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Guns versus Butter: A Budgetary Trade-Off in the MENA Region?

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Abstract: Although the debate has become less heated in the post-Cold War period, no conclusive evidence has been reached regarding the economic impact of military spending. The aim of this paper is to investigate the existence and magnitude of budgetary trade-offs between military spending and human capital spending in the MENA (Middle East and North-Africa) region. It is striking that the guns versus butter hypothesis has not been studied extensively for the MENA region, given the high military burden this region faces. Due to limited data availability we can only include eight countries in our analysis. We therefore choose to employ the least squares dummy variable fixed effects model to control for country-specific heterogeneity. Our results suggest that there indeed exists a negative trade-off between military and human capital spending, with the opportunity costs of defense spending being higher for education than for health spending. While the level of economic development can mitigate the negative trade-off between defense and education spending, the level of resource wealth and democracy are not found to have a significant impact on the budgetary trade-offs.

Key words: Military spending, human capital, Middle East and North Africa

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*“If a government chooses to spend more on its army than on its people,
it cannot be regarded as committed to human development”*

(UNDP 1991, 83)

1. Introduction

The present paper empirically investigates the existence, direction and magnitude of budgetary trade-offs between military expenditures and human capital expenditures for the MENA region (Middle East and North Africa). The period of interest is the post-Cold War period (1990-2009). In short, we want to test if defense spending is indeed crowding out investments in more productive activities, such as health and education, as would be suggested by the guns versus butter hypothesis. In the past decades, numerous studies on the economic impact of military spending and the military apparatus have been conducted without yielding strong and unambiguous evidence one way or the other (Neuman 1994). The focus thereby has predominantly been on the consequences of military spending for economic growth. The impact of military spending on economic growth however is not straightforward and defense expenditures include both costs and benefits for an economy (Yildirim et al. 2005). We therefore limit our study to the cost-side of military spending, making use of the opportunity costs concept (Russett 1969). We consider the MENA region most appropriate to test our hypothesis given the region's, by Third World standards, high military burden in combination with relatively low levels of human capital formation (Looney 1993). If there indeed exists a negative budgetary trade-off between military expenditures and human capital expenditures, this link should become clear in the data for the MENA region. We will first conduct the analysis at the aggregate level, considering combined spending on education and health, and afterwards repeat the analysis for education and health spending separately. Education and health constitute together with social security (S) and welfare (W) a government's social spending. Yet only education (E) and health (H) expenditures are considered in our study because *“since education and health spending is likely to raise worker productivity more than social security or welfare spending, we would expect the effects of E&H spending on economic growth to be stronger than the effects of S&W spending”* (Aslam 2007, 42-43). An additional reason is the limited availability of government spending data for the MENA region. Formally, both through descriptive and analytical research, the following hypotheses will be tested:

- H₁: Increases in defense spending will result in decreases in human capital spending
- H₂: Increases in defense spending will result in decreases in education spending
- H₃: Increases in defense spending will result in decreases in health spending
- H₄: Economic and political factors such as income level, resource wealth, and level of democracy influence the magnitude of the budgetary trade-off

Making use of the fixed effects least squares dummy variable (LSDV) model, our hypotheses of a negative trade-off are confirmed. Increasing shares of defense spending relative to the total central government expenditures (CGE) negatively impact spending on human capital, education, and health. While the negative trade-off between defense spending and health spending is confirmed, the trade-off is significantly more negative for education spending. At the aggregate level, a one percentage point increase in defense spending decreases human capital spending by 0,3 percentage points. A one percentage point increase in defense spending decreases educational spending by 1,04 percentage points but only decreases health spending by 0,16 percentage points. Applying interaction terms we find that income growth can play an important role in tempering the negative trade-off between defense and education spending. The level of democracy on the other hand would negatively impact the negative trade-off between defense spending and health spending, a counterintuitive result. We do not find convincing evidence that resource wealth can reverse the negative budgetary trade-off between defense and human capital, education, and health.

The rest of the paper is divided as follows. Section II gives an overview of military expenditures and human capital accumulation in the MENA region. In section III the theory behind the guns versus butter hypothesis is explained. Section IV reviews the existing literature with regard to the consequences of military spending. In section V the model, explanatory variables, data and data sources, and the methodology are specified. The results are presented in Section VI. In section VII we discuss our results and the final section concludes.

2. Military Expenditures and Human Capital in the MENA Region

We will start by giving a short description of the military expenditures pattern for the MENA countries in the post-Cold War period. The following countries are part of the MENA region¹: Algeria, Libya, Morocco, Tunisia, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, and Yemen. The military spending data we use in this section are from the Stockholm International Peace Research Institute (SIPRI). Military expenditures include all current and capital expenditures on the armed forces, defense ministries, paramilitary forces, and military space activities².

Worldwide military expenditures rose in 2009 to an estimated 1531 billion US\$, representing an increase in real terms of 49 per cent compared to the level of 2000 (SIPRI 2010). North America (42,4%), Asia and Oceania (20,9%), and Western and Central Europe (18,8%) hold the largest shares of worldwide military spending³. Defense spending in respectively North America and Asia is heavily dominated by the U.S. and China. Africa (2%), Latin America (4,2%), and Eastern Europe (4,6%) hold modest shares. The Middle East has a share of 7,1%. In 2009⁴, total military spending in the MENA region increased from 76,4 billion US\$ in 2000 to 110,5 billion US\$ (SIPRI 2010). In the period 1990-1999 North Africa experienced a 54 per cent increase, from 2,4 billion US\$ to an estimated 3,7 billion US\$ in 1998. This growth record is remarkable, given the decrease in world military expenditures by 28,6 per cent in the same period. Also in the Middle East, military expenditures fell five per cent between 1990 and 1999 (SIPRI 2000).

A more interesting measure to gain inside in the degree of militarization is the military burden, i.e. military expenditures as a share of national GDP. By this measure, the Middle East and North Africa constitute together one of the most militarized regions in the world. SIPRI lists the countries with a high military burden for the period 2005-2010 (Table 1). All the countries with a military burden higher than 4% in any of the years 2005-2010 are included. Of the 20 countries listed, as many as nine countries are from the MENA region. In 2009, the world military burden was 2,7% (SIPRI 2010). We therefore expect that if military expenditures are indeed crowding out resources for human capital spending, this relation should become clear in the data for the MENA region. An alternative measure of militarization is the Global Militarization Index (GMI) from the Bonn International Center for Conversion (BICC)⁵. The GMI

¹ According to the World Bank

² An extended overview with all the spending categories included is available on http://www.sipri.org/research/armaments/milex/resultoutput/sources_methods/definitions

³ www.sipri.org/research/armaments/milex

⁴ Figures are at constant 2008 prices

⁵ www.bicc.de

measures the relative weight and importance of the military apparatus in relation to the society as a whole. The GMI includes measures such as the share of military expenditures in total GDP, the share of health spending as a share of GDP, the contrast between the number of (para)military forces and the number of physicians and the overall population, and the ratio of the number of heavy weapons available and the number of the overall population. The degree of militarization is expressed on a scale from zero to one thousand. The GMI could have been an interesting alternative measure for the empirical analysis but is not appropriate here, given that it includes data for both the independent (military expenditures) and dependent (health expenditures) variable. What was already reflected in the data for military expenditures becomes even more obvious if we look at the GMI for 2012⁶ (Table 2). Five states in the top ten of the states with the highest degree of militarization are from the Middle East (Israel, Syria, Jordan, Kuwait, and Saudi-Arabia). Three more countries from the Middle East (Oman, Bahrain, and the United Arab Emirates) and two countries from North Africa (Algeria and Libya) can be found in the top twenty. Egypt, Lebanon, and Morocco appear in the top thirty. Iran, Iraq, Qatar, and Yemen are less militarized while Tunisia seems to be an outlier in the region with a rather low GMI value.

To guarantee consistency of our measures for defense, education, and health spending, we use data from a single source, the Government Finance Statistics Yearbooks from the International Monetary Fund (IMF). Central government expenditures for each country are provided in local currency and will be discussed in more detail in the section on data description. Due to data availability we were only able to collect data for the entire period 1990-2009 for eight MENA countries: Bahrain, Egypt, Iran, Israel, Jordan, Kuwait, Lebanon, and Tunisia. Table 2 reports the 2011 United Nations (UN) Human Development Index (HDI) rankings for the MENA region. If we compare the GMI ranking with the HDI index, a clear picture emerges. The MENA region is facing high military burdens while at the same time experiencing relatively low levels of human development. Only a number of countries combine a high level of militarization with a reasonably high human development index (i.e. high-income country Israel and resource-rich countries such as Bahrain, Qatar, Saudi-Arabia, and the United Arab Emirates). In other words, if the hypothesis of a negative impact of defense spending on human capital spending is confirmed, this would put an additional burden on the already low levels of human capital.

⁶ The 2012 GMI is based on 2010 data

Table 1: World Military Burden (%), 2005-2010

Country	Military Expenditures (% GDP)					
	2005	2006	2007	2008	2009	2010
<i>Africa</i>						
Angola	4,5	4,5	4,4	3,7	4,3	4,2
Burundi	6,2	4,9	4,7	3,8	.	.
Chad	6,9	.	5,5	7,1	6,2	2,7
Djibouti	6,3	6,4	4,1	3,7	.	.
<i>Americas</i>						
USA	4	3,9	4	4,3	4,8	4,8
<i>Asia</i>						
Kyrgyzstan	3,1	3,2	3,4	3,4	3,5	4,4
Singapore	4,4	4	3,7	3,9	4,1	3,7
Timor Leste	2,5	5,2	6,6	5,3	6,6	4,9
<i>Europe</i>						
Armenia	2,9	2,9	3	3,4	4,2	4,2
Georgia	3,3	5,2	9,2	8,5	5,6	3,9
Russia	3,7	3,6	3,5	3,5	4,3	3,9
<i>Middle East</i>						
Israel	8	8,1	7,5	7,1	7	6,5
Jordan	4,8	4,8	6,1	5,9	6	5
Kuwait	4,3	3,6	3,6	3	3,9	3,6
Lebanon	4,4	4,5	4,6	3,9	4,1	4,2
Oman	11,8	11	10,3	7,6	9,6	8,5
Saudi-Arabia	8	8,3	9,2	8	11	10,1
Syria	5	4,4	4,1	3,6	4	4,1
UAE	5,6	5,1	5	5,5	7,6	6,9
Yemen	4,3	3,6	4,1	3,9	.	.

Source: SIPRI military expenditures database
(www.sipri.org)

In Table 3 military expenditures for each country are expressed as a share of combined education and health spending at three different points in time (1990, 2000, 2009) during the period 1990-2009, together with the military burden. As we already noted above, the data clearly indicate that the countries in our sample have high military burdens. One exception is Tunisia, whose share of military expenditures in GDP does not exceed 2% for the years considered. Countries like Israel and Kuwait show military burdens as high as 12,5% and 48,5% for 1990, although these shares decline over time. If we look at military spending as a share of spending on human capital, we see that the majority of the countries have disproportional defense expenditures. For some countries (Israel, Jordan, Kuwait, and Lebanon) the military spending is even higher than the combined spending on health and education. The UN estimates that the global share of military expenditures as a share of combined education and health expenditures accounts to 38 per cent (UNDP 1997), much lower than the average share for our panel of countries.

Table 2: GMI and HDI ranking, MENA region

Country	GMI Rank	HDI Rank
Algeria	18	96
Bahrain	14	42
Egypt	28	113
Iran	32	88
Iraq	33	132
Israel	1	17
Jordan	5	95
Kuwait	8	63
Lebanon	22	71
Libya	13	64
Morocco	23	130
Oman	12	89
Qatar	42	37
Saudi-Arabia	10	56
Syria	3	119
Tunisia	82	94
United Arab Emirates	17	30
Yemen	39	154

Sources:

Bonn International Center for Conversion: 2010 GMI ranking (<http://www.bicc.de/our-work/gmi.html>)

United Nations: 2011 HDI ranking (<http://hdr.undp.org/en/data/trends/>)

Table 3: Military Burden and Military Spending as a share of Human Capital Spending

Country	1990		2000		2009	
	Milex/GDP(%)	Milex/HC(%)	Milex/GDP(%)	Milex/HC(%)	Milex/GDP(%)	Milex/HC(%)
Bahrain	4,8	73	4	75	3,7	73
Egypt	4,7	68	3,2	40	2,1	40
Iran	2	35	3,7	57	.	35
Israel	12,5	178	7,8	87	6,3	87
Jordan	7,8	108	6,3	72	6,1	75
Kuwait	48,5	101	7,2	79*	4,4	55
Lebanon	7,5	135**	5,4	99	4,1	108
Tunisia	2	25	1,7	21	1,3	18

Sources: Milex/GDP data (SIPRI Military Expenditures database); Milex/HC data are own calculations based on IMF data

*data is for 1999, **data is for 1993

The importance of spending on health and education should be obvious. The human capital approach deals with investments in health, education, and other human capacities that can raise productivity (Todaro and Smith 2009, chapter 8). Similar to physical capital investments, a stream of higher future income will be generated if an initial investment in health or education is made. Next to the indirect ability to increase incomes does human capital investment also directly contribute to well-being. The benefits of human capital investment can be calculated by discounting the difference between the income gains and the total indirect and direct costs due to the investment. For education, this can be expressed as follows (Todaro and Smith 2009, Chapter 8):

$$\sum \frac{E_t - N_t}{(1 + i)^t}$$

With E_t the future income when the investment in education is made, N_t the income without investment in education, i the discount factor and t the expected years of working life. A similar formula can be applied to health investments.

Salehi-Isfahani (2010) discusses the human development performance of the MENA countries. While the low-income MENA countries (Egypt, Iraq, Morocco, Syria, Yemen) had HDI levels comparable to the average levels for Africa in 1990, many of them have managed to improve faster than other regions. Although the group of middle-income MENA countries (Algeria, Iran, Jordan, Lebanon, Libya, Tunisia) had in 1990 a lower average level of human development than Latin America, a region with a comparable GDP per capita, its human development index increased faster in the last decades. The high-income MENA countries (Israel, Bahrain, Kuwait, Oman, Qatar, Saudi-Arabia, United Arab Emirates), classifying second at the global level based on the income index, only rank third based on the HDI level. Salehi-Isfahani (2010) calculates that all MENA countries, except Jordan, underperform on the level of human development compared to what could be expected based on the per capita income level. The same holds for the education index, again with the exception of Jordan. This was the situation in 1990 and a similar analysis for 2005 shows little change. The health index however is for three countries (Jordan, Syria, and Tunisia) higher than expected based on the income level. Overall, mainly the high-income MENA countries underperform, both on the aggregate HDI and the health and education indices.

3. Theoretical Background

3.1 Military Spending and Economic Growth

Our hypotheses of negative trade-offs between defense spending and human capital spending categories do not imply that defense spending is always detrimental to an economy. The study of warfare-welfare trade-offs is only one element of the larger literature which tries to establish the relation between defense spending and economic growth. The idea that military expenditures and economic development were directly related and inversely correlated gained wide support in the seventies (Neuman 1994). The continuously increasing military expenditures at a global level together with sluggish growth levels brought the majority of the research community to belief that butter was being traded off for guns in the developing world. In the eighties, the public debate was not only about military expenditures anymore but also about the potentially negative consequences of arms transfers, military regimes, and military industries. The growing attention for this topic however did not result in a conclusive finding and until today the results regarding the much-studied relation between military spending and economic growth are mixed and inconclusive.

From a theoretical perspective distinguishes Al-Yousif (2002) between the supply-side and demand-side effects of defense spending on economic growth. The supply-side effects mainly deal with the opportunity costs concept as defense spending can divert resources away from other public spending categories such as health and education. Next to this, private consumption, investment, and savings can be negatively influenced by defense spending. Positive supply-side effects however also exist in the form of increased technological know-how, skill development, and improved infrastructure. Demand-side effects can also have a positive or negative impact, depending on the extent to which the economy is operating at full-employment. Given the often high unemployment and underconsumption many developing countries face, increases in government expenditures in the form of military expenditures can spur economic growth (Lebovic and Ishaq 1987).

Al-Yousif (2002) differentiates between four different findings in the empirical literature regarding the relation between defense spending and economic growth. Benoit (1978) was one of the first authors to give attention to the economic impact of defense spending. He concluded that defense spending positively affects economic growth by raising aggregate demand in a panel 44 developing countries. Deger (1986) reaches the same conclusion as Benoit (1978) but argues that the positive effect works through spin-off effects of defense spending on physical and social infrastructure (roads, transportation networks, and research and training). Next to these favorable socioeconomic spin-offs, defense spending can guarantee a

country security and stability, which is a necessary condition for development (Neuman 1994). A second finding was that defense spending has a negative impact on economic growth. The negative impact exists when taxes are used to finance the military expenditures thereby putting a higher burden on the tax-paying population (Al-Yousif 2002). Next to this, rising demand for sophisticated weapons can deteriorate a country's balance of payment and increase the debt burden (Neuman 1994). Smyth and Narayan (2009) find a positive long-term and short-term impact of military spending on the level of external debt for a panel of six Middle Eastern countries. Another possibility is that there is a trade-off with other more productive government spending categories (Apostolakis 1992). This last channel, by which defense spending crowds out health and education spending, will be the subject of this article and is consistent with the finding of a negative impact of defense spending on economic growth. Still other authors believe that the causality is bidirectional and that defense spending causes economic growth and vice versa (Kusi 1994) for a group of developing countries. A fourth finding is that there does not exist any relationship at all between defense spending and economic growth, or that at least the net impact is close to zero (Biswas and Ram 1986; Grobar and Porter 1989).

3.2 Opportunity Costs Concept

A crucial concept for the development of our theoretical model is the opportunity costs argument (Dabelko and McCormick 1977, 145-146):

“In a choice situation the concept of opportunity costs refers to the benefits foregone by selecting one option at the expense of several other options. Assuming resources are scarce, if an individual selects policy A, he foregoes the benefits derived from policies B and C. Such a definition does not imply, however, that the notion of opportunity costs applies only to mutually exclusive situations. The concept equally applies to a situation where resources are allocated in preferential rank-orderings. This latter situation is most applicable to nations when considering their budgetary expenditures”

The most well-known illustration of the opportunity costs concept when dealing with government expenditures is the guns versus butter dilemma. The guns versus butter dilemma proposes the trade-off between warfare and welfare (Apostolakis 1992) or in our case between military expenditures and expenditures on health and education. A government's resources are limited, and “...when public policy demands exceed the available public resources, budgetary trade-offs are bound to occur between and among different policy areas...” (Looney 1986, 77). A negative trade-off appears when human capital

expenditures decline due to increases in defense spending. In most cases however does a government budget not represent a zero-sum game. Harris, Kelly, and Pranowo (1988) make the more realistic assumption of a total government budget as an increasing-sum game with the total government budget increasing or decreasing on a year-to-year basis. Both defense and social welfare spending can therefore increase when the total budget grows, but what becomes important are the relative changes. Alternative definitions of a negative trade-off are now possible. Harris et al (1988) calculate the vulnerabilities of defense, education, and health spending to total central government expenditures cutbacks. Comparing sectoral vulnerabilities only provides suggestive evidence of a negative trade-off but the idea is that a low vulnerability of defense to total CGE cutbacks, may suggest a trade-off with expenditure categories with a higher vulnerability. Another possibility is to calculate the elasticities of the sectoral expenditures to CGE increases, in order to compare the speed at which the sectors grow relative to the growth of the total CGE. Again, higher positive elasticities for defense spending compared to those for education and health are only suggestive evidence of a negative trade-off between defense and human capital spending and should be extended with more thorough analysis. In the next section we review the existing literature with regard to the budgetary trade-off between military and human capital.

4. Literature Review

Before we come to the empirical analysis, we report on the most important results found in earlier literature. A wide variety of articles on the warfare-welfare spending trade-off has been written for the period before 1990. For the post-Cold War period however, less research has been done. Neuman (1994) argues that the debate has become less heated in the post-Cold War period and that there has emerged a consensus that a more complex and nuanced approach to a potential budgetary trade-off is necessary. The main conclusion after reviewing the literature from the last decades is probably that “*more than thirty years of research on the positive or negative consequences of various military activities for the civilian sector has failed to yield strong and unambiguous evidence one way or the other*” (Neuman 1994, 91).

One of the first studies on the public policy implications of defense and welfare expenditures is Caputo (1975) in which the relation between warfare and welfare spending for four Western democracies (Australia, Sweden, the United Kingdom, and the United States) for the period 1950-1970 is studied. The main conclusion at which the authors arrive is that previous findings of an explicit trade-off between defense and welfare expenditures should be reconsidered. Contrary to earlier results, defense spending has a strong and positive impact on health spending. The hypothesis of a negative impact of increasing defense expenditures on education expenditures however is confirmed but the relation is not statistically significant. Indeed, studies prior to Caputo (1975) reached different conclusions for different time periods and different groups of countries. Russett (1969), according to Caputo (1975) the only researcher whose work “*has dealt with the trade-off question both within and between nation-states in a systematic and comprehensive manner*” (Caputo 1975, 425) confirms the guns versus butter hypothesis for the U.S for both education and health spending. For the same period (1938-1968), a negative trade-off between warfare and education spending is found for France and the United Kingdom. However, making use of an improved model, Russett (1982) reconsiders the budgetary trade-off between military and human capital spending for the U.S. in the period 1941-1979. Including a wide range of explanatory variables for both the education and health equation, no evidence of a systematic trade-off is found. In another study (Peroff and Podolak-Warren 1979) for the U.S and for a similar time period (1929-1974), the evidence rather points in the direction of a negative trade-off between military spending and health spending. Dabelko and McCormick (1977) provide, at a global level, cross-national evidence for the opportunity costs of defense spending. Special emphasis is placed on the role of economic development and regime type. A negative trade-off is found both for public education and health spending, across all countries and all years (1950-1972). However, the magnitude of the relation is weak. The ‘strongest’ trade-off is found for the year 1965 ($\beta = -0,12$) and measures the impact of defense spending on education spending. A 1 per cent increase in defense spending in this case only leads to a 0,12 per cent decrease in education spending. The

coefficients for the other time periods, both for the impact on education and health spending, are also negative but even more limited in magnitude. For the 14 regressions, only six coefficients on military spending are significant. Moreover, contrary to the expectation, the level of economic development shows no or little impact on the strength of the opportunity costs. Regime type however does play a significant role, with personalist regimes having higher opportunity costs of defense spending compared to centrist and polyarchic regimes. The hypothesis of higher opportunity costs for the centrist regimes compared to the polyarchic regimes however is not confirmed by the data. One drawback of the study by Dabelko and McCormick (1977) is the use of cross-sectional analysis, which we consider not appropriate to analyze the trade-off hypothesis. The results however certainly give some idea about the defense-human capital trade-off at a global level for the period under study because the cross-sectional analysis is done for seven different time periods with the results being relatively stable over time. While the impact of military spending on both education and health spending across time remains more or less stable, the opportunity costs of defense spending for education are higher than those for health. In general, the trade-off relation seems to be universal but very weak. Other variables however should be included in the model in order to claim a more reliable result.

Looney (1986) studies the budgetary trade-off for thirteen Latin American countries for the period 1972-1983 using time series data to analyze each country separately. The author analyzes eight different central government spending categories⁷. We will only report the statistically significant results for the trade-offs with health and education. For Chile, Bolivia, Paraguay, and Uruguay a positive trade-off between defense and health spending is found. For three other countries (Ecuador, Costa Rica, El Salvador) a negative trade-off is found. Bolivia is the only country for which a positive trade-off between defense and education is found, while several other countries (Argentina, Chile, Mexico, El Salvador) showed a negative trade-off. In other words, there is not a clear trade-off pattern arising for Latin America as a whole. One important common factor among the countries studied is being an arms producer or not. Except for El Salvador, a negative trade-off between defense and social expenditures (all categories) is found for the arms producing countries and vice versa. A more recent study on Latin-America comes from Apostolakis (1992). The author empirically tests the existence of a trade-off between defense and other public needs (health, education, social security, public works). The analysis is done for 19 countries and captures a longer time period (1953-1987) compared to Looney (1986). Contrary to the finding in Looney (1986), the guns versus butter hypothesis is confirmed using time-series, cross-sectional and pooled analysis confirming that military expenditures crowd out the potential allocations for social upgrading.

⁷ Public services, health, education, social security-welfare, housing, other community services, economic services, and other purposes

Harris, Kelly, and Pranowo (1988) test the existence and strength of trade-offs between defense and education and health expenditures for a large number of less developed countries (LDCs). Their cross-sectional analysis for 50 LDCs did not reveal a significant trade-off, with few countries showing a strong negative correlation between defense and human capital expenditures. The authors however recognize the limited strength of the cross-sectional methodology to arrive at a final answer regarding the budgetary trade-off, given that it only captures the relation at one point in time and is thus very sensitive to the dates chosen for the analysis. “*This analysis is by definition a weak way of determining the existence and nature of trade-offs*” (Harris et al 1988, p. 167). Next to this, the responsiveness of the different government budget categories to total budget decreases is calculated. The idea is that a relatively low responsiveness of the defense budget can be an indication of a trade-off with spending categories with a higher responsiveness. All three budget categories showed a relatively low responsiveness, suggesting that no trade-off exists. Also the elasticity of defense expenditures to central government expenditures increases is calculated. The defense budget was not found to increase more (decrease less) with an overall increase (decrease) of the government budget compared to the education and health budget. Next to the cross-sectional evidence, a longitudinal analysis, based on the model in Verner (1983) is performed for 12 Asian countries for the period 1967-1983. Their simple model uses central government expenditure on defense as a percentage of total central government expenditure as the main independent variable and the share of education/health expenditure in total expenditure as the dependent variable. The annual GDP growth rate per capita is used as the control variable. Little evidence of a trade-off is found. Applying education as the dependent variable, only one country (Nepal) shows a negative trade-off with defense expenditure, while six other countries with a positive trade-off are identified. For the health budget, three countries (India, Indonesia, and Singapore) show a negative trade-off. The findings do not confirm the hypothesis of a negative trade-off between defense and human capital expenditures. Out of a total of 24 potential trade-offs (12 countries and two dependent variables, health and education), only four negative trade-offs are identified. In summary, the authors find little evidence for the existence of a trade-off, although they state that “*we remain unconvinced that no trade-offs exist, and this leads us to examine reasons why such trade-offs might not be revealed.*” (Harris et al 1988, 175). A more recent study by Hirnissa, Habibullah, and Baharom (2009) explores the relation between military, education, and health expenditures for eight Asian countries⁸ (1971-2006). In order to identify causal relations, the Autoregressive Distributed Lag Model to Restricted Error Correction Model (ARDL-RECM) is used. Overall, a long-term relationship is detected between the spending categories but for two countries no relationship is observed while for the other countries, differing granger causality among the variables is found. The only consistent relation found, is a positive one between health and education spending.

⁸ These countries are Malaysia, Indonesia, Singapore, Philippines, Bangladesh, Nepal, Sri Lanka and South Korea

A number of country-level studies have been performed. Yildirim and Sezgin (2002) apply a multi-equation framework to investigate budgetary trade-offs for Turkey (1924-1996). The authors find a negative trade-off between defense and health spending and a positive trade-off between defense and education spending. Education and health spending are found to compete in the public budgeting process. Kollias and Paleologou (2011) analyze the existence of a trade-off between defense, education, and social spending in Greece, the country with the highest military burden in Europe. Contrary to the guns versus butter hypothesis, a positive relation between defense and education and defense and social spending is found.

Next we turn to some evidence regarding the warfare-welfare trade-off in the MENA region. Although the MENA region is characterized by high military burdens, studies on the existence of a budgetary trade-off are very limited. On the other hand, several studies have been performed on the effects of defense spending on economic growth. Aslam (2007) finds for the Middle East a negative productivity effect of the defense sector on economic growth. Also defense spending in the region is significantly negatively related to economic growth. In a dynamic panel data setting, Yildirim, Sezgin, and Öcal (2005) investigate the link between military expenditures and economic growth in the Middle East and Turkey for the period 1989-1999. The results indicate a growth-enhancing effect of military expenditures. Al-Yousif (2002) studies the relationship between defense spending and real economic growth in six MENA region countries (Bahrain, Iran, Kuwait, Oman, Saudi Arabia, and the United Arab Emirates) making use of the Granger-causality test within a multivariate error-correction framework. The author finds that neither defense nor economic growth can be considered exogenous and that the relation cannot be generalized across countries but rather should be studied at the country-level, taking into account the specific socio-economic circumstances. In a recent study, Chang et al. (2011) use the generalized method of moments (GMM) to study 90 countries over the period 1992-2006. Looking to the regional-level evidence, a strong negative impact of military spending on economic growth is found for the Middle East. A similar negative finding is reported by Lebovic and Ishaq (1987) for the non-oil-exporting Middle Eastern countries, while no clear pattern emerges for the complete sample of Middle Eastern countries. Abu-Bader and Abu-Qarn (2003) find a negative impact of military spending on economic for Egypt, Israel, and Syria.

After reviewing the existing literature, it becomes clear that the research community has not arrived yet at a final answer regarding the warfare-welfare spending trade-off. The evidence for a budgetary trade-off is mixed and depends heavily on the chosen methodology, the selected (group of) countries and time period. Even for similar countries and time periods, different outcomes have been obtained. This emphasizes the importance of a cautious interpretation of our own results and the need for more studies on the relation

between defense spending and several aspects of the economy. Next to this, it is striking that such limited attention has been given to the MENA countries, given their traditionally high military burdens and low levels of human capital development. The majority of the defense economics literature studying the MENA region limits its attention to the direct relationship between military spending and economic growth and does not take into account the potential trade-off between defense and human capital spending.

5. Empirical Analysis

5.1 Model

Our aim is to develop a model that allows to test for the warfare-welfare hypothesis and at the same time goes beyond the models applied in previous literature. Several studies have introduced models with only one or two control variables, and are therefore not exploiting the trade-off hypothesis to the full extent. A few examples are Apostolakis (1992), Verner (1983), Harris et al (1988), and Dabelko and McCormick (1977). These studies typically use a measure of education and/or health spending as the dependent variable, a measure for defense spending as the independent variable and include a measure for economic development as the only control variable⁹. Yildirim and Sezgin (2002) propose to use the model by Russett (1982). Indeed, the model in Russett's study on the U.S. is among the most complete ones in the existing literature, or in the words of the author "*whereas one should always wonder whether the equation is misspecified, it is not obvious to me that I have, for example, left out a variable importantly associated with both military and the dependent variable in a way that would seriously distort the result*" (Russett 1982, 774). The author considers separate equations for the percentage year-on-year change in health and education spending and includes both economically and politically relevant variables in the right-hand side of the equations. The main contribution of Russett (1982) compared to other studies is the inclusion of demand factors for education and health spending, while the standard model only includes supply factors of human capital spending. We reproduce here the model used by Russett (1982):

$$\text{Education} = a - b_1\text{Military} + b_2\text{Health} + b_3\text{Housing} + b_4\text{Productivity} - b_5\text{Capacity} + b_6\text{GNP} + b_7\text{Taxes} + b_8\text{Population} \\ < 18 + b_9\text{Enrollment} - b_{10}\text{BattleDeaths} - b_{11}\text{Republican} + e$$

For the model with public spending on health as the dependent variable, a number of obvious changes are made. Spending on education will move to the right-hand side of the equation and the share of the population under age 18 and total enrollment are removed from the model and replaced by the share of the population over age 65.

We will deviate from the model in Russett (1982) in a number of ways. First, Russett (1982) applies a rate-of-change model in which not the levels of government spending but the year-on-year changes are

⁹ Dabelko and McCormick (1977) also introduce regime type in their model.

considered. Our main model relies on government expenditures as a share of total government spending, a choice which will be motivated below. Second, data availability is an issue for several of the countries in our panel. We can therefore not include measures for housing expenditures, productivity and capacity utilization, the level of tax revenues and the share of the population under age 18. We do use however the rate of unemployment which is considered an alternative measure for capacity utilization, and we argue that only including the gross enrollment ratio (GER) is sufficient to capture the demand for education spending. Third, the model in Russett (1982) refers to a specific country context, i.e. the U.S. Due to the low number of conflicts¹⁰ in our panel in the post-Cold War period, we do not include a measure of war intensity. Because there is no simple way to characterize the political landscape across the countries in our panel as it is for the U.S., we use the Polity2 measure as an indication of the degree of democracy. Fourth, we will introduce a number of interaction terms in our analysis to see if factors such as economic development, resource wealth, or level of democracy change the magnitude of the trade-off between defense and human capital spending. The simple inclusion of variables such as level of economic development, political regime, and tax revenues do not allow to test whether these influence the magnitude of the trade-off between defense and human capital spending. Fifth, next to the disaggregate analysis for education and health we will consider total spending for human capital. Finally, other variables next to the ones included in Russett's (1982) model have been used in the trade-off literature. We will therefore extend our model with total government spending as a share of GDP (Looney 1986) and natural resource wealth (Lebovic and Ishaq 1987; Looney 1983).

An important methodological issue is the definition and operationalization of the expenditure terms (Peroff and Podolak-Warren 1979). Ratio measures can be used to express the government spending in terms of total GDP or total central government expenditures. Other options are per capita measures or absolute level measures. Russett (1982) uses a rate-of-change model in which all the expenditure categories are expressed as the yearly percentage change relative to the previous year. If we would work with absolute or per capita spending data and the budgetary allocation process represents an expanding-sum game, the negative trade-off might not be identified. We choose therefore not to work with such measures. To clarify this, we provide a simplified and therefore obvious example by Hayes (n.d., p.28). Assume a simplified central government budget in which only two categories, defense and welfare, change from year 1 to year 2. With the total budget increasing from \$100 to \$200 from year 1 to year 2, both defense and welfare spending benefit in absolute terms, increasing from respectively \$15 and \$15 to \$40 and \$20. In relative terms however, defense spending has gained at the expense of welfare spending. Where both categories had 15% of the total budget in year 1, military spending (respectively welfare

¹⁰ <http://www.correlatesofwar.org/>

spending) in year 2 represents 20% (respectively 10%) of the total government budget. We therefore choose to work with the ratio measure (Harris et al 1988; Looney 1986; Peroff-Podolak-Warren 1979; Verner 1983) because we are convinced that expressing the spending levels as a proportion of total CGE is most appropriate if we want to test for the existence of a budgetary trade-off.

5.2 Explanatory Variables: Theoretical Motivation

We argued earlier that a careful consideration of the explanatory variables is crucial to arrive at accurate estimations of the budgetary trade-off between defense and human capital spending. In what follows, we justify our choice of explanatory variables based on previous research.

Intuitively, the level of development of a country will influence the decisions and actions it takes. Because the level of development determines a country's resources, it is expected that differences in national wealth will also affect the degree of trade-off between defense and human capital spending. We reproduce here the argument by Dabelko and McCormick (1977). Given that a lower level of development implies less resources to spend, a less developed country is expected to have a higher opportunity cost of defense spending. While a more developed country can allocate more resources to defense without substantially impacting the education and health spending, this is not the case for less developed countries. Another advantage the more developed countries have, is a higher number of budgetary areas, meaning that an increase in defense spending will have a more limited impact on another single area, such as education or health (Dabelko and McCormick 1977). Russett (1982) includes three measures to control for economic conditions: the GNP growth rate in constant dollars, an index of economic productivity, and an index of capacity utilization. High economic or productivity growth is expected to limit the negative impact of military spending on social spending, while an economy operating close to its maximum capacity would reinforce the negative trade-off. We decide to use the constant GDP per capita measure for the level of economic development and use the level of unemployment to measure the level of economic activity. According to Russett (1982), an economy producing close to full utilization, or with a low unemployment will have a negative impact on the trade-off.

We have earlier mentioned the use of a measure of regime type when we discussed the paper by Dabelko and McCormick (1977). The authors see two problems when including regime type in the model. First of all, an appropriate measure has to be found. One common measure of regime type is the Polity2 score from the Polity IV Project, measuring the degree of authoritarianism/democracy with a scale ranging from minus ten to plus ten with minus 10 being most authoritarian. However, the division by Gregg and Banks (1975) into personalist, centrist, and polyarchic regimes might be a more appropriate measure. After all, the theory suggests that the highest opportunity costs of military spending will be found in

personalist regimes, followed by those in centrist and polyarchic regimes. At least the hypothesis of personalist regimes facing the highest opportunity costs is confirmed by the data used in Dabelko and McCormick (1977). The problem with the Polity2 measure is that a Polity2 score of for example minus five indicates that the country is authoritarian, and thus not polyarchic, but the distinction between a personalist and centrist regime cannot be made using this measure. In Hadenius and Teorell (2006) however, a regime classification by country and by year is made. However, the within-country variation over time is very limited and therefore not appropriate to include in our fixed effects model. Moreover, the expected higher opportunity costs for personalist regimes, typically governed by an individual or a small group being close to the military, is probably something we should not be concerned about given that none of the countries in our panel are classified as a military regime (one-party, no-party, traditional, and multiparty). Russett (1982), in his time-series analysis for the U.S. included a dummy for a Republican president and hypothesized a negative sign for its coefficient. The findings however indicate that the party of the president does not play a significant role. Lebovic (2001) finds a significant positive impact of the level of democracy on the size of nonmilitary spending relative military spending. We therefore expect that a higher level of democracy has a positive impact on both education and health spending, and thus on human capital spending in general. Because more democratic regimes will be held accountable for their actions by the public, which is generally in favor of welfare spending (Lebovic 2001), it is expected that a higher degree of democracy tempers the negative trade-off between warfare and welfare spending.

We will also include natural resource wealth, as this has been suggested to influence the budgetary trade-off relation (Lebovic and Ishaq 1987; Looney 1983). We selected the natural resource rents per capita to account for a country's resource wealth. The rents represent the net revenue of the natural resources after production.

Russett (1982) hypothesizes the trade-offs to be different depending on the (intern)national political circumstances. The author therefore introduces a measure to control for the intensity of conflict during wartime. The measure used is the number of battle deaths among U.S. military personnel. Peroff and Podolak-Warren (1979) test the impact of wartime by introducing an interaction term for war years and defense expenditures. Years in which wars occur are expected to increase the negative impact of defense spending on health spending, and we hypothesize a similar impact on education. Although we acknowledge the importance of a factor such as war intensity for the budgetary trade-off relation, we cannot account for it in our study due to the limited number of conflicts in our sample in the period 1990-2009.

In most of the studies only supply pressures on education and health spending have been included. However, also demand pressures are important for human capital spending. When using education spending as the dependent variable, the total population under age 18 and total school enrollment can be

used to measure the size of the population to be educated. When using health expenditures as the dependent variable, the total population over 65 can be included given that they experience the greatest need for health care. For the education and health spending equations we include respectively health and education spending as an explanatory variable. Caputo (1975) provides support for a simultaneous movement of both human capital spending categories.

We can now formally write down the three equations we want to estimate:

1. $\text{Human_Capital/CGE} = a - b_1\text{Defense/CGE} + b_2\log(\text{GDP}_{pc}) + b_3\text{Resources}_{pc} + b_4\text{Polity2} + b_5\text{CGE/GDP} + b_6\text{Total_Enrollment} + b_7\%\text{Population}>65 - b_8\text{Unemployment} + e$
2. $\text{Education/CGE} = a - b_1\text{Defense/CGE} + b_2\text{Health/CGE} + b_3\log(\text{GDP}_{pc}) + b_4\text{Resources}_{pc} + b_5\text{Polity2} + b_6\text{CGE/GDP} + b_7\text{Total_Enrollment} - b_8\text{Unemployment} + e$
3. $\text{Health/CGE} = a - b_1\text{Defense/CGE} + b_2\text{Education/CGE} + b_3\log(\text{GDP}_{pc}) + b_4\text{Resources}_{pc} + b_5\text{Polity2} + b_6\text{CGE/GDP} + b_7\%\text{population}>65 - b_8\text{Unemployment} + e$

The signs of the coefficients indicate the expected relation. The most important coefficient for our case is b_1 which is expected to be negative, representing a negative trade-off between defense and both human capital, education, and health.

5.3 Description of Data and Data sources

All the data on public expenditures is collected from different issues of the International Monetary Fund (IMF) Government Finance Statistics Yearbook (GFSY). These data are for government expenditures on defense, health, and education. All public expenditures in the GFSY are expressed in local currencies. We also collect the total outlays in order to calculate our preferred ratio measures. The total central government expenditures (CGE) as a share of GDP are also used as a control in all three equations. The GDP measure to calculate the CGE/GDP ratio is from the World Bank and represents constant GDP in local currency. The GDP per capita measure is the real GDP per capita in constant 2000 US\$ from the World Bank. As a measure of natural resource wealth we use natural resource rents per capita from The

Wealth of Nations dataset of the World Bank¹¹. The natural resource rents are all expressed in USD. To capture total resource wealth we summed the rents per country for all natural resources present¹². Data for unemployment (as a share of the total labor force), and the share of the population older than 65 are from the World Bank. The gross enrollment ratio (GER), defined as “*the total enrollment within a country in a specific level of education, regardless of age, expressed as a percentage of the population in the official age group corresponding to this level of education*”, is from the UNESCO Institute of Statistics. To indicate the level of democracy/autocracy we use the Polity2 variable from the PolityIV dataset¹³. The Polity2 variable measures the political regime on a scale from minus ten (institutionalized autocracy) to plus ten (institutionalized democracy). The measure is based on the competitiveness of political participation, the openness and competitiveness of executive recruitment and constraints on the chief executive.

5.4 Methodology

The methodology we will employ to estimate our models is the least squares dummy variable (LSDV) regression model. The one-way fixed effects model assumes the existence of systematic differences across countries that are captured by country-specific constant terms (Yildirim and Sezgin 2005). The LSDV model is one specification of the fixed effects models, next to the within-groups and the first differences fixed effects. While in the two alternative models, the model is manipulated in such a way that the unobserved effect is eliminated, the unobserved effect is explicitly brought into the model by applying LSDV (Dougherty 2011, chapter 14).

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} + \dots + \beta_k X_{k,it} + \gamma_2 C_2 + \dots + \gamma_n C_n + \mu_{it}$$

Y_{it} is the dependent variable (human capital, education, and health spending as a share of CGE) with $i = 1, \dots, n$ representing the countries in our analysis and $t = 1, \dots, T$ the year. T and n in our analysis equal respectively twenty and eight. $X_{j,it}$ represents the independent variables with coefficients β_j . C_i is a binary dummy for the countries taking value 0 or 1 with γ_i being the coefficients and μ_{it} is the error term. By employing the LSDV model, we can estimate the pure effect of the explanatory variables, because we are controlling for any unobserved heterogeneity. Each country dummy will absorb the effects of any time-

¹¹ The Wealth of Nations provides gross natural resource rents. We used population data from the World Bank to calculate the resource rents per capita for each country

¹² The natural resources considered include wood, oil, natural gas, coal, bauxite, copper, lead, nickel, phosphate, tin, zinc, gold, silver, and iron ore

¹³ <http://www.systemicpeace.org/polity/polity4.htm>

invariant country-specific factors for that particular country. By this, the coefficients of the fixed effects model will not be biased due to omitted time-invariant factors. The number of dummies included in the model equals $n-1$ to avoid the problem of serial correlation. Next to the ability of panel data to deal with bias caused by unobserved heterogeneity, panel data also allows us to reveal dynamics that would otherwise be hard to detect with cross-sectional data. A third advantage of panel data is the large number of observations (Dougherty 2011), although our n is limited to eight countries, we still have a considerable number of observations due to the relatively long time period ($T = 20$). In a balanced panel there are $n \cdot T$ observations consisting of time series of length T on n parallel units.

A few disadvantages appear when using the LSDV model. One drawback of a fixed effects model is that observed characteristics remaining constant for each individual have to be dropped from the model. The use of a random effects model would not be appropriate in our case given that the precondition for the observations to be drawn randomly from a given population is violated. When the entities in a panel data set are countries and those countries constitute a certain predefined group, as is the case for the countries of the MENA region, those countries cannot be said to represent a random sample of the 200-odd sovereign states in the world (Dougherty 2011). A second precondition is that the unobserved effect, measured by the coefficients on the $n-1$ dummy variables, is distributed independently of the X_j variables. The Durbin-Wu-Hausman test takes this precondition as the null hypothesis. If the null hypothesis cannot be rejected, both the fixed and random effects estimations are consistent and will generate similar results but the LSDV fixed effects model will be inefficient because an unnecessary set of dummy coefficients is estimated. If on the other hand the null hypothesis can be rejected, the random effects estimates are subject to unobserved heterogeneity bias and the preferred model is the fixed effects model.

6. Results

6.1 Correlation analysis

We start the empirical analysis with a simple correlation analysis between the different government spending categories (Table 4). All categories are expressed as a share of total central government expenditures. The correlation analysis only serves to get a first idea of the relation between our variables of interest.

Table 4: Correlation coefficients, all countries (1990-2009)

Variable	Defense	Human Capital	Education	Health
Defense	1			
Human Capital	-0,2**	1		
Education	-0,34***	0,92***	1	
Health	0,14	0,7***	0,37***	1

The signs of the correlations are partly consistent with our hypotheses of a negative trade-off between defense spending and social welfare spending. A negative correlation coefficient exists between military spending and human capital and education spending but a positive, though insignificant, correlation coefficient appears for spending on defense and health. Strong positive correlations exist between all social welfare spending categories (human capital, education, and health). Next, we take a look at the correlation coefficients at the individual country-level, which is feasible because of the limited number of countries in our sample (Table 5). For each cell, the number of observations are given. The country-level correlation coefficients provide suggestive evidence that there is a negative trade-off between military spending and human capital spending, if any. For education spending, no pattern can be derived from looking at the country-level correlations while there is some evidence of a negative relation between defense and health spending. Again, looking at the correlation coefficients only serves as a preliminary analysis to get an idea of the relation between the variables of interest.

Table 5: Correlation Coefficients, individual countries (1990-2009)

Variable	Military expenditures			
	Positive	Negative	Non-Significant	Total
Human Capital	0	3	5	8
Education	1	1	6	8
Health	1	3	4	8

6.2 Fixed Effects LSDV Models

We now come to the most important part of the analysis, which is the estimation of the three equations using the fixed effects LSDV model.

6.2.1 Human Capital

We first analyze the impact of defense spending on total human capital spending, by applying the LSDV methodology to the initial human capital spending model:

$$\text{Human_Capital/CGE}_{it} = \beta_0 - \beta_1 \text{Defense/CGE}_{it} + \beta_2 \log(\text{GDP}_{pc})_{it} + \beta_3 \text{Resources}_{pc,it} + \beta_4 \text{Polity2}_{it} + \beta_5 \text{CGE/GDP}_{it} + \beta_6 \text{Total_Enrollment}_{it} + \beta_7 \text{Population} > 65_{it} + \beta_8 \text{Unemployment}_{it} + \gamma_2 C_2 + \dots + \gamma_8 C_8 + \mu_{it}$$

Our initial model explains a relatively high share of the variation in human capital spending ($R^2 = 80\%$) and the F-test for joint significance is significant at the 1% level rejecting the null hypothesis that all coefficients are equal to zero. The coefficient we are most interested in, β_1 , enters significant at the 5% level. The negative sign confirms our hypothesis of a negative trade-off between military spending and spending on human capital. Both Polity2 and total enrollment (respectively the proxies for level of democracy and the level of demand for education) have a significant effect at the 5% level on human capital spending. The negative coefficient for Polity2 however implies that more democratic regimes spend less on human capital as a share of total central government spending, a counterintuitive finding for which no clear explanation can be given. A higher enrollment ratio on the other hand results, as expected, in a higher spending on human capital. Although included by Russett (1982) in both the education and health spending model, the coefficient for unemployment enters strongly insignificant in our original

model. Moreover, also the interaction term for military spending and unemployment, as a proxy of capacity utilization, is insignificant. An additional reason for leaving out unemployment is that it might cause a multicollinearity problem. We calculate the variance inflation factor (VIF) (suggested by O'Brien 2007 among others) to test for this multicollinearity problem. We regress unemployment on the other explanatory variables and find an R^2 of 86,7%. A tolerance of 0,13 or a VIF of 7,5 indicates a multicollinearity problem so we decide to leave unemployment out of the model. Although the R^2 -value drops in the model without employment, it still explains a large share of the variation in human capital spending. Again, our coefficient for military expenditures is significant at the 5% level and has the expected negative sign. The findings for Polity2 and enrollment from the original model are confirmed. One important difference compared to our original model is that natural resource wealth, measured by resource rents per capita, enters significant. The negative sign implies that the more resources a country has, the lower its spending on human capital as a share of total government spending. Also the share of CGE in total GDP has a negative impact on human capital spending although the magnitude is weak.

Next, we extend our model¹⁴ by including a number of interaction terms. We believe that the level of economic development, the political regime, and resource wealth should be included in the model as done in earlier literature but we argue that testing for their impact on the warfare-welfare trade-off should be done by including interaction terms. We first include an interaction term for level of military spending and level of GDP per capita to see if a more negative trade-off appears for higher levels of economic development. Dabelko and McCormick (1977) hypothesize that a higher level of economic development will have a strengthening effect on the negative trade-off between military spending and spending on health and education. The interaction term however is highly insignificant casting doubt on the hypothesis of lower opportunity costs of defense spending when a country reaches a higher level of economic development. We decide to leave out the interaction term and include another interaction term for military expenditures and the Polity2 variable. The interaction term for Polity2 is highly insignificant suggesting that the level of democracy of a country does not impact the magnitude of the defense-human capital trade-off. The final interaction term we want to include is for resource wealth. The interaction term is significant at the 1% level and negative suggesting that increasing military expenditures constitute a higher burden for human capital spending in resource-rich countries. The final and improved model is shown in Table 6. The explanatory variables explain 74,9% of the variation in human capital spending and the F-test for joint significance is highly significant. The main coefficient of interest, β_1 , is significant at the 5% level and has a negative sign. Holding all other independent variables constant, an increase of 1 percentage point in the share of defense spending, leads to a decrease of 0,3 percentage points in human capital spending as a share of CGE. Furthermore, a 100 US\$-increase in resource rents per capita leads to

¹⁴ This is the model without unemployment

an increase in the share of human capital spending of 0,9 percentage points. The interaction term of defense spending and resources rents per capita however is negative. This means that for every proportional increase in defense spending, an increase in resource rents makes the negative trade-off between defense and human capital spending more negative. The magnitude of the interaction term however is negligibly small. The share of CGE in GDP and the gross enrollment ratio (GER) are both significant. A one percentage point increase in the CGE/GDP ratio leads to a decline of 0,21 percentage points in human capital spending while a one percentage point higher GER corresponds to a 0,46 percentage point higher spending on human capital. GDP per capita, the Polity2 score and the share of the population over 65 have no significant impact on human capital spending.

Next to the dummy least squares model we estimate the human capital model with the random effects methodology. In order to decide on which of the two models we should rely, we apply the Hausman test. The null hypothesis of the Hausman test is that the difference in the coefficients between the two models is not systematic. In other words, that the random and fixed effects model yield similar coefficients. The Hausman test indicates that the random effects estimators are inconsistent. The fixed effects model will therefore be our preferred model.

6.2.2 Education

Next, we estimate the initial model for education expenditures with the LSDV methodology:

$$\text{Education/CGE}_{it} = \beta_0 - \beta_1 \text{Defense/CGE}_{it} + \beta_2 \text{Health/CGE}_{it} + \beta_3 \log(\text{GDP}_{pc})_{it} + \beta_4 \text{Resources}_{pc,it} + \beta_5 \text{Polity2}_{it} \\ + \beta_6 \text{CGE/GDP}_{it} + \beta_7 \text{Total_Enrollment}_{it} + \beta_8 \text{Unemployment}_{it} + \gamma_2 C_2 + \dots + \gamma_8 C_8 + \mu_{it}$$

The initial model has a good fit with an R^2 of 85,7%. The coefficient on military expenditures is negative and significant at the 5% level, suggesting that there is a negative trade-off between defense and education spending for our panel of MENA countries. Also resource rents per capita, Polity2, and central government expenditures as a share of GDP have a significant impact and they all have a negative effect on education spending as a share of total government spending. We first test for the interaction effect between military expenditures and GDP per capita. The interaction term is positive and significant at the 1% level indicating lower opportunity costs of military spending for education spending in countries with an increasing GDP per capita. The coefficient on military expenditures now is significant at the 1% level and indicates a strong negative trade-off with education spending. Unemployment has a strong positive impact on the share of educational spending. Next we add an interaction term for military spending and resource wealth to the previous model. Including an interaction term further improves the model, with an

R²-value as high as 91,4%. The interaction term is significant at the 5% level and negative although the magnitude is again very low. The coefficient on military spending is negative and significant at the 1% level indicating that a one percentage point increase in military spending leads to a decrease of 1,04 percentage point in education spending. In our final model, the positive relation between health and education spending is confirmed. Both Polity2 and the share of CGE in GDP have a significantly negative impact on education spending while unemployment and the level of economic development, measured by GDP, have a positive impact. The final model for education spending is given in Table 6. The fixed effects estimation is again the preferred methodology given that the Hausman test rejects the null hypothesis that the random effects model is consistent.

6.2.3 Health

Finally, the model for health expenditures is estimated:

$$\text{Health/CGE}_{it} = \beta_0 - \beta_1 \text{Defense/CGE}_{it} + \beta_2 \text{Education/CGE}_{it} + \beta_3 \log(\text{GDP}_{pc})_{it} + \beta_4 \text{Resources}_{pc,it} + \beta_5 \text{Polity2}_{it} \\ + \beta_6 \text{CGE/GDP}_{it} + \beta_7 \text{Population}>65_{it} + \beta_8 \text{Unemployment}_{it} + \gamma_2 C_2 + \dots + \gamma_8 C_8 + \mu_{it}$$

The initial fixed effects model with all theoretically relevant variables included explains ‘only’ 67,2% of the variation in health expenditures. Moreover, only education expenditures and the share of the population over age 65 enter significant and with the expected positive sign. Both higher education spending and a larger share of elderly people have therefore a positive impact on health spending as a share of total government spending. When we extend our initial model however with the interaction terms for resource wealth and level of democracy, a negative trade-off between military expenditures and health expenditures is identified, although the trade-off is relatively weak (-0,16) and only significant at the 10% level. Next to the positive and significant coefficients for education spending and the share of the population over age 65, resource wealth and level of democracy have a significant effect on health spending (respectively negative and positive). The interaction terms indicate that the negative trade-off is more costly in more democratic regimes and less costly in resource-rich regimes. The explanatory variables explain together 76,8% of the variation in health spending, a significant improvement compared to the initial model. The final model, estimated with the fixed effects model is given in Table 6. The Hausman test clearly indicates that the fixed effects model is the preferred model and that the random effects model is inconsistent.

Table 6: Fixed Effects LSDV Model

Independent Variable	Dependent Variable		
	Human Capital/CGE	Education/CGE	Health/CGE
Milex/CGE	-0,30**	-1,04***	-0,16*
Education/CGE			0,31***
Health/CGE		0,42**	
Log(GDPpc)	8,37	9,82*	-3,70
Milex*GDPpc		0,00004 ***	
Resource Rents per capita	0,009***	0,0056**	-0,002*
Milex*Resource Rents per capita	-0,000000397***	-0,00000026**	0,000000081*
Polity2	-0,09	-0,91***	0,58***
Milex*Polity2			-0,048***
CGE/GDP	-0,21***	-0,15***	0,027
Gross Enrollment Ratio	0,46***	0,02	
Unemployment		1,07***	-0,12
Population over 65	-1,61		2,34**
R-squared (%)	74,9	91,4	76,8

Levels of significance are indicated by 1, 2, and 3 asterisks for 10%, 5%, and 1%, respectively

7. Discussion

Using the fixed effects least squares dummy variable model, our hypotheses of a negative impact of defense spending on human capital spending are confirmed for our panel of eight MENA countries in the post-Cold War period. At the aggregate level, an increase of one percentage point in defense spending as a share of CGE decreases the combined spending on health and education as a share of CGE by 0,30 percentage points. Our analysis at the disaggregate level reveals an interesting result, as increased defense spending puts a much higher burden on education spending than it does on health spending. It is not immediately clear what the reason for this is although the higher opportunity costs of defense spending for education relative to health is also found in Dabelko and McCormick (1977). While a one percentage point increase in defense spending as a share of CGE decreases educational spending a share of CGE by 1,04 percentage points, it decreases the proportional public health spending only by 0,16 percentage points. The finding of a negative trade-off between warfare and welfare spending implies that governments in the MENA region, in times of increased defense spending, cut back on investments in health and education. This could be especially detrimental to the development prospects of the countries in the Middle East and North Africa, given the already high military burdens and the relatively low levels of human development. We should however be careful not to generalize our conclusions to all the countries in the MENA region, given the limited number of countries in our dataset. We call for more studies including additional countries from the MENA region in the analysis. Limited data availability on government spending however remains a issue. In any case, if military spending is indeed crowding out investments in human capital, as our results suggest, then the debate should be about how to decrease military spending in the MENA region. Yildirim and Sezgin (2005) for example find for a panel of 92 countries that a higher degree of democracy is associated with lower levels of military spending. An evolution towards more democracy in the region could therefore contribute to lower military spending and a reduced negative impact on human capital spending. That this transition process will not necessarily be smooth and peaceful has been demonstrated by the recent social unrest in several countries in the MENA region (Egypt, Tunisia, Syria).

The positive trade-off between public spending on health and education is confirmed in our analysis and works in both directions, with increased health spending leading to increased spending on education and vice versa. The finding of a positive relation between education and health spending is consistent with the results in Hirnissa et al (2009). Contrary to what we would expect is the effect of the level of economic development on social spending not unambiguous. No significant impact is found in the human capital and health equations, while the impact on education spending is positive but only significant at the 10% level. The level of economic development however, does influence the strength of the trade-off relation

between defense and education spending. The interaction coefficient of 0,00004 implies that at a GDP per capita level of 10.000 US\$, a one percentage point increase in defense spending leads to a 0,4 percentage point increase in education spending on top of the negative direct impact of military spending. The positive interaction term has an important implication, i.e. at a GDP per capita level of 26.000 US\$, the direct negative impact of defense spending on education spending is neutralized, everything else constant. Countries such as Bahrain, Israel, and Kuwait already show such levels of GDP per capita. This result therefore provides support for the role that income growth can play in tempering the negative budgetary trade-offs between military spending and spending on education.

The evidence on the role of resource wealth is mixed. At the aggregate level, increased resource rents indeed lead to higher human capital spending. While education spending seems to benefit from increases in resource wealth, health spending will be reduced under these circumstances, although the impact is only significant at the 10% level and limited in magnitude. The positive impact of resource rents on education expenditures is confirmed in Stijns (2001). The author finds for the period 1970-1999 for a panel of 102 countries that a 1\$-increase in resource rents generates an additional yearly spending on education of five cents. It has been argued in the literature (Russett 1982) that increases in tax revenue should reduce the pressures for a budgetary trade-off as more resources become available. We argue here that increased resource wealth can have a similar impact, which can even be more positive as no extra tax-burden has to be put on the population. We only find weak evidence for this hypothesis however. Although the interaction term for military expenditures and resource wealth enters significant in all three equations, the signs are not consistent across them and the magnitude of the effect is negligible. It is not immediately clear to us why increased resource wealth shows such a low impact on the budgetary trade-off, although there remains a difference between having the financial means, through natural resources, to invest in human capital and the political willingness to do so. One possibility is that the effect of resource wealth is partially captured by the GDP per capita measure which includes income from natural resources. Non-resource GDP data could help to gain additional insight in the separate roles of GDP per capita and level of resource rents per capita (Stijns 2001). The introduction in the analysis of other important oil producers from the MENA region such as Saudi-Arabia, the United Arab Emirates, Iraq, Libya, and Algeria¹⁵ could provide additional insights.

Also regarding the level of democracy we do not find consistent evidence across the three equations. According to Lebovic (2001) does the level of democracy positively impact the share of non-military relative to military budget. Tavares and Wacziarg (2001) study the relation between democracy and

¹⁵ Important oil producing countries in the MENA region according to the CIA World Factbook. All countries belong to the top 20 of oil producing countries in the world (according to the daily extracted amount of crude oil and natural gas)

economic growth and identify improved human capital accumulation as one of the channels positively affecting growth. While in our data there is indeed a positive impact of the level of democracy on health expenditures, the effect on education spending is negative. If we extend the logic in Lebovic (2001), more democratic regimes have a higher responsibility to bear towards the public, which holds them responsible for their actions through elections. If we assume that the public prefers welfare over warfare, a more democratic regime will feel more pressure not to let defense spending crowd out spending on human capital. Testing for this with an interaction term for military spending and level of democracy does not confirm this hypothesis however. On the contrary, a negative interaction term in the health equation suggests that more democratic regimes will enforce the weak negative trade-off between defense and health spending.

8. Conclusion

The aim of this study has been to analyze the relation between defense spending and human capital spending in the MENA region for the post-Cold War period (1990-2009). The guns versus butter hypothesis states that defense spending is crowding out investment in more productive activities, such as health and education. Making use of the fixed effects least square dummy variable methodology and extending on one of the most complete models in the literature, this negative trade-off is indeed confirmed in our data. At the aggregate level leads an increase of one percentage point in defense spending as a share of central government expenditures to a decrease in the combined spending on health and education as a share of central government expenditures by 0,30 percentage points. The results at the disaggregate level reveal an interesting insight: while a one percentage point increase in defense spending as a share of central government expenditures decreases education spending a share of central government expenditures by 1,04 percentage points, it decreases the proportional public health spending only by 0,16 percentage points. Increased defense spending thus puts a higher burden on education spending than it does on health spending. It might be interesting to further investigate the reasons behind this finding. Given that the MENA region is characterized by high levels of militarization and rather low levels of human capital, the finding of a negative budgetary trade-off might imply a detrimental impact of increases in defense spending on human capital development in the region.

We improved on previous studies by including interaction terms in our model. We find no convincing evidence however that resource wealth or the level of democracy are significantly tempering the negative warfare-welfare trade-off. Level of economic development, measured by GDP per capita, on the other hand reduces the negative impact of defense spending on education spending. One clear limitation of our study is the limited number of countries we could include for the MENA region due to data availability. Future research could extent on our study when government spending data becomes available for other MENA countries, in the first place those countries with significant defense spending such as the United Arab Emirates and Saudi-Arabia. Because of the small sample size, our results should be interpreted cautiously and might not be generalizable for the whole MENA region. We believe however to we have taken a first step in coming closer to a more definite answer regarding the warfare-welfare relation in the MENA region.

By studying the budgetary trade-off between defense and human capital spending for the MENA region, we have filled a gap in the literature investigating the economic consequences of defense spending. To date, there do not exist other studies explicitly modeling the budgetary trade-off between warfare and welfare for the MENA region. This is rather surprising given the high military burdens in the region. Data issues concerning government spending for the MENA region however have led many studies to focus on

the direct link between defense spending and economic growth. Our finding of a negative trade-off will hopefully encourage further research on the topic, thereby coming closer to a more conclusive answer to the questions posed in this article. The discussion regarding the economic and societal consequences of defense spending are today more pertinent than ever given the recent social unrest in several highly militarized Arab countries such as Egypt, Syria, and Tunisia.

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