



WINTER IS COMING: CONTROLLED CONFLICTS AND THE OIL-PRICE GEOPOLITICAL-RISK PREMIUM

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“Winter is Coming: Controlled Conflicts and the Oil-Price Geopolitical-Risk Premium”

Abstract

This paper presents a simple dynamic growth model of investment, consumption, passive military spending, and active military spending for an oil-exporting country. Passive military spending (arms buildup) adds to security, while active military spending (conflict) depletes it, but adds to output and hence civilian capital (as a proxy for geopolitical risk premium in oil prices) in a non-monotonic way (some geopolitical risk is good for an oil exporter, but too much risk is not). It is shown that when the risk premium is sufficiently small, the optimal policy function does not support any positive active military spending at any level of civilian capital and security. However, with a sufficiently high geopolitical risk premium, the model country engages in controlled conflict (positive active military spending) when civilian capital is low. A controlled conflict in the latter case can shift the production function up, allowing the country to boost its consumption and arms buildup. This explains the big increase in the geopolitical risk premium following the Arab Spring, which included, among other disruptions, a military intervention by Saudi Arabia in Bahrain, as well as the smaller geopolitical risk premium following the recent Saudi-led war against the Houthis in Yemen. If oil prices remain low, depleting the civilian capital of Saudi Arabia and other oil exporters, it may be rational, according to our model, to expect greater military activity, both to deal with geopolitical risks in the region, and to boost oil prices through the geopolitical risk premium.

Introduction

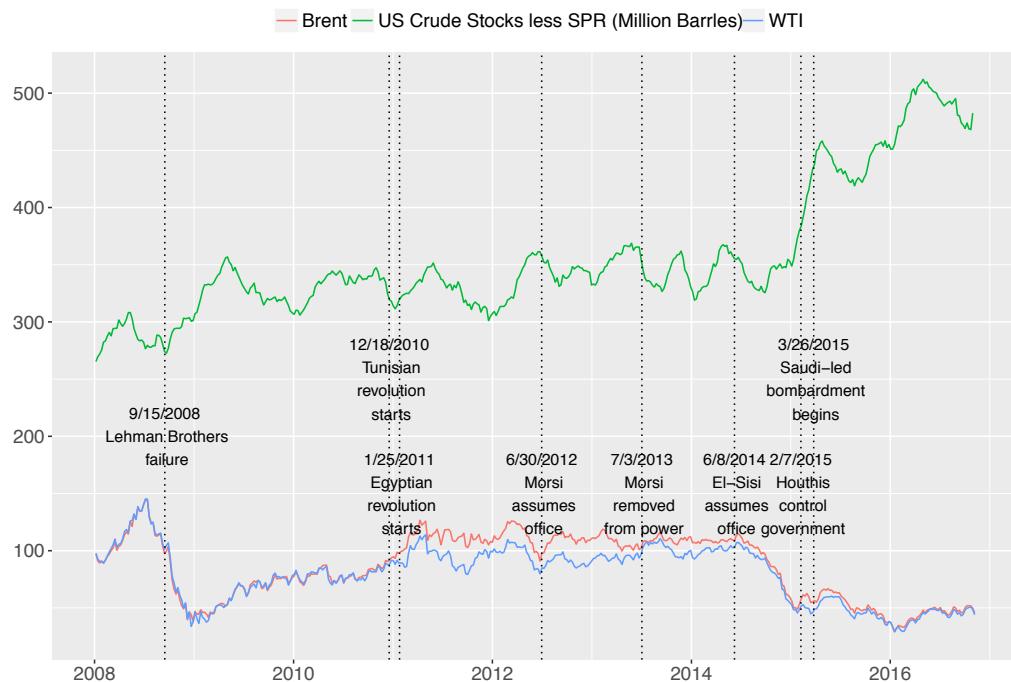
Following the Great Recession, crude prices plunged well below \$50 per barrel, and then recovered partially to near \$80, until the Arab Spring started near the beginning of 2011. The latter amplified risks of disruption in Middle East oil supply, especially as demonstrations spread to the Eastern Province of Saudi Arabia and Bahrain, requiring military intervention. Figure 1 shows that Brent prices led the increase in prices of both Brent and WTI above \$100 per barrel, and the Brent-WTI spread continued, while high crude prices persisted despite mounting inventories, as measured by U.S. crude oil stocks, excluding the Strategic Petroleum Reserve—which serves as a traditional measure of trends in global oil storage due to poor data on storage outside of the United States, c.f. Kilian and Murphy (2014).

El-Gamal and Jaffe (2018) argued that these oil prices near \$100 per barrel represented a market compromise between a much higher predicted price—in the case of an actual supply disruption due to regime change or other Arab Spring-related causes—on the one hand, and a much lower price that would clear the market on the other. The excess liquidity in financial markets helped to fuel this geopolitical risk premium in oil prices, represented both by higher prices and a positive Brent-WTI premium, and supported by the story of the Arab Spring. Figure 2 illustrates the Brent-WTI premium, which was mostly driven up by the Brent price (the latter has a correlation of 0.6 with the premium, whereas WTI has a correlation of 0.3).

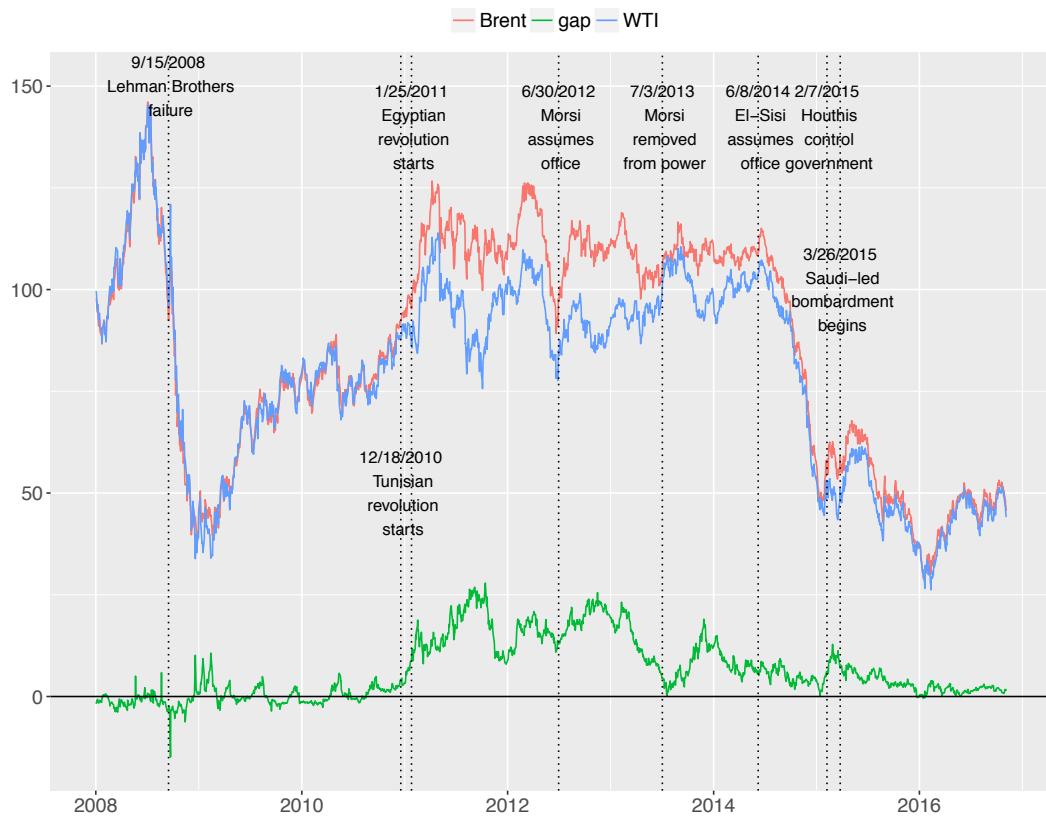
However, El-Gamal and Jaffe's analysis (2013) showed that regime change does not lead to significant reduction in oil output. Even extreme cases, such as in Hugo Chavez's Venezuela, lead to reductions in new investment and slower production growth, but not to outright disruption. Thus, the prediction that "if the outright war scenario is excluded, we expect prices to fall precipitously in the medium term (3-5 years)." In the event, once the new Egyptian President Abdel-Fattah El-Sisi was sworn into office in 2014, ushering the official end of the Arab Spring, the market glut, primarily caused by global economic deceleration and shale production, drove prices down to \$50 per barrel, reflecting the reduced geopolitical risk.

In March 2015, shortly after the death of Saudi King Abdullah, the decline in oil prices was stemmed, and partially reversed, as Saudi Arabia led a war effort on neighboring Yemen to oust the Houthi forces that had led a successful coup to take power the previous month. The Houthi accession to power in February 2015, and then the beginning of the Saudi air bombardment campaign in March 2015, caused two smaller waves of increase in the geopolitical risk premium, wherein Brent prices led WTI upward past \$60 per barrel, and a positive Brent-WTI premium was restored, albeit partially. The market's reaction to the Yemen war was clearly muted relative to its reaction to the Arab Spring because the potential disruption of oil flow through the Strait of Bab El-Mandeb was a remote possibility, and not nearly as threatening as an escalation of violence in the Persian Gulf, near the Strait of Hormuz, when the Arab Spring had spread to Bahrain.

Figure 1. WTI and Brent Prices, and U.S. Crude Stocks, Excluding SPR



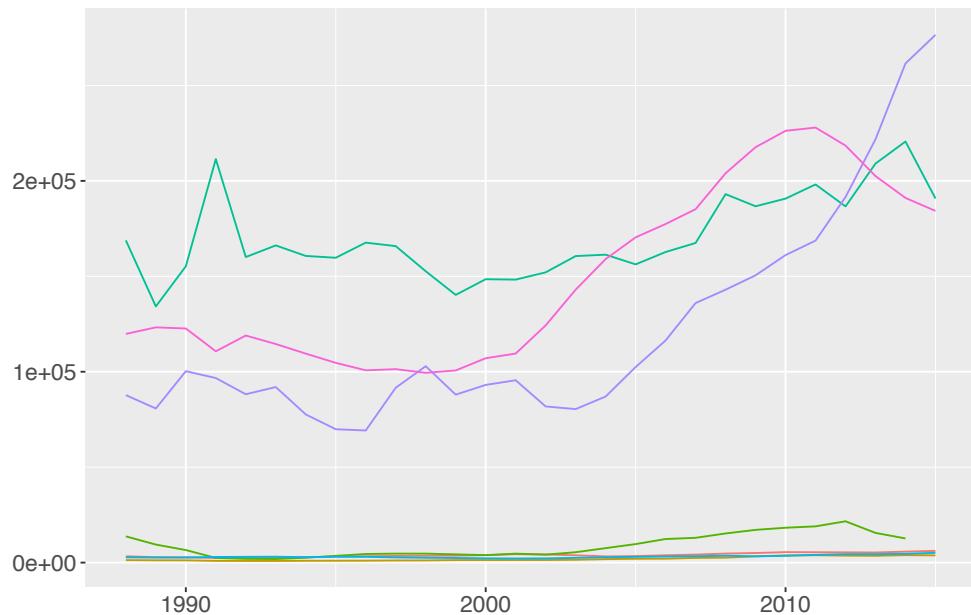
Source: Chicago Mercantile Exchange (CME), Intercontinental Exchange (ICE), and Energy Information Administration (EIA), via Quandl.com.

Figure 2. Brent-WTI Premium

Source: CME and ICE, via Quandl.com.

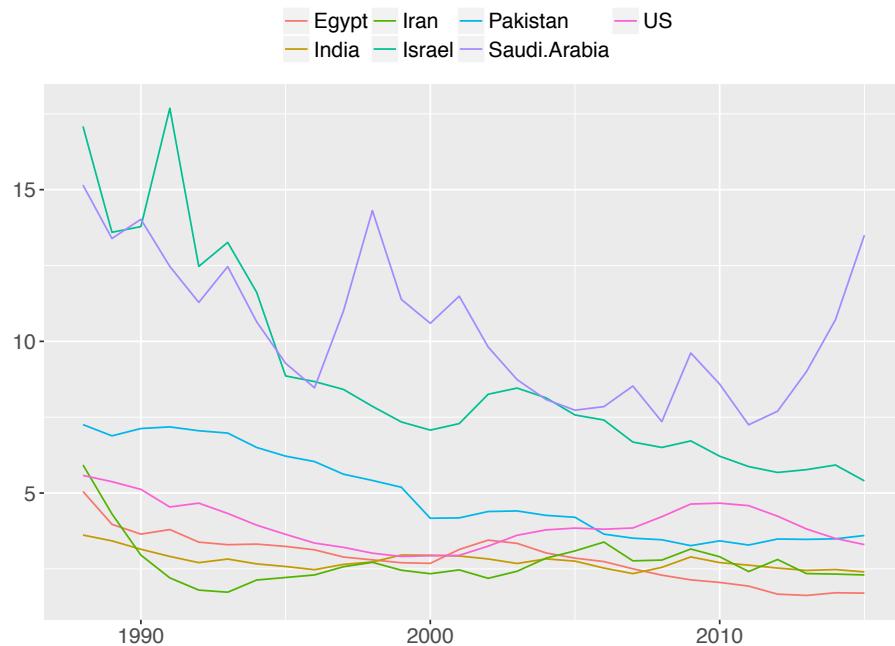
Recognizing this potential to increase precautionary demand for oil exports during a global slump, major oil producers must recognize that active military expenditures may be of value not only to secure their own sovereignty and resources, but also to increase their oil proceeds by boosting demand and preventing prices from falling further. This paper provides a formal model to explain why an oil exporting country would plan military activism during a global slump in order to boost its revenues. The same model will also help to explain another anomaly in the behavior of such an oil exporter: excessive spending to build its arsenal during periods of plentiful oil revenue. The data on this phenomenon is shown in Figures 3 and 4. Saudi Arabia's military expenditures per capita have been growing exponentially since the Iraq invasion in 2003, and in recent years have exceeded per capita military spending in the United States and Israel. In this regard, the model in this paper will distinguish between and simultaneously explain passive military spending (i.e., an arsenal buildup) that takes place during times of plentiful revenues, and active military spending, which takes place during times of low oil prices.

Figure 3. Military Spending per Capita in Current USD



Source: World Bank – World Development Indicators Database 2016.

Figure 4. Military Spending as a Percentage of GDP



Source: World Bank – World Development Indicators Database 2016.

Remarkably, Saudi military spending may resume its growth, from \$46 billion in 2015 to a projected \$57 billion in 2016, cementing the kingdom's status as "the third- or fourth-largest in terms of military spending in the world," as Deputy Crown Prince Mohammed bin Salman put it.¹ Other estimates of military spending in 2016 were lower than the aforementioned budgeted amount. IHS Markit estimates suggested Saudi military spending was only \$47.6 billion in 2015 and a projected \$45.9 billion in 2016,² which would place Saudi Arabia sixth in overall military spending after the United States, China, the United Kingdom, India, and Russia, though per capita military spending would still be extremely high.

Variations in estimates of actual levels of military spending in 2016 and beyond are mainly driven by estimates of realized oil prices and the resulting fiscal space for Saudi Arabia, Russia, and other countries running large fiscal deficits at current prices. It would be naive, however, to assume that oil exporters will treat oil prices as exogenous when deciding on the timing and scope of military expenditures, which include, among other things, the costs of military and quasi-military operations, as well as the acquisition or production of weaponry. Likewise, it would be naive for forecasters of oil prices to assume that prices will be determined exclusively by market fundamentals, including potential speculative behavior fueled by cheap credit, and to treat geopolitical altercations and military spending as exogenous.

However, to my knowledge, the two bodies of literature on "oil price shocks" and the demand for military expenditures have not been integrated by considering the endogeneity of military spending and operations in oil price determination and vice versa. This paper aims to fill this gap in the literature by developing a dynamic model of the demand driving an oil exporter's military spending that endogenizes the effect of military spending and operations on oil prices, solving the model numerically, and investigating the effect of endogenizing the oil price geopolitical premium on the military spending and economic growth of oil-exporting countries. This model helps to address the issue of "correlation vs. causation" that may arise when one forecasts the resumption of military activity at a higher rate following financial difficulties due to prolonged periods of low oil prices. Needless to say, the conclusion is not, cynically, that countries would manufacture wars to raise oil prices, but that the choice of timing and the extent of a conflict may certainly be influenced by the anticipated, geopolitically induced financial byproducts of such conflicts.

¹ Glen Carey and Zainab Fattah, "Saudi Arabia to Overhaul Military in Plan for Life After Oil," *Bloomberg*, April 26, 2016, accessed at <http://www.bloomberg.com/news/articles/2016-04-25/saudi-prince-seeks-to-bolster-military-industry-to-meet-demand> on May 1, 2016.

² Ivana Kottasova, "Oil crunch bites: Russia and Saudi Arabia cut defense budgets," *CNN Money*, March 31, 2016, accessed at <http://money.cnn.com/2016/03/31/news/saudi-arabia-russia-military-spending/>.

1. Model of Demand for Military Spending

The model presented here draws on two heretofore disparate literatures. The first is a large literature on “oil shocks,” mostly in terms of unexpected supply reduction or growth, c.f. Hamilton (1996, 2003), but that also deals with unexpected demand growth, c.f. Barsky and Kilian (2004). This literature has mainly treated these shocks as exogenous, and used impulse response functions in vector autoregression models with various specifications to study the results of such shocks. This literature started in the aftermath of Middle East geopolitical factors that coincided with OPEC’s increasing market power in the 1970s, but later studies uncovered asymmetries and other subtleties, both in terms of oil price responses to potential geopolitical and market factors, and in terms of real economic responses to oil price fluctuations, which often take the form of jumps, c.f. Askari and Krichene (2008).

A second large literature of interest is focused on demand for military spending, mostly at the country level, and its relation to economic growth; c.f. Deger and Sen (1995) and Smith (1980, 1989, 1995) for excellent surveys, and Abu-Bader and Abu-Qarn (2003), Al-Jarrah (2005), and Farzanegan (2011) for studies on Middle East countries. Underlying models of demand for military spending assume national utility functions that depend on consumption of real goods and services, the growth of which depends positively on investment in non-military capital, and the abstract good “security,” which depends positively on military spending (restricted to acquisition in an arms race framework). This literature also finds mixed empirical evidence of the effect of military spending on economic growth, with a possible synthesis based on stages of economic development; c.f. Landau (1998), who finds a quadratic relationship between military spending and growth, and Alptekin and Levine (2012) who perform a meta-analysis of the extant literature. Moreover, as Knight et al. (1996) have argued, the effects of allocating funds to military spending rather than education or other economic spending may only have noticeable effects in the very long run, undermining the value of empirical analysis with relatively short datasets.

This paper aims to link the two literatures by allowing for the endogeneity of geopolitical risk amplification factors. Recognizing that geopolitical risk can add a significant premium to oil prices, due to potential or actual supply disruptions, major oil exporters may benefit from the amplification of geopolitical risks, especially during periods of low and/or declining prices. This incentive is particularly important because, as the first body of literature has shown, dramatically rising prices can adversely affect global economic growth, but low and declining prices have a much more muted positive effect on growth. Hence, the negative economic effect of declining prices for an oil exporter is not mitigated by increasing demand, at least in the short to medium term. However, an increase in geopolitical risk can prompt countries to increase their precautionary demand for oil, even during periods of weak economic growth.

Starting with Brito (1972), the theoretical literature on the dynamics of military spending has been constructed in continuous time—e.g., see Gong and Zou (2003) and the references

therein for extending the model to investigate the effect of military spending on growth and vice versa. For our purposes in this paper, a discrete-time version of the model will be easier to solve numerically without much loss in intuition. The instantaneous utility function has been assumed to be dependent on the consumption and military expenditures of the country and other countries, the balance of which determines the country's level of security.

In this regard, Deger and Sen (1984) argued convincingly that less developed countries are unlikely to engage in military spending in order to boost domestic demand, but may limit strategic pinning of military spending to regional threats. Because of typical asymmetry in regional conflicts, they modeled the military burden as a military spending-to-GDP ratio instead of absolute levels of military spending. Deger and Sen (1984) develop their differential game approach by first studying an optimal control approach for a less developed country's problem, taking external threats as given, thus focusing on the allocation of national income between civilian consumption and military expenditure. To this, we add investment in a capital stock that can be used later for production of consumer or military goods:

$$\begin{aligned} Y_t &= F(K_t) = C_t + M_t + I_t, \\ K_{t+1} &= (1 - \gamma)K_t + I_t. \end{aligned}$$

Security is measured by the armaments stock S_t , which evolves according to the law of motion (adapted for discrete time in this paper, and complicated further below):

$$S_{t+1} = (1 - \delta)S_t + M_t,$$

where δ is the rate of depreciation of the country's stock of armaments. The country's utility in each period $u(C_t, S_t, \vartheta_t)$ depends on its civilian consumption C_t , security level S_t , and a threat variable ϑ_t , which is exogenous in Deger and Sen's (1984) framework (the latter also make utility a function of S_t/Y_t and C_t/Y_t , but for the purposes of this paper we regard it to be a function of the country's actual levels of consumption and arsenal). The main innovation in this paper is that the threat level ϑ_t may indeed have an immediate negative effect on utility $\partial u / \partial \vartheta < 0$, but may contribute to the growth rate of an oil exporter's national income, taken to be constant in Deger and Sen (1984), through increased oil prices.

We abstract from the game considerations of the arms-race literature but enrich the model in two dimensions. The first is to recognize that not all military spending increases security, as measured by S_t , and the second is to recognize that the threat level ϑ_t is endogenously dependent on military spending. Indeed, for example, Saudi Arabia's recent campaign in Yemen, or similar military expenditures in active operations, would reduce the home country's stock of armaments and increase its vulnerability to external threats. In other words, we can decompose M_t into passive military spending PM_t and active military spending AM_t , and model security as measured by the stock of armaments and the external threat as follows:

$$S_{t+1} = (1 - \delta)S_t + PM_t - AM_t,$$

and we can further model the level of regional threat as follows, with $G_\theta > 0$, $GAM > 0$:

$$\vartheta_{t+1} = G(\vartheta_t, AM_t).$$

We also model output Y_t as a concave function of ϑ_t , indicating that some threat of output disruption leads to higher oil prices and revenues, but excessively high threats lead to reduction in growth, either because of actual disruption in production or transportation of the country's oil or because importing countries seek other sources of oil during periods of heightened risk and price (e.g., North Sea oil in the aftermath of the Arab-Israeli War and Iranian revolution, and shale more recently), with $F_\vartheta(K, \vartheta) > 0$, $F_{\vartheta\vartheta}(K, \vartheta) < 0$:

$$Y_t = F(K_t, \vartheta_t).$$

2. Dynamic Programming and Numerical Solution

Thus, in our model, an oil-exporting country may choose to increase its active military spending, despite the resulting depreciation of its armaments stock S_t and increased risk ϑ_t , both of which negatively impact instantaneous utility, if the gains from higher output (through the geopolitical premium channel) outweighs those temporary losses. The infinite horizon problem faced by this country is

$$\max_{\{C_t, AM_t, PM_t\}} \sum_{t=0}^{\infty} \beta^t u(C_t, S_t, \theta_t)$$

subject to

$$F(K_t, \theta_t) = C_t + AM_t + PM_t + I_t,$$

$$K_{t+1} = (1 - \gamma)K_t + I_t,$$

$$S_{t+1} = (1 - \delta)S_t + PM_t - AM_t,$$

$$\vartheta_{t+1} = G(\vartheta_t, AM_t).$$

A more complete model for a major oil exporter would include a choice on how much oil to produce each period. However, adding this choice variable would only enrich the model if reducing production can effectively result in higher prices. This would have been a reasonable modeling assumption a decade ago. However, current market conditions are such that coordination among major producers is next to impossible, and a country would only lose market share by reducing production. Therefore, K_t is a proxy for production capacity, and the model assumes that oil producers will not voluntarily produce below

capacity to increase prices or prevent them from falling further. The main mechanism for increasing prices in this model, thus, is the geopolitical risk premium, which depends on ϑ_t . To solve this model numerically, we now turn to parametrizing the functions $u(\cdot)$, $F(\cdot)$, $\delta(\cdot)$, and $G(\cdot)$.

We begin with the production function F , which we assume to be a well-behaved, neo-classical production function of capital K , but to have greater concavity in ϑ , indicating that excessively high levels of geopolitical risk can result in the destruction of oil facilities or disruption of transportation. Contained proxy wars between Saudi Arabia and Iran in Yemen or Syria may thus correspond to mild levels of ϑ that may increase prices through increased precautionary demand, but an outright war, like the Iran-Iraq War of 1980–88, would have disastrous consequences for these countries. A simple separable production function of the following form captures most of the interesting features, where $0 < \alpha < 1$:

$$F(K_t, \vartheta_t) = AK_t^\alpha + M\vartheta_t(1 - \vartheta_t).$$

Thus, the geopolitical risk premium is maximal at $\vartheta = 0.5$, increasing in M for $0 < \vartheta < 1$. Clearly, as M increases, both the level and curvature of $F(K, \vartheta)$ as a function of ϑ increase. Thus, Figure 5 illustrates the production function with an extreme geopolitical premium (and curvature), with $M = 400$, while Figure 6 illustrates the baseline production function with minimal geopolitical premium, $M = 4$.³

Likewise, we can capture the important features of the country's utility function by making it separable by consumption C_t and the combination of armaments stock S_t and regional risk ϑ_t , where $0 < \kappa, \tau, \rho < 1$, and scaling factor $\psi > 0$

$$u(C_t, S_t, \theta) = C_t^\kappa + S_t^\tau - (\psi\theta)^\rho.$$

Finally, the law of motion for regional geopolitical risk can be parametrized as irreversibly increasing in active military spending:⁴

$$\vartheta_{t+1} = \vartheta_t + \eta AM_t.$$

The Bellman equation for this problem defines implicitly the value function of the problem as a function of the state variables (K_t, S_t, ϑ_t) :

³ For the numerical results shown below, we compare the cases with $M = 4$ and a moderate geopolitical risk premium case of $M = 40$. However, the production function for the extreme case of $M = 400$ is shown here for clearer visual illustration of the induced concavity.

⁴ Adding stochastic shocks to production and security slowed down computation, because of Monte Carlo integration to compute expected value of continuation, without altering results qualitatively. Hence this version of the paper studies deterministic dynamics. Also, more elaborate parametric forms yielded similar results. Therefore, we present this simpler version of the model for clarity.

$$V(K, S, \theta) = \max_{C, AM, PM} \left\{ u(C, S, \theta) + \beta V(K', S', \theta' | K, S, \theta; C, AM, PM) \right\},$$

subject to the constraints

$$F(K, \theta) = C + AM + PM + I,$$

$$K' = (1 - \gamma)K + I,$$

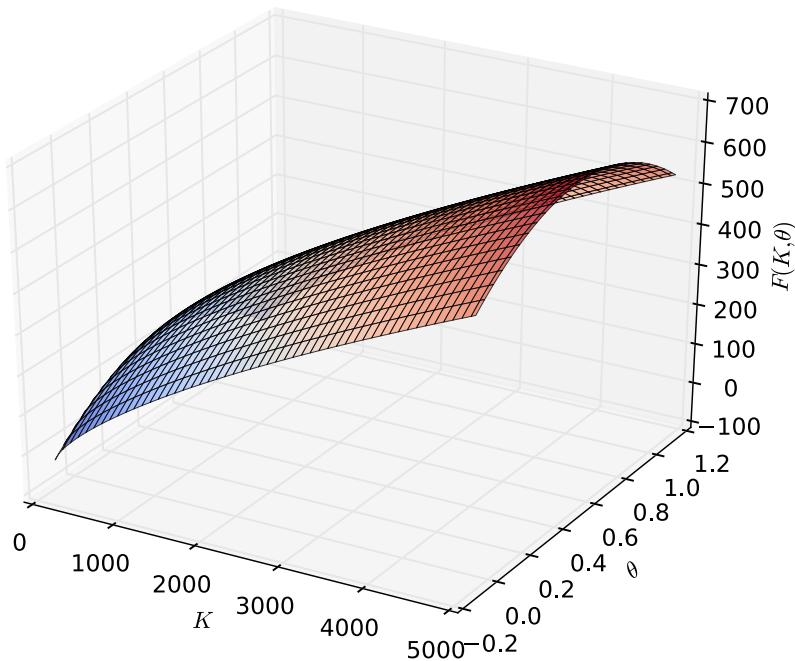
$$S' = (1 - \delta)S + PM - AM,$$

$$\theta' = \theta + \eta AM.$$

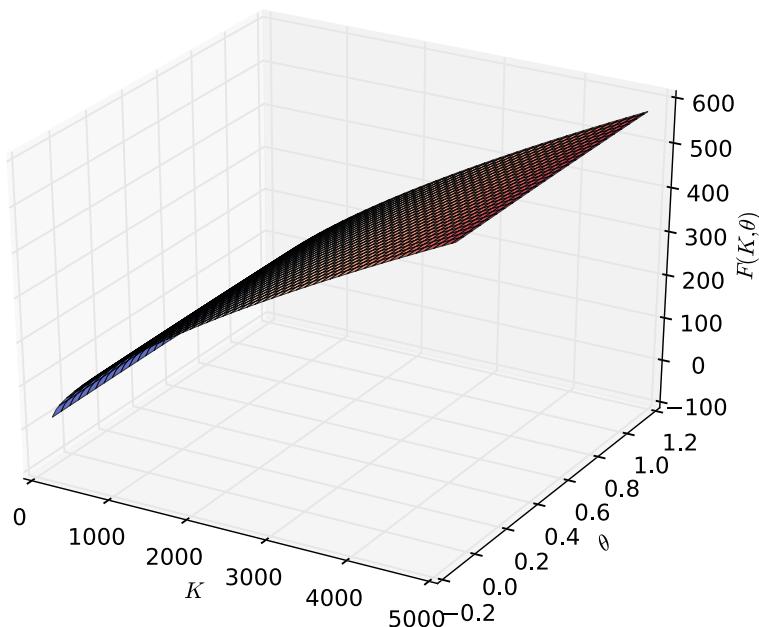
For each pair (K, S) , and candidate value function V , there are multiple local optima over the optimal policies $\{C, AM, PM\}$ in each iteration.⁵ This results in jagged optimal policy functions, as shown below, because different combinations of consumption and security can yield the same utility.

The baseline model with parameters $A = \psi = 1.0, \rho = 0.8, \alpha = 0.75, \kappa = \tau = 0.5, \eta = 0.1, \xi = 0.01, \delta = \gamma = 1 - \theta = 0.1, M = 4$, yields the value function shown in Figure 8 at $\vartheta = 0$. Optimal passive military spending and consumption are shown in Figures 10 and 11, respectively, and active military spending is zero for values of the state (K, S, ϑ) , as illustrated in Figure 9. The corresponding figures for the case with $M=40$ is shown in Figures 12–15, respectively, for value function, active military spending, consumption, and passive military spending.

⁵ Calculations were performed in julia on a MacPro6,1 using the package NLopt for three-dimensional constrained optimization over $\{C, AM, PM\}$ in each iteration and the package Interpolations for linear interpolation of the last-iteration value function $V(K, S, \vartheta)$.

Figure 5. Production Function Example with $A = 1, M = 400, \alpha = 0.75$ 

Source: Author's own calculation.

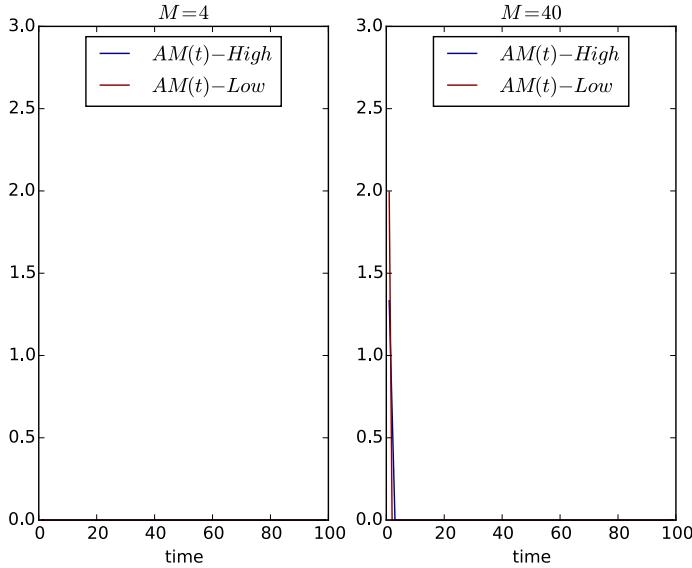
Figure 6. Production Function Example with $A = 1, M = 4, \alpha = 0.75$ 

Source: Author's own calculation.

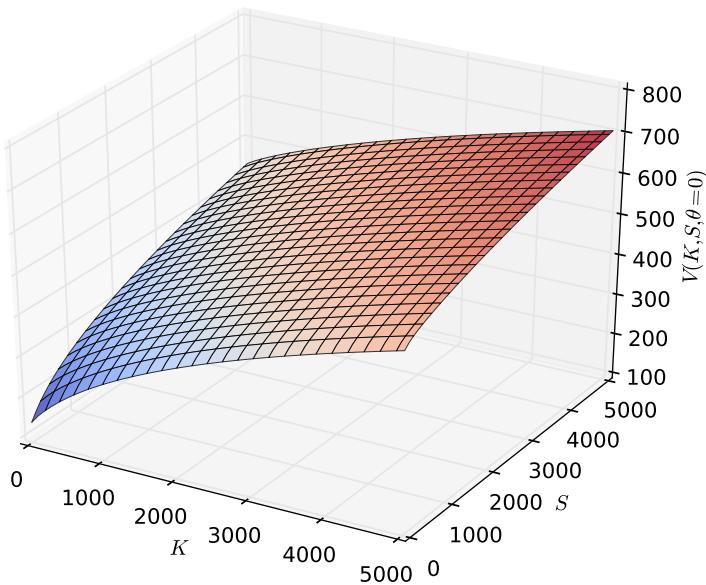
It is easiest to understand the differences between the two models by generating time series of the state and policy variables, which are shown in Figures 16 and 17, respectively. The time series show clearly that the country is better off with $M = 40$, i.e., when the geopolitical risk premium is larger, than it is with $M = 4$. Figure 17 shows that the steady-state (jagged as it may be due to numerical issues) levels of consumption and passive military spending are higher for the case of $M = 4$, regardless of whether the country starts with high or low levels of civilian capital K and military capital S . The biggest difference between the cases $M = 4$ and $M = 40$ is clearly in the size of the arsenal S in the latter. The steady-state civilian capital stock K is approximately the same in the two cases, with the bulk of the risk premium utilized to support higher levels of consumption and arms purchases.

The driving factor for differences between the models for $M = 4$ and $M = 40$, starting at $\vartheta = 0.1$ and starting either low or high (K, S), are highlighted in Figure 7, which shows that active military spending will be utilized in the case with $M = 40$, but not with $M = 4$. For the low starting case $K = S = 200$, the country would engage in immediate military spending of 2, pushing ϑ to 0.3 to effect a larger immediate jump in the production function allowing it to catch up with the steady state, which is reached more slowly in the case $K = S = 400$, with a smaller initial active military expenditure of 1.33, pushing ϑ to 0.23, followed by a second small military expenditure of 0.66, pushing ϑ to 0.3, which facilitates convergence to the steady-state pattern. Needless, the specific numerical values in this example are less important than the qualitative features of the model, which are summarized in the concluding remarks that follow.

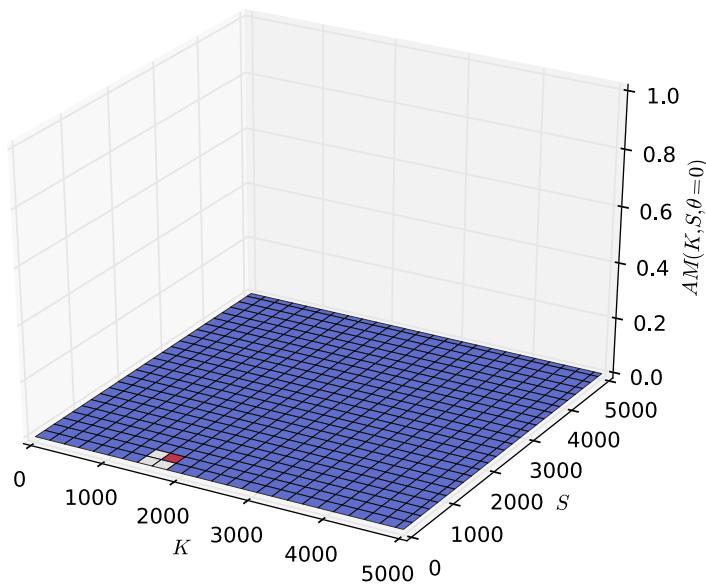
Figure 7. Time Series of Active Military Spending for Models with $M = 4$ and $M = 40$



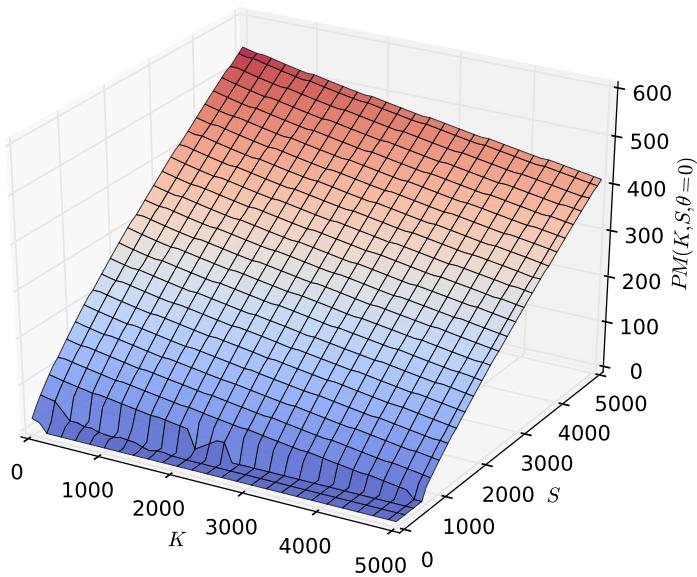
Source: Author's own calculation.

Figure 8. Value Function in Example with $M=4$, at $\vartheta = 0$ 

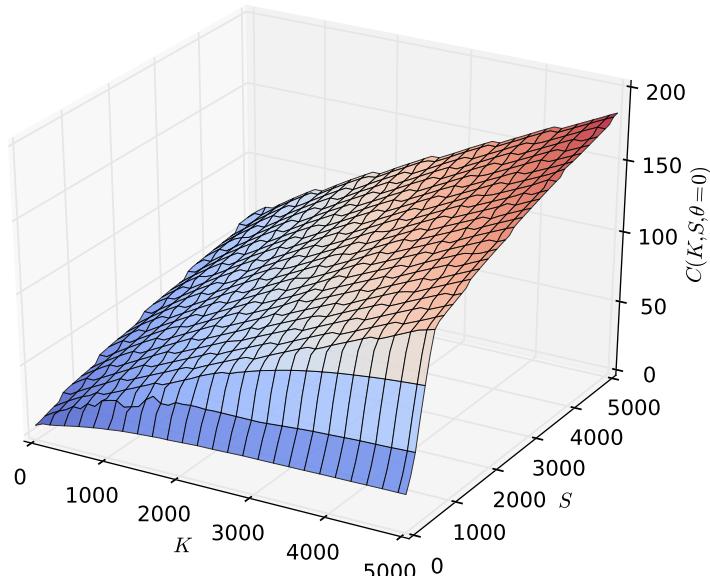
Source: Author's own calculation.

Figure 9. Active Military in Example with $M = 4$, at $\vartheta = 0$ 

Source: Author's own calculation.

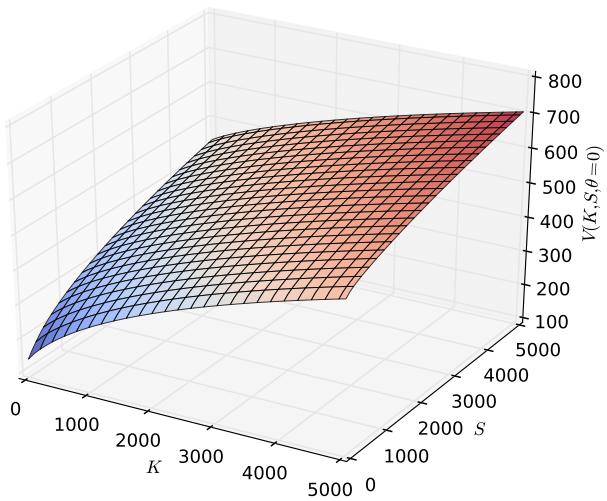
Figure 10. Passive Military Spending in Example with $M=4$, at $\vartheta=0$ 

Source: Author's own calculation.

Figure 11. Consumption in Example with $M=4$, at $\vartheta=0$ 

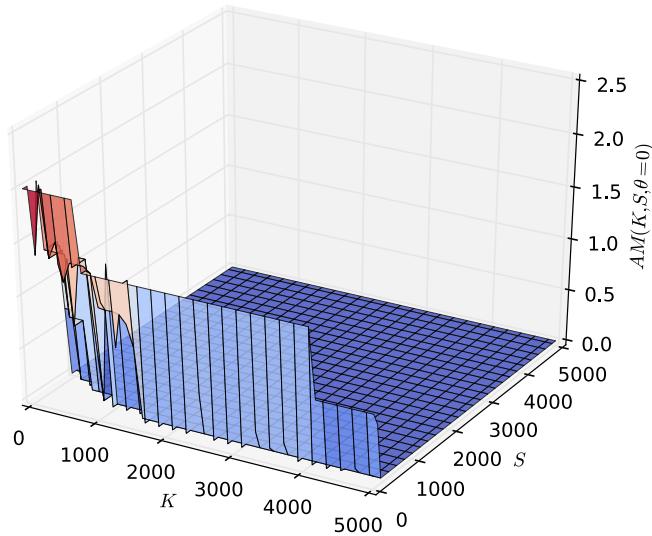
Source: Author's own calculation.

Figure 12. Value Function for $M = 40$, at $\vartheta = 0$

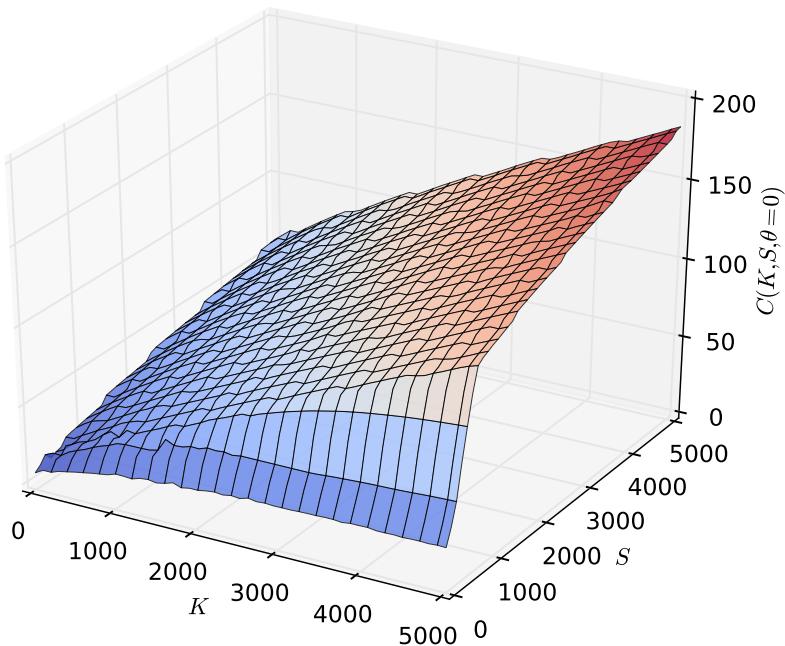


Source: Author's own calculation.

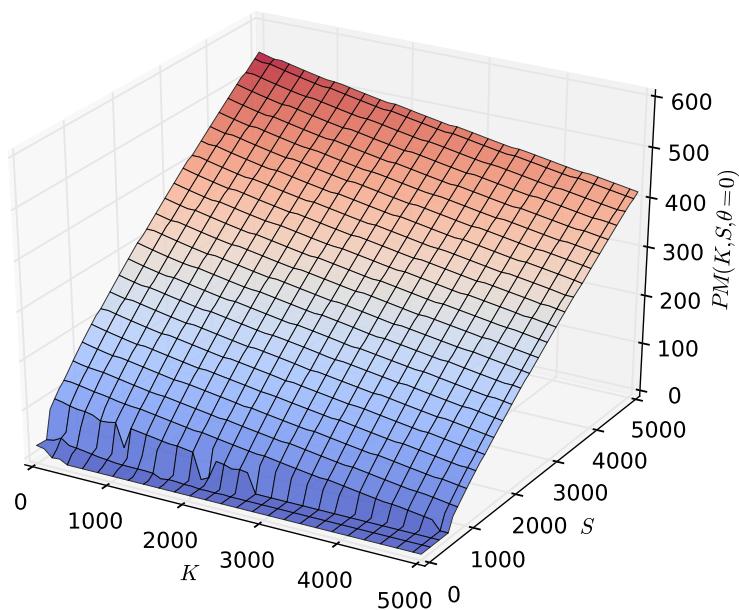
Figure 13. Active Military Spending for $M = 40$, at $\vartheta = 0$



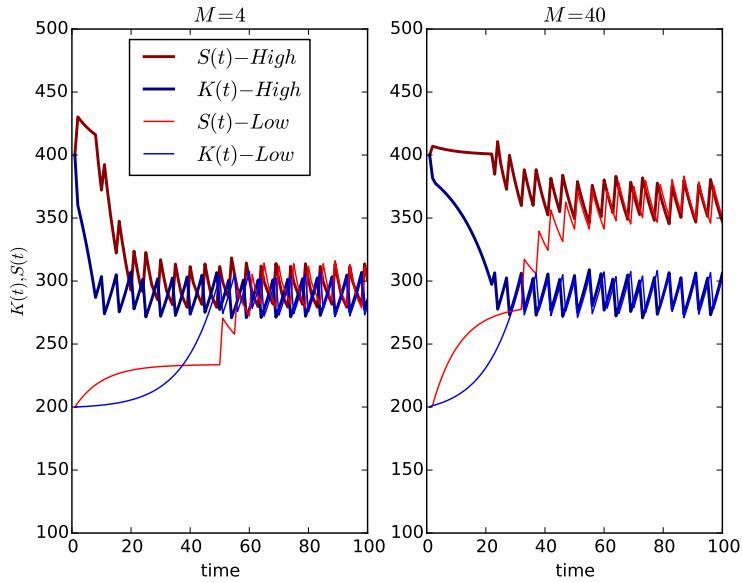
Source: Author's own calculation.

Figure 14. Consumption Spending for $M = 40$, at $\vartheta = 0$ 

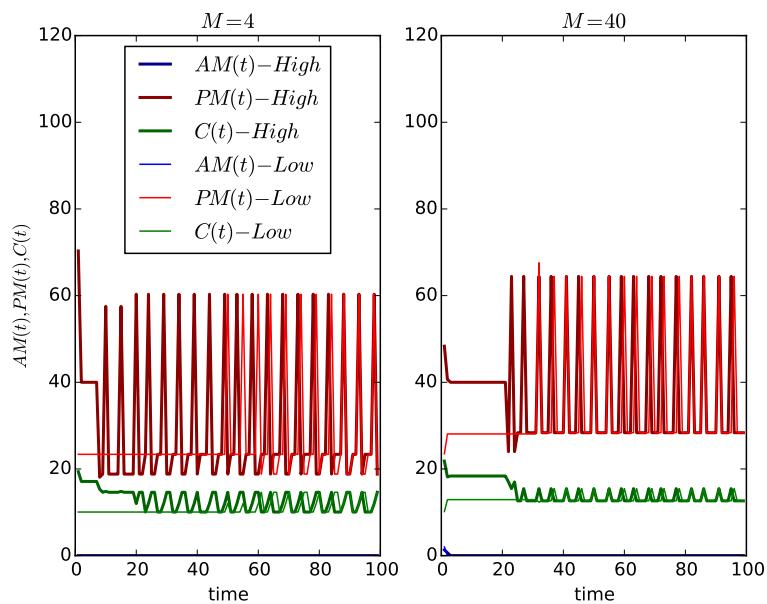
Source: Author's own calculation.

Figure 15. Passive Military Spending for $M = 40$, at $\vartheta = 0$ 

Source: Author's own calculation.

Figure 16. Time Series of State Variables for Models with $M = 4$ and $M = 40$ 

Source: Author's own calculation.

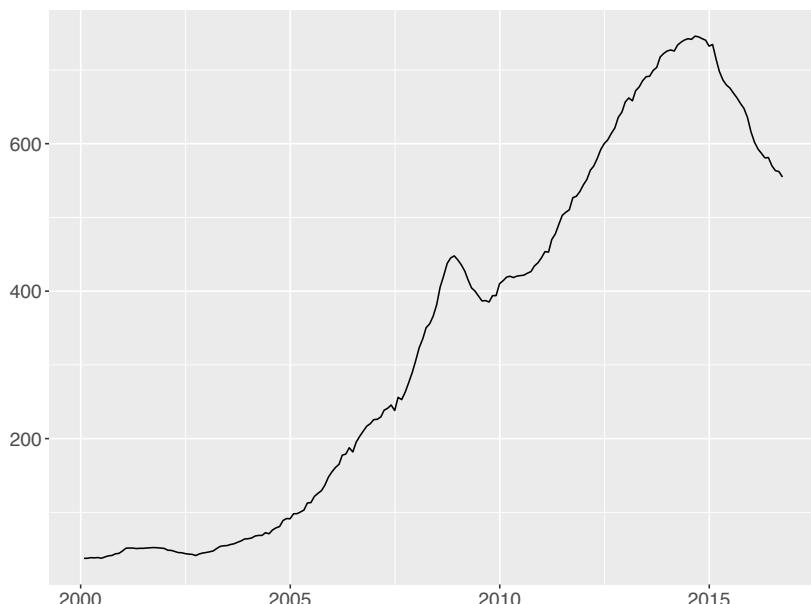
Figure 17. Time Series of Policy Variables for Models with $M = 4$ and $M = 40$ 

Source: Author's own calculation.

3. Concluding Remarks: Impending War?

The prolonged period of low oil prices since summer 2014 has caused an undeniable financial strain on Saudi Arabia, Russia, Venezuela, and other oil exporters. Figure 18 shows the sharp decline of Saudi Arabian reserves, at the pace of approximately \$100 billion per annum. At this pace, the IMF has predicted that Saudi Arabia will run out of reserves by 2020.⁶ The limited war in Yemen has contributed to the large fiscal deficit in Saudi Arabia, especially because war expenditures have been estimated at \$200 million per day, while the resulting geopolitical premium in Brent prices has been muted, at least compared to during the Arab Spring period.⁷

Figure 18. Saudi Arabia Foreign Reserves



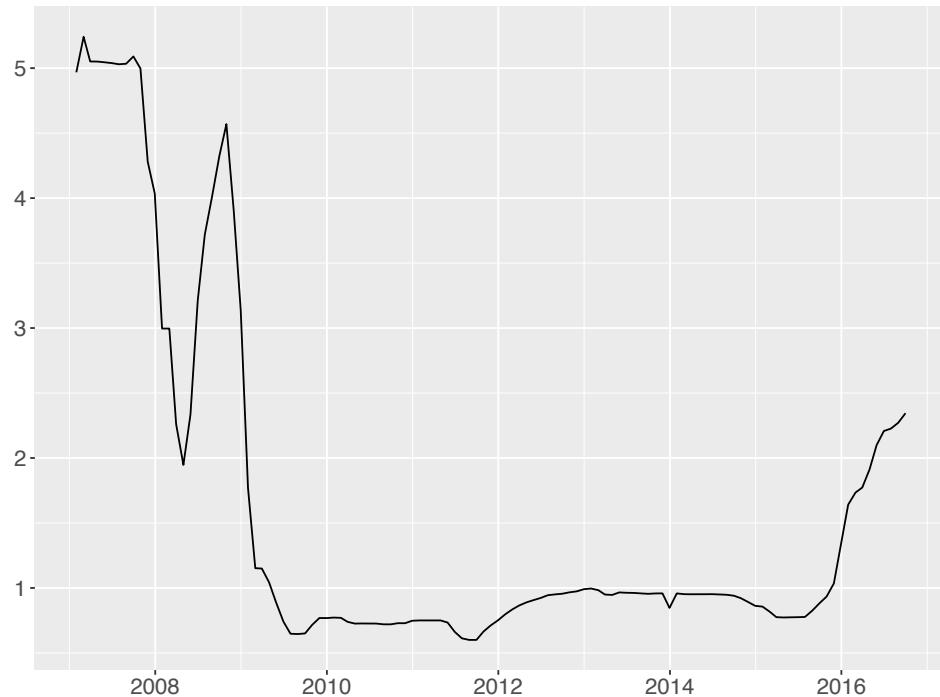
Source: Saudi Arabian Monetary Agency.

⁶ Ahmed Feteha, "Saudis Risk Draining Financial Assets in 5 Years, IMF Says," *Bloomberg*, October 20, 2015, at: <http://www.bloomberg.com/news/articles/2015-10-21/saudis-risk-draining-financial-assets-in-five-years-imf-says>.

⁷ Glen Carey, "The Saudi Town on the Frontline of Yemen's War," *Bloomberg*, December 21, 2015, at: <http://www.bloomberg.com/news/articles/2015-12-21/in-one-saudi-town-gunfire-all-day-brings-yemen-war-near-home>.

Saudi Arabia has attempted to decelerate the financial hemorrhage by reducing costs, such as by delaying projects and payments for previous projects to private contractors, and financing its deficits by selling bonds to domestic banks, for example. This has put many private companies in financial distress,⁸ and consequently constrained liquidity in the banking system, as illustrated by the elevated interbank rate shown in Figure 19.

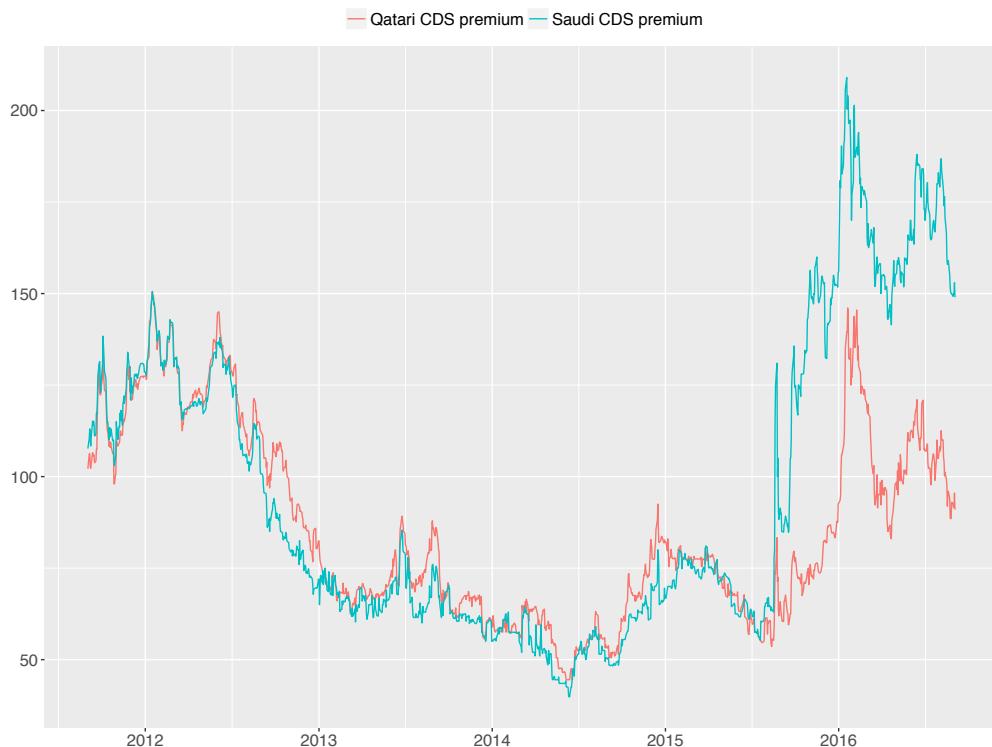
Figure 19. Saudi Arabia Three-Month Interbank Rate



Source: Saudi Arabian Monetary Agency.

Encouraged by the recent success of a major Qatari bond sale, Saudi Arabia believes it can borrow against its reserves and other assets as collateral, and sold \$17.5 billion in dollar-denominated bonds in October 2016. However, credit markets suggest that Saudi credit risk is significantly higher than Qatari credit risk. Figure 20 illustrates how the credit default swap premia for the two countries had tracked reasonably closely until mid-2015, when the Saudi five-year credit default swap premia diverged significantly above its Qatari counterpart. The volume of outstanding five-year Saudi credit default swaps has also increased significantly in recent months, suggesting that market participants who may buy Saudi bonds are buying credit insurance to protect against potential defaults.

⁸ Nicolas Parasie, "Saudi construction conglomerate hits hard times amid oil decline," *Wall Street Journal*, March 23, 2016, at <http://bloom.bg/1Ghs5eN>.

Figure 20. Saudi Arabia and Qatar Five-Year Credit Default Swap Premia

Source: Bloomberg.

As mentioned earlier, other countries that are heavily dependent on oil exports have also been struggling financially. Most notably, the Russian economy has been in a deep recession during 2015 and 2016, which has exacerbated financial sector weaknesses.⁹ Geopolitical conflicts with ISIL and other militant groups in Iraq, Syria, and Yemen have grown in significance in recent years. Those conflicts have contributed to the financial strain in regional players who have played active parts in the conflicts, without generating a sufficiently large geopolitical risk premium in oil prices to cover the financial losses. This confluence of factors may incentivize those players, most notably Russia and Saudi Arabia, to intensify military activities in the region, both to reduce the geopolitical risks posed by various militant groups, with the welcome side effect of increasing the geopolitical risk premium in oil prices to reduce financial pressures on their economies.

⁹ See <https://www.imf.org/en/News/Articles/2016/07/13/13/05/NA071316-Russia-Adjusting-to-Lower-Oil-Prices>.

References

- [1] Abu-Bader, S. and A. Abu-Qarn. 2003. "Government Expenditure, Military Spending and Economic Growth: Causality Evidence from Egypt, Israel, and Syria." *Journal of Policy Modeling* 25: 567–83.
- [2] Al-Jarrah, M. 2005. "Defense Spending And Economic Growth In An Oil-Rich Country: The Case of Saudi Arabia." *Pakistan Economic and Social Review* 43(2): 151–66.
- [3] Alptekin, A. and P. Levine. 2012. "Military Expenditure and Economic Growth: A Meta-Analysis." *European Journal of Political Economy* 28: 636–50.
- [4] Alquist, R. and L. Kilian. 2010. "What Do We Learn from The Price of Crude Oil Futures?" *Journal of Applied Econometrics* 25: 539–573.
- [5] Askari, H. and N. Krichene. 2008. "Oil Price Dynamics (2002–2006)." *Energy Economics* 30: 2134–53.
- [6] Barsky, R. and L. Kilian. 2004. "Oil And The Macroeconomy Since The 1970s," Working Paper 10855, National Bureau of Economic Research, Cambridge, Massachusetts.
- [7] Baumeister, C. and L. Kilian. 2015. "40 Years of Oil Price Fluctuations: Why the Price of Oil May Still Surprise Us." CFS Working Paper Series, No. 525, Goethe University Frankfurt.
- [8] Brito, D. 1972. "A Dynamic Model of an Armaments Race." *International Economic Review* 13: 359–75.
- [9] Brown, S. and H. Huntington. 2013. "Assessing The U.S. Oil Security Premium," *Energy Economics* 38: 118–27.
- [10] Chevillon, G. and C. Riffart. 2009. "Physical Market Determinants of The Price of Crude Oil And The Market Premium." *Energy Economics* 31: 537–49.
- [11] Deger, S. and S. Sen. 1984. "Optimal Control and Differential Game Models of Military Expenditure in Less Developed Countries." *Journal of Economic Dynamics and Control* 7: 152–69.
- [12] Deger, S. and S. Sen. "Military expenditure and developing countries." In *Handbook of Defense Economics Vol. 1*, edited by K. Hartley and T. Sandler, 275–307. Amsterdam: Elsevier, 1995.
- [13] Dunne, P. and S. Perlo-Freeman. 2003. "The Demand for Military Spending in Developing Countries." *International Review of Applied Economics* 17(1): 23–48.

- [14] El-Gamal, M. and A. Jaffe, "Oil Demand, Supply, and Medium-Term Price Prospects: A Wavelets-Based Analysis," Working Paper, Rice University's Baker Institute for Public Policy, Houston, TX, June 2013.
- [15] Farzanegan, M.R. 2011. "Oil Revenue Shocks and Government Spending Behavior in Iran." *Energy Economics* 33: 1055–69.
- [16] Gong, L. and H. Zou. 2003. "Military spending and Stochastic Growth." *Journal of Economic Dynamics and Control* 28: 153–170.
- [17] Hamilton, J. 1996. "This Is What Happened to The Oil Price–Macroeconomy Relationship," *Journal of Monetary Economics* 38: 215–20.
- [18] Hamilton, J. 2003. "What Is An Oil Shock?" *Journal of Econometrics* 113: 363–98.
- [19] Hooker, M. 1996. "What Happened to The Oil Price–Macroeconomy Relationship?" *Journal of Monetary Economics* 38: 195–213.
- [20] Joerding, W. 1986. "Economic Growth and Defense Spending." *Journal of Development Economics* 21: 35–40.
- [21] Kaufmann, R. and B. Ullman. 2009. "Oil Prices, Speculation, and Fundamentals: Interpreting Causal Relations among Spot and Futures Prices." *Energy Economics* 31: 550–58.
- [22] Kilian, L. and D. Murphy. 2014. "The Role of Inventories And Speculative Trading in The Global Market for Crude Oil." *Journal of Applied Econometrics* 29: 454–78.
- [23] Knight, M., N. Loayza, and D. Villanueva. 1996. "The Peace Dividend: Military Spending Cuts and Economic Growth." Policy Research Working Paper 1577, World Bank, Washington, D.C.
- [24] Landau, D. 1993. "The Economic Impact of Military Expenditure." Working Paper #1138, World Bank, Washington, D.C.
- [25] Lin, P. and C. Lee. 2012. "Military Spending, Threats, and Stochastic Growth," *Bulletin of Economic Research* 64(1): 8–19.
- [26] Miller, J.I. and R.A. Ratti. 2009. "Crude Oil And Stock Markets: Stability, Instability, and Bubbles." *Energy Economics* 31: 559–68.
- [27] Smith, R. 1980. "The Demand for Military Expenditure." *The Economic Journal* 90(360): 811–20.

- [28] Smith, R. 1989. "Models of Military Expenditure." *Journal of Applied Econometrics* 4(4): 345–59.
- [29] Smith, R. "The Demand for Military Expenditure." In *Handbook of Defense Economics Vol. 1*, edited by K. Hartley and T. Sandler, 69–87. Amsterdam: Elsevier, 1995.