

# Corporate Communism: When Capitalism Loops Back into Authoritarianism

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## Abstract

This paper examines the emergence of "corporate communism," a paradoxical phenomenon where extreme capitalism transforms into a system resembling state communism through corporate consolidation and monopolistic control. The study traces a three-stage evolution: from free market capitalism through corporate oligopoly to corporate monopoly, analyzing how this progression undermines the fundamental principles of capitalistic free markets. The paper explores how debt mechanisms, surveillance systems, and climate policy implementation demonstrate this transformation, drawing parallels with historical collapses of centralized power structures. Using data from multiple long-term studies and economic indicators, including the Doomsday Clock and inflation cycles, the research suggests a critical convergence of systemic risks around 2040-2045. The analysis concludes that without significant intervention to preserve market competition and limit corporate power, capitalism may complete its transformation into an authoritarian system functionally identical to state communism.

## 1. The Paradox of Extreme Capitalism

At first glance, capitalism and communism seem to be diametrically opposed. Capitalism is built on private property and free markets, while communism abolishes both, replacing them with state control. However, when capitalism reaches an extreme stage dominated by monopolies and corporate oligarchies, it paradoxically begins to resemble the centralized control characteristic of communism. This phenomenon, which we will call "corporate communism," occurs when corporations amass so much power that they effectively replace the state as the dominant authority over society, controlling political institutions, markets, and even public life.

In traditional communism, the state owns the means of production and directs the people. In corporate communism, corporations own the state and control the people. The result is the erosion of free markets, individual choice, and democratic governance. Understanding how this transformation occurs requires tracing the evolution of capitalism from a competitive system into an oligopoly, then into a monopoly, and ultimately into corporate communism.

## **2. From Free Markets to Corporate Communism: The Three-Stage Process**

### **2.1 Free Market Capitalism (Competitive Markets)**

At its ideal form, capitalism thrives on competition. A multitude of actors engage in trade, production, and innovation, each pursuing their own self-interest. According to Adam Smith's "invisible hand" principle [1], this decentralized decision-making process leads to efficiency and economic growth. No single entity has enough power to manipulate the system, and the constant pressure of competition drives innovation and progress.

In such a system, each market participant seeks to maximize their own gain, a behavior that inherently reflects an effort to extract as much value as possible from the system. Paradoxically, this pursuit of individual advantage equates to a constant attempt to undermine the very foundations of capitalism, as every actor, in striving to optimize their position, inherently acts in ways that could erode the system's stability—even if doing so ultimately means destroying capitalism itself. However, because no single actor is large enough to dominate or significantly damage the system, capitalism remains resilient. This decentralized competition ensures that each business must serve consumers effectively or risk being replaced by a competitor. Thus, while no participant is a true defender of capitalism—since all are ultimately motivated by self-interest, even at the expense of capitalism's survival—it is this collective dynamic of internal tension and self-regulation that makes capitalism both durable and productive, maintaining a balance despite the underlying forces working against it.

### **2.2 Corporate Oligopoly (Distorted Markets)**

As some companies gain a competitive edge—whether through superior innovation, strategic acquisitions, or regulatory capture—they begin to dominate their respective markets. Instead of engaging in direct competition, a handful of large corporations form oligopolies, where they cooperate to maintain market dominance rather than challenge one another.

At this stage, innovation slows down because established firms no longer face meaningful competition. Economic efficiency declines as these corporations focus on maximizing profits not by improving their products but by manipulating supply chains, influencing legislation, and limiting consumer choice. Over time, product quality has diminished while prices have increased, driven not by free market forces but by market concentration.

A clear example can be seen in the pharmaceutical sector, where the consolidation of major companies has resulted in inflated drug prices, as oligopoly power allows for the suppression of generic alternatives and the maintenance of high margins, prioritizing corporate profits over consumer health. Similarly, in automotive manufacturing, major mergers have led to fewer brands and models, decreasing the variety and innovation in the market while increasing vehicle prices, often with fewer options for customization. In the home appliance sector, the dominance of a few large manufacturers has led to a decline in product durability, with many modern appliances designed for planned obsolescence, forcing consumers to replace them more frequently. The media and entertainment industries also reflect this trend, with large corporations controlling most outlets, reducing content diversity, and imposing higher subscription fees on consumers. In agriculture and food production, a few dominant corporations control much of the market, driving up prices for healthier and organic products while pushing highly processed, lower-quality food. In the banking and financial sector, consolidation has led to fewer

institutions controlling a larger share of the market. This concentration drives up fees, limits access to services, and reduces competition. Finally, in the tech industry, dominant companies have consolidated power, limiting consumer choices, raising prices for services, and undermining privacy. In all these cases, market concentration has stifled competition, hindered innovation, and left consumers with fewer, more expensive options [2].

Additionally, these oligopolistic firms begin influencing politics, financing campaigns, lobbying lawmakers, and shaping regulations in ways that entrench their dominance. Government policies start to reflect corporate interests rather than those of the general population.

### **2.3 Corporate Monopoly (Destroyed Markets)**

The final stage occurs when a single corporation effectively controls an entire sector or even multiple sectors of the economy. At this point, market mechanisms have ceased to function. The dominant corporations do not need to compete, and their primary focus shifts from economic efficiency to preserving their power.

Without competition, innovation stagnates, and economic growth slows unless companies artificially increase profit margins by reducing quality or cutting costs in ways that harm consumers. In industries closer to monopolies than oligopolies, this lack of competition leads to soaring prices, limited access to essential services, and a growing gap between the needs of consumers and the products or services being offered. The absence of competitive pressure not only stifles innovation but also results in a market where consumers are left with fewer choices, lower quality, and higher costs for the same or even inferior products.

As corporations accumulate overwhelming influence, their power begins to resemble that of an authoritarian state. Through lobbying, regulatory capture, and revolving-door employment between corporate executives and government officials, these entities shape national policies to serve their own interests. The state, originally intended to regulate and balance economic forces, becomes a mere extension of corporate power, resulting in corporate communism.

## **3. Debt as a Mechanism of Corporate Control**

A crucial enabler of corporate communism is national debt. Governments, burdened by ever-growing fiscal deficits, become financially dependent on corporations and financial markets. This dependency forces policymakers to prioritize the interests of large financial institutions, multinational corporations, and elite investors over the needs of ordinary citizens [3].

Indebted governments are more susceptible to corporate influence because they must continuously attract capital. Politicians, rather than enacting policies that serve the public good, often cater to the demands of financial markets, fearing economic consequences if they do not comply. This economic servitude explains why political leaders rarely challenge corporate power, even when public dissatisfaction is widespread.

## **4. Totalitarian Features of Corporate Communism**

While corporate communism is distinct from historical forms of state communism, it shares key authoritarian characteristics [4]. This system of control proves more resilient than traditional state authoritarianism precisely because it maintains the appearance of market freedom while exercising comprehensive control through economic and technological mechanisms. The perceived legitimacy of market forces masks the intentional nature of this control, making it simultaneously more pervasive and more difficult to resist than direct state authority. The result is a system that replicates the centralized control of state communism while maintaining the outward appearance of market capitalism.

### **4.1 Centralized Economic Control**

In classical state communism, centralized planning committees determined production quotas, resource allocation, and pricing structures under the guise of collective benefit. Corporate communism manifests this control differently yet achieves similar ends. Through extensive vertical integration, multinational corporations now control entire supply chains, from raw material extraction to retail distribution. Rather than market-driven pricing, cartel-like behavior among dominant firms determines costs and availability of goods. Resource allocation decisions, ostensibly driven by market forces, are instead determined by corporate profit maximization strategies that often conflict with public needs. The suppression of innovation occurs through strategic patent monopolies, aggressive vertical integration, and predatory pricing practices. Much like state planning committees, a small consortium of executives and major shareholders now makes production decisions that affect millions.

### **4.2 Surveillance and Social Control**

Contemporary corporate surveillance systems have surpassed the capabilities of historical authoritarian states in both scope and sophistication. Through the integration of digital technologies, corporations maintain continuous monitoring of individual location data, communication patterns, purchase histories, and social networks. Predictive algorithms powered by artificial intelligence not only anticipate behavior but actively shape it through personalized manipulation. Corporate-controlled digital identity systems have become de facto requirements for participation in modern society, while social credit mechanisms implemented through financial and technical services create powerful behavior modification tools. The control of information access through search algorithms and content moderation systems enables unprecedented influence over public discourse and knowledge dissemination.

### **4.3 Suppression of Dissent**

Modern methods of suppressing dissent have evolved beyond traditional censorship into a sophisticated system of economic and social control. Financial suppression operates through the denial of banking services, payment processing, and manipulation of credit scores, effectively creating an economic exile for targeted individuals. Technical suppression employs subtle methods such as algorithmic downranking and shadow banning, creating the illusion of free speech while effectively

nullifying its impact. Corporate entities deploy coordinated media campaigns against critics, leveraging professional reputation attacks and automated content filtering systems. Legal suppression occurs through strategic lawsuits, restrictive non-disclosure agreements, and selective enforcement of intellectual property claims, creating a chilling effect on public discourse.

#### **4.4 Elite Capture of Governance**

The mechanism of governance capture has evolved beyond traditional lobbying into a comprehensive system of institutional control. Corporate influence now extends through complex financial relationships, including campaign finance dependencies and strategic manipulation of market conditions to influence policy outcomes. The revolving door between corporate leadership and regulatory agencies ensures alignment between government policy and corporate interests. Policy formation increasingly occurs through corporate-dominated processes, with legislation often authored by industry representatives and implemented through private sector mechanisms. The privatization of government functions and corporate control over critical infrastructure has created a shadow state apparatus operating beyond democratic oversight.

### **5. The Climate Hypocrisy**

A clear manifestation of corporate communism can be observed in the disproportionate burden of climate policies. Governments worldwide are incentivizing or mandating the transition from gasoline-powered vehicles to electric alternatives, often presenting it as a necessary step toward reducing carbon emissions. However, this transition imposes significant financial strain on middle-class households, which may be required to replace a functional \$30,000 gasoline vehicle with a \$45,000 electric vehicle, absorbing the economic costs of decarbonization.

In stark contrast, the wealthiest 0.01% of the population continue to generate thousands of tons of CO<sub>2</sub> annually, with the highest individual emitters exceeding 10,000 tons per year due to private jet travel and superyacht operations [5]. A single one- to two-hour private jet flight produces emissions comparable to an entire year of car usage for the average passenger vehicle, while one week of superyacht operation can surpass the lifetime emissions of a conventional car (see Appendix 1). Despite these extreme disparities, climate policies overwhelmingly focus on restricting the carbon footprint of ordinary citizens, with targets such as reducing per capita emissions to just 1.61 tons by 2050 [6].

The political discourse surrounding climate change has evolved significantly over the decades. The Kyoto Protocol, adopted in 1997, was a landmark international treaty that committed its parties to reduce greenhouse gas emissions, based on the premise that global warming exists and is likely caused by human-made CO<sub>2</sub> emissions. The protocol established legally binding obligations for developed countries to reduce their emissions. Fast forward to 2015, the Paris Agreement marked another pivotal moment, with countries globally agreeing to limit global warming to below 2 degrees Celsius, with efforts to limit the increase to 1.5 degrees. This agreement allowed nations to set their own commitments, thereby increasing the scope of international climate policy. In 2023, the European Union took a significant step by deciding to end the sale of petrol cars by 2035, aiming to reduce carbon emissions and promote electric vehicle adoption. However, in 2024, under pressure from major

car manufacturers, the law was amended to permit the use of carbon-neutral fuel reflecting the ongoing tension between environmental goals and economic interests.

This asymmetry highlights the structural mechanisms of corporate communism, wherein regulatory measures disproportionately impact the general population while preserving the privileges of the economic elite. Despite public discourse on environmental responsibility, luxury industries, corporate executives, and political leaders make minimal concessions, ensuring that the costs of sustainability are borne primarily by those with the least financial flexibility.

## 6. Historical Parallels

The rise and eventual downfall of corporate communism may be compared to other historical systems where elite control led to stagnation and collapse [7].

As Rome transitioned from a republic to an empire, economic and political power concentrated into the hands of a small elite. The Senate, once a balancing force, became a puppet of the emperors. This concentration of power, compounded by military overreach, economic instability, and internal corruption, led to the erosion of democratic processes. The elite increasingly prioritized their own interests over the common good, and as social unrest and political fragmentation grew, the empire's ability to maintain cohesion weakened, ultimately contributing to its decline.

In pre-revolutionary France, the monarchy and aristocracy controlled vast wealth while imposing severe economic hardships on common citizens, who struggled with high taxes and food scarcity. This deepening inequality, compounded by the lavish lifestyle of the elites and their indifference to the suffering of the people, led to widespread discontent. As the monarchy's inability to address the needs of the populace became more evident, public unrest grew, culminating in the French Revolution. The revolution dismantled the existing feudal order and sought to establish a new system of governance, one that promised equality and liberty for all.

The USSR collapsed under the weight of its centralized economy, bureaucratic inefficiency, and elite corruption. The concentration of power in the hands of a small political elite led to stagnation, as state-controlled industries failed to innovate and meet the needs of the population. This lack of adaptability, coupled with widespread corruption and mismanagement, weakened the foundation of the Soviet system. As economic problems intensified and public dissatisfaction grew, the inability of the state to reform or respond to the changing global order ultimately caused the dissolution of the USSR.

In contemporary society, there has been a notable shift in the distribution of power, with governments—originally intended to represent the collective interests of the populace—now increasingly aligning with the priorities of a concentrated political and corporate elite. This concentration of authority, where powerful corporations and political leaders exert disproportionate influence over policy formation, has created a widening disconnect between governing institutions and the broader population. Similar to how the Roman Senate became subservient to imperial authority, modern democratic processes are often undermined by corporate interests, resulting in a dilution of democratic accountability. The escalating inequality, fueled by the extravagant lifestyles of the elite and their disregard for the socioeconomic struggles of the general populace, has contributed to growing public dissatisfaction. Industries operating as monopolies, once integral to societal function, now exhibit systemic stagnation, failing to innovate or effectively respond to evolving demands. This failure to

adapt, coupled with entrenched corruption—manifesting in practices ranging from illicit financial transactions to insider trading and the revolving door phenomenon—has led to an economic and political framework that increasingly prioritizes profit over public welfare. As a consequence, the populace is left with a deepening sense of disillusionment and frustration.

## **7. The Unsustainable Trajectory of Capitalism**

The modern era of capitalism can be traced back to the mid-19th century, with industrialization driving mass production, technological advancements, and global economic expansion. From roughly 1850 to the late 1920s, this phase was marked by rapid growth, but also periodic financial crises that foreshadowed deeper systemic risks. The Long Depression (1873–1896) and the Panic of 1907, while distinct from the Great Depression, revealed structural instabilities tied to speculation, credit expansion, and the absence of regulatory mechanisms.

The 1929 crash fundamentally altered capitalism. The Fordist model of mass production, which had driven industrial expansion, faced inherent limits—most strikingly exemplified by declining demand as workers, who had become the primary consumer base, could no longer absorb production. In response to economic stagnation, planned obsolescence gained theoretical traction in the early 1930s, reshaping production cycles to sustain perpetual demand [8]. The New Deal temporarily stabilized the system, and the post-World War II economic boom created an illusion of indefinite prosperity. However, this period of stability was underpinned by unique historical conditions, including reconstruction efforts and state intervention, rather than a structural solution to capitalism’s inherent contradictions.

A turning point arrived in 1971 with the collapse of the Bretton Woods system, marking the shift toward financialization and speculative capital accumulation [9]. The ensuing decades saw real wages stagnate while corporate profits soared, exacerbating wealth disparities both within and between nations. The neoliberal policies of the 1980s further widened these gaps, dismantling labor protections and prioritizing market deregulation. By the 1990s and 2000s, financialization had solidified corporate dominance over policymaking, with governments increasingly acting as guarantors of financial stability rather than enforcers of economic equity.

Today, despite repeated crises—many of which should have resulted in structural corrections—major financial institutions have remained entrenched, shielded by mechanisms such as quantitative easing (QE) and tightening (QT), which are central bank policies that expand or contract liquidity in the financial system. Initially framed as a temporary response to market volatility, this strategy has evolved into a permanent feature, injecting liquidity into financial markets to sustain asset prices. QE injects money into the economy by purchasing financial assets, such as government bonds, at full value even when their market value has fallen due to lower yields compared to newer bonds. Conversely, QT withdraws liquidity by reducing asset holdings. Qualitative and quantitative easing (QQE) and tightening (QQT) extend these practices to a broader range of assets, including corporate bonds and equities. These interventions disrupt free-market dynamics. In a true market, bond prices should reflect supply and demand, with older, lower-yield bonds selling at a discount. Central banks undermine this principle by creating a parallel market where investors can offload risk without incurring losses. This eliminates the natural balance between buyers and sellers, distorting asset prices and incentivizing excessive risk-taking, ultimately eroding the foundations of a free market.

Looking ahead, multiple indicators suggest capitalism is approaching a critical juncture. Reports such as *The Limits to Growth* (1972) [10], *Beyond the Limits* (1992) [11] and *Limits to Growth: The 30-Year Update* (2004) [12] have consistently projected economic and ecological tipping points around 2040 (see Appendix 2). Notably, while the estimated collapse date has remained stable, the deadline for taking corrective action has progressively shifted indicating a narrowing window for meaningful change. The Doomsday Clock, a symbolic measure of humanity's proximity to existential global risks [13], suggests an increasing likelihood of collapse scenarios between 2023 and 2101, with multiple indicators converging around 2040–2045 (see Appendix 3). This symbolic timepiece reflects a synthesis of global stressors such as geopolitical instability, environmental degradation, and technological threats. Projections from various datasets reinforce this timeline, highlighting 2040–2045 as a critical period where compounding risks may reach a tipping point. The Doomsday Clock's trend is not merely symbolic but serves as a broader indicator of systemic vulnerabilities and the potential for cascading failures in human systems if global governance and resilience measures remain inadequate. In parallel, long-term inflationary cycles demonstrate the formation of a century-old triangular trendlines that indicates mounting systemic pressures likely to culminate in the coming decades [14] (see Appendix 4). This pattern, initially broken in 2022 but subsequently reintegrated, signals weakened structural integrity. The convergence of these trendlines in 2058 may mark a decisive turning point as soon as 2035. An upward breakout could drive inflation rates above 40%, with the base of the triangle measuring approximately 4000 basis points. Conversely, remaining below resistance—predicted to cross zero around July 2079—could result in a deflationary spiral, reaching rates as low as -30%. Both scenarios, unprecedented since the inception of modern capitalism, underscore the fragility of current economic systems. These signals collectively suggest that the current trajectory of capitalism is unsustainable in its existing form.

## 8. Defending True Capitalism

True defenders of capitalism should oppose monopolies, as they undermine the foundational principles of capitalism—private property, free markets and competition. Market participants can resist monopolistic control either by adopting alternative selling strategies—such as innovating new products or business models, which is challenging—or by changing their purchasing habits, favoring small businesses and actively boycotting monopolistic corporations, which is comparatively easier.

If monopolies continue unchecked, we risk completing the "loop" where hyper-capitalism transforms into a centralized, authoritarian system indistinguishable from state communism. Preventing this requires strict antitrust enforcement, government independence from corporate influence, and a public that is aware of the dangers of unchecked economic power.

Ultimately, the real struggle is not between capitalism and communism but between free markets and centralized control—whether that control is exerted by the state or by corporate monopolies. When economic and political power become too concentrated, competition fades, innovation stalls, and individual freedoms erode. The alternative is simple: either societies reclaim control over their institutions, ensuring that political and economic systems serve the public interest, or they resign themselves to a future where the state is nothing more than a subsidiary of untouchable multinational corporations.



## 9. Appendix

### 9.1 Appendix 1

The stark difference highlights massive carbon inequality, where a single luxury transport event equals multiple years of an average person's carbon footprint:

#### I. Fuel Consumption Basis:

Private Jet: 750-1,000 liters/hour

Large Yacht: 3,500-5,000 liters/day

Average Car: 7-8 liters/100 km, ~1,400-1,600 liters/year (20,000 km driven)

#### II. CO2 Emission Conversion:

Diesel/Jet Fuel: ~2.6-3 kg CO2 per liter

Gasoline: ~2.3 kg CO2 per liter

#### III. Annual Comparisons:

Private Jet: ~1-2 hours flight = 1 year car emissions

Large Yacht: 1 week = ~10 years car emissions

Calculation based on total fuel consumed and converted to CO2 equivalent

### 9.2 Appendix 2

#### I. The Limits to Growth (1972)

Forecast: Global collapse around 2040

Action deadline: 2000

Ground-breaking study using the World3 computer model to simulate global systems interaction, demonstrating how exponential growth in population, industrialization, and pollution would collide with finite resources.

#### II. Beyond the Limits (1992)

Forecast: Global collapse around 2040

Action deadline: 2000-2010

Twenty years after the first report, this update confirmed humanity had already overshoot Earth's carrying capacity in several areas, validating the original model's warnings.

#### III. Limits to Growth: The 30-Year Update (2004)

Forecast: Global collapse around 2040

Action deadline: 2015-2020

Showed that 30 years of historical data closely matched the "standard run" scenario from 1972, while introducing more detailed scenarios and technological possibilities.

Throughout all three reports spanning 30 years, the projected 2040 timeline for systemic global decline has remained remarkably consistent, while the window for preventive action has progressively closed.

### 9.3 Appendix 3

YEAR	SECONDS	YEAR	SECONDS	YEAR	SECONDS
1947	420	1980	420	2007	300
1949	180	1981	240	2010	360
1953	120	1984	180	2012	300
1960	420	1988	360	2015	180
1963	720	1990	600	2017	150
1968	420	1991	1020	2018	120
1969	600	1995	840	2020	100
1972	720	1998	540	2023	90
1974	540	2002	420	2025	89

Table 1

The data from Table 1 is represented in Figures 1 to 5, which analyze different time intervals starting respectively from 1947, 1963, 1972, 1991, and 2010. For each subset, both a linear curve fitting and the three highest  $R^2$  polynomial fits were applied to project trends in the Doomsday Clock's progression. The Doomsday Clock regression analyses reveal multiple potential zero-point intersections. Linear models, across different time intervals, predict critical points in 2101, 2045, 2040, 2023, and 2026, while polynomial regressions suggest a more concentrated range of intersections in 2044, 2025/2044, 2026/2026, 2028, and 2028, with a final upward crossing in 2154 indicating potential crisis resolution.

While other subsets of data could lead to different projections, the results suggest a likely window for reaching zero between 2023 and 2101 for linear models and between 2025 and 2044 for polynomial models. The convergence of predictions around the 2040s, despite varying methodological approaches, highlights this period as particularly significant for systemic stability.

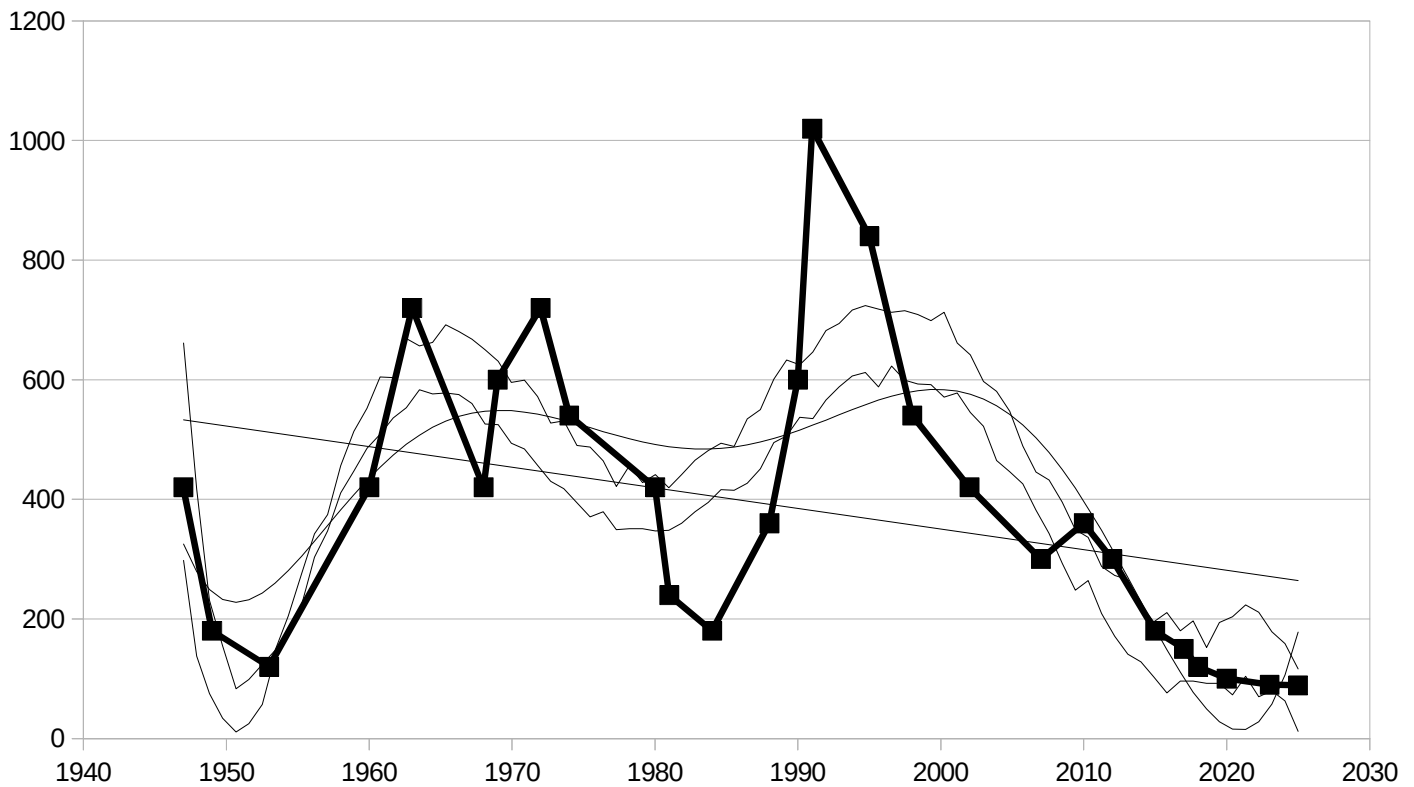


Figure 1

$$f(x) = -3.4462184251463 x + 7242.54954937159$$

$x = 2101.59$   
 $R^2 = 0.111648666380453$

$$f(x) = -3.15297586186172E-11 x^8 + 4.37258182569781E-7 x^7 - 0.00259547355885 x^6 + 8.54133162193925 x^5 - 16803.8574443196 x^4 + 19690109.3403952 x^3 - 12577124255.0248 x^2 + 3169823731780.77 x + 199960644253088$$

$x = \{-51.62, 1854.22, 1898.44 \pm 98.77 i, 2012.44 \pm 136.29 i, 2121.87 \pm 66.18 i\}$   
 $R^2 = 0.584994322421216$

$$f(x) = -5.11571458693153E-8 x^7 + 0.000712040395867 x^6 - 4.24728136392364 x^5 + 14074.3963330315 x^4 - 27982377.7253989 x^3 + 33379170487.233 x^2 - 22119677444213.4 x + 6281886395548823$$

$x = \{1938.73 \pm 15.39 i, 1975.32 \pm 36.53 i, 2023.10 \pm 30.71 i, 2044.39\}$   
 $R^2 = 0.620342851842428$

$$f(x) = 8.62410017864999E-7 x^6 - 0.010270104702046 x^5 + 50.9575463965611 x^4 - 134841.84498346 x^3 + 200699926.861347 x^2 - 159313399601.021 x + 52690218602046$$

$x = \{1949.33 \pm 5.87 i, 1984.00 \pm 18.11 i, 2020.97 \pm 1.00 i\}$   
 $R^2 = 0.5442177081427$

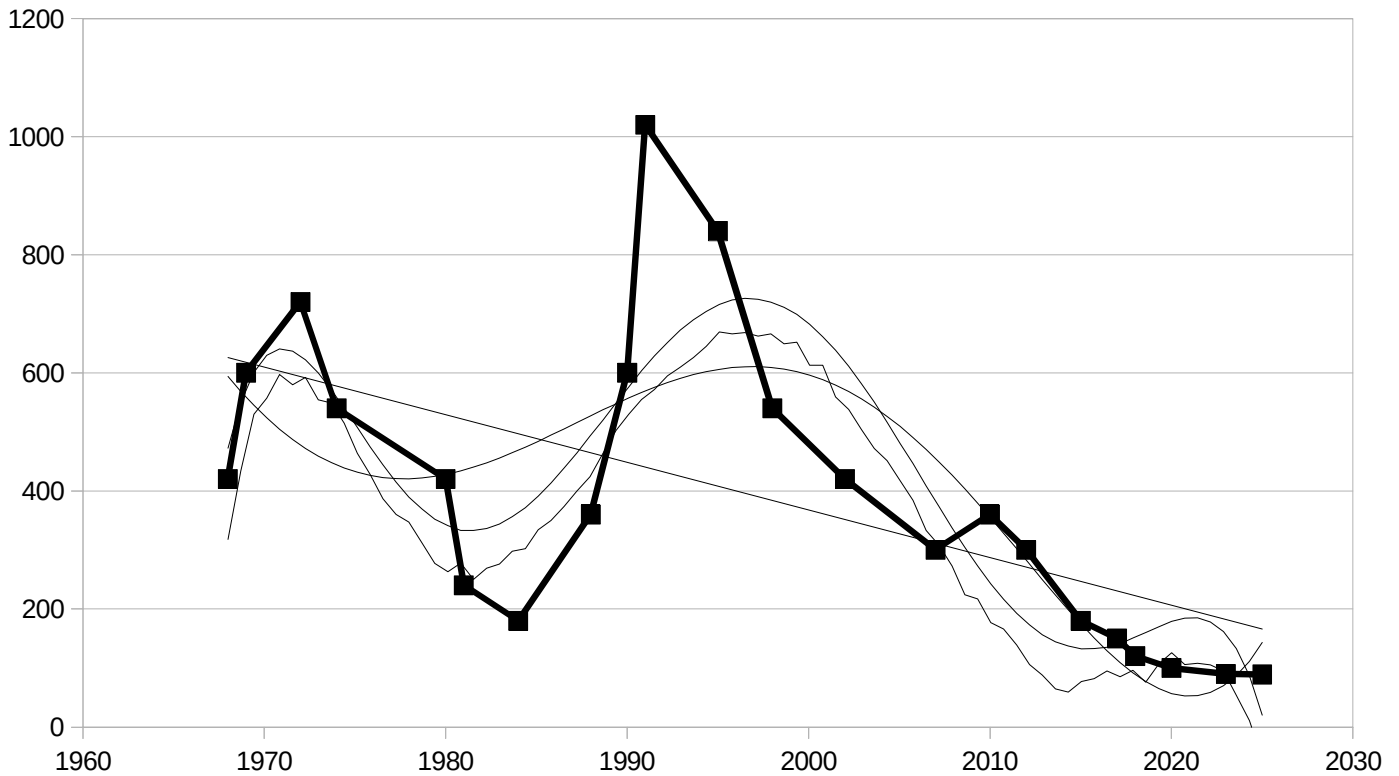


Figure 2

$$f(x) = -8.06994900519862x + 16507.9313336101$$

$$x = 2045.61$$

$$R^2 = 0.349201289684957$$

$$f(x) = 4.90806412370934 \cdot 10^{-8} x^7 - 0.000693922071339 x^6 + 4.20410598437009 x^5 - 14148.3062903659 x^4 + 28564583.3938238 x^3 - 34597521937.1359 x^2 + 23277319987681.5 x - 6711019744022823$$

$$x = \{1954.48, 1973.98 \pm 26.68 i, 2018.36 \pm 30.73 i, 2044.60, 2154.65\}$$

$$R^2 = 0.651669516731947$$

$$f(x) = -7.42052389968231 \cdot 10^{-6} x^6 + 0.088919061226576 x^5 - 443.949837285081 x^4 + 1182120.17797704 x^3 - 1770524138.82922 x^2 + 1414264903302.3 x - 470693708212793$$

$$x = \{1965.67, 1980.89 \pm 7.80 i, 2014.97 \pm 5.97 i, 2025.46\}$$

$$R^2 = 0.716275055305741$$

$$f(x) = 2.45930851022345 \cdot 10^{-5} x^5 - 0.244190282846261 x^4 + 969.789136480894 x^3 - 1925616.42005371 x^2 + 1911638276.02702 x - 759058160821.15$$

$$x = \{1935.81, 1975.40 \pm 14.43 i, 2021.30 \pm 3.29 i\}$$

$$R^2 = 0.584132068816316$$

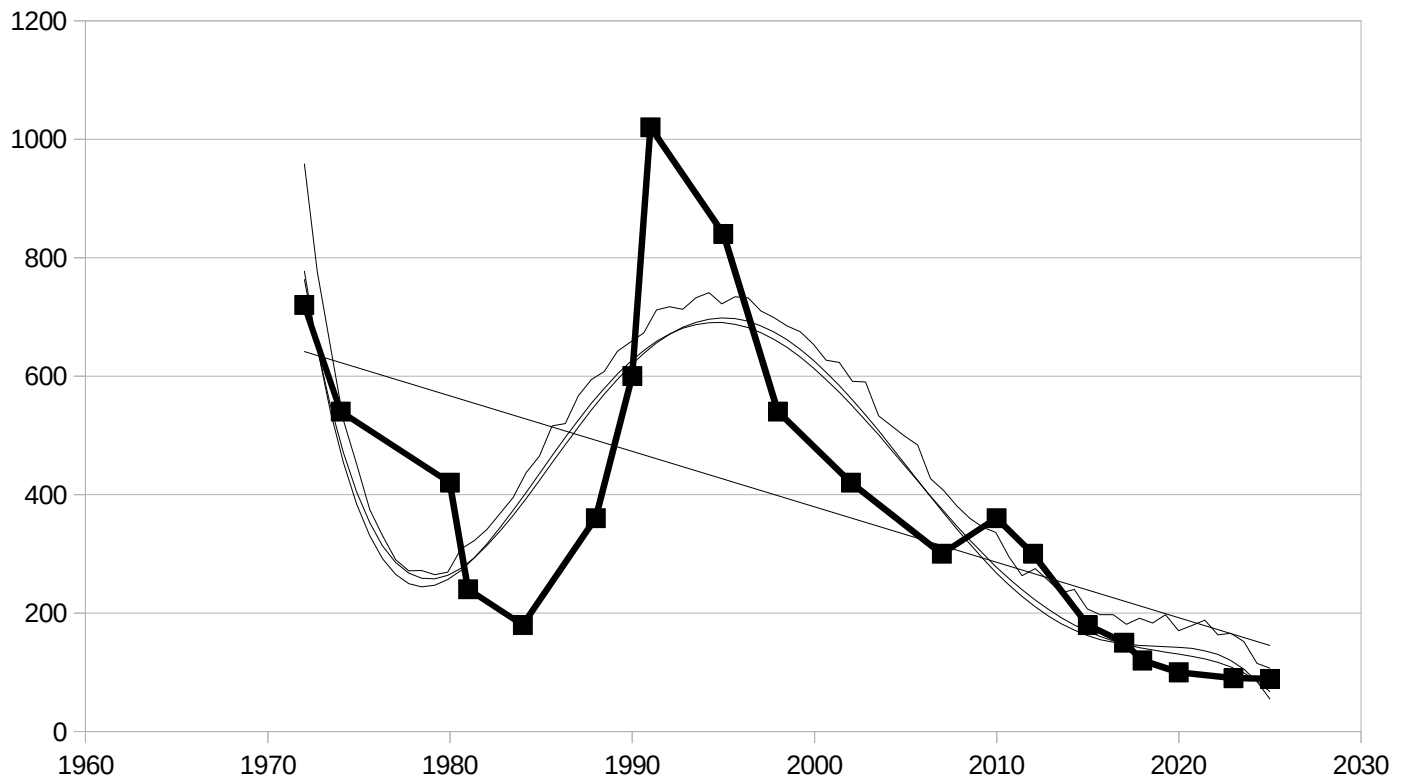


Figure 3

$$f(x) = -9.3720605819514 x + 19123.5083698685$$

$$x = 2040.48$$

$$R^2 = 0.367178432511139$$

$$f(x) = -4.49410323341341E-08 x^7 + 0.000629183495035 x^6 - 3.77523748881043 x^5 + 12584.85618009133 x^4 - 25171730.8917915 x^3 + 30209171031.9888 x^2 - 20141960671881 x + 5755693553996917$$

$$x = \{1889.61, 1928.18 \pm 89.46 i, 2021.30 \pm 117.48 i, 2105.81 \pm 54.11 i\}$$

$$R^2 = 0.68516689235588$$

$$f(x) = -1.31729047822135E-06 x^6 + 0.015683610408652 x^5 - 77.7954905691988 x^4 + 205786.095259908 x^3 - 306163917.934427 x^2 + 242909165932.073 x - 80292515568579.8$$

$$x = \{1891.87, 1977.85 \pm 5.76 i, 2016.10 \pm 8.21 i, 2026.21\}$$

$$R^2 = 0.748123456660027$$

$$f(x) = -0.00011528093167 x^5 + 1.15466210142788 x^4 - 4625.95428831048 x^3 + 9266308.04420017 x^2 - 9280493456.04269 x + 3717785232968.53$$

$$x = \{1977.60 \pm 5.15 i, 2017.12 \pm 8.98 i, 2026.63\}$$

$$R^2 = 0.74662325024006$$

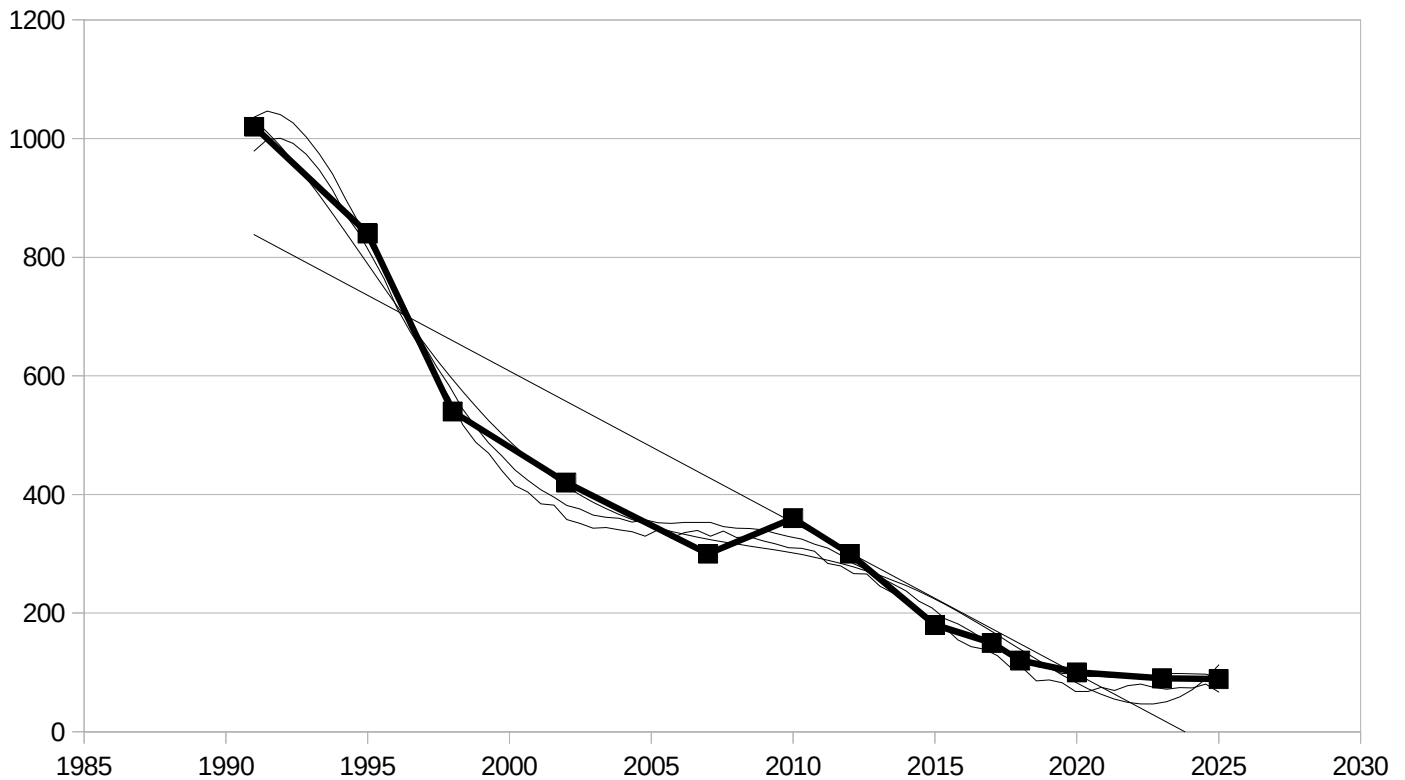


Figure 4

$$f(x) = -25.5477591186223 x + 51703.7376189967$$

$$x = 2023.81$$

$$R^2 = 0.889832756167012$$

$$f(x) = -3.33747834927987E-08 x^7 + 0.000417296644686 x^6 - 2.20108335768505 x^5 + 6317.92684626516 x^4 - 10577664.9732746 x^3 + 10199073933.5021 x^2 - 5120359295382.48 x + 978567575806177$$

$$x = \{445.06, 1989.63, 1994.75, 2009.20 + - 9.98 i, 2027.75 + - 6.03 i\}$$

$$R^2 = 0.98751841474581$$

$$f(x) = -4.77436148324328E-05 x^6 + 0.575711308163434 x^5 - 2892.53932778607 x^4 + 7750840.53200889 x^3 - 11682536411.7504 x^2 + 9391187146755.83 x - 3145494169957667$$

$$x = \{1986.83, 2001.10 + - 8.26 i, 2020.62 + - 6.23 i, 2028.12\}$$

$$R^2 = 0.993125538283495$$

$$f(x) = 0.000449333147817 x^5 - 4.5092588846549 x^4 + 18100.7698076781 x^3 - 36329053.9220312 x^2 + 36456610434.4995 x - 14633682217481.6$$

$$x = \{1982.53, 2003.74 + - 10.21 i, 2022.71 + - 2.18 i\}$$

$$R^2 = 0.985457608720717$$

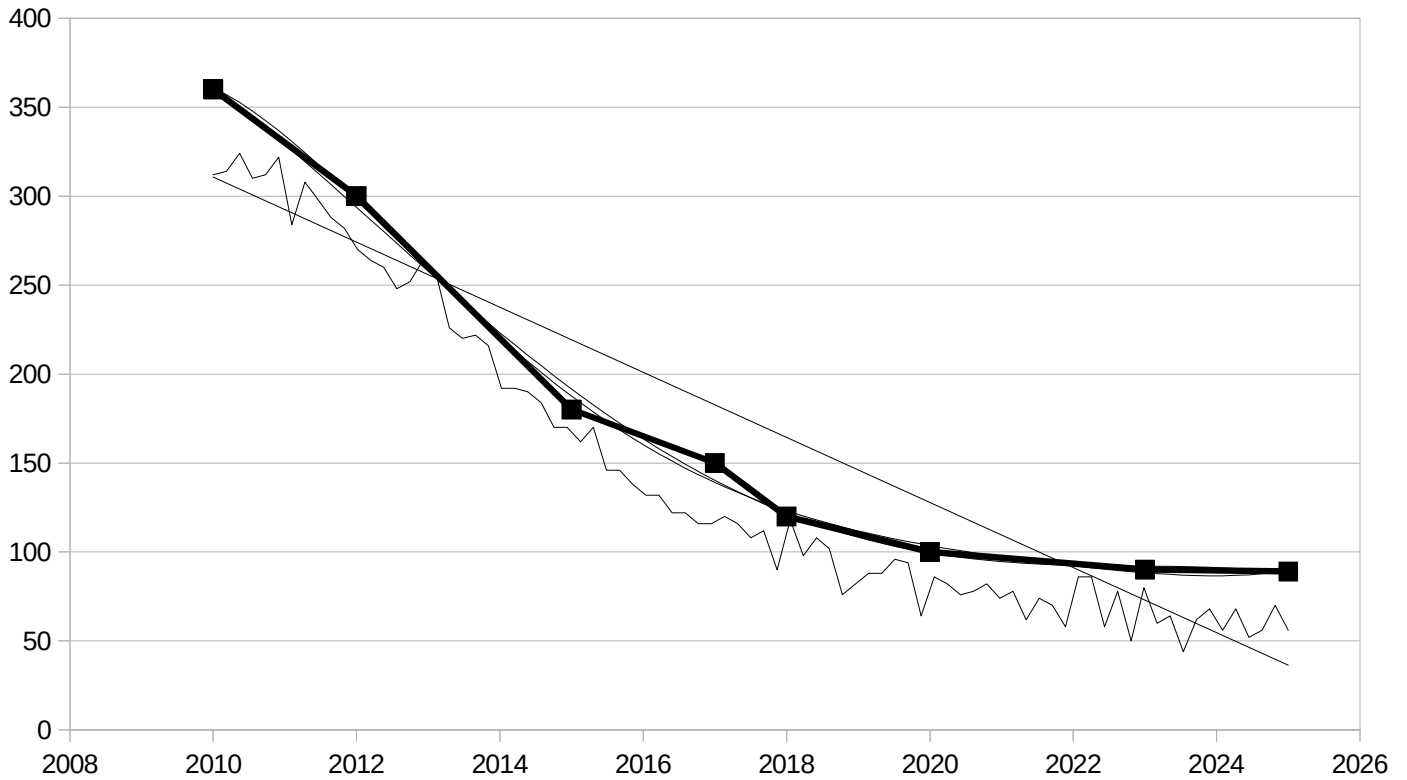


Figure 5

$$f(x) = -18.2930107526882 x + 37079.7741935484$$

$$x = 2026.99$$

$$R^2 = 0.843891677592076$$

$$f(x) = 0.000148705832251 x^6 - 1.79663094346378 x^5 + 9044.30161118655 x^4 - 24282111.1582939 x^3 + 36670503984.734 x^2 - 29535377911773.4 x + 9.9118202987584E+15$$

$$x = \{1991.61, 1993.90, 2015.18 \pm 15.84 i, 2032.95 \pm 8.69 i\}$$

$$R^2 = 0.896293007167226$$

$$f(x) = 0.002585972502932 x^5 - 26.1006344459222 x^4 + 105374.932094024 x^3 - 212712319.234179 x^2 + 214692595094.125 x - 86676338966233.2$$

$$x = \{2005.24, 2017.79 \pm 6.70 i, 2026.16 \pm 4.11 i\}$$

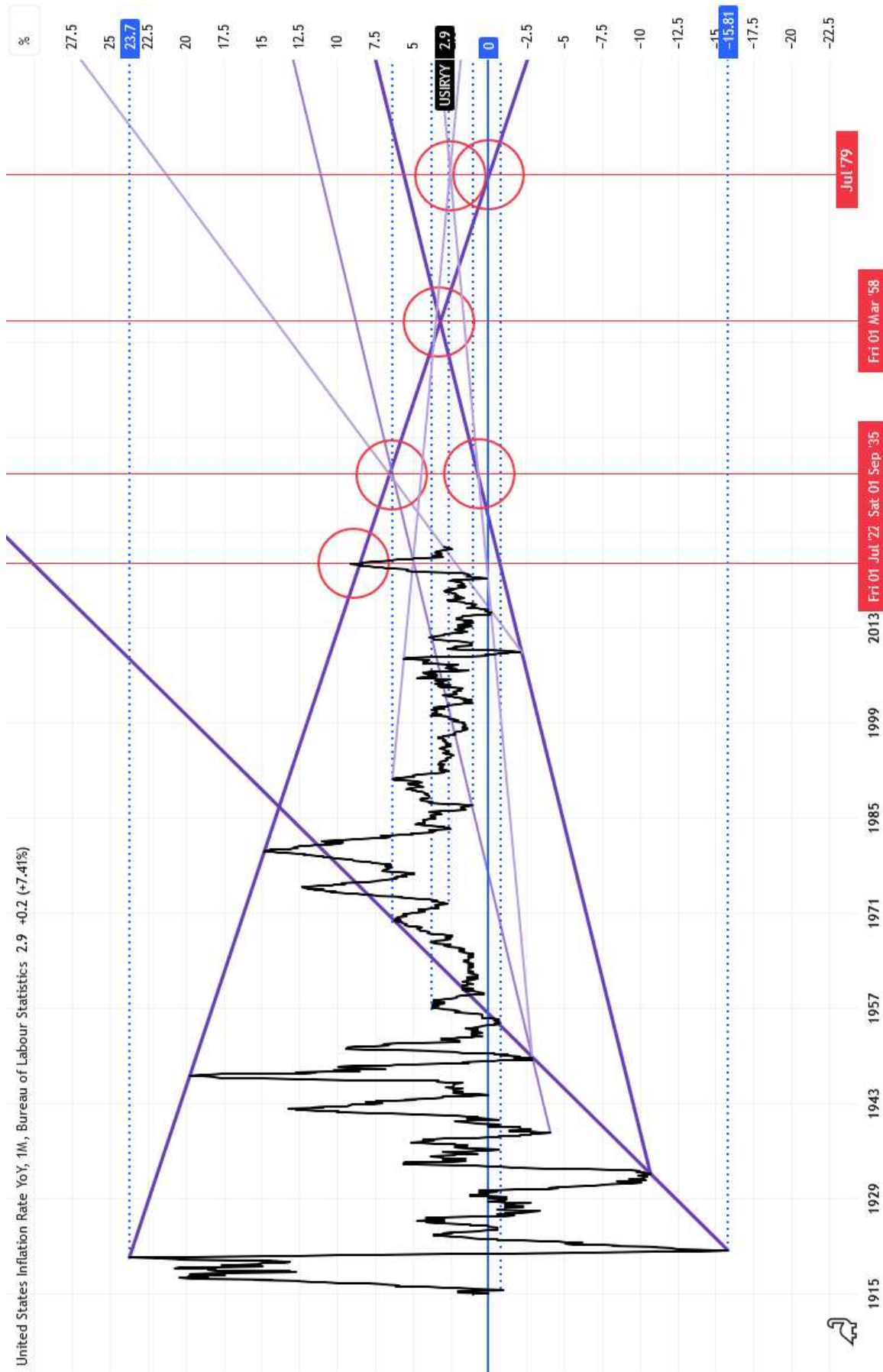
$$R^2 = 0.997118708075374$$

$$f(x) = -0.014701829560101 x^4 + 118.646945130763 x^3 - 359062.43374689 x^2 + 482945151.178817 x - 243586855629.031$$

$$x = \{2000.92, 2020.17 \pm 6.29 i, 2028.96\}$$

$$R^2 = 0.996202325612442$$

# 9.4 Appendix 4





## 10. References

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