

## Drobisch's Legacy to Price Statistics

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# Drobisch's Legacy to Price Statistics

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## *Short Summary of Paper*

In order to provide information concerning the significant contributions to price index theory made by Moritz Wilhelm Drobisch (1802-1896), this paper presents an account of his pioneering scientific achievements together with a synopsis of his personal and professional life. He was the first to formulate the unit value index as well as the Laspeyres and Paasche price indices. These three indices are the key for the official inflation measurements that are made around the world today.

Keywords: Price, Inflation, Index Theory, Measurement

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\*I was motivated to write this article by the retirement of a highly esteemed colleague, Peter von der Lippe at the *Universität Duisburg-Essen*. His enthusiasm for price statistics and their originators was infectious. This paper is testimony to that fact. I am indebted to Nick Barton and Claudia Haller for excellent research assistance. John Brennan's generous advice greatly improved the readability of this paper. Two anonymous referees and the editors of this journal provided several invaluable comments.

## *Long Summary of Paper*

This paper attempts to establish a greater awareness among researchers for the noteworthy contributions to price index theory made by Moritz Wilhelm Drobisch (1802-1896), a German mathematician and philosopher at the *Universität Leipzig*. Few economists and statisticians are aware of the fact that neither Étienne Laspeyres nor Hermann Paasche originally devised the well-known price indices that presently carry their names. Moritz Wilhelm Drobisch was the first to publish them in 1871 in a treatise and, shortly thereafter, in an abridged version that appeared in this very journal. He rejected them, however, because in his view they were inappropriate measures of inflation. Instead, he devised the unit value index, which he regarded as superior to all other price index formulas. This paper contains a description of his pioneering scientific achievements together with a synopsis of his personal and professional life. Its purpose is to give credit where credit is due, but more importantly, it attempts to recognize these seminal contributions in light of the factors that have tarnished them in the recorded annals of price index history. It attempts to put them into their proper perspective.

# 1 Introduction

If asked to name the two price index formulas that are the most renowned, economists and statisticians alike would probably answer in unison, the Laspeyres and Paasche indices. The references most often quoted are their famous articles published in 1871 and 1874 in this very journal. Unfortunately, few researchers are aware, however, that neither of these two scholars, Étienne Laspeyres (1834-1913) nor Hermann Paasche (1851-1925), devised these two index formulas.<sup>2</sup> Instead, they first appeared in a publication authored by Moritz Wilhelm Drobisch (1802-1896), a mathematician and philosopher at the *Universität Leipzig*. In addition, he also developed the unit value index. These three price indices are the key to the official inflation measurements made around the world today. Therefore, this distinguished scholar's contribution to price statistical research should be appropriately acclaimed and acknowledged.



M. W. Drobisch



E. L. E. Laspeyres



H. Paasche

Figure 1: Three German Price Statisticians.

In 1871, the *Königliche Sächsische Gesellschaft der Wissenschaften* (Royal Scientific Society of Saxony) published a treatise written by its founder Drobisch (1871a). Later that year, Drobisch (1871b) wrote an abridged version of that treatise, which appeared in this journal. Today it is known that these two publications provide the scientific basis for modern applied price statistics. In the original paper, Drobisch (1871a: 37-39) proposed three index formulas: the unit value index and a pair of index formulas that subsequently became known as the Laspeyres and Paasche indices. Among these three formulas, he clearly expressed a preference for the unit value index, which he thought was an optimal price index formula.

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<sup>2</sup>Notable exceptions are Balk (2008: 7 and 8, footnotes 11 and 13) and ILO *et al.* (2004: 265, footnotes 7 and 8).

At that time, many prominent economists and statisticians considered these articles. Not surprisingly, Étienne Laspeyres and Hermann Paasche were drawn to them as well. In his response to Drobisch's (1871a) publication, Laspeyres (1871: 306) suggested the index formula that was later to carry his name. This suggestion elicited an immediate and pointed response from Drobisch (1871c: 423):

“However, also this formula is not new. As Laspeyres could have seen in my first paper, which he had available, I initially tried this approach myself to calculate price increases and I described the reasons that persuaded me not to continue with this approach.”

This crucial phrase verbalizes the undeniable facts concerning this unfortunate historical incident. In the end, the scientific recognition for the discovery of the two most widely known price indices today was erroneously bestowed. It brings to light, however, Moritz Wilhelm Drobisch's culpability in this scholarly dispute as well. He rejected these price indices as inappropriate for price inflation measurements and instead formulated the unit value index, the index formula he considered to be optimal. The tragedy of this episode lies in his failure to recognize the inherent inconsistencies present in the unit value index due to the manner in which he formulated it. Everything considered, however, even though his foray into the field of price statistics was a brief one, the lasting contributions he made are indeed noteworthy.

The purpose of this paper is to convey information and, additionally, to produce a greater awareness concerning this important scholar. It attempts to give credit where credit is due, but more importantly; it tries to put this unfortunate historical incident into its proper perspective. Consequently, the paper proceeds as follows. Section 2 contains a short description of the pioneering contributions to price index theory made by Moritz Wilhelm Drobisch. Economists and statisticians alike know little about his personal and professional life and, therefore, a brief summary is provided in Sections 3 through 5. Section 6 contains a eulogy and the concluding remarks are contained in Section 7.

## 2 Contribution

Wilhelm Georg Friedrich Roscher (1817-1894), *ordentlicher Professor* (Professor) at the Faculty of Philosophy of *Universität Leipzig*, was the person who aroused Drobisch's interest in price index theory. Roscher was the founder of an approach to academic economics that is known the *Ältere Historische Schule der Ökonomie* (early Historical School of Political Economy). He was considering the problem: How should the mean price change of  $N$  different items between some base time period,  $t = 0$ , and a comparison period,  $t = 1$ , be calculated, if it is assumed

that the same  $N$  items are sold in the marketplace in both time periods? He was undecided whether the price index formula proposed by Carli (1764),

$$P_C = \frac{1}{N} \sum \frac{p_i^1}{p_i^0},$$

or the one proposed by Jevons (1863),

$$P_J = \sqrt[N]{\prod_{i=1}^N (p_i^1 / p_i^0)},$$

where  $p_i^t$  is the price of item  $i$  ( $i = 1, \dots, N$ ) observed in time period  $t$  and  $\sum$  is used to denote  $\sum_{i=1}^N$ , would yield the most suitable result.<sup>3</sup> Therefore, he asked his senior colleague Drobisch (1871a: 44; 1871c: 417, footnote 3) for some guidance.

Drobisch was lecturing in the areas of mathematics and philosophy at the time and his interest in the subject was stimulated by this request. He agreed to look into the issue. In his treatise, Drobisch (1871a: 32-33) recognized that various items have different purchase relevancies among consumers. Accordingly, a price index formula should give stronger weights to the price developments of the highly relevant items and lesser weights to the others. Therefore, a proper price index formula must take into account the quantities transacted in the base,  $q_i^0$ , and comparison time periods,  $q_i^1$ . This led him to reject both the Carli and Jevons indices in search of a more appropriate solution to the problem. He asked himself: How should the relevance of an item be represented in a price index formula?

In a preliminary step, Drobisch (1871a: 35) stated that all of the quantities should be measured in a common unit of weight (*Zentner* = 50 kg.) and, consequently, the prices of the items involved would need to be adjusted accordingly. This could be accomplished by multiplying the original quantity data,  $q_i^t$ , and dividing the original price data,  $p_i^t$ , by some transformation factor,  $z_i$ . Drobisch did not explicitly use transformation factors but directly employed the converted quantities,  $\tilde{q}_i^t = q_i^t z_i$ , and prices,  $\tilde{p}_i^t = p_i^t / z_i$ .

He approached the measurement problem from the standpoint of a simple scenario where the quantities transacted remained constant over time,  $\tilde{q}_i^0 = \tilde{q}_i^1 = \tilde{q}_i$ . For such a scenario, Drobisch (1871a: 36) proposed the following index formula:

$$P_{Lo} = \frac{\sum \tilde{p}_i^1 \tilde{q}_i}{\sum \tilde{p}_i^0 \tilde{q}_i}. \quad (1)$$

Unbeknownst to him, however, Lowe (1822: Appendix 94-95) had proposed this formula half a century earlier. Presently, it is known as the Lowe index,  $P_{Lo}$ .

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<sup>3</sup>For an exposition of the early history of price index research see Balk (2008, Chapter 1) and Diewert (1993).

He then progressed to a scenario with variable quantities,  $\tilde{q}_i^0 \neq \tilde{q}_i^1$ . For this scenario, Drobisch (1871a: 37-38) suggested two alternative formulas:

$$P_L = \frac{\sum \tilde{p}_i^1 \tilde{q}_i^0}{\sum \tilde{p}_i^0 \tilde{q}_i^0}, \quad (2)$$

and

$$P_P = \frac{\sum \tilde{p}_i^1 \tilde{q}_i^1}{\sum \tilde{p}_i^0 \tilde{q}_i^1}. \quad (3)$$

Subsequently, these two formulas have become known as the Laspeyres,  $P_L$ , and Paasche,  $P_P$ , indices. Drobisch stated that with unchanging quantities these two formulas are equal to the previous formula,  $P_{Lo}$ . Furthermore, Drobisch (1871a: 39) recognized that due to their inherent symmetry, both formulas are theoretically equivalent. He regarded this equivalence as a serious weakness. Drobisch (1871c: 425) indicated, however, that the arithmetic mean of these indices could be used as a measure of price change:

$$P_D = \frac{P_L + P_P}{2}.$$

Even though he considered this formula as unsatisfactory, some price statisticians presently denote it as the Drobisch index,  $P_D$ .

His preferred price index, however, was a somewhat different one. In the derivation of this index, Drobisch (1871a: 39) took as the point of departure the unit value formula:

$$P_{UV}^t = \frac{\sum \tilde{p}_i^t \tilde{q}_i^t}{\sum \tilde{q}_i^t}, \quad \text{for } t = 0, 1. \quad (4)$$

In the previous year, Segnitz (1870: 184) had proposed the unit value formula (4) in an article published in this journal, a fact that Drobisch (1871a) failed to mention. Segnitz cautioned, however, that the use of this formula should be limited to homogenous items and the example he gave was different quantities of the cereal grain, rye. When heterogeneous items are considered the situation becomes much more complicated. These items are denominated in a variety of different units of measure and, as a result, the summation,  $\sum \tilde{q}_i^t$ , yields a meaningless number. Drobisch was aware of this problem and thought he had the appropriate solution in hand. He believed that by measuring the quantities in a common unit of weight, the *Zentner*, and adjusting the prices accordingly, he had solved the problem.

Consequently, Drobisch (1871a: 39) defined the unit value index,  $P_{UV}$ , as the ratio of two unit values:

$$P_{UV} = \frac{P_{UV}^1}{P_{UV}^0} = \frac{\sum \tilde{p}_i^1 \tilde{q}_i^1}{\sum \tilde{p}_i^0 \tilde{q}_i^0} \frac{\sum \tilde{q}_i^0}{\sum \tilde{q}_i^1}. \quad (5)$$

Drobisch (1871a: 39; 1871c: 422-423) pointed out that with constant quantities,  $\tilde{q}_i^0 = \tilde{q}_i^1 = \tilde{q}_i$ , this formula simplifies to his previous proposal (1) and also to his other proposals (2) and (3).

Drobisch regarded his unit value index (5) as superior to all other price index formulas.<sup>4</sup> He recognized that combining heterogeneous items into an aggregate quantity presents a problem but he was confident that his weight-related conversion scheme had solved it. Unfortunately, he failed to recognize that this weight-related conversion method involves a summation,  $\sum \tilde{q}_i^t$ , that could require combining some very different items, for example, a *Zentner* of butter and a *Zentner* of indigo dyestuff. Although these items have equal weight, they have extremely different monetary values. This invalidates the unit values calculated by formula (4) and, therefore, the unit value index (5) as well. Moreover, this weight-related conversion of prices and quantities is not even possible when intangibles such as services are involved.

In their responses to Drobisch's (1871a) proposals, Laspeyres (1871: 307) and Paasche (1874: 172) both expressed their reservations regarding the unit value index (5). Laspeyres saw no problems involved with the proposal to transform all of the data into a common weight based unit of measure. He criticized Drobisch, however, on the grounds that the unit value index formula allowed the quantities to change over time. He suggested that the base period quantities,  $\tilde{q}_i^0$ , should prevail during the comparison period as well, which yields index formula (2). This index today bears his name. Furthermore, Laspeyres (1871: 308) pointed out that the unit value index (5) violates the Identity Axiom. This axiom postulates that with constant prices, a price index should equal one regardless of the changes in the quantities that might take place.

Paasche (1874: 172), on the other hand, suggested taking the comparison time period quantities,  $\tilde{q}_i^1$ , as fixed. Consequently, he advocated formula (3). Today this index is known as the Paasche Index. Drobisch (1871a) first proposed it as well, although, he subsequently rejected it. Paasche (1874) did not mention Drobisch's contribution at all, while Laspeyres (1871: 305) did recognize that the written recommendations expounded by Drobisch (1871a: 30) would lead to the correct index formula.

From today's perspective, the price statistical research of Moritz Wilhelm Drobisch seems to contain a surprising lack of consistency. The astute research qualities he demonstrated in the derivation and analysis of the Laspeyres and Paasche indices stand in stark contrast to his failure to recognize the obvious inconsistencies of his weight-related unit value index (5) when it is applied to heterogeneous items.

Nevertheless, the legacy that he leaves behind in the field of official price measurement cannot be overlooked. As a rule, statistical agencies compute price inflation estimates by comparing prices in a base time period to those in a comparison period utilizing a two-stage process. The elementary level is concerned with the price changes of individual items. An item is a narrowly defined group of products that

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<sup>4</sup>Lippe (2007: 18, footnote 43) points out that Drobisch's unit value index should not be confused with the unit value index used in some statistics of foreign trade.

should be as homogeneous as possible. The official recommendation of ILO *et al.* (2004: 164) is to compute these price changes using Drobisch's unit value index formula (5). The upper level of price measurement is concerned with aggregating the unit values and quantities computed at the elementary level into an overall price change. This is most often accomplished utilizing a Laspeyres or Paasche type price index. Moritz Wilhelm Drobisch proposed both of these index formulas. Therefore, the complete process of official price measurement relies upon concepts that he devised.

His contribution, however, goes even further. Drobisch (1871a) considered his unit value index (5) to be appropriate for the upper level of price aggregation as well. Some fourteen years later, Lehr (1885) studied his work and concluded that the unit value index formula (5) is a useful concept but the weight-related conversion relies on an incorrect basic premise. In order to illustrate Lehr's consideration, formula (5) can be expressed in an alternative form. Utilizing the transformation factors,  $z_i$ , the original quantities,  $q_i^t$ , and the original prices,  $p_i^t$ , formula (5) can be expressed in the following manner:

$$P_{UV} = \frac{\sum p_i^1 q_i^1 \sum q_i^0 z_i}{\sum p_i^0 q_i^0 \sum q_i^1 z_i}. \quad (6)$$

Lehr (1885: 38-39) recognized that in order to make the summation,  $\sum q_i^t z_i$ , meaningful, the units in which the quantities,  $q_i^t z_i$ , are measured had to be of comparable value and not simply of comparable weight. Therefore, he proposed the following scheme for the calculation of the transformation factors:

$$z_i = \frac{p_i^0 q_i^0 + p_i^1 q_i^1}{q_i^0 + q_i^1}, \quad \text{for } i = 1, 2, \dots, N. \quad (7)$$

Substituting this result into formula (6) yields the Lehr index. A number of years later, Davies (1924: 185) made a similar proposal. Instead of formula (7), he proposed the following formulation for the transformation factors:

$$z_i = \sqrt{p_i^0 p_i^1}, \quad \text{for } i = 1, 2, \dots, N.$$

Substituting this result into formula (6) yields the Davies index. Auer (2009) demonstrated with a systematic analytical elaboration that the proposal of Davies (1924: 185) is a member of a specific set of price indices. Auer named this set the generalized unit value indices and demonstrated that the Laspeyres and Paasche indices are also members of this particular family.

Drobisch's (1871a,b,c) short excursion into price index theory resulted in a considerable boon for this area of research. He developed the unit value index (5), as well as the Laspeyres (2) and Paasche (3) indices. Who was this distinguished German scholar? Why is it that he is not better known among researchers within the field? Fortunately for us, eight years after his passing one of his grandsons, Walther Neubert-Drobisch (1902), wrote an illuminating biography based upon a collection

of diaries and letters that he had inherited. Much of the information hereinafter relies upon this informative source.

### 3 Adolescence

Moritz Wilhelm Drobisch's father, Karl Wilhelm Drobisch, was a religious and patriotic man.<sup>5</sup> Raised in a rather poor family, due to his diligence and persistent nature, he, nevertheless, attained the respected position of *Stadtschreiber* (city clerk) in the city of *Leipzig*. At that time, *Leipzig* was an important and wealthy city in the Kingdom of Saxony. He was content in his marriage, even though he and his wife suffered the loss of four of their six children. Only two of their daughters lived beyond childhood. In 1790, at the age of thirty-five, his beloved wife passed away. He recuperated from this loss, however, and was able to remarry four years later. He married Renata Dorothee Wilhelmine Klotz, the thirty-three year old daughter of a state judicial employee from *Grimma*, a small town located southeast of *Leipzig* on the *Mulde* River.

After seven years of a childless marriage, on the sixteenth of August 1802 the couple was blessed with their first child, Moritz Wilhelm Drobisch. On Christmas Eve the following year, Karl Ludwig was born. Karl Ludwig was later to become a well known music teacher, conductor, and composer. At a young age, the two boys lost their twenty-eight year old stepsister in 1809. This was a tragic loss and one that their father never fully recovered from.

Nevertheless, as the boys grew older, their father taught them many things. Consequently, they could already read, write, and were performing some basic mathematical calculations long before they entered primary schooling at the *Nicolaischule* (Nikolai School) in *Leipzig*. Education played an important role in the Drobisch household and, as a result, the boys came to view their father's study as if it were some kind of "holy" room. Their minds were quite engaged during these formative childhood years as they eagerly embraced many new ideas. For example, Moritz Wilhelm and his younger brother enjoyed stargazing late into the night from the roof of their home. The two boys became very interested in astronomy and began calculating the phases of the moon, the movement of the planets, and soon they had learned the names of the most famous constellations.

From October the 16th to the 19th, 1813, the *Völkerschlacht bei Leipzig* (Battle of the Nations) took place on the outskirts of the city. Moritz Wilhelm was eleven years old at the time and watched the ensuing battle from the roof with his telescope. At its conclusion, he was fortunate enough, from a short distance, to witness King Friedrich I of Saxony offer the defeated Napoleon Bonaparte a glass

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<sup>5</sup>Apart from where otherwise noted, this section is based upon the biography by Neubert-Drobisch (1902: 1-20).

of wine. Napoleon hastily drank the wine and, in a mood of desperation, angrily threw the empty glass to the ground. What he had just seen made a strong and lasting impression upon young Moritz Wilhelm's mind. To him it symbolized how the unrealized ambitions of Napoleon and those of his ally the Kingdom of Saxony were now laid at their feet like the glistening shards of the shattered wine glass. He decided then and there to fully develop his physical and mental skills and to become a strong contributor for his fatherland.

Regrettably, however, this idyllic childhood, one that played such an important role in the boys' early intellectual development, came to an abrupt end in 1815 with the passing of their father. As a result, Moritz Wilhelm's mother sent him away to the prestigious *Fürstenschule St. Augustin zu Grimma* (secondary school) and Karl Ludwig followed two years thereafter. The money their father had bequeathed was intended for this schooling and also for their subsequent university education. Moritz Wilhelm enjoyed his three years at the *Fürstenschule* and the fertile academic environment that existed there nurtured his preexisting interests in mathematics and astronomy. This was in part due to his interactions with a gifted teacher who engaged the young man in inspiring debates. To some extent, this teacher played the roll of a surrogate father for Moritz Wilhelm. In his free time, he continued to engross himself in his most important hobby, astronomy. As evening approached, he would eagerly look forward to secretly observing the stars with the equipment he purchased with the pocket money he had saved. During these adolescent years he returned to Leipzig infrequently, only to visit his mother during school vacations in the summer months.

On March 28th, 1820, at the age of seventeen, Moritz Wilhelm began studying mathematics and physics at the *Universität Leipzig*. While most of his peers were indulging themselves in the newly discovered freedom called "student life", Moritz Wilhelm gave his academic responsibilities first priority. It was said that more often than not, he refrained from drinking beer and instead drank a glass of milk. As a result, after just one year he was already giving private lessons in mathematics. With the money he earned he increased his personal library and added to his accumulation of astronomical instruments. He politely declined the private invitations that were offered by his professors for he feared that such engagements would inhibit his personal and intellectual independence. During these initial years at the university, he was an extremely purposeful and resolute young man.

At the age of twenty, Moritz Wilhelm lost his dear mother on March 6th, 1822. Consequently, he and his brother departed the family home in search of a new place to live. They found a suitable room and rented it from the widow Anna Maria Leichsenring. Two month later in May, Moritz Wilhelm, his brother, and another fellow student hiked to the scenic *Sächsische Schweiz* via *Grimma*, *Meißen*, and *Dresden*. At the conclusion of this enjoyable trip, he returned to Leipzig a bit perplexed. He had decided, in the meanwhile, to turn his focus towards more cultural

and worldly things and not any longer to devote himself solely to his scholarly activities. He became increasingly captivated by the arts. His appreciation for music and literature, especially the works of William Shakespeare, grew. It was during this period of uncertainty that Moritz Wilhelm became acquainted with Emilie Charlotte Leichsenring, one of his landlady's three daughters. He had begun to write poetry and during this courtship, which ultimately lasted five years, he wooed her with many of his delightful poems. He enjoyed writing poetic prose and did so for the remainder of his life. This interlude into belletristic literature, however, was brief and lasted only a year and a half. He stated at its conclusion, "The reading of novels had corrupted me." After some soul searching, he recommitted himself to the study of mathematics and the sciences. The appreciation for music and the arts that he had gained, however, never left him.

## 4 Adulthood

Moritz Wilhelm Drobisch returned to being an exceedingly focused and studious young man.<sup>6</sup> He completed his studies at the *Universität Leipzig* in the Faculty of Philosophy in four years. In 1824, at the young age of twenty-two, he received the academic degree of *Dr. phil. in Mathematik* (Ph.D.-Mathematics) with a dissertation entitled: *Praemissae ad theoriam organismi generalem, theoriae analyseos geometricae prolusio* (An Introduction to the Theory of Analytical Geometry). During that same year he was granted his *Habilitation* in Philosophy (postdoctoral lecture qualification) and became a *Privatdozent* (qualified external lecturer). It had always been his ambition to become a teacher at a *höhere Schule* (secondary school) and so he felt very fortunate to be able to teach at the university level. Before long he was giving lectures in several mathematical subjects, physical geography, and popular astronomy. In 1826, at the age of twenty-four, he was appointed *außerordentlicher Professor* (Adjunct Professor) in the Faculty of Philosophy and by the end of that same year, following a proposal of the government and not the university, he was selected to be *ordentlicher Professor* (Professor) of Mathematics. Unfortunately, the appointment was not without its controversy because some of the older faculty members voiced strong opposition to the appointment. They believed that he was too young and lacked the required experience for the position. One of his supporters, however, came to his rescue by sarcastically suggesting that Dr. Drobisch's "mistakes" would surely diminish with the passage of time.

The meteoric ascent of his academic career, culminating in the attainment of a professorship, offered him the prospect of entering into a prearranged marriage of convenience with one of the most influential families in *Leipzig*. Like his father before him, however, he resisted the temptation. He had no great craving for one of those

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<sup>6</sup>Apart from where otherwise noted, this section is based upon Neubert-Drobisch (1902: 21-49).

frivolous, overly satiated rich daughters, instead he desired a woman who would be a proper mother for his yet to be born children and a skillful homemaker. In 1827, on the thirteenth day of September he married Emilie Charlotte Leichsenring. A marriage that was to last some forty-four years and one that was to be blessed with five daughters and three sons. Their initial happiness, however, was not destined last. As parents, they were forced to endure the tragic loss of five of their beloved children. Only three of their daughters survived. Consequently, as he grew older he became increasingly spiritual and devout in his beliefs. He cautioned that scientists should not be condescending towards religious faith and that they should not attempt to place themselves above it.<sup>7</sup>

He delivered his first lecture on philosophy in 1832. This event proved to be a milestone in his professional career for it marked the start of a long process where he shifted his intellectual emphasis away from mathematics towards philosophy. Ten years later in 1842, he was appointed *ordentlicher Professor* (Professor) of Philosophy.<sup>8</sup> He resigned his professorship in mathematics in 1868, a position he held for forty years. From that point on he devoted his scholarly activities to the fields of philosophy and psychology.<sup>9</sup>

The person who had the greatest scientific influence upon him was the philosopher, psychologist, and pedagogue, Johann Friedrich Herbart (1776-1841), Professor of Philosophy at *Universität Göttingen*. Prof. Herbart recognized his unique capacity to integrate philosophy and mathematics and appreciated it as an outstanding scientific trait. To commemorate his death in 1841, Prof. Drobisch delivered a poignant eulogy in his honor. Shortly afterwards he was approached by a group of students who asked his permission to commission a portrait of his likeness. Pleased by the gesture, he agreed and prepared a comment for inscribing at the base of the lithograph (see Figure 2).

“The flame of bona fide science  
is kindled by the spark of inspiration,  
it nourishes itself from the fuel of hard work and  
burns undimmed only in the breath of freedom.”

(„Die Flamme der echten Wissenschaft  
entzündet sich an dem Funken der Begeisterung,  
nährt sich von dem Öl des Fleißes und  
brennt ungetrübt nur in der Lebensluft der Freiheit.“)

Moritz Wilhelm Drobisch seldom left his much-loved city of *Leipzig*. He felt completely at home there and was intimately linked to its university. Occasionally,

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<sup>7</sup>Neubert-Drobisch (1902: 64).

<sup>8</sup>Neubert-Drobisch (1902: 79).

<sup>9</sup>Neubert-Drobisch (1902: 123).



Figure 2: Prof. Drobisch, 1841; Source Neubert-Drobisch (1902: inner cover).

however, he was called upon to travel. In these instances he complied dutifully and did so either in the company of his wife or alone.<sup>10</sup> He was a reluctant traveler, unless of course, the trip was one of his periodic “escapes” into the scenic countryside that surrounded *Grimma*. There he could find the solace and happiness he sought as he nostalgically immersed himself in the memories of his adolescent school days at the *Fürstenschule*. Afterwards, when he returned to his everyday responsibilities in *Leipzig*, he always felt a sense of renewal and invigoration.<sup>11</sup>

The death of his beloved wife Emilie Charlotte in 1871 was a hard blow.<sup>12</sup> In difficult moments, however, he quietly spoke words of encouragement to himself and found solace in his work. Many years before, he had written the following poetic lines:<sup>13</sup>

<sup>10</sup>Neubert-Drobisch (1902: 58ff., 67ff., 109ff., 119).

<sup>11</sup>Neubert-Drobisch (1902: 35f., 54).

<sup>12</sup>Neubert-Drobisch (1902: 125).

<sup>13</sup>Neubert-Drobisch (1902: 49).

“Never mind the transition from day to night,  
Heed not the cyclic change of the seasons,  
Engross yourself in the depth of knowledge,  
Produce things of significance, worth, and veracity;  
Then you will be contented for the moment,  
And the days will tacitly run their course.”

(„Vergi den Wechsel von Tag und Nacht,  
Vergi die Wechsel des Jahres,  
Vertiefe Dich in des Wissens Schacht,  
Schaff Hohes, Edles und Wahres;  
Dann bist Du glcklich im Augenblick,  
Und still trgt jeder Tag sein Geschick.“)

## 5 Academic

Moritz Wilhelm Drobisch placed great emphasis on his teaching assignments.<sup>14</sup> An extremely hard working and conscientious professor, he took great pride in meticulously preparing his lectures.<sup>15</sup> In addition to his customary lectures in mathematics and philosophy, he also conducted lectures in such diverse fields as psychology, popular astronomy, physical geography, logic, and the philosophy of religion. His lectures were clearly presented, well organized, and scientifically precise. The solutions to the problems he posed were presented in a logical and lucid manner. His lively lecturing style was highly valued by the students at the *Universitt Leipzig* and his personal vitality allowed him to continue teaching well into his octogenarian years. Finally, at the age of eighty-four, he requested to be released from his responsibilities as a lecturer due to an eye complaint.<sup>16</sup>

His style of writing, as evidenced by the books and numerous scientific articles he published, was characterized by a high degree of finesse, clarity, and precision.<sup>17</sup> Initially, his scholarly work dealt solely with mathematically related subjects. As he aged, however, his primary interest began to shift ever more towards the philosophical and psychological bodies of thought. Subsequently, these were the areas where he received considerable acclaim. Nevertheless, during the later part of the 1860’s he began to have an increased interest in statistical topics. Regrettably, however, his two articles in 1871 were his only foray into the field of price statistics.

In spite of his teaching and extensive research activities, over the years he served in numerous administrative capacities for the university. He did not solicit these additional academic responsibilities because he viewed them as a hindrance to his

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<sup>14</sup>Apart from where otherwise noted, this section is based upon Neubert-Drobisch (1902: 73-128).

<sup>15</sup>Heinze (1896: 713ff.).

<sup>16</sup>Heinze (1896: 699).

<sup>17</sup>Heinze (1896: 699f.).

primary duties. Nevertheless, he served as *Dekan* (Dean) of the Faculty of Philosophy on eight separate occasions and as a member of the faculty senate. He was the *Rektor der Universität Leipzig* (president) during 1841 and 1842. As *Rektor* he officially represented the university at numerous governmental meetings, scientific congresses, and at formal social gatherings. He did so dutifully but would have much preferred the solitude of his hiking tours in Saxony's scenic countryside.<sup>18</sup> He remarked later, however, that the experiences he had as *Rektor* helped save him from becoming a complete scientific recluse and forced him to live the life of a man of the world. During the meager amount of free time that he allowed himself, however, he especially enjoyed attending concerts at the *Gewandhaus zu Leipzig* (Concert Hall) where Felix Mendelssohn Bartholdy (1809-1847) was the *Gewandhauskapellmeister* (conductor) from 1835 to 1847.



Figure 3: Prof. M. W. Drobisch, cir. 1877; Source: Wiemers (2003).

In addition to all this, he was a *Mitglied* (member since 1834) as well as later *Präsident* (Chairman, 1848-1863) and *Ehrenmitglied* (honorary member, 1877) of the *Fürstlich Jablonowskische Gesellschaft der Wissenschaften zu Leipzig* (Prince Jablonowski Scientific Society of Leipzig), an organization that encouraged scientific work through the awarding of prizes. Laspeyres (1862) won such a prize for his study of the economics' literature and the history of economic thought in the Netherlands during the period 1600 to 1785. As Chairman of the society, he advocated its modernization and wanted to transform it into a scientific society that published original research. He failed in this attempt, however, because he could not change the constitution of the organization. As a result, he founded the independent *Königliche*

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<sup>18</sup>Neubert-Drobisch (1902: 54).

*Sächsische Gesellschaft der Wissenschaften* (Royal Scientific Society of Saxony) and on July 1st, 1846, he delivered the inaugural address on the occasion of the 200th anniversary of the birth of Gottfried Wilhelm Leibniz. He wrote the constitution himself and firmly established the independence of the new society from the *Universität Leipzig*. He made it clear that the main objective of the society was the publication of research and one such publication was Drobisch's (1871a) own treatise on price statistics.<sup>19</sup>

To commemorate the fiftieth anniversary of his professorship in 1876, Moritz Wilhelm Drobisch was ceremonially proclaimed *Ehrenbürger der Stadt Leipzig* (honorary citizen) at the *Rathaus* (City Hall). He received the title of the highest official of the royal court, *Königlich Sächsischer Hofrat*, 1862, and *Geheimer Hofrat*, 1866, (Court Counselor). He was decorated with numerous medals including, *Ritterkreuz des Königlich Sächsischen Civil-Verdienstordens*, 1844, and the *Comthurkreuz des sächsischen Albrechtordens*, 1877. He accepted all of these honors gratefully and with humility, but was of the opinion that he had earned none of them. The *Königliche Sächsische Gesellschaft der Wissenschaften* recognized Prof. Drobisch for his role as their founding father with the creation of the Moritz-Wilhelm-Drobisch-Medaille in 1971.<sup>20</sup>

## 6 Eulogy

Moritz Wilhelm Drobisch was considered to be a very honorable and trustworthy person.<sup>21</sup> It was said that he personified the “*kategorische Imperativ*” (Categorical Imperative) formulated by Immanuel Kant (1724 – 1804), the great 18th century German philosopher. This fundamental ethical principle guided his actions as he determined what was morally right throughout the course of his life. A devout Christian who followed the Protestant faith, he lived by a set of moral guidelines that led him to be a respectful, honest, and unassuming man. Consequently, on the occasion of the fiftieth anniversary of his professorship, these virtuous character traits were revealed when he donated all of the monetary gifts he received to benefit financially disadvantaged students.<sup>22</sup>

In his dealings with strangers, he was always very considerate and extremely polite. Nevertheless, on these occasions he would often appear quite serious. This was sometimes misconstrued and it was said that he distrusted those he did not know well. This was not the case. At social functions such as birthday parties, confirmations, weddings, or other such festive occasions, he would display a quite

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<sup>19</sup>Wiemers (2003: 9ff.).

<sup>20</sup>Wiemers (2003: 16).

<sup>21</sup>Apart from where otherwise noted, this section is based upon Neubert-Drobisch (1902: 127-131).

<sup>22</sup>Heinze (1896: 718).

amiable demeanor. He would amuse others with his cordial, albeit slightly sarcastic personality. Sometimes he would even entertain guests with his own poetry, poems of both a serious and a humorous nature.<sup>23</sup>

Towards the end of his long and fruitful life, Moritz Wilhelm Drobisch remained intellectually active and spry. He became, however, more and more reclusive. Having outlived his dearly beloved wife Emilie Charlotte by a quarter of a century as well as a substantial number of his closest university colleagues, while experiencing acutely the associated loneliness, he displayed his characteristic humility and devout spirituality by leaving behind this moving testimonial:<sup>24</sup>

“I have lived long and strived relentlessly,  
Attempted much, alas I achieved little.  
More than my worth, I was venerated,  
Unmerited fortune was bestowed upon me.  
Only this attestation may I make,  
That I endeavored to live a dutiful life.  
Whenever I strayed from the path of righteousness,  
I humbly trust in the grace of God  
And into the loving hands of the Lord  
I entrust my final days and my demise.”

*(„Lange hab’ ich gelebt und gestrebt,  
Viel gesponnen, doch wenig gewebt.  
Mehr als ich wert war, ward ich geehrt,  
Mehr als Verdienteren Glück mir beschert.  
Nur das Zeugnis darf ich mir geben,  
Daß ich bemüht war, pflichttreu zu leben.  
Wo ich gewichen vom rechten Pfade,  
Hoff’ ich in Demut auf Gottes Gnade  
Und in des liebenden Vaters Hände  
Leg’ ich den Lebensrest und mein Ende.“)*

Moritz Wilhelm Drobisch died in *Leipzig* shortly before the seventieth anniversary of his professorship on September 30th, 1896. He was ninety-four years old.

## 7 Conclusion

Moritz Wilhelm Drobisch was a multifaceted scholar who held the academic positions of Professor of Mathematics and Professor of Philosophy, both separately and

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<sup>23</sup>Neubert-Drobisch (1902: 49).

<sup>24</sup>Neubert-Drobisch (1902: 131).



Figure 4: Moritz Wilhelm Drobisch in His Study at the Age of 90; Source: Neubert-Drobisch (1902: 96b).

concurrently, at the *Universität Leipzig* over a tenure lasting some sixty-eight years. His scientific contributions were insightful and varied, for he was equally at home in a wide variety of scholarly disciplines.

In 1871, his scientific curiosity led him into the field of price statistics. It remains to this day an unresolved mystery, however, regarding the question: Why was his interest in price statistics so brief, lasting only one year? One can only speculate. Was it his scholarly dispute with Étienne Laspeyres? Certainly that robbed him of much of the satisfaction associated with his scientific contributions in this area. He had reached the age of sixty-nine and the bereavement associated with the death of his beloved wife during that same year certainly added a great emotional burden. The professorship he held in mathematics for forty-two years had previously been resigned three years earlier. As a result, his scholarly interests were shifting away from mathematically related subjects towards those of a philosophical and psychological nature. He entered the field of price statistics at the request of a faculty colleague and after formulating the unit value index he probably felt that he had found the optimal answer to the question. Perhaps he felt that his work in this area was complete. All of these factors probably played a role. If his contributions had been received in a more positive way, then would he have lingered for a longer period in the area of price statistical research? This intriguing mystery will remain

unsolved.

The scientific recognition for the discovery of the two most widely known price indices today was erroneously bestowed. Moritz Wilhelm Drobisch's culpability in the course of events that lead to this outcome, however, must not be overlooked. At the time, he rejected these two price indices as inappropriate for price inflation measurements and instead formulated the unit value index. The tragedy of this episode, however, lies in his failure to recognize the inherent inconsistencies present in his favored index due to his fixation upon a weight-related formulation.

It is certain, however, that Moritz Wilhelm Drobisch's brief but fruitful foray into the field of price statistics yielded a quantum leap in this branch of science. He enriched the field with the introduction of three fundamental index concepts: the Laspeyres, the Paasche, and the unit value index. With these three indices he laid the theoretical cornerstone upon which price index methodology has been built. These formulas are the key for the official inflation measurements that are made around the world today. The seminal contributions he made were significant and should be appropriately acclaimed and acknowledged.

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