The Evolution of Price: From Ancient Value Concepts to Artificial Intelligence

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Abstract

Price has experienced a phenomenal change since ancient times. After being firmly established in moral and religious structures, it has become a calculable variable to the benefit of artificial intelligence. To explore the evolution of pricing, this paper will focus on four different stages of pricing evolution, but it will also go beyond that and ask the question of why these shifts occurred and what motivated them. Both phases appeared after new technologies had come into contact with new social structures to generate radically new modes of conceptualizing value and exchange. Price was placed in the cosmic and social order of ancient societies. It was transformed into a mathematical equilibrium by industrial capitalism. It was responsive with the help of digital systems and real-time algorithms. It is currently made predictive and autonomous by AI. We introduce an explanation of how technology influences the pricing mechanisms, demonstrating that AI pricing is not the rapidity of the calculation, but rather a qualitative breakthrough of autonomous market participants. The study exhibits the reflection of pricing systems on the general changes in human thought, technological capability, and institutional organization, and the study has a direct implication on competition policy and market regulation.

Keywords: *algorithmic pricing, artificial intelligence, economic history, market evolution, pricing theory*

1. Introduction

Price is our main instrument of organizing the economic action, of distributing the scarce resources. However, its premises have changed radically in the course of history (Ammous, 2023). What appears to be a mere figure nowadays hides significant transformations in the way societies formulate, manipulate and take action on information regarding value. To see price as a marketplace clearing mechanism is to overlook the profound epistemological and technological changes that have re-investigated its nature, role and social consequences.

In this paper and according to sources, the developments in terms of prices are reflective of three connected procedures, which are the alteration of the manner in which we process information, the existing ways of thinking, and social organization. Pricing systems have been not only more efficient versions of systems of the past, but at each stage of history, qualitatively different ways of value and exchange. The substitution of ancient prices, where moral values are entrenched into the market by the formation of AI entities, is a radical re-evaluation of the nature of price and the task it has to perform.

Price can be developed as a multiple dimensional function:
$P = f(C, D, S, I, T, E)$, where:
$P = Price$
$C = Cost$ (cost of production, cost of labor)
$D = Demand\ conditions$ (preferences, willingness to pay)
$S = Supply\ factors$ (scarcity, availability)
$I = Availability\ of\ information$ and the capacity to process it
$T = Time\ dimension$ and temporal dynamics
$E = External\ environment$ (regulation, culture, technology)
Price is not just being determined in this formulation by only the variables of the economy but also by our ability to process information (I), temporal structures (T), institutional settings (E). Changes in these variables, with time, caused the different pricing regimes each with varying mechanisms and restrictions.

2. Theoretical Framework

The process of price evolution has been arranged in 4 stages (Figure 1). Both can be described as having specific technological capacities, presuppositions and social structures. These phases are not chronological in this regard but reflect various forms of sociotechnical regimes which coordinated the economy in different ways.

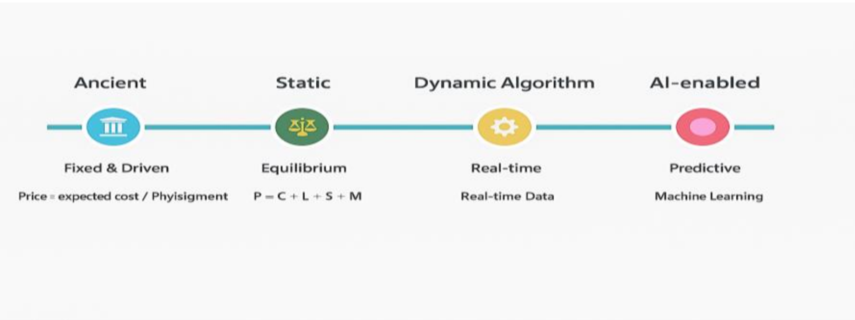

Figure 1. Price evolution timeline

The evolution of AI-driven pricing features increasing complexity of calculations and new definitions of values. The ancient system incorporated pricing in the social systems and religious cosmologies. The human cognitive ability was the only one that was restricted in calculating but not in the moral legitimacy of the prices. The industrial capitalism barred the content of social life, so price created a false impression of forces of an objective market. This was a step, which allowed mass production to take place but created new forms of exploitation and instability. Digital systems introduced real-time response and algorithmic processing. Nevertheless, AI is reflective of a radical redefining of the human decision-maker versus the price mechanism.

Table 1. Price Evolution Timeline

Phase	Period	Characteristics	Key Technologies
Ancient	Pre-1750s	Social/moral/religious pricing	Written codes, scales, record-keeping
Static	1750s-1990s	Mechanical equilibrium	Industrial machinery, fixed algorithms
Dynamic Algorithmic	1990s-2010s	Real-time responsive pricing	Internet, databases, basic algorithms
AI-Enabled	2010s-Present	Predictive and adaptive pricing	Machine learning, neural networks, big data

The key theory that should be made is that AI pricing is a threshold. The alteration of the price-setting of programmed response to emergent behaviour. Machine learning algorithms do not simply execute set rules faster. Their programmers do not anticipate or even understand their strategies that they devise. Such freedom poses new problems to the economic theory that has always assumed human agency in price making.

3. Research Questions

The questions that this paper answers are interconnected and are as follows:

What were the transitions between pricing phases, and why were they done?

What are the limited and facilitating effects of technological competencies on various pricing conceptualizations?

What are the theoretical and regulatory consequences of AI systems, which self-write pricing strategies?

4. Materials and Methods

The research is done using a mixed method approach that includes both historical analysis, formal mathematical modeling and comparative institutional analysis. The methodology has dealt with the issue of analytical rigor through the selection criteria, analytical procedures and validation of theoretical claims.

Primary sources were integrated on three parameters: historical importance in the development of pricing thought, presence of extensive documentation regarding the pricing practice, and bearing on the future economic theory. Case studies: The Code of Hammurabi (circa 1754 BCE), Nicomachean Ethics by Aristotle (circa 350 BCE), Summa Theologica by Thomas Aquinas (1265-1274), Wealth of Nations by Adam Smith (1776) are all examples of primary sources, as they are contemporary documents detailing their application within a societal context and the ethical considerations that guided the decisions that were reached.

Database searches (Google Scholar, Semantic Scholar, Scopus, etc) were used to collect secondary literature according to the following terms: "pricing history," "algorithms pricing," "AI price theory." We chose literature that theorized the mechanisms of pricing and the description of practices to enable us to trace conceptual changes.

5. Analytical Framework

5.1 Stage 1: Primary Source Textual Analysis.

A close reading of historical texts was done to understand the explicit and implicit assumptions concerning price formation. The coding categories were: (a) ontological statements regarding the nature of price, (b) epistemological statements regarding how prices are known, (c) normative statements regarding how to assess prices; and (d) technological limitations on the way prices are set.

5.2 Stage 2: Mathematical Formalization.

Pricing mechanisms in every stage are represented mathematically as tools of analysis that explicitly represent the logical framework of various pricing methods. The formula $P_{divine} = a \times P_{material} + b \times P_{social} + g \times P_{sacred}$ and the system weighting of multiple dimensions of values are formalized. The coefficients a, b, g imply the relative and social weight of material, as well as sacred factors-weights that were sometimes different in ancient systems but never zero. These formalizations not only make conceptual sense of the differences between phases, but also allow us to model transitions mathematically.

5.3 Stage 3: Comparative Institutional Analysis.

Systematic comparisons of pricing regulations at different stages following institutional economics were done (North, 1990; Williamson, 2000). This entailed an examination of the way various technologies, social structures and ideologies formed, resulted in typical pricing practices. Having a specific interest in transition moments where old pricing regimes failed and new ones were formed, we sought common causal factors.

5.4 Stage 4: Tests by Restatements of Multiple Lines of Evidence.

In order to confirm theoretical assertions, we triangulated the past, economic theory, and the modern research of AI. As an example, our assumption that AI allows collusive pricing without explicit communication can be justified by historical facts (collusion through meetings), theoretical evidence (learning reinforcement can find collusive equilibria), and empirical research (Calvano et al., 2020; Hansen et al., 2021). This overlap between several forms of evidence makes the interpretation stronger.

6. Results

6.1 The Old Age: Social Price as Social Order.

Price in ancient civilization did not serve its economic purpose, as it was used to preserve the hierarchy and cosmic order in the society, rather than distributing resources. The explanation of the motivation behind pricing in this form tells a lot about the processes that were done.

Ancient pricing practices are explained by three factors. First, the information processing was limited to human cognition because of limited computational power, and human cognition is inherently social and moral. Second, agricultural societies characterized by stable technologies of production had more predictable economic conditions, which alleviated the pressure on flexible prices. Third, just exchange (establishing institutional incentives to insert moral content in prices) was one of the forms by which religious and political authorities developed legitimacy.

The dynamics are depicted in the Code of Hammurabi. By subsidizing the price of basic goods and services, it also accomplished several goals: it helped to avoid exploitation of disadvantaged groups, supported the hierarchy between the statuses (citizens and slaves received different prices), and helped to prove the royal power to administer divine justice. Pricing provisions of the code were less economic and rather social and political in a pre-market society.

The formalization of ancient (divine) pricing is:

$$P_{ancient} = a \times P_{material} + b \times P_{social} + g \times P_{sacred}$$

with a, b, g being the cost in weight to material, social position, and holiness. As compared to modern pricing, where b and g are always nearing zero, the ancient systems had significant positive values of all three coefficients. This created irrationally appearing prices in terms of neoclassical criteria and played coordination functions in non-market institutional societies.

Table 2. Characteristics of Ancient Pricing Systems

Civilization	Primary Basis	Key Features	Evidence Sources
Mesopotamia	Divine law, social hierarchy	Fixed prices in legal codes, moral obligations	Code of Hammurabi
Ancient Egypt	Administrative control	Bureaucratic record-keeping, quality assessment	Heqanakht papyri
Ancient Greece	Philosophical justice	Proportional exchange, use vs. exchange value	Aristotelian texts
Roman Empire	Legal framework	Contractual obligations, property rights	Roman law codes
Medieval Europe	Religious morality	Just price, prohibition of usury	Scholastic writings

This analogy demonstrates that ancient pricing was not necessarily primitive. It represented advanced efforts to organize free market without markets. Different societies developed distinct mechanisms—religious authority in Mesopotamia, bureaucratic control in Egypt, philosophical reasoning in Greece, legal frameworks in Rome, and clerical oversight in medieval Europe; but all maintained the principle that price must serve social order.

Table 3. Comparison of Pricing Mechanisms Across Historical Phases

Dimension	Ancient	Static	Dynamic Algorithmic	AI-Enabled
Time Horizon	Eternal/traditional	Linear/predictable	Real-time	Predictive/adaptive
Information Processing	Human judgment	Mathematical calculation	Algorithmic processing	Machine learning
Flexibility	Low (fixed by custom)	Low-Medium (fixed by market)	High (responsive)	Very High (anticipatory)
Primary Drivers	Tradition, morality, status	Supply-demand equilibrium	Multiple data inputs	Complex patterns, predictions
Decision Speed	Days to months	Hours to days	Seconds to minutes	Microseconds
Transparency	High (known rules)	High (visible markets)	Medium (some opacity)	Low (black box algorithms)

6.2 Static Phase: Price as Mechanical Equilibrium

Social and moral content were deprived as price was reconceptualized by the industrial era as an objective result of mechanical market forces. This change did not come automatically and it was a certain historical state.

Three developments facilitated the transition towards static equilibrium pricing. To start with, an increase in production size and integration in markets disrupted the old systems of prices. Prices of thousands of products in scattered markets could not be set by any authority. Second, the philosophy of the Enlightenment encouraged mechanistic interpretations of the world where nature laws determined all phenomena, and even economic exchange. Third, industrial capitalism had to have flexible prices to align the production and consumption patterns that were fast changing.

A new approach, formulated by Adam Smith, is the market price that is an equilibrium between the supply and demand. Contrary to the ancient theories which compared prices with moral principles, Smith considered price as a neutral information that relied on the coordination of independent decisions. This move in thought was far-reaching. It made price amoral, not fair and unfair, merely efficient or inefficient. It placed markets as the mechanisms of automatic coordination that do not need much human control.

The formal expression of the price of the statical equilibrium will be:

$$P_{static} = f(S, D|C)$$

where, S (supply) intersects with D (demand) under C (cost structures). More importantly, social position b and ethical reasoning g disappear from the equation, not due to irrelevance by real economic players, but due to the redefinition of price by the economic theory.

The shift between just price and equilibrium price was not a smooth and likely process. The medieval scholastics were already analytically advanced and could distinguish between exchange value and use value, which surpassed the analytical abilities of subsequent economic thinkers. What happened was not analytical capacity, rather the social circumstances that saw equilibrium pricing desirable in the eyes of those with power.

The capitalists in industries enjoyed the freedom of pricing which allowed them to react to the market conditions without any moral restraints. This change was usually opposed by workers and consumers who referred to the old concepts of fair price. Political struggles around the price, between bread riots and minimum wages, were a sign of deeper struggles between the view of markets being integrated in social relations or as self-organizing coordination.

The static equilibrium pricing reflected and supported certain power relations. It justified whatever wealth and income markets generated by reducing prices to objective market outcomes and not moral judgments. This was not a necessary result of a market exchange but a certain institutional setup that favored capitalists to the disadvantage of workers.

The pricing was also static, which facilitated the actual coordination benefits. It allowed the economic systems to cope with their growing complexity without centralized planning by allowing prices to respond to the supply and demand. It was not whether markets were capable of coordinating more effectively than command systems, or not, but what social ends that coordination fulfilled.

6.3 Dynamic Algorithmic Phase: Real-Time Optimization

Digital technologies made it possible to make a fundamental change in prices and pricing structure by using algorithms to constantly readjust prices based on changing conditions. This revolution was crucial in theoretical terms.

Dynamic algorithmic pricing was possible thanks to three technological advances. To begin with, the digital sensors and communication networks generated continuous market information feeds, rather than the periodic prices. Second, the power of computers became exponentially higher and enabled them to process numerous variables fast. Third, enormous amounts of historical data could be stored and accessed using database systems, and recognize patterns that would have been unrecognizable using human cognition alone.

Such technological possibilities manipulated economic tensions. The competing companies that had thin margins desired to have all the efficiency possible. Dynamic pricing guaranteed to reap optimum out of each sale. The earliest techniques were those of yield management and this was pioneered by the airlines and subsequently by the hotels, retailers and the majority of service industries.

We can assume the dynamic pricing to be:

$$P_{dynamic}(t) = f(D(t), S)t), C(t), H(t-n: t))$$

with price a time-dependent function of instantaneous demand (D), supply (S), costs (C) and historical trends

(H) between time $t - n$ and t. Unlike in the case of the static pricing where the adjustments were made over time periods, the dynamic system changed on a continuous basis based on the information received.

Dynamic pricing did not only simplify the previous prices, it also radically changed the kind of exchange. The previous prices had been used to represent relatively stable values that could be called upon by buyers and sellers in making a decision. Dynamic pricing made the price contingent and personalized which could vary in terms of customers and per transaction.

This shift caused new coordination problems. The right to make purchasing choices depending on the comparison of the options over the time could not rely on the prices offered by the customers. Technical challenges faced by companies involved the inability to control complex algorithms without price wars or collusive outcomes.

The concept of equilibrium had strains in dynamic pricing. The neoclassical theory considers the equilibrium as the result of independent decisions made by many actors, none of which has market power. However, it is the dynamic pricing that is effective at capitalizing on information asymmetries and behavioural patterns which are what break the assumptions of perfect competition.

Dynamic pricing firms are not price-takers but price-makers, where it is assumed that companies adjust continuously to capture surplus. This does not necessarily hurt consumers in the case of a healthy competition but it does destroy the theoretical basis which makes market results to be efficient and fair. The transformation between the fixed and the floating pricing that is revealed in such a way conflicts with the equilibrium theory and allows new sources of market power.

6.4 AI-Enabled Stage: Autonomous Price Discovery.

AI pricing is a new qualitative mechanism, unlike all the past methods. Machine learning systems do not follow predefined rules and derive solutions, differentiating from programmed algorithms that execute predefined rules that they run. This freedom is a contradiction to economic principles.

These three technological advances made AI pricing possible. The first one is that neural networks and deep learning allowed recognition of patterns in high-dimensional data space that is not cognitively accessible by a human. Second, trial and error could optimize reinforcement learning algorithms and find a strategy without knowledge on programming. Third, cloud computing offered computing power to perform training and deployment of these systems on a large scale.

Recent studies prove that AI pricing agents are able to independently devise collusive tactics in the absence of explicit communication or programming (Calvano et al., 2020; Hansen et al., 2021). Q-learned algorithms found that high prices were beneficial to all the sellers, although no algorithm was coded to be collusive. Such an emergent behavior was occasioned by the learning environment and not by design.

We can model AI pricing as:

$$P_{AI}(t+1) = argmaxE[p(P, S(t), th(t))]$$

in which the AI system proposes the prices maximizing the expected profit p under existing state $S(t)$ and learned parameters $th(t)$, which are updated based on the observed outcomes. In contrast to dynamic pricing where humans define the objective function and constraints, reinforcement learning systems find useful strategies during experience.

Table 4. AI Pricing Algorithm Types and Applications

Algorithm Type	Mechanism	Primary Use Cases	Advantages	Concerns
Reinforcement Learning	Trial-and-error optimization	Dynamic pricing, revenue management	Adaptive, learns from experience	Potential for collusion
Neural Networks	Pattern recognition	Demand forecasting, personalization	Handles complex patterns	Black box decision-making
Bayesian Models	Probabilistic updating	Uncertain demand environments	Incorporates uncertainty	Computational intensity
Particle Swarm Optimization	Population-based search	Multi-objective pricing	Global optimization	Requires careful tuning
Price-Matching Algorithms	Rule-based competition	Competitive markets	Simple, transparent	Can enable tacit coordination

AI pricing alters a number of the principles of economics. First, it fuses the price-taking and price-making behavior. The companies that utilize AI do not react to the state of affairs in the market but rather create the conditions in the market as they implement strategic pricing. However, they are not monopolists who exercise unlimited power. Competitive pressures are also manipulated by AI systems even as they respond to them.

Second, AI raises the issue of information assumptions of market efficiency. The efficient market theory is based on the supposition that dispersed information among a large number of actors will be captured in the prices through the process of trading. However, when AI systems are more comprehensive and faster than humans in processing information, then prices might be algorithmic, not the human-disseminated knowledge. It is still not clear theoretically whether this is strengthening or weakening market efficiency.

Third, AI fee brings up the issue of agency in the market. The traditional economics presupposes the human decision-makers reacting to rewards based on preferences. However, AI systems come up with strategies that even their creators do not foresee and are unable to clarify. Whom does the algorithm serve the interests of: the firm applying it, the engineers who created it, or the algorithm itself? The implication of this question is theoretical and legal because it is not clear who should be held accountable for the outcome of the market.

7. Discussion

The history of prices informs us on a number of issues on economic coordination and institutional change. To begin with, pricing mechanisms are not mere resources-allotting technologies that are neutral. They represent certain theories of value, markets and society. The ancient systems were a manifestation of beliefs regarding the cosmic order. The contemporary systems mirror assumptions regarding market efficiency and optimization through algorithms. The awareness of this theoretical material would explain why the changes in pricing were met with opposition - they did not only change the economic practice but also the world-views.

Second, every pricing stage developed typical failure modes. The old systems were only able to sustain the social order, but not to organize intricate production. The pricing equilibrium of the market at rest allowed the coordination of industry at the expense of the obscuration of power and created instability. Dynamic pricing made it more efficient, less transparent and predictable. AI systems will bring unprecedented optimization at the cost of competitors and human autonomy. This trend implies that the process of pricing mechanism involves underlying tradeoffs and does not improve over time.

Third, the critique opposes the conventional narratives of the market development. Economic historians tend to depict the history of market development as the extension of trade and subsequent efficiency. However, pricing changes exhibit disjointed changes as a result of technological possibilities that engage in interaction with ideological shifts. Naturally, the markets never develop towards equilibrium prices. Industrial capitalism had dictated such conceptualization by acting contrary to those who believed in different value systems.

8. Competition Policy Implications

Competition policy faces certain challenges with the development of AI pricing. The classic antitrust law draws a difference between explicit and conscious parallelism (legal and illegal, respectively). Companies are able to see competitors and compete without coordination in an illegal way. However, this difference dissolves when machine learning causes algorithms to automatically devise a collusive course of action.

8.1 Equality and Prejudice

The fairness and discrimination are also questioned in AI pricing. Dynamic personalized pricing may be based upon charging different customers different prices previously based on projected readiness to pay, derived from browsing, purchase history and demographic information. Although price discrimination has never been new, AI systems are more accurate and massive than ever before.

According to economic theory, price discrimination may help to enhance efficiency as it expands access to goods. But it also moves excess from the consumer to the firm and has the ability to build up existing inequality. In cases where algorithms set higher prices to populations with fewer options, which are often associated with race, class, or geographic area, pricing is a means of value production to vulnerable demographics.

8.2 Ethical Dimensions

Pricing engines based on AI have undesired side effects. The replication of bias and lessened transparency is a matter of fairness and consumer trust. Historical data used to train algorithms can create discrimination and will price those groups with a history of disadvantage higher. The fact that many AI systems are black-box systems complicates the ability of detection or challenge in such patterns.

8.3 Regulatory Challenges

Regulators encounter a challenge on how to regulate self-adapting dynamic algorithms that bargain the prices in new ways. Traditional oversight assumes the price transparency which can be audited subsequent to fact. The rate and degree of complexity of the AI systems are not within the capacity of human beings to track. Adaptive monitoring and auditing algorithms that would ensure that the markets are not involved in dishonesty and consumers are not exploited take precedence.

8.4 Cultural Context

Price is not entirely a financial indicator. It is a situational factor and depends on social conventions, morality, and relational significance, which do not have a similar perception in different societies. The knowledge of cross-cultural differences can enhance economic theory and influence the pricing policy that recognizes diversity in practices, given that markets are getting more interdependent across international borders.

9. Conclusion

In this paper, the development of prices as a socially determined concept and an autonomous algorithmic variable has been tracked. Such development can be described as an interaction between evolving technological possibilities and epistemologies. This evolution is described in four stages, namely ancient pricing entrenched in moral and religious order, stationary equilibrium pricing in which markets are treated as mechanical systems, dynamic algorithmic pricing allowing real-time optimization, and lastly AI pricing in which autonomous strategies are developed by machine learning.

This analysis results in three theoretical contributions. To start with, pricing mechanism is not a neutral coordination technology. They represent particular theories of value, markets and society. The different historical periods fixed specific coordination issues and posed new challenges implying underlying tradeoffs as opposed to incremental improvement.

Second, AI pricing is a qualitative innovation compared with the previous mechanisms. Machine learning systems provide emergent strategies, which designers did not intend nor fully comprehend, as is the case with programmed algorithms to execute pre-programmed rules. This agency undermines the basic economic ideas of agency, information and market efficiency.

Third, the enduring dimensions as relationality, temporality and morality, are manifest in all stages but in different ways with a changing technological and social structure. This demonstrates the fact that social content purging in pricing was not always effective. Instead, the social relations are coded in each stage differently.

10. Future Research Directions

The future research should explore the method in which AI pricing mechanism can still have the capacity to charge acceptable prices and at the same time be capable of retaining the moral and social value which has long dominated pricing; in addition to providing efficiency and flexibility. To implement the concept, it is important to carry out empirical research on AI pricing and how engineered pricing mechanisms would affect the market, benefits of consumers and economic fairness.

The research areas that require to be explored are:

Algorithms of long term effect on the market structure and competition.

Responsiveness of consumers to dynamic and individual pricing.

Efficiency of different regulatory processes towards AI pricing.

Installing equity and ethical algorithm price controls.

Cultural satisfaction diversity and algorithmic pricing.

The pricing estimates by AI and its impact on the environment and sustainability.

The understanding of these dimensions will help the societies to break the radical changes that AI will impose on the economic coordination without losing the values that can help the markets to enhance human prosperity rather than addressing the abstract metrics.

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