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PRO BONO PUBLICO? DEMAND FOR MILITARY SPENDING BETWEEN THE WORLD WARS

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This article analyzes the demand for military spending in the 1920s and 1930s, based on variables arising from the international system and the selected countries. The main premise is that the military spending was an impure public good, implying that both public and private benefits drove the demand for this type of expenditure. Threats arising from the autocratic states in the 1930s increased these expenditures, and democracies overall tended to spend less. Moreover, the absence of clear international leadership by the USA or UK destabilized the international system and increased military spending, with alliances failing to produce a public good effect. Military spending resulted in joint products at the level of state and within state, and the level of economic development seemed to exert a downward pressure on the military spending of these states. There were some contradictory spillover effects felt by these states. On the whole, this article suggests that scholars should expand their explanatory models to include impure public good influences in military spending analysis.

Introduction

The interwar period features many elements that have dominated the economic and political discourse over the nature of the period: the Great Depression, the impact and causes of the world wars, the rise of communism and fascism, and the emergence of new nation states, to name a few. However, there have been fewer efforts to understand the military competition and the government spending patterns of the period as a whole, and what those patterns meant for some of these larger questions: Were democracies inherently more peaceful? What elements drove the arms race in the 1930s? What forces mattered more–the domestic or external factors? In addition, it is often assumed that military spending (or national defense) was a public good that arose from the preferences of the public as well as the perceived threats and the support of friendly allies.

Demand for Military Spending Between the Wars

The study of military spending has often focused on periods like the Cold War or the period preceding the First World War, during which alliances competed and, to an extent, influenced the spending decisions. For example, as shown in the classic study by Mancur Olson and Richard Zeckhauser (1966), alliances providing a public good type deterrence also incurred free riding from within, i.e. smaller nations tended to free ride on the efforts of the larger nations.[1] Moreover, these periods featured extended arms races, which were also tied to great power politics and competition. The interwar period is perhaps a better example of a "normal" period, since it featured both the postwar period of de-escalation and efforts at disarmament as well as a period of economic crisis and an arms race. Thus, we can study the impact of the impure public good aspects of spending choices in conjunction with structural variables in a more typical (and varying) setting. Moreover, previous studies of military spending behavior have focused on individual country studies (like Max Hantke and Mark Spoerer, 2010, on Germany), specific aspects of the military competition in this period (such as Jari Eloranta, 2011, on the failure of the League of Nations as a potential alliance), or on the long-run study of military spending, with scant attention paid to the interwar period.[2]

The main goal here is to explain the aggregate and individual countries' demand for military spending during the interwar period based on influences arising from the international "system," alliances, and interactions between and within states. The answers provided in this article suggest that military spending was an impure public good, implying a combination of both public and private benefits during this period. The impure public benefits at the various levels were linked to the actions of the alliances and domestic players, namely business coalitions, in a complex evaluation of the needs of a particular country. There is already

[1] See also Todd Sandler (1977) on alliances and free riding.

[2] For a classic comparative study of the late Cold War spending, see e.g. Leonard Dudley and Claude Montmarquette (1981). An exception to the rule is Mauro Rota (2016), which analyzes military spending from the late 19th century to 1930 – however, in his article the focus on the role of democracy in determining military spending levels, similar to Jari Eloranta et al. (2014).

evidence, for example in Eloranta (2007), which suggests that the rent seeking of domestic economic interest groups, along with many bureaucratic players, was often fairly successful, exerting significant upward pressure or constraints on spending levels.

At the level of the international "system," this article will explore the impacts of systemic changes on the military spending levels. It seems that forces among the 17 states indeed played an important role in determining the demand for military spending among the said states. Often the exact impact of these forces is difficult to ascertain precisely, for example the rise of autocratic nations seemed to increase military spending among these states. Yet, the concentration of economic and military resources did not occur along the same lines in the 1930s compared to the immediate period following the First World War. Changes in the interwar system illustrated that there was a leadership vacuum, both economically and militarily. The idea that economic leadership in a system is crucial to understanding foreign relations has been influential especially among international relations theorists in the post-Second World War period. For example, Robert Keohane, Joseph S. Nye, Paul Kennedy, Charles Kindleberger, and Robert Gilpin are among those who claim a strong relationship exists between the pursuit of leadership and economic development. According to Keohane and Nye, a state is likely to provide hegemonic leadership in the international regime if there are benefits to be gained from such action, with the hegemon being able to change the rules of the game rather than having to adapt to changes imposed by others. This hegemon's economic and political leadership can erode due to crises or shifts in the overall balance of power between the states in the international system. At such a time, the so-called secondary powers, the followers, respectively react by altering their goals to challenge the leader's position.[3] In the interwar period, there was no clear hegemon, which served to loosen the potential constraints for military competition, such as we saw in the 1930s following an economic crisis.

Another avenue of research that has attracted a lot of attention among political scientists concerns the role democracies play in international

[3] See esp. Robert Keohane and Joseph Nye (1977), Barry Eichengreen (1992), and Charles Kindleberger (1973, 1983).

politics. In particular, the so-called democratic peace argument centers on the claim that democracies, due to the fact that democracies do not seem to engage in conflicts with other democracies as well as due to the nature of their institutions, are more peaceful actors on the international stage. Clearly the democracies as a whole also behaved differently compared to the autocracies in the interwar period. They seemed to spend less for military purposes, and an increase in the level of democracy seemed to decrease the impulse to spend on defense. At the level of the system, the new authoritarian challengers represented a systemic threat in the 1930s, to which the democracies on the aggregate responded slowly. International security leadership, in turn, was not forthcoming from the League of Nations, which was unable to act as the guardian of the status quo sealed in Versailles. In fact, many of the interwar states did not view military spending as a public good arising from any interwar alliances. In fact, alliances providing a pure public good in the form of deterrence are quite rare.[4]

In this article I will first discuss the theoretical framework and previous studies of military spending in order to frame the analysis and data. After that, I will address some of the key characteristics of the international "system" and how to analyze it in the interwar context. Then I will discuss and analyze individual countries' military spending behavior, and engage in quantitative testing of the demand for military expenditures.

Perspectives on the Study of Public Goods and Military Spending

There have been several historical and interdisciplinary studies on war and societies focusing on economic and fiscal trajectories in the long run. Studies like those by Niall Ferguson (2001) and Paul Kennedy (1989) offer meta-level explanations of various aspects of military spending demand formation and the competition for power by different types of states.[5] Yet,

[4] Here the analysis stops at the level of states, thereby not delving deeper into the political frameworks within countries. This approach can, of course, be taken even further to the micro-level, i.e. the consumers. See e.g. David Throsby and Glenn Withers (2001).

[5] See also William McNeill (1982) and Maurice Pearton (1982).

there have been few studies offering analytical treatment (or presenting relevant data) of the military spending of the Great Powers and smaller states in the interwar period, neither in the military historiography or among the social sciences in general. Some of the earliest accounts were actually written by contemporaries such as Francis Hirst (1937). These accounts, however, cannot offer reliable statistical information, especially for the 1930s. A good example of recent work combining the theoretical aspects of economics with historical case studies and offering new data in a comparative fashion is Mark Harrison (1998). This edited volume, however, does not offer analysis or data for the 1920s.[6]

Historical studies relating to military spending in the interwar period are often heavily focused on the 1930s and the rearmament experience in particular. Robert Frankenstein's (1982) study on the French military spending and G.C. Peden's (1979) book on the British case are fine examples of such efforts, often providing comparative data and/or time series on the military spending of various states for the entire period.[7] Hantke and Spoerer (2010) have analyzed German military spending and the economic effects of the Versailles Treaty limitations on German fiscal fortunes in the 1920s in a quantitative fashion that is quite rare in the literature. Jari Eloranta (2011) in turn has written about the failure of the League of Nations as a limiting force for the military spending of most of its members in the 1920s and 1930s, as well as a study of military spending policies and interest groups in Finland, Sweden, and the UK (see Eloranta, 2009). Some of the longer-run studies of the economic history of military spending, for example by Oriol Sabaté Domingo (2016a, b), also touch on the interwar military spending patterns, particularly Spain.[8] Most studies, however, have not analyzed the interwar military spending consistently and comparatively, especially quantitatively. In this study, the quantitative

[6] See also Stephen Broadberry and Mark Harrison (2005).

[7] Nonetheless, there are few quantitatively oriented studies attempting to assess the impact of the 1930s rearmament. See esp. Nicholas Crafts and Terence Mills (2013), Timothy Hatton and Mark Thomas (2010), Mark Thomas (1983).

[8] On the importance of long-run military spending analysis, see esp. Philip Hoffman (2011, 2012, and 2015).

analyses are based on the database developed in Eloranta (2002) and complemented in Eloranta (2011).[9]

How have theories of state behavior at the *system* level been linked to the analysis of military spending? According to George Modelski and William Thompson (1996), military spending is an important component of competition for resources in a system and that engaging in such expenditures represents a tradeoff between the benefits gained by military spending and the domestic consumption costs involved. Obviously, although often overlooked, all of these patterns embody different implications and theoretical models in order to explain the military spending of a state or a group of states on the whole, something that has been absent from the analyses of the interwar period.

Another type of literature, mainly stemming from defense economics, institutional economics, as well public choice[10] theoretical models, views the *actors* involved in the budgeting process as well as the *procurement* side of military contracts as crucial elements in the analysis of military spending. This type of analysis has also rarely been done in the context of the interwar period. For example, a variant of choice-theoretic model of defense, closely related to the premises of most public choice literature, views government bureaucrats as making the military expenditure recommendation based on their own desire to maximize their bureau's power and prestige, along with attendant personal gains. Another variant emphasizes the role played by defense lobbies and other types of interest groups in order for them to achieve various benefits from the government's provision of defense.[11]

As Paul Samuelson argued, "collective consumption goods" are goods whose consumption by an individual leads to no subtraction of that good

[9] The intricacies of the data, including annual data vs. fiscal year data, are discussed in those sources. On the whole, a great deal of effort was expended to make sure the data are comparable. As Eloranta (2002) shows using statistical comparisons of the various sources, the data seem to be fairly consistent for most of these nations.

[10] See e.g. Keith Hartley (2012), Sandler and Hartley (1995).

[11] Sandler and Hartley (1995, 57-58).

from another individual.[12] This definition of a public good has been modified and improved upon by public sector economists over the years, for example James Buchanan (1968). He defined a non-exclusion principle as such that additional consumers may be added at zero marginal cost. While no good or service is likely to perfectly fit this definition of a public good, Buchanan cites national defense as coming close "to the descriptive purity."

Following the Samuelsonian tradition, in current research pure public goods are usually defined as having two essential features: 1) non-excludability of benefits; 2) non-rivalry of benefits.[13] Furthermore, there are also different types of "publicness" among public goods, depending on the extent of congestion in consumption and the costs of excluding the good from others. This means that they can perhaps be distinguished further into pure public goods, quasi-public goods, and merit goods, all produced in the "political markets."[14] Thus, a more precise definition of a public good, contrary to Samuelson's early contributions, reflects the fact that goods may possess merely elements of publicness, to varying degrees, and may therefore possess characteristics of non-price exclusiveness or non-rivalness in consumption.[15] These goods that stand in-between, whose benefits are partially rival and/or partially excludable, are often referred to as impure public goods, which is the term preferred in this article. One important sub-class of such goods, for which benefits are excludable but partially non-rival, is called club goods. Activity by individuals and/or groups to pursue such goods may give rise to multiple outputs—private, public, and impure public—that are defined as joint products.[16]

One of the first important distinctions to be made in the analysis of the demand for any public good is the level of analysis—i.e., whether one wishes to analyze the demand for a public good at the level of a state or

[12] Paul Samuelson (1966b, 57-58). See also Samuelson (1966a).

[13] Sandler and Hartley (1995, 4); Jeffrey Hummel and Don Lavoie (2000, 38). Origins of these distinctions can be found in Olson and Zeckhauser (1966).

[14] Reino Hjerppe (1997, 14-15).

[15] John Cullis and Philip Jones (1987, 20-21).

[16] Richard Cornes (1996, 9); Sandler and Hartley (1999). See also Olson and Zeckhauser (1966).

within a particular group of nations, such as an alliance. Some of the most important insights into the analysis of military spending have originated from the analysis of NATO by Olson and Zeckhauser (1966). They argued that an alliance—as opposed to the "public" in a state—should be treated as providing a public good for its members in the form of deterrence against aggression, yielding either purely or impurely public benefits, although the authors did not develop the latter dimension of the analysis very far. A purely public good cannot be denied from the nonpayers (or agents who pay less for it), and thus the agents who value the good will overprovide for it. Others can free ride to a certain extent at the expense of the said agents. A key notion supporting the idea of NATO providing a pure public good arises from the weapons technology and the strategic aspects of the post-Second World War period. When it is possible for a state to retaliate on behalf of its allies in a way that produces devastating damage and this retaliatory threat is deemed automatic and credible, the conditions for a purely public good alliance (non-rivalry, non-excludability) are in place. For example, in the case of nuclear deterrence there is no reason to limit the size of the group sharing the good if the above conditions are met. NATO's strategy of Mutual Assured Destruction (MAD) in 1949-1966 indeed provided such conditions, yet since and before then, alliances have rarely possessed the required pure public good qualities.[17]

In this article the focus is on the military spending demand as a common response by the selected countries, to ascertain how prevalent the public good characteristics among them were. Since the time period is too short to offer very reliable individual country regression results, not to mention the issue of limited degrees of freedom, the regression analyses will be performed with pooled data. The primary tool used here is, assuming that the countries selected faced similar "shocks" (especially external ones) that affected them all, the technique of Seemingly Unrelated Regressions (SUR). I will, however, evaluate these results with Two-Stage Least Squares (2SLS) if endogeneity and autocorrelation are both

[17] Olson and Zeckhauser (1966), Sandler and Hartley (1999). On the international system, see Kindleberger (1981, 1986).

encountered. 2SLS assumes the presence of Nash equilibrium(s), implying independent behavior among the countries in the initial regressions upon investigating the pure public good characteristics. The preferred solution here, nonetheless, is to solve these problems within the SUR-framework. Yet, the choice of technique will depend on several pre-conditions as well as certain empirical considerations.

The model utilized here combines several elements at various levels of interaction. At the level of state, prices (often assumed common for all or excluded from the analysis altogether[18]), full income, and threats form the key independent variables, which is a typical model used in the defense economics literature. Moreover, alliances can provide a public good in the form of deterrence, which leads to suboptimality in defense provision as well as exploitation of the "large" by the "small." The most important factors that are missing from this type of framework are, in particular: 1) systemic influences; 2) impacts of regime type; 3) adequate representation of the price of "defense;" and 4) group influences on the budgetary process within the states (bureaucracies, industries, as well as other interest groups). Pure and impure benefits are usually both present in forming the demand for a public good, with the pure public goods model often being nested in the derived impure public good models.

Following the framework outlined by Barry Buzan et al. (1998), the levels of analysis in this article thus include: 1) *international system*, meaning the largest conglomerates of interacting or interdependent units that have no system level above them; 2) *international sub-systems*, such as alliances, meaning groups of units within the international system that can be distinguished from the entire system by the particular nature or intensity of their interactions with or interdependence on each other; 3) *single units*, here referring to states, meaning actors composed of various subgroups within a unit, sufficiently cohesive and independent to be differentiated from other such units; and 4) *subunits*, meaning organized groups of individuals within the units that are able or wish to affect the behavior of the unit, such as bureaucracies or lobbies. Before investigating the demand components from the various levels, I explore some of the

[18] See e.g. Sandler and James Murdoch (1990).

overall trends in military spending and systemic developments in this period.

International "System" and Interwar Military Spending

Most of the world was dominated by the Western great powers, following the colonial exploits of the 19th century, with the fall of the Ottoman Empire leading to even greater Western domination. More precisely, Europeans or the former colonies of Europe in the Americas controlled 84 per cent of the earth's land surface in 1914. The West can of course be a bit misleading as a description, since these nations certainly did not a uniform political entity, especially having just fought one of the deadliest conflicts in human history.[19] Nonetheless, the interwar period could lend itself well to the analysis of a "world system" or "Western system", albeit a disjointed one. Moreover, one of the premises here is that the interwar period can be studied as a uniform period. For example, the Great Depression simply could not be understood without the failure of the renewed Gold Standard and the absence of centralized monetary cooperation among states.[20]

As discussed here, it is essential to include the systemic dimension in the military spending analysis. On the basis of data availability and the dichotomy between democracies and autocracies, the comparisons in this article consist of either 17 states[21], or, respectively 11 European states.[22] These 17 countries in fact represent this aforementioned "world system" quite well, since they formed 84.8 per cent of the "world" military expenditures (abbreviated as ME) in 1913 and 87.7 per cent of the "world"

[19] Samuel Huntington (1996, e.g. 50-53). See also William McNeill (1982).

[20] Eichengreen (1992), Beth Simmons (1997).

[21] Austria, Belgium, Denmark, France, Finland, Germany, Italy, Japan, the Netherlands, Norway, Portugal, the Soviet Union, Spain, Sweden, Switzerland, the UK, and the USA.

[22] The countries listed in the previous footnote less: Austria, Germany, Italy, Japan, the Soviet Union, and the USA. This group of 11 states forms a more similar group, both in terms of data sources and military spending behavior.

ME in 1929.[23] They were naturally equally dominant economically as well.[24]

Table 1

Original CINCs (Based on the Entire COW Database) and the Modified CINCs in a 17-country System for France, Germany, Russia/USSR, the United Kingdom, and the United States, 1920-1938

YEAR	*FRA, CINC*	*FRA, MOD CINC*	*GER, CINC*	*GER, MOD CINC*	*RUS, CINC*	*RUS, MOD CINC*	*USA, CINC*	*USA, MOD CINC*	*UK, CINC*
1920	5.92	9.08	7.22	7.99	10.21	18.19	12.79	11.81	28.47
1925	6.07	9.57	7.93	9.49	10.20	11.69	9.37	12.58	25.06
1930	6.13	9.84	7.33	8.81	14.95	14.31	7.63	11.39	22.36
1935	5.20	7.53	10.18	13.75	18.12	19.83	7.17	9.93	18.86
1938	4.55	6.28	15.34	15.78	16.61	21.22	7.54	9.43	16.46

Source: see Eloranta (2002) for details. Original COW-indices generated with the EUGene software and database.
Note: Details on the COW database can be found in Singer and Small (1993). Details about the method of common currency conversions can be found in Eloranta (2002).

We can learn more about the distribution of power among these states by looking at their overall economic and military resources. For example, the total resource share, the so-called CINC (Composite Index of National Capabilities), is usually calculated as an arithmetic average of six series: the share of military personnel, the ME share, the energy consumption share, the iron and steel production share, the total population share, and

[23] Calculated using the most comprehensive military spending database (National Capabilities) available: David Singer and Melvin Small (1993). The figure in 1929 includes also Finland, which was not separately in existence in 1913. Without Finland, the figure for 1929 was 87.5 per cent.

[24] See e.g. Prados de la Escosura (2000), Huntington (1996), Angus Maddison (1995, 2007).

the urban population share. This type of data are considerably less reliable for the following countries in the sample of 17 states: Austria, Germany, Italy, Japan, and Russia/USSR. The reasons include both source problems as well as conceptual problems involved with the data series, such as the inclusion of war expenditures. Also, the energy consumption share commonly used in the Correlates of War (COW) CINCs, which may be a poor proxy for economic stature in a system, was here replaced with the real GDP share explained in Eloranta (2002).[25] Thus, the military resource share (MILCINC) of a country is calculated as an average of only the military components in the CINC (the military personnel share and the real ME share). Table 1 displays a comparison with the original COW CINCs and the new, modified CINCs constructed here.

The comparison suggests, despite the samples not being the same, that the new CINCs indicate a significant upwards adjustment for Russia in particular, as well as for Germany in 1935 and the United States in 1930, for example. The new modified CINCs make, in addition, the British decline seem more gradual, which also seems to more or less apply to the other cases as well. Quite surprisingly, the new CINCs bestow the Soviet Union the "lead" in the total resources in 1938, whereas the old estimates indicated approximate parity between Germany, the United States, and the Soviet Union in the same year. Soviet data is, nonetheless, perhaps the most suspect in this sample due to, for example, lack of readily available exchange rates.

Russia's strong showing in the CINC-scores and the military resource shares has been discussed before by William Wohlforth (1987) for the pre-First World War period. The same weaknesses certainly plagued the interwar Soviet Union as with the case of pre-revolutionary Russia; i.e., how to mobilize its vast capabilities.[26] On the other hand, it may be difficult to separate the perception of defensive and offensive capabilities in the macro-level estimations. And, to be certain, Russia possessed

[25] In addition, energy consumption appears to be highly correlated with economic growth (see Vaclav Smil (1994), e.g. 206), yet it is hard to argue it would represent national economic resource levels better and more accurately than the concept of (real) GDP.

[26] For further discussion, see Harrison (2000).

immense defensive capabilities that were displayed in the two World Wars and did engage in significant military reforms after its shocking defeat against Japan in 1905. This critique of the use of the CINC scores notwithstanding, it may however be plausible that these countries reacted to such perceptions in their military spending decision-making. In addition, one could reasonably expect that the military resource shares would be more significant than the aggregate CINC scores in the system estimations.

In terms of evaluating the qualities and changes in the system in question, there are several potential variables available for military spending analyses. It has been suggested, for example, that the effect of system-level capability concentration, with capabilities concentrated mostly in the hands of major powers (or just one hegemon), might have an enhancing decision-making certainty effect, although there is no consensus on this. A standard way in the conflict research literature to measure capability concentration is:

$$CONC_t = \sqrt{\frac{\sum_{i=1}^{N_t}(S_{it})^2 - 1/N_t}{1 - 1/N_t}} \quad (1)$$

where S_{it} equals the proportion of the aggregate capabilities (CINC) possessed by a major power in year *t*; N_t=the number of major powers in the system in year *t*. This index takes a value from 0 to 1. Although many studies have indicated that system-level capability concentration is unrelated to the occurrence of a major power war, this system indicator has not previously been tested as a possible determinant of military spending.[27] A decline in the concentration of total resources (CINCs) should increase the polarity in the system, thus inducing higher ME by the states in the system. Other indicators that will be utilized here, in addition to the ones already mentioned, include the CINCs and military resource shares of the declining and prevailing systemic leaders (assumed to be the UK and USA), the total 17-country system military spending and its

[27] Daniel Geller and Davd Singer (1998).

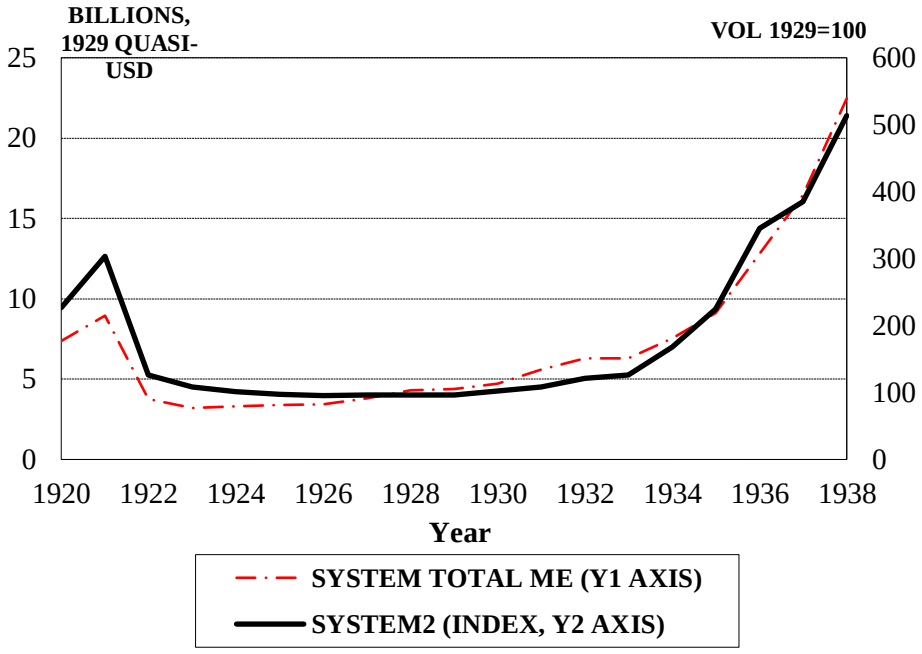
dispersion (measured by coefficient of variation), the CINCs of democracies and autocracies on the aggregate, the military spending shares of democracies and autocracies, and individual country alliance effects.[28] Subsequently, an increase in the total system military spending should induce a positive threat response in the form of increased military spending by the individual states; an increase in the dispersion of military spending by the states in the system should represent mounting threats to the individual states, thus inducing higher military spending; and a decline in the concentration of military resources (MILCINCs) should increase polarity in the system, thus increasing uncertainty in the system, and should induce higher military spending among the individual states.

Additionally, based on the democratic peace argument[29] as well as the discussion on the leadership effects, we can argue that: 1) an increase in the total resources held by democracies in the system should exert a spillover effect for the individual states, thus inducing a reduction in their military spending; 2) an increase in the aggregate military spending of democracies in the system should exert a spillover effect for the individual states, thus inducing a reduction in their military spending; 3) an increase in the total resources held by autocracies in the system should represent a threat for individual states, thus inducing an increase in their military spending; 4) an increase in the aggregate military spending of autocracies in the system should represent a threat for individual states, thus inducing an increase in their military spending (at a lag); 5) individual nations in the system should respond, in the form of either challenger or follower behavior in their military spending, to changes in the military spending behavior of the perceived systemic leader(s); 6) individual nations in the system should respond, in the form of either challenger or follower behavior in their military spending, to changes in the total resources held by the systemic leader(s); and 7) individual nations in the system should respond, in the form of either challenger or follower behavior in their

[28] See Eloranta (2002), Appendix 2 for details on the sources.

[29] See esp. Seung-Wham Choi (2011), Allan Dafoe and Bruce Russett (2013), Bueno De Mesquita et al. (1999), Michael Mousseau (2000), John Oneal and James Ray (1997), Sebastian Rosato (2003), and Russett (1993).

military spending, to changes in the military resources of the systemic leader(s). All of the hypotheses revisited here assume a time lag due to the slowness of the budgetary process.



Source: See Eloranta (2002), Appendix 2, for details.
Note: SYSTEM TOTAL ME calculated as the sum of the real ME figures of the seventeen states in 1929 quasi-USD. SYSTEM2 equals the combined mean military burden and military personnel index, weighted by the countries' share of total real ME in 1929 quasi-USD, for seventeen states. The volume index was set as 1929=100 for the individual states.

Figure 1
Total System (Real) Military Spending and a System Threat Index in a System of Seventeen States, 1920-1938

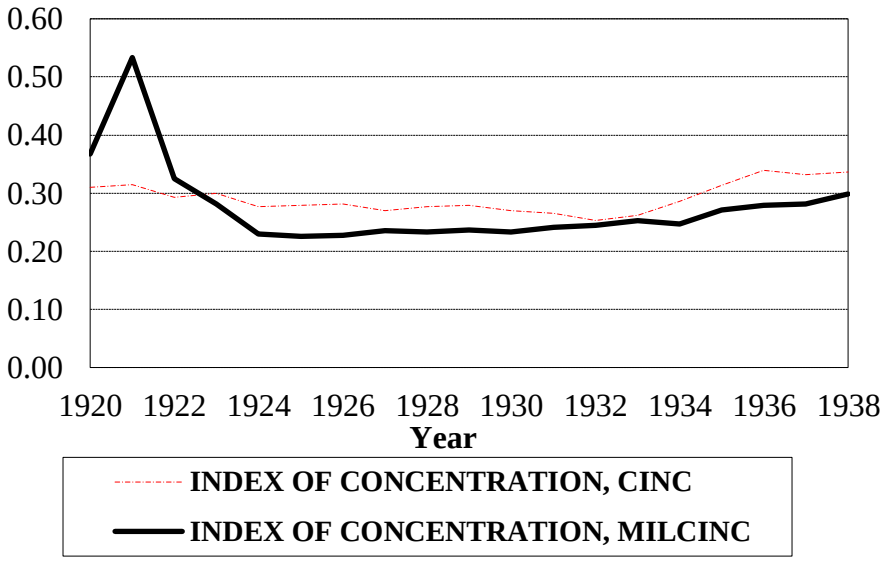
Before moving to the statistical treatment of these hypotheses, we should peruse the systemic developments, the military spending behavior of democracies in comparison with autocracies, as well as the implications

of the leadership qualities in the system. Additionally, a review of the military spending patterns in the system may be warranted, especially if a balance existed in the way that the economic resources and military resources were valued by the individual states. As seen in Figure 1, systemic "threats" at first glance seemed to decline after the early 1920s, only to surge from circa 1933 onwards. Both the total system ME and an approximate threat index indicate remarkable support for such an assessment. The increase of systemic military spending threat was dramatic and continuous for the rest of the 1930s.

However, if we look at Figure 2, this preliminary appraisal of the period becomes more dubious. Especially based on the balance of power literature, the assumption usually is, similar to some of the hypotheses explored here, that decreasing concentration of power leads to systemic instability. The 1920s therefore was not only a period of decreasing total military spending, but also a period of new states could level the playing field in terms of military resources. This development is hardly visible in the development of the total resource concentration. This might suggest that the 1920s already provided the seeds of the systemic instability of the 1930s. The increasing concentration in the depression decade was the result of the new challengers, namely great powers, emerging onto the international scene. Did similar developments take place in the "power balance" between the democracies and the autocracies?

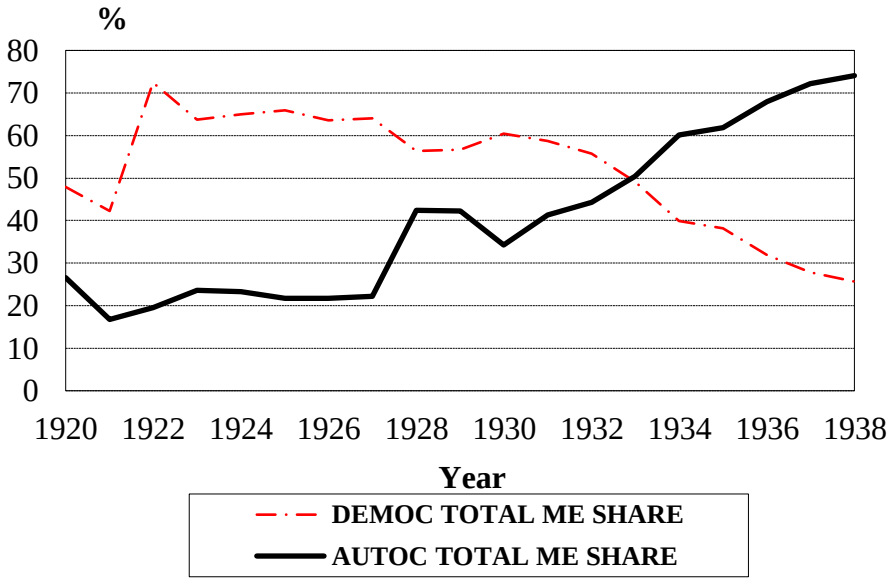
The ascendancy of the authoritarian nations and their military spending role indeed began already after the mid-1920s, although the balance between the democracies and the autocracies did not shift until 1933, with especially Germany tipping the balance (see Figure 3). After that, the decline of democracies as a military force was a fairly rapid phenomenon. Thus, the 17-country system was at first destabilized by the deconcentration of military resources in the 1920s, with the rapid decline of democracies further fueling this process in the 1930s. The argument that the deconcentration of military resources was indeed destabilizing is closely linked to the absence of military leadership by the Western economic giants, especially the United States. Whereas the United Kingdom allocated even more for military purposes than its share of total resources would have warranted for some of the period, the U.S.

MILCINC was far lower than its economic and political position "required". The absence of a credible military leader, not to mention an economic leadership broker, made this deconcentration a destabilizing force in the 1920s.



Sources: see the system (seventeen states) data sources in Eloranta (2002), Appendix 2.
Note: Indices of concentration calculated as indicated in the text. Definitions of CINC and MILCINC provided in the text.

Figure 2
Indices of Concentration, for CINC and MILCINC, 1920-1938



Sources: See system state data sources in Eloranta (2002), Appendix 2.
Note: DEMOC (=democracies) defined as those scoring at least six in the Polity IV democracy index; AUTOC (=autocracies) defined as those scoring at least three in the Polity IV autocracy index. Real ME calculated as explained in other figures and in Eloranta (2002), Appendix 2.

Figure 3
Total Real Military Spending Shares of the Democracies Versus the Autocracies in the 17-country System, 1920-1938

The Demand for Military Expenditures as an Impure Public Good

This section represents an effort to concentrate on the types of variables one could utilize in the analysis of the demand for military spending as an impure public good in the interwar period. As the previous sections have suggested, military spending cannot be understood solely in terms of pure public good characteristics in this period. Military spending is determined through a combination of forces emanating from the various explanatory levels (system, alliance, state, within state) explored in this

article. Accordingly, suitable variables have to be found to represent the influences arising from all of these levels. In addition to the efforts to introduce systemic level variables, as well as variables consistent with the hypotheses on leadership and regime type, I also will discuss how to measure the spillovers and threats more credibly. Furthermore, political market proxies, representing the influences and structure of the political system within states, will be explored and developed. Second, this section brings forth the results of the estimations using all of the independent variables hypothesized to be relevant.

There are almost limitless possibilities of how to measure the "actual" impact of spillovers and threats on a country. In terms of the SPILLOVER variable, it is possible to utilize the 11-state "alliance" as a possible source of spillovers, measured by the real ME (in 1929 quasi-USD). However, it is very likely that countries react to changes in either their own military stock or the relative strength of their military stock compared to other states. The first effect, implying that a state makes its adjustment on the basis of its standing in the (17-state) system, could perhaps be proxied by the concept of MILCINC introduced earlier. The second is more difficult to approximate. I will make the assumption that the United Kingdom and France were the main sources of spillovers among the 11 European states (for which the data is more reliable). Thus, for example the following kind of a spillover variable was calculated:[30]

[30] The spillover variable can also be expressed as:

$$SPILLOVER_i = \left(\frac{\left(\frac{MP_{UK}}{MP_i}\right) + \left(\frac{RT_{UK}}{RT_i}\right)}{\left(\frac{MP_{UK,t-1}}{MP_{i,t-1}}\right) + \left(\frac{RT_{UK,t-1}}{RT_{i,t-1}}\right)} - 1 \right) x100$$

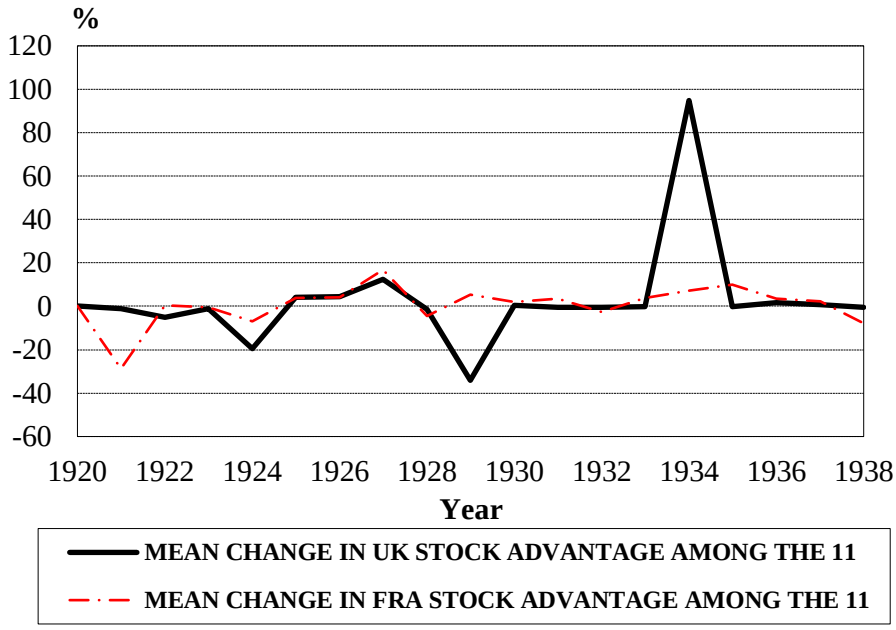
I would like to thank Mark Harrison for clarifying my thinking on this.

$$SPILLOVER_i = \left(\frac{\left(\frac{\left(\frac{MP_{UK}}{MP_i} + \frac{RT_{UK}}{RT_i} \right)}{2} \right) + \left(\frac{\left(\frac{MP_{UK,t-1}}{MP_{i,t-1}} + \frac{RT_{UK,t-1}}{RT_{i,t-1}} \right)}{2} \right)}{\left(\frac{\left(\frac{MP_{UK,t-1}}{MP_{i,t-1}} + \frac{RT_{UK,t-1}}{RT_{i,t-1}} \right)}{2} \right)} \right) x100 \quad (2)$$

in which *MP* represents the number of military personnel and *RT* represents the real tonnage of a nation *i* in comparison with the United Kingdom. In essence, Equation 2 measures the *change* (from *t*-1 to *t*) in the comparative stock advantage for the United Kingdom over country *i* as a mean percentage (calculated also for France). The same variable was calculated to measure the influence of France over these countries (calculated also for the United Kingdom). Since Switzerland had no sea borders and thus no effective tonnage, only the *MP* variable was used in this case. The use of this variable presupposes almost perfect knowledge on these two military stock variables by these nations, which is not an untenable assumption. The information on these was within the reach of all of these nations via the League of Nations publications, especially the Armaments Year-Books.[31]

As Figure 4 below displays, the mean relative military stock advantage of the United Kingdom plummeted especially in the late 1920s, only to recover strongly in the mid-1930s, which means that the behavior of the great powers and the "weak" states was not entirely similar at this time. France's advantage, in comparison, developed in a more stable manner. The "weak" states were less willing to compromise on their military stock at the height of the European disarmament illusion in the late 1920s.

[31] Eloranta (2011) has further analysis and figures on the military threat estimations and the use of the League of Nations data.

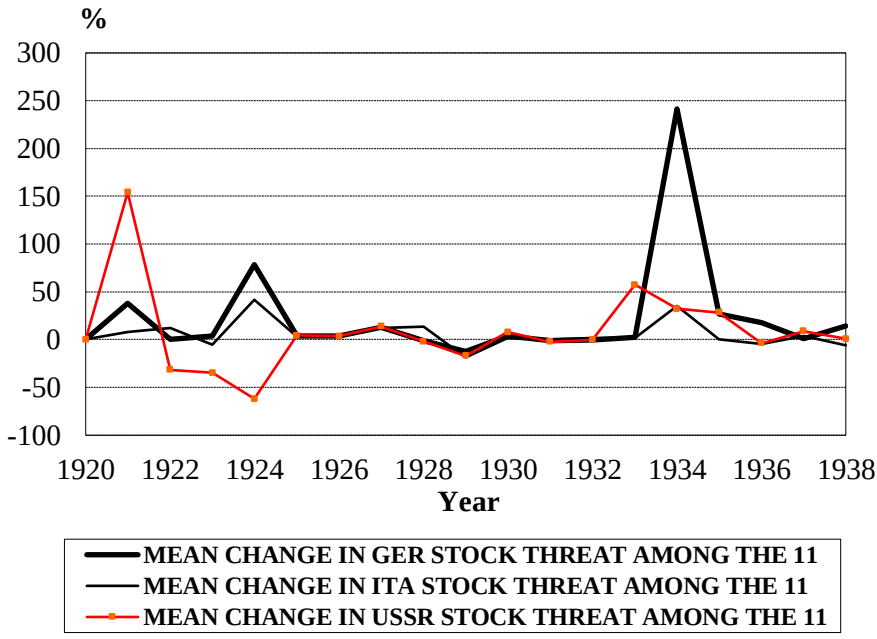


Source: See Eloranta (2002), Appendix 2 for further details.
Note: Military stock advantages calculated according to Equation 2.

Figure 4
Mean Annual Change in the Relative Military Stock Advantage of France and the United Kingdom in the Sample of 11 European States, 1920-1938

As far as the threat variables are concerned, we can explore different options for the possible threats. The combined threat index (COMBTHRT), a German-weighted threat index (GERTHRT), or a German-Soviet-weighted threat index (GERSOVTHRT) all attempt to approximate the main threats felt by these states. Threats were thus calculated as combined indices with different weighting schemes. The individual countries representing threats were assumed to be Germany, the Soviet Union, Italy, and Austria (on the basis of the First World War). Thus, individually, the development of these countries' defense shares and the number of their military personnel were both turned into volume

indices (1931=100), and then combined with equal weights for a particular country to form the threat index. If a value was missing from one of these series, only one of the indicators was used for that particular year. Next, a combined index was formed with the following weights: 2/7 for others, 1/7 for Austria (the weakest of these countries). This index could initially be tested for Portugal and Spain,[32] as well as for the two great powers in the sample.



Source: See Eloranta (2002), Appendix 2.
Note: Military stock threat calculations based on earlier discussion in the text.

Figure 5
Mean Annual Change in the Relative Military Stock Threat Felt by the 11 European States from Germany, Italy, and the USSR, 1920-1938

[32] Also, in the case of these two countries, their respective defense shares or military burdens were tested as possible sources of threats due to their occasionally uneasy political relationship.

A German-weighted index (the combined aggregate index of all countries 1/2, Germany's threat index 1/2 of the weighting) could initially be used for Belgium, the Netherlands, Norway, and Switzerland. A German-Soviet-weighted index (the combined aggregate index of all countries 1/3, Germany's threat index 1/3, and the Soviet Union's threat index 1/3 of the weighting) could form the starting point for the statistical testing in the cases of Finland and Sweden. These weighting choices were chosen due to geographic proximity and strategic threat (Austria developed similar to Hungary, which is not included due to limited data).

In addition, I also calculated a stock adjustment variant of the threat, in the vein done for the spillover effect of the United Kingdom above, to measure the stock advantage (or disadvantage) of Germany, Italy, and the Soviet Union. One must emphasize two things, however: 1) the data for these states are, similar to the military spending data, less satisfactory than for the 11 states analyzed in detail; and 2) it is unclear how much knowledge the 11 countries actually possessed especially on the size of the armed forces of the authoritarian states. Nonetheless, I will also test the statistical significance of these threat indices against the competing representations described above. As Figure 5 shows, the change in the relative military stock threat imposed by Germany in this period remained almost stable until 1934, when the buildup of German armed forces and military stock compelled this indicator to rise sharply. In the late 1930s, the German military threat increased slower relative to the 11 selected states. In the Italian case, most of the interwar period revealed efforts to increase its military readiness, yet the threat impact posed by these efforts remained meager. In the Soviet case, the delayed impact of the Civil War and the chaotic early 1920s can be seen clearly in Figure 5. The Soviet Union did increase its potential military stock threat in the 1930s, although not as much as Germany especially in the closing years of the decade.

In terms of relative military spending patterns, which provide more depth to the analysis of threats, these are displayed in Table 2 for some of the countries in the sample. First, the spending levels were typically lower in the 1920s, although for some countries the military burden was quite high still in 1920, as a result of the First World War. Second, the rearmament in the latter half of the 1930s was quite rapid, especially for the authoritarian nations. Third, the spending levels of the economic

leaders, i.e. the UK and the USA, was quite low in comparative terms. Regardless, these patterns need to be confirmed with more in-depth quantitative analysis.

Table 2
Interwar Military Spending Patterns

Year	Aus	Germ	Fra	Ita	Jap	Rus	Spa	Swe	UK	USA
1920	0.0	0.3	4.0	10.0	5.9	7.0	2.4	2.1	3.1	2.6
1925	0.7	0.9	2.5	2.6	2.8	9.7	3.1	2.1	2.5	0.8
1930	0.9	0.9	4.6	3.8	3.0	2.3	2.6	1.6	2.3	0.9
1935	1.3	6.6	6.0	3.9	5.7	5.5	2.2	1.4	2.8	1.3
1938	2.1	14.6	6.8	6.4	22.7	10.7	4.1	1.7	6.5	1.5

Source: Eloranta (2002). The figures presented are military burdens (=military expenditures as a percentage of GDP).

What about the impact of the political markets and bureaucracies? If military bureaucracies are to behave in a fashion predicted by public choice theorists, they tend to overextend the budget beyond the "required" limits and favor producers more than consumers.[33] The latter assumption seems particularly reasonable in the interwar period, since voters/consumers, unlike the other groups mentioned by Keith Hartley (2012) previously, were rarely organized as an interest group in Western countries until after Second World War. Even though it is difficult to find descriptive variables to represent bureaucratic influences, especially in a comparative fashion, I will attempt to see whether military expenditures were influenced by the preceding year's military spending (ME_{t-1}). Thus, it would reveal whether the previous year's budget was the basis for either similar or differing levels to come.

[33] See e.g. Sandler and Hartley (1995, 119). As William Niskanen has hypothesized, most bureaus, unless constrained by the aggregate demand, have a budget-maximizing incentive in the short run. Most of this spending also tends to be capital-intensive by nature. Niskanen (1971), Part IV, Section 12.

Competition within the political economy, especially among officials selected for a limited term, can also have a profound effect on a nation's military spending policy. Electoral uncertainty associated with such competition between the political parties may impart a negative bias on the military spending of a particular state. The myopic bias of the legislators, inasmuch they feel the burden of military expenditures in lower current consumption, can be the functional mechanism for this impact. The incumbent legislator is interested in maximizing his or her own immediate interest, which is ensuring re-election.[34] Furthermore, I will test whether increased party fragmentation, implying more electoral confusion and increased political competition, lowers military spending levels. I will utilize the so-called *party fractionalization index* (*F*) to proxy this effect:

$$F = 1 - \sum_{i=1}^{n} (t_i)^2 \quad (3)$$

where t_i is the proportion of members associated with the *i*th party in the lower house of the legislature. Thus, the higher the *F*, the more fragmented the political field is.[35]

As the analysis of war initiation by democratic states has shown, military spending might be linked to election cycles in the political markets, perhaps due to preceding weak economic performance.[36] Here I will investigate this in a crude format by employing election year dummies as possible explanatory variables. Election cycles, especially campaigns to the lower house of the parliament, might lead to lower military expenditures, since the politicians running for the seats might have to make promises to cut taxes. Additionally, I will analyze whether other internal political factors–namely the degree to which a premier is dependent on the parliament to remain in office, which could induce lower spending the higher it is, since he/she would have to rely on broad coalitions to govern–had an impact on the interwar military spending

[34] Michelle Garfinkel (1994, e.g. 1294-1295).
[35] This type of data can be found e.g. in Arthur Banks (1976).
[36] Kurt Gaubatz (1991), Geller and Singer (1998).

levels. These are, however, imperfect proxies and just the starting point in this type of analysis.[37]

The following independent variables were expected to have a positive sign, at a lag: total system ME (SYSTOTME); coefficient of variation in the military spending of the system countries (SYSTOTMECV); total resources (CINCs) held by the autocracies (AUTOCCINC), with countries scoring three or more in a given year in the Polity IV scale qualifying as representing autocratic rule; and total ME by such autocracies (AUTOCTOTME). Moreover, the following variables were expected to incur a negative coefficient at a lag: concentration of the total resources (CINCs) held by the system countries (CINCCONC); and concentration of the military resources (MILCINCs) held by the system countries (=MILCINCCONC).

The rest of the signs would depend on an individual country's position—i.e., its importance in the international system—and thus great powers would be expected to behave differently than other states. Also, there should be differences among the great powers depending on their regime type. For example, Germany might be expected to engage in challenger behavior, resulting in either a large, negative coefficient respective of the economic leader(s), or in fact responding to their decline only at the systemic level. A democratic challenger such as France should also incur a negative, albeit a more moderate coefficient as a direct response to, for example, American military burden. Its challenge would be more in line with an attempt to keep Germany in check than as a move towards greater power in international politics. This would in turn reflect on the systemic military spending responses. "Weak" states could act like followers, "copying" the military spending behavior of the leader(s) at a lag, or ignore the behavior of the leader(s) altogether. It should be emphasized that this approach ignores many of the fundamental structures usually "driving" military spending behavior in any state, especially dyadic threats and spillovers, as well as impure public good influences,

[37] For deeper analysis of political rents and rent seeking, see Eloranta (2009).

which are not evaluated here directly. Thus I will estimate the following equation, which is an extension of the discussions in the article:

$$ME_{it} = \beta_0 + \beta_1 SYSTEM_{t-1,t-2} + \beta_2 ALLIANCES_{it} + \beta_3 INDIVIDUAL\!COUNTRY_{it,t-1} \quad (4)$$
$$+ \beta_4 CONTROLS_{it} + \varepsilon_t$$

The hypothesized signs of the independent variables and the full explanations of the independent variables are explored in Table 3. The preferred method of estimation is the SUR, which allows a correction for heteroskedasticity and contemporaneous correlation in the errors across equations. The possibility of multicollinearity is also taken into account by examining the correlation matrix of the variables while carrying out the estimation procedures. Finally, the results were tested for autocorrelation up to three lags. In order to estimate Equation 4, I will first apply SUR with cross-section weights to estimate the parameters of the 17-country system, utilizing White heteroskedasticity-consistent standard errors and covariance. As Todd Sandler and Keith Hartley have noted, the SUR technique may be appropriate when a nation is a member of an alliance and demand equations are estimated for multiple allies.[38]

Furthermore, in order to verify whether the inclusion of the countries with more dubious data (1920-1938: AUT, GER, RUS/USSR) influenced the underlying SUR system, I also estimated the pooled regression for a sample of 11 European states separately.[39] As indicated previously, one lag was the beginning assumption, yet the optimum lag structure was tested up to three lags. The equations were corrected for autocorrelation if needed. Although the estimated systems were expected to display certain joint responses, one would have to be careful not to place too much emphasis on these estimates alone, due to the forcing of common response coefficients for most of these variables. To partially correct for that, I also included cross-section-specific fixed effects and tested whether (SUR) Panel-Corrected Standard Errors (PCSEs) were appropriate. The only

[38] Sandler and Hartley (1995, 62). On an application of this method, see e.g. Cornes and Sandler (1994), Murdoch and Sandler (1986), Sandler and Murdoch (1990).

[39] The data reliability issues and other concerns are discussed at length in Eloranta (2002).

Table 3: List of Proposed Independent Variables

Name	*Full Description*	*Calculation and/or Sources*	*Expected Sign*
SYSTEM:			
SYSTOTME	Total (real) military spending in the system of 17 states, lagged	Idem.	+
SYSTOTMECV	Coefficient of variation for the variable above, lagged	Idem.	+
CINCCONC	Concentration of CINCs (=Composite Index of National Capabilities) among the 17 states	See text (CINCs and the components generated by EUGene)	-
MILCINCCONC	Concentration of the military components in the CINCs among the 17 states	Idem.	-
AUTOCCINC	Share in the total CINCs by autocratic nations (=countries scoring three or smore in the Polity autocracy scale) among the 17 states	Idem.	+
AUTOCTOTME	Share of (real) military spending by autocracies, as defined above among the 17 states	Idem.	+
USAME¤	Lagged military burden or defense share for USA	Idem.	?
UKME¤	Lagged military burden or defense share for UK	Idem.	?
USACINC	CINC for USA	Idem.	?
UKCINC	CINC for UK	Idem.	?
USAMILCINC	Military components of CINC for USA	Idem.	?
UKMILCINC	Military components of CINC for UK	Idem.	?
ALLIANCES:			
ALLIANCE DUM	Alliance dummy equals 1 for years during which a nation was part of an alliance (dummies devised separately for each alliance)	Constructed from ATOP (2000) database	-
INDIVIDUAL COUNTRY:			
EUROPEMEPRICE	Real European unit price of military goods	Explained in Eloranta (2002b)	-
INCOME	Real GDP per capita	See Maddison (2003) for details	+
GERTHREAT	Same as above, but weighted (half of total) with Germany	Idem.	+
GERSOVTHREAT	Same as above, but weighted with Germany (third of total) and Soviet Union (third of total)	Idem.	+
ME_{t-1}¤	Lagged military burden or defense share (t-1)	See text	+
PRESP	Parliamentary responsibility (=the degree to which the premier is dependent on parliamentary majority in the lower house to remain in office), 0-3	Banks 1976	-
F	Party fractionalization index	See text	-
ELECTIONDUM	Dummy set to 1 for each year of elections to the lower house of parliament		-
CONTROLS:			
POP	Level of population	See Maddison (2003) or COW	?
DEMOC	Level of democracy, 0-10	Polity IV	-

Note to Table 3: Lags up to t-2 will be utilized in the following regressions. Alliance dummy 1 = Belgium; 2 = Denmark; 3 = France; 4 = the Netherlands; 5 = Norway; 6 = Portugal; 7 = Spain; 8 = Sweden; 9 = Switzerland; 10 = the UK. In each equation, I tested whether any of these dummies were statistically significant (and only those are listed in each table).

variables that were not transformed into logs were: the various dummy variables, the party fractionalization index (F), level of democracy (DEMOC), and parliamentary responsibility (PRESP). Finally, I conducted both panel and individual unit root tests[40] on the following variables: military burdens, defense shares, real GDP per capita, F, PRESP, and DEMOC. None of the variables seemed to have common unit roots in the panel, while both DEMOC and F seemed to indicate thepossibility at the individual country level. Even though the individual samples are short and thus the unit root tests notoriously unreliable, I tested the influence of both the undifferenced and differenced (*I*, 1) series.

Furthermore, in order to verify whether the inclusion of the countries with more dubious data (1920-1938: AUT, GER, RUS/USSR) influenced the underlying SUR system, I also estimated the pooled regression for a sample of 11 European states separately.[41] As indicated previously, one lag was the beginning assumption, yet the optimum lag structure was tested up to three lags. The equations were corrected for autocorrelation if needed. Although the estimated systems were expected to display certain joint responses, one would have to be careful not to place too much emphasis on these estimates alone, due to the forcing of common response coefficients for most of these variables. To partially correct for that, I also included cross-section-specific fixed effects and tested whether (SUR) Panel-Corrected Standard Errors (PCSEs) were appropriate. The only variables that were not transformed into logs were: the various dummy variables, the party fractionalization index (F), level of democracy (DEMOC), and parliamentary responsibility (PRESP). Finally, I conducted both panel and individual unit root tests[42] on the following variables: military burdens, defense shares, real GDP per capita, F, PRESP, and DEMOC. None of the variables seemed to have common unit roots in the panel, while both DEMOC and F seemed to indicate the possibility at the individual country level. Even though the individual samples are short and thus the unit root tests notoriously unreliable, I tested the influence of both the undifferenced and differenced (*I*, 1) series.

[40] No cointegration vectors were discovered between the series.

[41] The data reliability issues and other concerns are discussed at length in Eloranta (2002).

[42] No cointegration vectors were discovered between the series.

Table 4

Summary Statistics of the Dependent Variables, 1920-1938

	MILBUR (17)	*MILBUR (11)*	*DFSHARE (17)*	*DFSHARE (11)*
Mean	2.83	2.31	18.15	18.09
Median	2.26	2.21	16.14	17.21
Min	0.00	0.58	0.00	4.25
Max	22.67	6.93	68.93	47.58
Std. Dev.	2.53	1.28	9.95	7.10
N	323	209	323	209

Source: Eloranta (2002).

Table 5

Mean Military Burdens, Defense Shares, Military Expenditures (in a Common Currency) Divided by Population, 11 European Nations and the Other Six Nations, 1920-1938

Year	*MILBUR (11)*	*MILBUR (6)*	*DFSHARE (11)*	*DFSHARE (6)*	*ME/POP (11)*	*ME/POP (6)*
1920	2.62	4.30	20.24	22.65	705.91	1359.85
1921	2.70	2.45	18.48	14.53	782.88	1365.65
1922	2.43	2.99	17.51	12.72	790.15	495.98
1923	2.12	4.02	18.44	24.78	715.16	478.77
1924	2.07	2.88	18.08	13.98	700.60	538.05
1925	2.08	2.89	18.59	15.27	737.11	557.53
1926	2.02	2.54	17.90	14.56	725.40	590.10
1927	2.00	2.59	18.52	14.31	778.06	628.13
1928	1.95	2.47	18.10	14.73	771.06	725.76
1929	1.87	2.51	17.48	14.41	785.60	698.55
1930	2.15	1.98	18.34	14.50	907.04	778.31
1931	2.21	2.87	17.77	13.93	955.12	897.08
1932	2.25	3.48	17.57	13.89	1002.53	1010.92
1933	2.26	3.19	16.24	14.33	1009.33	1060.87
1934	2.25	3.65	16.41	17.43	1149.73	1550.25
1935	2.49	4.04	15.93	21.60	1173.44	1958.72
1936	2.56	5.78	16.76	26.67	1227.94	3066.06
1937	2.74	7.47	19.54	30.47	1329.56	3931.07
1938	3.21	9.67	21.91	31.94	1599.65	5277.03

Notes: On the conversion to a common currency, see Eloranta (2002) for details. 11 European nations: Belgium, Denmark, Finland, France, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK. The other six are: Austria, Germany, Italy, Japan, Russia/Soviet Union, and the USA.

As Table 5 indicates, the military burdens of the group of countries outside the core 11 European nations (with the exception of the USA) were, on average, higher and the standard deviation was also greater. The defense shares were more or less similar in both groups, but yet again the standard deviation was more substantial in the larger group. Moreover, there were further differences between the two groups. The military burdens in the group of six rose much faster in the 1930s. The same applies to the defense shares after 1935. The real military spending levels, adjusted by population, were higher for the group of six in the early 1920s and again after 1934. The discrepancy in the spending levels was particularly pronounced before the start of the Second World War.

As Table 6 displays, system threats were not considered consistent, although the best fit model suggested a possible positive impact. Concentration of total resources incurred positive coefficient, contrary to the earlier assumptions, whereas concentration of military resources did reduce military spending. The results for the impact of the behavior of autocracies were somewhat contradictory too. Concentration of resources to these nations actually reduced military spending, whereas the threat posed by their military spending was consistent. Most of nations in this pool did not consider the United States or the UK particularly significant for their military spending decisions, although we can observe some challenger behavior. Most alliances did not have an impact on them, and in the few cases that they did, they did not induce free riding. Prices did not matter in this case, and the income effect was in the opposite direction that theory would suggest. The German or Soviet threat did not have an impact on the military spending among these nations.

What about domestic political influences, at least based on the rough proxies used in these calculations? There was certainly an autoregressive component to the military spending, which could indicate a bureaucratic influence on the budgeting processes. Parliamentary responsibility had the hypothesized influence, reducing spending slightly as the premier became more accountable to the legislature. Party fractionalization had only a negligible impact, although with the correct sign. Elections did not seem to influence spending decisions.

Table 6
Pooled Demand for Military Burden among the 17 States, 1920-1938

VARIABLE	***Model 1 (System and Alliances)***	***Model 2 (Plus Individual Country Effects)***	***Model 3 (Best Fit, with Controls)***
CONSTANT	4.39***	9.62***	9.10***
SYSTEM:			
SYSTOTME	-0.11 (t-2)	0.18 (t-2)	0.49*** (t-2)
SYSTOTMECV	0.63 (t-2)	0.71 (t-2)	0.46** (t-2)
CINCCONC	1.15 (t-1)	2.71*** (t-1)	3.13*** (t-1)
MILCINCCONC	-0.89*** (t-2)	-0.69 (t-2)	-0.43*** (t-2)
AUTOCCINC	-0.53* (t-1)	-0.91*** (t-1)	-0.66*** (t-1)
AUTOCTOTME	0.15** (t-1)	0.32*** (t-1)	0.22*** (t-1)
USAME¤	-0.33 (t-1)	-0.86*** (t-1)	-0.80*** (t-1)
UKME¤	0.14 (t-1)	0.20 (t-1)	-
USACINC	-2.12 (t-1)	-3.54*** (t-1)	-3.45*** (t-1)
UKCINC	-0.94** (t-2)	-1.00*** (t-2)	-
USAMILCINC	1.18 (t-1)	2.09** (t-1)	2.09*** (t-1)
UKMILCINC	-0.76* (t-2)	-0.33 (t-2)	
ALLIANCES:			
ALLIANCE DUM 1	-0.08***	0.02	-
ALLIANCE DUM 2	0.09***	0.03	-
ALLIANCE DUM 4	-0.07*	-0.03	-
ALLIANCE DUM 8	0.23***	0.12**	0.11*
ALLIANCE DUM 9	0.49***	0.38***	0.47***
INDIVIDUAL COUNTRY:			
EUROPEMEPRICE	-	0.12	-
INCOME	-	-1.17***	-1.10***
GERTHREAT	-	-0.02	-
ME_{t-1}	-	0.45***	0.48***
PRESP	-	-0.06***	-0.07***
F	-	-0.00**	-
ELECTIONDUM	-	-0.00	-
CONTROLS:			
POP	-	-	0.21
DEMOC	-	-	-0.00
N	289	266	289
S.E.	0.36	0.25	0.26
ADJ. R^2	0.86	0.92	0.93

Notes: * = null of no correlation rejected at 10 per cent level; ** = null rejected at 5 per cent level; *** = null rejected at 1 per cent level. Cross-section specific coefficients not listed here. Cross-section SUR (PCSE) standard errors used, with cross-section weights. Moreover, alliance dummies are specified under Table 3. Alliance dummies not listed amongst the independent variables were not statistically significant and hence omitted. Model 2 includes country-specific fixed effects.

Table 7

Pooled Demand for Defense Share among the 17 States, 1920-1938

VARIABLE	***Model 1 (System and Alliances)***	***Model 2 (Plus Individual Country Effects)***	***Model 3 (Best Fit, with Controls)***
CONSTANT	1.09***	-7.49***	-5.61***
***SYSTEM**:*			
SYSTOTME	-0.01 (t-2)	0.37*** (t-2)	0.36*** (t-2)
SYSTOTMECV	0.26*** (t-2)	0.21 (t-2)	-
CINCCONC	0.71*** (t-2)	-0.49 (t-2)	
MILCINCCONC	-0.21*** (t-2)	-0.11 (t-2)	
AUTOCCINC	0.05* (t-1)	0.49*** (t-1)	0.35*** (t-1)
AUTOCTOTME	0.04* (t-2)	0.06 (t-2)	0.06** (t-2)
USAME¤	0.08** (t-2)	0.03 (t-2)	
UKME¤	0.12 (t-2)	1.09*** (t-2)	0.71*** (t-2)
USACINC	-0.03 (t-2)	1.84*** (t-2)	1.41*** (t-2)
UKCINC	0.18* (t-2)	1.12*** (t-2)	1.01*** (t-2)
USAMILCINC	-0.09* (t-1)	0.75** (t-1)	0.38** (t-1)
UKMILCINC	0.19*** (t-1)	0.38*** (t-1)	0.49*** (t-1)
***ALLIANCES**:*			
ALLIANCE DUM 2	0.16***	0.10***	0.08***
ALLIANCE DUM 9	0.27***	0.19***	0.19***
INDIVIDUAL COUNTRY:			
EUROPEMEPRICE	-	0.06	0.07**
INCOME	-	1.08*	-
GERTHREAT	-	0.37***	0.25***
ME_{t-1}¤	-	0.44***	0.43***
PRESP	-	-0.04*	-0.08***
F	-	-0.00	-0.00*
ELECTIONDUM	-	-0.01	-
CONTROLS:			
POP	-	-	-0.07
DEMOC	-	-	0.01*
N	289	266	266
S.E.	0.34	0.26	0.26
ADJ. R^2	0.81	0.82	0.82

Note: at 5 per cent level; *** = null rejected at 1 per cent level. Cross-section specific coefficients not listed here. Cross-section SUR (PCSE) standard errors used, with cross-section weights. Alliance dummies are explained under Table 3. Alliance dummies not listed amongst the independent variables were not statistically significant and hence omitted. Model 2 includes country-specific fixed effects.

We can verify these results by replicating the exercise for the defense shares, which measures budgetary preferences for military spending, a slightly different measure than spending as a share of the GDP (see Table 7). System threats were, again, not consistent, although the best fit model suggested a possible positive impact like before. Concentration of total resources and concentration of military resources both were not relevant in these specifications. The behavior of autocracies showed up more clearly as threats, as hypothesized. Also, the nations analyzed in this article certainly followed the decisions made by the UK and USA in their budgeting decisions. Only two of the alliances had any impact on them, and free riding was again absent. Price and income effects were by and large missing. The German threat was clearly relevant for them, most likely especially in the 1930s. Finally, the impact of the domestic political markets was the same as before.

I also wanted to replicate the results using only the (more reliable) data for the 11 European nations. The results are displayed in Table 8. The total system ME seemed to have the opposite impact than hypothesized, whereas the dispersion of system ME had the expected positive impact, with a large coefficient. The concentration of resources did seem to have negative impact on military spending, with the exception of Model 1. The same did not apply to military resources. They also felt the threat from the broader economic impact of autocracies and their increased military spending in the 1930s. Decisions and economic/military impact made by the UK and USA were felt keenly by these nations, although the impacts were not consistent across the board. Alliance impacts were again irrelevant, with no discernible free riding. Prices increased spending, income decreased it. German stock threat was mostly irrelevant, whereas the spillovers from other European "allies" resulted in free riding among them. Nonetheless, as argued in Eloranta (2011), there were significant impure public good factors at play too in their military spending decisions. The political market factors examined here were mostly irrelevant, with the exception of the autoregressive component.

Table 8: Pooled Demand for Military Burden among the 11 European States, 1920-1938

VARIABLE	***Model 1 (System and Alliances)***	***Model 2 (Plus Individual Country Effects)***	***Model 3 (Best Fit, with Controls)***
CONSTANT	2.75**	2.93	2.02
***SYSTEM**:*			
SYSTOTME	0.21 (t-2)	-2.93*** (t-2)	-3.11*** (t-2)
SYSTOTMECV	1.36*** (t-2)	2.96*** (t-2)	2.95*** (t-2)
CINCCONC	0.84* (t-1)	-3.27*** (t-1)	-3.79*** (t-1)
MILCINCCONC	-0.70*** (t-2)	-0.11 (t-2)	-
AUTOCCINC	-0.47*** (t-1)	0.32*** (t-1)	0.37*** (t-1)
AUTOCTOTME	0.16*** (t-2)	1.78*** (t-2)	1.88*** (t-2)
USAME¤	-0.54** (t-1)	1.38*** (t-1)	1.62*** (t-1)
UKME¤	-0.13* (t-2)	0.63*** (t-2)	0.63*** (t-2)
USACINC	-1.66** (t-1)	3.58*** (t-1)	4.16*** (t-1)
UKCINC	-0.34 (t-1)	-5.77*** (t-1)	-6.11*** (t-1)
USAMILCINC	1.18** (t-1)	-3.97*** (t-1)	-4.63*** (t-1)
UKMILCINC	-0.56 (t-1)	3.27*** (t-1)	3.75*** (t-1)
***ALLIANCES**:*			
ALLIANCE DUM 2	0.11***	0.03	-
ALLIANCE DUM 3	-0.10**	0.04	-
ALLIANCE DUM 9	0.68***	0.19***	0.19***
INDIVIDUAL COUNTRY:			
EUROPEMEPRICE	-	0.35***	0.35***
INCOME	-	-0.76***	-0.84***
GERSTOCKTHREAT	-	-0.00**	-0.00**
SPILL1		-2.51***	-2.63***
ME_{t-1}¤	-	0.64***	0.63***
PRESP	-	-0.01	-
F	-	-0.00	-0.00***
ELECTIONDUM	-	-0.01	-
CONTROLS:			
POP	-	-	-0.16
DEMOC	-	-	-0.00
N	187	176	176
S.E.	0.10	0.05	0.05
ADJ. R^2	0.95	0.98	0.98

Note: See notes to Table 7. Additionally, GERSTOCKTHREAT, SPILL 1 (see Eloranta, 2011, for details), and SPILL2 (UK stock impact, see text for details, not statistically significant) were calculated as described in the text. * = null of no correlation rejected at 10 per cent level; ** = null rejected at 5 per cent level; *** = null rejected at 1 per cent level.

Table 9
Pooled Demand for Defense Share among the 11 European States, 1920-1938

VARIABLE	***Model 1 (System and Alliances)***	***Model 2 (Plus Individual Country Effects)***	***Model 3 (Best Fit, with Controls)***
CONSTANT	4.89***	16.00**	19.79***
***SYSTEM**:*			
SYSTOTME	-0.14* (t-1)	-0.04 (t-1)	-0.20*** (t-1)
SYSTOTMECV	-0.61*** (t-1)	-1.68*** (t-1)	-2.79*** (t-1)
CINCCONC	3.04*** (t-1)	8.95** (t-1)	8.95*** (t-1)
MILCINCCONC	0.58*** (t-1)	2.72*** (t-1)	3.50*** (t-1)
AUTOCCINC	-0.81*** (t-1)	-1.87* (t-1)	-1.79*** (t-1)
AUTOCTOTME	0.24*** (t-1)	0.91** (t-1)	0.87*** (t-1)
USAME¤	0.14*** (t-2)	0.02 (t-2)	
UKME¤	0.54*** (t-1)	-0.75 (t-1)	-0.87*** (t-1)
USACINC	-2.65*** (t-1)	-5.52 (t-1)	-5.82*** (t-1)
UKCINC	-0.31** (t-2)	-2.87*** (t-2)	-3.79*** (t-2)
USAMILCINC	0.93*** (t-1)	1.67 (t-1)	1.84*** (t-1)
UKMILCINC	1.29*** (t-1)	1.29*** (t-1)	4.82*** (t-1)
***ALLIANCES**:*			
ALLIANCE DUM 2	0.14***	0.09***	0.10***
ALLIANCE DUM 3	-0.06**	0.03	
ALLIANCE DUM 7	-0.06**	-0.07**	-0.09***
ALLIANCE DUM 9	0.28***	0.04	-
INDIVIDUAL COUNTRY:			
EUROPEMEPRICE	-	-0.77***	-1.11***
INCOME	-	-0.07	-
GERSTOCKTHREAT	-	-0.00	-
SPILL1	-	-1.17***	-1.35***
ME_{t-1}¤	-	0.61***	0.64***
PRESP	-	-0.02	-
F	-	-0.00	-0.00**°
ELECTIONDUM	-	0.01	-
CONTROLS:			
POP	-	-	0.17
DEMOC	-	-	0.01*°
N	187	176	176
S.E.	0.08	0.06	0.06
ADJ. R^2	0.84	0.91	0.93

Notes: Same notes as Table 8.

When I replicated the analyses using the defense shares of the 11 European nations, as seen in Table 9, the systemic forces were again relevant, but they had the wrong signs. The impact of the behavior of autocracies was a bit contradictory, with their military spending clearly increasing the propensity to invest in defense. American and British behavior did influence their decision-making, although the signs were not entirely consistent with the hypotheses. Alliances were, as seen before, not very relevant for budgeting choices. Prices in this case had the theorized sign, while income effects were absent. Spillovers were clearly important to them, up to a degree, and the previous year's spending levels had a big impact on the current year's levels. The other remaining factors tested here did not influence them much at all.

Conclusions

Interwar military spending has not previously been analyzed as comprehensively and comparatively as is done here. Most of the earlier studies have focused either on long-term spending behavior of individual states, the 1930s arms race, or the impact of the world wars. Moreover, the classic studies in defense economics, like Olson and Zeckhauser (1966), have focused on the Cold War period, thus ignoring the opportunity to analyze for example the functioning of alliances in other periods and historical settings. Here the focus is on the idea that while some part of military spending (and national defense, the final product) can be considered a public good, there are influences at various levels of an international system that make military spending an impure public good.

It seems theoretically likely that the demand for military spending in any country would be based both pure and impure public good characteristics influenced by forces arising from the four explanatory levels discussed in this article: 1) system; 2) alliances; 3) state; and 4) within states (individuals and groups). The military expenditure behavior of the 17 nations analyzed in this article suggests that all of these levels, even though it was impossible to delve into deeper analysis of the fourth level, mattered in their spending behavior. Here I focused on developing appropriate proxies to investigate those effects. I analyzed the demand for military burdens (military expenditures as a percentage of GDP), the structural variable, and defense shares (military expenditures as a

percentage of central government spending), and a budgetary variable, using panel regressions.

The interwar period was a turbulent one, with several economic and political crises that caused shifts in the international system. The First World War left the world, and Europe in particular, in disarray with the Gold Standard in tatters, a crippled League of Nations, massive pressures on government budgets, domestic political turmoil, and a number of unstable new democracies. While the 1920s was a period of uneasy disarmament compromises and fewer threats, a persistent economic downturn turned the 1930s into an extensive arms race, finally culminating in the Second World War. The nations analyzed in this article had to make their military spending choices against the backdrop of such events.

In general, the systemic threats were not entirely consistent, although they clearly had an impact in most of the specifications; however, the signs were not often as hypothesized. The concentration of total and military resources had a similar, contradictory impact. For example, in the sample of 17 nations the concentration of military resources reduced their military burdens. The results for the impact of the behavior of autocracies was less contradictory, especially for the defense shares, and most of these nations considered the increasing economic and political roles of such states a threat to them. The impact of the UK and the USA was felt most keenly in their budgeting decisions, although the direction of this impact was at times not clear. The lack of a clear leading nation (or nations) certainly destabilized the military spending decision-making of these states in this period.

Moreover, most alliances did not have an impact on them, and in the few cases that they did, they did not induce free riding. This again underscores the fact that the Cold War period is quite unusual in history, and that scholars should pay attention to other periods as well. Furthermore, prices had almost no impact on them, or had the wrong sign. Only the last specification, with the defense shares of the smaller group of 11 European nations, yielded the correct sign. The German or Soviet threat did not have much of an impact on the military spending of these nations. Spillovers from a possible European "alliance" did lead to free riding among the smaller group of states, but only in a limited sense. This is also

consistent with the argument in Eloranta (2011), i.e. that the League of Nations did not function as a credible alliance, or even as an institution that could mediate international disputes. Thus, there was no public good effect arising from the interwar alliances in any form.

Impure public good influences emerged also from the domestic political economies. For example, there was certainly an autoregressive component to the military spending in most of the specifications, which could indicate a bureaucratic influence on the budgeting processes. Parliamentary responsibility had the hypothesized influence, reducing spending slightly as the premier became more accountable to the legislature, only in few of the cases. Party fractionalization, with possibly lower spending levels with higher fractionalization due to the need to compromise, had only a negligible impact. Elections did not seem to influence spending decisions. However, all of these factors combined suggest that the domestic political setting was crucial in order to understand the impure public good nature of military spending. Similarly, other studies have emphasized the domestic rent seeking processes as one of the keys to unraveling the logic behind military spending decision-making.

Obviously, this study only identifies some of the structural factors at the various levels of analysis, and should be complemented by in-depth country studies, some of which have already been published. But such studies are still lacking for many of the states analyzed in this article. Hopefully historians will take up the challenge of better utilizing the growing international datasets to analyze this period, as well as other historical periods, using the abundant interdisciplinary quantitative tools. Moreover, the results here suggest that the traditional models of defense economists (such as the classic model with prices, income, alliances, and threats as explanatory variables) may be too simplistic to explain military spending credibly. Scholars should consider adding variables from the level of system, as well as within states, to complement their analytical frameworks. Another potential avenue to explore, which was not done here, would be to incorporate the impact of distance and geography into the analysis, which certainly would impact the type of spending these countries engaged in. Military spending, as shown here, certainly was

influenced by impure public good characteristics arising from the weakness of the alliances and domestic political competition.

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