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All Roads Lead to Rome

Subsidized Centralization: An Economic Analysis of the Roman Road Network

Introduction

Empire is the political phenomenon that occurs when a polity expands beyond its regional economic and geographic basin.[>] Using historical inquiry to better understand the processes by which a polity expands and maintains an empire can provide insights into the organizational forces underlying historical and modern events. These processes span economics, politics, history, anthropology and geography. This paper will explore one such process; how the construction of the Roman road network subsidized the centralization of economic activity and political power, thereby facilitating the effective control of a vast empire from a central point. A combination of economic modeling and political anthropology will, hopefully, help to explain a process that animated Roman history—and that remains active in the modern world. Specifically, this paper focuses on how the process of import replacement acts as a brake on the formation of Empire, and how the Roman subsidization and design of their road network counteracted the tendency towards import replacement. By inhibiting import replacement in its provinces, Rome was able to effectively reduce political devolution and maintain centralized control over its far-flung empire.

The Roman Republic was founded in 512 BCE, and by 268 BCE was in control of nearly the entire Italian peninsula. From that point, until the Rome reached its greatest geographic expanse under the Emperor Trajan, its history was one of continual expansion. Rome was by no means a monolithically centralized polity—forces of centralization and decentralization were constantly in conflict, and many regions and governors had significant degrees of autonomy. However, the ability of the central point of Rome to exert significant control over regions as far flung and diverse as England, Palestine, and Egypt remains no small feat. As Rome expanded, one of the principle challenges confronting the integrity of the empire was the inherent difficulty of exerting

efficient command and control over the functions of a huge and diverse domain. Expansion created an increasing need for firm, centralized control to effectively leverage economies of scale (both political¹ and economic) in order to compensate for increasing diseconomies of scale. The Roman road network in Britain and the Italian peninsula provide examples of subsidized financing and Rome-centric orientation that enhanced economic and political centralization. The resulting road network, literally a calcification of Empire, was a critical factor in the success of Rome.

The Import Replacement Cycle

Import replacement is the process by which settlements transition from an economy oriented towards imports and exports to an economy that replaces those imports with self-sufficient production. Import replacement was a common feature of peripheral economic zones prevalent within the Roman Empire. Long supply lines at the periphery increase the cost of imported goods, until at some distance from the center the increased cost of transportation offsets the economy of scale provided by centralized production. Beyond that distance it becomes more economical to replace imports with local production than to pay the cost of transporting them from a central region:

Eventually . . . the most distant farmers are so far from the existing city that it becomes profitable for some manufacturing plants to move [or emerge at] the new locations part of the way from the center to the frontier. When some firms begin to do this, they immediately generate a cumulative process of city growth in the new locations.

As peripheral economies go through the import replacement process, the economic center of gravity shifts from the political center to a virtual doughnut ring of peripheral economies (see Figure 1). The economic tendency towards import replacement acts also as an economic centrifugal force, creating an economic power vacuum in the political center. As “development led by import-replacement rather than export promotion diversifies, stabilizes, and strengthens the local economy import replacement leads to the rise of regional power centers that compete with the original center for control of the periphery.

¹ “political”, read “economically and militarily”

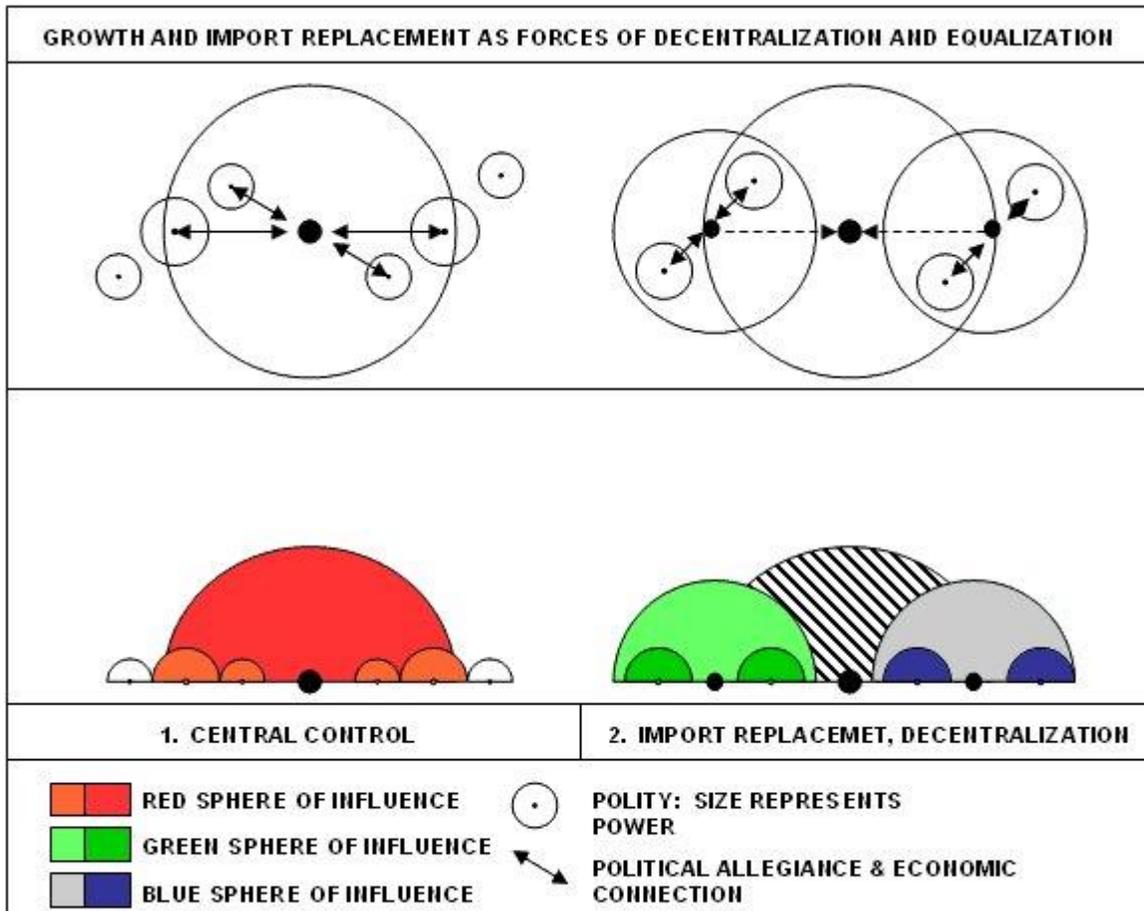


Figure 1: Growth and Import Replacement as Forces of Decentralization and Equalization

The economic power vacuums created a disparity between the political and economic importance of the central point. In the case of Rome, its “huge population was maintained not by trade or manufacture but by the taxes and rents of the empire.” The burden of transporting goods over long distances prevented Rome from serving as both the center of political power and the center of economic production, despite the potential benefits of economy of scale in the manufacture of goods. *As economic power is a critical component in a state’s political power, the development of economic power vacuums could have created political instability, with the tendency for the economic periphery to dissolve into separate polities.* Without some means to hold the political reigns of distant regions from a central point, Rome would not have been able to maintain such a vast area under its control.

If the vagaries of history, geography and the uneven distribution of resources can be temporarily ignored, the economically optimized geographic distribution of human settlement would conform to the hexagonal pattern of Walther Christaller's *Central Place Theory* (see Figure 2). Christaller's framework demonstrates the path-of-least-resistance for societal formation. The cost of transportation and the information processing burdens of hierarchy impose economic costs on any polity that expands beyond a theoretical optimum area of control. Figure 3 illustrates how peripheral economic regions will tend to aggregate into separate, peripheral polities that compete with the center as transportation costs make their formation more energy efficient than maintaining an enlarged, centralized structure.

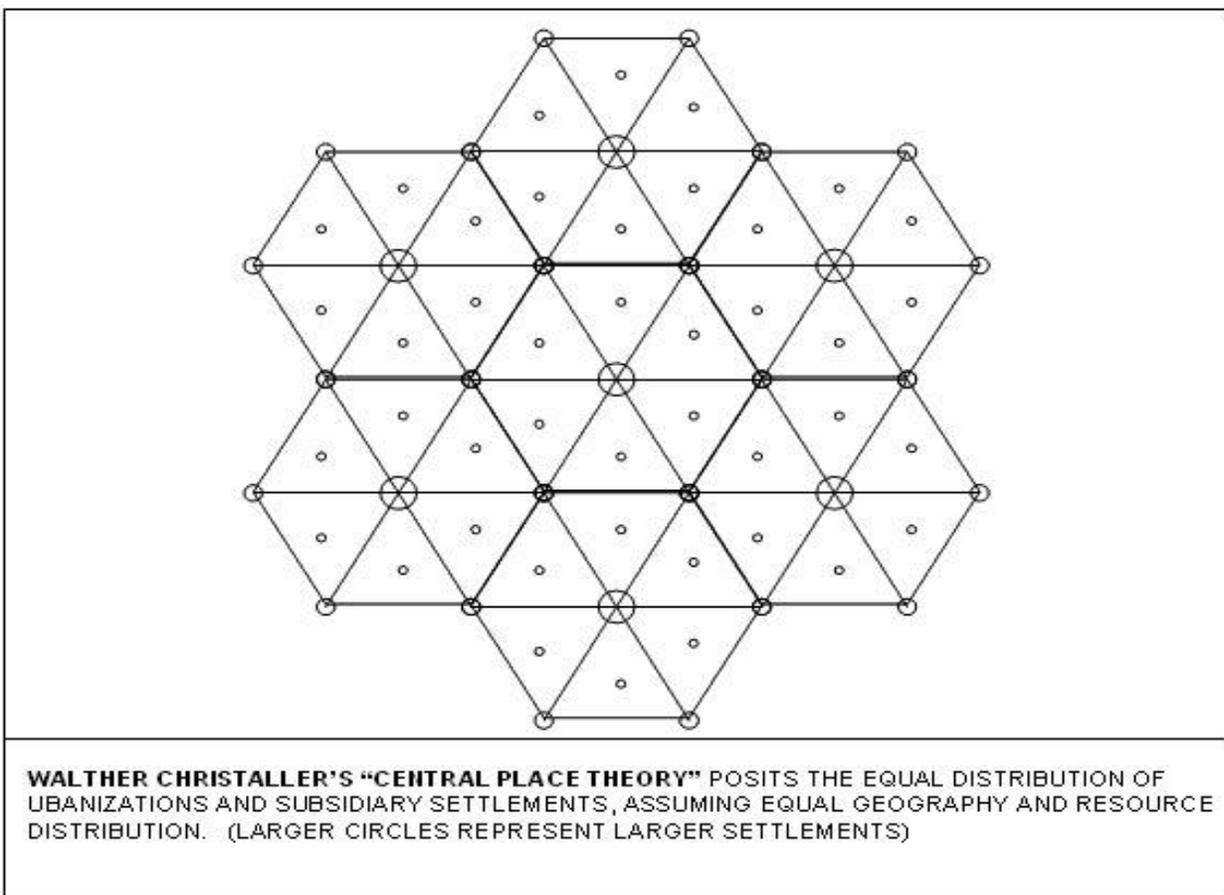


Figure 2: Walther Christaller's "Central Place Theory"

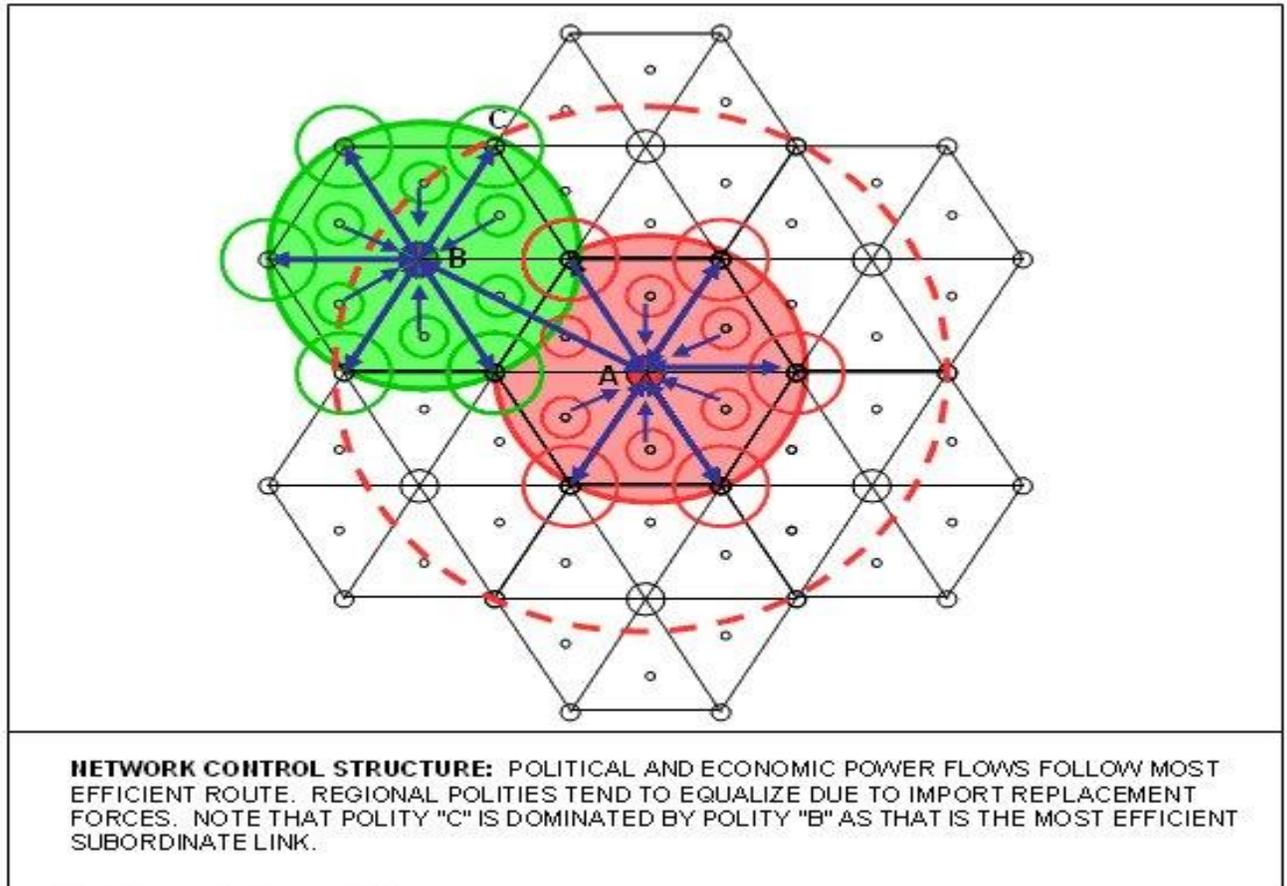


Figure 3: Network Control Structure

The built environment can also influence the process of spatial self-organization, as it creates a geography in which such economic costs are not uniformly imposed. Roads and other “man-made transportation networks are a powerful component of the self-organization of economic space Any society that wishes to deviate from Christaller’s optimum spacing and distribution must provide a continual input of formational energy in order to maintain a non-conforming pattern—a subsidy. Empire, a vast distortion of the preferred polity size in Christaller’s natural pattern of organization, is especially dependent on mechanisms that subsidize the energy demands of its formation and maintenance.

Many of the major empires that preceded Rome shared a common source of formational energy. As described by historian Karl Wittfogel, they were largely “hydraulic” empires The mechanism of centralization was their shared need to pool massive labor and resources to build and maintain the irrigation works of a river basin

upon which their agricultural sustenance depended. Rome formed in the absence of great public-irrigation projects, and in the absence of the natural constraint of a river basin. As such, it required a new mechanism of political centralization to provide formational energies and counter the distributed spacing and centrifugal tendency of economic organization. Rome pioneered a new form of Empire, a *connectivity empire*, laying the groundwork for modern hierarchal state-economies (See Figure 4).

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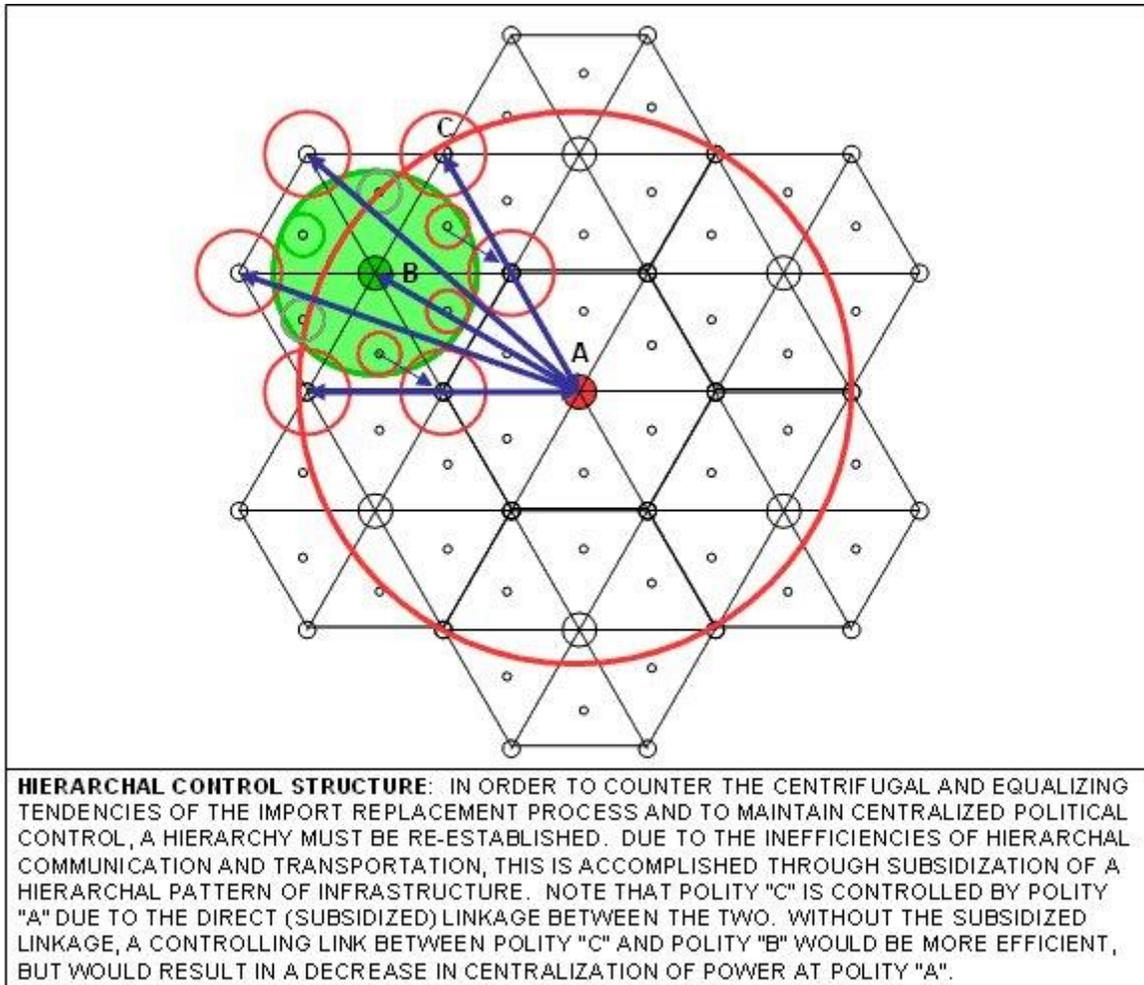


Figure 4: Hierarchal Control Structure

Rubicon of Empire: Subsidization of Centralization Mechanisms

The subsidization of the means of centralization, facilitating the expansion of a polity beyond the optimal bounds of economics and geography, is the litmus test of Empire. Subsidization of the means of centralization distorts the price equilibrium of certain

activities to favor those that benefit centralized control. In Rome, road construction was a subsidized economic activity because the cost of construction is not directly financed by use-associated mechanisms. In other words, the state collected taxes from people who were not the primary users of the roadways (taxing farmers, populations adjacent to construction sites, conquered peoples) and *applied that money to finance road construction.* ²As *Strade Publicum*, the roads were free to use. The result was that those entities that made extensive use of the roads, agents of the state, the military, and agents of import and export, did not have to account for the true cost of their activities. Their activities of trade and political control were, in effect, subsidized by the road construction policies of the empire.

As transport economists Brownlee and Heller point out, “it is essential that means of transport be properly priced so as to avoid over-allocation or under-allocation of resources to transport services as a whole, to particular forms of transport, or to particular segments of any given form Traditional liberal-economic theory holds that market forces will most efficiently allocate scarce resources, and that any command-input to allocate these resources—for example, to build a network of roadways—is an

² Subsidy of other means of communication – i.e. heavy aircraft and naval-merchant vessel fleet; DARPA; aerospace transportation fleet – telecomm infrastructure – Internet, cheap reliable and redundant plus the means of linking it all together – cell phones, telecom satellites – missile technology; subsidy of heavy industry with large defense contracts, etc.; POL – natural gas and petroleum security – Sudan as an example – corporate roads and airfields have dual use – both military and private sector use;

Afghanistan – connect rural to Kabul , “All Roads Lead to Kabul”..”... political context – A. *However, the international situation is evidently shaping in such a way that the road to Paris and London lies via the towns of Afghanistan, the Punjab and Bengal. .Naturally we had in mind even earlier on the need to assist the revolution in Asia and had never abandoned the idea of revolutionary offensive wars. But it was not so long ago that we were still, with a considerable measure of justification, directing all our attention and all our thoughts to the West.”* Leon Trotsky, *The Trotsky Papers* (5957-5959), edited by Ian H. Meijer (The Hague: Mouton and Co., 1964), pp. 621-627. Trotsky, **Sochineniia** volume 13, pages 33-7; alternate text: “ *a cavalry corps of 30-40,000 horsemen must be formed to invade India. The road.....We must seize the moment and somewhere in the Urals must concentrate a revolutionary academy...*” B.”ink line’

inefficient distortion of market forces. If Roman road construction was, therefore, economically inefficient, then why would the empire persevere on such a course for centuries? ***The answer is that such activity—the subsidization of the means of centralization—was necessary in order to counteract the centrifugal forces of import replacement.***³ The Roman roads were a means of subsidizing long distance trade the viability of import replacement, helping to ensure that regional economic centers (especially in the less developed provinces) could not become sufficiently powerful to challenge Rome for control.

Roman Roads: The Calcification of Empire

The particular feature of the Roman roads that this paper explores is their Rome-centric design methodology. The design of the road network demonstrates the strong influence of the builders' desire to ensure that communication, trade and power flowed along roads directly "to Rome, which for the most part by-passed the old urban centers."> Figure 4 provides a theoretical illustration of exactly such a design methodology. While conscious intent on the part of the network's designers is not clear, it is demonstrable that the network had the effect of subsidizing those links that connected most directly with Rome or with Roman political outposts (such as Londinium), while often penalizing those links that connected potentially rival regional centers with their immediate periphery (see Figure 5).

³ "Import replacement", read "ideological" replacement – the creation of alternate socio-economic relations, i.e. "relationships". Gramsci's 'trench works'.



Figure 5: Roman Road Layout

The geography of the Roman Empire placed the road network in a position of particular importance. Throughout history, maritime transport was considerably more efficient than land transport when dealing with bulk goods. In Rome, the central position of the Mediterranean further increased the efficiency of maritime transport. However, due to the maritime dominance of Carthage, and the geography of the Italian peninsula, Rome developed as a land power, not effectively challenging Carthage for hegemony over “their” *Mare Nostrum* until late in Rome’s development. As a result, Rome evolved an increased dependency on land transportation. Furthermore, pirates posed a significant threat to maritime transport well after the defeat of Carthage.⁴ While the Mediterranean served as a central highway, Rome’s military challenges existed at the perimeters and far away from maritime transport options; Britain, Germany, Gaul, and Parthia all lay beyond the reach of the Mediterranean hub. Additionally, while maritime transport was faster and more efficient for the transport of bulk products, such as grain from Egypt, it was significantly slower as a means of communication. Efficient roadways with networks of mounted messengers could span several hundred miles a day. This speedy, reliable connectivity was critical to the effective command and control of an empire.⁴

⁴ How geography influences policy.

While the Roman roadways fulfilled the normal functions of roads such as trade, military transport, communications, they did so in a manner that directed power flows towards Rome, and specifically precluded the accumulation of regional power. The “political significance of the courses taken by certain roads should be noticed. Agde, [was the] main center of Marseilles’ commerce, yet neglected by the via Domitia; the [via] Appia passed by [the once significant source of rival Greek power on the Italian peninsula,] Tarentum The political cohesion of Roman Italy “depended on a space economy defined by the road.”

The physical layout of the road system served to centralize the flow of power in the empire. In low-intensity or non-centralized civilizations, roadways are an emergent phenomena. They grow out of economic necessity in a pattern that more closely resembles ecology than hierarchy (see the pre-Roman trackways of Britain in Figure 6).

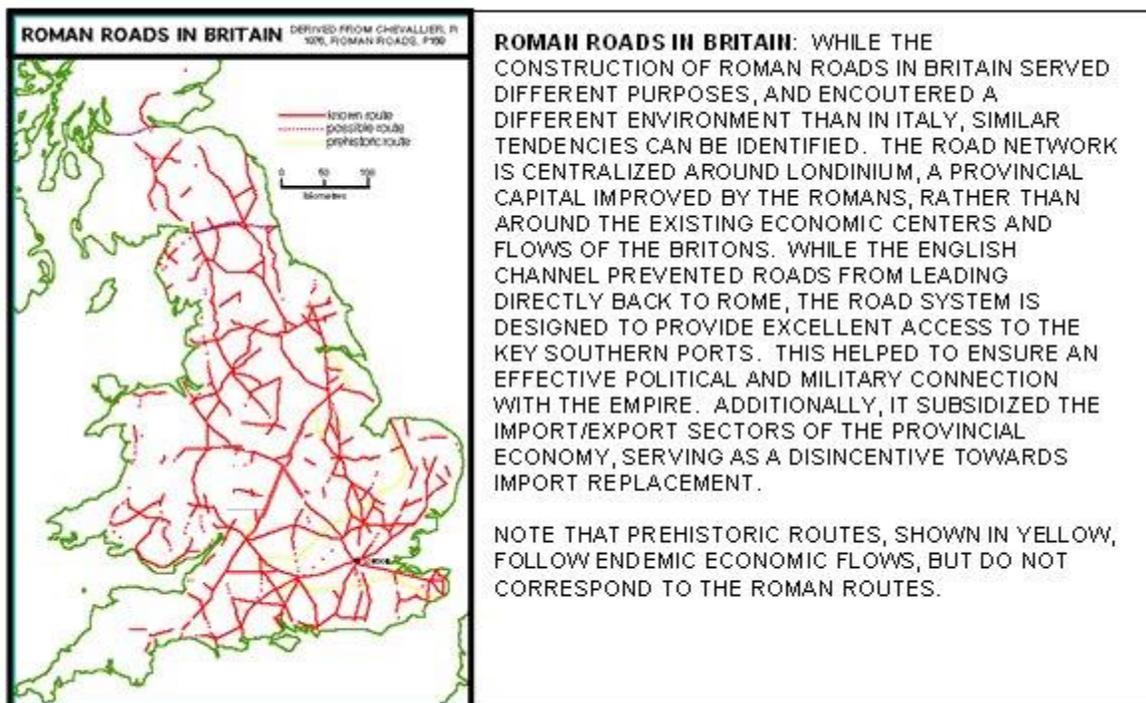


Figure 6: Roman Roads in Britain

Current theories on network architecture⁶ and the inefficiencies of hierarchy suggest that the most economically efficient road system would be distributed and decentralized—very different from the roads of Rome. *But road systems that grow to optimize their economic function do not necessarily serve the political goals of a central power.* Such distributed road systems tend to encourage, not prevent the process of

import replacement, and the resulting devolution of political power. The Roman road system, while less efficient from a purely economic standpoint, carefully reversed the natural tendency towards distribution in favor of centralization. *Roman roads normally ignored the pre-Roman roadways as these served to further the development of regional economies and polities.* By providing subsidized road systems that bypassed traditional regional political centers and channeled resources and trade directly to imperial administrative centers (like Londinium) or to Rome, *rather than with each other, Rome hindered the outlying regions from developing independent regional economic and political networks.* Their intent was, in the words of historian Ray Laurence, to “create a system that unified those members of the state at a distance from Rome . . . it was this space economy that facilitated the appropriation and political domination of distant territory by the Roman state Laurence, however, expresses the common opinion that this tendency was merely the result of the skewed “nature of Roman space-time,” implying, in my opinion incorrectly, that Roman leaders were incapable of thinking through complex economic problems. While they may not have used modern economic constructs, the Roman road system is a sophisticated example of political subsidy.

In Roman Italy, the road network radiated outwards from Rome, providing direct connections with regional cities and resource basins. Conspicuously, it did not efficiently connect these regional entities with each other. As illustrated in Figure 5, these spoke roads specifically flowed communications and trade efficiently to Rome, and only with far greater difficulty between outlying entities. The physical geography of Italy makes this trend even clearer. Italy is defined by the Apennines, a mountain range that runs the length of the peninsula like a central spine. Economically efficient road layout would have resulted in the confluence of roads at the point before a roadway crosses these mountains. Instead, the Roman road system pushes across the Apennines at more points than necessary, directly connecting key points on the Adriatic with Rome. On the western side of the Apennines there is a conspicuous absence of roadways connecting the cities of Cortona, Florentia (Florence), Seana (Siena), and Pisae (Pisa). More recent Italian history illustrates the wisdom of this Road layout, as the alternative economic and political center of gravity of Florence, Siena and Pisa posed an ongoing challenge to Italian unification until modern times.

Roman Britain provides another, although different, example of the role of the Roman road network in maintaining the integrity of the empire. Roman road building in Britain largely ignored the placement of pre-Roman trackways (See Figure 6). Rather than providing connectivity between local settlements, *the Romans built roads connecting their new capital of Londinium with regional Roman forts*. While their road network did provide interconnectivity to the local economy, it ensured that these points of connection occurred at an imperial outpost, and that they directed economic flows not to the traditional British economic centers, but to the new imperial administrative center of Londinium. This facilitated the control and regulation of the conquered Britons, even encouraging them to Romanize by relocating to one of the new but economically prosperous Roman crossroad towns. Additionally, the Roman roads in Britain provided excellent connectivity with ports on the English Channel. This acted as a subsidy to trade in imports and exports (especially tin), and inhibited the development of indigenous import replacement industries.

Conclusion

The Roman Empire utilized a Rome-centric road system as an effective means of centralizing command and control to counteract the centrifugal tendencies and diseconomies of scale of such a vast empire. The use of subsidized financing to construct the road-network of Rome was essential in the reshaping of the Roman economy to facilitate Empire. Combined with a design methodology that inhibited the development of competing power-centers, the road network played a key role in the creation and maintenance of the most expansive empire in the world in its day. Critically, the shift from the irrigation-based centralization mechanisms of Wittfogel's hydraulic empires to the connectivity-based centralization of Rome facilitated the expansion of Rome far beyond the geographic limitations of preceding empires. While the specific history of the Roman road system served as an example to illustrate these mechanisms, it is the role of Roman roads in the broader process of empire formation that is of critical relevance to the understanding of this historical pattern, and of its application to the challenges facing humanity today.

In this paper, the term "Empire" is used in an economic sense to refer to a vast yet centrally controlled polity. This should be differentiated from the political meaning of the term Empire: a polity that is ruled by an emperor. While the polity of Rome transitioned

politically from a Monarchy (ruled by a king) to a Republic (ruled by the Senate) to an Empire (ruled by an Emperor), Rome became an Empire—in the economic sense used in this paper—when it expanded its political borders beyond the Italian peninsula.

This paper proposes the term economic/geographic *Basin* as the concept that the uneven geographic distribution of resources, terrain, climate, economic history, etc. creates a virtual drainage basin for economic activity, where there are economic tendencies for trade and production to pool and flow in a prearranged manner. For example, rainfall along the Front Range of the Colorado Rockies will gravitate toward the Gulf of Mexico and not the Pacific, unless some artificial system distortion—such as using outside energy to pump the runoff across the continental divide—overcomes the attraction of the terrain basin. A *Basin* performs the function of an *attractor* in chaos-theory.

For additional background history on ancient Rome, and for sources for this brief summary, see http://en.wikipedia.org/wiki/Ancient_Rome.

Michael Schuman, “Going Local”: 56.

F. W. Walbank, “The Decline of the Roman Empire in the West”: 30.

Paul Krugman, “How the Economy Organizes Itself in Space: A Study of the New Economic Geography”: 254.

Michael Schuman, “Going Local”: 56.

Neville Morley, “Metropolis and Hinterland”:

Colin Renfrew and Paul Bahn, “Archaeology: Theories, Methods, and Practice”: 187.

R. A. Wilson, “Prometheus Rising”: 63.

Paul Krugman, “How the Economy Organizes Itself in Space: A Study of the New Economic Geography”: 258

To include the Egyptian kingdoms (Oriented around Nile Hydrology), Assyrian empire (Tigris & Euphrates, later adding the Nile), Mauryan (Ganges, Indus), and Qin Dynasty (Yellow and Yangtze). These were the major “hydraulic” empires that preceded Rome. According to the definition of empire given in the opening paragraph (polity exceeding economic and geographic basin), the Egyptian kingdoms may not qualify as an “Empire”, as they only intermittently expanded beyond the Nile basin, a natural

economic and geographic region. The others pass the litmus test of Empire as they spanned more than one river basin (each an economically and geographically optimal basin). The Hittite, Elamite, Phoenician, Persian, Athenian and other empires Empires do not conform to Wittfogel's "Hydraulic" concept, nor are they adequately explained by the "Connectivity" concept of Rome. Various formational factors, from maritime trade access to metallurgy advances have been used to explain their respective formation, but further analysis is beyond the scope of this paper.

Karl Wittfogel, "Oriental Despotism: A Comparative Study of Total Power."

Brownlee, O.H., and Walter W. Heller, "Highway Development and Financing,": 249.

Neville Morley, "Metropolis and Hinterland": 180.

Rome's first significant assertion of maritime dominance came with the First Punic War against Carthage in 264-241 B.C.

While Rome completed their destruction and conquest of Carthage by 146 B.C., there was still the need in 67 B.C for the Roman general Pompey to conduct a campaign

against the Cilician sea raiders. See "Piracy Timeline" at

http://pirateshold.buccaneerssoft.com/pirate_timeline.html

Raymond Chevallier, "Roman Roads": 205.

Ray Laurence, "The Roads of Roman Italy": 39.

Mark Buchanan, "Nexus: Small Worlds and the Groundbreaking Science of Networks": 46.

R. A. Wilson's SNAFU principle, see Wilson's "Prometheus Rising": 78.

Raymond Chevallier, "Roman Roads": 79-80.

Ibid: 78.

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