

I. PROCESSES AND CYCLES

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Long-Term Dynamics of Ruling Structures in the West, China, and Russia

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Abstract

National periodic dynamics are explored based on government types or dynasties in the West, China, and Russia in the post-Roman/Han era. The period of these cycles is approximately 375 years with some substructure. This analysis first reviews shorter periodic national dynamics from the time scales of political cycles (16 years) and government cycles (72 years) within the United States. Then, the distinct features of long-term periodic dynamics in the West, China, and Russia are explored. The West and China developed relatively independently until the 18th century. During the period of the Roman and Han empires, China has evolved in a rather stable location in contrast to the moving center of Western leadership. In contrast, Russia was influenced by both the East (through nomadic tribes) and the West (through trade and wars). While the average period of about 375 years is seen in all, there is substructure, especially in Russian history that suggests the simultaneous overlap of two frequencies (an additional 450-year cycle). This time frame is consistent with the predator-prey model of two interacting human groups with birth and death rates derived from the expected human lifetime.

Keywords: national cycles, system dynamics, Russia, China, Western Europe.

Introduction

Previous patterns in various organizational scales have been researched, for example, in technology waves (and resulting business cycles) such as Kondratieff cycles of 45–60 years duration. Further studies of rise and fall of states use price and population data to guide dynamic models which often consider the competition of multiple social classes (Korotayev 2006; Turchin 2003). Similar but slightly different period durations were found in energy transitions and leadership in Western capitalism (LePoire 2010). Tessaleno Devezas and George Modelski (2003) hypothesized an extension to longer periods. In order to verify this, we consider the pattern of political reigns in three regions: the West, China, and Russia in the post Han/Roman empire period (starting in *Kondratieff Waves: Processes, Cycles, Triggers, and Technological Paradigms 2022 17–38* DOI: 10.30884/978-5-7057-6191-3_02

about the 6th century). Instead of focusing on population or economic trends within one dynasty or state, the focus is on the possible relationship between multiple (often two) consecutive dynasties or states at a particular location. This is done because there are often political reactions in the transition to the next political form, so that, for example, the summed period of a consecutive pair of states might indicate a pattern whereas the period of each state separately would not show a pattern.

The approach is to first explore the shorter cycles in political direction and national goals in the U.S. by analyzing the swing of political parties of the presidency since World War II and the sequence of high ranking presidents, respectively. This will extend the national cycles to periods of 16 years and approximately 75 years, each observed for about five full cycles. Longer political cycles (of about 375 years) in types of government will then be explored by investigating major changes in governmental form in three regions: the West (of which the U.S. only was involved in the most recent period), the East represented by China, and Russia which experienced mixed influences from both East and West (see Fig. 1).

The selection of periodization clearly includes large uncertainty. Limitations of complex transitions over time and location are often found in periodization. This is especially difficult in the history of the West in which the location of the major power is often decentralized and its center base moves over time. The earliest cycles soon after the Roman Empire / Han period contains large uncertainties due to the lack of documentation, its biases, and incompleteness. The proposed periodization in this paper starts with the traditional periods and then, after discussion, includes some minor changes.

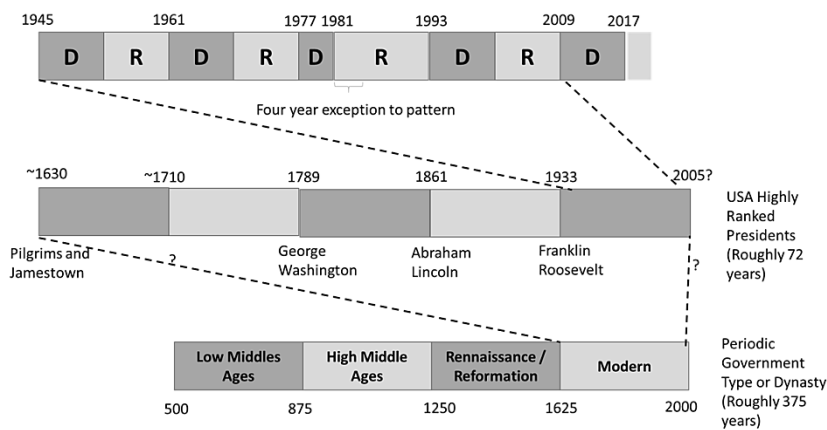


Fig. 1. Periodic political cycles with different time scales as will be presented in the paper. D = Democratic party, R = Republican party

After the discussion of the data to support this view, a simple predator-prey model is reviewed with the expected cycle period being derived from the natural birth rate of humans as if they formed two types of competing political perspectives. The substructure of the cycles is also analyzed to identify possible superposition of cycles with slightly different periods.

Short-Term Periodic National Patterns in the U.S.

To establish the short-term cycles and to derive a potential longer-term period duration, the dynamics of national patterns in the development of the U.S. is investigated. The longer-term period is then later used to view the longer histories of the West, East (China), and Russia.

During the post-World War II era oscillations occurred in the U.S. political leadership. This was a time when leadership needed to balance the economy, military, civil rights, and environmental concerns while competing in new technological areas such as space, jets, and computers. Instead of being dominated by one political view, the parties traded control (through elections) over the presidency every eight years (from 1945 to the present with one exception from 1980 to 1984).

Leadership requires exploration of new potential social and technological paths; whereas followers can learn through the trials and errors of the leaders to proceed along a well-trodden path. The cycles of political leadership of the U.S. during the Cold War can be interpreted as exploration in alternating political directions. In this case eight years in a Republican direction are followed by eight years in a Democratic direction.

Many engineered physical systems use oscillations as a way to maintain a system in an out-of-equilibrium state. One analogy in applied physics is the strategy to sail against the wind by tacking (other physics examples in dynamic equilibrium include the inverted pendulum and magnetic focusing of particle beams). The natural tendency for a sailboat is to go with the wind. However, by alternating directions between traveling at angles to the left and right of the wind direction (tacking), the net effect is to travel against the wind. The tacking frequency is chosen based on the difficulty of the transition and bounds of the width. Other dynamical stabilities are achieved by applying oscillations in maintaining an inverted pendulum by the use of alternating upward and downward motions at its base and in maintaining a charge particle beam by alternating the transverse focusing dimension.

Another pattern is seen before the U.S. began the leadership pattern discussed above. The fundamental cycles seem to occur about every 72 years (about a human lifetime) as seen by the sequence of great presidents (measured from their inauguration dates) who led the country through a crisis period (Danzer *et*

al. 2002). These include George Washington (1789) in the Revolutionary War and country foundation, Abraham Lincoln (1861–1865) with the Civil War, and Franklin Roosevelt (1933–1945) with the Great Depression and World War II.

Each period dealt with an aspect of the country's growth: physical growth to continental scale (1790–1860); a transition based on technological and population growth (1860–1945), followed by a growing global leadership role (1945–2020). These periods addressed major questions that could be resolved by many options but also included advancing technological changes in communications, transportation, energy, and export. In the midst of each period, impactful presidents (Andrew Jackson, Theodore Roosevelt, Ronald Reagan) led corrective actions. These technologies tended to facilitate governing a wider area. The U.S. arrival on the global scene was at first cautious but then accelerated after WWII with many of the competing industrialized countries left with diminished resources. During this leadership phase, as discussed above, the best paths were not at all obvious or taken, leading to periodic political swings to test the boundaries of leadership within an emerging global community.

There were two additional periods before the U.S. Constitution of about 75 years. First, in the years leading up to 1701, William Penn helped to form the basis of American society with religious freedom and government checks and balances in his Pennsylvania colony. Further back to the 1630 time frame when early colonies were forming – Jamestown in 1609, the Pilgrims in 1620 followed by the Massachusetts Bay colony in 1630, and the Dutch along the Hudson with the founding of New Amsterdam in 1630, which would later be renamed New York City. This gives a time frame of about 375 years for the development of the U.S.

Another quantitative measure is the correlation time period of the relative ranks of the presidents by current historians (Rottinghaus and Vaughn 2018). The ranking by time of the presidents is shown in Fig. 2, such that the average is zero. Some of the leading presidents can be seen in their high ranking – Washington (on the left), Lincoln at about 75 years as a lone spike, and Roosevelt at about 150 years. The not so significant spike near the end is Obama (between the low rankings for G.W. Bush and D. Trump). It should be noted that the rankings change with time, as historians are able to better incorporate results and context over time.

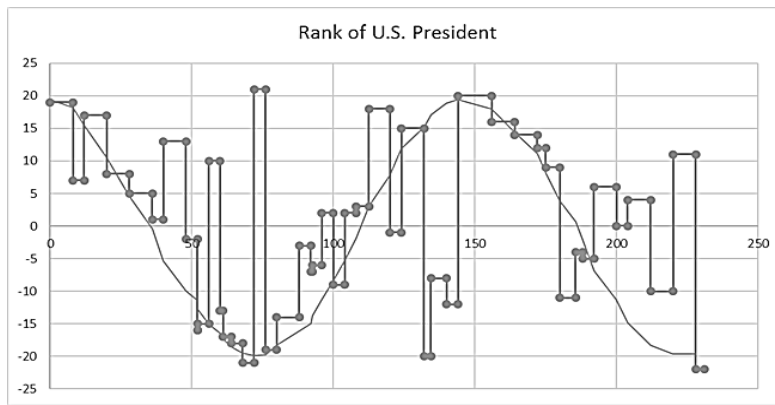


Fig. 2. Rank of presidents by year after the U.S. Constitution (*i.e.*, starting with George Washington and ending in Trump)

Source: Rottinghaus and Vaughn 2018.

If the time-correlation is taken (summing the product of rank (t)*rank ($t+\Delta t$) for all appropriate times t . Then the following curve in Fig. 3 is obtained, which shows the most negative correlation at about 64 years followed by the largest positive correlation at 150 years. This seems to show that the circumstances of the highest-ranking presidents alternate between top of a peak (Washington and Roosevelt) and bucking the trend at the bottom of a trough (Lincoln and the recent situation). The time between these leading presidents is then approximately 75 years, which is very similar to the 72-years cycle described above.

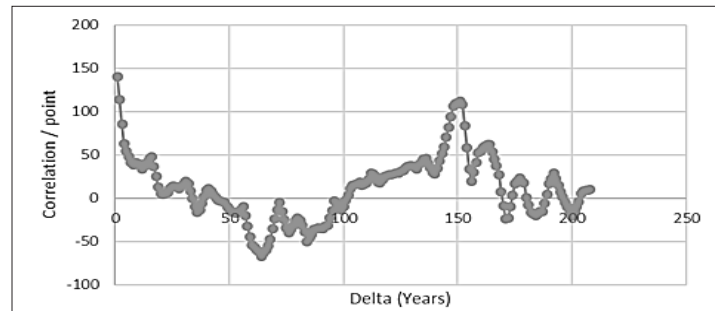


Fig. 3. Correlation between ranks at t and $t+\Delta t$. The most negative correlation occurs at 64 years where the largest positive correlation is about twice this at 150 years

Source: Rottinghaus and Vaughn 2018.

Comparison to Kondratieff Waves

Typical Kondratieff waves thought to be related to the clustered development of new technologies and investments typically last 45–60 years. Schumpeter continued to identify the clusters around steam engines and cotton, railways and steel, electrical engineering and chemicals, petrochemicals and automobiles. The current technology cluster concerns information technology. Another technology cluster related to cybernetics and medicine is predicted to occur in the 2030s and 2040s (Grinin and Grinin 2014). Others identified 19 waves further back in history starting with the Northern Song in the mid-900s (Thompson 2016).

The 72-year political cycle seems to be at an odd interval compared to Kondratieff waves – too short for one wave and too long to cover two full waves. An indication of what might be the relationship between the two comes from Edward Jayne (2005) as interpreted by Berry and Dean (2014). Thus, the beginning of political cycles alternates between upswing and downswing periods. Perhaps, the 72-year cycle comprises 1.5 Kondratieff cycles such that one starts at a peak while the next starts at the second subsequent trough. An average Kondratieff period of 48 years would lead to a 1.5 cycles' period of 72 years.

There are some ways to measure this. One is based on the trend in income inequality. While the GINI coefficient has only been measured from the 20th century, Lindert and Williamson (2016) recently estimated earlier GINI coefficients to the colonial period (see Fig. 4). The specific GINI coefficient started low (0.43) in colonial times, rose to about 0.5 at about the time of Lincoln. It continued relatively high through the 1920s but then rapidly fell to 0.4 in 1950. Since then it has risen to 0.51. These are about the times of the leading presidents Washington, Lincoln, Roosevelt, and recent times. Washington and Roosevelt presided at relatively low GINI, whereas Lincoln and the current president are at high GINI.

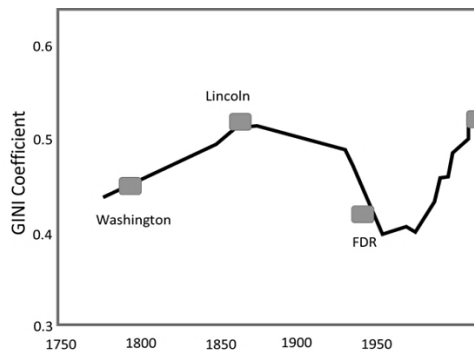


Fig. 4. Estimated trend in income inequality (GINI) throughout the history of the U.S.

Source: Lindert 2016.

Comparison to Russian Political Waves

A recent analysis by Boris Romanov (2016) identifies four cycles of 36 years in Russian history. Each cycle starts with a radical departure from a rejected previous cycle, followed by the formation of a new regime to tackle the new challenges, and ends with internal and external conflicts. The first cycle starts in 1891 with the assassination of the reformer Tsar Alexander II whose policies led to an economic boom but ended with revolutions and wars (Russian-Japanese War and World War I). The second cycle started with the 1917 Revolution followed by rapid industrialization (while much of the world stagnated after the Great Depression) and ended with World War II and the beginning of the Cold War under Stalin. The third cycle started with the reforms after Stalin, leading to advanced technologies including space exploration but resulted in the Afghan War, the Chernobyl accident, and the falling oil prices, which contributed to ending the Soviet era. The fourth cycle started with the radical reforms in the 1990s under Yeltsin, which led to large uncertainties, followed by the stabilization under Putin. This cycle has not ended yet but Romanov predicted (in 2001) that beginning in about 2013 conflicts would begin to arise with another cycle starting about 2025. Recently Rozov (2018) detailed specifics about the dynamics of recent cycles, which incorporated similar events and time frames with previous analysis of Pantin and Lapkin (1998) (see Fig. 5).

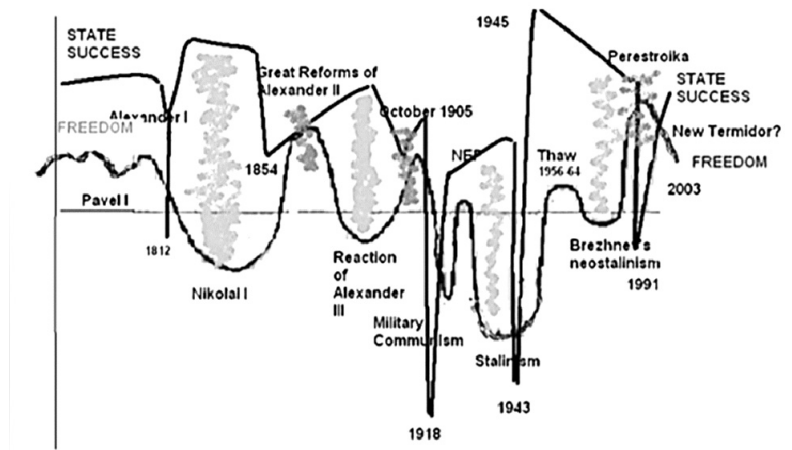


Fig. 5. Dynamics of 'freedom' and the 'state success' levels for the last 200 years in Russia. The lower smoother line is a fluctuation of reforms and counter-reforms according to Lapkin and Pantin (1998). The upper line presents the changes of the 'state success'

Source: Rozov 2018.

Combination of two of these 36-year cycles would be comparable to the 72-year period in U.S. presidential history. The rough comparisons would be Tsar Mikhail Romanov with the Pilgrim and Jamestown founders, Tsar Peter the Great with William Penn, Tsarina Catherine the Great with George Washington, Alexander II with Abraham Lincoln, Stalin with FDR, and Putin with whoever is identified in this current U.S. period.

Western Periods

The Western periods are difficult to determine. The traditional periods are the three stages of the Middle Ages from 500 to 1500 followed by the Modern Age. These periods are not equally split with the Low Middle Ages from 500 to 1000, the High Middle Ages from 1000 to 1350, and the Late Middle Ages from 1350–1500. The Modern Age can be further split many ways with the Age of Exploration, Reformation, Enlightenment, Agricultural Revolution, Industrial Revolutions, the Long 18th century, Napoleonic Wars, Louis XIV's Wars, World Wars, Cold War, and Information Age (Hart-Davis 2010).

An alternative is to split the same time frame into equal periods of time, *i.e.* 375 years from 500 to 2000. The latest period corresponds to the previous discussion of 375 years of development of the U.S. from the beginning of the New World Colonies. This duration (375 years) is used for three earlier periods in Western European history (see Fig. 6). Later in this paper, these periods will be compared with the periods of governing rulers in both Russia and China.

- 500–875: most of the traditional Low Middle Ages after the fall of the Roman Empire;
- 875–1250: the High Middle Ages covering the rise of Italian states, specifically Venice;
- 1250–1625: covering the Renaissance, Early Exploration and the Reformation;
- 1625–2000: covering the Scientific, Agricultural, and Industrial revolutions.

The Low Middle Ages (495–875) covers the period from the fall of the Roman Empire to the Viking invasions. The first migration phase ended with the death of Attila the Hun and the fall of Rome. Byzantium, the eastern Roman Empire, remained intact; however, the Justinian Plague of 571 killed much of the Byzantine population and affected some Western areas. Feudal systems developed after the diminished trade in the West. Islam flourished after Byzantine power diminished in the Middle East. The Islamic invasion of Western Europe was checked in 832 during the Battle of Tours. While education deteriorated, the spread of Christianity and monasteries created a mechanism for later commonality and revival of learning such as the reigns of Charlemagne (died in 814; the Treaty of Verdun in 843) and King Alfred the Great of England (871–899). King Alfred stemmed the tide of the Viking in the British Isles while in

the same time period the Viking Rollo accepted Normandy in exchange of protection of Paris (876).

The High Middle Ages (875–1250) saw a rebirth of trading and learning (Gimpel 1976) partly as a result of interactions with Islamic communities in Spain and the Arab world. Venice grew as it traded with Byzantium and supplied many goods for the Crusades during this period becoming one of the wealthiest European cities. Robert Lopez documented changes in trade, agriculture, industry, and banking in his book *The Commercial Revolution of the Middle Ages, 950–1350* (Lopez 1976). A similar leap in technology was realized in Europe between 900 and 1300 in water power, agriculture, mining, leading to the creation of a mechanical clock in the late 13th century (*Ibid.*). While the papacy started this period quite weak, it gained strength under Pope Leo IX and continued as the Crusades took place. The crusaders lost Jerusalem in 1244, and all crusades ended in 1291.

During the next period (1250–1625), the Renaissance took place starting in Florence with the early writers Dante Alighieri (1265–1321) and Petrarch (1304–1374). Increasing trade through Europe was facilitated by the introduction of the Hindu-Arabic numerals for bookkeeping in 1202 by Fibonacci (Lopez 1976). New social relationships were required to adjust to the loss of about $\frac{1}{3}$ of lives during the years of the Black Death in the middle of the 14th century. The economy rebounded and was included in the Commercial Revolution of the High Middle Ages with the formation of the Hansa League when Lubeck joined Hamburg concerning trading rights (Jordan 2004). Later, exploration, started by Portugal and Spain, and imported ideas led to greater confidence and growth as new mechanical devices were deployed in agriculture and trade. The religious unity of Europe slowly broke down over the period with multiple claims to the papacy and calls to end forms of corruption, which eventually led to the Reformation, which in turn led to many religious wars including the devastating Thirty Year War which was ended with the peace of Westphalia in 1648.

The Scientific and Industrial Revolutions (1625–2000) started with the combination of observation, mathematics, and theories with Kepler and Galileo in the early 17th century. The scientific progress was maintained during the Enlightenment through the organization of scientific societies and the dissemination of information through printed journals. The newly independent Dutch developed their economy during the Golden Age through stock markets and trade of bulk goods instead of mostly luxury goods. This economic leadership passed to England, which later merged with Scotland and Wales to form the United Kingdom, and was later surpassed by the United States (LePoire 2010). The scientific breakthroughs provided the sustained development of instruments, understanding, and applications. This positive feedback between science and applied technology opportunities led to major innovations such as the Watt

steam engine in about 1776. In the same year, Adam Smith formulated the fundamentals of economics, and the US began to test the ideals of enlightenment for independence.

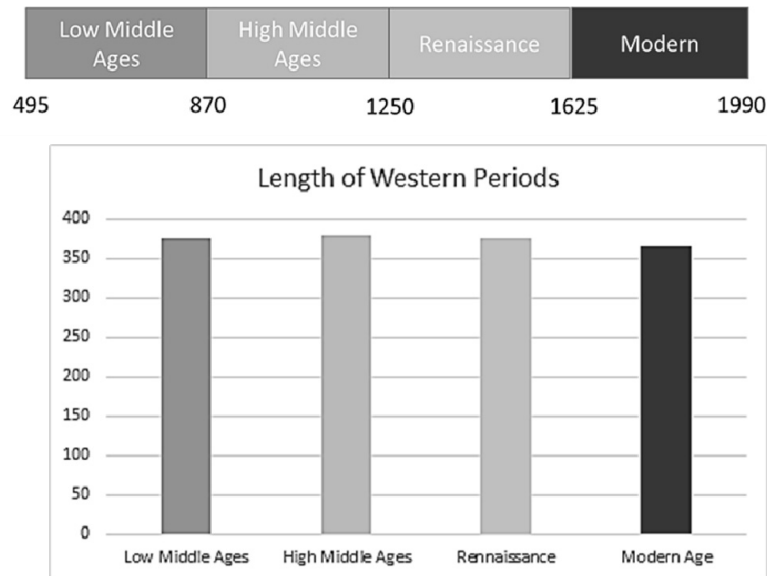


Fig. 6. Proposed equal-time periodization for Western Europe

Geographical and Conceptual Mirrors

Each of the three countries, the U.S., Russia, and China, has a unique history and geography, which can be compared and contrasted. Russia was originally a border European country, which came under a series of invasions. The relatively young U.S. was established as a European colony, which incorporated many waves of immigrants. China has the longest history of leadership and survival as a country but the technological and political leadership were punctuated by western influences. However, it seems to be on the way to incorporate both Eastern and Western methods into a new leadership position. First, the comparison is made between the U.S. and Russia in terms of geography and history. Then there are identified the pairs of government rulers that show the similar pattern of an approximately 375-year cycle.

Russia and the U.S. can be viewed as countries that developed on opposite sides of Europe. With some similar large influences from Europe, the countries have a number of similarities but the geography is mirrored with the major early population centers closer to Europe (*i.e.*, the American east coast and the Russian west including Moscow). This comparison is not new, the 19th-century

French historian, Alexis de Tocqueville, made comparisons and predictions of the countries' later rivalries in his 1835 book *Democracy in America*. This came true during the Cold War as they competed as superpowers, even though they were former allies during the Second World War fighting central Europe on their respective eastern and western fronts.

In some ways, the geography of the United States and Russia shows similarities when reflected (*i.e.*, east in one is west in the other) about Europe (Gilbert 2007). First, some large-scale comparisons are identified. Beyond the early population centers frontiers formed after crossing a set of north-south low-rising old mountain chains (the U.S. West across the Appalachians and Russian Siberia across the Urals). Both these frontiers had been originally settled by Asiatic tribes, which interacted with the explorers, trappers, mineral resources, and development. To the south of these populated regions are the citrus fruit-producing and recreational areas of Florida in the United States and Caucasus region between the Black and Caspian Seas in Russia. Both have great rivers draining the agricultural watersheds: the Mississippi, Ohio, and Missouri River Basin in the United States and the Volga, Don, and Dvina river system in Russia. Both these systems allow for internal transportation of goods. However, a major difference is that the rivers in Siberia run from south to north, which does not make them suitable for cross-country or oceanic transportation of goods and materials.

Russian Pairs

The history of Russia shows a slightly different pattern than Western Europe (Bushkovitch 2011; Channon and Hudson 1996; Gilbert 2007). The starting time is again at about the beginning of the 6th century (500) when the second phase of the migration began after the Attila the Hun died and the Huns retreated towards the East. This early period is the most difficult to define since the history of the various groups was not well documented and often not distinguished as one group might merge or be mentioned under different names. After the first 375-year period, however, the leadership is better delineated with the Varangians (Vikings), Byzantines, Mongols, Muscovy, Czars, and the USSR. Note that the center of the Slavic group is not stationary with early roots in the south during the times of Kievan Rus and then moved north and east towards Moscow. It is argued below that there were three 375-year periods from about 875 to the fall of the USSR. Each period consists of two sequential forms of government (*i.e.*, Varangians followed by Byzantium; Mongols followed by Muscovy; Czars followed by the USSR). The pattern of the partition of time between these pairs is of interest. The first government of the pairs seems to be more influenced by outside forces, for example, Vikings, Mongols, and Western Europe than the subsequent government of the pair.

Avar / Slavs (500–862)

After the fall of the Roman Empire, many tribes started moving being no longer contained by the Romans and pressured by groups coming from the East such as the Huns. The Huns under Attila reached the furthest penetration into Europe but turned back in 451. Subsequently Attila died leaving a power vacuum. The Huns retreated to the East and many settled in the Carpathians in the area of today's Hungary and were joined by another Asiatic Tatar group, the Avars, who were used by Byzantine emperor Justinian to keep the Slavs in check from Balkan incursions. The Byzantine Justinian plague weakened the Avars and the Slavs strengthened throughout the 7th century. The beginning of this period can be represented by the first named Slavic leader Daurerentius (Curta 2001), who in 578 declared independence from paying tribute to the Avars. Full independence in 605 was sustained through various incursions (*e.g.*, the Khazar Kingdom [650–750] until the Vikings, known as the Varangians came to trade or invade in the 9th century).

Again, this is the most difficult period to characterize since the history, names, and perspectives are uncertain. One current narrative (Channon and Hudson 1996) can be interpreted as the Slavs forming in the early 5th century under Avar/Byzantine influence for just over a century. This was followed by about 300 years of constant fighting to maintain independence. Using the unit of 75 years as a subunit, this is approximately one subunit of outside influence followed by four subunits of relative stability.

Vikings / Byzantines (862–1237)

A quick summary of this period focuses on the Rurik dynasty (Carlsson and Selin 2012), established by the Vikings' trading along the Russian Rivers which eventually expanded south, resulting in the formation of Kievan Rus. While some might consider this a single Kievan Rus dynastic period, here it is split based on the early growth with pagan influences from Rurik to Vladimir, and later feuding and semi-independent Northern principalities after the conversion to Christianity.

In the 9th century, the Vikings traded and settled in what is now northern Russia. Prince Rurik established the Rurik Dynasty in Novgorod in 862. His son Oleg expanded to protect the river trade over the next three decades. Trade along the Russian rivers extended from the Baltic down to the Black Sea and the Caspian Sea. The interaction of the Vikings from the north and the Byzantines from the south led to a beneficial exchange of trade and ideas in the development of Kievan Rus centered in the capital of Kiev. In 950, the Byzantine missionary brothers Cyril and Methodius brought the eastern orthodox religion from Constantinople (current-day Istanbul) and developed an alphabet to support the translation of the Bible. The good relationship with the Byzantines in the south continued with Oleg's great-grandson Vladimir marriage to the Em-

peror's sister in 988. He continued to expand the territory, which established Kievan Rus as the largest European federation at the time of his death in 1015. The Vikings were the most influential for about 153 years (two units) with the Byzantine Kievan Rus lasting until the Tatar invasion in 1237 (about 222 years, or three units).

Mongols / Muscovy (1237–1613)

A quick summary of this period is the influence of the Tatars for about 239 years from 1237 to Ivan III's refusal to pay tribute in 1476 and the defense of Moscow four years later. Muscovy expanded its territory under Ivan IV including the defeat of the Tatars in Kazan in 1552. After Ivan IV died in 1584, the successor was not identified and many foreign powers tried to claim the Russian throne. This 'Time of Troubles' was ended with the recognition of the first Romanov czar, Mikhail Romanov in 1613 (137 years after Ivan III refused to pay Tatar tribute).

The Tatars (Mongols) developed a flexible and mobile force that was able to conquer China and then move east across the central Asian steppes to take Kievan Rus cities. When their leader died in China, the Mongols stopped the advance before reaching Western Europe. The western Mongols, the Golden Horde, set up their main fort at Sarai (near present-day Kazan), which is east of Moscow at the confluence of Volga tributaries. At about the same time the Roman Catholic Church threatened from the west with Swede and Germanic forces with Teutonic knights in its tradition of the Holy Land crusades. The Russians feared these knights more than the Mongols since the Mongols were religiously tolerant and allowed the Russians self-rule, as long as the Russians paid an annual tribute to the Mongols. Alexander Nevsky defended the Northern part of Russia. He was appointed the Grand Prince of Kiev in 1252 for this defense but decided to pay tribute to the stronger Tatars. Under Ivan III, Muscovy gained power and territory which allowed the curtailment of tribute payments in 1476 and the later defense against the Tatar military four years later. Muscovy continued to expand with the takeover of the Tatars in Kazan in 1552 under Ivan IV. As mentioned above, after Ivan IV died in 1584, the 'Time of Troubles' followed. These turbulent times ended with the first Romanov czar, Mikhail Romanov in 1613. The Mongol era lasted about 239 years (three units) followed by the independence of Muscovy for 137 years (two units) to the beginning of the Romanov Dynasty.

Czars / Communism (1613–1991)

Although Peter the Great (the 17th century) and Catherine the Great (the 18th century) attempted to incorporate Western science, technology, and politi-

cal thought of the Enlightenment into Russian culture, the political structure remained based on the Czar, the boyar nobility, and the serfs. Russia's expansions resulted from wars with the Swedes, Ottomans, and native populations in Siberia. The Russian Empire became powerful enough to attract attention from Western European powers. From the French Revolution came a militaristic force led by Napoleon Bonaparte to challenge monarchies throughout Europe. After stunning victories, Napoleon arrived in Moscow after the Russians burned the city to deny the potential supplies for the French army to survive the winter of 1812.

About a century later in World War I, the Germans challenged the czar's regime against a modernized autocratic state. In a strange twist of fate, the Germans facilitated the conversion of Russia to Communism by allowing Vladimir Lenin to cross Germany from Switzerland to St. Petersburg to lead the revolution and lead Russian withdrawal from World War I. However, the Germans in their later attempt to conquer Russia in WWII were repelled by the Russians on many fronts with weather playing a crucial role again in the defense of Moscow, the siege of Leningrad, and the turning at Stalingrad. The Russians had massive civilian and military casualties during the war with losses of about 25 million.

Free market forces caught up with the communist ideology in the late 1980s. Again it is ironic that one of the reasons for the collapse was the free market crash of the price of oil in the mid-1980s – a major Russian export. If the oil price stayed as high as in the early 21st century, the USSR might have been able to sustain itself at least a while longer. In summary, the czars' dynasty lasted for about 300 years (four units) and was followed by a relatively short reign of communism (one unit).

This combination of Russian Dynasty and governmental eras is displayed in Figs 7 and 8 with each period described above being represented with light and dark gray bars. It is seen that the duration of the pairs is roughly 375 years with the first period (light gray) increasing with duration in subsequent pairings. These four pairings roughly follow the Western Europe periods of the Low Middle Ages; the High Middle Ages; the Renaissance; and the Modern Era (Scientific and Industrial Revolutions). This can be interpreted as the normal 375-year cycle (approximately five 75-year cycles with the way that it is presented). Surprisingly, this could also be interpreted with six 75-year cycles if the pairing is shifted (dark gray followed by light gray bars) as shown on the right side. This would have an approximate 450-year pairing cycle with Slavs/Vikings, Byzantines/Mongols, Muscovy/Czars, and Communism/new cycle.

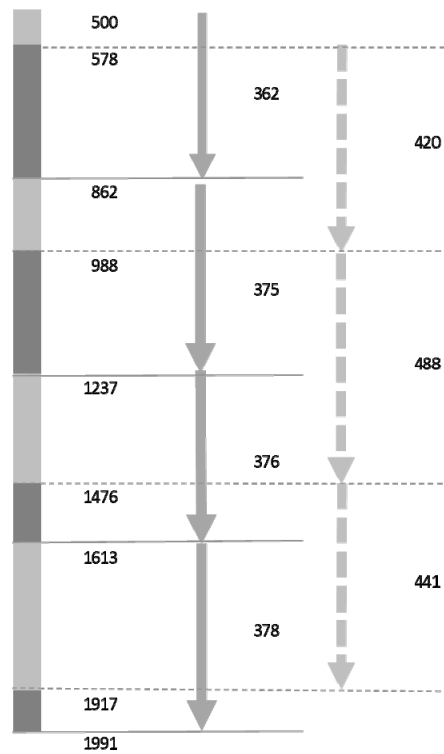


Fig. 7. Diagram of Russian government dynasties or styles as described in the paper. The far left shows the pairs in light and dark gray. The mid column shows the period with about 375-year duration. The right column shows the shifted set with a longer period of about 450 years

Note that this periodization is close but somewhat different from the traditional periods (Martin 2010) of Kievan Rus (850–1240), Appanage Rus (1240–1480), Muscovite Rus (1480–1721), Imperial Russia (1721–1917), and Soviet Russia (1917–1991) (*Ibid.*). A period of early Slav formation was added here but it is realized that the dates and events of this era are quite uncertain. Here the Kievan Rus period is divided into two with the conversion to Christianity being the dividing time. The traditional Appanage Rus is identified here as the similar Mongol Rule period. The traditional Muscovite era extends about 100 years beyond the Muscovy era defined here. This paper uses the beginning of the Romanov Dynasty (1613) whereas the traditional era ends with the latter part of Peter the Great's reign when the traditional Imperial Russia begins.

Peter Turchin and Sergey Nefedov (2009) considered in detail dynamics of secular cycles in the Muscovy (1460–1620) and the Romanov periods (1620–1922). The beginning and end dates are slightly different. The duration of both these periods in their analysis is 462 years whereas here (and in Fig. 8) they have a combined length of 441 years.

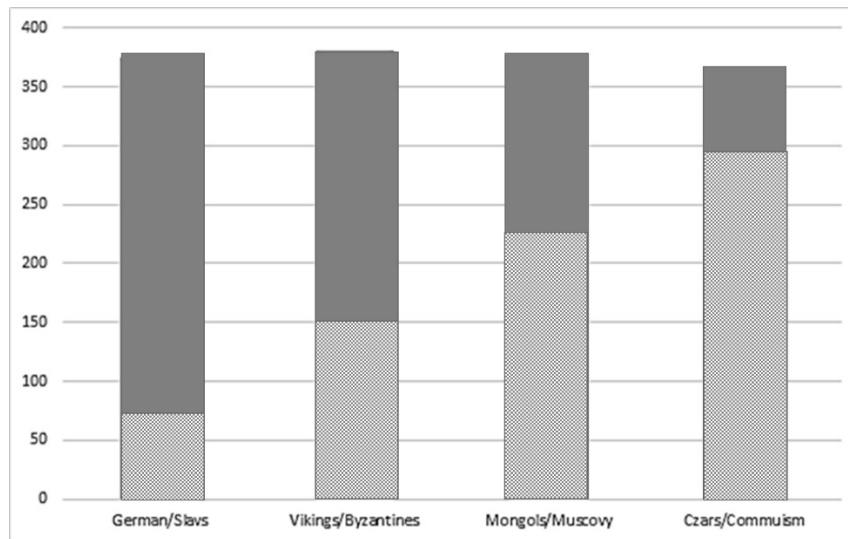


Fig. 8. The left column bars of Fig. 7 showing the pairing as described in the text split by period to be compared with the similar figure for the West (see Fig. 6) and China (see Fig. 9)

China Pairs

Another comparison can be made between China and the U.S. China is currently a relatively homogenous Han population, with authoritarian government, a creditor export economy, and relatively non-religious outlook in a country that has been thriving for thousands of years. The U.S. is opposite in many ways – a mixture of people from throughout the world, with a democratic government, debtor economy, strong religious ties, and a relatively young history of less than 250 years.

Ancient Chinese dynasties were roughly contemporaneous from the end of the Old Egyptian Kingdom to the early part of the Ptolemaic Kingdom. The Xia (from 2200 BCE), the Shang (from 1750 BCE), and the two Zhou Dynasties of the Western Zhou (from 1045 BCE) and the Eastern Zhou (770 BCE) are not included in this analysis. Detailed descriptions of the patterns within dynasties can be found elsewhere (*e.g.*, Elvin 1973; Mielants 2002). One hypothesis outlined by Elvin is that throughout the cycles agricultural technologies advanced leading to the relatively stable large political unit with growing population.

However, this continuous advance led to a high-level equilibrium trap where the productivity was as high as possible for an agrarian society but the population growth led to few available resources to move to the next level of technology.

Qin / Han

The analysis in this chapter begins with the first unified dynasty (Ropp 2010) founded by Qin Shihuangdi in 221 BCE. However, this dynasty was relatively short (15 years) when the Han established their dynasty that lasted 426 years (206 BCE to 220). This was roughly simultaneous with the height of Roman power in the West (Second Punic War to the end of the Pax Romana).

Three Kingdoms / Jin / North and South Dynasties

This was followed by a period of 369 years (220–589) of disunity with eras known as the Three Kingdoms, the Jin Dynasty and the North and South Kingdoms. This corresponds to the end of the Roman Empire and the Barbarian Invasions.

Sui / Tang

The first era similar to those explored above in the Western European and Russian histories begin with the reunification of China again during the short-lived Sui dynasty (581–618) followed by the Tang dynasty (618–907). The end of the Tang is about the same time as the check of the Viking invasions by King Alfred of England and the settlement of Rollo in Normandy.

Five Dynasties and Ten Kingdoms / Song

China was once again divided during the Five Dynasties and Ten Kingdoms era (907–960) but was then unified with prosperous and creative times of the Song (960–1279). The Song is at about the same time as the High Middle Ages in Europe.

Yuan / Ming

The short Yuan foreign rule (1279–1368) was followed by the Ming (1368–1644). The Ming supported exploratory ocean expeditions by Zheng He in the early 15th century but was later focused on internal issues. The contagious Black Death plague came from the Mongols, which caused the death of a large fraction of the population in both China and Europe. The Ming were contemporaneous with the European Habsburgs, Renaissance, and Reformation periods.

Qing / British Influence / Civil War / Communism

The last dynasty, the Qing (or Manchu) started in 1644 and was quite stable through the 18th century. Europeans pushed more trade with China for tea, silk, and porcelain. Much of the new world silver ended up in China to pay for these. In the early 19th century, the English discovered a new trade item that grew in their Indian colony – opium. While the Chinese resisted the trade

through laws, the English fought to maintain the trade with the Opium Wars in the mid-19th century. After a long decline, the Qing fell in 1920 with the advent of civil war, followed by Japanese invasion during World War II, and the communist victory in 1949. In the early 1980s the Chinese economy was allowed to embark on a semi-free market model which led to rapid economic growth.

These groups of governing dynasties and eras are shown in the following Fig. 9. It is seen that the six groups had durations averaging about 370 years with the first five having a short period followed by a longer dynasty. The last four have an average duration of about 360 years, a bit shorter than that seen in Russia and Western Europe. The last grouping is complicated by the heavy influence of the West and introduction of modern technology.

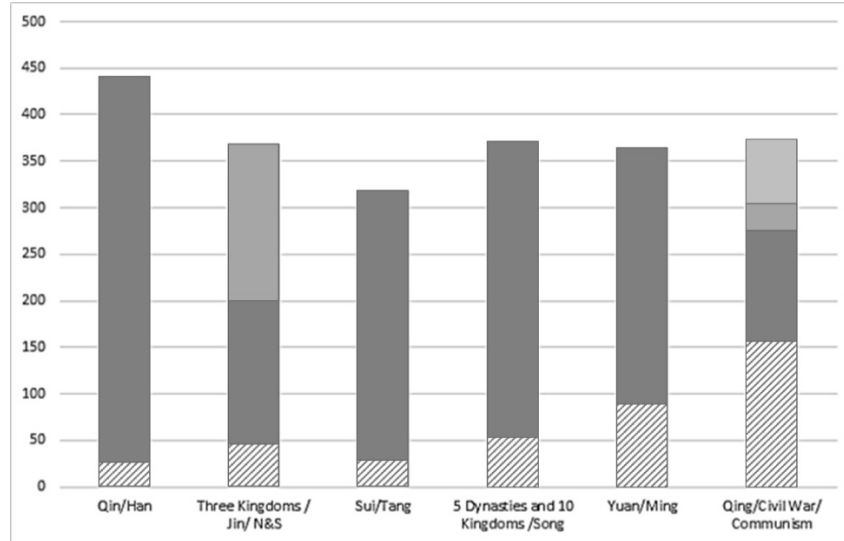


Fig. 9. Groupings of Chinese Dynasties and governments. The earliest is on the lower left. The latest is the 20th century communist period in the upper right. Four of these six periods have pairs. The other two (the period after the Han and the most recent period) are formed from three each. In the far right column, the Qing period is shown divided at the bottom with the dark gray bar showing the period of English influence during the 19th century

Discussion

A summary of the three regions' four periods covering roughly the last 1,500 years are compiled in Fig. 10. It shows the West and Russia with about the same period of 375 years but China's is shorter at about 360 years. The ex-

pansion of the first (light gray) versus the second (dark gray) government form is seen in the Russian sequence.

As discussed before, cyclical behaviors of populations of predators (foxes) and prey (rabbits) (Berryman 1992; Turchin 2003) can occur naturally if the system starts out of balance. For example, if the foxes outnumber the rabbits, the fox population would at first decrease while more rabbits are born. The rabbits would overshoot the equilibrium population before the fox population would recover to its initial point. In this way a predator-prey system cycles throughout time with the duration of one cycle equal to 2π divided by the geometric average of the rabbit birth rate and the fox death rate. (Note that this is not the overall population growth rate. The peak population among different cycles can be the same.) If there are two competing groups with a birth rate and death rate for a sustained population with lifespan of 60 years (*i.e.*, the birth rate = death rate = $1/60$ per year), then the oscillation period would be 376 years. Turchin (2003) used an example of a lifespan of 50 years leading to a period of 314 years. This is very close to the oscillation time between governing periods in the West, Russia, and China.

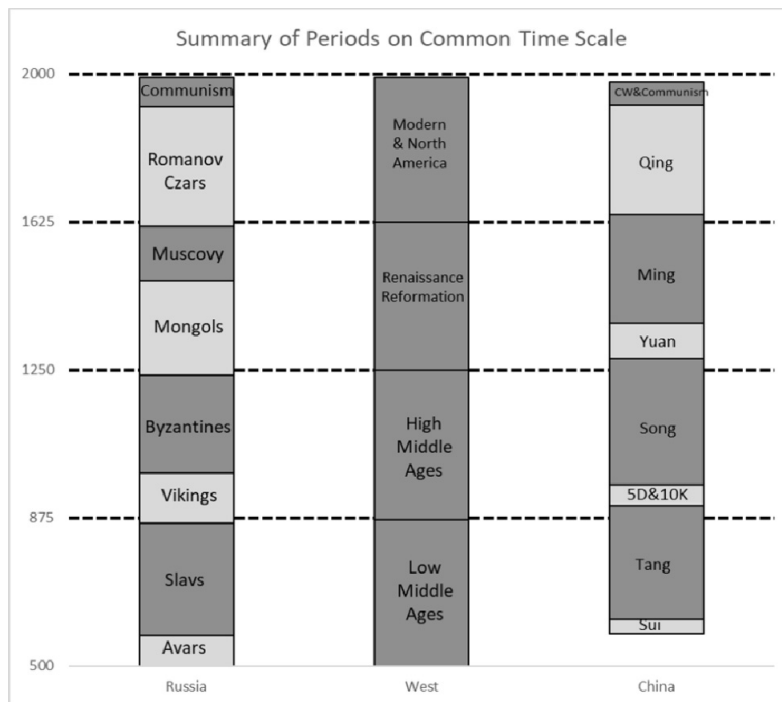


Fig. 10. A summary by combining and labeling Figs 2, 4, and 5 by stacking the sequential periods for Russia, the West, and China

The shift in the 375-year period split between the early and later government forms in Russian history can be modeled as the beating of two separate frequencies instead of just one. This second frequency was identified above by starting shifting the pairs by one. An example of a pair of beating frequencies is demonstrated in Fig. 11 that reproduces the pattern seen in the Russian sequence. The black arrows along the time (x) axis correspond to the first form of government in the pair presented in Fig. 8. The black dashed line is then the second form of the pair. The dashed vertical lines separate the 375-year periods (the time axis is in units of 75-year blocks). It is seen that the first of the pair over the next periods increases in duration. The black curve is generated by the product of two sine waves with slightly different frequencies – one with a period of ten units and the other with a period of twelve units.

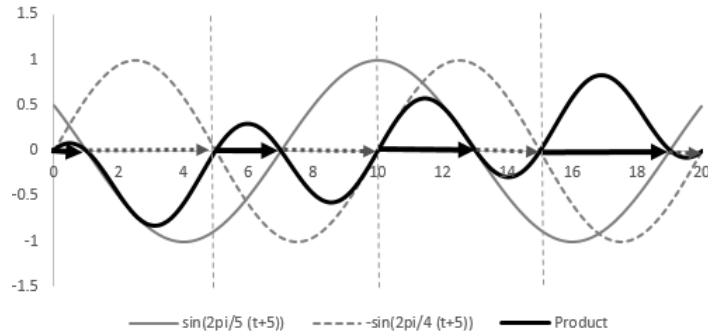


Fig. 11. Demonstration of how the substructure of the Russian pairing might show the two separate frequencies (solid and dashed gray lines) by considering the product (black) of two sinusoids

Summary

This paper explored cycles within countries' ruling dynamics. This included the cycles in the U.S. of the tacking in presidential party every eight years during post-World War II leadership. This post-WWII period was a continuation of 72-year cycles since the country's inception with each cycle addressing development questions. Each of the three cycles had a leading presidential figure and a secondary administration. The 72-year US cycles fit in with the longer 375-year cycles of Western development.

This Western European Cycle was compared to dynasties in Russia, and China with similar periods of about 375 years identified, although details of what happened in those periods differed. Russia and China had two major dyn-

asties within each 375-year period. In Russia, the relative durations of the two dynasties changed with time. In China there seemed to be one major dynasty along with a relatively shorter period of transition, which might include a chaotic state.

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