

# Economic Collapse as Deinstitutionalization Process: Evidence and Theory from the Fall of Rome

---

## **Abstract:**

*We use a sample of historical explanations of the fall of the Roman Empire to sketch a process theory in which deinstitutionalization is a central element in the causal chain resulting in the collapse of an entire economic system. Our thought experiment reveals the crucial importance of institutions and enforcement mechanisms in maintaining the necessary level of trade and commerce to sustain public costs needed to manage external shocks. Complementing this insight, we highlight the role of population decline and the negative effects of internal and external shocks to the economy.*

Keywords: Economic collapse, economic history, Rome, strategy, new institutional economics, strategy.

## Introduction

For the last thousand years, Western Europe has been built on constant economic growth. At first, this growth was slow and sensitive to slowdowns and reverse development, but since the early 19<sup>th</sup> century, it has been extremely dramatic (Fogel, 2004). Economic growth has also affected the ways in which we understand and theorize economic phenomena, such as economic growth, organizations, industrial production, and the distribution of welfare (McCloskey, 2006). Thus, we have an array of solutions and predictions regarding how to accelerate and manage growth in firms (Chandler, 1977; Penrose, 1995), industries (Geroski, 1990), and national economies (Acemoglu, 2008). However, the amount of research on economic growth is reflected in the dearth of studies on economic collapses. Especially, few studies explain or predict economic collapses as deinstitutionalization processes. We hope to make progress towards this type of theory building on premises from new institutional economics (North and Thomas, 1970; North, 1990; Williamson, 2000).

We build our theorizing on the literature concerning the long-term collapse of a sophisticated economic system: Rome in late antiquity. Despite scattered empirical evidence, the latest empirical research (Scheidel, Morris, and Saller, 2007; Ward-Perkins, 2005) establishes a clear overall picture. In AD 250, the Roman Empire was prosperous and had a complex economic system based on large-scale trade, specialized production (Temin, 2001; Geraghty, 2007), and a stable institutional framework and enforcement system (North, 1990). After the overthrow of the last emperor in 476 and before the re-emergence of large-scale European commerce (North and Thomas, 1970), the western regions of the former Roman Empire lost population, commerce became marginalized and localized, engineering skills deteriorated, and institutional stability was shattered (Ward-Perkins, 2006). Although there were dramatic regional differences in the severity of the downturn (McCormick, 2001; Demandt, 2007) and

the centuries also included some better periods, the picture that emerges is of the near destruction and rebuilding of a unified economic system in the western parts of the Empire.

We conduct a thought experiment that combines, categorizes, and rearranges our knowledge of the economic history of the collapse of the Roman Empire. We use an exhaustive collection of literature including hundreds of causal claims concerning the collapse of Rome (see Appendix). By reinterpreting this sample of causal claims, we create a theoretical model that builds on historical knowledge and insights from institutional theory (Williamson, 2000; North, 1990). The model expands current understanding by sketching the process of economic collapse in a way that has potentially predictive power and that details the mechanisms and processes preceding the collapse of an economic system.

We contribute to the heterogeneous literature on economic collapse by offering a deinstitutionalization model that connects to long-term institutional explanations and is focused on the causal chain that ends with collapse. Our model sketches a causal process that identifies the dynamics among several factors. That said, while the literature on the collapse of the Roman Empire has relied on every possible explanatory category, it has failed to offer thought experiments that could educate economists or social scientists interested in the nature and processes of extreme and extended deinstitutionalization (cf. Oliver, 1992) or strategy scholars interested in the management of collapse and decline processes. Our model may be used for simulations and counterfactual modelling, thus becoming a starting point for an enhanced understanding of deinstitutionalization and economic collapses.

Finally, it is important to remember that we do not study or contribute to Roman economic history in the traditional sense. The most recent historical and archeological studies on Roman economic history emphasize the richness and complexity of historical developments (e.g., Scheidel, Morris, and Saller, 2007; Harper, 2016) and are, by all accounts, a solid

scientific discourse (Christ, 1970; Demandt, 1984). Our thought experiment may enrich and clarify this discourse, although that is not our primary target as we use *the literature on* Roman economic history and not *the history of* Rome.

## Roman Empire in Research Literature

Compared to other examples (e.g., Ober, 2015; Peterson & Haug 2005), the collapse of the Roman Empire has attracted substantial attention from researchers ranging from Petrarch and Machiavelli to Montesquieu and then to modern historians. The first precise and scientific treatment of the subject was Edward Gibbon's six-volume *The History of the Decline and Fall of the Roman Empire*, published from 1776 to 1789. As the main factor for the decline, Gibbon cited the traditional concept of "moral decadence," which depleted the will and capability to defend the Roman way of life and the borders of the state. He emphasized the significance of the Christianization of the Empire in comparison to older Roman values that he identified as having been the glue that held the Empire together. Furthermore, Gibbon was the person who dated the death of the Empire to the year 476 when the Germanic chief Odoacer overthrew the last Western Roman emperor, Romulus Augustulus. This marked the end of the Roman Empire as a sovereign governmental entity and – more importantly – the end of its civilization, culture, art and philosophy, which "fell into the darkness of the middle ages." (cf. also Le Beau 1752-1815)

The 19<sup>th</sup> century brought more detailed descriptions of the evolution of the Roman Empire from the perspectives of the event's history, politics, government, legal system and cultural development (Mommsen 1854-56; Weber, 1891). These new perspectives questioned Gibbon's idea of moral decadence as main factor in the decline. The moral shift could have been a factor in the process, but new approaches pictured a more complex phenomenon that was neither inevitable nor sudden. The decline emerged from several cyclical factors, and this

development has established an enduring foundation that understands the complexity of the process (Bury 1889). For example, the dissolution of the tax base and its resources led to political instability and external invasions (Ward-Perkins 2000; McMullen 1988), or external factors such as the simultaneous wars with Persian Sassanids in the east and the pressure of the Germanic people in the west made it impossible for Rome to prevent its dissolution (Heather 2005; Ferrill 1986; Thompson 1982).

“The fall” of the Empire is itself an idea that has not had unanimous support. Since 1960s, the concept of the “Late Roman Empire” has framed the Roman world as a social and cultural entity that faced crises and changes but did not disappear (Ward-Perkins 2005, 172-184). This “Pirenne thesis” has been an influential starting point for the problematization of the époque between antiquity and the middle ages since 1920s. The theory sees the evolution of the Roman world as a series of small changes that led from the world of antiquity to the middle ages without a collapse. Germanic kingdoms that became provinces of the Empire were thoroughly Romanized, and Roman culture and traditions continued to thrive in Christianized forms. Hence, medieval states such as the Frankish Empire are simply a continuum of the Roman Empire (Pirenne 1927).

The Pirenne thesis was later extended to perspectives that included social relations between the Roman and Germanic peoples (e.g., Goffard 1989; Thompson 1982; Mathisen 1993). Furthermore, a new historical period, “late antiquity” (Brown 1971), was designated to describe the age that began around third century and lasted to the eighth. The idea of “decay” was eradicated, and instead, more neutral approaches of transformation, change and transition were emphasized in which the Roman Empire did not fall or collapse but rather faced a slow metamorphosis into a different, but not necessarily inferior, institutional system (see also, e.g., Potter 2004). This assumption has characterized modern Roman studies ever since. Therefore, the question of whether Rome fell is still a central piece in the puzzle of Roman

studies. However, most historians have endorsed at least the theory of a partial decline (e.g., Swain & Edwards 2003; Jones 1964; Finley 1973; Musset 1965; Duncan-Jones 1990; Cameron 1993; Liebeschuetz 2006; Brown 1992; Cameron et al. 2000; McMullen 1990).

The Germanic tribes' attacks on and immigration into provinces of the Western Empire and the inability of the central government and army to defend the borders against these invading "barbarians" are still in most studied main factors explaining why the Roman Empire disappeared on the eve of the sixth century. Therefore, scholars have tried using different perspectives to understand how Roman territory was overrun by much smaller and scattered Germanic groups (e.g., Potter 2004; Lenski 2002; Grant 1990; Ferrill 1986; Walbank 1969; Salmon 1963; Haywood 1958). In older studies, the concept of race plays a central role, mirroring the race theories of late 19th century onward. These theories indicate that the intermingling of other ethnic groups with the Romans weakened the whole empire. This has sometimes been attributed to slaves and settlers from the Middle East (e.g., Frank 1916; Vogt 1945) and Germanic people (Haywood 1958). However, from the late 19<sup>th</sup> century onward, a deeper analysis addressing changes in demographic structures and relations between different social groups has criticized these racial theorems and widened our understanding of the general development of later the Roman Empire (e.g., Heather 2005; Ward-Perkins 2005; Moorhead 2000; Thompson 1982).

From a broader perspective, the Empire was not negatively impacted by racial intermixing but more by cultural changes that other groups brought to Roman society. In this case, a factor such as the Germanification of the Roman army could be a reason behind the disintegration of its structure and morale, rendering it incapable to defending the Empire (e.g., Salmon 1963). However, some modern scholars have challenged the idea of fifth-century barbarian invasions and taken a rather positive view of the role of these tribes in shaping modern Europe (Musset, 1975; Pohl 1997; Bowersock 2000). Some have questioned

the very idea of invasions, stating that the accommodation of Germanic people was important to upholding Roman power and defending the borders (Goffard 1980).

Wars between Romans and newcomers were common, but they primarily resulted in mutual arrangements and ultimately the incorporation of the barbarians into the fabric of the West. However, most scholars tend to study the decline of the Western Empire, which is a natural approach given that the Eastern Empire, which became the Byzantine Empire, remained more prosperous and stable thorough the centuries. Perhaps these western researchers are more interested in “the making of Europe.” (Liebeschuez 2006, 644-645) In fact, the Eastern Empire survived until the Ottoman conquest of Constantinople in 1453; the Byzantine Empire considered itself to be descended directly from the Roman Empire, not as one successor state among many. No doubt, a separation of government between the Eastern and Western Empires under Constantine (AD 306-337) began the divergence of the two governmental systems, eroding the central authority and its capability for action (Jones 1966; Honoré 2004; Walbank 1962; Haywood 1958).

One specific research stream has relied on socioeconomic theories. These theories include Marxism and socialist concepts, theories of class struggle and capitalism (Rostovtzeff 1926) and changes in the social structure of the elites as reasons for unfavorable changes in social structure, bureaucracy, and class distinctions (Walbank, 1969; McMullen 1988). There is a consensus that the collapse was a prolonged process with uneven effects on Romans themselves. Most likely, the people at the time would not have known that their Empire was in decline. Additionally, the collapse was most pronounced in the economy and trade. Culturally and even in terms of Roman law, the juncture was less severe than in the economy where activities changed from sophisticated trade and exchange to local economic systems (McCormick, 2000). Finally, the impact of the fall was more severe in some regions than others. Some locations regressed dramatically (Ward-Perkins, 2005), while others, especially

in Italy and France, did not. Studying and theorizing the collapse of Roman Empire therefore means focusing on system-level functionality. In the next section, we assess the theoretical understanding of these processes and their potential mechanisms.

## Theoretical Background and Motivation

Economic collapses<sup>1</sup> have received a fair amount of attention from historians, social scientists, biologists, and “doomsday predictors.” (Tainter 1988; Yoffee 1988) The corpus falls into three categories. First, in the 20th century, scholars formulated several grand theories (Spengler 1918; Toynbee 1939; Sorokin 1950; 1957; Coulborn 1954; 1966; Kennedy, 1987) to explain and predict the cultural decline of civilizations. Second, new advances in social sciences and archaeological methods increased the empirical body of research on collapsed empires (Eisenstadt 1967; 1969; Cipolla 1970; Gunderson 1976; Renfrew 1978; Kaufman 1988; Yoffee & Cowgill 1988). Finally, increased concerns about climate change and environmental degradation have been reflected in contemporary collapse studies (Meadows et al. 1972; Catton 1980; Ponting 1992; Diamond 2005), stressing environmental change as a key factor in the collapse of ancient civilizations (McGovern 1988; Diamond 1994; 2005; Kammen et al. 1994; Redman 1999; Lima 2014; Yeakel et al. 2014; Wiener 2014). These studies suggest that changing environmental conditions affect the human population and act as an external cause of decline (Yu et al. 2000; Hunt 2005; Gallet et al. 2006; Zhang et al. 2007; 2010; Fischer-Kowalski 2009; McMichael 2012; Medina-Elizalde et al. 2012). Researchers have also suggested that the human impact on the

---

<sup>1</sup> We follow Yoffee and Cowgill’s (1988) conceptual definitions of *decline* and *collapse*. First, *collapses of civilizations* that indicate a sudden or rapid disappearance of distinct cultural entities are scarce. Dramatic societal transformations are usually better understood in terms of *political fragmentation*, which leads to the creation of new, smaller political units that may preserve selected traditions and institutions from the previous culture. A *breakdown of society*, often understood as a classic case of *collapse*, is not synonymous with a collapse of civilization, as the cultural traditions of civilization are not customarily restricted to a single state and may be practiced in other societies within the sphere of influence.

ecological sphere may trigger environmental changes that either contribute to or cause a decline in societies (Brander & Taylor 1998; Redman 1999; 2004; Costanza et al. 2007).

Most of the literature on collapsing societies focuses on specific geographical and historical contexts. Alongside the decline of the Roman Empire, the collapse of the Mayan Empire in 600-1100 (Thompson 1954; Sabloff 1971; Culbert 1973; 1977; Sharer 1977; Crist & Paganini 1980; Hamblin & Pitcher 1980; Richardson 2000; Webster 2002; Lucero 2002; Peterson & Haug 2005; Douglas et al. 2015), the disappearance of the Easter Island civilization (Van Tilburg 1994; Brander & Taylor 1998; Flenley & Bahn 2003; Bologna & Flores 2008), and the evolution of ancient Greece (Ober, 2015) are probably the best known cases of these collapses in scholarly literature. Several studies from recent decades (e.g., Cowgill 1988; Tainter 1988; Diamond 2005) argue that the collapse of civilizations is a recurrent phenomenon with distinctive structural features that may contribute to the disintegration of societal entities and thus allow predictive theorizing.

A fundamental question in the collapse literature has been whether the breakdown and fall of society can be explained by causal factors or whether it is only explainable in more complex causal terms. For example, the Mayan Empire was unable to cope with recurrent droughts (Richardson 2000; Medina-Elizalde et al. 2012; Douglas et al. 2015), and the people of Easter Island suffered the dramatic effects of deforestation (Ponting 2007; Bologna & Flores 2008). Changes in climate and water level have caused consecutive periods of decline in the Yangtze Delta area (Yu et al. 2000; Zhang 2007; 2010; Wang et al. 2005; 2010). These factors of decline triggered and exacerbated social instability and disintegration that in turn contributed to these collapses but were not solely their causes. Additionally, ultimate causes of these declines may exist that are not always apparent, especially in the cases of collapse that lack historical data or seem to derive from a variety of sources that are best understood as systems of complex dynamics (Tainter 1988; Turchin 2003).

Several recent contributions have attempted to explain the framework and dynamics of civilization collapse by using mathematical and economic modelling in evaluating importance of primary and secondary causes of decline (Turchin 2003; Reuveny 2012; Motesharrei et al. 2014; Pande et al. 2014). These studies follow a longer tradition in economic history that seeks economic and rational explanations for radical transformations. Economists and economic historians have typically focused on economic collapses as phases of economic development (e.g., North and Thomas, 1970). Therefore, scholars have studied financial crises (Kindleberger and Aliber, 1978/2011) and the decline of countries and regions (Elbaum, Lazonick and Best, 1987; Rapp, 1976) extensively, but they have given considerably less attention to studying these total collapses of economic systems, such as that of the Roman Empire and its aftermath.

One avenue of research is especially valuable in the explanation of economic collapses. This specific stream of literature focuses on the role of institutions in the evolution of economic systems (cf. Libecap, 1997; Wallis, 2016). In particular, we continue the work of North and Thomas (1970; 1973), who theorize explaining long-term radical transformations of economic systems. Their pioneering work and more recent advancement in institutional theory (e.g., Allen, 2011; Williamson, 2000) guide us in seeking rationalized explanations of economic behavior. These behaviors (e.g., decisions concerning the nature of agricultural production) are determined partly by higher order contractual arrangements and formal and informal institutions (North, 1990). However, these same behaviors can also be the engine of institutional change. Accordingly, seeing an economic collapse from the perspective of the accompanying deinstitutionalization processes<sup>2</sup> requires us to focus on both the economic

---

<sup>2</sup> By deinstitutionalization, we refer to system-level transformation processes that (a) connote multiple economic regions and (b) potentially occur over extended periods of time. While earlier sociologically oriented deinstitutionalization literature (e.g. Davis, Diekmann, & Tinsley, 1994; May, Rayter, & Ledgerwood, 2016; Oliver, 1992) is relevant for us in the form of ideas, they are also distinctive in their focus on more fine-grained analytical units and operate with a different set of causal mechanisms and time scales.

context in which the actors are embedded and the functionality of the broader institutional and contractual system.

The model of North and Thomas (1970) begins with demographic fundamentals. All economic systems face resource constraints that are hard to manage, especially without technological advances (Goldstone, 2002). The perspective adopted by North and Thomas emphasizes the limitations in carrying capacity of agricultural production and the consequent pressures toward population growth. Thus, the premise is that population size affects both the number and magnitude of economic transactions as well as the availability and price of labor. While later empirical research on economic growth is less unanimous regarding the role of population size on economic growth in premodern societies (e.g. Harper, 2016), we assume the role of population to be of the utmost importance, as both the productivity and the size of markets were functions of population size in the pre-industrial era (Goldstone, 2002).

The second element in the North and Thomas (1970) framework and later in the canon of institutional literature (for an overview, see Williamson, 2000) is the necessity of predictable and functioning institutions (e.g., Langlois, 1986; Allen, 2005). Institutions are needed because each economic transaction is a risk. Safeguarding against these risks is costly for the reasons explicated in the research on transaction cost economics (Williamson, 1991); this is especially true concerning the costs of monitoring and searching. The role of institutions – formal and informal – is to create a framework that helps to lower transaction costs and subsequently increase the number and volume of transactions. In other words, large-scale economies without a sufficient institutional framework would logically fail or at least the lack of such framework would prevent economic growth (e.g. Acemoglu, 2008). The literature also demonstrates the evolutionary nature of institutions: institutional systems emerge and develop as a function of power positions and interests in a society. These same dynamics may render the system obsolete, resulting in the erosion and demise of institutional systems (cf.

Argyres and Liebeskind, 1999). Institutionalists emphasize the role of external system shocks (e.g., Mantzavinos, North and Shariq, 2004; Robertson and Langlois, 1994) or “critical junctures” (Pierson, 2000) as important mechanisms in the transformation of institutions.

Finally, the institutional literature emphasizes the importance of administration and enforcement mechanisms. The underlying logic of these mechanisms is that a third party must monitor and secure contacts between economic actors. In practice, the enforcement role belongs to governments and other public sector organizations (North, 1990; Greif, Milgrom and Weingast, 1994) or to some less formal communities (Leeson, 2007). In the latter case, the economic transactions are smaller, local and, as indicated by North and Thomas (1970: 45), enforced by landlords. The strength and functionality of the enforcement mechanism is obviously at stake during dramatic transformations, and it is assumed that most economic collapses also mean a shift of power in this respect.

## Analysis

In the following, we focus on the assumed mechanisms of institutional change and economic collapse in the context of Roman history: Commerce and trade address the transactional base of the Roman economy, demography addresses the resources and economic potential, and administration, institutions and politics address the institutional framework and enforcement mechanisms influencing the costs of transacting.

### Commerce and Trade

The consensus in the literature (Rostovtzeff 1957; Vogt 1965; Lot 1966; Walbank 1969; Jones 1974; Hopkins 1980; Ward-Perkins, 2005; Scheidel et al. 2007) is that trade and commerce in the late Roman Empire declined in terms of both quality and quantity. The volume of trade and consumption declined from early Roman times (Rostovtzeff 1957;

Mazzarino 1966) and finally marginalized and localized (Antonio 1979) because of lost regions in Africa and Spain as well as deurbanization and a shift to the natural economy in which bilateral commerce and trade occurred between monasteries and farmhouses (Haywood 1958; Walbank 1962; McCormick, 2000). The breakdown of industrial and commercial ties between cities and social groups contributed significantly to economic decentralization, circumscribing market areas and limiting consumption while accelerating the process of feudalization in the western parts of the Empire (Walbank 1962; MacMullen 1988).

In terms of quality, restrictions in internal markets, the small role of commerce in the national economy and structural weaknesses contributed to the weakening of trade and commerce in the Roman Empire (Lot 1966; Walbank 1962; 1969; Antonio 1979; Wickham 1984).

Similarly, the dynamics of the quantitative decline in trade originated from numerous factors. Some of these factors were present throughout the imperial era and others only during specific periods. Constant factors, such as costly transportation (Westermann 1915; Jones 1974), the upkeep of non-productive classes of society (Boak 1955; Duncan-Jones 2004) and the lack of purchasing power among the lower classes (Rostovtzeff 1957; Boak 1955), potentially impeded consumption. Among the periodic factors were high taxation (Lot 1966; Walbank 1969) and the decrease of private capital (Boak 1955; Vogt 1965; Lot 1966; Mazzarino 1966; Hopkins 1980; MacMullen 1988), especially after frequent waves of inflation following the mid-third century barbarian invasions (Rostovtzeff 1957; Haywood 1958; Vogt 1965) and piracy (Rostovtzeff 1957), as well as increased custom restrictions, increased external competition and the crisis of the slave market (Mazzarino 1966; Walbank 1962; 1969).

The Roman market was restricted by social factors originating from class differences (Walbank 1962), the growing self-sufficiency of estates (Westermann 1915; 1962; Walbank

1962; 1969; Vogt 1965; Antonio 1979) and the societal divisions of the population (Walbank 1962). The low rate of economic activity among the upper classes (Rostovtzeff 1957; Vogt 1965; Lot 1966) and the weak governmental support for organized industries (Westermann 1915; Vogt 1965; Hopkins 1980) meant that commerce had only a minor role in the economy and society. The weakness of capitalism (Lot 1966) and the decreased demand were additional impediments to the Roman trading system.

The decline of the commercial system had political, economic and societal consequences. Some of the outcomes of the declining trading system, such as decreased demand and inflation, were cyclical and exacerbated the problems that plagued Roman commercial activities. The decline of trade resulted in industrial and market decline, economic decentralization (Walbank 1962), the reintroduction of primitive trade and production methods (Rostovtzeff 1957; Lot 1966; Walbank 1969) and a smaller number of agricultural producers (Boak 1955). Asian trade became tilted toward imports, and large gold reserves were thereby transferred to Eastern and Asian countries in the third century (Bury 1958). This decline in trade arguably reduced incentives to innovate and increase productivity (Boak 1955); it also caused difficulties in food production (Westermann 1915; Antonio 1979), causing external markets to become more important. Correspondingly, the qualitative decline of the trade system diminished the quantitative volume of trade. This radical transformation and de facto collapse, especially of long-distance trade and the number of economic transactions (Ward-Perkins, 2005), was elemental in the fall of Imperial Rome's economic system.

## Demography

A declining population and its causes have been a popular topic in the literature. We can mention classic causes, such as lead pipes (Gilfillan 1965), the erosion of farmland and the disappearance of the forests (Diamond 2005), climate change (Huntington 1965) and

epidemics (McNeill 1976). The so-called Antonin plague of AD 165-180 has been associated with the permanent deterioration of the Empire (Boak 1955). The more recent literature is also unanimous in linking the fall of the Roman Empire to the decline of its population. In an economy based on the size of the workforce, the effects of a declining population range from economic activity to military recruiting. This downward trend in demography and its effect on the decline of the Roman Empire is explained in terms of malnutrition, plagues, declining agricultural production and a shortage of manpower.

Malnutrition and food shortages weakened people in all social groups (Jones 1966; Liebeschuetz 2001). The number of live births fell, life expectancy decreased, and people had less resistance to diseases and plagues (Frank 1962). Recurring bad harvests, the shrinking of cultivated acreage and the decline of agricultural productivity decreased food availability (Boak 1955; 1963; McCormick 2001; Ward-Perkins 2005). The situation further deteriorated with natural disasters, climate change and erosion-driven soil exhaustion (Liebeschuetz 2001; Mitchell 2007), though an earlier view by Boak (1963) and Rostovtzeff (1957) disagreed, believing that the environmental effect on agricultural production did not have a significant impact beyond Greece and the Italian peninsula. Cary (1963) rejected the climate argument altogether. Since Roman demography was determined by Malthusian principles (Scheidel 2007, 50 - 52), the scarcity of available food resources caused a decrease in the size of the population. This cycle worked both ways. McCormick (2001) used a set of imperial laws from the fourth to the sixth centuries to prove a drastic decrease in farmland acreage due to depopulation. Environmental problems, inefficient and inadequate production and the state's arguably destructive policy of overtaxation (Boak 1955; 1963; Jones 1974) triggered frequent famines among the peasantry, hastening the process of decline.

Arguably, many factors led to the agricultural decline of the Roman Empire. Reactions to declining agricultural production aggravated the impact of initial factors: the decrease of

taxable income was countered with increased tax rates, malnutrition damaged the ability of producers to increase yields, and population decline hindered the military power of the Empire against its enemies. According to the literature, recurrent wars and two devastating plagues in the second and third centuries had catastrophic and lasting demographic consequences (Simkhovitch 1916; Huntington 1917; 1963; Haywood 1958; Boak 1955; Hands 1963; Cameron 1993; Liebeschuetz 2001; McCormick 2001; Mitchell 2007). Giardina (2007, 757) estimates that the decline in population reached 20 percent during the first (AD 165) and the second (AD 250) smallpox epidemics. Based on archeological settlement evidence, Duncan-Jones (2004) argues that epidemics had the largest impact during the third century. In addition to the resulting social instability, structural change toward estates and the subsequent decline of the rural population were factors in the demographic downturn (Rostovtzeff 1957; Boak 1955; Westermann 1915).

From a military perspective, the increasing barbarization of the Roman army, its structural and institutional decline and the mounting pressure of external conquering armies were partial outcomes of this shortage of Roman manpower (Simkhovitch 1916; Baynes 1943; Rostovtzeff 1957; Haywood 1958; Boak 1955; 1963; Jones 1974; Grant 1990; Lenski 2002).

From the third century onwards, it became increasingly difficult to recruit enough Roman soldiers (Boak 1955; Finley 1965). Boak (1963) provides an example of how Marcus Aurelius had difficulties in enrolling Roman recruits after catastrophic plagues, leading him to import more barbarians into the Roman army. In our survey, this decrease in manpower is explained by the rural decline, shrinking family size and the increasing share of non-producing classes who could avoid the enrollment. The standstill of productivity caused resource shortages. During the Pax Romana, the number of slaves who could be forced into military service decreased due to the declining supply (Walbank 1962; Westermann 1915; Finley 1965; Schiavone 2000) and the growth of humanitarian sentiment (Walbank 1962)

Additionally, during the continuous wars, high casualties depleted Rome's military resources (Boak 1955). These factors and outcomes weighted the balance of military power to favor external militaries. According to Scheidel (2007, 49), shortages of manpower were most severely felt in frontier areas in the western provinces. Essentially, population decline was both a causal mechanism in and a symptom of the fall of the Roman Empire.

### Administration, Institutions and Politics

Three major elements in the institutional enforcement system (North, 1990) of Imperial Rome were the central government, the military, and the provincial governments. The meta-narrative in our texts is that difficulties in interaction between these three cornerstones of Roman rule weakened the state with calamitous results. Researchers seem to agree that the imperial system ceded its civic nature to military rule and its power to local landlords.

The emperor had been the final authority in the Empire since Augustus (r. 27 BC to AD 14). In principle, the Senate legitimized the emperor's rule, and his power was originally tied to the constitutional framework of the late republic in which authority was divided among the Senate, tribunes and censors. However, the late imperial system consolidated these powers in the emperor, culminating in the reign of Diocletian (284-305) when the Senate was largely excluded from decision making as a source of legates, diplomats, generals and administrators of the emperor's council (*consilium*).

Although the Senate dominated policy discussions until the end of the Antonine dynasty in AD 192, the equestrians took on an increasingly important role in the *consilium*. In theory, the Senate had the power to choose the new emperor, but it did so mindful of acclamation by the army and Praetorian Guard. The fatal feature of the institution was a lack of any durable way to transfer the power of the emperor peacefully to his successor. Although most emperors indicated their choice of successor, usually a close family member or adopted heir,

military generals and Praetorians enthroned and rather brutally dethroned emperors on a regular basis. The result was a ruler whose first loyalty was to the supporting army, not to the populace. Governmental stability was most threatened when it could not pay the troops or keep them placated. This led to the rise of the usurpers and the outbreak of civil wars. This was seen especially during the chaotic third century (AD 235 to 284) when 20 emperors were recognized by the Senate, another 20 were not, and many others laid claim to the throne. The Empire never fully recovered (Potter 2004; Haywood 1958; Perowne 1966; Grant 1990; Scheidel & Friesen 2009; Antonio 1979; Cameron 1993; Perowne 1966; Cary 1963).

The political role of the army has been described as an “army first policy” (Vogt 1965), military anarchy (Scheidel & Friesen 2009), and an army dependent absolutism (Perowne 1966). The central position of the military was continuous expansion of the imperial dominions even when control and administration over those areas was difficult or even impossible (Cameron 1993; Grant 1990, Lot 1966). The army relied on public funds and thus had a central position in imperial financial policy (Haywood 1958; Grant 1990; Vogt 1965; Jones 1974).

Moreover, many scholars question the administrative competence of emperors in relation to the failures of the government. Haywood (1958) notes that the emperors often lacked real control and managerial competence. Ferrill (1986) highlights the importance of emperors’ leadership capabilities and the results of their strategic decisions. Grant (1990) accuses the last 16 emperors of incompetence, stating that under them, power slipped into the hands of the army, interest groups and the landed aristocracy.

The central administration was based on aristocratic nominations and positions, a system to which Brown (1971) assigns the hallmarks of amateurism, the victory of vested interests and narrow horizons. The system was heavily bureaucratic and too rigid to handle turbulence and

new challenges. It was thus arguably incapable of change, unable to consider the needs of subjects and unable to reform itself. The bureaucracy expanded time after time, and as its growth showed no way of being controlled, the tax burden increased. It was also susceptible to corruption and nepotism, concentrating more on administrators' own positions and wealth (Swain 2004; Potter 2004; Schiavone 2000; Grant 1990; McMullen 1988; Rostovtzeff 1957; Heitland 1962; Walbank 1962; Antonio 1979; Jones 1966; Cary 1963). Furthermore, no expert staff of planners were available to reveal long-term views and actions. The defense of the Empire was understood to be the administration's primary task, and most worries over imperial administration revolved around military funding and the need for recruits. The large aristocratic court and council cut the emperor off from the public so that the people's needs and thoughts had no influence on decision making (Vogt 1965).

At the local and provincial levels, a shift from the old *curiales* institution to a patronage framework was the main factor in the decline of central power and the accelerated development of a more local and self-sufficient system. Originally, the provincial government centered on large cities in which councils, magistrates and assemblies governed themselves. This structure needed few imperial officials, and the imperial system left most of the administration to the local communities themselves. The term *curiales* referred to the merchants, businessmen, and mid-level landowners who served in their *curia* as magistrates and *decurions*. This institution was based on the Roman governing tradition of *munera* ("duty," "obligation"), meaning that public works and services would be provided by public-spirited men of high status and wealth. Curiales were expected to procure funds for public building projects and welfare systems. They would often pay for these expenses out of their own incomes to increase their personal prestige. The curiales were also responsible for the collection of imperial taxes and providing food and board for the army, among other things.

Most munera was performed without any compensation and was thus sensitive to economic crises. By the third century, the economic burden of officers had become too onerous, and well-to-do townsmen, refusing to fill the offices and council seats, withdrew to their estates and became landlords (Walbank 1969; Vogt 1965). Moreover, to build loyalty to the emperor and central government, the landholdings of high bureaucrats and senate members were excluded from taxes, and thus, the burden fell upon smaller landowners and provincial workers (Jones 1966; Haywood 1958). Heavy taxation and obligatory service chipped away at the foundation of the system (Boak 1955) and might have increased the level of corruption (Rostovtzeff 1957a). No real attempts were made on the part of the central government to defend either the curial class or the Pax Romana. As military anarchy spread, the former trust in loyal and functioning municipalities ceased to be a cornerstone of imperial rule, leaving provincial centers to decay (Liebeschuetz 2001; Randsborg 1989; Scheidel & Friesen 2009; Vogt 1965; Mazzarino 1966).

Eventually, the emperor had to rely on local landlords to collect taxes. This led to the exclusion of officials from great estates that were becoming self-sufficient economic enclaves even before the reign of Theodosius I (347-395). The most powerful landlords both collected taxes and presided over courts as protectors of their clients from the authorities, which eroded central government control over its subjects. Furthermore, worker shortages forced landlords to compete for labor and to offer benefits such as protection from heavy taxation and military service, causing financial and military difficulties for the central government (Walbank 1969; Perowne 1966; Haywood 1958; Westermann 1915).

In response, the central government accelerated the stagnation of the society to prevent it from abandoning military, civic and peasant duties. Eventually, every man was bound to a hereditary occupation. Social mobility decreased and was regulated more strictly in the last two centuries. Development of the patronage system (servitude), ossification of class

divisions and compulsory service in local administrations imposed by the central government diminished needed social mobility and made late Roman society incapable of responding to economic threats (Grant 1990; Lot 1966; Vogt 1965; Walbank 1969).

In times of civil war and external threats, the wealthiest landlords raised their own armies to protect nearby areas. In areas inhabited by the Germanic tribes, the local Roman elite gave their loyalty to the tribes or formed alliances with them. Eventually, entire outlying provinces adopted a policy of self-reliance, calculating that this was preferable to relying on a weakened central government (Bang 2007; Galtung, Heiestad & Ruge 1979; Heather 1995; Walbank 1969; Perowne 1966; Brown 1971; Haywood 1958). The Roman settlement policy for Germans did not help. The government gave tribes their own areas on the frontiers of the Eastern Empire for protection against other tribes outside of the Roman borders, but they allowed the tribes to keep their own ruling systems under Germanic chieftains who usually did not recognize Roman authority (Ward-Perkins 2005; Grant 1990; Boak 1955; Haywood 1958; Moss 1937; Westermann 1915). Whether this was a consequence of Roman hostility toward the newcomers or the Germanic tribes' resistance to assimilation (Haywood 1958), Roman law made a strict distinction between "Roman citizens" and "barbarians." (Grant 1990; Brown 1971) Whether Rome's weakened cultural and political condition was more capable of assimilating newcomers (Lot 1966; Rostovtzeff 1957) is open to interpretation. However, losing control over the areas inhabited by Germanic tribes led a loss of tax revenue, weakening state finances, continuing inequality between ethnic groups, a disintegrating society and the creation of separate administrative systems (Grant 1990; Heather 1995). Furthermore, the Roman army was highly dependent on non-Roman recruits in its last centuries, undermining army loyalty and quality (Bury 1958; Salmon 1963; Boak 1955; Haywood 1958; Ferrill 1986). This "barbarization" of the army took a heavy toll on the army's loyalty to the central government (Salmon 1963; Boak 1955) and caused the

barbarization of imperial policy as a whole as well as the Romanization of the German tribes (Haywood 1958).

The rise of the church as a rival administrative and spiritual authority in the later period has been seen as a factor in the disintegration of the Roman government and its institutions (Vogt 1965; Brown 1971; Grant 1990). Emperors had to take part in ecclesiastic power struggles, and the new institution was an additional economic burden (Lenski 2002; Jones 1966). Some scholars have argued that Christian devotion undermined traditional Roman values and institutions by rejecting patriotism and state loyalty, which led to the rejection of military service (Grant 1990; Rostovtzeff 1957; Brown 1971), politics and civil service (Jones 1966). The Christian rejection of worldly interests also led to a decline in intellectual and cultural life (Rostovtzeff 1957; Lot 1966). A simultaneous shift in power from the central administration to feudal landlords and the erosion of the institutional system because of constant internal and external threats were important factors in the collapse of the economic system.

## Mechanisms and Processes of Collapse

Although the literature on the collapse of the Roman Empire is plentiful and heterogeneous, theoretical patterns related to the process can be identified. Figure 1 summarizes our theoretical reading of the collapse process.

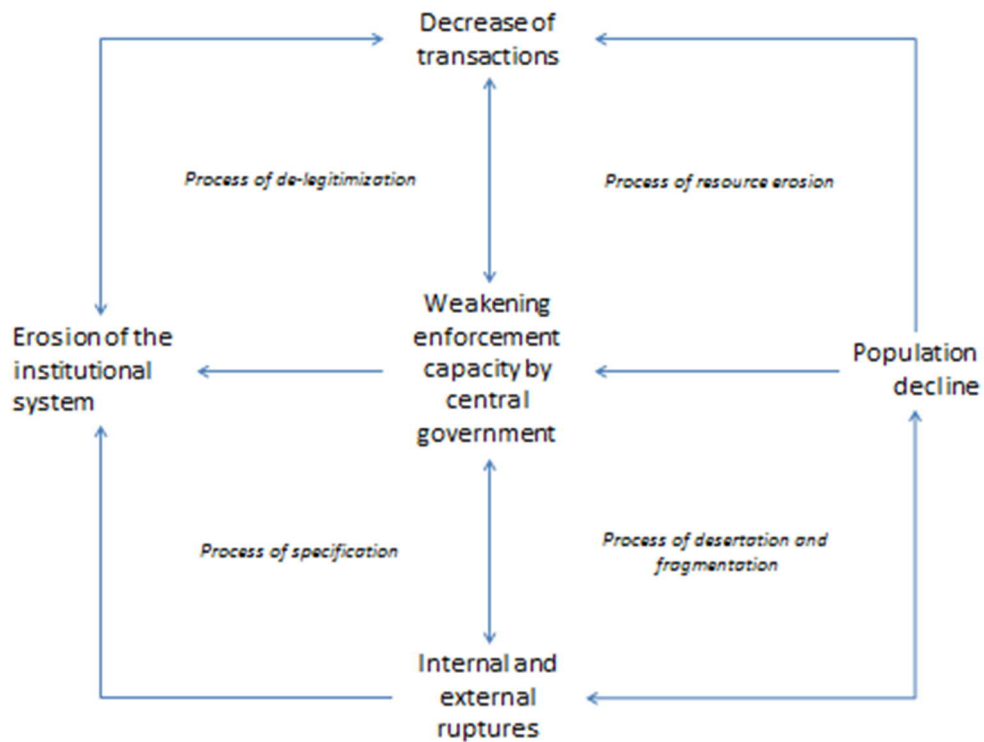


Figure 1: Theorized model of economic collapse.

Our stylized model is composed of five mechanisms and four parallel processes. The five mechanisms build on and complement the works by North and his colleagues (North, 1990; Mantzavinos, North and Shariq, 2004; Denzau and North, 1994) as well as new institutional theory more broadly (e.g., Williamson, 2000; Williamson, 1991; David, 1994, Greif, 1993). First, population decline directly affects the volume of trade and economic transactions; it weakens the enforcement capacity of the central government and affects and is affected by internal and external ruptures. Similarly, the weakening enforcement capacity is linked to internal and external ruptures and lessening volume of trade and transactions. We argue that these mechanisms catch the central analytical narratives from the voluminous research on the fall of the Roman Empire.

While the existing institutional literature could predict the existence of the five mechanisms, our reading of Roman history makes a novel contribution by showing the interdependence of

the mechanisms. While the whole transformation process from a relatively sophisticated market economy (Temin, 2001) to manorialism (North and Thomas, 1970; 1973) has similarities with other transformations (obviously, the shift from manorialism to a more modern economic process in Western Europe) our model places extra emphasis on the role of demographic cycles. In a society characterized by slow technological progress, the role of population density was crucial both as a resource for the central government and the production functions of the society and as a necessary condition for the market economy. Loss of people to diseases, wars, and territorial loss affected all elements of the economy, resulting in the emergence of a new economic system based on local self-sufficiency instead of trade and specialization.

Our model also includes four processes that are composed of configurations of mechanisms. First, the process of desertation and fragmentation describes the joint effect of population decline, internal and external threats, and the lessening power of the central administration. As a consequence of this process, the Empire lost its comprehensive role, while the power was taken by local authorities, landlords, and war chieftains. This could especially be seen in the frontier provinces, such as Gaul and Britain, where civil wars had weakened defense, causing migration to safer areas. Under these conditions, it was difficult to hold areas in tight imperial control, and eventually, they emerged from its direct control, as John Moorhead (2001: 67-68) describes:

*“Yet the north was experiencing depopulation, towns becoming smaller and many rural sites being deserted... and the fear of aggressors from across the Rhine is likely to have been more important than whatever damage this aggressor [usurpers] may have done. Some of the abandoned land became forest, but by the late third century, Germanic people were abandoning their settlements to the east of the Rhine and occupying vacant land within imperial territory. Whereas peoples who had travelled long distances brought an end to Roman rule around the western Mediterranean, in the north of Gaul, developments arising from internal disruption and the peaceable settlement of outsiders would bring about. It was into this unstable environment, which saw the headquarters of the praetorian prefect transferred from Trier to the southern town of Arles at about the turn of century.”*

Similarly, the overall decline of the population during turbulent times had led to a rivalry between landlords, who needed labor, and the state, which suffered from a lack of recruits for its army. As Frank Walbank (1969: 96) shows us, the situation eventually evolved toward a patronage system and more independent power centers:

*“Everywhere the colonate was constantly being recruited from the ranks of the independent peasants, whom hard times drove to throw themselves on the mercy of the local landlord, surrendering their freedom in exchange for his patronage and protection. In A.D. 368, this practice was declared illegal by the same emperor Valens, who thus sought simultaneously to check and utilize an inevitable but ultimately disruptive institution. In fact, the great landlords threw against the State and usurped its functions...by weakening the central authority, the manorial system weakened defense too, and especially in the western provinces, it accelerated the disruption of the Empire.”*

Second, the process of specification resulted in hundreds if not thousands of institutional systems and enforcement authorities instead of one or a few (e.g., in the case of usurper regimes). The Roman Empire’s failure to fully integrate is also an important issue, as paraphrased in Hopkins (1980: 101):

*“At the risk of simplification, they lead us to envisage the Roman Empire in the central period of the High Empire (the first two centuries A.D.) as comprising three spheres: (A) an outer ring of frontier provinces in which defensive armies were stationed, (B) an inner ring of relatively rich tax-exporting provinces, such as Spain, southern Gaul, northern Africa, Asia Minor, Syria and Egypt, and (C) the centre, comprising Italy and the city of Rome, the seat of the Court and of the central government, which, like the armies on the frontiers, consumed a large volume of taxes.”*

In Britain, for example, the institutional setting was a mix of pre-Roman practices and norms and Roman rules and laws enforced both by local authorities and Roman administration. As Collingwood and Myres (1956) describe in their classic history of Britain:

*“Within the general framework of a Roman province, there was plenty of room for local self-government (164) ...by using even the kings of these tribes, when they were willing to be so used, as imperial legates. (167) It was the policy of the Empire to foster self-government on the part of provincials not only in their various tribal units, but to a certain extent even in the province as a whole. (169)”*

The specification of institutional rules concerned not only geographic locations but also subgroups across the Empire. In particular, the rise of the Christian church and Christianity “...caused the status of citizenship to lose its meaning, which involved no consciousness of

an obligation to maintain the Roman Empire against its enemies (and thus) the population lacked a strong sense of shared interest.” (Liebeschuetz 2001) Accordingly, an important sub-process resulting in the transformation away from the larger and more centralized institutional system was the emergence and return of various smaller institutional systems.

Third, the process of resource erosion describes the joint effect of population decline and the decrease in market transactions resulting in a lessening and ultimately insufficient capacity to maintain the Empire’s institutional stability. Resource erosion resulted in the decline of economic activity in various ways:

*“In the West, by contrast, where the tributary nexus between imperial authorities and local elites had been broken, economic activity declined. In Britain, collapse was sudden; in other areas, decline was a much more gradual and slow process. But, once outside the tributary economy, the provincial magnates of old stock and new ‘barbarian conquerors’ found it impossible to maintain extraction at the previous level and sophistication. Their capacity for concentrating and mobilizing agricultural surplus resources was much more circumscribed, and their monopoly powers in ‘selling’ protection were seriously weakened.” (Bang 2007, 52-53)*

The whole Western part of the Roman Empire increasingly “...was not equal to the task of administering the whole Empire....” (Collingwood and Myres 1956: 275), especially on the periphery. Accordingly, the declining volume of trade and population and the resulting difficulties in maintaining and developing the enforcement mechanism jointly resulted in difficulties keeping the economic system integrated.

Finally, the process of delegitimization describes the combined effect of a weakened central government and fragmented institutional orders. In parallel, self-sufficient manors and monasteries were increasingly less dependent on multilateral trade and accordingly did not need the Pax Romana anymore. Instead, the inert bureaucracy and heightened public costs became a burden for local – and often isolated – economic entities. As Heather (1995) has noted, the loss of legitimacy of Imperial Rome and its administration occurred rapidly:

*“...because of the appearance of new military forces, the Roman state was no longer capable of sustaining local elites in this fashion (and hence of constraining their loyalties either), the*

*whole point of attachment to the Empire disappeared. As a result, they naturally tended in such circumstances to look elsewhere for props to their position, notably to whichever barbarian immigrant group was currently most powerful in their own locality. In practice, such switches of loyalty could happen surprisingly quickly.”*

The relatively rapid delegitimization process is understandable from the double-pressure of internal and external threats faced by local elites. Under this pressure, the prestige of the central government and the subsequent legitimacy of institutional rules eroded and fundamentally changed the economic system:

*“There was, of course, a close connection between failure 'abroad' and the usurpations and rebellion 'at home'. It is not coincidence that Honorius faced so many usurpers in the years following the Vandal, Alan, and Sueve crossing of the Rhine at the end of 406. His failure adequately to defend the Empire dealt a devastating blow to the prestige of his regime and encouraged those who wanted strong rule and successful defense against the invaders...”  
(Ward-Perkins, 2005:45)*

## Discussion

The purpose of our research was to theorize and explicate the mechanisms and processes predicting economic collapses as deinstitutionalization processes. The identified mechanisms corroborate and clarify theoretical assumptions from new institutional economics literature while simultaneously offering a stylized reading of the collapse of the Roman Empire. More importantly, the identified processes add granularity to this theoretical approach. Therefore, our research makes contributions to scholarship into two directions: how and why economies collapse and the evolutionary processes resulting in institutional transformations and deinstitutionalization.

In the framework of collapse studies, we highlight the breakdown of Roman society as a breakdown of institutional enforcement and contractual arrangements. The collapse of the Roman Empire was a thorough dissolution of formalized and state-instigated institutions that metamorphosed into different usurping institutional groupings that provided more efficient

rules for economic and social organization with fewer transaction costs (see Eisenstadt 1969; Williamson, 2000). Frequently incorporated into collapse studies, the concept of carrying-capacity, whether ecological (Diamond 2005; Culbert 1988) or economical, is often used as an analytical tool to pinpoint the maximum limit of each society's ability to overcome the costs of its existence. The changes to this equilibrium are caused by either the degradation of society's vitality or an increase in its burden, resulting in a state of overload. Our contribution to this framework is an analysis of how and why the Roman institutional system exceeded its carrying capacity and gradually transformed toward a decentralized feudal institutional system in the absence of a legalized political center. Thus, the underlying scheme in our analysis is that Roman institutional systems encountered external and internal stress sufficient to overburden its vitality. Failure to respond and adapt to these pressures resulted in a downward spiral, societal decline and ultimately, institutional breakdown.

For institutional scholars, our research offers two novel findings. Our analysis complements existing historical knowledge on institutional transformations (e.g., Allen, 2011; Greif, 1993; North and Thomas, 1970; Ober, 2015) by explicating the mechanisms and processes related to the collapse of Rome. Our contribution is especially novel, as we demonstrate the fundamental importance of population density and the volume of trade not only as results of institutional framework (cf. Acemoglu, Johnson and Robinson, 2005) but more so as the antecedents of the legitimacy of this framework. In other words, the legitimacy of an institutional system is dependent on the pay-off as perceived by the economic actors (cf. North, 1990). Importantly, this pay-off calculation may maximize individual and organizational level economic value, yet the overall effect may be fatal, as in the case of the Roman Empire. Second, our research emphasizes the need to study deinstitutionalization processes not only as based on individual-level mechanisms but also as results of system-level evolutionary dynamics. This would call for more research on simulations and counter-

histories to challenge and complement those narrative fallacy cases such as that which Roman history must include.

An obvious limitation of our research is the historicism of our material and/or the problems of perceiving modern world from the perspective of a historical process that occurred centuries ago. The first defense is Ober's (2015) reminder that "...patterns of human behavior are fundamentally similar across societies widely separated in time and space." The second – and more important one – is that the history of Rome is the closest equivalent to our own time in the sense that a well-functioning market economy may erode and fail. Whether this is only a negative issue may be questionable, but Imperial Rome (again, its western parts) is the only natural experiment of a situation in which population decline catalyzes system-wide changes in institutions, trade, and ultimately in all aspects of the society. Simultaneously, economic growth halted for centuries. The modern world has never faced the combination of declining population and halted economic growth (cf. George, Howard-Grenville, Joshi, and Tihanyi, 2016). Our message to policy-makers and strategy scholars is to consider this type of situation: what if the modern economic order starts to transform, and is it even possible to recognize this transformation if it takes centuries to take shape?

## Literature

- Acemoglu, Daron (2008). *Introduction to Modern Economic Growth*. New Jersey: Princeton University Press.
- Acemoglu, Daron, Johnson, Simon & Robinson, James A. (2005). Institutions as a Fundamental Cause of Long-Run Growth. *Handbook of Economic Growth*, 1, 385 - 472.
- Allen Douglas W. (2011). *The Institutional Revolution: Measurement and the Economic Emergence of the Modern World*. Chicago: University of Chicago Press.
- Antonio, Robert J. (1979). The contradiction of domination and production in bureaucracy: The contribution of organizational efficiency to the decline of the Roman Empire. *American Sociological Review*, 44, 6, 895 - 912.
- Argyres, N. S., & Liebeskind, J. P. (1999). Contractual commitments, bargaining power, and governance inseparability: Incorporating history into transaction cost theory. *Academy of Management Review*, 24(1), 49-63.
- Bang, Peter F. (2007). Trade and empire: In search of organizing concepts for the Roman economy. *Past & Present*, 195, 3 - 54.
- Baynes, Norman H. (1943). The decline of the Roman power in Western Europe. Some modern explanations. *Journal of Roman Studies*, 33, 1-2, 29-35.
- Boak, Arthur E. R. (1955). *Manpower Shortage and the Fall of the Roman Empire*. London: Ann Arbor.

- Bologna, M. & Flores, J. C. (2008). A simple mathematical model of society collapse applied to Easter Island. *Europhysics Letters*, 81(4), 48006.
- Bowersock, Glen W. (2000). *Late Antiquity: A Guide to the Postclassical World*. Cambridge (MA): Harvard University Press.
- Brander J.A. & Taylor M.S. (1998). *The simple economics of Easter Island: A Ricardo-Malthus model of renewable resource use*. *American Economic Review* 88(1), 119-138.
- Brown, Peter (1971). *The World of Late Antiquity from Marcus Aurelius to Muhammad*. London: Thames and Hudson.
- Brown, Peter (1992). *Power and Persuasion in Late Antiquity: Towards a Christian Empire*. Madison: University of Wisconsin Press.
- Bury, John B. (1958). *History of the Later Roman Empire from the Death of Theodosius to the Death of Justinian (AD 395 to AD 565) in Two Volumes*. New York: Dover. 1<sup>st</sup> published in 1923.
- Bury, J.B. (1889). *A History of the Later Roman Empire: 395 AD to 800 AD*. London: Macmillan and Co.
- Cameron, Averil & Garnsey, Peter (eds.) (1998), *Cambridge Ancient History, XIII: The Late Empire, AD. 334-425*. Cambridge: Cambridge University Press.
- Cameron, Averil, Ward-Perkins, Bryan & Whitby, Michael (eds.) (2000), *Cambridge Ancient History, XIV: Late Antiquity: Empire and Successors, A.D. 425-600*. Cambridge: Cambridge University Press.
- Cameron, Averil (1993), *The Mediterranean World in Late Antiquity AD 395-600*. London and New York: Routledge.
- Cary, Max (1963), *A History of the Greek World From 323 to 146 BC*. London: Methuen.
- Catton William R. (1980), *Overshoot: The Ecological Basis of Revolutionary Change*. Urbana, Ill.: University of Illinois Press.
- Chandler Jr, Alfred D. (1977), *The Visible Hand*. Cambridge (MA): Harvard University Press.
- Christ, Karl (1970), *Der Untergang des Römischen Reiches*. Darmstadt: Wissenschaftliche Buchgesellschaft.
- Cipolla, Carlo (1970), *The Economic Decline of Empires*. London: Methuen.
- Costanza, R. & Graumlich, L. & Steffen, W. & Crumley, C. & Dearing, J. & Hibbard, K. & Leemans, R. & Redman, C. & Schimel, D. (2007), 'Sustainability or Collapse: What Can We Learn from Integrating the History of Humans and the Rest of Nature?'. *A Journal of the Human Environment* 36, 7, 522 - 527.
- Coulborn, Rushton (1954), 'The Rise and Fall of Civilizations'. *Ethics*, 64, 205 - 216.
- Coulborn, Rushton (1966), 'Structure and Process in the Rise and Fall of Civilized Society'. *Comparative Studies in Society and History*, 8, 404 - 431.
- Crist, Raymond E. & Paganini, Louis A. (1980), 'Rise and Fall of Mayan civilization'. *American Journal Economics and Sociology*, 39, 1, 23 - 30.
- Culbert Patrick T. (1973), *The Classic Maya Collapse*. Albuquerque: University of New Mexico Press.
- Culbert Patrick T. (1977), 'Maya Development and Collapse: An Economic Perspective'. In Hammond, Norman (ed.) 'Social Process in Maya Prehistory: Studies in Honour of Sir Eric Thompson'. London, New York and San Francisco: Academic Press, 510 - 530.
- David Paul A. (1994), 'Why are Institutions the 'Carriers of History'? Path Dependence and the Evolution of Conventions, Organizations and Institutions'. *Structural Change and Economic Dynamics*, 5, 2, 205 - 220.
- Davis, Gerald F. & Diekmann, Kristina A. & Tinsley, Catherine H. (1994), 'The Decline and Fall of the Conglomerate Firm in the 1980s: The Deinstitutionalization of an Organizational Form'. *American Sociological Review*, 59, 4, 547 - 570.
- Demandt, Alexander (1984), *Der Fall Roms*. Köln: Beck.
- Demandt, Alexander (2007), *Die Spätantike: Römische Geschichte von Diocletian bis Justinian, 284-565 n. Chr.* Köln: Verlag C.H. Beck.
- Denzau, Arthur T. & North, Douglass C. (1994), 'Shared Mental Models: Ideologies and Institutions'. *Kyklos* 47, 1, 3 - 31.
- Diamond, Jared (1994), 'Ecological Collapses of Past Civilizations'. *Proceedings of the American Philosophical Society*, 138, 3, 363 - 370.
- Diamond, Jared (2005), *Collapse: How Societies Choose to Fail or Succeed*. New York: Penguin.
- Douglas, Peter M. J. & Pagani, Mark & Canuto, Marcello A. & Brenner, Mark & Hodell, David A. & Eglinton, Timothy I. & Curtis, Jason H. (2015), 'Drought, Agricultural Adaptation, and Sociopolitical Collapse in the Maya Lowlands'. *Proceedings of the National Academy of Sciences of the United States of America*, 112, 18, 5607 - 5612.
- Duncan-Jones, Richard P. (1990), *Structure and Scale of Roman Economy*. Cambridge: Cambridge University Press.
- Duncan-Jones, Richard P. (2004), 'Economic Change and the Transition to Late Antiquity'. In Swain, Simon & Edwards, Mark (eds.), 'Approaching Late Antiquity: The Transformation from Early to Late Empire'. Oxford: Oxford University Press, 20 - 52.

- Eisenstadt Shmuel N. (1967), *The Decline of Empires*. Englewood Cliffs, NJ: Prentice-Hall.
- Eisenstadt Shmuel N. (1969), *The Political Systems of Empires: The Rise and Fall of the Historical Bureaucratic Societies* New York: Free Press.
- Elbaum, Bernard & Lazonick, William & Best, Michael H. (1987), *The Decline of the British Economy*. Oxford, UK: Clarendon Press.
- Ferrill, Arther (1986), *The Fall of the Roman Empire. The Military Explanation*. London: Thames and Hudson.
- Finley, Moses I. (1965), 'Technical Innovation and Economic Progress in the Ancient World'. *The Economic History Review*, 18, 1 (Essays in Economic History Presented to Professor M. M. Postan), 29 - 45.
- Finley, Moses I. (1973), *The Ancient Economy*. Berkeley: University of California Press.
- Fischer-Kowalski, Marina (2009), 'How to Conceptualise the Collapse of Civilisations - A Plea for a Social-Ecological Theory of Society'. *Gaia - Ecological Perspectives for Science and Society*, 18, 1, 13 - 14.
- Flenley John & Bahn Paul (2003), *The Enigmas of Easter Island*. New York: Oxford University Press.
- Fogel, Robert W. (2004), *The Escape from Hunger and Premature Death, 1700-2100: Europe, America, and the Third World* (Vol. 38). Cambridge: Cambridge University Press.
- Frank, Tenney (1916), 'Race Mixture in the Roman Empire'. *The American Historical Review*, 21, 4, 689 - 708.
- Frank, Tenney (1962), 'Race Mixture in the Roman Empire'. In Kagan, Donald (ed.) 'Decline and Fall of the Roman Empire. Why Did It Collapse?'. Lexington: D. C. Heath and Co.
- Gallet, Yves & Genevey, Agnes & Le Goff, Maxime & Fluteau, Frédéric & Eshraghi, Safar Ali (2006), 'Possible Impact of the Earth's Magnetic Field on the History of Ancient Civilizations'. *Earth and Planetary Science Letters*, 246, 1-2, 17 - 26.
- Galtung, Johan & Heiestad, Tore & Rudeng, Erik (1980), 'On the Decline and Fall of Empires: The Roman Empire and Western Imperialism Compared'. *Review (Fernand Braudel Center)*, 4, 1, 91 - 153.
- George, G., Howard-Grenville, J., Joshi, A., & Tihanyi, L. (2016). Understanding and tackling societal grand challenges through management research. *Academy of Management Journal*, 59(6), 1880-1895. doi:10.5465/amj.2016.4007
- Geraghty, R. M. (2007). The impact of globalization in the Roman empire, 200 BC-AD 100. *Journal of Economic History*, 67(4), 1036-1061.
- Geroski, Paul A. (1990), 'Innovation, Technological Opportunity, and Market Structure'. *Oxford Economic Papers*, 42, 3, 586 - 602.
- Giardina, Andrea (2007), 'The Transition to Late Antiquity'. In Scheidel, Walter & Morris, Ian & Saller, Richard (eds.), 'The Cambridge Economic History of the Greco-Roman World'. Cambridge: Cambridge University Press.
- Gibbon, Edward (1776-89)(reprinted in 1938), *The Decline and Fall of Roman Empire*. London : J. M. Dent & Sons.
- Gilfillan, S. Colum (1965), 'Lead Poisoning and the Fall of Rome'. *Journal of Occupational and Environmental Medicine*, 7, 2, 53 - 60.
- Goffard, Walter (1980), *Barbarians and Romans AD 418-584: The Techniques of Accommodation*. Princeton: Princeton University Press.
- Goffard, Walter (1989), *Rome's Fall and After*. London and Ronceverte: The Hambledon Press.
- Goldstone, Jack A. (2002), 'Efflorescences and Economic Growth in World History: Rethinking the 'Rise of the West' and the Industrial Revolution'. *Journal of World History*, 13, 2, 323 - 389.
- Grant, Michael (1990), *The Fall of the Roman Empire*. London: Michael Grant Publications Ltd.
- Greif, Avner (1993), 'Contract Enforceability and Economic Institutions in Early Trade: the Maghribi Traders' Coalition'. *American Economic Review*, 92, 525 - 548.
- Greif, Avner & Milgrom, Paul & Weingast, Barry R. (1994), 'Coordination, Commitment, and Enforcement: The Case of the Merchant Guild'. *Journal of Political Economy*, 102,4, 745 - 776.
- Gunderson, Gerald (1976), 'Economic Change and the Demise of the Roman Empire'. *Explorations in Economic History*, 13, 43 - 68.
- Hamblin, Robert L. & Pitcher Brian, L. (1980), 'The Classic Maya Collapse: Testing Class Conflict Hypothesis'. *American Antiquity*, 45, 246 - 267.
- Hands, A. R. (1963). The fall of the roman empire in the west: A case of suicide or 'force majeure?'. *Greece & Rome*, 10(2), 153-168.
- Harper, K. (2016). People, Plagues, and Prices in the Roman World: The Evidence from Egypt. *Journal of Economic History*, 76(3), 803-839. doi:10.1017/s0022050716000826
- Haywood, R. M. (1958). *The Myth Of Rome's Fall*. New York: Thomas Y. Crowell Co.
- Heather, P. (1995). The Huns and the end of the Roman Empire in Western Europe. *The English Historical Review*, 110(435), 4-41.
- Heather, P. (2005). *The Fall of the Roman Empire. A New history of Romans and Barbarians*. Oxford: Oxford University Press.

- Heitland, W. E. (1922). The Roman Fate. In *Decline and Fall of the Roman Empire: Why Did It Collapse*. Ed. Donald Kagan (1962). Lexington: D.C. Heath and Co., 13-22.
- Heitland, W. E. (1926). An economic history of rome. *The Economic Journal*, 36(144), 598-605.
- Honoré, T. (2004). Roman law AD 200–400: from cosmopolis to Rechtstaat?. In *Approaching Late Antiquity: The Transformation from Early to Late Empire*. Ed. Simon Swain and Mark Edwards. Oxford: Oxford university Press, 109-132.
- Hopkins, K. (1980). Taxes and trade in the Roman Empire (200 BC-AD 400). *The Journal of Roman Studies*, 70, 101-125.
- Hunt, BG; Elliott, TI (2005) "A simulation of the climatic conditions associated with the collapse of the Maya civilization". *CLIMATIC CHANGE* Volume: 69 Issue: 2-3 Pages: 393-407
- Huntington, E. (1917). Climatic change and agricultural exhaustion as elements in the fall of Rome. *The Quarterly Journal of Economics*, 173-208.
- Jones, A. H. M. (1966). *The Decline of the Ancient World*. New York: Longman.
- Jones, A. H. M. (1974). *The Roman Economy*. Rowman and Littlefield.
- Jones, A.H.M. (1964). *The Later Roman Empire 284-602: A Social, Economic and Administrative Survey*. Oxford.
- Kammen DM et al. (1994) *Preindustrial Human Environment Impacts: Are there lessons for Global Change Science and Policy?*. *Chemosphere* 29, 5
- Kaufman H (1988), *The collapse of ancient states and civilizations as an organizational problem*. In Yoffee & Cowgill (eds.), 219-236
- Kennedy, P. (1987). *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500 to 2000*, New York, Vintage Books.
- Kindleberger, C.P. and Aliber, V. (1978/2011). *Manias, Panics, and Crashes*. Palgrave Macmillan, New York.
- Langlois RN. 1986. Rationality, institutions, and explanation. In *Economics as a Process: Essays in the New Institutional Economics*. New York, Cambridge University Press; 225–55.
- Le Beau, C. *Histoire du Bas-Empire en commençant à Constantin le Grand (27 volumes, 1752-1815)*.
- Leeson, P. T. (2007). An-arrgh-chy: The Law and Economics of Pirate Organization. *Journal of political economy*, 115(6), 1049-1094.
- Lenski, N. (2002). Failure of Empire. Valens and the Roman state in the Fourth Century AD, 56.
- Libecap, G. (1997). The New Institutional Economics and Economic History. *The Journal of Economic History*, 57(3), 718-721. doi:10.1017/S0022050700019112
- Liebeschuetz, J. H. W. G. (2001). Late Antiquity and the concept of decline. *Nottingham Medieval Studies*, (45), 1-11.
- Liebeschuetz, J.H.W.G. (2006). *Decline and Change in Late Antiquity: Religion, Barbarians and Their Historiography*. Aldershot: Ashgate.
- Lima M. (2014), "Climate change and the population collapse during the ""Great Famine"" in pre-industrial Europe". *ECOLOGY AND EVOLUTION* Volume: 4 Issue: 3 Pages: 284-291
- Lot, F. (1966). *The End of the Ancient World and the Beginning of the Middle Ages*. London: Routledge.
- Lucero L (2002), *The collapse of the Classic Maya: a case for the role of water control*. *American Anthropologist* 104: 814 - 826
- Mantzavinos C, North DC, Shariq S. 2004. Learning, institutions, and economic performance. *Perspectives on Politics* 2(01): 75–84.
- Mathisen, R. W. (1993). *Roman Aristocrats in Barbarian Gaul: Strategies for Survival in Age of Transition*. Austin, Texas.
- May, R. C., Rayter, G. R., & Ledgerwood, D. E. (2016). Institutional Erosion and Its Effects on Russia's Corporate Leadership. *Journal of Leadership & Organizational Studies*, 23(2), 191-207. doi:10.1177/1548051816636622
- Mazzarino, S. (1966). *The End of the Ancient World*. New York: Alfred A. Knoph.
- McCloskey, D. N. (2006). *Bourgeois Virtue*. John Wiley & Sons, Ltd.: New York.
- McCormick, M. (2001). *Origins of the European economy: communications and commerce AD 300-900*. Cambridge University Press.
- McGovern T (1988), *Northern islands, human error, and environmental degradation: a view of social and ecological change in the medieval North Atlantic* . Cambridge University Press
- McMichael AJ (2012), *Insights from past millennia into climatic impacts on human health and survival*. *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA* Volume: 109 Issue: 13
- McMullen, Ramsay (1988). *Corruption and the Decline of Rome*. New Haven and London: Yale University Press.
- McMullen, Ramsay (1990). *Changes in the Roman Empire. Essays in the Ordinary*. Princeton: Princeton University Press.

- McNeill, W. H. (1976). *Plagues and peoples*. Anchor. Garden City.
- Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). *The limits to growth*. New York.
- Medina-Elizalde, Martin; Rohling, Eelco J (2012), Collapse of Classic Maya Civilization Related to Modest Reduction in Precipitation. *SCIENCE* Volume: 335 Issue: 6071 Pages: 956-959
- Mitchell, S. (2014). *A History of the Later Roman Empire, AD 284-641*. John Wiley & Sons.
- Mommsen, T. (1854-6). *Römische Geschichte I-III*. Munich.
- Moss, H. S. L. B. (1937). Revisions in economic history: VI. the economic consequences of the barbarian invasions. *The Economic History Review*, 7(2), 209-216.
- Motesharrei, S., Rivas, J., & Kalnay, E. (2014). Human and nature dynamics (HANDY): Modeling inequality and use of resources in the collapse or sustainability of societies. *Ecological Economics*, 101, 90-102.
- Musset, L. (1965). *Les Invasions: Les Vagues germaniques*. Paris.
- Musset, L. (1975). *The Germanic invasions: the making of Europe, AD 400-600*. Paul Elek.
- North DC, Thomas RP. (1973), *The Rise of the Western World: A New Economic History*, Cambridge University Press: Cambridge.
- North DC. (1990), *Institutions, Institutional Change and Economic Performance*, Cambridge University Press: Cambridge.
- North, D. C., & Thomas, R. P. (1970). An Economic Theory of the Growth of the Western World1. *The Economic History Review*, 23(1), 1-17.
- Ober, J. (2015). *The rise and fall of classical Greece*. Princeton University Press: New Jersey.
- Oliver, C. (1992). THE ANTECEDENTS OF DEINSTITUTIONALIZATION. *Organization Studies*, 13(4), 563-588. doi:10.1177/017084069201300403
- Penrose, E. T. (1995). *The Theory of the Growth of the Firm*: Oxford University Press, USA.
- Perowne, S. (1966). *The end of the Roman world* London, Hodder.
- Peterson LC & Haug GH (2005), "Climate and the collapse of Maya civilization. *AMERICAN SCIENTIST* Volume: 93 Issue: 4 Pages: 322-329
- Pierson P. 2000. Increasing returns, path dependence, and the study of politics. *American Political Science Review* 94(02): 251-67.
- Pirenne, H. (1927). *Les villes du Moyen Age: essai d'histoire économique et sociale*. Maurice Lamertin.
- Pohl, W. ed. (1997). *Kingdoms of the Empire. The Integration of Barbarians in Late Antiquity*. Leiden, New York and Cologne.
- Ponting C (1992), *A Green History of the World: The environment and the collapse of great civilizations*. New York: St. Martin's Press.
- Ponting, Clive (2007), *A New Green History of the World: The Environment and the Collapse of the Great Civilization*. New York: Penguin Books.
- Potter, David S. (2004). *The Roman Empire at Bay AD 180-395*. London and New York: Routledge.
- Randsborg, Klavs (1989). *The Demise of Antiquity: Europe and the Mediterranean in the First Millennium AD*. *Annual Review of Anthropology*, 18, pp. 227-244.
- Rapp, R. T. (1976). *Industry and economic decline in seventeenth-century Venice (Vol. 69)*. Harvard Univ Pr.
- Redman C (1999), *Human Impact on Ancient Environments*. Tucson: University of Arizona Press
- Redman C et al. (2004), *The archaeology of Global Change: The impact of humans on environment*. Washington DC: Smithsonian Books
- Renfrew C (1978), Trajectory discontinuity and morphogenesis: The implications of catastrophe theory for Archaeology. *American Antiquity* 43: 203 - 222
- Reuveny R (2012), Taking Stock of Malthus: Modeling the Collapse of Historical Civilizations, *ANNUAL REVIEW OF RESOURCE ECONOMICS*, VOL 4 Book Series: Annual Review of Resource Economics Volume: 4 Pages: 303-329
- Richardson G (2000), *The Great Maya Droughts*. Albuquerque: University of New Mexico Press
- Robertson, Paul L. & Langlois, Richard (1994), *Institutions, Inertia and Changing Industrial Leadership*. *Industrial And Corporate Change*, 3, 2, 359 - 378.
- Rostovtzeff, M. (1957). *The Social and Economic History of the Roman Empire (2nd edn, revised PM Fraser)*.
- Rostovtzeff, M. I. (1926). *The social & economic history of the Roman Empire (Vol. 1)*. Biblio & Tannen Publishers.
- Sabloff JA (1971), The collapse of classic Maya civilization. In "The Patient Earth" (ed. Harte J & Socolow R), 16 - 27
- Salmon, E. (1963). *The Roman Army and the Disintegration of the Roman Empire*. In *The Fall of Rome. Can It Be Explained?* Ed. Mortimer Chambers. New York: Holt, Rinehart and Winston, 37-46.
- Scheidel, W., & Friesen, S. J. (2009). The size of the economy and the distribution of income in the Roman Empire. *The Journal of Roman Studies*, 99, 61-91.
- Scheidel, Walter (2007), 'Demography'. In Scheidel, Morris & Saller (eds.) *The Cambridge Economic History of the Greco-Roman World*. Cambridge, Cambridge University Press, 38 - 87.

- Scheidel, Walter, Morris, Ian & Saller, Richard (eds.) (2007), *The Cambridge Economic History of the Greco-Roman World*. Cambridge, Cambridge University Press.
- Schiavone, A. (2000). *The end of the past: Ancient Rome and the modern West*. Harvard University Press.
- Sharer RJ (1977), *The Maya Collapse Revisited: Internal and External Perspectives*. In "Social Process in Maya Prehistory: Studies in Honour of Sir Eric Thompson (ed. Hammond), 531-32
- Simkhovitch, V. G. (1916). Rome's fall reconsidered. *Political Science Quarterly*, 31(2), 201-243.
- Sorokin Pitirim (1950), *Social philosophies of an age of crisis*. Beacon Press, Boston
- Sorokin Pitirim (1957), *Social and cultural dynamics*. Porter Sargent, Boston
- Spengler O (1918), *The decline of the West*. New York: Alfred Knopf.
- Swain, S. & Edwards, M. eds. (2003). *Approaching Late Antiquity: the Transformation from Early to late Empire*. Oxford.
- Swain, S. (2004). Introduction. In *Approaching Late Antiquity: The Transformation from Early to Late Empire*. Ed. Simon Swain and Mark Edwards. Oxford: Oxford university Press, 1-19.
- Tainter J (1988), *The collapse of complex societies*. Cambridge University Press
- Temin, P. (2001). A Market Economy in the Early Roman Empire. *The Journal of Roman Studies*, 91, 169-181. doi:10.2307/3184775
- Thompson JES (1954), *The rise and fall of Maya Civilization*. Norman: University of Oklahoma Press
- Thompson, E. A. (1982). *Romans and Barbarians: The Decline of the Western Empire*. Wisconsin: The University of Wisconsin Press.
- Toynbee A (1933-1954), *A Study of History*. Oxford: Oxford University Press
- Turchin P (2003), *Historical dynamics: Why States Rise and Fall?*. Princeton Studies in Complexity, Princeton, New Jersey.
- Van Tilburg JA (1994), *Easter Island: Archaeology, Ecology & Culture*. Washington DC: Smithsonian Institution Press.
- Vogt, Joseph (1967). *The Decline of Rome. The Metamorphosis of Ancient Civilisation*. London: Ebenezer Baylis and Son.
- Walbank, F. W. (1962). Trend in the Empire of the Second Century A.D.. In *Decline and Fall of the Roman Empire: Why Did It Collapse*. Ed. Donald Kagan. Lexington: D.C. Heath and Co., 13-22.
- Walbank, F. W. (1969). *The Awful Revolution : The Decline of the Roman Empire in the West*. Liverpool: Liverpool University Press.
- Wallis, J. (2016). The New Economic History and Beyond: The Scholarship of Douglass C. North. *The Journal of Economic History*, 76(3), 937-947. doi:10.1017/S0022050716000851
- Wang X & Chen F & J Zhang & Yang Y & Li J (et al.) (2010) Climate, desertification, and the rise and collapse of China's historical dynasties, *Human ecology* 38.1
- Wang, SW (2005) "Abrupt climate change and collapse of ancient civilizations at 2200BC-2000BC" *PROGRESS IN NATURAL SCIENCE-MATERIALS INTERNATIONAL* Volume: 15 Issue: 10
- Ward-Perkins, B. (2000). Specialized production and exchange. *The Cambridge ancient history*, 14, 425-600.
- Ward-Perkins, B. (2005). *The fall of Rome: And the end of civilization*. Oxford University Press.
- Weber, Max (1950), *The Social Causes of the Decay of Ancient Civilization*. *The Journal of General Education*, 5, 1, 75 - 88.
- Weber, Max. (1891), *Die römische Agrargeschichte in ihrer Bedeutung für das Staats- und Privatrecht* (Stuttgart, F. Enke, 1891) at Internet Archive <https://archive.org/details/dieromischeagra00webegoog>. Retrieved January 2nd, 2017.
- Webster D (2002), *The Fall of the Ancient Maya*. New York: Thames and Hudson
- Westermann, W. L. (1915). The economic basis of the decline of ancient culture. *The American Historical Review*, 20(4), 723-743.
- Wickham, C. (1984). The other transition: From the ancient world to feudalism. *Past & Present*, (103), 3-36.
- Wiener, Malcolm H. (2014), "THE INTERACTION OF CLIMATE CHANGE AND AGENCY IN THE COLLAPSE OF CIVILIZATIONS ca. 2300-2000 BC". *RADIOCARBON* Volume: 56 Issue: 4 Special Issue: SI Pages: S1-S16
- Williamson OE. (1991). Strategizing, economizing, and economic organization. *Strategic Management Journal* 12(3): 75-94.
- Williamson OE. (2000). The new institutional economics: taking stock, looking ahead. *Journal of Economic Literature* 38(3): 595-613.
- Yeakel, Justin D.; Pires, Mathias M.; Rudolf, Lars; et al. (2014), Collapse of an ecological network in Ancient Egypt. *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA* Volume: 111 Issue: 40
- Yoffee N & Cowgill GL (1988), *The collapse of ancient states and civilizations*. University of Arizona Press
- Yoffee, Norman (1988), Introduction. In Yoffee N & Cowgill GL (eds.), *The collapse of ancient states and civilizations*. University of Arizona Press, 1 - 20.

- Yu, SY; Zhu, C; Song, J; et al. (2000), "Role of climate in the rise and fall of Neolithic cultures on the Yangtze Delta. *BOREAS* Volume: 29 Issue: 2 Pages: 157-165
- Zhang Z & Tian H & Cazelles B et al. (2010), Periodic climate cooling enhanced natural disasters and wars in China during AD 10-1900. *PROCEEDINGS OF THE ROYAL SOCIETY B-BIOLOGICAL SCIENCES* Volume: 277 Issue: 1701
- Zhang, David D.; Brecke, Peter; Lee, Harry F.; et al (2007), "Global climate change, war, and population decline in recent human history". *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA* Volume: 104 Issue: 49 Pages: 19214-19219.

## Appendix: Description of the review process

The history of the Roman Empire is undoubtedly one of the most studied topics in all scientific fields. For this reason, conducting a meta-analysis of this mass of books and articles is a complex process. We focus on the literature addressing the collapse of the Roman Empire and follow the norms of systematic literature reviews. Table 1 depicts the research process.

P	Description:	Object:	Definitions:	Initial amount:	Books:	Book articles:	Art.	Total
1	Obtaining basic literature	List of books extracted from Roman bibliographies	All available	29	26	0	1	27
2	Reading of literature and gathering all potentially relevant titles (to Excel)	Bibliographies	Index terms /topics: Rome/Roman (empire), antiquity + decline, collapse, failure, agriculture, economy, commerce, institutions, development, population, exchange, technology, government, transportation	395	280	32	83	422
3	Database search: extensive search of all potentially relevant studies	Melinda, Google Scholar, BL, Rwdatabase, WoS	Supplementary searches on other publications (scholars found in stage 2)	358	40	0	318	780
4	Selection of literature in relation to the research	Collected reference database (780 titles)	Title, description, author's significance, publication date, period under research (see ref. 1)	780	53[2]	[14]	22	75
5	Going through selected titles by reading and collecting decline factors (sentences) to Excel	75 selected titles	Decline factors (see ref. 2)	75	41[2]	[14]	15	56

We focused on the literature published from the early 1900s that discusses the development of the Roman Empire from the second to the fifth centuries. We collected and analyzed publications on the history of this period concerning population, institutions, exchange, transportation, technology, government, commerce, and economy. Due to the enormous body of literature, we excluded publications on individual cities and regions (e.g., city of Rome, Gaul) that do pertain to development on the grand scale. We also excluded titles addressing decline in areas other than those mentioned above, such as art and architecture.

Our survey of the literature began with a list of the 29 most significant monographs in the field. Twenty-seven of the titles were available to us. We examined the bibliographies of these books to incorporate sources that, at least in part, covered the Roman Empire and its economic, institutional and social development between the second and sixth centuries B.C. These sources addressed topics such as governance, technology, commerce, agriculture, the environment, population, and transportation. Because the titles of publications do not always reflect the content, we incorporated all publications. We had 422 titles. At the same time, familiarity with these books made it possible to focus on the research topic.

After compiling a database from the bibliographies of 27 monographs, we began collecting more literature from internet databases and added 358 titles. At this point, we had 780 references. We used the same index terms as in phase two, including searches of authors we had previously found. After compiling a database of 780 books and articles on the decline of Rome, we examined every reference. We reduced the number of the titles by limiting ourselves to books and articles that directly addressed the decline of the Roman Empire.

To choose the most relevant selection of literature, we used abstracts, information on authors, the number of times a source was cited (Web of Science) and the year of publication. For articles, we considered the journals in which they were published. We placed the most respected journals (examples *Journal of Roman History*) ahead of the others. We also look at the topics of the studies to find every unique explanation for the decline. Studies of rarely mentioned causes, such as lead poisoning, the influence of religion and race theories were included in the final database. Even though the 18<sup>th</sup> and 19<sup>th</sup> centuries produced many studies on the decline of Rome, we limited our search to the studies published in the 20<sup>th</sup> and 21<sup>st</sup> centuries.<sup>3</sup> Because the studies published before the Second World War often cited these

---

<sup>3</sup> See Christ (1970) and Demandt (1984) for coverage of the older literature on the collapse of the Roman Empire.

older studies, we are certain that all the factors presented in the previous centuries are mentioned in our database. We were able to narrow the number of the sources to 75 titles, 51 of which are monographs, 22 of which are articles and two of which are books of essays comprising 14 articles by different authors.

Having defined our final research material, we combed it through using critical qualitative analysis and searched propositional clauses that underlined causal relationships between a certain factor and the decline of the Roman Empire. We also noted any counter arguments. We exported these clauses into an Excel spreadsheet. These 75 sources gave us 620 clauses, each indicating one decline factor. We open coded this sample of decline factors then aggregated the sample to the three categories reported in this paper.