INTRODUCTION

Intellectual innovations within fourteenth-century natural philosophy occupy an important place in the history of scientific thought. Over the course of the century, philosophers subjected elements of the Aristotelian model of the natural world to critical analysis, advancing claims of logic, mathematical consistency, and empirical evidence against Aristotelian authority. The selective critique of Aristotle was informed by a wealth of new questions and innovative speculations. Beneath these speculations lay a profound reconceptualization of nature.[1]

In broad terms, the conceptual landscape that emerged in the fourteenth century resulted from a striking shift in the models derived to represent order and activity in the natural world: from a static world of numbered points and perfections to a dynamic world of ever-changing values conceived as continua in expansion and contraction; from a mathematics of arithmetical addition to a mathematics of geometrical multiplication, newly accepting of the approximate and the probable; from a world of fixed and absolute values to a shifting, relational world in which values were understood to be determined relative to changing perspectives and conditions; and from a philosophy focused on essences and perfections to one dominated by questions of quantification and measurement in respect to motion and change. Each of these new directions proved to be of great importance to the future of scientific thought.[2]

[1] Marshall Clagett, "Some Novel Trends in the Science of the Fourteenth Century," in Charles Singleton (ed.), *Art, Science, and History in the Renaissance* (Baltimore, 1967), 275–303, esp. 302–03; Anneliese Maier, "La doctrine de Nicolas d'Oresme sur les 'configurationes intensionum,'" in Maier, *Ausgehendes Mittelalter*, 3 vols. (Rome, 1964–77), vol. I, 335–52, esp. 336–37. For additional bibliography on this point, see chapter 6.

[2] For an assessment of the importance of several of these innovations to science – geometricization of space, concepts of relativity, a mathematics of the approximate and of limits – see Alexandre Koyré, *From the Closed World to the Infinite Universe* (Baltimore, 1957), 1–27. Koyré, however, situates these innovations later than the fourteenth century in almost all cases. For an appreciation of the

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Proto-scientific speculation in the fourteenth century developed within the rigorous intellectual culture of the university, particularly at Paris and Oxford. The abstraction, logical density, and technical complexity characterizing this speculation engage and impress logicians and historians of science to this day. Given the highly refined and formal intellectualism of scholastic natural philosophy, it is understandable that with few exceptions historians of medieval science have hesitated to step outside the sphere of intellectual culture in their search for the factors influencing its development.

This book suggests a broader historical explanation for the new directions taken in fourteenth-century natural philosophy than has so far been offered. It argues that the transformation of the conceptual model of the natural world, accomplished within the technical disciplines of the universities of Oxford and Paris c. 1260–1380, was strongly influenced by the rapid monetization of European society taking place over this same period, beyond the university and outside the culture of the book. It analyzes the impact of the monetized marketplace on the most striking and characteristic concern of natural philosophy in this period: its preoccupation with measurement, gradation, and the quantification of qualities. It investigates the transference of insights from the philosophical comprehension of the monetized marketplace to the philosophical comprehension of nature. It traces how those perceptual shifts essential to the emergence of modern science – the shift toward quantification, geometric representation, multiplication, relativity, probability, mechanistic order, and dynamic equilibrium – were grounded in the experience and comprehension of monetized society.

In the early years of the fourteenth century, English natural philosophers associated with Merton College, Oxford, initiated a vital new approach to the study of motion and qualitative change.[3] These scholars, now known collectively as the "Merton School" or the "Oxford Calculators," constructed a highly technical logic and mathematics of measurement.[4] They applied mathematical rules and quantitative schemata to a

contributions of fourteenth-century thinkers in these areas, see John Murdoch, "From Social into Intellectual Factors: An Aspect of the Unitary Character of Late Medieval Learning," in John Murdoch and Edith Sylla (eds.), *The Cultural Context of Medieval Learning* (Dordrecht and Boston, 1975), 271–348, esp. 287. James Weisheipl characterized fourteenth-century developments in natural philosophy at Oxford as a "revolution in scientific thought," in "The Place of John Dumbleton in the Merton School," *Isis* 50 (1959), 439–54, 439.

[3] Edith Sylla, "Medieval Quantifications of Qualities: The 'Merton School,'" *Archive for History of Exact Sciences* 8 (1971), 7–39; James Weisheipl, "Developments in the Arts Curriculum at Oxford in the Early Fourteenth Century," *Mediaeval Studies* 28 (1966), 151–75; Marshall Clagett, *The Science of Mechanics in the Middle Ages* (Madison, 1959), 206.

[4] John Murdoch, "*Mathesis in philosophiam scholasticam introducta*: The Rise and Development of the Application of Mathematics in Fourteenth-Century Philosophy and Theology," in *Arts libéraux et*

wide range of philosophical questions concerning qualities and motions, including the question of motion in space.[5] In the process of refining their logico-mathematical analysis of qualitative change, the Calculators laid the foundations for a future mathematical physics.

By the second quarter of the fourteenth century, masters at the University of Paris began to adopt the intellectual interests and methods of the English Calculators. As they did so, the passion to measure and quantify that characterized the proto-science of *calculationes* quickly invaded every realm of scholastic thought, including theology. Soon not only entities that had never been measured before, but also those that have never been measured since, were subjected to a kind of quantitative analysis. Theological questions concerning the most subjective and seemingly immeasurable qualities, such as the strength of Christian charity, or the comparison of human love to Christ's love, or the means by which the quality of grace increases in the soul, were routinely treated as problems of quantification, and subjected to analysis according to the latest developments in the logic and mathematics of measurement.[6]

Struck by the application of measuring schemata to the solution of philosophical and theological problems, John Murdoch asked: "How and why did the near frenzy to measure everything imaginable come about in the fourteenth century?"[7] Murdoch's question, first posed more than two decades ago, is central to this present study. How are new conceptual possibilities created? Why are new intellectual problems and approaches suddenly brought to prominence? With characteristic forthrightness, Murdoch admitted that he could not answer with certainty how a measuring "mania" came to dominate speculation in this period, but he suggested a number of possibilities. His first suggestion pointed to a creative dynamic produced solely from within the logic of the intellectual-philosophical debate.[8] His second suggestion broadened the range of influence to include the "catalyst" of theological concerns.[9] Here he

philosophie au moyen âge: Actes du Quatrième Congrès international de philosophie médiévale (Montreal, 1969), 215–46. For additional bibliography on the Calculators, see chapters 6 and 7.

[5] The conceptual linking of motion and qualitative change is central to the natural philosophy of this period and particularly characteristic of the Calculators' work. Weisheipl ("Dumbleton," 447) notes, for example, that the Calculator Thomas Bradwardine treated velocity as if it were a qualitative ratio capable of being intensified or lessened in the same manner as color and heat. On this linkage, see Clagett, *Science of Mechanics*, 199–219.

[6] John Murdoch, "*Subtilitates Anglicanae* in Fourteenth-Century Paris: John of Mirecourt and Peter Ceffons," in Madeleine Pelner Cosman and Bruce Chandler (eds.), *Machaut's World: Science and Art in the Fourteenth Century* (New York, 1978), 51–86; Murdoch, "Unitary Character," esp. 280–303; Murdoch, "*Mathesis*," 238ff. The Calculators' application of mathematical rules to theological problems is discussed further in chapters 6 and 7.

[7] Murdoch, "Unitary Character," 287.

[8] Murdoch (*ibid.*) stresses the influence of the philosophical thought of Duns Scotus and William of Ockham. For the unifying influence on scholastic philosophy of Aristotelian authority, see Murdoch, "Unitary Character," 308.

[9] Murdoch, "Unitary Character," 288–89.

cited, above all, the many dimensions of measurement involved in the central theological question of the relation of finite humanity to an infinite God.[10]

In explaining the new frenzy to measure qualities primarily as the working out of problems generated from within the philosophical tradition, Murdoch articulates a position on philosophical and scientific innovation prevalent among historians of medieval science. Murdoch goes further, however, when he suggests as a third area of influence the social and intellectual milieux of the university.[11] Edith Sylla has investigated this connection between philosophical speculation and its university setting in depth. She has shown the relationship between the vibrant, sometimes fierce, "disputational context" of the university and the evolving mathematical and logical form of both the questions asked and the answers considered successful in philosophical debate.[12] While acutely conscious of the impact of scholastic society on the shape and direction of philosophical inquiry, Sylla has limited her consideration of social factors to the society of scholars within the schools. With few exceptions, historians of medieval science have hesitated to step outside the university and outside the sphere of a refined intellectual culture in their analysis of fourteenth-century natural philosophy.[13]

[10] Murdoch, "Unitary Character," 289, 298–303. For a general discussion of the application of measurement languages to theological problems, see Murdoch, "Unitary Character," 289–307. For more on the role of theological controversy in the development of philosophical languages of measurement, see Edith Sylla, "Autonomous and Handmaiden Science: St. Thomas Aquinas and William of Ockham on the Physics of the Eucharist," in Murdoch and Sylla, *Cultural Context*, 349–91; Sylla, "Godfrey of Fontaines on Motion with Respect to Quantity of the Eucharist," in A. Maierù (ed.), *Studi sul XIV secolo in memoria di Anneliese Maier* (Rome, 1981), 105–41, esp. 107–09.

[11] Murdoch, "Unitary Character," 309. Although Murdoch considered the influence of the social environment of the university, he concluded that, "At best, social factors account for available possibilities; they seldom say anything about which ones were taken up and why" (309). Murdoch also (272 n. 2) briefly mentioned the possible influences on philosophy from the disciplines of medicine and law. This valuable insight is considered further in chapters 6 and 7.

[12] Edith Sylla, "The Oxford Calculators," in Norman Kretzmann, Anthony Kenny, and Jan Pinborg (eds.), *The Cambridge History of Later Medieval Philosophy* (Cambridge, 1982), 541–63; Sylla, "The Oxford Calculators in Context," *Science in Context* 1 (1987), 257–79.

[13] There are notable exceptions to this statement. In the specific case of *calculationes*, Janet Coleman ("Jean de Ripa, OFM, and the Oxford Calculators," *Mediaeval Studies* 37 [1975], 130–89, 131) suggests a connection between the expansion of commercial calculation in the fourteenth century and the increasing concern for calculation and measurement in university thought of the same period. For a specific argument linking economic thought and philosophical speculation, see William Courtenay, "The King and the Leaden Coin: The Economic Background of 'Sine qua non' Causality," *Traditio* 28 (1972), 185–210. Courtenay's more recent work continues to explore these connections. For a discussion of medieval scientific development at every point sensitive to its social and economic context, see Brian Stock, "Science, Technology, and Economic Progress in the Early Middle Ages," in David Lindberg (ed.), *Science in the Middle Ages* (Chicago, 1978), 1–51. The influence of practical measurement in social life on modes of measurement developed within scholastic natural philosophy is recognized by Pierre Souffrin, "La quantification du

As the reading of any text in natural philosophy from this period indicates, the great majority of positions taken and points made were in response not to external experiences or influences, but to questions and positions defined by the ongoing debate. In this literature, logic dominates and leads. Evidence of direct experience in the world beyond the text is rare. Historians of medieval science have, therefore, directed their attention primarily toward the internal elements of scholastic debate and of university culture.

While the internal analysis of texts and traditions provides the base on which all intellectual history must rest, at certain points its limitations in explaining intellectual innovation become apparent even to those most committed to its practice.[14] These limitations are especially clear in the case of major shifts in perception and direction like those that defined fourteenth-century natural philosophy.[15] It is difficult to see (to take one set of examples) how influences coming solely from within the schools can explain the strength of the intellectual movement of *calculationes*, or the preoccupation with measurement and relation that informed it, or the faith in the potential of quantification that underlay it, or the new perceptual models of the natural world from which it arose. Understanding intellectual innovation of this magnitude requires an approach that focuses on the *interaction* between the culture of the schools and new conceptual models coming from beyond the schools – in this case models that took shape as scholars directly (and sometimes painfully) experienced and sought to comprehend the dynamic of the monetized marketplace.

mouvement chez les scolastiques: la vitesse instantanée chez Nicole Oresme," in Jeannine Quillet (ed.), *Autour de Nicole Oresme: Actes du Colloque Oresme organisé à l'Université de Paris* XII (Paris, 1990), 63–83, esp. 66. For connnections between commercial culture, numeracy, and mathematical innovation, see Warren Van Egmond, *The Commercial Revolution and the Beginnings of Western Mathematics in Renaissance Florence, 1300–1500* (Ph.D. dissertation, Indiana University, 1976); Alexander Murray, *Reason and Society in the Middle Ages* (Oxford, 1978); Richard Hadden, *On the Shoulders of Merchants: Exchange and the Mathematical Conception of Nature in Early Modern Europe* (Albany, N. Y., 1994). Particularly relevant here is the work of Michael Wolff investigating the connection between scholastic economic theory and natural philosophy. See Michael Wolff, *Geschichte der Impetustheorie: Untersuchungen zum Ursprung der klassischen Mechanik* (Frankfurt a/M, 1978); also, Michael Wolff, "Mehrwert und Impetus bei Petrus Johannis Olivi," in Jürgen Miethke and Klaus Schreiner (eds.), *Sozialer Wandel im Mittelalter: Wahrnehmungsformen, Erklärungsmuster, Regelungsmechanismen* (Sigmaringen, 1994), 413–23.

[14] Witness the puzzlement of John Murdoch (cited 3) concerning the "frenzy" to measure.

[15] On this point, another statement of John Murdoch's is revealing: "When one looks for evidence in the sources that might provide a tolerably clear answer to such a question [i.e., why the use of logic as an analytic tool increased so greatly between the thirteenth and fourteenth centuries] (or to many other questions having to do with new trends that occurred in the fourteenth century), one almost feels that, between those fourteenth-century works that 'have it' and those thirteenth-century ones that don't, some evil genius has systematically destroyed the key works that could provide an answer." See "The Involvement of Logic in Late Medieval Natural Philosophy," in Stefano Caroti (ed.), *Studies in Medieval Natural Philosophy* (Florence, 1989), 3–28, 5.

Without the vibrant intellectual culture of the medieval university in place – its disputational context, its characteristic attention to detail and logical rigor, its passion to synthesize – social experience and economic insights would never have been translated into new conceptual models, much less into mathematical and logical languages capable of expressing and refining these models. But at the same time, the rigid formality of scholastic discourse, and the focus of fourteenth-century natural philosophy on the technical intricacies of mathematics and logic, has disguised the rich layer of contact between philosophical speculation and social experience in this period. The biography of virtually every natural philosopher of note from the late thirteenth century reveals that the world of higher thought was not bounded by the walls of the university, whether actual or metaphorical. The new conceptual model of nature's form and activity arose in the minds of men who were deeply involved in the life of their society and highly conscious of the transformative process of monetization taking place within it.

The students and masters at Oxford and Paris lived in urban settings where the effects of monetization and commercialization were everywhere to be seen and experienced.[16] Were the student to venture into High Street in Oxford, or to cross the Grand pont in Paris, he would likely be caught up in crowded markets as he measured the price of a coveted pen or book or tankard against the coins in his purse. If he were a foreigner to the city, as was most likely, he would be brought into frequent contact with moneychangers and the complex equations that converted his currency into locally accepted coin. He would be required to calculate and husband his resources in a society that provided numerous opportunities for spending. It is hardly surprising that the earliest surviving letters from university students witness their preoccupation with monetary shortages and record their pleas for financial aid.[17]

The involvement of the student in the world of the market was not limited to periodic encounters, nor did it end with his inception as master. If anything, it seems to have increased in the case of those scholars most responsible for the new proto-scientific direction in natural philosophy. The one constant in the biographies of these scholars is that they were repeatedly given responsibilities in practical affairs drawing on thinking far removed from their philosophical and theological training. Indeed, the most innovative and influential scholars of the century seem

[16] For a remarkable fourteenth-century description of Paris as a giant marketplace written by a contemporary scholar and natural philosopher, see Jean de Jandun, *Tractatus de laudibus Parisius*, in Le Roux de Lincy and L. M. Tisserand (eds.), *Paris et ses historiens aux XIVe et XVe siècles* (Paris, 1867), 32–79.

[17] Charles Homer Haskins, "Letters of Mediaeval Students," in *Studies in Mediaeval Culture* (New York, 1929), 1–35, esp. 7–21, 27–28.

almost to have been on an informal bureaucratic track, with their experience as administrators beginning during their university careers and ending with exalted positions in the bureaucracies of Church or civil government.[18]

Within the universities, every examination taken, every grade passed and degree earned, had a price attached to it. The surviving administrative records from Oxford and Paris attest to the range of fees charged and the amount of conscious effort required of the master-scholars in the assessment and collection of these fees – for the teaching masters at the university were in almost all cases its administrators as well.[19] The minute monetary regulation and gradation of university life was further complicated by the habit of varying each fee levied in proportion to the ability of each student to pay. Again it was ordinarily the teaching masters who were charged with assessing, collecting, accounting for, and recording these fees.[20] The evidence in surviving university records for continued bureaucratic involvement has led one modern scholar to conclude that university masters of the fourteenth century spent as much of their time performing administrative duties as they did writing and lecturing.[21]

The economic writings left by these masters (examined in chapters 3–5) reveal how strongly their administrative experience influenced their perceptions of money and exchange. The same scholars whose economic writings are studied in this book and whose work demonstrates the clearest insight into the structure of economic life – Godfrey of Fontaines, Henry of Ghent, Peter John Olivi, John Duns Scotus, Geraldus Odonis, Walter Burley, Richard Kilvington, Jean Buridan, Nicole Oresme – all made significant and forward-looking contributions in the area of natural philosophy. To take but one example, each of these thinkers played a vital role in refining the concept of qualitative intensity,

[18] For more detail on the administrative involvement of Merton Calculators (especially Thomas Bradwardine and William Heytesbury) and on the equally influential Parisian natural philosophers Jean Buridan and Nicole Oresme, see chapter 1. Additional biographies illustrating this pattern of administrative activity on the part of influential natural philosophers are given in chapters 5 and 6.

[19] William J. Courtenay, "The Registers of the University of Paris and the Statutes Against the *Scientia Occamica*," *Vivarium* 29 (1991), 13–49, esp. 18. Evidence from the surviving records of the university for the Parisian masters' continual involvement in university administration is considered in chapter 1.

[20] For more on the minute, bureaucratic, and monetary grading of student activity, see Jacques Verger, "Le coût des grades: droits et frais d'examen dans les universités du Midi de la France au moyen âge," in Astrik L. Gabriel (ed.), *The Economic and Material Frame of the Mediaeval University* (Notre Dame, Ind., 1977), 19–36. For the involvement of Merton Scholars in these college administrative tasks, see chapter 1.

[21] William Courtenay, "The London *Studia* in the Fourteenth Century," *Medievalia et humanistica* 13 (1985), 127–41, esp. 131–32.

a concept central to the intellectual movement of *calculationes* and to proto-scientific thought in the fourteenth century.[22]

Despite ample evidence for the involvement of fourteenth-century natural philosophers in the economic life of their time, not one directly acknowledges the impact of social and economic experience on his philosophical speculation. While in their economic writings they continually state that "money measures all things" (*inventum est nummisma ut sit medium et mensura omnium commutabilium*), and while they investigate in great depth how money performs its function of measuring, relating, and equalizing, they never directly acknowledge its influence on their philosophical preoccupation with these same questions of measurement, relation, and equalization. Although they often remark on money's extraordinary success as an instrument of gradation and commensuration, they never acknowledge it as a model for the conceptual instruments they themselves devised to perform similar functions within philosophical discourse. At a number of points in the following pages I discuss this lack of acknowledgment (or recognition) and what I believe are its probable causes, but some general observations can be made here.[23]

In contrast to modern scientific attitudes, scholastic thinkers expressed strong doubts that scientific truths could be based upon personal and particular experiences of an ever-changing object world. They believed that observations drawn from personal experience lacked the necessity, universality, and truth-value required by science. There was, consequently, a concerted effort to cleanse philosophical discourse from the taint of its contact with contingent experience. Insights drawn from the experience of nature were quickly denatured – translated into propositions and logical terms deemed to be the proper subjects of scholastic debate. In a paradox that has often been remarked upon, many of the most important works in natural philosophy of this period contain not a single reference to personal observations of nature.

Experiences drawn from economic life carried with them a double weight of negative connotations since, even when scholastic thinkers recognized the importance of economic activity, they remained suspicious of it. When the influential natural philosopher, Jean Buridan, writes on economic questions, he shows conclusively that he understands the multi-faceted role of money as an instrument of measurement in ex-

[22] For an essay that considers the contribution of each of these thinkers to the question of qualitative intensity, see Anneliese Maier's influential study, "Das Problem der intensiven Grösse in der Scholastik," in *Zwei Grundprobleme der scholastischen Naturphilosophie: Studien zur Naturphilosophie der Spätscholastik* (Rome, 1951), 1–79. See also chapter 6 in this book.

[23] See chapter 6, 196–98, and chapter 7, 209–10.

change – particularly money's capacity to bring the most diverse goods into a common system of measurement and relation.[24] Faced with a parallel question of measurement in his commentary on Aristotle's *Physics*, Buridan asks whether money as a common measure of diverse goods can serve as a "proper" model for the philosophical measurement of diverse species. Here, however, in the context of natural philosophy, he concludes that it cannot. Speaking within a tradition of medieval economic commentary, he notes that money can measure only relative and ever-changing economic values, not the essential qualities and natures that are of concern to philosophy. Even more damaging in his eyes was the association of monetary measurement with fraud. The economic value that money measures as selling price is, Buridan writes, often distorted through a bargaining process in which deception is intended by both buyer and seller. Thus, although Buridan is acutely aware of money's function as the common measure of all goods in his society, he cannot accept its influence as a measure in philosophy.[25] A similar disjunction is found in the work of every philosopher considered in this book. Given the strict requirements for truth, universality, and necessity in the highly formal discourse of scholastic natural philosophy, medieval thinkers never explicitly acknowledge the influence of any model drawn from the tainted sphere of the marketplace on their philosophical speculation.

In the absence of this conscious recognition (the "smoking gun," so to speak), I have relied throughout on the method of isolating and comparing elements of the scholastic model of the monetized marketplace (including the model of money as measure) with the defining elements of the proto-scientific model of nature that emerged in the fourteenth century. After isolating the elements that I believe define both intellectual spheres, I detail the verbal and formal similarities existing between them and the many levels of connection joining them. To make it easier for the reader to test the strength of these connections, I use the same category headings in my chapters on scientific thought as I do in my chapters on economic thought.

In order to explore the relationship between economic insights into the monetized marketplace and philosophical insights into the workings of nature, it is necessary to link areas of historical investigation rarely

[24] Buridan's rich insights into money and exchange are found at many points in chapter 5; his contributions to natural philosophy are discussed in chapters 6 and 7.

[25] Jean Buridan, *Quaestiones super octo phisicorum libros Aristotelis diligenter recognite et revise a magistro Johanne Dullaert de Gandavo* (Paris, 1509; reprint, Frankurt a/M, 1964), VII.6, 106va–107rb. Buridan's determination on this point is considered in greater detail in chapter 6. The failure on the part of scholastic thinkers to consciously link money as economic measure to money as philosophical measure is considered at many points in chapters 5–7.

considered together: economic history, the history of economic thought, and the history of science. The goal of integrating the findings in these areas determines the structure of this work. In chapter 1, I provide definitions of monetization, market development, and monetary consciousness that are followed throughout the work. I then consider the progress of monetization and the level that market organization had achieved in England and France by the middle of the fourteenth century. The chapter concludes with details from the biographies of leading fourteenth-century natural philosophers, illustrating their involvement in a range of administrative duties that brought them into close contact with the economic life of their society.

Scholastic philosophers inhabited an intellectual universe as well as a social universe. Authoritative texts and contemporary philosophical debates framed and mediated their social experience. Knowledge of the rich tradition of scholastic writing on economic subjects is essential to understanding how scholastic thinkers "experienced" the new dynamic of the monetized marketplace. In chapters 2 through 5 I investigate the scholastic literature on money and market exchange, considering both the authoritative texts inherited on these subjects and the important additions and corrections made to these texts in the thirteenth and fourteenth centuries.

Chapter 2 considers Aristotle's detailed discussion of money and economic exchange in Book V of the *Nicomachean Ethics*. Aristotle's conception of economic exchange as a dynamic process of equalization, one that could be represented both as a mathematical equation and as a geometric figure, had great influence on scholastic economic thinking. His markedly mathematical, geometrical, and relativist treatment of exchange provided an important textual ground for the later linking of scholastic economic thought with proto-scientific speculation.

In chapter 3 I consider the two earliest and most influential commentaries on Aristotle's *Ethics*: those of Albertus Magnus and Thomas Aquinas. These commentaries reveal the understanding, acceptance, and even expansion of Aristotle's sophisticated analysis of money and exchange by Christian thinkers of the middle of the thirteenth century. They provide as well the point against which we can measure the rapid development of money and market consciousness from the late thirteenth century.

Chapter 4 is divided into two parts, both of which are concerned with the central question of equality and equalization in exchange. The first part considers the definition of equality in writings on usury and just price theory from the earliest church councils through the thirteenth century. The second part follows the history of the changing philosophical conception of equality and equalization through the late thirteenth century: