

Pro Bono Publico? Demand for Military Spending between the World Wars

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Abstract

This paper aims to analyze the aggregate and individual countries' demand for military spending during the 1920s and 1930s, based on variables arising from the international system and the countries themselves. 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 increased autocracy in the 1930s increased these expenditures, and democracies on the whole tended to spend less. Moreover, the absence of clear international leadership by the economic giants of the period, like US or UK, destabilized the international system and increased military spending. 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. Rising prices of "defense" in general decreased their relative military spending. There were quite contradictory spillover effects felt by these states.

1. 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 states, to name a few. However, there have been fewer efforts to understand the military spending patterns of the period, 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?

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, in this period. The impurely public benefits at the various levels were linked to the actions of the domestic players, namely business coalitions, in a complex evaluation of the international factors and domestic "needs".

At the level of the international "system", this article will explore the impacts of systemic changes — namely, balance of power, the democratic peace argument, as well as systemic leadership (or the lack of it) — on the military spending levels. It seems that systemic forces — with the systemic analyses based on a 17-country system covering the

key states in the international economy — indeed played an important role in determining the demand for military spending among the said states. Whereas 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, this concentration did not occur in the same lines in the 1930s compared to the immediate period following the First World War. Usually the systemic forces represented a destabilizing force in the international system.

Clearly the democracies as a whole also behaved different than the autocracies. 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. Typically the interwar states did not consider military spending as a public good in an alliance framework. In fact, it is here argued that alliances providing a pure public good in the form of deterrence were extremely rare, since the military technology did not provide such characteristics for the pre-NATO alliances. In general, the decision-making systems embodied by the various types of interwar democracies seemed to provide support for the idea of democratic peace even at the level of military spending. Moreover, the interwar democracies as a whole clearly spent less for military purposes than the authoritarian regimes, and it seems that the level of authoritarian rule was important in determining the level of military spending in relative terms. Finally, the leadership vacuum caused by the passive foreign (and economic) policy stance of the two leading democracies, the United States and the United Kingdom, destabilized the international system even further, thereby rendering disarmament almost impossible to achieve. These factors contributed to the strengthening of impurely public tendencies, especially within states, in the military spending decision-making of these European democracies.

Thus, it seems that the demand for military spending was certainly *impurely public*, which includes nested pure public characteristics, influenced by forces arising from the four explanatory levels discussed throughout this article. Military spending also yielded joint products at the level of state and within state. Military expenditures were not an income-normal good at level of state, and in fact the level of economic development seemed to exert a downward pressure on the military spending of these states. Rising prices of “defense” in general decreased their relative military spending. There were quite contradictory spillover effects felt by these states, yet they responded to increasing threats by increasing their military spending at a lag (usually one year).

2. Perspectives on the Research on Public Goods and Military Spending

There have been several historical and interdisciplinary studies on war and societies that taken the form of explaining economic and fiscal trajectories in the long run. Accounts like Niall Ferguson’s *Cash Nexus* and Paul Kennedy’s studies offer meta-level explanations of various aspects of military spending demand formation and the

competition for power by different types of states.¹ Yet, 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 *Armaments. The Race and the Crisis* (1937) by Francis W. Hirst. 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 *The Economics of World War II* (1998), a compilation edited by Mark Harrison. This compilation, however, does not offer analysis or data for the 1920s. 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 *Le prix du réarmement français 1935—1939* (1982) and G.C. Peden’s *British rearmament and the Treasury, 1932-1939* (1979) 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.²

Studies focusing on the military spending of a single state during the whole period are also quite rare. Finnish historian Vilho Tervasmäki’s (1964) study on Finnish military spending and the Finnish Diet is one of the few exceptions in this regard. Max Hantke and Mark 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, utilizing both qualitative sources on the League of Nations and quantitative analysis of military spending patterns. Business historians, in turn, have studied some of the large arms producing and trading companies of this period, yet even in those studies the focus has been on the 1930s and, by and large, on the Great Powers. Most studies, however, have not analyzed the individual countries’ military spending as a uniform phenomenon nor have they undertaken very far-reaching, consistent comparisons between the various states in the interwar period.

How have theories of state behavior at the system level been linked to the analysis of military spending? According to George Modelski and William R. Thompson (1996), it is

¹ See e.g. **Ferguson, Niall**. 2001. *The Cash Nexus: Money and Power in the Modern World, 1700-2000*. New York: Basic Books, **Kennedy, Paul**. 1989. *The Rise and Fall of the Great Powers. Economic Change and Military Conflict from 1500 to 2000*. London: Fontana, **McNeill, William H.** 1982. *The Pursuit of Power. Technology, Armed Force, and Society since A.D. 1000*. Chicago: The University of Chicago Press, **Pearson, Maurice**. 1982. *The Knowledgeable State: Diplomacy, War, and Technology since 1830*. London: Burnett Books : Distributed by Hutchinson.

² Nonetheless, there are few quantitatively oriented studies attempting to assess the impact of the 1930s rearmament. See **Crafts, Nicholas and Terence C Mills**. 2013. "Rearmament to the Rescue? New Estimates of the Impact of “Keynesian” Policies in 1930s' Britain." *The Journal of Economic History*, 73(04), 1077-104, **Hatton, Timothy J and Mark Thomas**. 2010. "Labour Markets in the Interwar Period and Economic Recovery in the Uk and the USA." *Oxford Review of Economic Policy*, 26(3), 463-85, **Thomas, Mark**. 1983. "Rearmament and Economic Recovery in the Late 1930s*." *The Economic History Review*, 36(4), 552-79.

possible to ascertain fourteen approaches to analyze the relationship between war and long-term economic growth, in terms of relationship between wars, economic upswings, and economic downswings. Most of them put forward the connotation, either implicitly or explicitly, that 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 *as a system*.

Another type of literature, mainly stemming from defense economics, institutional economics, as well public choice³ 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 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 and prestige. 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.⁴

What is a public good? Does military spending or, more accurately, national defense qualify as a *pure* public good? One of the first more comprehensive definitions of a public good can be found in Paul Samuelson's seminal works on the topic in the 1960s. He defined "collective consumption goods" as goods whose consumption by an individual leads to no subtraction of that good from another individual. Individuals also consume these goods according to their own preferences.⁵ This definition of a public good has been modified and improved upon by public sector economists over the years. For example James Buchanan (1968) in his well-known study *The Demand and Supply of Public Goods* described pure public goods in the following manner:⁶

"By the orthodox definition of a pure public good or service is *equally available* to all members of the relevant community. A single unit of the good, as produced, provides a multiplicity of consumption units, all of which are somehow identical. Once produced, it will not be efficient to exclude any person from the enjoyment (positive or negative) of its availability."

Buchanan also defined this nonexclusion principle as such that additional consumers may be added at zero marginal cost. This kind of polarized definition, in fact acknowledged by him, seems quite restrictive and has attracted plenty of criticism. Actually, no good or

³ See e.g. **Hartley, Keith**. 2012. *The Economics of Defence Policy: A New Perspective*. Routledge. **Sandler, Todd and Keith Hartley**. 1995. *The Economics of Defense*. Cambridge: Cambridge University Press.

⁴ _____. 1995. *The Economics of Defense*. Cambridge: Cambridge University Press.

⁵ **Samuelson, Paul A.** 1966b. "The Pure Theory of Public Expenditure," *The Collected Scientific Papers of Paul A. Samuelson. Vol. II*. Cambridge: Cambridge University Press, 57-58. See also _____. 1966a. "Diagrammatic Exposition of a Theory of Public Expenditure," *The Collected Scientific Papers of Paul A. Samuelson. Vol. II*. Cambridge: Cambridge University Press,

⁶ **Buchanan, James M.** 1968. *Demand and Supply of Public Goods*. Chicago: University of Chicago Press.

service can fit this definition of a public good, although Buchanan cites national defense as coming close "to the descriptive purity".⁷

Following the Samuelsonian tradition, in current research pure public goods are usually defined as having two essential features: 1) Nonexcludability of benefits; 2) Nonrivalry of benefits. Nonexcludability refers to the aspect that the good is available to all once provided and its benefits cannot be restricted. Nonrivalry means that a unit of the said good can be consumed by one individual without detracting from further consumption of the good by someone else.⁸ 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 (exclusion is feasible, yet there are strong social externalities and incentives governing its public provision), and merit goods (goods about which individuals are not sufficiently informed to assess the true private benefits which can be derived from their consumption or for which individuals have defective preferences), all produced in the "political markets".⁹

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 nonprice exclusiveness or nonrivalness in consumption.¹⁰ 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 paper. One important sub-class of such goods, for which benefits are excludable but partially nonrival, 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 here defined as joint products.¹¹

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 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 Mancur Olson and Richard Zeckhauser (1966). They argued that an alliance — as opposed to the "public" in a state — should be treated

⁷ Ibid.

⁸ **Sandler, Todd and Keith Hartley.** 1995. *The Economics of Defense*. Cambridge: Cambridge University Press., 4; **Hummel, Jeffrey Rogers and Don Lavoie.** 2000. "National Defense and the Public-Goods Problem," R. Higgs, *Arms, Politics, and the Economy. Historical and Contemporary Perspectives*. New York: Independent Institute, 38. Origins of these distinctions can be found in **Olson, Mancur and Richard Zeckhauser.** 1966. "An Economic Theory of Alliances." *Review of Economics and Statistics*, 48(3), 266-79.

⁹ **Hjerpe, Reino.** 1997. *Provision of Public and Merit Goods: Towards an Optimal Policy Mix?* Helsinki: United Nations University, World Institute for Development Economics Research. 14-15.

¹⁰ **Cullis, John G and Philip R Jones.** 1987. *Microeconomics and the Public Economy: A Defence of Leviathan*. Basil Blackwell., 20-21.

¹¹ **Cornes, Richard.** 1996. *The Theory of Externalities, Public Goods, and Club Goods*. Cambridge: Cambridge University Press., 9; **Sandler, Todd and Keith Hartley.** 1999. *The Political Economy of Nato*. Cambridge: Cambridge University Press. See also **Olson, Mancur and Richard Zeckhauser.** 1966. "An Economic Theory of Alliances." *Review of Economics and Statistics*, 48(3), 266-79.

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 do 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 (nonrivalry, nonexcludability) 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.¹²

In this paper we are interested in the individual country military spending demand, as a common response by the selected countries. 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 here be performed with pooled data. The primary tool used here is, assuming that the countries selected here faced similar "shocks" (especially external ones) that affected them all, the technique of Seemingly Unrelated Regressions (SUR). We will, however, evaluate these results with Two-Stage Least Squares (2SLS) if endogeneity and autocorrelation are both 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, if encountered, with Three-Stage Least Squares (3SLS). Yet, the choice of technique will depend on several pre-conditions as well as certain empirical considerations.

At the level of state, prices (often assumed common for all or excluded from the analysis altogether¹³), full income, and threats form the key independent variables. Alliance 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 framework are, in particular: 1) Systemic influences; 2) Impacts of regime type; 3) Adequate representation of the price of "defense"; 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

¹² _____. 1966. "An Economic Theory of Alliances." *Review of Economics and Statistics*, 48(3), 266-79, **Sandler, Todd and Keith Hartley**. 1999. *The Political Economy of Nato*. Cambridge: Cambridge University Press. On the international system, see **Kindleberger, Charles P.** 1981. "Dominance and Leadership in the International Economy: Exploitation, Public Goods, and Free Rides." *International studies quarterly*, 242-54, _____. 1986. "International Public Goods without International Government." *The American Economic Review*, 1-13.

¹³ See e.g. **Sandler, Todd and James C Murdoch**. 1990. "Nash-Cournot or Lindahl Behavior?: An Empirical Test for the Nato Allies." *The Quarterly Journal of Economics*, 105(4), 875-94.

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 Buzan et al. (1998), the levels of analysis here 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; 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, lobbies. Buzan et al. also include a fifth level of analysis, that of an individual, which is not pursued here. Before investigating the demand components from the various levels, we will explore some of the overall trends in military spending and armaments in the interwar period.

3. International “System” and Its Military Spending Characteristics in the Interwar Period

Did the world or at least the Western states form a “system” in the interwar period? Is there reasonable basis for treating it as such? In fact, most of the world was dominated by the Western Great Powers, following the colonial exploits of the 19th century, almost exclusively by 1920, 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.¹⁴ 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, endorsed by both Beth Simmons and Barry Eichengreen, that the interwar period can and perhaps should 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.¹⁵

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, here the comparisons consist of either 17 states¹⁶, or,

¹⁴ **Huntington, Samuel P.** 1996. *The Clash of Civilizations and the Remaking of World Order*. New York: Penguin Books. e.g. 50-53. See also **McNeill, William H.** 1982. *The Pursuit of Power. Technology, Armed Force, and Society since A.D. 1000*. Chicago: The University of Chicago Press..

¹⁵ **Eichengreen, Barry.** 1992. *Golden Fetters: The Gold Standard and the Great Depression, 1919-1939*. Oxford: Oxford University Press, **Simmons, Beth A.** 1997. *Who Adjusts? Domestic Sources of Foreign Economic Policy During the Interwar Years*. Princeton: Princeton University Press.

¹⁶ Austria, Belgium, Denmark, France, Finland, Germany, Italy, Japan, the Netherlands, Norway, Portugal, the Soviet Union, Spain, Sweden, Switzerland, the UK, and the USA.

respectively 11 European states.¹⁷ These 17 countries in fact represent this aforementioned “world system” quite well, since they formed 84.8 per cent of the “world” ME in 1913 and 87.7 per cent of the “world” ME in 1929.¹⁸ They were naturally equally dominant economically as well.¹⁹ The purpose here, however, is not to estimate war proneness like for example conflict scientists have done rather than try to estimate their (joint) demand for military spending in this system, as responding (or not) to common systemic and/or individual indicators.

First, however, we should discuss the various types of systemic indicators. 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 the urban population share. This type of data are considerably less reliable for the following countries in the sample of seventeen: 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 COW CINCs, which may be a poor proxy for economic stature in a system, was replaced with the real GDP share explained in Eloranta (2002).²⁰ 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.

¹⁷ 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.

¹⁸ Calculated using the most comprehensive military spending database (National Capabilities) available: **Singer, J. David and Melvin Small.** 1993. "National Material Capabilities Data, 1816-1985," Ann Arbor, MI: J. David Singer, University of Michigan, and Detroit, MI: Melvin Small, Wayne State University [producers], 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.

¹⁹ See e.g. **de la Escosura, Leandro Prados.** 2000. "International Comparisons of Real Product, 1820–1990: An Alternative Data Set." *Explorations in Economic History*, 37(1), 1-41, **Huntington, Samuel P.** 1996. *The Clash of Civilizations and the Remaking of World Order*. New York: Penguin Books, **Maddison, Angus.** 1995. *Monitoring the World Economy 1820-1992*. Paris: OECD, _____. 2007. *The World Economy Volume 1: A Millennial Perspective Volume 2: Historical Statistics*. Academic Foundation.

²⁰ In addition, energy consumption appears to be highly correlated with economic growth (see **Smil, Vaclav.** 1994. *Energy in World History*. Boulder: Westview Press., 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.

Soviet data is, nonetheless, perhaps the most suspect in this sample due to, for example, lack of readily available exchange rates.

Table 1. Original CINC's (Based on the Entire COW Database) and the Modified CINC's in a 17-country System for France, Germany, Russia/USSR, the United Kingdom, and the United States, 1920-1938

<i>YEAR</i>	<i>FRA, CINC</i>	<i>FRA, MOD. CINC</i>	<i>GER, CINC</i>	<i>GER, MOD. CINC</i>	<i>RUS, CINC</i>	<i>RUS, MOD. CINC</i>	<i>USA, CINC</i>	<i>USA, MOD. CINC</i>	<i>UK, CINC</i>	<i>UK, MOD. CINC</i>
1920	5.92	9.08	7.22	7.99	10.21	18.19	12.79	11.81	28.47	29.20
1925	6.07	9.57	7.93	9.49	10.20	11.69	9.37	12.58	25.06	27.87
1930	6.13	9.84	7.33	8.81	14.95	14.31	7.63	11.39	22.36	26.13
1935	5.20	7.53	10.18	13.75	18.12	19.83	7.17	9.93	18.86	21.33
1938	4.55	6.28	15.34	15.78	16.61	21.22	7.54	9.43	16.46	18.63

Sources: 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 & Small (1993). Details about the method of common currency conversions can be found in Eloranta (2002).

The dilemma of Russia's strong showing in the CINC-scores and the military resource shares has been perceptively addressed by William C. Wohlforth for the pre- First World War period.²¹ The same qualities certainly plagued the interwar Soviet Union as well; i.e., how to mobilize its vast capabilities.²² 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 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 (especially regarding the futility of trying to assess the probability of war with them), it may however be plausible that these countries reacted to such perceptions in their military spending decision-making. In addition, following Wohlforth, it is here expected 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 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:

²¹ Wohlforth, William C. 1987. "The Perception of Power: Russia in the Pre-1914 Balance." *World Politics*, 39(03), 353-81. This article is an illustrative critique of the use of these aggregate indices of power distribution.

²² For further discussion, see Harrison, Mark. 2000. "The Soviet Union: The Defeated Victor," M. Harrison, *The Economics of World War II. Six Great Powers in International Comparison*. Cambridge: Cambridge University Press, 268-301.

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

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.²³ A decline in the concentration of total resources (=CINC) 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 CINC 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 dispersion (measured by coefficient of variation), the CINC of democracies and respectively autocracies on the aggregate, the military spending shares of democracies and respectively autocracies, and individual country alliance effects.²⁴ 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 (=MILCINC) 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 argument²⁵ 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

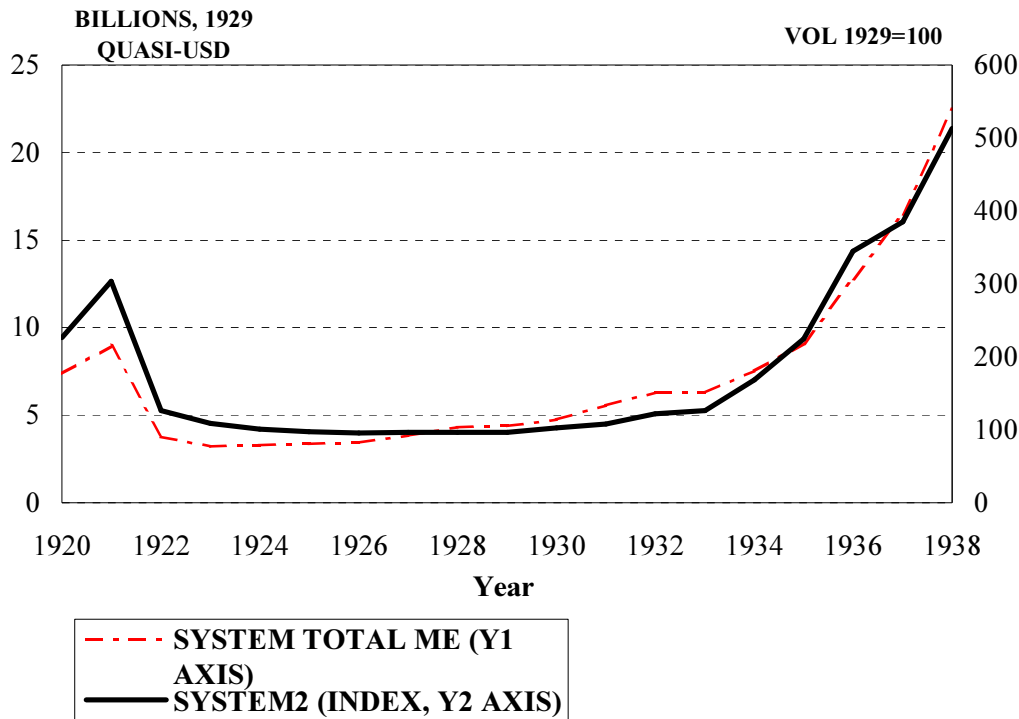
²³ **Geller, Daniel S. and J. David Singer.** 1998. *Nations at War. A Scientific Study of International Conflict.* Cambridge: Cambridge University Press. 122.

²⁴ See **Eloranta, Jari.** 2002. "External Security by Domestic Choices: Military Spending as an Impure Public Good among Eleven European States, 1920-1938," *Department of History and Civilisation.* Florence, Italy: European University Institute, Appendix 2 for details on the sources.

²⁵ See esp. **Choi, Seung-Whan.** 2011. "Re-Evaluating Capitalist and Democratic Peace Models1." *International studies quarterly*, 55(3), 759-69, **Dafoe, Allan and Bruce Russett.** 2013. "Does Capitalism Account for the Democratic Peace? The Evidence Still Says No." *Assessing the Capitalist Peace*, 110-26, **De Mesquita, Bruce Bueno; James D Morrow; Randolph M Siverson and Alastair Smith.** 1999. "An Institutional Explanation of the Democratic Peace." *American Political Science Review*, 791-807, **Mousseau, Michael.** 2000. "Market Prosperity, Democratic Consolidation, and Democratic Peace." *The Journal of Conflict Resolution*, 44(4), 472-507, **Oneal, John R. and James Lee Ray.** 1997. "New Tests of the Democratic Peace: Controlling for Economic Interdependence, 1950-85." *Political Research Quarterly*, 50(4), 751-75, **Rosato, Sebastian.** 2003. "The Flawed Logic of Democratic Peace Theory." *American Political Science Review*, 97(04), 585-602, **Russett, Bruce.** 1993. *Grasping the Democratic Peace. Principles for a Post-Cold War World.* Princeton, New Jersey: Princeton University Press.

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); 7) 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 resources of the systemic leader(s). All of the hypotheses revisited here assume a time lag due to the slowness of the budgetary process.

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



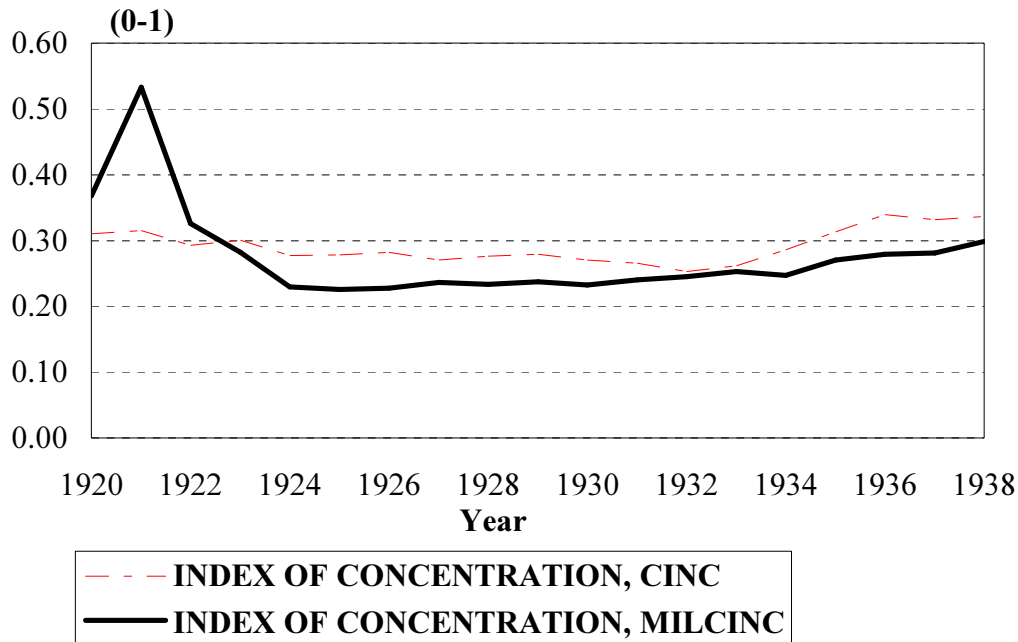
Sources: see Eloranta (2002), Appendix 2, for details.

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.

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 resurge 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.

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

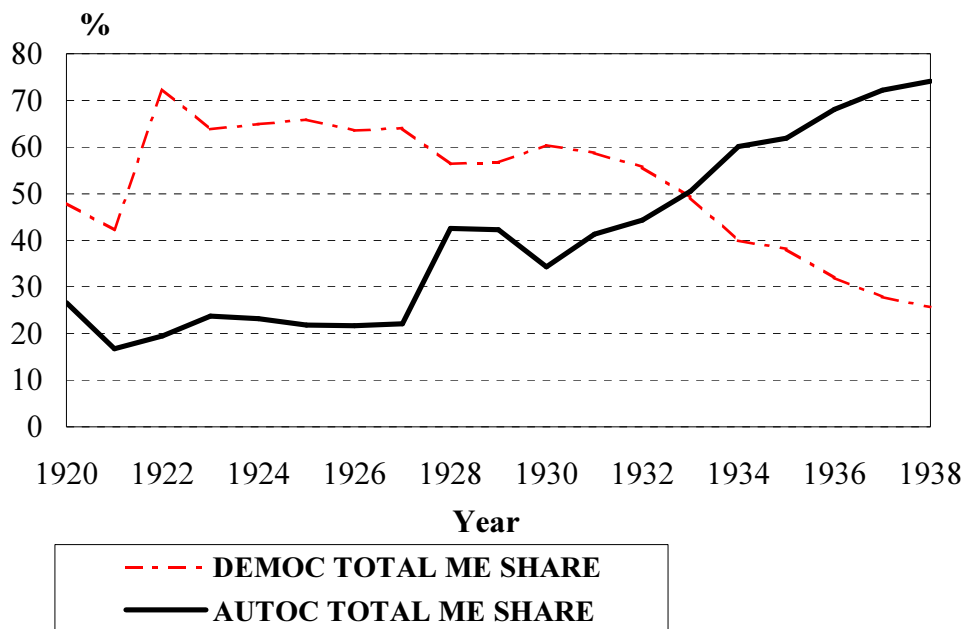


Sources: see the system (seventeen states) data sources in Eloranta (2002), Appendix 2.

Note: indices of concentration calculated as indicated in the text. Definitions of CINC and MILCINC provided in the text.

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 tested in this section, 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 evening 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 on to the international scene. Did similar developments take place in the “power balance” between the democracies and the autocracies?

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



Sources: see the 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; AUTO (=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.

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.

4. The Demand for Military Expenditures as an Impure Public Good among the Individual Countries

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 paper. 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, here we will discuss how to measure the spillins and threats more credibly. Furthermore, political market proxies, representing the influences and structure of the political system within state, 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 SPILLINS variable, we have already introduced one possible spillin term in the previous section. It is based on utilizing the eleven 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. Here we 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 spillin variable was calculated:²⁶

$$SPILLINS_i = \frac{\left(\frac{\left(\frac{MP_{UK} + RT_{UK}}{MP_i + RT_i} \right)}{2} + \frac{\left(\frac{MP_{UK,t-1} + RT_{UK,t-1}}{MP_{i,t-1} + RT_{i,t-1}} \right)}{2} \right)}{\left(\frac{MP_{UK,t-1} + RT_{UK,t-1}}{MP_{i,t-1} + RT_{i,t-1}} \right)} \times 100 \quad (2)$$

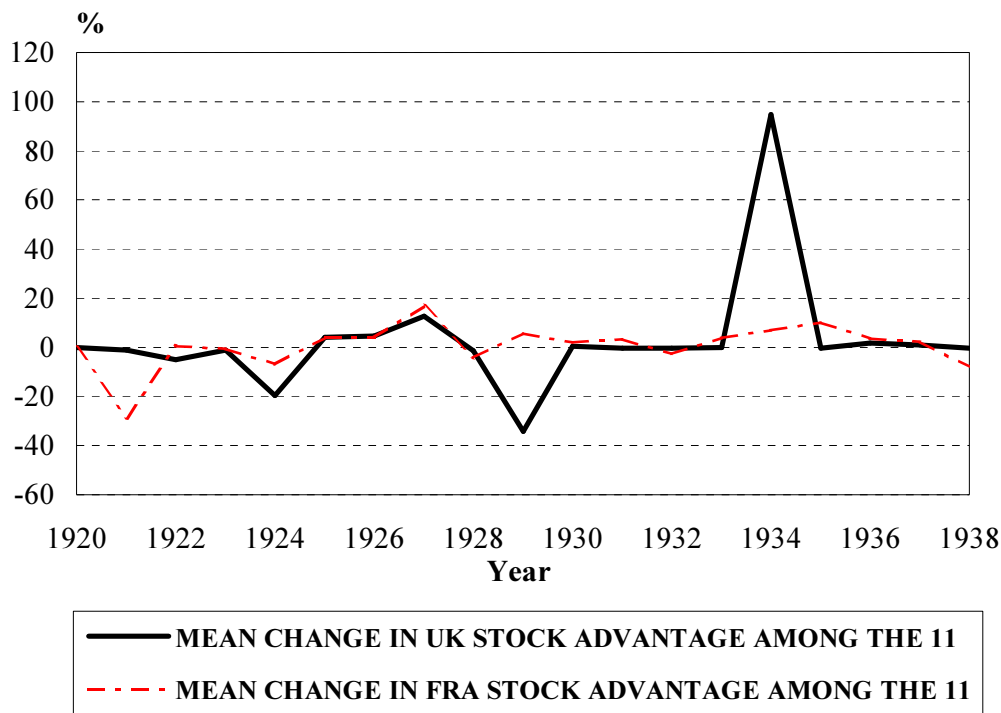
in which MP represents the number of military personnel and RT represents the real tonnage of a nation i in comparison with the United Kingdom. In essence, Equation 2 measures the *change* (from $t-1$ to t) in the comparative stock advantage for the United Kingdom over country i as a mean percentage (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

²⁶ The spillin variable can also be expressed as: $SPILLINS = \left(\frac{\left(\frac{MP_{UK}}{MP_i} \right) + \left(\frac{RT_{UK}}{RT_i} \right)}{\left(\frac{MP_{UK,t-1}}{MP_{i,t-1}} \right) + \left(\frac{RT_{UK,t-1}}{RT_{i,t-1}} \right)} - 1 \right) \times 100$

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

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 in fact all that 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-Books²⁷. 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.

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



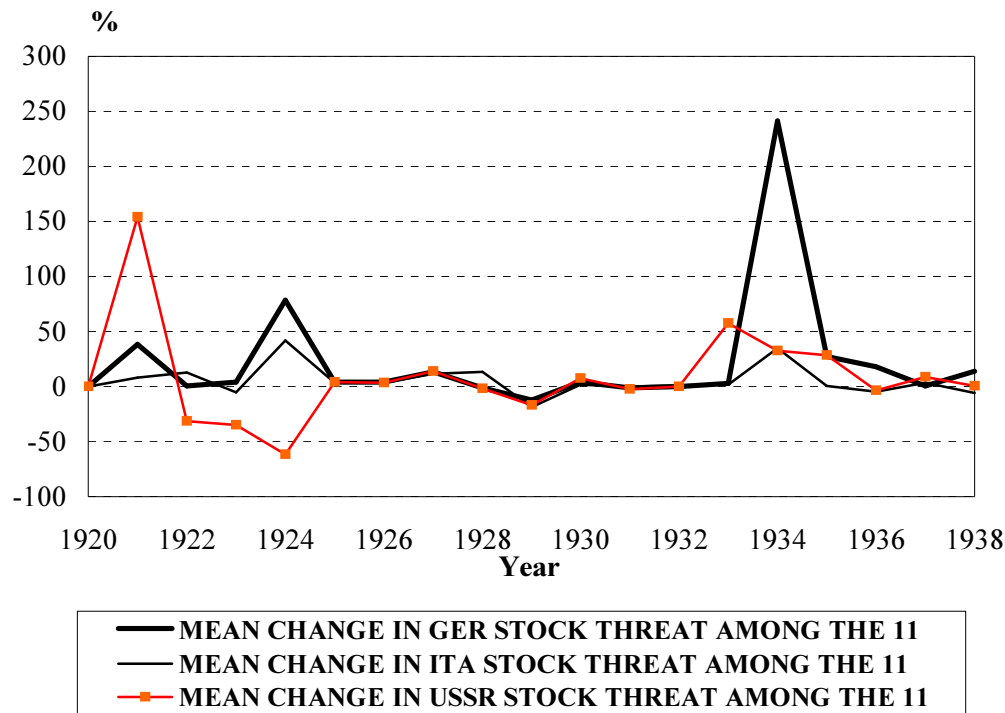
Sources: see Eloranta (2002), Appendix 2 for further details.
 Note: military stock advantages calculated according to Equation 2.

As far as the threat variables are concerned, we want to 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

²⁷ Eloranta, J. 2011. "Why Did the League of Nations Fail?" *Cliometrica*, 5(1), 1-26. has further analysis and figures on the military threat estimations and the use of the League of Nations data.

(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 Spain²⁸, as well as for the two Great Powers in the sample. 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).²⁹

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



Sources: see Eloranta (2002), Appendix 2.

Note: military stock threat calculations based on earlier discussion in the text.

²⁸ 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.

²⁹ Japan, which could possibly have formed a threat against especially British colonial interests, is not included in the calculations. The emphasis here is to investigate the European dimension of threats in particular.

In addition, we 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 is, similar to the military spending data, less satisfactory than for the eleven states analyzed in detail; 2) It is unclear how much knowledge the eleven countries actually possessed especially on the size of the armed forces of the authoritarian states. Nonetheless, we 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 respective of the eleven 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.

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.³⁰ The latter assumption seems particularly reasonable in the interwar period, since voters/consumers, unlike the other groups mentioned by Keith Hartley 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, here we 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.

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.³¹ Here we will test whether increased party fragmentation, implying more electoral confusion and increased political competition, lowers military spending levels. We will utilize the so-called *party fractionalization index* to proxy this effect:

³⁰ See e.g. **Sandler, Todd and Keith Hartley**. 1995. *The Economics of Defense*. Cambridge: Cambridge University Press. 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, William A.** 1971. *Bureaucracy and Representative Government*. New York: Aldine-Atherton, Inc., Part IV, Section 12.

³¹ **Garfinkel, Michelle R.** 1994. "Domestic Politics and International Conflict." *The American Economic Review*, 84(5), 1294-309. e.g. 1294-1295.

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

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.³²

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.³³ Here we 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, we 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 levels. These are, however, imperfect proxies and just the starting point in this type of analysis.³⁴

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); 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

³² This type of data can be found e.g. in **Banks, Arthur S.** 1976. "Cross-National Time Series, 1815-1973," ICPSR, Ann Arbor, MI: Inter-university Consortium for Political and Social Research,

³³ **Gaubatz, Kurt Taylor.** 1991. "Election Cycles and War." *Journal of Conflict Resolution*, 35(2), 212-44, **Geller, Daniel S. and J. David Singer.** 1998. *Nations at War. A Scientific Study of International Conflict.* Cambridge: Cambridge University Press.

³⁴ For deeper analysis of political rents, see **Eloranta, Jari.** 2009. "Rent Seeking and Collusion in the Military Allocation Decisions of Finland, Sweden, and Great Britain, 1920–381." *The Economic History Review*, 62(1), 23-44.

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 here 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, which are not evaluated here directly.

Thus we will estimate the following equation, which is an extension of the discussions in the paper:

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

The hypothesized signs of the independent variables and the full explanations of the independent variables are explored in Table 2 below. The preferred method of estimation here is the SUR, which allows a correction for heteroskedasticity and contemporaneous correlation in the errors across equations. If endogeneity were to arise as a possible problem, 3SLS could be employed to improve the coefficient estimates. 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, we 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.³⁵ 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, we also estimated the pooled regression for a sample of eleven European states separately³⁶. 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, we also included cross-section-specific fixed effects and tested whether (SUR) Panel-Corrected Standard Errors (PCSEs) were appropriate. The only variables that were not

³⁵ **Sandler, Todd and Keith Hartley.** 1995. *The Economics of Defense*. Cambridge: Cambridge University Press. 62. On an application of this method, see e.g. **Cornes, Richard and Todd Sandler.** 1994. "The Comparative Static Properties of the Impure Public Good Model." *Journal of Public Economics*, 54(3), 403-21, **Murdoch, James C and Todd Sandler.** 1986. "The Political Economy of Scandinavian Neutrality." *The Scandinavian Journal of Economics*, 88(4), 583-603, **Sandler, Todd and James C Murdoch.** 1990. "Nash-Cournot or Lindahl Behavior?: An Empirical Test for the Nato Allies." *The Quarterly Journal of Economics*, 105(4), 875-94.

³⁶ The data reliability issues and other concerns are discussed at length in **Eloranta, Jari.** 2002. "External Security by Domestic Choices: Military Spending as an Impure Public Good among Eleven European States, 1920-1938," *Department of History and Civilisation*. Florence, Italy: European University Institute,

Table 2. List of Proposed Independent Variables

<i>Name</i>	<i>Full Description</i>	<i>Calculation and/or Sources</i>	<i>Expected Sign</i>
<u>SYSTEM:</u>			
<i>SYSTOTME</i>	Total (real) military spending in the system of 17 states, lagged	Idem.	+
<i>SYSTOTMECV</i>	Coefficient of variation for the variable above, lagged	Idem.	+
<i>CINCCONC</i>	Concentration of CINC's (=Composite Index of National Capabilities) among the 17 states	See text (CINC's and the components generated by EUGene)	-
<i>MILCINCCONC</i>	Concentration of the military components in the CINC's among the 17 states	Idem.	-
<i>AUTOCCINC</i>	Share in the total CINC's by autocratic nations (=countries scoring three or more in the Polity autocracy scale) among the 17 states	Idem.	+
<i>AUTOCTOTME</i>	Share of (real) military spending by autocracies, as defined above among the 17 states	Idem.	+
<i>USAME</i> [□]	Lagged military burden or defense share for USA	Idem.	?
<i>UKME</i> [□]	Lagged military burden or defense share for UK	Idem.	?
<i>USACINC</i>	CINC for USA	Idem.	?
<i>UKCINC</i>	CINC for UK	Idem.	?
<i>USAMILCINC</i>	Military components of CINC for USA	Idem.	?
<i>UKMILCINC</i>	Military components of CINC for UK	Idem.	?
<u>ALLIANCES:</u>			
<i>ALLIANCE DUM</i>	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	-
<u>INDIVIDUAL COUNTRY:</u>			
<i>EUROPEMEPRICE</i>	Real European unit price of military goods	Explained in Eloranta (2002b)	-
<i>INCOME</i>	Real GDP per capita	See Maddison (2003) for details	+
<i>GERTHREAT</i>	Same as above, but weighted (half of total) with Germany	Idem.	+
<i>GERSOVTHREAT</i>	Same as above, but weighted with Germany (third of total) and Soviet Union (third of total)	Idem.	+
<i>ME_{t-1}</i> [□]	Lagged military burden or defense share (t-1)	See text	+
<i>PRESP</i>	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	-
<i>F</i>	Party fractionalization index	See text	-
<i>ELECTIONDUM</i>	Dummy set to 1 for each year of elections to the lower house of parliament		-
<u>CONTROLS:</u>			
<i>POP</i>	Level of population	See Maddison (2003) or COW	?
<i>DEMOC</i>	Level of democracy, 0-10	Polity IV	-

Note: Lags up to t-2 will be utilized in the following regressions.

transformed into logs were: the various dummy variables, the party fractionalization index (F), level of democracy (DEMOC), and parliamentary responsibility (PRESF). Finally, we conducted both panel and individual unit root tests³⁷ on the following variables: military burdens, defense shares, real GDP per capita, F, PRESF, 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, we tested the influence of both the undifferenced and differenced (*I, 1*) series.

Table 3. Summary Statistics of the Dependent Variables, 1920-1938

	<i>MILBUR (17)</i>	<i>MILBUR (11)</i>	<i>DFSHARE (17)</i>	<i>DFSHARE (11)</i>
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

Sources: see Eloranta (2002).

Table 4. Mean Military Burdens, Defense Shares, Military Expenditures (in a Common Currency) Divided by Population, 11 European Nations and the Other Six Nations, 1920-1938

<i>Year</i>	<i>MILBUR (11)</i>	<i>MILBUR (6)</i>	<i>DFSHARE (11)</i>	<i>DFSHARE (6)</i>	<i>ME/POP (11)</i>	<i>ME/POP (6)</i>
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

Sources: see previous tables.

³⁷ Based on the array of tests available for pooled series in EViews. No cointegration vectors were discovered between the series.

Notes: On the conversion to a common currency, see Eloranta (2002a) 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 3 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.

Table 5. Pooled Demand for Military Burden among the 17 States, 1920-1938

<i>VARIABLE</i>	<i>Model 1 (System and Alliances)</i>	<i>Model 2 (Plus Individual Country Effects)</i>	<i>Model 3 (Best Fit, with Controls)</i>
<i>CONSTANT</i>	4.39***	9.62***	9.10***
<u>SYSTEM:</u>			
<i>SYSTOTME</i>	-0.11 (t-2)	0.18 (t-2)	0.49*** (t-2)
<i>SYSTOTMECV</i>	0.63 (t-2)	0.71 (t-2)	0.46** (t-2)
<i>CINCCONC</i>	1.15 (t-1)	2.71*** (t-1)	3.13*** (t-1)
<i>MILCINCCONC</i>	-0.89*** (t-2)	-0.69 (t-2)	-0.43*** (t-2)
<i>AUTOCCINC</i>	-0.53* (t-1)	-0.91*** (t-1)	-0.66*** (t-1)
<i>AUTOCTOTME</i>	0.15** (t-1)	0.32*** (t-1)	0.22*** (t-1)
<i>USAME</i> □	-0.33 (t-1)	-0.86*** (t-1)	-0.80*** (t-1)
<i>UKME</i> □	0.14 (t-1)	0.20 (t-1)	-
<i>USACINC</i>	-2.12 (t-1)	-3.54*** (t-1)	-3.45*** (t-1)
<i>UKCINC</i>	-0.94** (t-2)	-1.00*** (t-2)	-
<i>USAMILCINC</i>	1.18 (t-1)	2.09** (t-1)	2.09*** (t-1)
<i>UKMILCINC</i>	-0.76* (t-2)	-0.33 (t-2)	-
<u>ALLIANCES:</u>			
<i>ALLIANCE DUM 1</i>	-0.08***	0.02	-
<i>ALLIANCE DUM 2</i>	0.09***	0.03	-
<i>ALLIANCE DUM 3</i>	-	-	-
<i>ALLIANCE DUM 4</i>	-0.07*	-0.03	-
<i>ALLIANCE DUM 5</i>	-	-	-
<i>ALLIANCE DUM 6</i>	-	-	-
<i>ALLIANCE DUM 7</i>	-	-	-
<i>ALLIANCE DUM 8</i>	0.23***	0.12**	0.11*
<i>ALLIANCE DUM 9</i>	0.49***	0.38***	0.47***
<u>INDIVIDUAL COUNTRY:</u>			
<i>EUROPEMEPRICE</i>	-	0.12	-
<i>INCOME</i>	-	-1.17***	-1.10***
<i>GERTHREAT</i>	-	-0.02	-
<i>GERSOVTHREAT</i>	-	-	-
<i>ME_{t-1}</i>	-	0.45***	0.48***
<i>PRESP</i>	-	-0.06***	-0.07***
<i>F</i>	-	-0.00**	-
<i>ELECTIONDUM</i>	-	-0.00	-
<u>CONTROLS:</u>			
<i>POP</i>	-	-	0.21
<i>DEMOC</i>	-	-	-0.00
<i>N</i>	289	266	289
<i>S.E.</i>	0.36	0.25	0.26
<i>ADJ. R²</i>	0.86	0.92	0.93

Sources: see previous tables. * = null of no correlation rejected at 10 per cent level; ** = null rejected at 5 per cent level; *** = null rejected at 1 per cent level.

Note: cross-section specific coefficients not listed here. Cross-section SUR (PCSE) standard errors used, with cross-section weights.

Moreover, as we can see in Table 4, 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 World War II.

Table 6. Pooled Demand for Defense Share among the 17 States, 1920-1938

<i>VARIABLE</i>	<i>Model 1 (System and Alliances)</i>	<i>Model 2 (Plus Individual Country Effects)</i>	<i>Model 3 (Best Fit, with Controls)</i>
<i>CONSTANT</i>	1.09***	-7.49***	-5.61***
<u>SYSTEM:</u>			
<i>SYSTOTME</i>	-0.01 (t-2)	0.37*** (t-2)	0.36*** (t-2)
<i>SYSTOTMECV</i>	0.26*** (t-2)	0.21 (t-2)	-
<i>CINCCONC</i>	0.71*** (t-2)	-0.49 (t-2)	-
<i>MILCINCCONC</i>	-0.21*** (t-2)	-0.11 (t-2)	-
<i>AUTOCCINC</i>	0.05* (t-1)	0.49*** (t-1)	0.35*** (t-1)
<i>AUTOCTOTME</i>	0.04* (t-2)	0.06 (t-2)	0.06** (t-2)
<i>USAME</i> □	0.08** (t-2)	0.03 (t-2)	-
<i>UKME</i> □	0.12 (t-2)	1.09*** (t-2)	0.71*** (t-2)
<i>USACINC</i>	-0.03 (t-2)	1.84*** (t-2)	1.41*** (t-2)
<i>UKCINC</i>	0.18* (t-2)	1.12*** (t-2)	1.01*** (t-2)
<i>USAMILCINC</i>	-0.09* (t-1)	0.75** (t-1)	0.38** (t-1)
<i>UKMILCINC</i>	0.19*** (t-1)	0.38*** (t-1)	0.49*** (t-1)
<u>ALLIANCES:</u>			
<i>ALLIANCE DUM 1</i>	-	-	-
<i>ALLIANCE DUM 2</i>	0.16***	0.10***	0.08***
<i>ALLIANCE DUM 3</i>	-	-	-
<i>ALLIANCE DUM 4</i>	-	-	-
<i>ALLIANCE DUM 5</i>	-	-	-
<i>ALLIANCE DUM 6</i>	-	-	-
<i>ALLIANCE DUM 7</i>	-	-	-
<i>ALLIANCE DUM 8</i>	-	-	-
<i>ALLIANCE DUM 9</i>	0.27***	0.19***	0.19***
<u>INDIVIDUAL COUNTRY:</u>			
<i>EUROPEMEPRICE</i>	-	0.06	0.07**
<i>INCOME</i>	-	1.08*	-
<i>GERTHREAT</i>	-	0.37***	0.25***
<i>GERSOVTHREAT</i>	-	-	-
<i>ME_{t,j}</i> □	-	0.44***	0.43***
<i>PRESP</i>	-	-0.04*	-0.08***
<i>F</i>	-	-0.00	-0.00*
<i>ELECTIONDUM</i>	-	-0.01	-
<u>CONTROLS:</u>			
<i>POP</i>	-	-	-0.07
<i>DEMOC</i>	-	-	0.01*
<i>N</i>	289	266	266
<i>S.E.</i>	0.34	0.26	0.26
<i>ADJ. R²</i>	0.81	0.82	0.82

Sources: see previous tables. * = null of no correlation rejected at 10 per cent level; ** = null rejected at 5 per cent level; *** = null rejected at 1 per cent level.

Note: cross-section specific coefficients not listed here. Cross-section SUR (PCSE) standard errors used, with cross-section weights.

As Table 5 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 than 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.

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 6). 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 here as threats, as hypothesized. Also, the nations here 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.

We also wanted to replicate the results using only the (more reliable) data for the 11 European nations. The results are displayed in Table 7. 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 were mostly irrelevant, with the exception of the autoregressive component.

Table 7. Pooled Demand for Military Burden among the 11 European States, 1920-1938

<i>VARIABLE</i>	<i>Model 1 (System and Alliances)</i>	<i>Model 2 (Plus Individual Country Effects)</i>	<i>Model 3 (Best Fit, with Controls)</i>
<i>CONSTANT</i>	2.75**	2.93	2.02
<u>SYSTEM:</u>			
<i>SYSTOTME</i>	0.21 (t-2)	-2.93*** (t-2)	-3.11*** (t-2)
<i>SYSTOTMECV</i>	1.36*** (t-2)	2.96*** (t-2)	2.95*** (t-2)
<i>CINCCONC</i>	0.84* (t-1)	-3.27*** (t-1)	-3.79*** (t-1)
<i>MILCINCCONC</i>	-0.70*** (t-2)	-0.11 (t-2)	-
<i>AUTOCCINC</i>	-0.47*** (t-1)	0.32*** (t-1)	0.37*** (t-1)
<i>AUTOCTOTME</i>	0.16*** (t-2)	1.78*** (t-2)	1.88*** (t-2)
<i>USAME</i> □	-0.54** (t-1)	1.38*** (t-1)	1.62*** (t-1)
<i>UKME</i> □	-0.13* (t-2)	0.63*** (t-2)	0.63*** (t-2)
<i>USACINC</i>	-1.66** (t-1)	3.58*** (t-1)	4.16*** (t-1)
<i>UKCINC</i>	-0.34 (t-1)	-5.77*** (t-1)	-6.11*** (t-1)
<i>USAMILCINC</i>	1.18** (t-1)	-3.97*** (t-1)	-4.63*** (t-1)
<i>UKMILCINC</i>	-0.56 (t-1)	3.27*** (t-1)	3.75*** (t-1)
<u>ALLIANCES:</u>			
<i>ALLIANCE DUM 1</i>	-	-	-
<i>ALLIANCE DUM 2</i>	0.11***	0.03	-
<i>ALLIANCE DUM 3</i>	-0.10**	0.04	-
<i>ALLIANCE DUM 4</i>	-	-	-
<i>ALLIANCE DUM 5</i>	-	-	-
<i>ALLIANCE DUM 6</i>	-	-	-
<i>ALLIANCE DUM 7</i>	-	-	-
<i>ALLIANCE DUM 8</i>	-	-	-
<i>ALLIANCE DUM 9</i>	0.68***	0.19***	0.19***
<u>INDIVIDUAL COUNTRY:</u>			
<i>EUROPEMEPRICE</i>	-	0.35***	0.35***
<i>INCOME</i>	-	-0.76***	-0.84***
<i>GERTHREAT</i>	-	-	-
<i>GERSTOCKTHREAT</i>	-	-0.00**	-0.00**
<i>SPILL1</i>	-	-2.51***	-2.63***
<i>SPILL2</i>	-	-	-
<i>ME_{t-1}</i> □	-	0.64***	0.63***
<i>PRESP</i>	-	-0.01	-
<i>F</i>	-	-0.00	-0.00**°
<i>ELECTIONDUM</i>	-	-0.01	-
<u>CONTROLS:</u>			
<i>POP</i>	-	-	-0.16
<i>DEMOC</i>	-	-	-0.00
<i>N</i>	187	176	176
<i>S.E.</i>	0.10	0.05	0.05
<i>ADJ. R²</i>	0.95	0.98	0.98

Sources: see previous tables. GERSTOCKTHREAT, SPILL 1 (see Eloranta (2011) for details), and SPILL2 (=UK stock impact, see text for details) 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.

Note: cross-section specific coefficients not listed here. Cross-section SUR (PCSE) standard errors used, with cross-section weights. ° = differenced version of variable used.

Table 8. Pooled Demand for Defense Share among the 11 European States, 1920-1938

<i>VARIABLE</i>	<i>Model 1 (System and Alliances)</i>	<i>Model 2 (Plus Individual Country Effects)</i>	<i>Model 3 (Best Fit, with Controls)</i>
<i>CONSTANT</i>	4.89***	16.00**	19.79***
<u>SYSTEM:</u>			
<i>SYSTOTME</i>	-0.14* (t-1)	-0.04 (t-1)	-0.20*** (t-1)
<i>SYSTOTMECV</i>	-0.61*** (t-1)	-1.68*** (t-1)	-2.79*** (t-1)
<i>CINCCONC</i>	3.04*** (t-1)	8.95** (t-1)	8.95*** (t-1)
<i>MILCINCCONC</i>	0.58*** (t-1)	2.72*** (t-1)	3.50*** (t-1)
<i>AUTOCCINC</i>	-0.81*** (t-1)	-1.87* (t-1)	-1.79*** (t-1)
<i>AUTOCTOTME</i>	0.24*** (t-1)	0.91** (t-1)	0.87*** (t-1)
<i>USAME</i> □	0.14*** (t-2)	0.02 (t-2)	
<i>UKME</i> □	0.54*** (t-1)	-0.75 (t-1)	-0.87*** (t-1)
<i>USACINC</i>	-2.65*** (t-1)	-5.52 (t-1)	-5.82*** (t-1)
<i>UKCINC</i>	-0.31** (t-2)	-2.87*** (t-2)	-3.79*** (t-2)
<i>USAMILCINC</i>	0.93*** (t-1)	1.67 (t-1)	1.84*** (t-1)
<i>UKMILCINC</i>	1.29*** (t-1)	1.29*** (t-1)	4.82*** (t-1)
<u>ALLIANCES:</u>			
<i>ALLIANCE DUM 1</i>	-	-	-
<i>ALLIANCE DUM 2</i>	0.14***	0.09***	0.10***
<i>ALLIANCE DUM 3</i>	-0.06**	0.03	
<i>ALLIANCE DUM 4</i>	-	-	-
<i>ALLIANCE DUM 5</i>	-	-	-
<i>ALLIANCE DUM 6</i>	-	-	-
<i>ALLIANCE DUM 7</i>	-0.06**	-0.07**	-0.09***
<i>ALLIANCE DUM 8</i>	-	-	-
<i>ALLIANCE DUM 9</i>	0.28***	0.04	-
<u>INDIVIDUAL COUNTRY:</u>			
<i>EUROPEMEPRICE</i>	-	-0.77***	-1.11***
<i>INCOME</i>	-	-0.07	-
<i>GERTHREAT</i>	-	-	-
<i>GERSTOCKTHREAT</i>	-	-0.00	-
<i>SPILL1</i>	-	-1.17***	-1.35***
<i>SPILL2</i>	-	-	-
<i>ME_{t-1}</i> □	-	0.61***	0.64***
<i>PRESP</i>	-	-0.02	-
<i>F</i>	-	-0.00	-0.00**°
<i>ELECTIONDUM</i>	-	0.01	-
<u>CONTROLS:</u>			
<i>POP</i>	-	-	0.17
<i>DEMOC</i>	-	-	0.01*°
<i>N</i>	187	176	176
<i>S.E.</i>	0.08	0.06	0.06
<i>ADJ. R²</i>	0.84	0.91	0.93

Sources: see previous tables. GERSTOCKTHREAT, SPILL 1 (as before), and SPILL2 (=UK stock impact, see text for details) 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.

Note: cross-section specific coefficients not listed here. Cross-section SUR (PCSE) standard errors used, with cross-section weights. ° = differenced version of variable used.

When the analyses are replicated using the defense shares of the 11 European nations, as seen in Table 8, the systemic forces are again relevant, but they have the wrong signs. The impact of the behavior of autocracies is 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 for did not influence them much at all.

5. Conclusions

It seems theoretically likely that the demand for military spending in any country would be based both pure and impure public good characteristics, let alone in the interwar period, influenced by forces arising from the four explanatory levels discussed in this paper: 1) System; 2) Alliances; 3) State; 4) Within states (individuals and groups). The military expenditure behavior of the 17 nations analyzed in this paper suggests that all of these levels, even though here it was impossible to delve into analysis of the fourth level, mattered in their spending behavior. Here we focused on developing appropriate proxies to investigate those effects. We 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), the budgetary variable, using panel regressions.

The interwar period was a turbulent period, 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 the 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, the persistent economic downturn turned the 1930s into an extensive arms race, finally culminating in World War II. The nations analyzed in this paper had to make their military spending choices on such a backdrop of 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 (=positive). 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 did reduce 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. Most alliances did not have an impact on them, and in the few cases that they did, they did not induce free riding. Prices had almost no impact on them, or 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. Spillins from a possible European "alliance" did lead to free riding among the smaller group of states, but only in a limited sense.

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 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, with impure public good influences arising from all of the analytical levels, strongly suggest that military spending was an impure public good in the interwar period.

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