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Abstract

This thesis consists of three chapters. The first chapter is a survey of the economic literature on conflict studies and related to the next chapters of the thesis. I discuss the literature concerned with these two questions "Why do economists should involve in studying the determinants of war? Are there economic factors that cause the war?" I also study the different theories that explain the shifts to the distribution of power in the international system and the influence of these power shifts on conflict. Natural resources have been the focus of economic literature on conflict studies, hence, I devote a section to economic resources, energy, and conflict. The final topic of this chapter is on the arms trade, its determinants and its relationship with conflict which closely is relevant to study the third chapter of the thesis.

In the second chapter, "Uncertainty of Oil Prices and Interstate Conflict", which is co-authored by Professor Paola Valbonesi and Professor Massimiliano Caporin. We empirically study the relationship between oil price uncertainty and inter-state conflict incidence by using different Vector Auto-Regressive (VAR) models, also augmented with Heterogeneous (VHAR) components. We build two measures for oil price uncertainty and investigate the Middle East and North Africa (MENA) interstate conflict data. Our results show that uncertainty in the oil market increases the incidence of conflict in the region. By further decomposing the model for OPEC and non-OPEC members of the region, we found that while the OPEC members immunise themselves against conflict, oil price uncertainty affects the conflict in non-OPEC members positively.

The last chapter, which is my job market paper, presents theoretical and empirical models to investigate the effect of citizen's internet access on the governments' decision on arms import. The citizens have the opportunity to oppose the government's decision and the government seeks to receive foreign rent through buying arms from an external arm producer ally (policy orientation toward importing arms). The strength of the government policy (i.e. buy arms from a foreign ally) is its own private information.

The media outlets, by sending informative signals to citizens on how strong the government policy is, facilitate the decision to participate in collective action against the government. The aggregate participation of citizens with respect to the strength of policy determines whether the policy is changed or not. Theoretical predictions are tested by empirical analysis. My empirical findings show that internet access magnifies the effect of political participation rate on arms imports. These empirical results are gained by developing a cross-sectional data analysis of 70 countries from 1993 to 2017. A negative and significant coefficient for the interaction of internet access and political participation shows that higher internet access and higher political participation leads to lower imports of arms.

Chapter 1

A Survey of Economic Literature on Causes of Conflict, Resource Wars, and Arms Trade

1.1 Introduction

In this chapter, I survey the economic literature on the political economy of war. In so doing, I mainly refer to three large areas of research, closely related to each other, and to which Chapter 2 and 3 of this thesis contribute. The first area of research, broadly investigated by economists and political scientists as well, refers to the problem of why conflicts are waged in a rational player setting. Can we identify what are the causes of conflicts? Other branches of studying political economy of conflict pursue topics like ways of waging conflict[1], post-conflict consequences and reconstructions[2], and finally alternatives to war[3].

Among all of the economic causes of conflict, the presence of natural resources is argued to be a prominent reason. Then, this Chapter reviews a second area of research on how conflict arises in geographic regions endorsed with natural resources abundance. In Chapter 2, we confine special attention to fossil fuels - mainly oil resources in the aim to study how the uncertainty

[1] e.g. Shughart, William, et al. (2011); Joes (2015); Poutvaara and Wagener (2011)

[2] e.g. Logan and Preble (2011); Dancy (2011); Hechter and Vidal-Aparicio (2011); Flores and Nooruddin (2011)

[3] e.g. Cortright, Lopez, et al. (2011)

of oil prices interacts with the incidence of interstate conflict in an oil-rich region like the Middle East and North Africa.

Furthermore, this Chapter briefly illustrates a third area of research referring to arms trade, along with some discussion on the association of arms trade and conflict as approached in the existing literature. Generally, the literature classifies the main players of the arms trade (i.e. exporters and importer), their arms policies and relationships, and the arms flow patterns in this network (Kinsella, 2011). In this chapter, I focus on the determinants of arms trade among the players to provide insight for recognizing the arms importing policies. Such insight is the link to Chapter 3 of the thesis which studies internet access, political participation and arms imports. Note that the goal of Chapter 1 is not to provide an exhaustive review of the literature on war studies but rather summarizing the most relevant contributions in the research area my thesis develops on.

The remaining of this Chapter is organised as follows: in Section 1.2, I present the literature on the causes of conflict; in Section 1.3, I illustrate the relevant papers on economic resources and conflict; and in Section 1.4, I discuss contributions on arms trade.

1.2 Causes of Conflict

Why do economists study the determinants of war? Are there economic factors that cause the war[4]? These are relevant questions as wars are highly costly in terms of human capital, resources, infrastructure and development. If both of the parts involved in armed conflict are rational, they should prefer a bargained solution rather than a costly war. The political science literature provides some arguments and concepts to answer the questions above. Fearon (1995) considers the commonly employed rationalist explanations as i. anarchy; ii. expected benefits greater than expected costs; iii. rational preventive war; iv. rational miscalculation due to lack of information; and v. rational miscalculation or disagreements about relative power. However, this categorization of the rationalist explainations of war does not lead Fearon's research toward answering why decision-makers do not prefer diplomacy or negotiations to a costly war. He proposes three

[4]In the broadest sense, the concept of war refers to organised violence between distinct social entities (Malinowski, 1941). However, in the political literature Clausewitz (1832) defines war as a "continuation of politics by other means". In the economics literature, the conflict is a notion that is formalised by appropriation instead of production (Garfinkel & Skaperdas, 2007). Basically, rational agents not only engage in production and trade but also in appropriation and grabbing the production of others or defending theirs owns.

arguments to solve this puzzle and introduce them as the mechanisms or causal logic. First, private information and incentives to misrepresent the information in bargaining; second, war as the consequence of a commitment problem; and third, indivisibility of the issue at dispute. Following Fearon's categorization, we briefly present below papers in the economic and political science literature which elaborate on i) information asymmetry; ii) commitment problem; iii) indivisibility issue; moreover, we also add to this categorization the iv) agency issue and multilateral bargaining failure, on which Jackson and Morelli (2011) contribute.

Information Asymmetry - Bargaining failure as a consequence of asymmetric information has a root in the work by Myerson and Satterthwaite (1983). Asymmetries of information may be driven from unknown differences in strengths of the countries having various powers in armaments and facilities. Let's consider an illustrative example which shows how asymmetric information between players leads to bargaining failure and war. Suppose Country B has a dispute with Country A. Country A can be weak or strong with equal probability and, in case of war, the winner catches all the resources. If Country A is strong, then its probability of winning the war is equal to $3/4$, if Country A is weak this probability is $1/4$. Consequently, a bargained agreement should provide at least $3/4$ of resources minus the costs of war for A, so that A has the incentive not to enter the war. However, with asymmetric information, B cannot distinguish between strong A or weak A. So, if A is weak but pretend to be strong, A lose $3/4$ of resources minus war expenses in bargaining. In this case, if the costs of war are low enough to encourage B to enter the war, bargaining fails (Jackson & Morelli, 2011).

As Fearon (1995) highlights, information is fundamental in studying rational causes of war. Blainey (1988) concludes that an outbreak of conflict can only be due to asymmetric information about relative power. Wärneryd (2012) stresses that if the two parties involved in a potential conflict can agree on their relative probabilities of winning, there should be some peaceful equilibrium that could be accepted by both and prevent resource losses if the conflict develops. Also, in an imperfect commitment model Baliga and Sjöström (2004) underline that private information about each side's propensity to arm, can lead to arms races with probability close to one.

As a consequence of asymmetric information, wars occur when one side overestimates its ability to win or underestimates it's opponent's strength (Powell, 2002). Misrepresentation of private information usually exists in order to enhance bargaining power and its outcome. In addition, Fearon (1995) also points to overestimation of own military power by leaders, as

well as miscalculation of an opponent's willingness to fight (or miscalculation of the states' values for the issues relative to the costs of war). However, Fearon (1995) underlines that asymmetric information is not a sufficient reason for the incidence of war, but it can prevent the states from disclosing the information to other states. If both sides have enough incentive to approach negotiation, they could also have interest in communicating each other information about their relative power. On this ground, the most commonly theorised mechanism is the players' incentive to misrepresent their own strength. For example, when a state amplifies its strength and engages in a war in order to prevent future rivals from potential attacks.

By employing different approaches from the above presented, the economic literature also investigates asymmetry of information at the very ground of conflicts. For example, Chassang and Miquel (2010) present a global game[5] in which players have different assessment of the environment and the fear is a motive for conflict. Blattman and Miguel (2010) emphasise that the framework established by Chassang and Miquel (2010) is remarkable since it provides testable predictions as follows: first, armed conflicts are a consequence of negative economic shocks; second, states with higher national income and less volatile revenues experience less conflict; and, finally, higher expected income growth for future, reduces the risk of war today.

Commitment Problem - Another prominent strand of theories investigating wars origins refers to cases - like first strike advantage incentive and preventive wars - where credible commitment to peace cannot be established even in the presence of complete information (Walter, 1999). Powell (2006) shows that the commitment problem is rooted in large shifts in the future distribution of power. As an example, consider country A is weak currently, attempting to reach a deal with a relatively strong opponent - country B - on an issue like a border or natural resources. A promise to transfer a part of its benefits to B frequently in order not to be damaged by B. In future, if A has the chance to returns to relative strength, due to a shock in income or foreign aid, it will be tempted to deviate its earlier deal, thus decreasing the amount it had credibly promised according to the previous commitment. If this time-consistent but more modest transfer is lower than what B can gain by fighting today, B will wage war now to ensure the highest possible payoff. Accordingly, commitment problem works when one party can permanently change the strategic balance of power by waging a war in every moment (Garfinkel and Skaperdas (2000); Powell (2006);

[5]See about global game: Carlsson and Van Damme (1993) and Morris and Shin (1998)

McBride and Skaperdas (2009)). If going to war weakens or even eliminates an opponent permanently, the country will gain a peace dividend since it no longer needs to spend on arms to deter future conflict. Thus, the country has the incentive to wage bloody but short conflicts if peace deals are not credible. In presence of a commitment problem, the probability of war incidence is higher when conflict resolution and contract enforcement is not limited. Strong state institutions are supposed to accomplish commitments, while societies with weak institutions and inefficient checks and balances on executive power should empirically be those most likely to experience violent civil and interstate conflict (e.g. Fearon & Laitin, 2003; Bates, 2001; Skaperdas, 2008). The same authors highlight that commitment problems can arise in specific settings, among which: in presence of a promise not to attack done after a received transfer or expecting regular inter-temporal transfers; or of a preventive war or a war considered as a part of a dynamic bargaining process (in most cases, indeed, wars make negotiation among parts feasible).

Indivisibility Issue - Fearon (1995) considers the indivisibility among rationalist causes of war. Indivisibility is defined as a condition where the issue in dispute is not divisible, while an acceptable settlement requires division of goods proportionate to outcomes of a probable war. Examples of indivisibility issues are related to concepts of ethicity, religion, nationalism or homeland. The public opinion on indivisibility issues is so important, but public opinion alone does not make an issue indivisible; moreover, all indivisibility issues do not come from public opinion (Toft, 2006). With regard to this issue, Toft (2006) discusses the question of whether nationalists, religious believers, and terrorists are irrational actors. Although it is a controversial question and some policymakers count these actors as irrational, this author highlights that most of them calculate the expected costs and benefits of their actions, and then act to maximise their utility: in this perspective, for a fanatic religious person, suicide bombing can be a rational action.

In the war literature there are some causes, sometimes thought to be irrational, which can be explained using a broader definition of rationality (Jackson & Morelli, 2011). For example, religion-based wars can be used to increase the population of citizens of one religion. Instead, a reason why religion might be considered in the irrational realm is that leaders do not act according to their own rational choice but they act according to a religious code. Another example of disputed irrationality is the revenge as a reaction of ethnic cleansing and other ideological mass killings. But, ethnic wars incentives can be rationalised according to the population that belongs to

the probable winner of the war.

Other Causes - Jackson and Morelli (2011) highlight that agency problems and multilateral bargaining failures are also among the causes of war. The agency problem is raised because of bias between decision-makers viewpoint on war and the rest of their country. This problem may exist even if there are complete information and consistent agreement. Multilateral bargaining failures are more connected with the systemic or international level. Suppose that there are three countries: A, B, and C, with the same power and resources. If A and B cooperate to fight against C, A and B can divide the benefits of the resources of C into half and also take advantage of half-divided costs of war. But if they go to the bargaining table they may capture only one-third of all resources. In fact, bargaining fails in this context of multilateral disputes.

Levels of Conflict - We now move forward and briefly summarise in what follows other main categories of war studies which refer to other causes of wars. One categorization of war studies is related to different levels where conflicts can start. First, system or international level, second nation-state, and third individual level. The former studies the anarchy[6] in the international system, the distribution power among the states, alliances formation, trade patterns among states, and other common factors that related to the "external environment". The nation-state level investigates the fields related to the type of political systems or policymaking processes, public opinion and interest of different groups, ethnicity and nationalism. The individual level focuses basically on the personality of political leaders and their belief systems, psychological processes, emotional states and characterizations (Levy & Thompson, 2011).

System Level - According to the system level political economy , for studying wars at interstates level, one should consider the prominent realist theories which state that changes in power distribution lead to conflict (Brooks & Wohlforth, 2008; Keohane, 2005; Levy & Thompson, 2011). Two alternatives theories have been proposed by realist scholars in international relations: balance of power and power transition theories. As Levy (2015) mentions, according to the balance of power, the international environment is an equally distributed power system in which any disruption in the world balance may lead to war. In other words, the system always avoids hegemony of any state power and hegemonies are defeated by the alliance formation

[6] As defined by Levy and Thompson (2011) absence of governing authority capable of ruling out agreements and disputes.

of others and, probably, a war to prevent hegemony. On the other hand, power transition theory posits that one hegemonic power should always exist in order to maintain peace. Accordingly, the presence of great power or hegemony is necessary for peace and the emergence of any new power or hegemony leads to an increase in the risk of war. While there is an extended debate about which of these two theories can best describe wars in history, there is a common resulting point: any shift or change in the distribution of power in the global system can lead to war.

Another strand of literature in system level studies, refers to the effect of trade and economic interdependence on war or peace. On this ground, the stable relationship between the two sides of trade is recognised as capitalist peace. In other words, the capitalist peace model argues that peace can be achieved through democracy as well as a democracy that can be obtained by trade (Weede, 1995). However, there are some critiques for capitalist peace idea, the most prominent one is suggested by Blainey (1988) who argued that the causal relationship between trade and peace is exactly the opposite of the capitalist peace claim. In other words, peace causes trade to enhance. After 1990, thanks to the declining influence of Marxist-Leninist theories, scholars tended to form democratic peace and capitalist peace theories. Democratic peace explains that even imperfect democracies do not aim to go to war due to the characteristics of the democratic political systems (Levy & Thompson, 2011). A theoretical explanation for democratic peace can be found in democratic culture and norms and institutional constraints model which describe democratic states as war-averse since citizens will not vote to send themselves off to war (Russett & Oneal, 1909). Also, political decision-makers in democratic system states are institutionally inhibited from making independent choices about military actions because they are legally limited by institutional votes.

State (Nation) Level - At the national level, theories investigate which are the internal factors that can cause or prevent war. Blattman and Miguel (2010) state that it is more likely to occur civil wars in poor countries or those which encounter negative income shocks, experience weak state institutions and possess mountainous terrain or remote and low populated areas. The incidence of civil wars is commonly associated with poverty. In other words, the correlation between low per capita incomes and a higher probability of civil war is one of the pillars of empirical analysis in the literature. An apparent paradox is that war is sometimes recognised as the running force of technological and institutional development that built western economic growth. Blattman and Miguel points to the recurrence of interastate and interstate wars which played an important role in developing strong state

institutions in European history (Acemoglu & Robinson, 2006; Ferguson, 2002; Tilly & Ardant, 1975; Tilly, 1990).

Individual Level - In individual level theories, researchers study the causes of war and peace which relate to the behavior of key decision-makers of each agent participated in the conflict. Political leaders have a different experience, education, ideologies, and personality so they may act differently when facing the situation of deciding about war. Some international relation scholars apply prospect theory to explain the behavior of individuals in the field of the political economy of war. Prospect theory supposes that people frame their preferences around a reference point and considers the changes in the levels of the assets according to that reference point. Loss from the reference point has more weight than gain added to it (Levy & Thompson, 2011). These basic assumptions can predict some individual level behaviors such as political leaders pay more attention to supporting their current position rather than trying to enhance the situation; citizens penalise their leaders for losses more than when they fail to gain; political leaders take high risks to prevent losses; it is easier for states to cooperate to gain distributing as compared to distributing the losses.

1.3 Economic Resources and Conflict

The relationship between oil and war is a multidimensional and multidisciplinary subject that involves different fields such as politics, sociology, development, conflict, energy studies, geopolitics, international relations, international political economy, and international law. The literature on "resource curse" argues that natural resources abundance, increases the probability of war incidence (Basedau & Lay, 2009). This is because such abundance determines indirect institutional and economic instability. Natural resources create indirect institutional and economic causes of instability. As Ross (2008) states, one of the mechanisms through which the "curse" works is the economic syndrome of Dutch disease, famous for the adverse effects of raw natural resources discoveries on economic performance of producing and exporting states (Corden, 1984). Another aspect is the glut of revenues out of oil which is usually invested inefficiently if the governing state does not have a proper fiscal and institutional basis. Oil wealth also causes political deficiencies such as corruption, rent-seeking and less accountability for the dictators to repress or buy off their opponents. Such experiences can be observed in Venezuela, Iran, and Russia. The higher the oil revenues of government, the less accountable they become to their citizens, and this,

along with the above mentioned issues, can lead to instability and a higher probability of rebellion, civil wars, authoritarianism, secessionists rise and vulnerability to outside threats and rivals.

However, as Mehlum, Moene, and Torvik (2006) states, the diverging effects of natural resource presence on the economy is a consequence of differences in the quality of institutions. The same authors, also highlight that if institutions are "grabber friendly", the presence of more natural resources in a country will push income down, and the opposite occurs if the institutions are "producer friendly". They test this theory building on Sachs and Warner's (2001) influential works on the resource curse, and confirm the main hypothesis that institutions are decisive for the resource curse to be confirmed. Their results contrast the claims of Sachs and Warner that institutions do not play a role.

On the other hand, Basedau and Lay (2009) believe that the theory of the rentier state has largely been neglected in the study of peace and war. This theory suggests that regimes use revenue from abundant resources to buy off peace through patronage, large-scale distributive policies, and effective repression. Consequently, such rentier states would tend to be more stable and less prone to conflict. These two theories (resource curse and rentier stat theories) thus imply the contradictory effects of resource abundance on risk of conflict incidence. Accordingly, Basedau and Lay (2009) presents part of a solution to this apparent puzzle for the case of oil-producing countries. The key argument is that both resource wealth per capita and resource dependence need to be taken into account since only the availability of very high per capita revenues from oil allows governments to achieve internal stability. Basedau and Lay empirically find that oil-wealthy countries apparently manage to maintain political stability by a combination of large-scale distribution, high spending on the security apparatus and protection by outsiders.

Acemoglu, Golosov, Tsyvinski, and Yared (2012, p. 283) on the resource wars, find that "a key parameter determining the incentives for war is the elasticity of demand". If the resource is inelastic in demand, i.e. the elasticity is below one[7], the probability of conflict incidence intensifies over time. The reason is that the value of the available resources rises over the time of resource depleting and the oil-poor agent has a higher incentive to arm and fight oil-rich agent. The elasticity of demand identifies which of the

[7]Findings by Gately and Huntington (2002) and Pesaran, Smith, and Akiyama (1998) on the elasticity of oil demand show an approximation between 0.01 and 0.1 which categorises oil fields among inelastic demand resources.

two price or quantity effects dominates in determining the overall value of resource revenue. A demand elasticity lower than 1, causes price effect domination and thus the overall value of resource consumption escalates. This implies that armed conflict for a scarce, exhaustible and inelastic resource like oil happens with higher probability over time. Acemoglu et al. (2012) focuse on the scarcity of resources and the incentives for war in the presence of limited commitment. They find that in a limited commitment environment there are armament incentives. Consequently, regulation of prices and quantities under competitive markets might lead to war, even if there exists no experience of war before.

Caselli, Morelli, and Rohner (2015) establish a theoretical and empirical framework to study the effect of the geographic location of resource endowments on inter-state conflict. These authors mainly predict theoretically that conflict probability is higher if, first, at least one country has natural resources (especially if the resources are geographically closer to the border); and, second, in the case both countries have natural resources and such resources are located asymmetrically around the border. Caselli et al. empirically confirm their theoretical predictions by utilizing a dataset on oilfield distances from bilateral borders. They find that the oil's presence and location significantly affect inter-state conflicts after World War II. On similar arguments, and relating oil abundance and intrastate conflicts, Lei and Michaels (2014) use historical data of giant oilfield discoveries around the world from Horn (1990) to examine the effects of per capita oil production and oil exports on the incidence of internal armed conflict. Their findings show that giant oilfield discoveries increase the incidence of internal armed conflict by 5 to 8 percentage points. This increased incidence of conflict due to giant oilfield discoveries results is especially high for countries that had already experienced armed conflicts or coups in the decade prior to discovery.

Caselli and Tesei (2016) investigate - theoretically and empirically - how natural resource windfalls affect different types of political regimes. They categorise the different political regimes as democracies and autocracies and they find that higher income, obtained from positive shocks of natural resources, has almost no effect on democracies (i.e. Norway) or stable autocracies (i.e. Saudi Arabia) but it changes the political equilibrium in more unstable autocracies (i.e. Nigeria, Venezuela). Then, these authors frame a model with two players, an incumbent and a challenger, which aims to investigate the mechaniscm through which resource windfalls influence democraticies and autocracies. They measure natural resource windfalls as changes in the price of a country's principal export commodity and they

assume that such changes are plausibly exogenous to changes in a countrys political system. Similarly, other research in economic literature seek to isolate exogenous variation in income. Investigating Sub-Saharan Africa where most households rely on rainfalls to do agriculture and drought cause large reductions in income, Miguel, Satyanath, and Sergenti (2004) analyse income effects on the conflict. These authors use annual rainfall growth as an instrument for income growth, and annual country rainfall growth rates (current and lagged one year) as an instrumental variable for the per capita income growth terms in their second stage estimation equation. In their instrumental variable specification, they find that a 5 percent drop in income growth in the previous year increases the likelihood of civil conflict in the current year by up to 10 percentage points. Also, Besley and Persson (2008) exploit international commodity price movements to investigate civil war causes. Consistent with the predictions of their theoretical framework, rising import prices lead to greater conflict, which they argue is due to a drop in real wages. Export price increases are also associated with increased civil war prevalence since growing government revenue makes seizing the state increasingly attractive.

Considering the intrastate level war studies, influential work of Collier and Hoeffler (2004) surveys the greed and grievance effects of primary commodities' wealth on the likelihood of civil wars. Their seminal contributions shed light on the argument of political grievances and the economic incentives to rebel, which are decisive factors in war studies. On one hand, causes of conflict might be defined in terms of motives in which some insurgency happens when there are sufficiently large grievances from citizens willing to be involved in violent protest. On the other hand, rebellion might be an industry that generates profits from looting, so that the insurgents are the same as "bandits" or "pirates"' (Grossman, 1999, p. 269). Such rebellions are stimulated by greed (Grossman, 1991, 1999): it is a common assumption in this literature that rebellion does not loose any profitable opportunities arisen from chaos. Hirshleifer (1995, 2001) provides an important refinement on the motive versus opportunity definition. He classifies the possible causes of conflict into preferences, opportunities, and perceptions. The introduction of perceptions allows for the possibility that both opportunities and grievances might be wrongly perceived. Accordingly, as Collier and Hoeffler (2004) conclude, the model that focuses on the opportunities for civil war, performs well, whereas objective indicators of grievance have little explainatory power. They explain that proportion of natural resources in total exports is associated with conflict because of the opportunities that such resources provide for extortion, making rebellion feasible and attrac-

tive. While higher rates of secondary school attainment in the population are associated with a lower risk of civil war. Collier and Hoeffler emphasise that economic forces which have the ability to organise and finance a rebellion, most strongly predict civil war incidence.

The literature on the effects of natural resources presence and oil rents on civil conflicts is very rich (Brunnschweiler & Bulte, 2009; Collier & Hoeffler, 2005; Fearon, 2005; Ross, 2003a, 2004; Montalvo & Reynal-Querol, 2005; Cotet & Tsui, 2013; Arbatli, Ashraf, & Galor, 2015; Ross, 2003b; Koubi, Spilker, Böhmelt, & Bernauer, 2014); however, despite the importance and relevance of wars at "interstate" level in terms of destructiveness and huge economic consequences, limited efforts have been performed on this area.

Bazzi and Blattman (2014) test competing theories (opportunity cost motives vs. prize motives) that investigate the income and conflict relationship by disaggregating the volatility of exporting commodities in a cross-sectional model. They examine the effects of price shocks on the outbreak of new conflicts, the persistence, and intensity of ongoing conflict. With the empirics on export price shocks, they find that price shocks do not affect conflict occurence; however, higher prices, lead to shorter and less aggressive conflicts. This evidence contradicts the prize motives theory (that rising state revenues increase state capture motivations), and it supports the opportunity cost motives theory (that rising revenues improve the suppressive capability of the government and reduce citizens' motives to fight in an existing conflict). Finally, Bazzi and Blattman conclude that conflict incidence and persistence have different determinants. Ignoring such difference generates inconsistencies when studying the relationship between income and instability.

Theoretical contributions to the analysis of war mainly consist of contest models of armed conflict, see, for example, Hirshleifer (1991). In this strand of research, conflict is introduced as a way of generating income for any rational and self-interested group, individual or nation. So, the technology of conflict is investigated by a key function called conflict success function which is a mathematical relation whose inputs are the fighting efforts or weaponary technology of the combatants on each side and the output is a division of the price between them; for example, in the extreme case a total victory for one side and defeat for the other. The seminal paper on contest model is Haavelmo (1954), followed by Hirshleifer (1988), Garfinkel (1990) and Skaperdas (1992). It considers A and B as competing players and analyzes each side's effective allocation of resources to production versus appropriation. Garfinkel and Skaperdas (2007) summarise the two-player contest models rooted in a general equilibrium framework. While

production is modeled in the standard form of economic theory, appropriation is modeled by contest success function where inputs (e.g., weapons, G) translate into a probability of winning for side A , p_A and consuming the opponent (side B's) economic production in addition to their own. Following Hirshleifer (1988), the commonly used formulation of contest model in theoretical applications is presented in the following equation, where G_A refers to side A's weapons, G_B refers to B's weapons, and m captures the effectiveness of weapon in determining the winner:

$$p_A(G_A, G_B) = \frac{G_A^m}{G_A^m + G_B^m} \tag{1.1}$$

Contest model implies that propensity of winning increases with the relative capability of the parties' fighting technology.

Chapter 2 of this thesis on "Uncertainty of Oil Prices and Interstate Conflict" aims to add to this extended literature with an empirical investigation which addresses the dynamic relationship of conflict in Middle East and North Africa and uncertainty measures of oil price.

1.4 Arms Trade

The arms are not solely tradable goods but also tools for foreign policy, international relations, and geopolitical strategic concerns (Smith & Tasiran, 2005). On one hand, arms transfer can determine a more aggressive recipient behavior than a no ad hoc weapon acquisition. On the other hand, arms import can be a signal for the rivals about the recipients intensifying power so it can initiate a preemptive war. Smith and Tasiran (2005) states that the arms trade is a discipline where foreign policy issues such as security, human rights, and international power balance system are associated with economic issues such as trade, jobs, and profits.

At the intersection of the resource curse and on lierature arms trade is the paper by Bove, Deiana, and Nisticò (2018), which investigates the oil-poor and oil-rich relationships in trading arms. Specifically, these authors study the question of whether arms suppliers transfer the arms to oil-rich countries to secure the supply of oil. Their findings highlight that oil as a resource is a prominent factor affecting relationships betweem arms' suppliers and recipients. Furthermore, arms is usually an influential policy tool to secure the oil supply.

In this literature on arms transfer, the fundamental issue is to find out what is its effect on the stability of the arms receiver state. In other words,

do the arms imported lead to peace or trigger conflict? A number of research papers highlight that arms transfer can have a positive or negative relationship with conflict, depending on a variety of associated contingent situations. Conflict severity, the issue at stake in the conflict, historical and geographical links of rivals, types of traded arms, arms stocks of states, the mentality of political decision-makers, commitment to allies and propensity of foreign interventions are among the forces that shape the relationship between arms transfers and conflict (Anderton, 1995). The simplified model in Figure 1.1 shows attack and defend regions in a arms race between A and B and the weapons stocks of the two countries, W_A and W_B, are measured on the axes. If the weapons vector is in regions close to W_A or W_B, then respectively, A and B could attack each other and win the war. While, if weapon stock locate in the area of "No attack", the settlement implies no war. As in Anderton (1995), referring to Figure 1.1, the ambiguous relationship between arms and conflict can be described as follows. Let's consider α as the status quo in which A can attack B; in this setting, a third country transfers arms to help B in increasing weapon and the settlement to peace. Thus, A might perceive such transfer to B as eliminating A's advantage or eventually moving to a point where B could attack A. In this case, A might initiate preemptive war or intensify an existing war. Thus, the weapons exports to B serve as a catalyst for war.

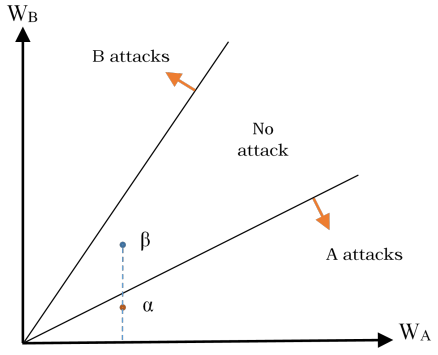

Figure 1.1: Arms transfer and conflict

However, research in this field warns about the negative consequences of transferring arms to critical regions where arms races and violent events take place frequently. For example, Ayoob (1995) states that although arms deliveries to Third World countries is not the only reason of conflict incidence, the easy access to such advanced weaponry leads to harmful regional arms

races, escalation, and prolongation of conflicts. Pamp, Rudolph, Thurner, Mehltretter, and Primus (2018) empirically investigate the effect of arms import on civil conflict onset and find that while arms imports are not a cause of conflicts, they significantly raise the probability of conflict onset in fragile conditions. Thus, arms not only behave as an effective deterrent but also promote conflict escalation.

In developing a historical analysis, Krause (1995) outlines three waves of the international arms transfers and arms production network. The first wave, from the fifteenth to the seventeenth century was followed by a two-century period of relatively stable military and technological development. The second wave started in the middle of the nineteenth century, with the rapid advance of the Industrial Revolution and led to the reframing event of World War II. Finally, the third wave goes from the cold war until today. Furthermore, Krause identifies five phases whitin those waves. In the first phase, significant military technology is recognised by some states that later become the leading suppliers of global arms network. In the second phase, the demand for arms rises, an expansion of the arms trade is evident. In third phase, demand for arms production technology increases as well as the demand for finished systems. The third phase leads to the rise of the second order of arms-producing states who are able to manufacture a wide range of military equipment, but limited in their capacity to innovate at the technological frontier. In the fourth phase, the international arms market observes tighter competition among a larger number of suppliers. The arms trade accelerates, as well as arms production capacity, and the third order of arms production states emerges. Capacity varies in the third order, but the need to import designs, machinery, and the essentials of production of the advanced systems is a common characteristic if such systems can be produced at all. In the final phase, the diffusion of military technological advancements slows down and the three order arms production network densifies.

This structure among arms producers is complemented by a lower number of states with no arms production capacity. If these states decides to acquire even a limited military capability, they must import arms. States that achieved independence as a result of decolonization after World War II were in this position, as well as others, like those in Latin America and, more in general, most developing states (Kinsella, 2011).

The international Peace Research Institute (SIPRI)[8] identified three patterns of arms supply. First, the hegemonic pattern, which was characterised

[8]See: https://www.sipri.org/databases/armstransfers

by the United States and the Soviet Union during the Cold War. This pattern involves the use of arms transfers to support a particular group in power, or to prevent the emergence of an alternative group which might be willing to accept the dominance of another country (Øberg, 1976). Second, an industrial pattern where exporting states are concerned primarily with supporting the economic viability of their own defense industries. Third, a restrictive pattern of supply, where producing states seek to minimise their involvement in local conflicts by refusing to provide arms to actual or potential insurgents. These three patterns are an ideal representation, as several political, economic and even humanitarian considerations factor are taken into account, i.e. for any given suppliers decision to arm, it has to be considered any recipient's decision, at any time.

In the analysis of the arms trade during and post World War II, Harkavy (1975) examines supplier and recipient market structures and investigates how they corresponded to the shifting distribution of power during these two periods. During the interwar period, suppliers market structure was oligopolistic: a large number of importing states considered multiple supplier relationships, and frequently arms acquisitions pass over the alliances. These patterns illustrate not only a more dispersed distribution of arms power among the major suppliers, but also less state involvement in the market as compared to subsequent years. After World War II, the supplier market became more concentrated and mostly dominated by the United States and the Soviet Union. No cross-alignment arms transfers were possible, and even mercantilism states typically failed to combine acquisitions from the opposing alliances, unless a change in government leadership brought about a major ideological reorientation. As Harkavy (1975)[p .11]] remarked, the Cold War arms trade was reflective of a "concatenation of factors involving bipolarity, stable hegemonic alliances under the leadership of the two major powers, an ideological focus of conflict, and a zeitgeist of total war."

Regarding the weapons categorizations, Levine, Sen, and Smith (1994) highlights four main categories of product in the arms market: weapons of mass destruction; major conventional systems; dual-use technologies and small arms. The political economy and institutional analysis of Comola (2012) investigates whether changes in political conditions impact the quantity of Major Conventional Weapons (MCW) exported to other countries. Utilizing a gravity-type panel TOBIT on democratic exporters and Stockholm International Peace Research Institute (SIPRI) data, she finds that the exporters government rightwing orientation has a positive and significant impact on arms export. This result may imply a general right-wing tendency to support the national industry and deregulate a heavy industry

exports such as arms. She also finds that if executives are in the last year of their term and can run for re-election, would tend to decrease arms exports. Also, Akerman and Seim (2014) use Stockholm International Peace Research Institute (SIPRI) data on international transfers of MCW to investigate the relationship between differences in democratic institutions and arms trade. Their goal is to find if the states have a tendency of arms trade within their political vicinity. To this aim, they develop gravity models of the likelihood of trade at the bilateral level and study the evolution of the global network over time. Their findings illustrate a robust negative relationship between differences in the democratic institutions and the likelihood of arms trade for the Cold War duration. Their findings is in line with the drastic global arms trade network growth, clustered and decentralised features over time. Furthermore, their results confirm that differences between the North Atlantic Treaty Organization(NATO) and Warsaw Pact members provide support for the perception that the Warsaw Pact was more strongly centralised around the Union of Soviet Socialist Republics (USSR) rather than NATO around the United Kingdom (UK), and the United States(US).

Note that the defense industry is unique in its structure, organization and performance's goal: on the one hand, arms exporters accept that such trade has a potential negative impact on their national security; on the other hand, arms exporters should be supported by a national will (preference) to maintain a domestic defense sector. Moreover, arms trade is heavily regulated with export controls and export subsidies often chasing contradictory objectives such as the promotion of domestic defense industry and the limitation of arms exports and/or their quality so as to ensure national security.

Brauer (2007) focuses mostly on developing countries production and trade of Major Conventional Weapons (MCW), their participation in the international network of arms industry, and the industrial qualifications that make their involvement and participation feasible. Brauer (2007) models the post-Cold War composition and location of arms manufacturing and analyzes characteristics of the Small Arms and Light Weapons (SALW) industry. Indeed, SALW industry has a harmful potential with a wide range of adverse effects on public health, education, institutions of law and order. Brauer (2007) suggests that the product-cycle models can explain some characteristics of the temporal diffusion of SALW supply. He points out that the presence of non-high income countries in the production of weapons of mass destruction and, similarly, in the production of nuclear weapons and R&D patents is increasing. The main conclusions of his work are that data sources are poor. Moreover, arms production and trade theory are underdeveloped on this topic; and, although non-proliferation regimes may have decreased

weapons proliferation, they have failed to demolish it. Finally, industrial actors' entry in the production of all weapons categories is upsurging and even further increase in future is expected.

Blanton (2005) specifically compares U.S. arms trade policy between Cold War and post-Cold War and states that during the Cold War the strategic goal was to besiege Communism while human rights and democracy has gained higher importance in the post-Cold War foreign policy. In the fight against Communism, arms deliveries were an instrument of influence and an indicator of U.S. political support. Blanton (2005) investigates the questions of whether the U.S. arms trades illustrate America's foreign policy goals and acts as a foreign policy tool to reflect concern for human rights and democracy. To address such questions, he examines the empirical linkage between U.S. foreign policy goals and arms export agreements with developing countries. He finds that U.S. arms transfers has experienced a transition between Cold War and post Cold War worlds. During the Cold War period, human rights in the recipient country were not a significant determinant of arms transfers - although democracy was positively linked to U.S. arms. After the Cold War period, both human rights and democracy affect significantly the eligibility of a country to receive arms.

Kollias and Sirakoulis (2002) utilise the demand for arms imports model of Levine and Smith (1997) and develop birth-death stochastic processes in steady state. The model supposes two antagonistic regional players engaged in an arms race satisfying their demand for weapons through imports from the international market. Kollias and Sirakoulis (2002) highlight the effects that arms imports have on the military balance between the two recipient countries. The model builds a state space of possible outcomes as a function of the military balance imbalance between the two countries involved.

One of the popular subjects of discussion in the literature of arms trade is the multinational arms export control. Free trade in arms can have negative externalities on national security. As a result, states receive benefits from the international coordination of arms controls. There has been relatively little economic analysis of these issues, partly because the network for arms trade is not an usual and transparent economic market. Moreover, issues such as differences in the security perceptions of exporters, the home bias and the characteristics of the competition between exporter firms may all make the implementation of export controls ever more challenging (Garcia Alonso & Levine, 2007). In this area Levine and Smith (2000) develops a model of the international trade to study the interaction between three types of security policy: first, the level of military forces, second, the controls on arms exports and finally, the rate of collaboration in weapons production. Levine

and Smith (2000) find that an increase in the price has two contrasting effects on arms purchaser: first it shifts the butter versus gun[9] expenditure combination towards the efficient outcome. Second, it causes a deterioration in their terms of trade. If the first effect dominates, then buyers as well as producers benefit from an increase in production.

Levine et al. (1994) treat the arms market as a case of international trade in an imperfectly competitive market, where inter-temporal contracts are important and there is an externality associated with the product. They investigate a setting where forward-looking, competing supplier governments are each deciding how much arms to sell to a generic recipient, taking into account both the economic benefits obtained from exporting the weapons and the security repercussions that will arise if weapons acquisition changes the behavior of the recipient. Levine and Smith (1997) examine multiple recipients whose arms imports are determined endogenously through an interactive dynamic game. The model is designed to capture the main features of the important case where supply to one regional power may prompt further acquisition of weapons by a rival power. Garcia Alonso and Levine (2007) shows that the military capability of the alliances during the Cold War had the properties of a public good. In this ground, the military power of one country had also benefits for other countries in a coalition. Thus, arms transfers to allies could increase alliance potentials and enforce cooperation. Literature has used elements of new trade theory, industrial organization and regulation theory with the added elements of security perceptions and (home biased) procurement to analyze how export control industrial policies impact on national security, the structure of the defense industry and the welfare of importer countries (Anderton et al., 1996). The empirical literature has contributed to provide a picture of the post-Cold War evolution of the arms trade markets and the security consequences of their existence.

Smith and Tasiran (2005) use a panel of data for 52 countries over the period 1981 to 1999 to analyze the demand functions for arms imports as a function of a proxy for the price, military expenditure, and per capita income. They also use a large panel of data with 19 time-series observations for 150 countries to estimate models of arms imports. Their findings suggest a non-linear relationship between income and the arms import. As the level of income and military expenditure grows, the arms import first rises and then falls because the domestic arms industry develops. Smith and Tasiran

[9]The tradeoff between arms expenditure for national security and citizen's needs for goods supported by public expenditure is usually referred to as the choice between "guns and butter" in the economic literature.

(2010) state that the data on domestic arms production capability is not sufficient. Accordingly, they use a random coefficient approach in order to identify any systematic influences of military expenditure, size of the armed forces or income on unobserved domestic production capability and eventually on arms import propensity. Their further findings show that the non-linear pattern is apparent in the cross-section relationship.

Levine et al. (1994) states that while the data on the number of weapons transferred is bad, data on prices are even worse. This is partly because the suppliers wish to maintain secrecy. For instance, the UK government has made a great effort to assure that the price the UK sells and the price that Saudi Arabia pays for Tornado aircraft under the Al Yamamah contract remain hidden from the public. The lack of data also reflects the complexity of the contracts which may cover: a package of products (spares, training, infrastructure) in addition to the systems; tied aid such as the US Foreign Military Assistance program; export credits and insurance; offsets (guarantees to purchase goods from the recipient); counter-trade (payment in goods, such as oil in the Saudi sale); and political concessions. All these elements are summarised in the single price of arms, thus the price often differs substantially from the cost of production. Furthermore, weapons may be donated to allies, and when the quantity supplied is heavily constrained, the price can be substantially above the market price. Considering empirical analysis in the field, one should first note that data are neither comprehensive nor perfect. The related empirical evidence, however, highlights that the international structure of the defense industry is such that a few developed countries are the main producers and exporters; and such trade is at least in recent times increasingly dependent on imports from developing countries, many of which are involved in regional or internal conflicts.

Blomberg and Tocoian (2013) conduct a wide range of tests using a series of models to study the demand for arms. Their results show that conflict is an important determinant in the demand for arms, particularly in the arms imports. Moreover, external war is the strongest determinant of arms imports, although terrorism, and internal conflict predict an increase in imports. These authors analyze the extent to which regions differentials are driving the results and find evidence that high conflict regions such as the Middle East and North Africa, as well as parts of East and South Asia, are hotspots for this activity.

Chapter 3 of this thesis on "Internet Access, Political Participation, and Arms Import" contributes to this large literature, by adding a theorerical and empirical investigation which addresses how citizens can contribute to the government's political decision on arms import.

Chapter 2

Uncertainty of Oil Prices and Interstate Conflict

Evidence from the Middle East and North Africa

2.1 Introduction

Natural resources are often a primary cause of major wars: no one can deny the key role of natural resources in the Iran-Iraq war, the Falklands war, or the Iraqi invasion of Kuwait and the subsequent Gulf War; other relevant examples are well documented by Caselli et al. (2015). Klare (2002) argues that natural resources became more important after the end of the Cold War, creating more incentives for states to initiate wars. The term "resource curse" is commonly used in the literature of political economy of natural resources to describe the negative consequences for states of having an abundance of natural resources (Basedau & Lay, 2009). Such abundance often indirectly leads to institutional and economic instability, and increases the probability of war.

Oil is particularly relevant to the discussion of the resource curse and the effect of natural resource abundance on states' institutional and economic stability. Because the global distribution of fossil fuels is not uniform and oil is an internationally-traded source of energy, oil is considered a strategic and politically-sensitive commodity that is important to energy security. Economists have long argued about the effects of oil price shocks on macroeconomic performance and consider oil prices a decisive contributor to various macroeconomic outcomes at the national and international level. Higher oil prices have been pinpointed as the cause of recessions, periods of excessive

inflation, reduced productivity, and lower economic growth (Barsky & Kilian, 2004). Fossil fuels are a key input for growth and industrialisation, and as demand increases so too do concerns about a peak in oil reserves and supply uncertainty (Owen, Inderwildi, & King, 2010). Oil price uncertainty negatively affects aggregate investment, output, and consumption (Pindyck, 1990; Ferderer, 1996). Oil price uncertainty is also one of the determinants of foreign exchange rates, influencing the import and export levels of oil-rich countries. Of course, conflict also affects the supply of natural resources. Instability often pushes extractors, whether oil companies or national governments, to cut back on exploitation of resources. While the relationship is bi-directional, the literature has mostly addressed the effect of natural resources on conflict (Besley & Persson, 2011; Collier & Hoeffler, 2004; Rohner, 2011; Mehlum et al., 2006). Our objective is to investigate the two-way interaction of conflict and oil market uncertainties. We run our empirical analysis on two main variables: conflict and oil price uncertainty. Analysing the impact of oil price uncertainty on the onset of interstate conflicts, we're faced with two deeply entwined variables: oil price uncertainty can be both a factor in the development of conflict and a consequence of war.

As discussed in Barsky and Kilian (2004), even though it is widely argued that increases in oil prices are largely driven by "exogenous" political events in the Middle East, recent history shows that Middle East instability does not necessarily lead to higher oil prices. Some shocks in oil prices bear no apparent relation to events in the Middle East: the oil price shocks of March 1999 and November 2000, for example, were significant but were unrelated to any particular incident in the Middle East. Moreover, Barsky and Kilian (2004) highlights the decline in crude oil prices in 2001 as a significant counter example to the prevailing wisdom. The low prices of this era coincided with the terrorist attacks of September 11, 2001, the outbreak of war in Afghanistan, and a build-up in the U.S. Strategic Petroleum Reserve.

Macroeconomic studies of energy markets such as Barsky and Kilian (2004) and Kilian (2009) reveal that it is a mistake to consider oil price uncertainty and conflicts in the Middle East and North Africa (MENA) countries as exogenous variables. Oil supply uncertainty and oil price changes both affect and are affected by unrest. Hence, the issues of co-determination of variables, unclear anecdotal evidence, and dynamic interdependence among variables need to be addressed. The novelty of our research is to utilise a Structural Vector Auto Regression (SVAR) framework where the dynamics might also take an Heterogeneous AR form (SVHAR). These models account for the contemporaneous and lagged impact across variables, as well as for

the associated impact of specific lagged periods (i.e. the previous semester and the previous year). Notably, these models are widely used in the area of energy market analysis (Hamilton, 2009; Basher, Haug, & Sadorsky, 2012).

Even though it is generally argued that oil supply shocks drive oil price shocks, influential work by Kilian (2009) shows that oil price fluctuations have historically been preceded by a combination of aggregate demand shocks and precautionary[1] demand shocks. Disruption in precautionary demand can be a consequence of concerns over unforeseen increased demand, supply declines, or both. He suggests precautionary demand shocks can be interpreted as a shift in the conditional variance, as opposed to the conditional mean, of oil supply shortfalls. Faster growth and higher income are both associated with higher demand for fossil fuel energy today and in the future. This volatility is depicted in the oil price uncertainty index, while increased uncertainty around oil prices may make conflicts more likely to escalate, due to the lack of information about the future value of resources and economic activities (Acemoglu & Robinson, 2005; Ross, 1999; Stern & Kander, 2012; Wrigley, 1990). Natural resources are a mechanism of economic power and any disruption to the supply of resources can precipitate conflict between states. Any controlling relationship (directly or through an alliance) over natural resources, especially oil, affects the balance of economic power directly, and thus uncertainty in oil prices often reflects changes or shifts in power.

Our empirical analysis of oil market uncertainties and conflict is mostly based on the theoretical frameworks of Chassang and Miquel (2010) and Acemoglu et al. (2012), among many other economic theories dealing with conflict. As highlighted in the theoretical work done by Chassang and Miquel (2010), in an incomplete information game where players have different assessments of the environment and fear is a motive for conflict, predatory and preemptive incentives are the determinants of cooperation and conflict. In contrast, in a complete information game, only predatory motives result in conflict incidence.[2] Uncertainty in the value of the payoffs creates strategic uncertainty in equilibrium. The presence of uncertainty in the model maintains both the preemptive and predatory motives for conflict. A volatile oil market signals to the oil-poor state that availability of oil is uncertain, and can eventually lead the oil-poor state to take hostile actions to control the

[1] Responding to increased uncertainty about future oil supply shortfalls or fears about future oil supply shortfalls

[2] In the exit game model, Chassang and Miquel (2010) assigns predatory motives if one player is tempted to attack a peaceful opponent, and preemptive motives if the attack is made to avoid a surprise attack from the opponent.

future supply of oil. Given this situation, the oil-rich state has an incentive to attack preemptively to gain the first-strike advantage and prevent invasion. Thus, uncertainty can push the equilibrium condition towards war and is one of the determinants of conflict. Following Acemoglu et al. (2012) on resource wars, "a key parameter determining the incentives for war is the elasticity of demand". If the resource is inelastic in demand (the elasticity is below one[3]), the probability of conflict incidence rises over time. As the source of the resource is depleted over time, the value of the resource rises, and the oil-poor agent's incentive to incite conflict with the oil-rich agent increases. The elasticity of demand identifies whether the price or the quantity effect dominates in determining the overall value of the resource revenue. If the demand elasticity is lower than 1, the price effect dominates and the overall value of resource consumption escalates. This implies that armed conflict for a scarce, exhaustible and inelastic resource like oil becomes more likely over time. Consequently, Acemoglu et al.'s theoretical analysis on the association of economic factors and resource wars and Chassang and Miquel's theoretical work on uncertainty in the value of resources and conflict escalation provide support for our research on how uncertainty in oil prices causes or relates to militarised conflicts.

This paper pays particular attention to the rise of interstate conflicts in the MENA region, which, in this analysis, includes the following 19 countries: Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, Turkey, United Arab Emirates, and Yemen. The region is the world's richest in oil resources. Oil resources vary from country to country, but proven oil reserves have generally been increasing year after year. The MENA states' economies are heavily dependent on income from energy exports (Cordesman, 1999). Saudi Arabia, Iraq, Iran, United Arab Emirates, Kuwait, Qatar, Algeria, Oman, Egypt, and Libya are the oil producing countries in the region. Jordan, Morocco, Israel, Lebanon, Bahrain, Turkey, Tunisia, Yemen, and Syria do not produce significant amounts of oil. Saudi Arabia, Iraq, Iran, United Arab Emirates, Kuwait, Algeria, and Libya are OPEC (Organization of Petroleum Exporting Countries) members; the others are not. According to the British Petroleum Statistical Review of World Energy, 51.4% of world oil reserves are located in the MENA region and 37.6% of world oil is produced there.[4] There have been multiple military conflicts in the MENA region and its

[3]Findings (e.g. Gately and Huntington (2002); Pesaran et al. (1998)) on the elasticity of oil demand shows an approximation between 0.01 and 0.1 which categorises oil fields as inelastic demand resources.

[4]To see the statistics refer to https://www.bp.com

neighbours that suggest a relationship between armed conflict and oil production. The most well known of these conflicts include the Iran-Iraq war, Gulf war, U.S. invasion of Iraq, Russian military intervention in Ukraine, and coalition intervention in Syria.

Our results indicate that the variables of oil price uncertainty and conflict incidence in the MENA region affect each other; however the effect of conflict on oil price uncertainty is contemporaneous while only long-term uncertainties in oil prices affect the incidence of conflict in MENA states. Moreover, when we broke down the results by OPEC and non-OPEC members, we found that oil price uncertainty significantly increases the incidence of conflict in non-OPEC MENA states, while the relationship is not statistically significant for OPEC members located in the MENA region. However, long-term uncertainties affect OPEC members' involvement in conflicts as well.

This paper contributes to three strands of literature. First, it adds an analysis of the economic causes of war (Fearon (1995); Levy and Thompson (2011)): we provide an empirical investigation of the occurrence of armed conflict in MENA countries. Second, our study contributes to the analysis of interstate conflicts over natural resources and studies of war at the systematic and international level. We empirically analyse the impact of the global energy market on the incidence of interstate war. Various studies have addressed the impact of the presence of natural resources and oil rents on civil (intrastate) conflict (Collier & Hoeffler, 2005; Fearon, 2005; Ross, 2003a, 2004, 2003b; Arbatli et al., 2015).[5] However, even though the market for oil is global, limited research has been done on the relationship between natural resources and conflict at the interstate level. Our objective in this analysis is to contribute to the study of war as part of the international system. Finally, our research contributes to the analysis of conflict in the MENA region specifically. According to the World Bank, the region has experienced a dramatic increase in violence during recent years (Devarajan, 2016).

The rest of the paper is organised as follows. Section 2.2 presents our data and methodology. Section 2.3 describes our results and Section 2.4 describes our robustness checks. Section 2.5 concludes with policy implications.

[5]Other studies in this category include: Brunnschweiler and Bulte (2009); Montalvo and Reynal-Querol (2005); Cotet and Tsui (2013); Koubi et al. (2014)

2.2 Data and Methodology

In this section we establish a dynamic empirical framework to analyse the effects of oil market uncertainty on inter-state conflict incidence. Our focus is on the MENA region's interstate conflicts. The states in this set are heterogeneous in terms of their oil market characteristics as well as their attitude toward conflict involvement. We also consider developing different dynamic models to determine whether today's energy market instability causes high oil prices or conflicts in the future.

As noted above, work by Barsky and Kilian (2004) challenges the conventional wisdom that political events in the Middle East are the main driver of increases in oil prices. However, one cannot ignore the effect of supply shocks on oil prices. We examine the direct effects of oil price uncertainty on the incidence of conflict by utilising a general empirical model that simultaneously estimates the parameters of interest in a dynamic fashion, allowing for both channels of transmission.

We develop our empirical analysis based on monthly frequency data from two main databases. The first, on conflict, is the Militarized Interstate Disputes (MID) dataset of Palmer, dOrazio, Kenwick, and Lane (2015), which defines all interstate conflicts in the period 1816-2010. We use MID to obtain interstate conflicts in the 19 countries in MENA which we defined before. Because of constraints on data available for other variables, we use an observation period of January 1973 to December 2010, giving us a sample size of 456 months. The second dataset concerns oil prices. We use monthly data for the West Texas Intermediate (WTI) price of oil (Dollars per Barrel) from the Macro Trend Dataset[6]. We use also daily price variations in WTI spot prices taken from the U.S. Energy Information Administration dataset.The former cover the entire period 1973-2010, and the latter start in 1986, thus reducing the sample size to 300 months. Table 2.1 shows the descriptive statistics for the variables used in this analysis. Figure 2.1 and Figure 2.2 provide insight of the main time series of conflict and oil price uncertainties for the period of January 1973 to December 2010.

As a proxy for oil demand and a global control variable, we adopt Kilian's index of economic activity dataset (Kilian, 2009). In our empirical analysis, we also consider the changes in the oil quantity by including different time series of oil production and consumption as control variables. Information on global oil production and oil consumption are taken from the U.S. Energy Information Administration. A weighted average of the foreign exchange

[6]https://www.macrotrends.net/1369/crude-oil-price-history-chart

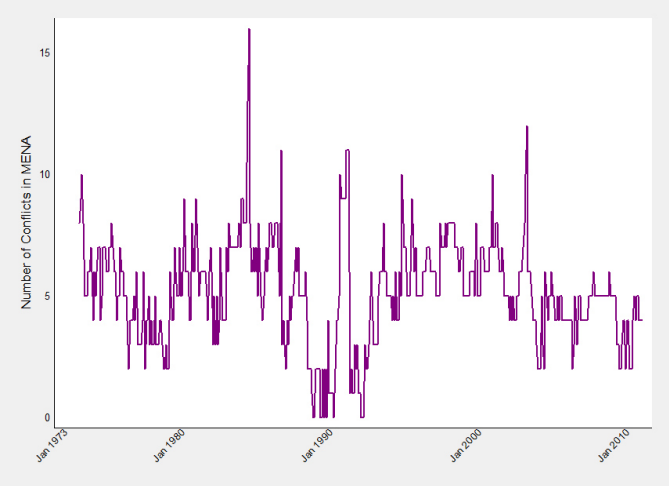

Figure 2.1: Conflict in MENA

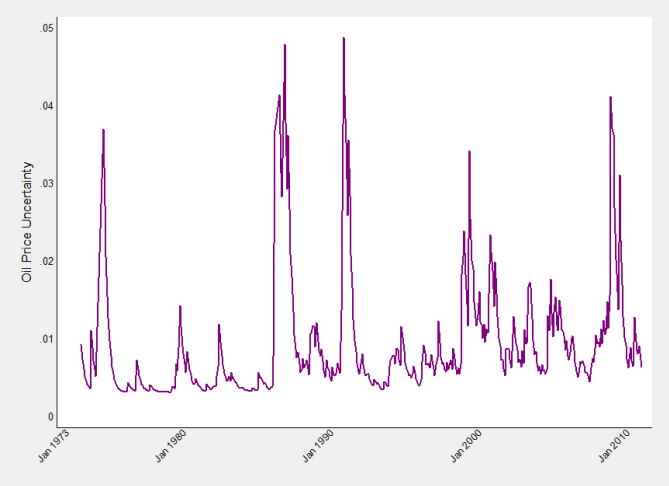

Figure 2.2: Uncertainty of oil prices

Table 2.1: Descriptive Statistics

Variables	Sample	Mean	Std Dev	Min	Max
	1973M01-2010M12				
Oil price return	456	0.005	0.09	-0.381	0.844
Conflict	456	0.262	0.20	0	1
Economic activity	456	4.096	26.32	-56.10	74.16
Industrial production	456	1357.352	274.91	915.64	1905.54
World countrig growth	456	1.236	125.83	-554	264
U.S. Dollar	456	0.144	1.07	-4.00	6.69
Production growth	456	0.008	0.01	-0.094	0.067
Consumption growth	456	0.007	0.03	-0.115	0.152
	1986M01-2010M12				
Daily oil price return	7,944	0.002	1.14	-0.333	0.211
conflict	300	0.297	0.22	0	1
Economic activity	300	4.491	25.50	-56.10	66.36
Industrial production	300	1513.936	199.86	1179.59	1905.54
World count rig growth	300	-1.073	115.84	-537	264
U.S. Dollar	300	0.115	1.24	-4.00	6.69
Production growth	300	0.001	0.01	-0.068	0.046
Consumption growth	300	0.001	0.03	-0.100	0.104

value of the U.S. dollar (USD) against the currencies of a broad group of major U.S. trading partners is captured from the Federal Reserve Bank of Saint Louis dataset[7]. Finally, rig count data as an exogenous proxy for oil production is captured from the Baker Hughes dataset[8].

In the remaining part of this section, we explain our empirical strategies, starting with the definition of the variables we consider. In particular, we explain how we build the conflict variable (Section 2.2.1) and uncertainty in oil price variable (Sections 2.2.2). Then, we introduce the dynamic models identifying the parameters of interest.

2.2.1 Conflict Variable

We build a conflict indicator by starting with a dummy variable C_{it} which is defined on a monthly frequency for the period January 1973 to December 2010 for each of the 19 countries in the MENA region. The dummy variable takes a value equal to 1 if there is a conflict in the specific month and 0 otherwise. The MID database includes daily data, defining a starting and finishing day for each conflict. Our dummy works on a monthly basis,

[7]https://fred.stlouisfed.org/series/TWEXBMTH

[8]http://phx.corporate-ir.net/phoenix.zhtml?c=79687p=irol-rigcountsoverview

assigning a value of 1 to the month if there exists at least one day of conflict within the month. The cumulative variable for all countries in the region is:

$$CI_t = \sum_{i=1}^{I} \omega_i c_{it} \tag{2.1}$$

where ω_i is the share of oil production for country i among the 19 countries under study, to give higher weight to conflicts that arise in major oil producing countries. We then proceed to the standardisation of our target variable in:

$$SCI_t = \frac{CI_t - min(CI_t)}{max(CI_t) - min(CI_t)} \tag{2.2}$$

where SCI_t is the standardised measure of the cumulative variable of conflict in the MENA region.

2.2.2 Uncertainty of Oil Price Variable

We use the two following approaches to derive uncertainty measures for oil prices: First, we build the proxy for uncertainty by estimating, on monthly oil price returns, a conditional variance model belonging to the GARCH family. Our uncertainty measure is

$$v_t = \sigma_t^2 \tag{2.3}$$

where v_t is our first proxy for the oil price uncertainty, σ_t^2 is the GARCH estimation on monthly oil returns, captured by means of Bollerslev (1986) Generalized Autoregressive Conditional Heteroskedasticity, GARCH(1,1). This model imposes serial dependence on the conditional variance of the oil price returns. The variance evolves as follows:

$$\varepsilon_t = z_t \sigma_t \tag{2.4}$$

$$\sigma_t^2 = \kappa + G_1 \sigma_{t-1}^2 + A_1 \varepsilon_{t-1}^2 \tag{2.5}$$

where ε_t is oil price returns, σ_t^2 the conditional variance, z_t a standardised error term, κ a constant, G_1 the GARCH coefficient, and A_1 the ARCH coefficient with $\kappa > 0$, $G_1 > 0$, $A_1 > 0$ and $A_1 + G_1 < 1$. Elder and Serletis (2010) adopts this measure for oil price uncertainty. They find that uncertainty surrounding oil prices has a negative and significant effect on real gross domestic product (GDP), durables consumption, and on several components of fixed investment and industrial production. By assumption, in

the GARCH model σ_t^2 responds symmetrically to both positive and negative deviations from the mean. In reality, a negative deviation from the mean of oil prices likely affects the incidence of conflict by a different magnitude than a positive deviation from the mean. So, we adopt the Exponential GARCH (EGARCH) model of Nelson (1991), which imposes a leverage effect and thus varies the impact of shocks depending on their sign. The EGARCH model is given by:

$$log(\sigma_t^2) = \kappa + \beta_1 z_{t-1} + \beta_2 log(\sigma_{t-1}^2) + \gamma \mid z_{t-1} \mid \xi_{t-1}^2 \tag{2.6}$$

where z_t is the innovation term which is obtained as the ratio between ε_t and σ_t, the coefficient β_1 captures the asymmetric effect of a negative shock on the conditional variance as opposed to a positive shock, γ monitors the lagged impact of shocks, and β_2 is the GARCH parameter.

Our second uncertainty proxy builds on daily frequency data from January 1, 1986 to December 31, 2010. In this case, we use the Realised Volatility (RV) estimator, corresponding to the summation of intra-period squared returns (Anderson, Bollerslev, & Meddahi, 2004). To derive an index for monthly oil price uncertainty we average the daily squared returns of oil prices for the whole month. The global oil market is not open all days during the month (it closes on weekends and some holidays) so the number of open days varies between months. Accordingly, we define v_t as follows:

$$v_t = \frac{1}{m} \sum_{j=1}^{m} r_{t,j}^2 \tag{2.7}$$

where v_t is a measure of oil price uncertainty, $r_{t,j}^2$ the daily squared returns of real oil prices and m the open market days within a given the month t (Guo, Kliesen, et al., 2005).

2.2.3 Dynamic Modelling of Uncertainty and Conflicts

Our empirical methodology is based on a bivariate monthly Structural Vector Autoregressive model, SVAR, which takes into consideration conflicts occurring in the MENA region as well as the uncertainty of oil's real price. This model enables us to understand the interaction between conflicts and energy markets. The relationship between oil prices and conflict incidence remains a matter of concern in quantitative literature, as it cannot be addressed using a regression model. Hence, a novelty of our analysis is the use of an autoregressive model to allow for endogenous oil price shocks as well as to take into account the dynamics of the variables of interest.

The general SVAR model is

$$AY_t = M + \sum_{j=1}^{p} \Phi_j Y_{t-j} + \Gamma X_t + \varepsilon_t \tag{2.8}$$

where A is the $K \times K$ structural matrix; Y_t is the $K \times 1$ vector of responses; M a $K \times 1$ vector of constants; Φ_j are matrices of coefficients of lagged values; and X_t are control variables that include Kilian's index of economic activity as a measure of oil demand globally, the weighted average of the foreign exchange value of the U.S. Dollar (to capture the effect of changes in exchange rates on oil prices), and industrial production of the OECD countries (as a measure of oil demand in industrial countries). We control for U.S. oil consumption as the U.S. is the top global consumer of oil for the period studied. We also control for the number of oil rigs operating globally as a measure of supply in the oil market. Finally, ε_t is the structural shock, which is assumed to be $I.I.D$ with mean zero and variance-covariance matrix of Σ. To determine the order p of the model, a Bayesian Information Criteria (BIC) is used. BIC is a criterion for model selection among a finite set of models. It is based, in part, on the likelihood function. Selection is based on the minimum value of the BIC. In our model, the minimum values belong to SVAR(1) for both measures of uncertainty of oil prices. Thus, we set $p = 1$ for all the following equations and analysis.

As discussed in Kilian (2011), the structural representation in Equation (2.8) needs an additional restriction for identification. We consider a short-run identification restriction in which we restrict the contemporaneous effects to only one of the response variables. We assume that conflict in MENA affects the uncertainty of oil prices contemporaneously [9]. However, we assume a lagged effect of oil price uncertainty (v_t) on conflict (SCI_t). Our assumption is based on consideration of the reality of starting an armed conflict. Because the economic, political and human cost of beginning an armed conflict is high, decision makers are likely to take such actions slowly and only after being presented with sufficient evidence. The resulting structural relationship between oil price uncertainty and conflict is identified in Equation 2.9:

$$\begin{bmatrix} 1 & 0 \\ \alpha & 1 \end{bmatrix} \begin{bmatrix} SCI_t \\ v_t \end{bmatrix} = \begin{bmatrix} \mu_c \\ \mu_v \end{bmatrix} + \begin{bmatrix} \varphi_{11} & \varphi_{12} \\ \varphi_{21} & \varphi_{22} \end{bmatrix} \begin{bmatrix} SCI_{t-1} \\ v_{t-1} \end{bmatrix} + \Gamma X_t + \begin{bmatrix} \varepsilon_{ct} \\ \varepsilon_{vt} \end{bmatrix} \tag{2.9}$$

[9] Note that Barsky and Kilian (2004) does not recognise this plausibility and his work can help us to solve the reverse causality problem in our model.

where SCI_t and v_t are, respectively, the conflict and uncertainty of oil prices variables at time t, in vector of responses, μ_c and μ_v are two constants and φ_{ij}, for $i, j \in \{1, 2\}$, are elements of the lagged values coefficients matrix. The estimated structural parameters are shown in Table 2.3. These results confirm our assumptions regarding the relationship between conflict and oil price uncertainty. In the next Section 2.3 those results will be discussed more in detail.

To estimate the SVAR model in Equation 2.8, we derive the reduced form model as depicted in Equation 2.10

$$Y_t = A^{-1}M + A^{-1}\Phi Y_{t-1} + A^{-1}\Gamma X_t + A^{-1}\varepsilon_t \tag{2.10}$$

where A is the structural matrix that contains α. This reduced form can be rewritten as

$$Y_t = \bar{M} + \Pi Y_{t-1} + \Psi X_t + \eta_t \tag{2.11}$$

where $\bar{M}$ is equal to $A^{-1}M$, Π is $A^{-1}\Phi$, Ψ is $A^{-1}\Gamma$ and η_t is $A^{-1}\varepsilon_t$.

2.2.4 The Vector Heterogeneous Autoregressive Model (VHAR)

To estimate the reduced form of our structural model, we employ the Vector Heterogeneous Autoregressive (VHAR) model, a flexible method to describe nonlinearities and long-range dependence in time series dynamics. Corsi (2009) suggests the VHAR model to describe asymmetric propagation of volatility between long and short time horizons. Our model specifications are as follows:

$$Y_t = \bar{M} + \Phi^{m} Y_{t-1m}^{m-1} + \Phi^{semiann} Y_{t-1m}^{semiann} + \Phi^{ann} Y_{t-1m}^{ann} + \Psi X_t + \eta_t \tag{2.12}$$

where m,$semiann$, and ann denote time horizons of one month, six months and one year, respectively.[10] There are also control variables as listed above: index of economic activity, trade-weighted U.S. Dollar index, OECD oil consumption, industrial production, and world rig count, which all work the same way as in the SVAR model.

[10] Basically *semiann* and *ann* response variables refer to the following components

$$Y_t^{semiann} = \frac{1}{6}\sum_{j=0}^{5} Y_{t-jm}^{(m)} \tag{2.13}$$

$$Y_t^{ann} = \frac{1}{12}\sum_{j=0}^{11} Y_{t-jm}^{(m)} \tag{2.14}$$

Once the reduced-form VAR and VHAR are estimated by maximum likelihood, dynamic time profile and the impacts of the shocks on response variables can be examined using Impulse Response Functions (IRFs). We use IRFs up to 20 lags and we also compute bootstrapped confidence intervals.

2.3 The Impact of Oil Price Uncertainty on Conflict

First, as required to have a consistent VAR estimation, we check that the time series are stationary (Elliott, Rothenberg, & Stock, 1992). Non-stationary time series lead to spurious regression and biased estimated parameters. The most common method to make the series stationary is first order differencing, or using growth rates of the variables. The standard unit root tests, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) are used to examine the stationary for all variables and the outcomes are presented in Table 2.2. Mostly level series are not stationary, hence a stationary test in first differences is conducted. The unit root test indicates that the "Conflict" variable and the uncertainty of oil prices variables ("EGARCH" and "Realized volatility") are stationary at level and the null hypothesis of a unit root in first order differences are rejected for all variables at 99% significance level. We conclude that the two response variables, conflict and oil price uncertainty, are stationary at level and all the other variables are first order stationary. We also recall that we use BIC to choose the optimal lag structure of the model.

The SVAR results in Table 2.3 inform us that the model we fit to constrain the contemporaneous effect of our response variables is just identified. The estimates of α are negative. Because the off-diagonal elements of the A matrix contain the negative of the actual contemporaneous effects, the estimated effects are positive, as expected. When the model is just identified, the SVAR parameter estimates can be computed via a transform of the VAR estimates. Precisely, we can think of the reduced-form VAR model as representing data generated from the structural VAR model.

Finally, the VAR estimation results, along with the Z-statistics, are presented in Table 2.4. First, our results confirm that the oil production indexes ("Production", "World count rig") are statistically significant with the expected sign in the "Oil price uncertainty" panel. This supports our hypothesis that higher oil production makes the market for oil more secure and less concerned about supply disruption, and eventually decreases oil price uncertainty. Regarding the variables of interest, the coefficient of oil price uncertainty in its first lag is positive and statistically significant in both of our models' estimations (as depicted in the "Oil price uncertainty lag(1)" in

Table 2.2: Unit Root Test Results

Unit root test	ADF		PPERON	
Variables	Level	First diff	Level	First diff
Oil price	-1.86	-18.75***	-2.36	-18.67***
EGARCH	-18.59***	-36.48***	-18.92***	-52.93***
Realized volatility	-35.48***	-42.30***	-27.32***	-61.42***
Conflict	-8.75***	-7.30***	-8.78***	-28.77***
Economic activity	-2.56	-3.73***	-3.04	-14.36***
Industrial production	-0.94	-23.96***	-0.98	-24.06***
World count rig	-1.24	-11.61***	-1.78	-11.17***
U.S. Dollar	-1.35	-14.29***	-1.22	-14.16***
Production	-1.15	-23.25***	-0.77	-23.93***
Consumption	-4.03***	-28.93***	-3.16	-30.97***

The table reports the Z-statistics of the ADF and PP unit root tests. Automatic selection criteria for the specication of the test equation (in terms of deterministic components and lag structure) is used. *** significance according to p-values at 1%

Table 2.3: SVAR Estimation for Two Measures of Volatility

Structural Parameter	α	σ^2_{CI}	σ^2_v
SVAR in EGARCH model	-0.0007*	0.1392*	0.0042*
SVAR in Realized Volatility model	-0.0002*	0.1481*	0.0008*

α is the structural parameter showing the contemporaneous effect of conflict on oil price uncertainty, $\sigma^2_{CI.t}$ and $\sigma^2_{v.t}$ are the structural shocks of conflict and uncertainty of oil price respectively. * Significant at 5%

the upper-right and upper-left panels of Table 2.4) of the conflict response variable. Also, the coefficient of the first lag of conflict ("Conflict lag(1)") is positive and significant in both models (as depicted in the "Conflict lag(1)" in the lower-right and lower-left panels of Table 2.4). Thus, model estimation coefficients suggest that oil price uncertainty and conflict incidence affect each other, as expected. In the VAR model, as shown in Equation 2.11, all response variables affect each other, both through the shocks they can generate as well as through dynamic interaction among the variables (i.e. through the lags of the VAR model). To observe such dynamics, the Impulse Response Functions (IRF) are depicted in Figures 2.3 and 2.4.

A positive oil price uncertainty shock leads to a positive response from the conflict index (i.e. an increase in conflict incidence) in both models (upper-right panel in Figure2.3 and 2.4). However, conflict shocks do not trigger a clear response from the oil price uncertainty index in the EGARCH model (lower-left panel in Figure 2.3 and 2.4). As observable in the upper-right panels of the IRFs in Figure 2.3 and 2.4, the responses are maximised at around month 5 to 6. This is our main motivation to enhance the VAR to VHAR models, as discussed before in Section 2.2.4. The VHAR model estimation helps us gain an effective understanding of the model's dynamic by adding 6-month and 12-month average components of the two response variables. These additional components lead to a VAR-type model with the feature of considering uncertainties realised over different time horizons. In Table 2.5, the semiannual variable of uncertainty (as depicted in "6-month oil price uncertainty" in the upper-left and upper-right panel) is positive and statistically significant: this shows that oil price uncertainty over a 6-month time horizon has a meaningful effect on conflict incidence. The results of VHAR are illustrated in Table 2.5.

Interestingly, in Table 2.5, the effect of conflict on oil price uncertainty is almost contemporaneous, as seen in the coefficient of "Conflict lag(1)" in the "Oil price uncertainty" panel, while the effect of oil price uncertainty on conflict is significant in the lagged variables "6-month oil price uncertainty" and "Annual oil price uncertainty". Hence the effect of oil price uncertainty on conflict incidence appears over the long term rather than as a short term lag. This is also confirmed in the IRFs as shown in Figure 2.5.

In addition, Table 2.3 confirms the intuition behind the VHAR results in the structural parameter estimation. In Section 2.2.3, we used this logic to identify the structural model. The structural parameter estimation, shown in Table 2.3, confirms the contemporaneous effect of conflict on oil price uncertainty measures.

Table 2.4: VAR(1), EGARCH and Realized Volatility Models

EGARCh model		**Realized volatility model**	
Response variable		Response variable	
Conflict	Coef.	Conflict	Coef.
Conflict lag(1)	0.707***	Conflict lag(1)	0.736***
	(20.96)		(18.82)
Oil price uncertainty lag(1)	1.787**	Oil price uncertainty lag(1)	1.780*
	(2.20)		(2.44)
Economic activity	0.001	Economic activity	0.003
	(0.69)		(0.30)
U.S. Dollar	0.002	U.S. Dollar	0.007*
	(0.58)		(1.68)
Industrial production	0.000	Industrial production	-0.319
	(0.40)		(-0.15)
World countrig	-0.000	World countrig	-0.008
	(-0.56)		(-0.12)
Consumption	0.410**	Consumption	0.515*
	(2.09)		(1.81)
Production	0.545	Production	0.084
	(0.96)		(1.00)
Response variable		Response variable	
Uncertainty of oil price	Coef.	Uncertainty of oil price	Coef.
Conflict lag(1)	0.003*	Conflict lag(1)	0.005***
	(1.73)		(2.62)
Oil price uncertainty lag(1)	0.087***	Oil price uncertainty lag(1)	0.086***
	(39.36)		(3.61)
Economic activity	0.004*	Economic activity	0.011*
	(1.82)		(1.74)
U.S. Dollar	-0.006**	U.S. Dollar	-0.002
	(-2.28)		(-0.73)
Industrial production	0.035***	Industrial production	0.012***
	(2.64)		(3.83)
World countrig	-0.042***	World countrig	-0.021***
	(-2.72)		(-4.60)
Consumption	0.004	Consumption	-0.161
	(0.60)		(-0.90)
Production	-0.022*	Production	-0.007*
	(-1.92)		(-1.66)

Left panel describes the estimation for our measure of uncertainty based on EGARCH and right panel the measure of uncertainty based on Realized Volatility. In round brackets (z-statistics) are reported. *, **, *** are statistically significant at 10%, 5%, and 1% confidence levels, respectively.

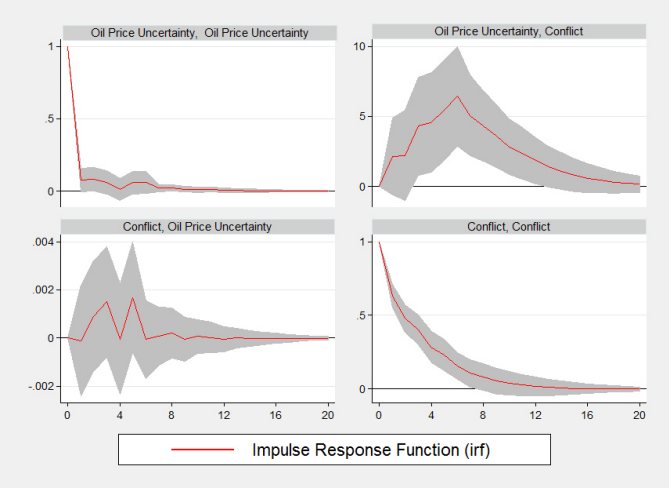

Figure 2.3: Impulse responses for EGARCH model
-The upper-right panel shows the effect of uncertainty shocks on conflict incidence, while the lower-left panel shows the reverse effect: that of conflict shocks on oil price uncertainty. The shaded area represents the 90% condence interval.

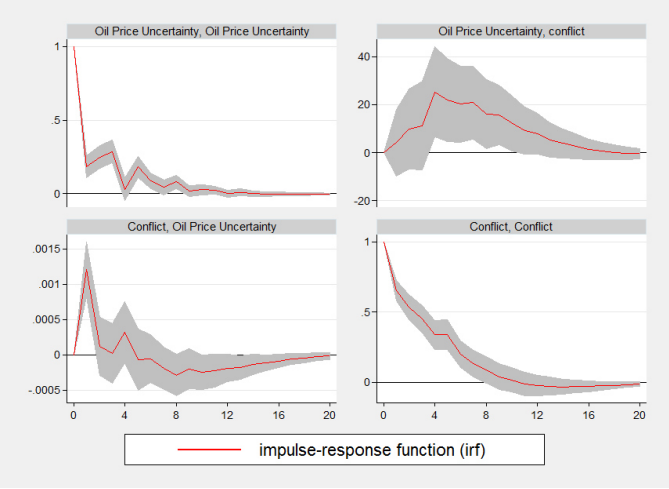

Figure 2.4: Impulse responses for Realized Volatility(RV) model
-The upper-right panel shows the effect of oil price uncertainty shocks on conflict incidence, while the lower-left panel shows the reverse effect: that of conflict shocks on oil price uncertainty. The shaded area represents the 90% condence interval.

Table 2.5: VHAR(1), EGARCH and Realized Volatility Models

EGARCh model		**Realized volatility model**	
Response variable		Response variable	
Conflict	Coef.	Conflict	Coef.
Conflict lag(1)	0.355***	Conflict lag(1)	0.360***
	(6.47)		(5.53)
Oil price uncertainty lag(1)	0.265	Oil price uncertainty lag(1)	0.157
	(0.33)		(0.65)
6-month conflict	0.755**	6-month conflict	0.828*
	(2.23)		(1.72)
6-month oil price uncertainty	0.734**	6-month oil price uncertainty	0.832**
	(2.25)		(2.18)
Annual conflict	0.355*	Annual conflict	0.462*
	(1.66)		(1.82)
Annual oil price uncertainty	0.695***	Annual oil price uncertainty	0.191***
	(4.72)		(3.29)
Economic activity	0.009	Economic activity	0.003
	(0.85)		(0.29)
U.S. Dollar	0.001	U.S. Dollar	0.004
	(0.31)		(0.18)
Industrial production	0.001	Industrial production	0.000
	(0.23)		(0.16)
World countrig	0.000	World countrig	0.000
	(0.12)		(0.63)
Consumption	0.185*	Consumption	0.312*
	(1.65)		(1.78)
Production	0.595	Production	0.398
	(0.91)		(0.84)
Response variable		Response variable	
Uncertainty of oil price	Coef.	Uncertainty of oil price	Coef.
Conflict lag(1)	0.001**	Conflict lag(1)	0.001***
	(1.96)		(3.86)
Oil price uncertainty lag(1)	0.636***	Oil price uncertainty lag(1)	0.077**
	(12.29)		(2.52)
6-month conflict	0.001	6-month conflict	0.001
	(0.08)		(0.08)
6-month oil price uncertainty	0.461*	6-month oil price uncertainty	0.362*
	(1.66)		(1.78)
Annual conflict	0.002	Annual conflict	0.004
	(0.24)		(0.67)
Annual oil price uncertainty	0.235*	Annual oil price uncertainty	0.228*
	(1.70)		(1.65)
Economic activity	0.006***	Economic activity	0.008*
	(3.12)		(1.73)
U.S. Dollar	-0.003**	U.S. Dollar	-0.003*
	(-2.38)		(-1.70)
Industrial production	0.000	Industrial production	0.000
	(1.03)		(0.54)
World countrig	0.000	World countrig	0.000
	(1.18)		(1.57)
Consumption	0.003	Consumption	0.000
	(0.43)		(0.96)
Production	0.545*	Production	0.084*
	(1.72)		(1.91)

Left panel describes the estimation for our measure of uncertainty based on EGARCH and right panel the measure of uncertainty based on Realized Volatility. "6-month oil price uncertainty" is the latest 6-month average of oil price uncertainty measures in both panels. "Annual oil price uncertainty" is the latest 1-year average of the oil price uncertainty measures in both panels. In round brackets (z-statistics) are reported. *, **, *** are statistically significant at 10%, 5%, and 1% confidence levels respectively.

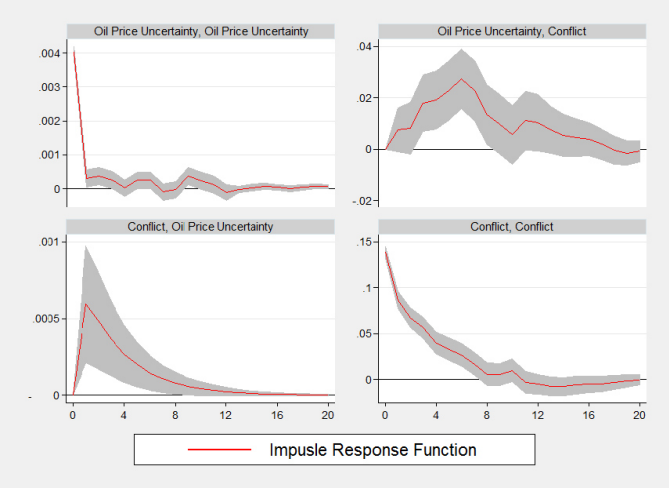

Figure 2.5: Impulse responses of VHAR
-The upper-right panel shows the effect of oil price uncertainty shocks on conflict incidence, while the lower-left panel is shows the reverse effect: that of conflict shocks on oil price uncertainty. The shaded area represents the 90% condence interval.

In the MENA region, Qatar, Oman, Egypt, Algeria, Libya, Iraq, Kuwait, United Arab Emirates, Iran, and Saudi Arabia (= 10 countries) belong to OPEC. OPEC is a powerful organisation with the ability to affect oil prices as well as to anticipate their direction, and thus membership in OPEC has potential to modify the relationship between oil prices and political stability. Accordingly, we decompose the VHAR model for OPEC and Non-OPEC member states of the MENA region. Results are shown in Table 2.6 and 2.7. The results show that increasing uncertainty surrounding oil prices has a significant effect on conflict incidence in Non-OPEC countries, while its effect in OPEC member states is not significant. To rationalise these findings, we argue that the OPEC cartel is successful at dampening the negative externalities of oil price uncertainty on its members, while their non-member neighbours in the MENA region suffer from the negative effects of oil price fluctuations. However, persistent oil price uncertainty can eventually affect OPEC members as well, as seen in the 6-month and 12-month uncertainty coefficients in the OPEC panel in Tables 2.6 and 2.7. Figures 2.6 and 2.7 show impulse response functions for these estimations. They confirm that positive conflict shocks in OPEC states affect oil price uncertainty immediately (lower-left panel of Figure 2.6), while conflicts starting in non-OPEC

countries do not have a significant effect on oil price uncertainty (lower-left panel of Figure 2.7). This mirrors oil market concerns about an OPEC supply shock. Conversely, oil price uncertainty shocks significantly affect the incidence of conflict in non-OPEC members (upper-right panel of Figure 2.7) but have a negligible effect of conflict incidence in OPEC member states (upper-right panel of Figure 2.6).

2.4 Robustness Checks

In this section we exploit different time series available from other datasets to perform some robustness checks of our model.

Different Conflict Variable: The Uppsala Conflict Data Program (UCDP) provides another dataset widely used to track the occurrence of conflict. The UCDP/PRIO Armed Conflict Dataset reports on conflicts where at least one of the antagonists is a state. We screened this dataset to find conflicts in the MENA region where both sides are states, and re-ran our analysis using this dataset. The results are consistent with those obtained using the Militarized Interstate Disputes (MID) dataset and show a positive relationship between oil price uncertainty shocks and conflict incidence. The impulse response functions from this test are illustrated in Figure 2.8.

Different Global Oil Price Index: Kilian (2009) uses a real oil price series based on the refiner acquisition cost of imported crude oil, which is provided by the U.S. Department of Energy, deflated by the U.S. Consumer Price Index (CPI). Using this index of oil prices in our model, significance and results are substantially equivalent to those obtained using WTI oil prices. The results of this test are shown in Figure 2.9.

Table 2.6: VHAR(1), EGARCH, OPEC and non-OPEC

EGARCh model		**Realized volatility model**	
Response variable		Response variable	
Conflict in OPEC	Coef.	Conflict in Non-OPEC	Coef.
Conflict lag(1)	0.626*	Conflict lag(1)	0.515*
	(1.82)		(1.91)
Oil price uncertainty lag(1)	0.154	Oil price uncertainty lag(1)	0.215**
	(0.53)		(2.36)
6-month conflict	0.237*	6-month conflict	0.167
	(1.71)		(0.52)
6-month oil price uncertainty	0.083	6-month oil price uncertainty	0.370*
	(0.68)		(1.85)
Annual conflict	-0.206*	Annual conflict	0.141∗
	(1.68)		(1.74)
Annual oil price uncertainty	0.147*	Annual oil price uncertainty	0.017*
	(1.93)		(1.71)
Economic activity	0.000	Economic activity	0.000
	(0.23)		(0.17)
U.S. Dollar	0.001	U.S. Dollar	0.000
	(0.29)		(0.03)
Industrial production	0.001	Industrial production	0.000
	(0.48)		(1.23)
World countrig	0.000	World countrig	0.001**
	(0.14)		(2.48)
Consumption	0.684	Consumption	0.025
	(0.28)		(1.30)
Production	0.000	Production	0.015
	(0.95)		(0.35)
Response variable		Response variable	
Uncertainty of oil price	Coef.	Uncertainty of oil price	Coef.
Conflict lag(1)	0.011***	Conflict lag(1)	0.001
	(3.87)		(1.23)
Oil price uncertainty lag(1)	0.833***	Oil price uncertainty lag(1)	0.858***
	(19.87)		(20.46)
6-month conflict	-0.012	6-month conflict	0.022
	(0.29)		(-0.13)
6-month oil price uncertainty	0.108*	6-month oil price uncertainty	0.081
	(1.82)		(1.19)
Annual conflict	0.008	Annual conflict	0.011
	(0.39)		(0.32)
Annual oil price uncertainty	-0.171**	Annual oil price uncertainty	-0.102**
	(-2.42)		(-2.10)
Economic activity	0.005*	Economic activity	0.000
	(1.77)		(1.59)
U.S. Dollar	0.004**	U.S. Dollar	0.004**
	(2.78)		(2.42)
Industrial Production	0.003**	Industrial Production	0.003**
	(2.80)		(2.59)
World countrig	-0.003***	World countrig	-0.003***
	(-2.58)		(-2.62)
Consumption	0.302	Consumption	0.259
	(0.56)		(0.70)
Production	-0.004**	Production	-0.004**
	(-1.98)		(-2.39)

Left panel shows the estimation of EGARCH model for OPEC member countries while right panel indicates the same model for non-OPEC members. In round brackets (z-statistics) are reported. *, **, *** are statistically significant at 10%, 5%, and 1% confidence levels respectively.

Table 2.7: VHAR(1), Realized Volatility, OPEC and Non-OPEC

EGARCh model		**Realized volatility model**	
Response variable		Response variable	
Conflict in OPEC	Coef.	Conflict in Non-OPEC	Coef.
Conflict lag(1)	0.061*	Conflict lag(1)	0.038*
	(1.68)		(1.66)
Oil price uncertainty lag(1)	4.599	Oil price uncertainty lag(1)	-2.268*
	(0.71)		(0.65)
6-month conflict	0.352*	6-month conflict	0.163
	(1.72)		(0.74)
6-month oil price uncertainty	0.072	6-month oil price uncertainty	0.326*
	(0.73)		(1.68)
Annual conflict	-0.397*	Annual conflict	-0.583*
	(1.82)		(1.95)
Annual oil price uncertainty	0.167*	Annual oil price uncertainty	0.029*
	(1.72)		(1.85)
Economic activity	-0.005	Economic activity	-0.009
	(0.28)		(0.18)
U.S. Dollar	0.001	U.S. Dollar	-0.003
	(0.62)		(0.57)
Industrial Production	0.001	Industrial Production	0.000
	(085)		(0.43)
World countrig	0.000	World countrig	0.000
	(0.25)		(0.75)
Consumption	0.125	Consumption	0.387
	(0.57)		(0.28)
Production	0.000	Production	0.0282
	(0.96)		(0.55)
Response variable		Response variable	
Uncertainty of oil price	Coef.	Uncertainty of oil price	Coef.
Conflict lag(1)	0.006**	Conflict lag(1)	0.002
	(2.45)		(0.97)
Oil price uncertainty lag(1)	0.008***	Oil price uncertainty lag(1)	0.076***
	(14.25)		(11.78)
6-month conflict	-0.001	6-month conflict	-0.007
	(-0.25)		(-0.58)
6-month oil price uncertainty	0.326*	6-month oil price uncertainty	0.175*
	(1.68)		(1.73)
Annual conflict	-0.001	Annual conflict	-0.032
	(-0.56)		(0.35)
Annual oil price uncertainty	-0.208*	Annual oil price uncertainty	-0.344*
	(-1.89)		(-1.69)
Economic activity	-0.007*	Economic activity	-0.005*
	(1.74)		(1.91)
U.S. Dollar	0.004***	U.S. Dollar	0.005***
	(2.82)		(2.54)
Industrial Production	0.001**	Industrial Production	0.003***
	(2.23)		(2.84)
World countrig	-0.006**	World countrig	-0.009*
	(-2.47)		(-1.67)
Consumption	0.659	Consumption	0.249
	(0.54)		(0.74)
Production	-0.047*	Production	-0.024*
	(-1.67)		(-1.79)

Left panel shows the estimation of Realized Volatility model for OPEC member countries while right panel indicates the same model for non-OPEC members. In round brackets (z-statistics) are reported. *, **, *** are statistically significant at 10%, 5%, and 1% confidence levels respectively.

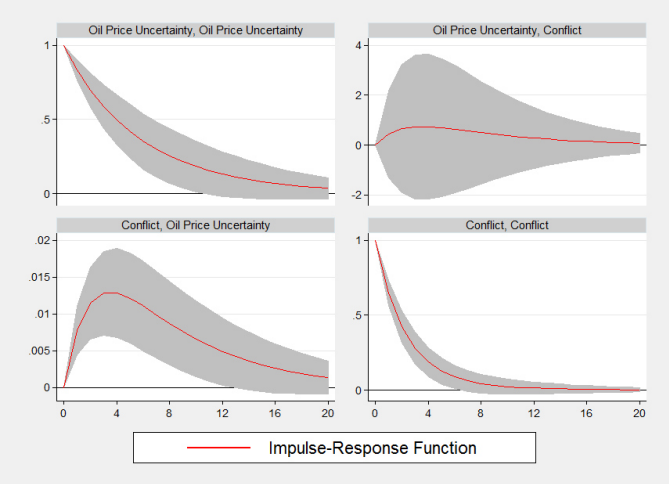

Figure 2.6: IRFs of VHAR, OPEC members

- The upper-right panel shows the effect of oil price uncertainty shocks on conflict incidence in OPEC member states, while the lower-left panel shows the impact of conflict shocks on oil price uncertainty. The shaded area represents the 90% condence interval.

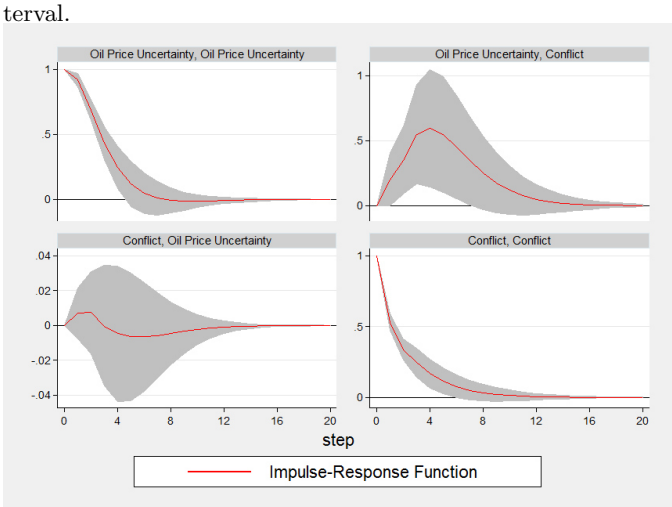

Figure 2.7: IRFs of VHAR, non-OPEC members

- The upper-right panel shows the effect of oil price uncertainty shocks on conflict incidence in non-OPEC states, while the lower-left panel shows the impact of conflict shocks on oil price uncertainty. The shaded area represents the 90% condence interval.

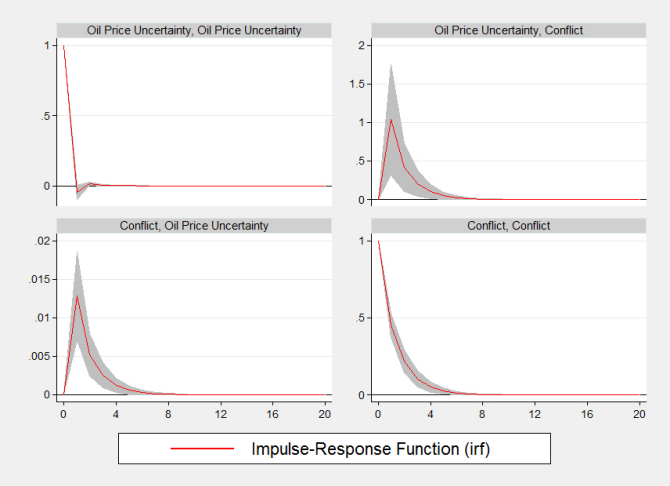

Figure 2.8: IRFs for robustness with alternative conflict measure

-Conflict is the standardised conflict variable in MENA from the UCDP/PRIO Armed Conflict Dataset. The shaded area represents the 90% condence interval.

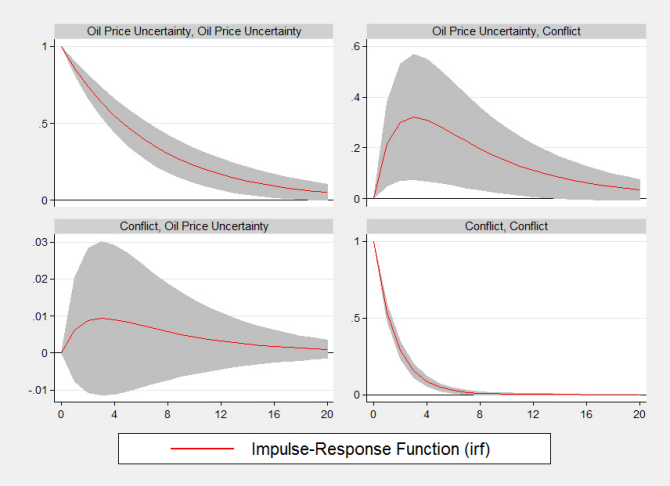

Figure 2.9: IRFs for robustness with alternative oil price measure

-In this test an alternative oil price uncertainty measure based on the refiner acquisition cost of imported crude oil is used. The shaded area represents the 90% condence interval.

2.5 Conclusion

The economic literature recognises natural resources as an important factor in investigating the occurrence of war and militarised conflicts. Oil resources can be particularly contentious due to their uneven distribution, their strategic characteristics, and their status as a globally traded commodity. At the same time, conflicts are common in the Middle East and North Africa and have potential to cause supply shocks that affect the oil market and oil prices. Given the existence of these and other complex connections between oil and conflicts, this paper investigates the relationship between oil price uncertainty and interstate conflict in the MENA region. Although this relationship needs to be investigated in a two-directional and dynamic fashion, the literature has mostly studied the two effects separately.

We build two indexes representing oil price uncertainty, using EGARCH and Realized Volatility specificationsdifferently from the existing literature on the topic; we then utilise several Structural Vector Auto Regression and Vector Heterogeneous Auto Regression models as empirical methodologies to capture the bi-directional relationship between conflict and oil price uncertainty. These methods are able to account for time lag in the relationship and we consider specific lagged periods including 6 months and 1 year. Our estimation is run for the period from January 1973 to December 2010, by using different datasets.

Our results can be summarised as follows.

For both measures of oil price uncertainty, conflict in the MENA region increases uncertainty surrounding oil prices almost contemporaneously. However, only longer-term increases in oil price uncertainty, i.e. elevated 6-month or one-year periods, have a positive influence on the incidence of interstate conflicts in the MENA region. This result is obtained by using different control variables including measures of global economic activity, oil demand and production.

Oil price uncertainty shocks do not affect the incidence of conflict involving OPEC members states, while they significantly increase the incidence of conflict in non-OPEC member states. Both our models confirm this result. Intuitive reasoning suggests that OPEC is successful in mitigating or even eliminating the negative effects of oil price uncertainty on its member states, while non-OPEC members suffer from instability caused by oil price uncertainty. However, longer-lasting oil price uncertainty can increase conflict incidence in OPEC members as well. Furthermore, conflict involving of OPEC member states leads to oil price uncertainty immediately, but conflict in non-OPEC member states does not lead to oil price uncertainty.

These conclusions lead to the following policy implications.

First, when tackling the problem of instability in the MENA region, which has and continues to have a negative global impact, policymakers should consider the impact of oil market volatility. It is impossible to address instability in the MENA region without considering the dynamic economic relationships linking oil-producing states, oil-importing states and their neighbours. Increased volatility in the oil market contributes to greater instability in the region and may eventually lead to another armed conflict, and oil market volatility is thus an important topic of consideration for the international community.

Second, energy markets would benefit from diversification. In particular, policymakers considering alternative energy projects (like renewable sources which are famous for high initiation costs) should consider the projects' potential to reduce armed conflict and its associated costs in their cost-benefit analysis.

Chapter 3

Internet Access, Political Participation, and Arms Import

3.1 Introduction

Improvements in information technology have had a tremendous effect on political decisions by publicising the actions of secretive regimes and making it easier for dissenters and protesters to coordinate. This paper investigates the effect of internet access on government arms import both theoretically and empirically. The analysis is motivated by the conviction that government spending on arms is a political decision regarding public goods. A significant body of literature, for example Russett (1982), highlights the precise trade-off between arms expenditures and other public goods, i.e. investment in infrastructure, education, public health, etc. In the economic literature, this trade-off between spending on arms and spending on citizens is referred to as the choice between "guns and butter".

The relationship between the government and citizens hinges on government willingness to adjust policies in response to public interest, both for the good of the country and in order to remain in office. Arms policies are one of the many levers than can be pulled to adjust the government-citizen relationship. Hartley and Russett (1992) finds that changes in public opinion consistently affect the changes in military spending. And Bove, Efthyvoulou, and Navas (2017) links political cycles and arms expenditures, while Comola (2012) investigates whether political conditions influence policies governing arms exports to other countries. Comola's results show that

concentration of political power is associated with lower levels of Major Conventional Weapons (MCW) exports. And both studies highlight that, close to elections, leaders decrease their arms trading and military expenditures. So arms purchases are, to some degree, responsive to citizen opinion.

This paper studies, theoretically and empirically, how citizens influence their government's decision on arms imports. Technology provides powerful tools that citizens can use to make their voices heard by the government. Access to the internet has already changed political debates in many ways, from the advent of online petitions to the rise of direct Twitter communication with elected officials. These trends illustrate the key role that internet plays government-citizen communication. As shown in Figure 3.1, the share of high-level democracies with broad internet access is increasing. Accordingly, the aim of this paper is to investigate whether internet access influences government-citizen interactions regarding levels of arms imports. To this end, I develop a theoretical model using a global game framework and then employ an empirical panel analysis to test the predictions of the model.

As Angeletos, Hellwig, and Pavan (2006) explains, government resistance to change and the level of coordination of opposition parties or dissenters play an important role in the outcome of bank runs, currency attacks, debt crises, investment crashes, adoption of new technologies, and other sociopolitical changes. In theoretical literature these phenomena are the subject of coordination games introduced by Carlsson and Van Damme (1993) called global games. Global games are incomplete information games where the actual payoff structure is determined by a random draw from a given class of games and where each player makes a noisy observation of the selected game. Morris and Shin (1998), Morris and Shin (2001), and Stephen and Shin (2003) show that there exists a unique equilibrium in these games when players have heterogeneous information about the payoff structure gained from asymmetric information about what they call the "fundamentals". Correspondingly, Angeletos et al. (2006) argue that policy analysis can be guided by the comparative statics of the unique equilibrium with respect to the policy instrument at hand.

Following the literature on coordination games modelling political decisions, I use a model with two players in an incomplete information setting. As in Angeletos et al. (2006), the building block of the information analysis is a global coordination game. In such a setting, a large number of small agents are choosing whether to attack the status quo the policymaker is defending. The status quo is changed as long as the aggregate attack is big enough. The policy makers willingness or ability to maintain the status

quo is not common knowledge among the agents. Instead, agents observe noisy private signals about it. Morris and Shin (1998), for example, analyses currency attacks using global games.[1] Edmond (2013) establishes a model in which a regime's chances of survival are affected by changes in information technology. In this model, media are classified into two categories: centralised and decentralised. Examples of the former include newspapers, radio, and cinema, through which a regime can invest in propaganda and generate large economies of scale of information control. In contrast, in decentralised media, the cost of controlling each piece of information is so high that is not feasible for the government to control it at large scales. This dis-economy of scale in controlling decentralised media makes regime change easier as the number of information sources increases. The internet and social media are the best examples of decentralised media. Furthermore, one of the interesting avenues of investigation which is opened by the global games is the importance of public information in contexts where there is coordination between players. If market participants are concerned about the reaction of other participants to news, the public nature of the news conveys more information than simply the "face value" of the announcement (Morris & Shin, 1998).

Accordingly, in the theoretical model presented in this paper, I propose a global game as in Edmond (2013) and Morris and Shin (1998) with a focus on the cooperation necessary among citizens to change the arms import policy of a government. As a result, the equilibrium condition is based not only on the government's decision regarding resources to allocate to arms import, but also on citizens' participation decisions. In Morris and Shin's model, the government pegs the currency at a fixed level because the government prefers to have a higher exchange rate than its fundamentals warrant. If speculators attack the peg and the government abandons the pegged currency, the speculators receive the given payoff. In my model speculators are replaced by citizens, who observe the trade-off between public goods ("butter") and government spending on arms ("guns") and recognise a potential payoff in forcing the government to reduce arms imports. If they attack the government's policy, each citizen receives a payoff accordingly. As in the currency attack model, the government wants to avoid failure, however in my model the government defends its arms import policy to avoid losing both foreign ally support and rents, and to maintain internal suppression and control. This interesting feature of arms import provides an opportunity

[1] Other applications of the global game can be found in Chassang and Miquel (2010), Boix and Svolik (2013), Goldstein and Pauzner (2005), and De Mesquita (2010).

for my research to use the currency attack model of Morris and Shin.

By adopting the global game framework as a tool, this paper contributes to the literature on the international arms trade. Essentially, in the theoretical analysis of this work, arms are policy tools of the government that need to be adjusted in equilibrium. I treat arms policy as a political and strategic decision for the government because trade in arms is unlike other commodity trade; arms are also a tool of foreign policy, international relations, and geopolitical concerns. Hence, to understand the arms trade mechanism, the political, economic, and security motivations of the involved actors are all relevant. On the political side, given the dependence associated with the buyer-supplier relationship, the government has to strategically decide whether to produce the weapons domestically or import the required arms. As Garcia Alonso and Levine (2007) describes, international arms trade relationships often imply a certain dependence between the importer and the supplier. However, importing arms is often an important part of a relationship with a foreign ally, and can even be tied to the importer receiving rents and support. Moreover, defense is often presented as one of the best examples of a pure public good.[2] Jones (1999) suggests that the more the good has the features of public good the more likely it is to be undersupplied or a subject to rent-seeking. On the economic side, producing arms domestically can provide employment and economic production. And on the security side, demand for arms is influenced by perceptions of internal or external security threats.

One of the motivators behind this analysis is arms transfers' quantitatively important place as a component of international trade. Arms recipients need guns and other weapons for security, and also seek to build closer relationships with allies by buying arms from them. As the U.S. Congressional Research Service (CRS[3]) illustrates, three-quarters of arms purchases in 2015 were by less-developed countries (Table 3.1). It is important to note that many weapons importers are involved in conflict situations and arms races, another distinctive characteristic of the arms trade.

This paper also contributes to the literature on the internet's effect on political activities. In particular, I investigate the effect of internet access on political participation, and specifically as a channel through which citizens can influence arms imports. As in Brady, Verba, and Schlozman (1995), the necessary resources for individual citizens to take part in political activities

[2]Hyman (2014) argues that defense is more public than schools, the health service, and transport systems (which are described as mixed goods).

[3]For more information refer to https://fas.org/sgp/crs/natsec/index.html

Table 3.1: Worldwide Arms Deliveries, 2015

Supplier	(1)	(2)
United States	16,93	70.31
Russia	7,200	86.11
France	7,000	88.57
United Kingdom	1,300	15.38
China	2,900	100
Germany	1,600	68.75
Italy	1,800	83.33
All other Europeans	4,400	54.55
All Others	3,100	38.71
Total	46,231	72.69

Column (1) worldwide deliveries value 2015 and column (2) percentage of total to developing world in millions of current 2015 U.S. dollars. Source: Congressional Research Service

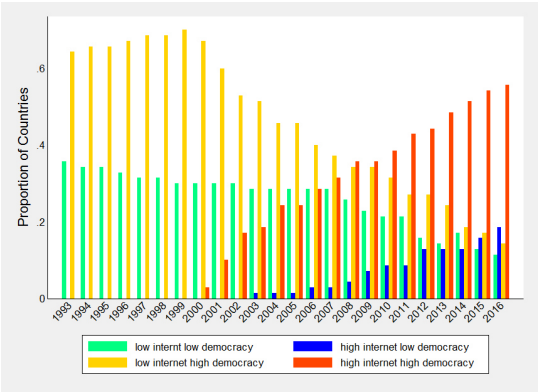

Figure 3.1: Proportion of democracies and autocracies with high and low level of internet.[a]

[a] I use the internet access data of 70 countries (for the list of countries please refer to Section 3.3) form World Bank data set for the period of 1993 - 2016. The country is a "low democracy " if Polity IV index is between -10 to 0, and "high democracy" otherwise. The country is "high internet" if more than 50% of citizens have internet access and "low internet" otherwise.

are time, money, and civic skills (defined as communication and organisational skills that facilitate effective participation). Membership in a group with shared political interests is also important for individuals to participate in political events. In fact, isolation from the recruitment networks through which citizens are mobilised to political engagement is a primary barrier to political participation. Information technology and internet access remove many of the barriers to political participation. Finding political information and ideas online takes fewer resources than finding the same information through other channels. Participation in online social networks facilitates communication and coordination and makes it much easier for citizens to find groups of others who share their political interests. This paper investigates how the internet, by facilitating political participation, affects government decisions on arms imports. We do this by exploiting a rich database on internet access provided by the World Bank that to the best of our knowledge, is for the first time adopted in the literature on arms trade.

Several recent empirical investigations highlight the effects of internet access on different political decisions. Enikolopov, Petrova, and Sonin (2018) proposes that social media can reduce corruption even in a country with limited political competition and heavily censored traditional media. Pierskalla and Hollenbach (2013) investigates the effect of cell phone technology on violent collective action in Africa. Campante, Durante, and Sobbrio (2017) finds that the initial negative impact of broadband diffusion on voter turnout in Italy was reversed in 2013 when the anti-establishment Five Star Movement[4] ran in the general election in Italy. Enikolopov, Petrova, and Zhuravskaya (2011) compares electoral outcomes of the 1999 parliamentary elections in Russia between geographical areas with and without access to an independent TV channel. Larcinese, Miner, et al. (2012) investigates the impact of broadband access on the 2008 U.S. presidential elections. In a related study, Gavazza, Nardotto, and Valletti (2015) finds that internet connection decreased turnout in the U.K., while while showing that broadband access is associated with different local government policies concerning taxation and expenditures. Miner (2015) finds that internet penetration increased turnout and had a general anti-incumbency effect in Malaysia. Finally, Bauernschuster, Falck, and Woessmann (2014) estimates the effect of broadband internet access on social capital and Andersen, Bentzen, Dalgaard, and Selaya (2011) investigates whether the employment of the

[4]The Five Star Movement (M5S) is a largely web-based political movement that united online groups and gradually evolved into an electoral force.

internet has served to lower the level of corruption across U.S. states and across the world.

In this paper's empirical analysis, I develop a panel that illustrates a negative impact of the interaction term of citizens' internet access and political participation on arms imports. The empirical analysis uses data on 70 arms-importing countries and investigates how internet access can affect political decisions. The empirical analysis explores the channels through which the internet affects the government's arms importation policies. Those channels include enhanced information and enhanced coordination. In the former, the internet affects the quality of information citizens receive and makes individuals more sensitive to political decisions. In the latter, the internet plays a role in easing the coordination of the citizens and their participation in political decisions. The coordination channel is modelled empirically by adding an interaction term of internet access and voter turnout. The results of the empirical analysis support the prediction of theoretical model, suggesting that internet access and political participation have a negative effect on arms imports.

The rest of the paper is organised as follows. Section 3.2 presents a theoretical model whose specifications are described in Sections 3.2.1, 3.2.3, 3.2.2, and 3.2.4. Then in Section 3.4 the empirical analysis is examined, and in Section 3.4.1 the empirical results are discussed.

3.2 Model

I present an incomplete information model called a global game which is based on a perturbation of the players' payoff information. As Carlsson and Van Damme (1993) describes, in this kind of coordination game, each player observes the selected game with some noise and then chooses one of two available strategies.

I model a country with two different agents. The first is a government deciding whether to import arms from a special ally. The government has security and strategic objectives, and receives support and rent from the arms import. The government's policy of arms import, θ, is its private information and is assumed to be uniformly distributed over a unit interval of $[0, 1]$. I assume that θ is strictly increasing in the level of arms import policy so that higher values of θ correspond to a stronger policy orientation toward arms import. Following the butter and gun model, the government has one unit of resources, derived from tax revenues. The government is responsible for allocating these resources to provide public goods. So if θ is

the level of arms import, $1-\theta$ corresponds to the share of resources allocated to public goods.

The second agent is n ex ante identical citizens each indexed by i. Each citizen has to decide whether to participate in changing the arms policy decision (attacking the policy), denoted by $s_i = 1$, or not to participate, denoted by $s_i = 0$. The proportion of participation is $S = \frac{1}{n}\int s_i di$. Each citizen takes a loss which is a function of θ and given by $f(\theta)$. I assume that f is strictly increasing in θ, so higher levels of θ correspond to higher losses for citizens, representing lower availability of public goods. In this setting I fix the largest possible loss at e^* which corresponds to the loss to each citizen if the government allocates its entire budget to arms import. However, e^* can also be interpreted as the minimum gain of the citizen from public good provision. In both interpretations, e^* is considered to be fixed and this is in line with the currency peg in Morris and Shin's (1998) model of currency attack. Thus, it is easy to understand that $e^* \geq f(\theta)$.

In the rest of this section I present the citizen's payoff (Section 3.2.1), government's payoff (Section 3.2.2), citizens information (Section 3.2.3), the equilibrium (Section 3.2.4), and the government's cost minimisation (Section 3.2.5).

3.2.1 Citizen Payoff

The government faces a continuum of citizens who have two strategies: to attack or not to attack the government's policy. There is a cost $p > 0$ to participate in the attack. If a citizen attacks the policy of arms import and the government abandons its policy, then the payoff for the citizen is $e^* - f(\theta) - p$. $f(\theta)$ is the associated arms import policy loss of each citizen and e^* is the minimum gain of the citizen from public good provision and considered to be fixed. If the government defends its policy, then the citizen pays the participation cost but has no gain, and the citizen's payoff is $-p$. If a citizen chooses not to attack the policy, the payoff is zero. Citizen payoffs are also contingent on the setting of the game: I assume that the setting is a "peace status" and, accordingly, citizens do not internalise any benefit from expenditure on arms import.

3.2.2 Government's Payoff

The government faces a trade-off when deciding whether to import arms. On one side, it derives a value $R > 0$, in the form of rent, from the foreign allies from which it imports the arms. On the other side, defending such a trade

policy has a cost. The cost depends on the state of the arms import policy, as well as on the proportion of citizens who attack the policy. Using $C(S, \theta)$ I denote the cost of defending an arms import level θ when a proportion S of citizens attacks the policy. If the government changes its policy orientation, it receives a payoff equal to zero, while the payoff of defending the arms import policy for the government is:

$$R - C(S, \theta) \tag{3.1}$$

I assume that C is continuous and is increasing along with S and θ. Additionally, to remove trivial solutions, I use:

Assumption 1 : $C(0, 0) > R$. If no arms are imported, then the cost of defending that policy is so high that it exceeds the value of R even if no citizen attacks the policy.

Assumption 2 : $C(1, 1) > R$. If all citizens participate in attacking the arms policy, then even at the highest level of arms import policy, the cost of defending the policy exceeds its value.

Assumption 3 : $e^* - f(1) < p$. At the highest state of the arms import policy, the profit of attacking that arms policy is so low that the citizens do not participate.

I define $\underline{\theta}$ as the value of θ at which $C(0, \theta)$ equals R. $\underline{\theta}$ is the value of θ at which the government is neutral between defending or abandoning the policy, in the absence of any citizen attack. In other words, when $\theta < \underline{\theta}$, the cost of defending the policy is higher than its value, even if no citizen attacks the policy. On the other hand, $\bar{\theta}$ is the value of θ at which the cost to a citizen of attacking the policy is equal to the amount they would gain from the attack. Thus $\theta > \bar{\theta}$ is the interval in which arms spending is sufficiently close to the highest state that citizens can not receive more benefit from attacking the policy than the attack will cost them. For graphical depictions of $\underline{\theta}$ and $\bar{\theta}$ refer to Figure 3.2 and 3.3.

Exploiting these two thresholds, $\underline{\theta}$ and $\bar{\theta}$, I categorise the government's policies under three different benchmarks. Following the categorisation in Obstfeld (1996), the state of government policy can be located in one of three intervals: $[\,0, \underline{\theta}]$, the so-called "stable interval", in which the rational action of the citizen is not to participate in attacking the policy; the "ripe for attack interval", in which θ belongs to $[\,\underline{\theta}, \bar{\theta}]$, and in which the government finds optimal to stick with its policy but a sufficient number of citizens can force the government to abandon its policy; and finally, the "unstable interval", in which θ belongs to $[\,\bar{\theta}, 1]$ and it is a dominant strategy for the government to abandon that policy.

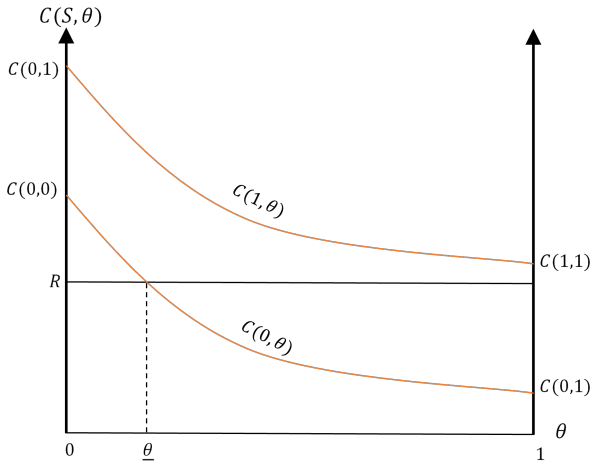

Figure 3.2: Government's costs of defending the arms policy

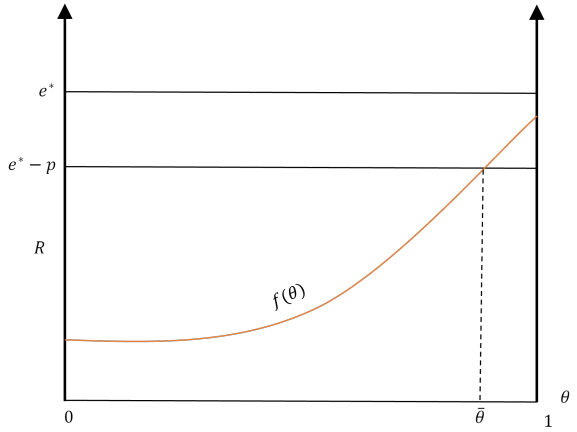

Figure 3.3: Citizen's payoff as a function of the arms policy

Clearly, the interesting interval is the "ripe for attack" region. If all citizens have perfect information, then multiple equilibria arise due to the self-fulfilling nature of the citizen's belief (Morris & Shin, 1998). As a result, it is not possible to determine when citizens' participation will lead to changing government policy. However, it is possible to show that by introducing incomplete information, i.e. uncertainty in the government's arms policy, a unique equilibrium can be obtained.

3.2.3 Citizen's Information

Citizens obtain information about the government from $n \geq 1$ media sources. Each source $j = 1, ..., n$ releases reports and each citizen i monitors the reports with idiosyncratic noise. $x_{ij} = \theta + \epsilon_{ij}$ where ϵ_{ij} is jointly IID normal across citizens and media sources with mean zero and precision $\hat{\alpha} > 0$. The average signal of citizen i is $x_i = \frac{1}{n}\sum_{j=1}^{n} x_{ij}$, which is normal with mean θ and precision $\alpha = n\hat{\alpha}$ proportional to n. Given the governments policy strength, the density of the average signal is:

$$f(x_i|\theta) = \sqrt{\alpha}\phi(\sqrt{\alpha}(x_i - \theta)) \tag{3.2}$$

where $\phi(.)$ denotes the standard normal PDF. Based on the signal that each citizen observes, they decide whether to attack the policy or not. The government observes the proportion of the citizens and also observes the θ. An equilibrium of this game consists of strategies for the government and for the continuum of the citizens such that no player has the incentive to change.

To define a reduced-form game for citizens as in Morris and Shin (1998), suppose $\delta(\theta)$ equals the proportion of citizens needed to force the government to abandon the arms import policy at state θ. As described in the model, $\delta(\theta) = 0$ in the "unstable" region, $\delta(\theta) = 1$ in the stable region, and in other cases it is the value of S which can solve $R - c(s, \theta) = 0$. The optimal strategy for the government at state θ is to abandon its arms policy if it observes the fraction of citizens S opposing the policy to be greater than or equal to $\delta(\theta)$. I take this optimal strategy for the government as given and characterise the reduced form game between the citizens accordingly. I denote the proportion of the citizens who attack the policy when they observe signal x as $\pi(x)$. Thus the accumulated proportion who end up attacking is given by $s(\theta, \pi)$ and, since x is normally distributed with mean θ and precision α, S is as follows:

$$s(\theta, \pi) = \int_{-\infty}^{+\infty} \pi(x)\sqrt{\alpha}\Phi(\sqrt{\alpha}(x - \theta))dx \tag{3.3}$$

On the other hand, the action of the government deciding whether to abandon its policy by observing the proportion of the citizens π is denoted as $A(\pi)$ and defined as follows:

$$A(\pi) = \{\theta | s(\theta, \pi) \geq \delta(\theta)\} \tag{3.4}$$

The payoff to the citizens of attacking the government policy at state θ when the proportion of the attackers is π is given by $h(\theta, \pi)$ as follows:

$$h(\theta, \pi) \equiv \begin{cases} e^* - f(\theta) - p & if \theta \in A(\pi) \\ -p & if \theta \notin A(\pi) \end{cases} \tag{3.5}$$

However, a citizen does not observe θ directly. Thus the payoff from attacking must be based on a posterior distribution of the state of θ conditional on the signal of x. The expected payoff then, conditional of the signal received, is denoted by $u(x, \pi)$:

$$u(x, \pi) = \int_{-\infty}^{x+\epsilon} h(\theta, \pi) d\theta \tag{3.6a}$$

$$= [\int_{-\infty \cap A(\pi)} (e^* - f(\theta)) d\theta] - p \tag{3.6b}$$

Since a citizen can guarantee a payoff of zero by not attacking the policy at all, the rational decision depends on whether u is positive or negative. If $u > 0$ then $\pi(x) = 1$ and if $u < 0$ then $\pi(x) = 0$.

3.2.4 Equilibrium

The above model specifications, as in Edmond (2013), result in a unique equilibrium when there is imperfect information about the government's policy. As laid out in Morris and Shin (1998), the threshold equilibrium exists at θ^* and x^*, where the citizens and the government are simultaneously content.

To provide insight into these thresholds, an argument is presented in three steps, respectively referred to as Proposition 1, Lemma 1, and Proposition 2.

Proposition 1: There is a unique x^* such that, in any equilibrium of the game with imperfect information regarding the government's arms import policy, a citizen with signal x attacks the policy if $x < x^*$.

To prove Proposition 1, I begin by defining I_k, a strategy profile where every citizen attacks the policy if and only if the message x which he receives

is less than a fixed number k. Then, the attacker's proportion is given by the indicator I_k.

$$I_k = \begin{cases} 1 & if x < k \\ 0 & if x \geq k \end{cases} \tag{3.7}$$

The expected payoff of attacking the policy derived from I_k follows the property that is described in Lemma (1).

Lemma 1: $u(k, I_k)$ is continuous and strictly increasing in k.

In other words, when the proportion of attackers is governed by I_k, and the marginal message is k, the payoff is decreasing as the arms import state is increasing. Put it another way, the higher the state of arms policy, the lower the payoff to attacking the policy for a citizen who is at the margin of attacking or not attacking. Such a property would be a reasonable feature of this model, reflecting the government's increased ability to resist citizen demands when arms spending is higher.

Taking the Lemma 1 as given, I now sketch the proof of Proposition 1. To this end, I need to find a unique k such that $u(k, I_k)$ is continuous and strictly decreasing in k. If I show that $u(k, I_k)$ is positive for small k and negative for large k, I can guarantee that $u(k, I_k) = 0$ for some k. When k is sufficiently small, the marginal citizen with message k knows that the state of the arms policy is in the "unstable" region, because such a message is possible only when θ is in the interval of $[0, \underline{\theta}]$. Since the payoff to attacking the policy is positive at any θ in this interval, it follows that $u(k, I_k) > 0$. Similarly, when k is sufficiently large, the marginal citizen with message k knows that the state of arms policy is in the "stable" region. Since the payoff to attacking the policy is negative at every state of arms policy in this region, $u(k, I_k) < 0$. Hence, there is a unique value of k for which $u(k, I_k) = 0$ and we define the value of x^* as the unique solution to $u(k, I_k) = 0$. This proves Proposition 1.

Proposition 2: There is a unique θ^* such that, in any equilibrium of the game, the government abandons the arms policy if and only if $\theta \leq \theta^*$.

Proof: In equilibrium, according to Lemma 1, π is given by I_{x^*}, and the aggregate participation of the citizens at state θ is defined as:

$$S(\theta, I_{x^*}) = \Phi(\sqrt{\alpha}(x^* - \theta)) \tag{3.8}$$

Aggregate participation $S(\theta, I_{x^*})$ is decreasing in θ, while $\delta(\theta)$ is increasing in θ. Figure 3.4 illustrates the derivation of the cutoff point for the state of arms policy at which the equilibrium citizen's participation is equal to

the value of the participation that induces policy change. It is easy to confirm that $x^* \geq \underline{\theta} - \epsilon$ since otherwise attacking the policy is a strictly better action, contradicting the fact that x^* is a switching point. Thus, $S(\theta, I_{x^*})$ and $\delta(\theta)$ cross precisely once. Now, define θ^* to be the value of θ at which these two curves cross. Then, $S(\theta, I_{x^*}) \geq \delta(\theta)$ if and only if $\theta \leq \theta^*$, so that the government abandons its policy if and only if $\theta \leq \theta^*$. This proves the presence of a unique equilibrium in the model.

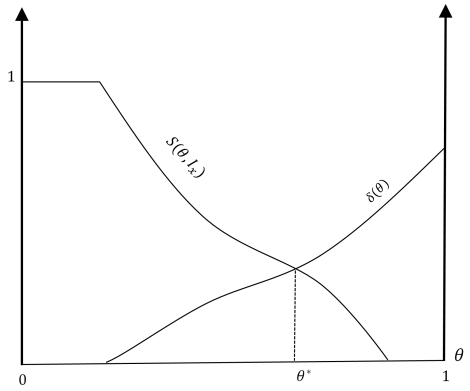

Figure 3.4: Equilibrium on arms policy.

An equilibrium of this model consists of citizens' beliefs $\pi(\theta|x_i)$ and participation decisions $s(x_i)$, the aggregate participation decision $S(x_i)$, the government's rent, and the level of arms import such that in equilibrium:
(1) a citizen with information x_i forms some posterior belief on how determined the government is in pursuing its policy;
(2) given a citizen's beliefs, $s(x_i)$ maximises the individual payoff;
(3) the aggregate decision of all citizens is derived;
(4) the allocation of resources by the government, given the aggregate decision and maximising its payoff, is determined.

3.2.5 Government's Cost Minimisation Problem

As in Morris and Shin (1998), when there is common knowledge among citizens there are multiple equilibria, but when θ is the government's private information which know only with noise, there is a unique equilibrium with a critical value of θ^* as seen in Figure 3.4.

Using linear costs, the government chooses θ to optimise its level of arms imports; it must minimise $S(\theta) + c\theta$. This is directly inferred from the governments payoff maximisation problem in Equation 3.1. This cost function

integrates the costs that the government pays for defending the arms policy of θ, which consist of $S(\theta)$ and a linear element, $c\theta$, that captures the direct cost of defending the arms policy. This direct cost reflects the cost the government needs to pay to suppress or control citizens unhappy with the policy, e.g. by increasing security spending to suppress riots. This cost also includes the more interesting costs of controlling media or disseminating propaganda, as in Edmond (2013), therefore c reflects to some extent government efforts to control the media.

The first order condition interior solution for the cost minimisation problem is $-S'(\theta) = c$. Since the aggregate attack is $S(\theta, I_x) = \Phi(\sqrt{\alpha}(x - \theta))$, the first order condition $-S'(\theta) = c$ can be written:

$$\sqrt{\alpha}\phi(\sqrt{\alpha}(x^* - \theta^*)) = c \tag{3.9}$$

It can be observed that $c/\sqrt{\alpha}$ must be sufficiently small for the condition to have a solution. In particular $c/\sqrt{\alpha} < \phi(0) \simeq 0.399$. If $c/\sqrt{\alpha} \geq \phi(0)$, then the signal precision α is too low relative to the cost of the arms policy, and the government is in a corner solution $\underline{\theta}$. In contrast, with high signal precision, there is an internal solution identical to Morris and Shin (1998)'s equilibrium. On the other hand, for θ^* we have $\theta^* = x^* - \epsilon$, where parameter ϵ solves $\sqrt{\alpha}\phi(\sqrt{\alpha}\epsilon) = c$. So the size of the attack has the form $S(\theta) = \Phi(\sqrt{\alpha}\epsilon)$.

The effectiveness of the signal precision is measured by its ability to reduce the government's threshold θ of the arms import level.

Proposition 3: For a sufficiently high signal precision α, the government threshold θ^* is strictly declining in α. In particular, for each c there is an $\alpha^*(c)$ such that $\partial\theta^*/\partial\alpha < 0$.

Proof: The proof is found by the definition of the composite parameter $z = \frac{c}{\sqrt{\alpha}}$

$$\frac{\partial\theta^*}{\partial\alpha} = \frac{\partial\theta^*}{\partial z}\frac{\partial z}{\partial\alpha} = \frac{-c}{2\alpha\sqrt{\alpha}}\frac{\partial\theta^*}{\partial z} \tag{3.10}$$

$$\frac{\partial\theta^*}{\partial\alpha} < 0 \iff \frac{\partial\theta^*}{\partial z} > 0 \iff z < z^* \tag{3.11}$$

To see why information precision is potentially important, consider that the aggregate attack is $S^*(\theta) = \Phi(\sqrt{\alpha}\epsilon)$, influenced by α, and it approaches 1 when $\alpha \to \infty$. Also the negative impact of information precision on θ^* discussed in Proposition 2 illustrates the inverse relationship between α and the governments chance of sustaining a higher arms import level. To extend the discussion on the information structure as Edmond (2013) describes, the

number of information sources n can simply be entered into the equation for the given aggregate attack as:

$$\frac{c(n)}{\sqrt{n\hat{\alpha}}} \tag{3.12}$$

As in the case of $c/\sqrt{\alpha}$, if this ratio is sufficiently small, there is an interior solution identical to Morris and Shin's benchmark. To find out how an increase in the number of signals changes the governments threshold θ_n^*, I continue as follows:

$$\frac{\partial \log \theta_n^*}{\partial \log n} = -2\big(\frac{c'(n)n}{c(n)} - \frac{1}{2}\big)\frac{\partial \log \theta_n^*}{\partial \log \hat{\alpha}} \tag{3.13}$$

For $\hat{\alpha} > \alpha^*$ and a fixed n, an increase in signal precision reduces the government threshold θ^*; but as n increases the overall effect depends on the amount of curvature in $c(n)$. Briefly, the overall effect depends on the degree of scale economies in information control.

The curvature of $c(n)$ is a natural measure of the government's ability to influence a changing informational environment. If it is harder to exert control over an ever-expanding array of media outlets, then that suggests that the average cost $c(n)/n$ is increasing in n, i.e. that there are diseconomies of scale in controlling media outlets. Alternatively, if there are complementarities in media control, with influence over one media outlet facilitating influence over others, then that suggests average cost $c(n)/n$ is decreasing in n, i.e. that there are economies of scale in controlling media outlets.

Suppose we are in the more interesting scenario of a high precision environment, where an increase in the per-unit signal precision $\hat{\alpha}$ indeed reduces the government's threshold θ^*. Then, what is the effect of an increase of n? Since the total precision for n media sources with $\hat{\alpha}$ precision for each of them is $\alpha = n\hat{\alpha}$, proportional to n, and the precision and cost effects work in offsetting ways, but for the case of constant average cost, $c(n) = nc$ is not neutral for the regime. In this case, the effective cost for the regime of obtaining a given-sized attack S is $\hat{c}\sqrt{n/\hat{\alpha}}$, so doubling n doubles the cost nc and doubles the total precision $n\hat{\alpha}$, but increases the effective cost by a factor of $1/2$.

Thus, whether new information technology will be threatening to a government will depend on the structural characteristics of the technology that determine the degree of scale economies in controlling it.

On that note, Edmond (2013) concludes that the internet can affect the coordination of citizens due to its decentralised nature. The government

will have a much harder time effectively controlling what information is transferred online than it will controlling centralised media sources like print, radio, and cinema. Moreover, these centralised information technologies' traceability puts citizens at risk of punishment for coordination. Finally, the internet can reach people with a more precise signal and is ideal for coordinating because it allows two-way interaction.

3.2.6 Theoretical Prediction

The following aims to empirically test the theoretical model discussed in the previous section. In my theoretical model, citizens receive a signal on the government's arms import policy. The internet can increase the precision of the signal, because it is difficult for political regimes to control. The model generates the following prediction.

Prediction: As the internet facilitates the coordination of citizens around political decisions related to arms importation, higher access to the internet will, depending on the participation of the citizens, reduce the government's arms imports.

The internet can affect citizens' political participation by allowing them to spread information in a way that is not directly controlled by the government and by helping them to coordinate. Moreover, the internet provides a place for citizens to nonviolently share ideas about how the governments is allocating the public budget. This effect is magnified by social media, where individuals can find like-minded citizens more easily.

In the next sections, I first describe the key features of the data on arms import and internet access, then specify the empirical model for estimation.

3.3 Data

I consider yearly data for 70 countries[5] on arms imports from 1993 to 2017. The dataset includes 1750 observations on country-year basis and descriptive statistics of the variables are illustrated in Table 3.2. The dependent

[5]Algeria, Angola, Argentina, Australia, Austria, Bahrain, Bangladesh, Belgium, Brazil, Canada, Chile, China, Colombia, Denmark, Ecuador, Egypt Arab Rep, Estonia, Finland, France, Germany, Ghana, Greece, Hungary, India, Indonesia, Iran Islamic Rep, Israel, Italy, Japan, Jordan, Kazakhstan, Kuwait, Latvia, Lebanon, Lithuania, Malaysia, Mexico, Morocco, Myanmar, Netherlands, New Zealand, Nigeria, North Korea, Norway, Oman, Pakistan, Peru, Philippines, Poland, Portugal, Qatar, Romania, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Syrian Arab Republic, Thailand, Turkey, United Arab Emirates, United Kingdom, United States, Venezuela RB, Vietnam, Yemen Rep.

variable in the empirical model is the Trend Indicator Value which is widely used in the arms trade literature taken from the Stockholm International Peace Research Institute (SIPRI) dataset for received arms (named "arms import").

I used the percentage of citizens who have access to the internet as one of the main independent variables. Internet access percentage counts all individuals who have used the internet (from any location or device) in the last 3 months. The data is obtained from World Bank dataset.[6]

"Democracy" is the regime's score, ranging from -10 to 10, on the autocracy to democracy spectrum developed by the Polity IV project[7] (Marshall, Gurr, & Jaggers, 2017).

"Arms force power" is the number of soldiers as a percentage of population, the number is obtained from the World Bank dataset for the 70 countries listed above for the period 1993 to 2017.

"NATO membership" is equal to 1 if the country is a member of NATO and 0 otherwise[8].

"Conflict" is an indicator of the presence of conflict in the given year in the given country; the data is from the Uppsala Conflict Data Program[9].

"Voters turnout" is a measure of voter turnout in presidential and parliamentary elections from the Voter Turnout Database[10].

"Arms embargo" is a dummy variable for countries with an arms embargo from either the United Nations or the European Union in place. The data is from the Stockholm International Peace Research Institute (SIPRI) arms embargo dataset[11].

Finally, I used data on Gross Domestic Production per capita, "Growth", "Unemployment", and "Population" from the World Bank Dataset.

In the remaining part of this section, I present more detail on the arms import data provided by SIPRI. Then in the next Section 3.4 I present my empirical model.

3.3.1 Arms Import Data

There are four main product categories in the international arms market: weapons of mass destruction, major conventional systems, dual-use tech-

[6]For further information about the data, refer to : https://data.worldbank.org/indicator/IT.NET.USER.ZS

[7]http://www.systemicpeace.org

[8]https://www.nato.int/cps/en/natohq/topics52044.htm

[9]http://ucdp.uu.se/

[10]https://www.idea.int/data-tools/vt-advanced-search

[11]https://www.sipri.org/databases/embargoes

nologies, and small arms (Levine et al., 1994). In this paper I focus on the second category of weapons, major conventional systems, which account for the bulk of the reported international arms trade. The Stockholm International Peace Research Institute (SIPRI) Arms Transfer Database[12] contains updated information on major conventional weapons and constructs a unit of measurement that tracks the flow of arms among states, based on its own measurement unit called the trend-indicator value (TIV). The TIV is based on the known unit production costs of known weapons and is useful for estimating the military capability transferred in arms sales rather than the financial value of the transfer. TIVs are best used as the raw data for calculating trends in international arms transfers over periods of time, global percentages for suppliers and recipients, and percentages for the volume of transfers to or from particular states. The arms trade as an explanatory variable in this analysis is based on TIV recipient data. [13]

3.4 Empirical Specification

In this section, I begin by modelling each government's decision on arms import expenditure as a function of internet access. I also allow the effect of internet access to vary with changes in political participation and economic development. With this latter term, I aim to capture the potential complementarity between economic downturns and internet access and the endogeniety that might arise due to the effect of economic conditions on the penetration of the internet. As Campante et al. (2017) states, it is likely that under bad economic conditions internet access affects citizens' political participation and the government's public expenditures composition.

Theoretically internet access affects arms imports through the mechanism of political participation. This mechanism supposes that access to the internet affects political participation, and aggregate political participation affects government decisions on spending. To test the relationship, the interaction term of internet access and voter turnout (as a proxy for political participation) is added to the empirical model. Adding an interaction term to the model can greatly expand our understanding of the relationships among the variables in the model and allows more hypotheses to be tested. My empirical approach is a panel where a country is denoted by i and a

[12] for further information about data refer to
http://armstrade.sipri.org/armstrade/page/values.php

[13] TIV can involve all the comparisons among the available data categorised by supplier or recipient. I used recipient data in this analysis.

Table 3.2: Descriptive Statistics

Variables		Mean	Std Dev	Min	Max
Arms import(TIV^1)	overall	0.009	1.27	-6.13	5.22
	between		0.09	-0.23	0.24
	within		1.26	-5.93	5.25
Internet access (percentage)	overall	2.77	3.46	-8.74	22.99
	between		1.01	0	4.07
	within		3.31	-9.30	21.75
Growth	overall	743.53	2734.56	-21709	26160.99
	between		889.28	1.58	5499.33
	within		2588.02	-23346.55	25073.82
Democracy	overall	3.88	7.04	-10	10
	between		6.83	-10	10
	within		1.90	-7.36	16.72
Armed force (percentage)	overall	0.007	0.17	-1.93	3.305
	between		0.02	-0.04	0.06
	within		0.17	-1.90	3.32
NATO membership (dummy)	overall	0.24	0.42	0	1
	between		0.41	0	1
	within		0.13	-0.71	0.68
Conflict (dummy)	overall	0.20	0.40	0	1
	between		0.33	0	1
	within		0.22	-0.75	1.16
Voter turnout(percentage)	overall	-0.07	0.06	-0.40	0.49
	between		0.05	-0.01	0.01
	within		0.06	-0.40	0.48
Arms embargo (dummy)	overall	0.08	0.27	0	1
	between		0.22	0	1
	within		0.15	-0.87	1.04
Unemployment (percentage)	overall	-0.007	0.21	-2.49	2.63
	between		0.032	-0.16	0.10
	within		0.15	-0.87	2.52
Population	overall	0.013	0.01	-0.03	0.16
	between		0.01	-0.01	0.06
	within		0.01	-0.04	0.10
Observations					
overall	1662				
between	n=70				
within	T=25				

1. See Section 3.3.1.

Parentheses shows the unit measure or if the variable is a 0-1 dummy.

generic year by t. The panel model is as follows in Equation (3.14):

$$\Delta AI_{it} = \alpha \Delta AI_{it-1} + \beta I_{it} + \gamma_1 G_{it} I_{it} + \gamma_2 P_{it} I_{it} + \nu X_{it} + f_i + f_t + u_{it} \quad (3.14)$$

where AI_{it} is arms imported by country i at year t, measured by the trend-indicator value (TIV) of arms importing countries[14]; I_{it} is the percentage of people who have access to the internet; G_{it} is a measure of the country's growth; P_{it} is a measure for political participation based on voter turnout in presidential or parliamentary elections; X_{it} is a vector of commonly used characteristics of country i which affect the arms import demand[15], including real GDP (larger economies should import higher volumes of arms), the unemployment rate, the level of democracy (Polity indicator), the number of armed forces as a percentage of the population, membership in NATO, involvement of country i in any form of conflict, and the absence or presence of an international arms embargo against country i; f_i and f_t are country and country-year fixed effects, respectively; and finally u_{it} is an $i.i.d$ error term.

The coefficient β captures the effect of internet access at zero growth and zero political participation growth. To control for the interactions between growth, political participation and internet access, γ_1 measures how country-level economic development translates into arms importation policy under differential internet access levels. Similarly, γ_2 shows how political participation differences lead to arms importation changes in the presence of changing levels of internet access. For example, if γ_1 is negative, then internet access enhances the effects of economic downturns on arm imports. If γ_2 is negative, internet access deepens the effects of political participation on arms import.

Equation 3.14 is a panel data specification in which I use the growth rates of each variable. Taking growth rates avoids the problems of non-stationary variables and remove the country-specific trends in levels. Thus it is reasonable to use both fixed effects and random effects estimators. A Hausman test illustrates that the model with random effects is preferable to fixed effects (with $chi^2(7) = 3.45$ and the associated p-value of 0.840, the null hypothesis that the individual-level effects are adequately modelled by a random-effects model fails to be rejected). A Breusch-Pagan test also suggests that a random effects model is appropriate. Accordingly, I employ a random effects

[14] In this empirical methodology all the countries with arms imports from 1993 to 2017 in the SIPRI dataset are reported. In this regression, some observations are excluded due to the lack of data. Thus I include all the available data on arms receiver countries.

[15] As an example, Bove et al. (2018) use the same controls.

estimator with heteroskedasticity and autocorrelation consistent standard errors using the Generalized Least Squares (GLS) regression method to obtain the test statistics. As Cavatorta and Smith (2017) notes, strategic interactions between countries can create strong cross-sectional dependence in panel data analysis of arms demand. In addition, Bove et al. (2017) utilises regressions with panel-corrected standard errors (PCSE) in order to account for the possibility of contemporaneous correlation across countries. For that reason, I also use a PCSE estimator. Moreover, a system GMM estimator is presented to capture the persistence of the dependent variable over time. As shown in Equation 3.14, a dynamic panel structure might fit the economic modelling of arms imports and the significance of α illustrates the relevance of such dynamics. Therefore, after fitting the model without the lagged arms import (without ΔAI_{it-1}), I verify how results change when the first lag of is introduced to the dependent variable.

3.4.1 Results

Table 3.3 presents an estimation of the arms import equation for the period 1993 to 2017 using different model specifications. I start with a random effect model where internet access is included without any interactions and only by its main effect coefficient (column (1) of Table 3.3). No effect of internet access is detected in that model. However, internet access affects arms significantly when the two interactions discussed in Equation 3.14 are added to the estimation, as seen in column (2) of Table 3.3.

It should be noted that the signs of the proxies for economic development, business cycle fluctuations, growth rate of GDP per capita, and unemployment illustrate two intuitive factors affecting arms imports. First, import of arms decreases in economic downturns. Second, larger economies import more arms. The results also indicate that exposure to conflict is associated with higher levels of arms imports, while arms embargoes do indeed play a statistically significant role in decreasing arms imports. Regarding the proxy for democracy ("Democracy"), my results find it has no significant effect on arms imports.

Internet access has the potential to influence the arms imports through two channels. First, it may make individuals more responsive to the state of the economy by improving the quality of their information about the economic situation. Second, it may enhance coordination among citizens, affecting their willingness to participate politically. These modes of action were discussed and predicted in the theoretical model of this analysis. Concerning the variable of interest, internet access influences arms imports when

Table 3.3: Internet and Political Participation in Arms Import

Dependent variable: $\Delta \ln$ Arms Import ($\Delta \ln AI$)				
	Random effects	Random effects	PCSE	GMM
	(1)	(2)	(3)	(4)
Lagged dependent				-0.283^{***}
				(-14.41)
$\Delta \ln$ Internet access $\times$		-0.037^{**}	-0.018^{**}	-0.149^{**}
$\Delta \ln$ Voter turnout		(-2.14)	(-2.12)	(-1.98)
$\Delta \ln$ Internet access $\times$		0.136^{*}	0.221^{*}	0.094^{**}
Growth		(1.82)	(1.74)	(1.88)
$\Delta \ln$ Internet access	0.862	-0.024^{***}	-0.036^{***}	$-.026^{***}$
	(0.06)	(-2.74)	(-2.66)	(-2.64)
Growth	0.521^{**}	0.003^{**}	0.001^{**}	0.001^{**}
	(2.26)	(2.06)	(2.25)	(2.13)
$\Delta \ln$ Voter turn out	0.098^{*}	-0.300^{**}	-0.300^{**}	-0.853^{***}
	(1.81)	(-2.54)	(-2.16)	(-4.23)
$\Delta \ln$ Unemployment	-0.307^{*}	-0.128^{***}	-0.186^{**}	-0.196^{*}
	(-1.81)	(-2.77)	(-2.30)	(-1.85)
$\Delta \ln$ Armed force	0.005^{*}	0.268^{*}	0.268^{*}	0.268^{*}
	(1.65)	(1.72)	(1.87)	(1.69)
Democracy	0.258	-0.004	0.006	0.011
	(0.08)	(0.8)	(0.43)	(0.12)
$\Delta \ln$ Population	-0.005	0.001	0.005	0.005
	(0.82)	(0.64)	(0.61)	(0.37)
Arms embargo	-0.007	-0.703^{**}	-0.036^{*}	-0.114^{*}
	(0.58)	(-1.98)	(-1.68)	(-1.72)
Conflict	0.004	0.151^{**}	0.060^{**}	0.065^{**}
	(0.021)	(2.08)	(2.12)	(1.99)
NATO	3.481^{*}	-1.046^{***}	-0.033^{**}	-0.058^{**}
	(1.82)	(-2.84)	(-1.97)	(-2.04)
Fixed year effects	Yes	Yes	Yes	Yes
Observations	1,631	1,553	1,631	1,631
Number of N	70	70	70	70
R^2	0.42	0.46	0.40	

Columns report estimated coefficients (Z-statistics). ***,**,* Show statistically signicant at the 1%, 5% and 10% condence level, respectively.

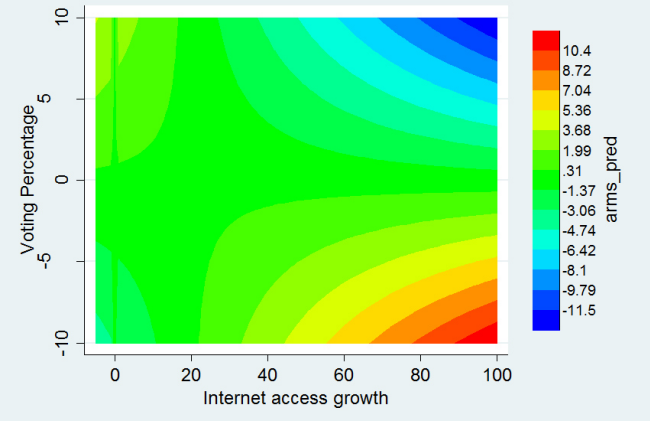

Figure 3.5: Predicted arms, internet, and political participation

the economy is performing poorly and the political participation rate is high enough. Thus in column (2) of the Table 3.3 I allow the coefficient of the internet to vary across the economic development proxy and political participation proxy. Focusing on the random effect model, I find that greater internet access is associated with lower arms imports during economic downturns. A 1 standard deviation increase in "Political participation" (0.06), for example, is associated with a differential decrease in arms imports between two countries with and without internet access of 0.026. These results persist when the two static frameworks are considered (see column (3) and (4)).

The post-estimation predictive margins contour plot is depicted in Figure 3.5. I used the margins of the regression model of arms trade which includes not only the main effects of the independent variables "internet access" and "political participation" but also the interaction term of these independent variables. Figure 3.5 is the contour representation of the predictive margins of arms imports ("arms_pred" in contours) as a function of internet access (in x axis) and political participation (in y axis) using a random effect panel data regression model and confirms the relationship between internet access, political participation, and arms imports. The blue top-right angle of the contour shows that higher internet access and political participation are associated with lower arms imports.

The findings in Table 3.3 provide robust evidence to support the theoretical model predictions. In particular, the negative sign of the internet access and voter turnout variables confirms my prediction that political participation decreases arms imports in the presence of higher access to the internet.

The empirical results also highlight the effect of internet access on arms imports during times of poor economic conditions. This is shown by the significant positive coefficient of internet and growth interaction term.

In Table 3.3 the estimation is based on all the observations of countries with arms imports from 1992 to 2017. However some of the countries in this sample are also arm exporters. To check the robustness of the estimation, I exclude the exporter countries: China, Germany, Italy, the U.S., and the U.K. The results of this estimation are presented in Table 3.4. The results in column (3) and (4) show the random effect model and GMM estimator respectively. Column (1) and (2) display the between and within estimators respectively. These results support the aforementioned predictions.

I also run the regression of Table 3.3 using between and within estimators. The results are summarised in Table 3.5. The within estimator is used to test the robustness of the findings by checking whether the results change by considering fixed effects model. The between estimator measures the difference in arms imports associated with a one unit difference in the average value of independent variables between individuals; it is essentially a cross-sectional concept. On the other hand, the fixed effect (within) estimator measures the difference associated with one unit change in independent variables at an individual level and is essentially a longitudinal concept. These results also confirm the prediction. The negative and significant coefficient of the interaction of internet access and political participation which is the main finding of the theoretical model is also confirmed in these estimations. However, the between estimators' coefficients for the interaction of internet access and voter turnout are larger in both estimations, as seen by comparing column (1) of Tables 3.4 and 3.5 with column (3) of Table 3.4 and column (2) of Table 3.3. This implies that countries with broader internet access import fewer arms, on average, than countries with less internet access. Also, the democracy coefficient becomes significant in the between estimator, while in the other models it was not significant. The between variation of the "democracy" variable is larger and between estimator significance implies that countries with higher levels of democracy import fewer arms. Overall, the primary results of the research are as predicted. Finally, to check the robustness of the model, I run a placebo by setting x a Gaussian random variable with the same mean and variance of the "internet access" ($x \sim N(2.77, 3.46)$). The random variable x replaces the observed internet access variable in the model and then the estimation is conducted. I find no statistically significant effect of x in the results which implies the new variable is totally unrelated with the other variables in the model and this reinforces the effect of internet access on arms import.

Table 3.4: Internet and Political Participation in Arms Import for non-Exporting Countries

Dependent variable: $\Delta \ln$ Arms Import ($\Delta \ln AI$)				
	B.E	Fixed effects	Random effects	GMM
	(1)	(2)	(3)	(4)
Lagged dependent				-0.229^{***}
				(-3.35)
$\Delta \ln$ Internet access $\times$	-0.267^{**}	-0.066^{**}	-0.098^{**}	-1.593^{***}
$\Delta \ln$ Voter turnout	(-1.98)	(-2.04)	(-1.98)	(-2.74)
$\Delta \ln$ Internet access $\times$	0.018^{*}	0.008^{*}	0.019^{*}	0.061^{*}
Growth	(1.71)	(1.85)	(1.75)	(1.77)
$\Delta \ln$ Internet access	-0.127^{**}	-0.036^{***}	-0.021^{***}	$-.097^{***}$
	(-2.42)	(-3.35)	(-3.85)	(-2.85)
Growth	0.001^{*}	0.001^{*}	0.002^{**}	0.003^{*}
	(1.72)	(1.67)	(1.84)	(1.71)
$\Delta \ln$ Voter turn out	0.319^{*}	-0.963^{*}	-0.412^{**}	-0.652^{**}
	(-1.68)	(-1.67)	(-1.82)	(-1.98)
$\Delta \ln$ Unemployment	-0.037^{*}	-0.012^{*}	-0.008^{*}	-0.023^{*}
	(-1.70)	(-1.72)	(-1.86)	(-1.92)
$\Delta \ln$ Armed force	0.648^{*}	0.788^{**}	0.636^{**}	0.544^{**}
	(1.75)	(2.23)	(2.18)	(1.99)
Democracy	-0.021^{*}	0.017	0.003	0.007
	(-1.73)	(0.31)	(0.25)	(0.14)
$\Delta \ln$ Population	2.522	$4.969^{*}*$	$4.772^{*}*$	$7.782^{*}*$
	(0.82)	(2.11)	(2.22)	(2.09)
Arms embargo	-0.0.29	-0.023^{**}	-0.063^{*}	-0.008^{*}
	(0.34)	(-2.06)	(-1.76)	(-1.92)
Conflict	0.281	0.592^{**}	0.336^{**}	0.083^{*}
	(0.41)	(2.42)	(2.14)	(1.78)
NATO	0.507^{*}	-0.540^{*}	-0.505^{**}	-0.002
	(1.69)	(-1.65)	(-2.33)	(-0.05)
Fixed year effects	Yes	Yes	Yes	Yes
Observations	1,510	1,508	1,510	1482
Number of N	70	70	65	65
R^2	0.36	0.38	0.39	

Columns report estimated coefficients (Z-statistics).***,**,* Statistically signicant at the 1%, 5% and 10% condence level, respectively.
In column (1) B.E is between estimator.

Table 3.5: Internet and Political Participation in Arms Import (Other Estimators)

Dependent variable: $\Delta \ln$ Arms Import ($\Delta \ln AI$)		
	Between estimator	Within estimator
	(1)	(2)
$\Delta \ln$ Internet access $\times$	-0.437^{**}	-0.018^{**}
$\Delta \ln$ Voter turnout	(-2.18)	(-2.12)
$\Delta \ln$ Internet access $\times$	0.128^{**}	0.844^{*}
Growth	(2.31)	(1.74)
$\Delta \ln$ Internet access	-0.421^{**}	-0.003^{*}
	(-2.42)	(-1.72)
Growth	0.421^{**}	0.112^{**}
	(2.19)	(2.28)
$\Delta \ln$ Voter turn out	0.316^{**}	-0.410^{**}
	(2.22)	(-2.19)
$\Delta \ln$ Unemployment	-1.255^{*}	-0.187^{***}
	(-1.76)	(-3.18)
$\Delta \ln$ Armed force	0.653^{*}	0.088^{*}
	(1.92)	(1.84)
Democracy	-0.008^{*}	0.017
	(-1.82)	(0.94)
$\Delta \ln$ Population	-0.382	3.700^{*}
	(0.28)	(1.79)
Arms embargo	-0.028	0.142
	(-0.42)	(0.63)
Conflict	-0.001	0.123
	(0.02)	(1.81)
NATO	-0.045^{*}	-0.193^{*}
	(-1.72)	(-1.73)
Fixed year effects	Yes	Yes
Observations	1,631	1,553
Number of N	70	70
R^2	0.45	0.42

Columns report estimated coefficients (Z-statistics).***,**,* Statistically signicant at the 1%, 5% and 10% condence level, respectively.

3.5 Conclusion

The literature on "guns and butter" agrees that government spending on arms is a political decision, especially when it involves importing arms from a foreign supplier in order to strengthen a diplomatic relationship. The information aspect of such deals has not been investigated in the framework of global games. If citizens of the importing country can be informed with high precision about their government's spending on arms, they are more likely to act to affect arms policy. Internet access affects the precision of information signals received by citizens, forming the theoretical basis for this paper. The model predicts that because the internet is a decentralised media source that is difficult for the government to control, as internet access increases, citizens will become more likely to take action against government policies they dislike. It further predicts that citizen involvement may be able to force a reduction in the level of arms imports below the level which is most beneficial for the government. Government policy on arms imports and the level of citizen participation are determined at a definable equilibrium.

Then, in the empirical part, a panel analysis of arms imports is conducted using the well defined arms trade data of SIPRI. The model estimates not only the main effects of the independent variables, internet access and political participation, but also the interaction term coefficient. The empirical findings confirm the model predictions. In particular, internet access affects arms imports if political participation is relatively high. Countries with broader internet access import fewer arms than countries with lower internet access. And higher internet access in lower growth countries is associated with lower arms imports, implying that when economic conditions are poor, having access to the internet can help citizens pressure governments to lower arms imports.

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