain Statutes now in force".[57] When Rork refused to appear before the justice, the justice accepted the testimony of "Two Credible witnesses" from nearby parishes, and Rork was convicted and fined five pounds. These cases demonstrate that the members of the public were willing to act individually against metrological offenders, while at the same time they subjected appointed inspectors to harassment. Overall, therefore, the imposition of a new, more intrusive system of enforcing accepted weights and measures, and not the more general issue of quantification, appears to have inspired hostility among the common people.

Furthermore, similar tensions between the public and local authorities appear to have been common in many areas of law enforcement in this period. Richard D. Storch argues that over the eighteenth century, the social status of the local constables declined considerably. Whereas at the beginning of the century, they came from the landowning and gentry classes, by 1800 they were often members of the working class. Constables that came from the lower classes were often far less vigilant because they tended to face severe ostracism from their peers when they actively sought out crime. Bedfordshire was one county where this change occurred

[56] B.R.O., Q.S.R. 1775/113.
[57] B.R.O., Q.S.R. 1786/105.

extensively.[58] In the area of weights and measures enforcement, the justices of the peace gradually replaced the reactive system of individual presentments with the appointment of inspectors, the inspectors did not come from the ruling elite, and the public appears to have resented this new type of surveillance performed by their peers. The justices must have been aware of the public's dislike of the inspections, as they attempted to soften the first convictions in 1802 by imposing the smallest fines possible. This likely helps to explain why members of Parliament who proposed metrological legislation, such as Samuel Whitbread, focussed on legislating harsher terms of enforcement rather than actual metrological change.

In conclusion, this local study reveals a number of issues facing the Bedfordshire justices of the peace who attempted to improve the metrological situation in their county. By the end of the eighteenth century, such a long period of time had passed since sets of standards were acquired for Bedfordshire's markets that the justices were required to spend very large sums of money purchasing new weights and measures. They gradually implemented an active system of weights and measures inspections in the face of popular hostility. The justices appear to have been motivated by both local problems and the developments concerning metrology in Parliament. In particular, the role played by Samuel Whitbread reflects the extent to which his duties as a local justice and as a member of Parliament were linked. His experience of procuring standards for Bedford and witnessing the public's reaction to metrological innovations, in particular inspections, are probably what led him to favour very conservative legislation. At the same time, his interaction with people in London who were interested in metrological reform,

---

[58] R. D. Storch, "The Old English Constabulary", *History Today*, vol. 49, no. 11 (November 1999), pp. 43-49. See also T. A. Critchley, "The New Police in London 1750-1830", in K. McCormick and L. A. Visano, eds., *Understanding Policing* (Toronto, 1992), pp. 85-112.

such as other members of Parliament and the brass founder, John Warner, probably contributed to his activity back in Bedford.

The importance of this relationship between the counties and Westminster lies in what will be argued in the following chapter. That chapter will directly address the question of why the government decided to adopt a new metrological system in 1824. It was seen in the first chapter that while R. E. Zupko does not address the impact of local situations on the government's reforming activities in any detail, Sheldon et al. and Julian Hoppit discuss this issue. Sheldon et al. emphasise the opposition between local and central interests, and argue that sustained opposition to reforms imposed by the government was an important aspect of England's economic development throughout the eighteenth century. Conversely, Julian Hoppit emphasises the importance of local interests as justices of the peace who also sat in the Commons called for metrological reform in Parliament.

The following chapter will build upon these insights and will locate the government's decision to adopt substantial metrological reform in 1824 within the context of the emergence of a new political discourse in Parliament as articulated by political economists. A new mode of understanding human society developed with the new political economy, which affected the government's understanding of weights and measures. This alone does not explain the move towards the imperial system, however. This new discursive network did not create an entirely new set of issues. Rather, it provided a mode of understanding things that had previously been understood differently. This is an important distinction to make because it places great importance on the development of the issue of weights and measures prior to the epistemic shift occurring in the early nineteenth century, instead of focusing excessively on the events following

this shift. The repeated calls for metrological reform in Parliament from people like Samuel Whitbread, who did so based largely on their local experience, will therefore be seen to have constructed the issue that subsequently took on a new discursive meaning.

Chapter 5: Synthesis.

The problem now arises of arriving at a form of synthesis that will bring the issues outlined in the previous chapters together into a relationship that offers a new interpretation of the English metrological debate leading up to 1824. The question of why the government came to favour a general standardisation, but one of such a conservative nature, must finally be addressed. The nature of the answer provided will depend upon the theoretical approach to be adopted. It will be argued that the adoption of an approach using discursive analysis in a manner articulated by Michel Foucault offers valuable insight into the government's decision to pursue standardisation. However, it will also be argued that this approach can leave many issues unaddressed. In addition to placing the government's actions within the discursive framework which Foucault provides in *The Order of Things*, the importance of the different understandings of weights and measures held by social groups outside government circles in the overall development of the standardisation debate must also be examined in order to offer an interpretation of this issue which reveals the processes of interaction and negotiation that were also involved in the development and enactment of the imperial system.

To begin with, none of the authors cited in chapter one locates the English metrological standardisation debate in relation to other specific activities in which the government was involved at the same time. A few of them discuss some general concerns of the government in this period, but only very briefly. For example, Sheldon et al. devote only one sentence to events occurring at the national level in the late eighteenth and early nineteenth centuries, which included high grain prices, Luddism, the wars with France and the war of 1812 with the United

States, "and a philosophy of *laissez-faire* increasingly dictating government policy".[1] Similarly, Julian Hoppit raises the idea that the standardisation debate could have reflected larger governmental concerns when he suggests that "in introducing the imperial system it [the government] may have been as concerned with 'tidy-mindedness', with ridding the statute books of dozens of arcane acts, as with radically changing the weights and measures in use through the length and breadth of the country."[2] Bruce Curtis offers an interpretation of the enforcement of weights and measures in terms of the agenda of the central government when he argues that the imposition of national metrological systems constituted a conscious effort on the part of governments to assert national sovereignty. However, his article is primarily concerned with Canada (or British North America), so that the English metrological debate forms only the background of his study.[3]

Furthermore, of the authors discussed in chapter one, only the works of R. E. Zupko and J. Hoppit discuss the actual adoption of the imperial system. Neither author appears to believe that any revolutionary change was effected with the adoption of the imperial system. Zupko provides an ambiguous answer to this question when he says that the 1824 act, "together with legislation issued in a fifty-year period thereafter, revolutionized to a considerable degree certain aspects of British metrology".[4] Hoppit stresses the conservative nature of the 1824 legislation, arguing that "the new system was highly cautious and arguably too pragmatic ... If

---

[1] R. Sheldon, A. Randall, A. Charlesworth and D. Walsh, "Popular Protest and the Persistence of Customary Corn Measures: Resistance to the Winchester Bushel in the English West", in A. Randall and A. Charlesworth, eds., *Markets, Market Culture and Popular Protest in Eighteenth-Century Britain and Ireland* (Liverpool, 1996), p. 4.

[2] J. Hoppit, "Reforming Britain's Weights and Measures", *English Historical Review*, vol. 108 (1993), p. 104.

[3] B. Curtis, "From the Moral Thermometer to Money: Metrological Reform in Pre-Confederation Canada", *Social Studies of Science*, vol. 28, no. 4 (August 1998), pp. 547-570.

[4] R. E. Zupko, *Revolution in Measurement* (Philadelphia, 1990), pp. 177-178.

in 1824 a dramatic step was taken, a long road had already been travelled and its end was only just in sight."[5] Both authors base their assessments on the effects of the legislation, since they support their assertions by pointing out that further legislation was required to finalise the universal adoption of the imperial system.

The possibility of a reinterpretation of both these points, that the standardisation debate was reflective of larger governmental issues or concerns and the low level of innovation involved in the development and adoption of the imperial system, is offered by Michel Foucault and Mary Poovey. Foucault and Poovey argue that a discursive change occurred in the late eighteenth century that affected the central government, as well as many other groups. To begin with, Foucault argues, in *The Order of Things*, that the entire "episteme", or network of discourses that formed the dominant mode of thought in all disciplines in this period, underwent a fundamental change that involved an alteration in the understanding of the notion of representation. This involved, at its core, the way in which words were believed to represent objects, as well as any other relationship in which one object was seen to stand for, or represent another. Foucault describes the "episteme" of the Renaissance, in which an object that was a representation had to contain part of that which it represented. In this way, for example, money had to contain the wealth that it represented, so it had to be inherently valuable itself. This was achieved by requiring money to contain fixed quantities of precious metal, so that the inherent value of coins could be immediately known by the people using them.[6]

This notion of representation changed, however, in the seventeenth century with the emergence of the "Classical episteme". With this epistemological configuration, words could

---

[5] J. Hoppit, "Reforming Britain's Weights and Measures", p. 104.
[6] M. Foucault, *The Order of Things* (New York, 1994), pp. 58-60.

represent objects without sharing any link with the objects other than the fact that humans had chosen a word to represent an object. Consequently, money no longer had to contain inherent value since it now only represented an exchange value: "Things take on value, then, in relation to one another; the metal merely enables this value to be represented, as a name represents an image or an idea, yet does not constitute it."[7] This notion of wealth formed the basis of mercantilism, and it was part of "the more profound opening up of a space common to both money and signs, to both wealth and representations."[8] Another epistemic shift occurred at the end of the eighteenth century, when it ceased to be believed that certain, indisputable knowledge must be based on empirical, sensory data. Instead, the abstractions that are characteristic of Ricardian political economy came to achieve the status of objective reality. Therefore, the Classical notion of representation could also involve the representation of such "things" as capital, production, and division of labour. As Foucault explains, empirical data became "nothing more than the effects of certain syntheses, or structures, or systems, which reside far beyond all the divisions that can be ordered on the basis of the visible. The visible order, with its permanent grid of distinctions, is now only a superficial glitter above an abyss."[9]

Mary Poovey provides a more detailed account of the development of the deductive principles involved in early nineteenth-century British political economy in her book, *A History of the Modern Fact*.[10] Poovey argues that the type of representation associated with the Classical episteme and mercantilism, as described by Foucault, evolved into a form of representation in which abstractions could be objectified as it came into contact with

[7] M. Foucault, *The Order of Things*, p. 176.
[8] M. Foucault, p. 179.
[9] M. Foucault, pp. 250-251.
[10] M. Poovey, *A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society* (Chicago, 1998).

experimental moral philosophy and Scottish conjectural history. Both of these eighteenth-century disciplines moved away from the empiricist notion of representation, according to which only empirically verifiable facts constituted scientific knowledge, as they sought the invisible structures that they believed unified what Foucault termed "the visible". A number of moral philosophers, such as Dugald Stewart, a professor of moral philosophy at Edinburgh University, taught many of the people who went on to become advocates of speculative, deductive (or Ricardian) political economy in the early nineteenth century.[11]

It was argued, in chapter two, that the government's interest in metrological standardisation changed in the second decade of the nineteenth century. It is, arguably, possible to interpret this change in terms of the theoretical framework provided by Foucault and elaborated by Poovey. Prior to 1814, great emphasis was placed on producing standards to be kept in one place, preferably the Exchequer. These were to be the only legal standards by which weights and measures could be assayed. Ten pages of the 1758 Carysfort Committee report were devoted to ascertaining what standards were in existence and how accurate each one was in relation to the legislation outlining its legal dimensions.[12] The committee recommended that the full set of weights and measures to be kept in the Exchequer, along with a second set for everyday use by the assayers, should constitute the only legal standards of the kingdom. In addition, the same committee's report presented in 1759 recommended that the various legal weights should be made out of specific metals, in order to be as accurate as possible.[13] The

[11] M. Poovey, *A History of the Modern Fact*, chapters 5 and 6, pp. 214-306.
[12] "Report from the Committee, Appointed to Inquire into the Original Standards of Weights and Measures in this Kingdom, and to Consider the Laws relating thereto." (26 May, 1758). *Reports from Committees of the House of Commons, 1715-1801. Vol. 2, pp. 428-438.*
[13] "Report from the Committee Appointed to Inquire into the Original Standards of Weights and Measures in this Kingdom; and to consider the Laws relating thereto." (11 April, 1759). *Reports from Committees of the House of Commons, 1715-1801. Vol. 2, p. 463.*

standard yard that John Bird produced for the House of Commons in 1758 was in fact gauged according to a natural standard, the length of the pendulum vibrating seconds, but this was not mentioned either in the Carysfort Committee reports of 1758 and 1759 or in the subsequent unsuccessful 1765 legislation based on the reports. The value of the standards, as standards, lay not in the fact that they represented an abstract, supposedly invariable natural unit of length or weight. Rather, they themselves were the standards. Their value lay inherently within them, and the copies of them used in localities had to agree with these specific standards.

A fundamental change in the government's understanding of the nature of metrological standards, that was in keeping with the discursive changes outlined by Foucault and Poovey, appears to have occurred close to 1814. In 1814, the Commons committee's report concerning Britain's weights and measures openly advocated the adoption of William Hyde Wollaston's metrological plan, which involved basing all units on two standards taken from nature: a yard based on the length of the pendulum vibrating seconds, and a gallon based on ten avoirdupoids pounds of pure water. It was only at this point that the members of the new Commons committee raised the issue of basing Britain's standards on invariable, easily reproducible standards adapted from natural phenomena to the level of predominance among the requirements of the new system. From that point until 1824, this remained the critical criterion of metrological reform. This can be clearly seen in the Imperial Weights and Measures Act of 1824. The act not only stated that the standard yard and pound must be easily reproduced in case either one was "lost, destroyed, defaced or otherwise injured",[14] but also that people in remote parts of the kingdom must be able to construct accurate standards without recourse to

[14] *Statutes of the United Kingdom, 5 George IV, cap. 74, vol. 9, p. 759.*

any existing standards:

> .. in all Cases of Dispute respecting the Correctness of any Measure of Capacity, arising in a Place where Recourse cannot be conveniently had to any of the aforesaid verified Copies or Models of the Standard Measures of Capacity, ... it shall and may be lawful to and for any Justice of the Peace or Magistrate having Jurisdiction in such Place, to ascertain the Content of such Measure of Capacity by direct Reference to the Weight of pure Rain water which such Measure is capable of containing.[15]

In relation to Foucault's and Poovey's arguments, the government, by this point in time, appears to have come to see the value of metrological standards as lying in the fact that standards were merely representations of invariable units of weight and measurement found in nature. Man-made standards no longer constituted the units in themselves. Furthermore, the 1824 act made no mention of the types of metal out of which different standards of weight were to be made. The metrological standards were no longer required to be made of specific types of metal since their physical constitution was no longer their most important aspect. This epistemological change correlates with the change that Foucault argues occurred in the conceptualisation of money. As money came to be understood as a representation of an abstract exchange value, rather than an object of inherent value, it no longer had to contain fixed amounts of precious metal. Similarly, metrological standards came to represent abstract constants found in natural reality, whose value lay in the fact that they constituted units of exchange.

With the discursive framework provided by Foucault and Poovey, therefore, it is possible to argue that a fundamental conceptual change did occur in the government's position on weights and measures in the early nineteenth century. This argument contrasts markedly with

[15] *Statutes of the United Kingdom, 5 George IV, cap. 74, vol. 9, p. 761.*

the interpretations offered by Zupko and Hoppit, who focus predominantly on the conservative nature of the 1824 legislation. This difference of interpretation arises from the fact that Zupko and Hoppit base their arguments on the effects of the legislation, in particular its lack of success in effecting metrological uniformity, whereas the change outlined by Foucault and Poovey occurred at the level of epistemology, and had to occur before the legislation was finally passed.

The question therefore arises of the relationship between the interpretations offered by Foucault and Poovey and those of Zupko and Hoppit. The fact that the passage of the Imperial Weights and Measures Act of 1824 did not bring about a radical metrological reconfiguration does not necessarily invalidate the thesis that a discursive change led, or enabled, the government to pass the legislation. Two factors must be investigated in order to offer a manner in which to incorporate both arguments. First, one must ask what are the limits of the effective, or determining, powers of a discursive change. The question of whether discursive change constitutes the sole, fundamental causal factor in a given situation, or whether other forms of causation continue to effect change (or continuity) in relation to, or in spite of, a new discourse or even "episteme", remains an unsettled issue among historians working with postmodern theory. For example, in *The Archeology of Knowledge*, Foucault argues that one must not seek humanly created links between ideas and statements. These links include such commonly accepted factors as locating the origins of a discourse in the exceptional ideas of an individual, and the propagation of such ideas through the operation of influence. These factors "are always themselves reflexive categories, principles of classification, normative rules, institutionalized types; they, in turn, are facts of discourse that deserve to be analyzed beside

others ... they are not intrinsic, autochtonous, and universally recognizable characteristics."[16] Instead, one must "be ready to receive every moment of discourse in its sudden irruption ...". This argument makes it very difficult to look for forms of human agency within a discursive milieu, even though Foucault goes on to say that our preconceived notions of how ideas spread "must not be rejected definitively of course, but the tranquility with which they are accepted must be disturbed."[17] In contrast, Mary Poovey appears to do precisely what Foucault argues against in *The Archaeology of Knowledge* in her *History of the Modern Fact*. As mentioned above, she argues that eighteenth-century Scottish conjectural historians and moral philosophers deliberately taught and influenced many young men who became speculative political economists.[18] Poovey therefore allows for significant human agency within the confines of a discursive formation.

The second factor requiring investigation is closely related to the first. One must question whether a discursive change involves the emergence of a new set of issues, or, alternatively, a new epistemological framework within which to understand previously existing issues in a new way. In other words, one must explicitly acknowledge how deeply one believes the "rupture" created by a discursive change affects the knowledge of a given period. On the one hand, whether Foucault is writing about discourse or power, he repeatedly stresses the importance of the discontinuity of knowledge caused by discursive ruptures, or dislocations. For example, in terms of power, he argues, in *Power/Knowledge*, that "only the historical contents allow us to rediscover the ruptural effects of conflict and struggle that the order imposed by

---

[16] M. Foucault, *The Archaeology of Knowledge* (London, 1972), p. 25.
[17] M. Foucault, *The Arhcaeology of Knowledge*, p. 25.
[18] See pp. 116-117 above.

functionalist or systematising thought is designed to mask."[19] Similarly, in *The Order of Things*, Foucault describes discursive changes in terms of fundamental historical discontinuties. He argues that the tendency of historians to trace the development of nineteenth-century political economy back into the eighteenth century is wrong because,

> all this quasi-continuity on the level of ideas and themes is doubtless only a surface appearance; on the archaeological level, we see that the system of positivities was transformed in a whole-sale fashion at the end of the eighteenth and beginning of the nineteenth century. Not that reason made any progress: it was simply that the mode of being of things, and of the order that divided them up before presenting them to the understanding, was profoundly altered.[20]

On the other hand, however, some of Foucault's historical works outline the continuity of concepts across different discursive periods. For example, in the second volume of his *History of Sexuality*, entitled *The Use of Pleasure*, he argues that the experience of sexuality did not develop in a gradual, linear historical progression, but rather that, beginning in antiquity, sexuality has meant very different things in different periods. However, Foucault is unable to avoid the continuous prohibitions, or "interdictions", that have characterised sexuality since antiquity, and his short dismissal of them is unconvincing: "isn't it the case that the philosophical, moral, and medical thought that formed in their [the ancient Greeks'] midst formulated some of the basic principles that later ethics - and particularly those found in the Christian societies - seem to have only had to revive? We cannot stop there, however; the prescriptions may be formally alike, but this actually shows only the poverty and monotony of interdictions."[21] Similarly, Poovey adopts a different approach from the most extreme notion

[19] M. Foucault, "Two Lectures. Lecture One: 7 January 1976" in M. Foucault, *Power/Knowledge: Selected Interviews and Other Writings* (New York, 1980), p. 82.
[20] M. Foucault, *The Order of Things*, p. xxii of preface.
[21] M. Foucault, *The Use of Pleasure: The History of Sexuality, Volume 2* (New York, 1990), p. 250.

of rupture advocated by Foucault. She explicitly rejects the more extreme arguments, inspired by Foucault, when she says that she "deliberately blurred the beginning and the end of the story I tell here because I want to insist that what Foucauldians identify as ruptures can also be interpreted as part of a continuous, if complex, process."[22] The problem of the relationship between what changes and what develops continuously is, arguably, an important aspect of the historical process that must be taken into account, but that is not resolved in any satisfactory manner by Foucault.

A different theorist, Charles Taylor, offers an interpretation of linguistic turn theory that incorporates human agency in relation to discourse, and which, arguably, can also help to understand the process of discursive change in a more comprehensive manner. Like Foucault, Taylor argues that humans are language animals who can only engage in thought through the expressive use of language. This means that expression pre-exists clear thought in humans. For example, in his essay, "Hegel's Philosophy of Mind", Taylor argues that in order to formulate an understanding of oneself (or to become a thinking individual), one must "conceive self-understanding as something that is brought off in a medium, through symbols or concepts, and formulating things in this medium as one of our fundamental activities."[23] This formulation occurs unconsciously at first, and then consciously as one gradually becomes aware of the subjectivity one has constituted for oneself through expression.

Taylor's argument contains two very important implications. First, because one must actively engage in the expressive use of language in order to create's one's own subjectivity, Taylor argues that the use of language constitutes action. Furthermore, as one uses language,

[22] M. Poovey, *A History of the Modern Fact*, p. 17.
[23] C. Taylor, "Hegel's Philosophy of Mind", in C. Taylor, *Human Agency and Language: Philosophical Papers I* (Cambridge, 1996), p. 85.

one also helps to shape it. Therefore, Taylor claims that human agency in relation to discourse lies in the expressive use of language. As he explains in his essay, "Language and Human Nature", "The capacity which language represents is realized in speech ... But if the language capacity comes to be in speech, then it is open to being continuously recreated in speech, continually extended, altered, reshaped. And this is what is constantly happening. Men are constantly shaping language, straining the limits of expression, minting new terms, displacing old ones, giving language a changed gamut of meanings."[24] This explanation of the relationship between people and language is far more reciprocal and dynamic than that asserted by Foucault.

The second implication of Taylor's argument is that it is not only individuals who engage in this exercise of expressive formulation and interpretation. Groups of people can come to understandings together, in such a way that the understanding agreed upon does not constitute merely the sum of the individuals' views. Rather, specifically social, or "inter-subjective", interpretations can also be formulated. Taylor uses this argument to claim that communities, as well as individuals, can exert agency through the use of language: "The nature of agency comes clear to us only when we have a clear understanding of the nature of action. This can be individual; but it can also be the action of a community, and in a fashion which is irreducible to individual action. It can even conceivably be the action of an agent who is not simply identical with human agency."[25] This helps to explain how collectivites, such as the government or the mercatorial community, could formulate discrete understandings of a discursive formation.

It is important to add that Taylor refrains from explaining specifically how these

[24] C. Taylor, "Language and Human Nature", in C. Taylor, *Human Agency and Language: Philosophical Papers I* (Cambridge, 1996), p. 232.
[25] C. Taylor, "Hegel's Philosophy of Mind', p. 93.

various groups come to be groups before they begin to establish inter-subjective links. Dror Wahrman makes an argument very similar to Taylor's in relation to the possibility that different groups can interpret a single thing very differently. Wahrman goes on to say that these groups arise due to material reality when he argues that many historians

> tend to ignore *the degree of freedom which in fact exists in the space between social reality and its representation.* The social process ceratinly imposes certain bearings and certain constraints on the possible and plausible ways in which it can be understood. But within these constraints there still remains a considerable space for different representations and interpretations of this social reality. A priori, moreover, such different representations are all within the bounds of plausibility: none of them is 'objectively' more true to life or more sensible than any other.[26]

The precise nature of the "social reality" descriibed by Wahrman is what Taylor does not explicitly define. Admittedly, Wahrman's conception of "social reality" as something separate from "its representation" is a problematic concept in terms of postmodern theory. However, if one posits a dominant discursive framework as constituting "social reality", Wahrman's argument presents a very interesting idea of the possibility of agency within discourse that is similar to Taylor's. Although it will be argued that the various social groups outlined in the three preceding chapters formulated differing interpretations of the metrological situation, it must also be admitted that the fundamental basis of these groups cannot, with confidence, be unequivocally stated in this thesis. More historical and theoretical research than that presented in this thesis must be undertaken before such a decision can be made.

In response to these questions of agency, historical change, and continuity, the ideas of Mary Poovey, Charles Taylor, and Dror Wahrman will be used to argue that if one moves

---

[26] D. Wahrman, *Imagining the Middle Class: The Political Representation of Class in Britain, c. 1780-1840* (Cambridge, 1995), p. 6.125

beyond identifying the discursive basis of the metrological standardisation debate, one can add levels of meaning to this topic that allow one to offer a more comprehensive interpretation of the development of the imperial system of weights and measures. In particular, an investigation of other projects that the government became involved in, at the same time that the discursive changes outlined above affected how its members understood the world, enables one to contextualise the early nineteenth-century metrological legislation in terms of the larger legislative interests of the government at that time. In this manner, one must examine the way in which the government worked within the discursive framework that defined the conceptual possibilities of its members. Therefore, this approach implies that members of the government enjoyed a notable degree of interpretive agency; the constitution of their ideas through the onset of a new discourse appears to have involved selection and interpretation on their part as they dealt with the pressing issues facing them. Furthermore, it will be argued that the fact that the issues involved in the development of the imperial system were isolated and articulated before the discursive shift altered the government's views on weights and measures is important. This undermines the primacy of completely discontinuous epistemological ruptures because it implies that while the political discourse surrounding the metrological debate changed, it did not introduce a completely new set of issues. Rather, the changes in the contents of the parliamentary committee reports and legislation themselves, aside from their success or failure, although very important, are fewer than the points of continuity. This would suggest that more than solely a discursive change of the nature described by Foucault and Poovey accounts for the success of the 1824 metrological legislation.

The predominant issue faced by the Liverpool ministry throughout its administration

was economic reform. Lord Liverpool was called to form a ministry in 1812, following the assassination of Spencer Perceval. By this time, Britain had been at war with France for two decades, and this had drained the country's resources drastically. Taxation and government borrowing had reached unprecedented levels, and continued to increase after Napoleon's disastrous experience in Russia led the allied forces to undertake a final assault against him. By 1815, the national debt had surpassed £850 million,[27] and the war had caused a grain crisis which pushed the price of grain up from 43s. per quarter in 1792 to 126s. per quarter in 1812, and finally down to 65s. per quarter in 1815.[28] At the same time, the country's population had increased very quickly, an average of 14 per cent annually in every year after 1799.[29] These factors were compounded when a severe trade recession occurred shortly after the end of the Napoleonic wars. The government contracts which had encouraged and sustained so much industrial and agricultural production throughout the war years were not renewed, and, at the same time, approximately 300,000 men were released from military and naval service without pensions. Therefore, as available employment decreased, the number of young men seeking employment grew dramatically. On top of these systemic economic problems, popular agitation increased, and the government began to fear the occurrence of revolutionary, or Jacobin, activity.

In response to these several crises, the government's primary objective appears to have become the prevention of such revolutionary activity by attempting to foster economic stability.

---

[27] J. W. Derry estimates that the national debt was £861 million, while F. O'Gorman claims it was £876 million. The national debt was only £153.4 million in 1779. J. W. Derry, *Reaction and Reform: England in the Early Nineteenth Century* (London, 1963), p. 51; F. O'Gorman, *The Long Eighteenth Century: British Political and Social History 1688-1832* (London, 1997), p. 241; G. Alderman, *Modern Britain 1700-1983: a Domestic History* (Beckenham, 1986), pp. 39-40.

[28] J. W. Derry, *Reaction and Reform*, p. 48.

[29] G. Alderman, *Modern Britain 1700-1983*, pp. 41-42.

Oppressive legislation was passed to control social unrest, but the majority of the government's initiatives were of an economic nature. This involved the nearly impossible task of balancing the different interests of the agricultural and commercial communities, for although both Houses of Parliament "remained the preserve of the landed interest"[30], since the early eighteenth century the government had been dependent on the mercatorial community for tax revenues and loans.[31] For example, one of the first economic initiatives following the end of the war was the attempt made to protect the agriculturalists by passing the Corn Law in 1815. This was followed by a very large concession to the commercial classes in the form of the substantial reduction of the property (or income) tax in 1816, following strong protests against the Corn Law from this group.[32]

As the government worked towards attaining greater national economic stability, and towards regaining public confidence in the country's financial state, its policies became increasingly directed towards the establishment of freer trade. Moreover, these policies caused increasing opposition on the part of the mercatorial classes, as what they perceived to be the selfishness of the landed interest in Parliament "disgusted the middling orders".[33] Historians are divided over the economic views of Liverpool himself. Philip Harling, for example, implies that the ministry lacked a definite set of economic principles when he argues that the government was primarily "committed to preserving the social and political authority ostensibly vested in

---

[30] J. Derry, *Reaction and Reform*, pp. 55-56.
[31] F. O'Gorman, *The Long Eighteenth Century*, p. 177. For a much more detailed analysis of this development, see also J. Brewer, *The Sinews of Power: War, money and the English state, 1688-1783* (London, 1989), chapter 7.
[32] N. Gash, *Lord Liverpool: The Life and Political Career of Robert Banks Jenkinson Second Earl of Liverpool 1770-1828* (London, 1984), p. 126.
[33] F. O'Gorman, *The Long Eighteenth Century*, p. 335.

the propertied classes by God."[34] In contrast, other historians credit Liverpool, and a number of his colleagues, with having held "new ideas in economic theory" influenced by political economists. J. W. Derry, for instance, argues that "in some ways the years of Liverpool's premiership illustrate how the ministry won its way through to a greater confidence in ideas which many of its members had held for some time".[35] Despite this debate, however, the majority of historians agree that the political economy advocated by Adam Smith became increasingly popular in Parliament, and in particular within the government more than the opposition, after 1815, especially once David Ricardo became a member of Parliament in 1819.[36] As Barry Gordon explains, the ministry came to adopt many speculative, Ricardian ideas, whereas its commercial opponents, led by Alexander Baring, argued that "national economic policy should be determined by analogies with the dictates of private business calculus."[37]

Therefore, the Liverpool government's actions, including the movement towards metrological standardisation, must be seen in the context of a series of political and economic crises brought about by a protracted period of warfare. As the ministry attempted to improve the country's economic situation, it drew increasingly on the new ideas advocated by Ricardo and other political economists. More specifically, this argument that the standardisation debate

---

[34] P. Harling, *The Waning of 'Old Corruption': The Politics of Economical Reform in Britain, 1779–1846* (Oxford, 1996), p. 153.
[35] J. Derry, *Reaction and Reform*, pp. 62-63.
[36] For example, see J. Rule, *The Vital Century: England's Developing Economy, 1714-1815* (London, 1992), p. 315. See also B. Gordon, *Political Economy in Parliament 1819-1823* (London, 1976); S. E. Finer, "The Transmission of Benthamite Ideas 1820-1850", in G. Sutherland, ed., *Studies in the growth of nineteenth-century government* (London, 1972); D. Winch, *Riches and poverty: An intellectual history of political economy in Britain, 1750-1834* (Cambridge, 1996); E. F. Paul, *Moral Revolution and Economic Science: The Demise of Laissez-Faire in Nineteenth-Century British Political Economy* (Westport, Connecticut, 1979), chapter 2.
[37] B. Gordon, *Political Economy in Parliament 1819-1823*, p. 72.

was a part of the larger issue of the government's attempts to foster greater economic stability is supported by a comparison of it with one of the most consuming issues of this period, the debate surrounding the currency. The problem of the currency began in 1797, when Parliament passed an act that stopped the Bank of England from issuing payments in gold since a huge portion of the country's gold reserves had been used to fund the war with France. Rather, paper notes were issued, and these could not be exchanged for metallic currency until new legislation to this effect was passed. This restriction was repeatedly renewed until 1814, when the date for the resumption of cash payments, or for the return to the gold standard, was set to be March 25, 1815. Due to strong opposition to a return to the gold standard among the commercial interest, however, the resumption date was repeatedly delayed until July 5, 1819 was decided upon. In early 1819, the ministry wanted to impose yet another delay, but a committee of enquiry was appointed instead, upon the request of the directors of the Bank of England.[38]

The commercial community opposed the restoration of the gold standard because, by this time, two main problems obstructing a resumption of cash payments faced the government. First, England was experiencing another severe shortage of gold that occurred when a large loan was made by a group of English merchants to the French government, which was experiencing difficulties making its war indemnity payments.[39] Secondly, the price offered for the English gold in France was so much higher than the price fixed by the English mint (called the "ancient standard of value"), that a divergence occurred in England between the official and practical market prices of gold. In order to return to the gold standard, therefore, the amount of paper currency in circulation would have to be reduced until the price of gold could be

[38] N. Gash, *Lord Liverpool*, pp. 140-142; B. Gordon, *Political Economy in Parliament 1819-1823*, p. 34.
[39] N. Gash, p. 139.

standardised at a single price, so that gold could constitute an invariable monetary standard. Baring, and a number of other financial men, opposed such a course of action because they believed an immediate reduction in paper currency would have severe deflationary effects on the domestic economy. In contrast, Ricardo advocated an immediate and complete restoration of the gold standard, because he felt deflation would cause a corresponding change in the price of all commodities.[40]

This opposition of views can be clearly seen in the reports produced by the committees of secrecy appointed by both the Commons and Lords in 1819 in response to the request of the directors of the Bank of England. The second Commons Secret Committee report was published in May, 1819. The committee members stressed the importance of achieving economic stability in order to allow Britain to prosper. An essential aspect of such stability was the fixing of the country's currency against an invariable standard of value, and gold was considered, by the government, to be the most invariable substance known in terms of value. They admitted that this was impossible as long as the price of gold was unstable, but they argued that the public had regained a satisfactory level of confidence in England's financial state, which meant that the temporary inconveniences caused by a return to the gold standard (in particular the forced reduction in the market price of gold) would not cause serious agitation among the general population. This claim was clearly made near the beginning of the report when it was stated that "This document furnishes a clear and decisive proof of the flourishing condition of the affairs of the Bank of England, and justifies that ample confidence which the Public have reposed in the stability of their resources."[41] Again, when discussing the need to fix

[40] B. Gordon, pp. 103-104.

[41] "Second Report of the Secret Committee on the Expediency of The Bank resuming Cash Payments." (May 6, 1819). *British Sessional Papers. House of Commons, vol. 3 (1819), p. 4.*

the price of gold above the price paid by the mint until the two prices could be brought into unison, the committee justified this temporary fluctuation in terms of the greater stability it would ultimately bring about. The objection was made that the manipulation of the price of gold "appears to recognise a departure from the ancient Standard of value; but it recognises it no otherwise than as it at present practically exists; it recognises it for a very limited period, and with no other view, than to provide for the gradual return to that Standard, the deviation from which it acknowledges."[42]

Similar testimony was also given by Ricardo before both committees. Not only did he advocate an immediate restoration of the gold standard, but he also complained that he felt the currency was very unstable as long as it was not based on a constant standard: "I consider that our currency is in a very unsatisfactory state, while the bank have the power of increasing or diminishing the circulation, and altering its value at their pleasure".[43] In contrast, Alexander Baring and other merchants wanted to stay off the gold standard, in order to allow a much greater level of flexibility for the currency. The government ultimately opted for a gradual resumption of cash payments, beginning in the spring of 1822.

The similarities between the currency debate and the developments in metrological standardisation are numerous. In general terms, both debates involved the government's favouring the legal imposition of invariable of standards, of money and weights and measures respectively, in order to bring about a new level of national economic uniformity. The opposing views stated by Baring and other mercatorial witnesses before the committees on the currency

---

[42] "Second Report of the Secret Committee on the Expediency of The Bank resuming Cash Payments." (May 6, 1819). *British Sessional Papers. House of Commons, vol. 3 (1819), p. 17.*

[43] "Second Report of the Secret Committee on the Expediency of The Bank resuming Cash Payments." (May 6, 1819). *British Sessional Papers. House of Commons, vol. 3 (1819), p. 136.*

reflect a lack of interest in standardisation that was found among this same group of people in relation to weights and measures: in both cases, enforced uniformity would cause an undesirable disruption in trade. Finally, it is interesting to note that Alexander Baring was given far less opportunity to speak before the committees as compared to Ricardo and others in favour of a return to the gold standard. This is similar to the disinclination to interview members of the commercial community found in the research done on weights and measures in the 1810s and early 1820s by the Commissioners appointed by the Commons.

More specifically, the return of the currency to the gold standard would have had two important implications for the country's metrological system. It was mentioned in chapter two that troy weights were used to measure coins, and that an act of 1774 reinforced this. A resumption of cash payments would place renewed importance on the establishment of conformity to these troy weights in order to ensure monetary stability. Therefore, it would be in the interest of the government's monetary policy to legally secure the dimensions of the money weights both as distinct from, and in relation to, the avoirdupoids weights used for everyday trade. At the same time, it would also be in the government's interest to avoid any radical metrological change that would necessitate an alteration in the troy units used to weigh gold used for currency, since this would render a smooth return to the gold standard more difficult. When placed in this context, both the government's desire for metrological standardisation and the conservative nature of the imperial system, with its explicit fixing of troy units in relation to the new avoirdupoids units, can be seen to have been advantageous in terms of the Liverpool government's larger financial and economic policy.

The existence of a distinct mercatorial economic discourse, very different from that

of the government, is reflected in the debates on both metrological standardisation and the currency. The government was forced to engage with the commercial community because this social group played such an important role in the raising of government revenues. In addition to this force of opposition faced by the government, another, smaller group of people helped shape the metrological developments leading to the adoption of the imperial system. It was suggested, in chapter two, that in this period the government was interested in certain types of weights and measures, in particular money weights in the 1770s, whereas metrological variation continued to be legally sanctioned for such things as corn bushels as late the 1790s. The issue of a general metrological standardisation, in contrast, was advocated by individual members of Parliament long before the government came to favour comprehensive standardisation in the second decade of the nineteenth century. This issue was repeatedly raised in Parliament by another distinct group of individual members of the Commons, including Sir John Riggs Miller, Samuel Whitbread, and Henry Sumner.

This group of people was involved in local government, which meant that they personally witnessed local problems involving the common people. The concerns they voiced over the abusive effects of metrological variation on the poorest groups in society had been voiced for centuries by concerned members of local ruling elites. For example, it was seen that Miller complained that the poor were forced to pay their rents with the largest bushels available, but were sold bread by the smallest acceptable measures. A very similar complaint was made by a member of Parliament for Derbyshire, Peter Fretchvile, in 1601 when he claimed that "the rich used a larger measure when buying grain for themselves and a smaller when selling it to

their poor neighbours."[44] In the earlier part of the same reign, when a metrological bill was before Parliament, the lieutenant of the Tower, who recorded parliamentary occurrences, wrote that he "hoped that poor men receiving doles of corn might have them measured by the largest bushel in use".[45] The idea that the poor were likely to be cheated through the use of ostensibly accepted customary measures was, therefore, very old by the time Miller articulated it.

This same group of people also appear to have been largely independent members of Parliament. Samuel Whitbread provides the best example of this characteristic. Although he was a member of the Whig opposition, every historical study of him emphasises the fact that he was guided more by his own principles than by any party affiliation. A typical description of Whitbread's reputation can be found in the editor's introduction to his notebooks, where it is claimed that although Whitbread was only officially in charge of three hundreds in Bedfordshire, "such was his reputation however among the people of Bedfordshire for justice tempered with honesty and kindness that many from beyond these arbitrary boundaries turned to him".[46] Whitbread also introduced many motions in Parliament that were soundly defeated: for instance, in 1795, his minimum wage bill was deafeated,[47] in 1808, he put forward a motion for peace with France which lost 253 to 108, and in 1809, his attempt to commit the Whigs to a "policy of reform" was equally unsuccessful.[48] Therefore, Whitbread's interest in weights and measures most likely arose from his desire for the immediate and genuine benefit of the common people for whom he was responsible. Similarly, Henry Sumner's ill-fated attempts to acquire proper

---

[44] D. Dean, *Law-Making and Society in Late Elizabethan England: The Parliament of England, 1584-1601* (Cambridge, 1996), p. 155.
[45] G. R. Elton, *The Parliament of England 1559-1581* (Cambridge, 1986), pp. 224-225.
[46] A. F. Cirket, ed., *Samuel Whitbread's Notebooks 1810-11, 1813-14* (Bedford, 1971), p. 7.
[47] G. Alderman, *Modern Britain*, p. 54.
[48] F. O'Gorman, *The Long Eighteenth Century*, pp.264- 265.

standards for Surrey displayed an attentiveness to the common people of that county. The concerns of both these men appear to have been centred on the problems facing active local governments attempting to adopt metrological changes in conformity with central legislation. Furthermore, the examination of the case of Bedfordshire discussed in chapter four revealed that local problems of weights and measures, combined with the effects of the local justices' attempts to apply central metrological legislation, both of which were witnessed by Whitbread witnessed in Bedfordshire, informed his activities in Parliament as well as in the county.

Overall, the role of these individuals, as members of both local and central government in a period seen by many historians as "something of a golden age for the independence of the local magistrates",[49] constituted another force affecting the central government's choices. The reciprocal relationship between central and local experiences, as can be seen particularly in Whitbread's actions, led these individuals to keep the possibility of metrological standardisation alive in Parliament until the government grew to favour it as well. As the government's conception of its own responsibilities changed, the fact that metrological uniformity became an object of serious consideration was most likely due in large part to the persistent raising of the issue by these individuals. The discursive change that appears to have affected the government provided a new conceptual framework with which to understand issues in a new way. However, in this case at least, the issue itself had been isolated and articulated previously.

To conclude, the purpose of this thesis has been to suggest that a variety of discrete forces created and propelled the English metrological standardisation debate over the seventy years preceding the imperial system's enactment. If one examines the parliamentary reports,

---

[49] F. O'Gorman, p. 287.

debates, bills, and statutes in isolation, it appears to be possible to explain the government's decision to seek comprehensive metrological standardisation, beginning around 1814, in terms of the epistemic changes occurring at this time as described by Foucault and Poovey. However, inconsistencies in this interpretation arise even at this superficial level. The ambiguity of the government's relationship with the mercatorial community, as well as Parliament's unwillingness to adopt the full extent of the changes advocated by committees in 1758, 1759, and 1814 raised questions about the government's own motives for seeking standardisation. The government appears to have been interested in metrological standardisation because it was seen to contribute to national economic stability. In contrast, merchants and tradesmen, and highly principled individual members of Parliament who also served as local justices of the peace, were discovered to have held different understandings of the nature and purpose of weights and measures reform than that of the government. It therefore became necessary to adopt a theoretical approach that allowed for human agency within discourses, and for attributing a level of historicity, or continuity, to the discourses themselves that is difficult to reconcile with Foucault's emphasis on sharp epistemological dislocations. With the help of ideas provided by Charles Taylor and Dror Wahrman, it became possible to argue that an interpretation unique to each social group studied in the previous chapters arose concerning weights and measures, and that a detailed process of interaction between these various discourses produced the passage of the Imperial Weights and Measures Act in 1824.

These findings suggest that linguistic turn theory offers the opportunity to add new levels of meaning to historical processes that have proven difficult to understand in terms of other theoretical approaches. However, one must be careful not to use the theory, whose stated

purpose is to enable historians to avoid imposing artificial unities on the past, to in fact to do just that. Foucault argues that a discursive analysis allows one to discover radical epistemological upheavals, or ruptures, beneath what can look like a gradual, linear, "seamless" progression from a more traditional point of view. However, the nature of such a discursive analysis is inherently an examination of the outer extremity of existence, since it allows one to identify the fundamental boundaries within which human cognitive and social activity occurs. In ending a historical analysis of an occurrence such as the adoption of the imperial system with the identification of those discursive boundaries, one risks interpreting everything studied solely in terms of them. This would, arguably, have the same effect as the imposition of any other narrow, totalising framework on the past.

BIBLIOGRAPHY

Primary Documents

Manuscripts:

Bedfordshire Record Office

Quarter Sessions Records (Q.S.R.):
Q.S.R. 1775
Q.S.R. 1786
Q.S.R. 1800
Q.S.R. 1802
Q.S.R. 1803
Q.S.R. 1807-1810
Q.S.R. 1815
Q.S.R. 1822
Q.S.R. 1824

Quarter Sessions Minutes (Q.S.M.):
Q.S.M. 19 (1792 – Midsummer Sessions 1796)
Q.S.M. 20 (Michaelmas Sessions 1796 – Midsummer Sessions 1800)
Q.S.M. 21 (Michaelmas Sessions 1800 – Michaelmas Sessions 1803)
Q.S.M. 22 (Epiphany Sessions 1804 – Michaelmas Sessions 1807)
Q.S.M. 23 (Epiphany Sessions 1808 – Midsummer Sessions 1811)
Q.S.M. 24 (Adjourned Midsummer Sessions 1811 – Easter Sessions 1814)
Q.S.M. 25 (Midsummer Sessions 1814 – Easter Sessions 1816)
Q.S.M. 26 (Midsummer Sessions 1816 – Epiphany Sessions 1820)
Q.S.M. 27 (Easter Sessions 1820 – Epiphany Sessions 1824)
Q.S.M. 28 (Easter Sessions 1824 – Michaelmas Sessions 1827)
Q.S.M. 31 (Easter Sessions 1833 – Easter Sessions 1835)

Parish Records:
P64/28/2 (1802)
P64/28/3 (1802)

Woburn Records:
X250/1 (1671)
X250/2 (1795)

Whitbread Papers:
W.1/364 (1814)
W.1/365 (1814)
W.1/366 (1814)

Miscellaneous Records:
R4/608/35-1
Q.A.V. 2/1
B.O.R.B. F4/69/157-158

Printed Sources:

British Sessional Papers:
House of Commons, 1731-1800. Bills. Vol. 4 (1765).
House of Commons, 1731-1800. Bills. Vol. 5 (1765).
House of Commons, 1731-1800. Bills. Vol. 25 (1795).
House of Commons. 1813-1814. Vol. 3.
House of Commons. 1814-1815. Vol. 1.
House of Commons. 1818. Vol. 15.
House of Commons. 1819. Vol. 3.
House of Commons. 1819. Vol. 11.
House of Commons. 1820. Vol. 7.
House of Commons. 1821. Vol. 4.
House of Commons. 1823. Vol. 3.
House of Commons. 1824. Vol. 3.
House of Commons. 1824. Vol. 7.

Hansard's Debates:
First Series. House of Commons. Vol. 37 (1818).
First Series. House of Commons. Vol. 39 (1819).
Second Series. House of Commons. Vol. 1 (1820).
Second Series. House of Commons. Vol. 10 (1824).

Reports from Committees of the House of Commons 1715-1801. Vol. 2.

Statutes at Large:
24 George III (1774)
31 George III (1791)
35 George III (1795)
37 George III (1797)
43 George III (1803)

Statutes of the United Kingdom:
Vol. 5, 1813-1815
Vol. 6, 1815-1816
Vol. 8, 1819-1822
Vol. 9, 1823-1824

Times (London):
14 April, 1790.
30 December, 1791.
1 October, 17981.

The Eighteenth Century Microfilm Collection (E.C.):

Bettesworth, J. *Arithmetic Made Easy, in the First Four Fundamental Rules.* London, [1780?]. E.C. reel 1428, no. 8.

Bonnycastle, John. *An Introduction to Mensuration, and Practical Geometry.* London, 1782. E.C. reel 1666, no. 4.

(Anonymous). *Commercial Tables.* Salisbury, 1790. E.C. reel 311, no. 1.

Dawes, John. *Pantometry; or, an Attempt to Systematize Every Branch of Admeasurement.* London, 1797. E.C. reel 1428, no. 13.

Dilworth, Thomas. *The Schoolmaster's Assistant: Being a Compendium of Arithmetic, Both Practical and Theoretical.* London, 1744. E.C. reel 308, no. 4.

Donn, Benjamin. *The Accountant and Geometrician.* London, 1765. E.C. reel 302, no. 6.

Everard, *Thomas. Stereometry, Or, the Art of Gauging Made easie, by the Help of a Sliding Rule.* London, 1705. E.C. reel 2188, no. 19.

Fisher, George. *Arithmetick in the Plainest and most Concise Methods hitherto Extant.* London, 1748. E.C. reel 302, no. 1.

Fisher, George. *Arithmetick in the Plainest and most Concise Methods hitherto Extant.* London, 1759. E.C. reel1666, no.1.

Fletcher, Abraham. *The Universal Measurer, and Mechanic.* London, 1762. E.C. reel 308, no. 10.

(Anonymous). *The Four First Rules of Arithmetic.* London, 1787. E.C. reel 1428, no. 10.

Good, J. *Measuring made Easy: or, the Description and Use of Coggeshall's Sliding Rule.* London, 1724. E.C. reel 337, no. 8.

Hatton, E. *The Gauger's Guide; or, Excise-Officer Instructed.* London, 1729. E.C. reel 309, no. 8.

Hawney, William. *The Compleat Measurer; or, the Whole Art of Measuring.* London, 1721. E.C. reel 2642, no. 2.

Hodgkin, W. *A Short, New, and Easy Method Of Working the Rule of Practice in Arithmetick.* London, 1731. E.C. reel 1428, no. 2.

Imison, John. *A Compendium of Arithmetic, Wherein The Rudiments of that noble Art are made easy to the weakest Capacity.* London, 1787. E.C. reel 337, no. 7.

Keith, Thomas, ed. *Hawney's Complete Measurer: or, the Whole Art of Measuring.* London, 1798. E.C. reel 2284, no. 1.

Leadbeater, J., and Assistants. *The Gentleman and Tradesman's Compleat Assistant; Or, the Whole Art of Measuring and Estimating, made Easy.* E.C. reel 2824, no. 3.

Leybourn, William. *Panathrimologia: or, the Trader's Sure Guide.* London, 1769. E.C. reel 3423, no. 5.

Lightbody, James. *The Gauger's Practice.* London, 1704. E.C. reel 302, no. 2.

Lowe, Solomon. *Arithmetic in Two Parts.* London, 1749. E.C. reel 302, no. 2.

Mair, John. *Book-Keeping Methodiz'd: or, A methodical treatise of Merchant-Accompts, according to the Italian Form.* Edinburgh, 1757. E.C. reel 3428, no. 4.

Mair, John. *Book-Keeping Moderniz'd: or, Merchant-Accounts by Double Entry, according to the Italian form.* Edinburgh, 1773. E.C. reel 3428, no. 5.

Moss, Thomas. *A Treatise of Gauging.* London, 1766. E.C. reel 2230, no. 7.

Neve, Richard. *Mathematicks made Plain, In the Solution of Variety Of Useful Propositions.* London, 1708. E.C. reel 2230, no. 9.

Overley, Isaac. *Measuring Made Easy.* London, 1739. E.C. reel 337, no. 6.

Pain, William. *The Practical Measurer, or Youth's Instructor.* London, 1783. E.C. reel 2283, no. 6.

Pardon, William. *A New and Compendious System of Practical Arithmetick.* London, 1738. E.C. reel 2283, no. 5.

Randall, J. *An Introduction To so much of the Arts and Sciences, More immediate concerned in an Excellent Education for Trade.* London, [1765?]. E.C. reel 308, no. 9.

A Report from the Committee, Appointed (Upon the 1st Day of December 1758) to Enquire into the Original Standards of Weights and Measures in this Kingdom, and to consider the Laws relating thereto. London, 1758. E.C. reel 341, no. 3.

Robertson, J. *A Compleat Treatise of Mensuration.* London, 1738. E.C. reel 1666, no. 2.

Robertson, John. *A General Treatise on Mensuration.* London, 1748. E.C. reel 338, no. 9.

Roy, William, Colonel. *Experiments and Observations Made in Britain, in Order to Obtain a Rule for Measuring Heights with the Barometer.* London, 1778. E.C. reel 2056, no. 8.

Sadler, Thomas. *A Complete System of Practical Arithmetic, (Both Vulgar and Decimal) On an entire new Plan.* Shrewsbury, 1773. E.C. reel 309, no. 2.

Shuckburgh, Sir George. *Comparison between Sir George Shuckburgh and Colonel Roy's Rules for the Measurement of Heights with the Barometer; in a Letter to Col. Roy, F.R.S. from Sir George Shuckburgh, Bart. F.R.S.* London, 1778. E.C. reel 2056, no. 7.

Symons, William. *The Practical Gager: or, the Young Gager's Assistant.* London, 1799. E.C. reel 309, no. 4.

Ward, George. *The Gauger's Practice: Or, A Compendious Way of Gauging Brewers Tuns; and the Gauging of Casks, according to the true Rules of Art.* London, 1704. E.C. reel 302, no. 9.

Webb, Benjamin. *The Complete Negotiator: or, Tables for the Arbitration and Combination of the Exchanges or all the Trading Countries in Europe, and for Reducing the Same to Par.* London, 1767. E.C. reel 338, no. 4.

Williams, Thomas. *Method to Discover the Difference of the Earth's Diameters* London, 1788. E.C. reel 1392, no. 8.

Wilson, John. *An Introduction to Arithmetic.* Edinburgh, 1752. E.C. reel 1666, no. 3.

Wood, Basil. *Stereometry: or, The Art of Solids Demonstrated Arithmetically. London*, 1707. E.C. reel 341, no. 5.

Worley, Thomas. *Tidesman's and Weigher's New Pocket Companion.* London, 1744. E.C. reel 1428, no. 7.

Secondary Sources

Books:

Alderman, Geoffrey. *Modern Britain 1700-1983: a Domestic History*. Beckenham, Kent: Croom Helm, 1986.

Barnett, David C. *London, Hub of the Industrial Revolution: A Revisionary History 1775-1825*. London: Tauris, 1998.

Bedfordshire Population Figures 1801-1991. Bedford: Bedfordshire and Luton Archives and Record Service, 1994.

Brewer, John. *The Sinews of Power: War, Money and the English State, 1688-1783*. London: Unwin, 1989.

Cirket, Alan F., ed. *Samuel Whitbread's Notebooks 1810-11, 1813-14*. Bedford: Bedfordshire Historical Records Service, 1971.

Craven, Maxwell. *John Whitehurst of Derby: Clockmaker and Scientist 1713-88*. Mayfield, Derbyshire: Mayfield Books, 1996.

Crosby, Alfred W. *The Measure of Reality: Quantification and Western Society, 1250-1600*. Cambridge: Cambridge University Press, 1997.

Dean, David. *Law-Making and Society in Late Elizabethan England: The parliament of England 1584-1601*. Cambridge: Cambridge University Press, 1996.

Derry, John W. *Reaction and Reform 1793-1868: England in the Early Nineteenth Century*. London: Blandford Press, 1963.

Elton, G. R. *The Parliament of England 1559-1581*. Cambridge: Cambridge University Press, 1986.

Favre, Adrien. *Les Origines du Système Métrique*. Paris: Les Presses Universitaires de France, 1931.

Foucault, Michel. *The Archaeology of Knowledge*. London: Tavistock, 1972.

Foucault, Michel (edited by Gordon, Colin). *Power/Knowledge: Selected Interviews and Other Writings 1972-1977*. New York: Pantheon, 1980.

Foucault, Michel. *The Order of Things: An Archaeology of the Human Sciences*. New York: Vintage, 1994.

Foucault, Michel. *The Use of Pleasure: The History of Sexuality, Volume 2.* New York: Vintange, 1990.

Fulford, Roger. *Samuel Whitbread 1764-1815: A Study in Opposition.* London: Macmillan, 1967.

Gash, Norman. *Lord Liverpool: The Life and Political Career of Robert Banks Jenkinson Second Earl of Liverpool 1770-1828.* London: Weidenfeld and Nicolson, 1984.

Godber, Joyce. *History of Bedfordshire 1066-1888.* Bedford: Bedfordshire County Council, 1984.

Gordon, Barry. *Political Economy in Parliament 1819-1823.* London: Macmillan, 1976.

Gould, Stephen Jay. *Full House: The Spread of Excellence from Plato to Darwin.* New York: Three Rivers Press, 1996.

Hans, Nicholas. *New Trends in Education in the Eighteenth Century.* London: Routledge and Kegan Paul, 1951.

Harling, Philip. *The Waning of 'Old Corruption': The Politics of Economical Reform in Britain, 1779-1846.* Oxford: Clarendon Press, 1996.

Kisch, Bruno. *Scales and Weights: A Historical Outline.* New Haven, Connecticut: Yale University Press, 1965.

Klein, M. Arthur. *The World of Measurements.* New York: Simon and Schuster, 1974.

Kula, Witold. *Measures and Men.* Princeton: Princeton University Press, 1986.

Linebaugh, Peter. *The London Hanged: Crime and Civil Society in the Eighteenth Century.* Harmondsworth: Penguin, 1991.

Malinowski, Bronislaw, Fuente, Julio de la, and Drucker-Brown, S. *Malinowski in Mexico: The Economics of a Mexican Market System.* London: Routledge, 1982.

Mason, Stephen F. *A History of the Sciences.* New York: Macmillan, 1962.

O'Gorman, Frank. *The Long Eighteenth Century: British Political and Social History 1688-1832.* London: Arnold, 1997.

Page, William, ed. *The Victoria History of the Counties of England: Bedfordshire.* London: University of London Institute of Historical Research, 1972 (originally published 1908)

Paul, Ellen Frankel. *Moral Revolution and Economic Science. The Demise of Laissez-Faire in Nineteenth-Century Political Economy.* Westport, Connecticut: Greenwood Press, 1979.

Poovey, Mary. A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society. Chicago: University of Chicago Press, 1998.

Pyenson, Lewis and Sheets-Pyenson, Susan. *Servants of Nature: A History of Scientific Institutions, Enterprises and Sensibilities.* New York: W. W. Norton and Company, 1999.

Rudé, George F. E. *Hanoverian London, 1714-1818.* London: Secker, 1971.

Rule, John. *The Vital Century: England's Developing Economy, 1714-1815.* London: Longman: 1992.

Skinner, F. G. *Weights and Measures: their ancient origins and their development in Great Britain up to AD 1855.* London: Her Majesty's Stationery Office, 1967.

Smith, Hance D. *Shetland Life and Trade 1550-1914.* Edinburgh: John Donald, 1984.

Taylor, Charles. *Human Agency and Language: Philosophical Papers, Vol. 1.* Cambridge: Cambridge University Press, 1985.

Taylor, Charles. *Philosophy and the Human Sciences: Philosophical Papers, Vol. 2.* Cambridge: Cambridge University Press, 1985.

Thompson, E.P. *The Making of the English Working Class.* London: Penguin, 1991.

Thirsk, Joan, ed. *The Agrarian History of England and Wales. Vol. 6, 1750-1850.* Cambridge: Cambridge University Press, 1989.

Thorne, R. G. *The History of Parliament: The House of Commons 1790-1820.* London: Secker and Warburg, 1986.

Wahrman, Dror. *Imagining the Middle Class: The Political Representation of Class in Britain, c. 1780-1840.* Cambridge: Cambridge University Press, 1995.

Webb, Sidney, and Webb, Beatrice. *English Local Government. Volume 1, The Parish and the County*. London: Frank Cass and Co., 1963.

Winch, Donald. *Riches and poverty: An intellectual history of political economy in Britain, 1750-1834*. Cambridge: Cambridge University Press, 1996.

Zupko, Ronald Edward. *Revolution in Measurement: Western European Weights and Measures Since the Age of Science*. Philadelphia: American Philosophical Society, 1990.

Articles:

Alder, Ken. "The Metric Revolution: A Social History of the Metric System in France". *Proceedings of the Annual Meeting of the Western Society for French History*, no. 21(1994), pp. 95-105.

Critchley, T. A. "The New Police in London 1750-1830". McCormick, K. and Visano, L. A., eds. *Understanding Policing*. Toronto: Canadian Scholars' Press, 1992.

Curtis, Bruce. "From Moral Thermometer to Money: Metrological Reform in Pre-Confederation Canada". *Social Studies of Science*, vol. 28, no. 4 (August, 1998), pp. 547-570.

Finer, S. E. "The Transmission of Benthamite Ideas1820-1850 ". Sutherland, Gillian, ed. *Studies in the growth of nineteenth-century government*. London: Routledge and Kegan Paul, 1972.

Kuhn, Thomas. "The Function of Measurement in Modern Physical Science". Kuhn, Thomas. *The Essential Tension: Selected Studies in Scientific Tradition and Change*. Chicago: Chicago University Press, 1977.

Hoppit, Julian. "Reforming Britain's Weights and Measures, 1660-1824". *English Historical Review*, vol. 108 (1993), pp. 82-104.

Leadley, Avril D. "Some Villains of the Eighteenth-Century Market Place". Rule, John, ed. *Outside the Law: Studies in Crime and Order 1650-1850*. Exeter: University of Exeter Press, 1982, pp. 21-34.

Sheldon, Richard; Randall, Adrian; Charlesworth, Andrew; Walsh, David. "Popular Protest and the Persistence of Customary Corn Measures: Resistance to the Winchester Bushel in the English West". Randall, Adrian and Charlesworth, Andrew, eds. *Markets, Market Culture and Popular Protest in Eighteenth-Century Britain and Ireland*. Liverpool: Liverpool University Press, 1996, pp. 25-45.

Schaffer, Simon. "A social history of plausibility: country, city and calculation in Augustan Britain". Wilson, Adrian, ed. *Rethinking social history: English society 1570-1920 and its interpretation*. Manchester: Manchester University Press, 1993, pp. 128-157.

Storch, Robert D. "The Old English Constabulary". *History Today*, vol. 49, no. 11 (November, 1999), pp. 43-49.