"The Role of Multinational Corporations in Chemical Nonproliferation"

by

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(Under the Direction of Robert Grafstein)

ABSTRACT

This study focuses on multinational corporations (MNCs) and their role in chemical nonproliferation. It seeks to understand the influence of MNCs on government commitment and implementation of chemical nonproliferation. Today, globalization of production has changed the landscape of economic and political calculation of states. The economic interdependency between nations raises the saliency of powerful multinational corporations. They are no longer bounded by borders. Instead, technology/product transfers within and between MNCs to them become powerful players in regional and local economies. Studies have traditionally focused the discussion of nonproliferation on national and international levels. The analysis of state implementation mostly hinges on political will, state capability and the characteristics of the regime itself (legal, enforcement etc.). Companies are frequently perceived as the passive target of nonproliferation policies. Yet, few studies examine the aggregated impacts of MNCs on nonproliferation and understand the implication for the future development of international nonproliferation regime. Drawing upon theories from multiple disciplines including international relations, economics, business management, and organizational behavior, I approach the issue of nonproliferation from the bottom up. I argue that MNCs can play a positive role in improving countries' chemical nonproliferation commitment. I employ both quantitative and qualitative

methodologies to examine the hypothesis. Within the quantitative context, I choose the Chemical Weapon Conventions (CWC) as my case study and adopt both Frequentist and Bayesian statistical approaches to analyze the impact of chemical MNCs on ratification and implementation of CWC. On the qualitative side, I select three countries (Saudi Arabia, China and Germany) and pair each with a leading global chemical MNC (SABIC, SinoChem and BASF respectively). These three case studies provide anecdotal examples of my argument. In combination, these two methodologies offer an innovative approach to the study of international nonproliferation.

INDEX WORDS: Nonproliferation Multinational Corporations Compliance
Stakeholder Theory Code of Conduct Sustainability
China Saudi Arabia Germany BASF Sinochem SABIC

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DEDICATION

My Mom, Dad, Haldun and My Denny Boy

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CHAPTER 1

INTRODUCTION

1.1 Background

Sarin, a colorless and odorless liquid, is considered one of the deadliest chemical weapons. It was used repeatedly in the history of warfare and caused countless deaths. Sarin was used four times against Iranian soldiers at the end of Iran-Iraq war in 1988. The Japanese religious sect Aum Shinrikyo released Sarin in a Tokyo subway and killed eight people and harmed over 200. The latest use was in Syria civil war in 2013 and produced a death toll of hundreds.[1] These examples strike to the core concept of this dissertation: chemical nonproliferation. The definition of "nonproliferation" is the prevention of Weapons of Mass Destruction (WMD), specifically referring to nuclear, chemical and biological weapons and their delivery systems. Bounded by international agreements, countries are neither allowed to use these weapons nor develop, produce, acquire, stockpile, retain, or transfer these items. Since the detonation of the first nuclear bomb in 1945, the history of international nonproliferation has been marked by series of agreements: the Nuclear Nonproliferation Treaty (NPT) in 1968, the Biological and Toxic Weapons Convention (BTWC) in 1975, the Chemical Weapons Convention (CWC) in 1997 and multilateral regimes such as the Nuclear Supplier's Group (NSG), Australia Group (1985), Missile Technology and Control Regime (1987), and the

[1] "Report reaffirms Syria chemical weapons use." Report reaffirms Syria chemical weapons use - Al Jazeera English. Al Jazeera Media Network, 7 Jan. 2015. Web. 01 Feb. 2017. <www.aljazeera.com/news/middleeast/2015/01/report-reaffirms-syria-chemical-weapon-use-201516223545804947.html>.

Wassenaar Arrangement (1996). Together, they provide an important institutional architecture to prevent or slow the spread of these dangerous materials and technologies.

This dissertation studies chemical nonproliferation with a focus on the CWC. The Geneva Protocol signed in 1925 prohibits states from using chemical and biological weapons. However, it does not address the production, storage or transfer of these weapons. After decades of negotiation, the international community finally reached an agreement on the CWC to tackle this important issue. CWC also established its implementation body – Office of the Prohibition of Chemical Weapons (OPCW), which became the most recognized international authority for chemical disarmament and nonproliferation issues and led to successful efforts in CWC membership universalization, compliance and implementation. Another international treaty addressing WMD nonproliferation is the United National Security Council Resolution 1540 (UNSCR 1540). It is a UN mandate requiring all member states to establish a national system to control the transfer of dangerous products and technologies. Though it is not specifically designed for chemical proliferation concern, it does have an overarching mandate that includes chemical nonproliferation. In addition to international treaties, countries also created informal forums such as Australia Group (AG) to ensure exports or transshipment do not contribute to the chemical or biological weapons in coordination with CWC.

1.2 Challenges

In addition to an amalgam of treaties, multilateral regimes and supranational organizations, national commitment and implementation is an important part of the nonproliferation apparatus. Countries make commitments by ratifying treaties and/or

joining multilateral regimes. Each country then promulgates legislation and regulations to implement its commitment. Such commitment and implementation requires significant political will, government capacity, and resources. In practice, countries vary significantly on the level of commitment and implementation for various reasons.

Furthermore, the complexity of nonproliferation issue has intensified since 9/11. It changed the landscape of proliferation threats because of the possibility of non-state actors' access to WMDs. As a result of the globalization of production and trade, advanced manufacturing capability is no longer the exclusive right of few western states. Instead, such new capabilities have spread widely to emerging economies globally. Technological progress also magnifies the "dual use" dilemmas within the nonproliferation community. "Dual use" refers to products and technologies that have both commercial and military or WMD applications. For example, new technology is developed to aerosolize chemicals for use in crop-dusting, yet the process of aerosolisation can also be used to weaponize chemicals. As technologies evolve at a rapid speed, the sheer volume of dual use materials and technologies in the chemical sector also signifies.

These challenges make national commitment and implementation even more important. However, gaps in national implementation create loopholes for proliferators, which damages the entire effort of nonproliferation. For instance, countries with weak strategic trade control system are often hubs for proliferators to set up front companies. Proliferators also exploit countries with comprehensive regulatory frameworks yet poor enforcement capability. The natural question is what causes such differences in countries' implementation of chemical nonproliferation and how to minimize it.

1.3 Traditional Approach

Chemical nonproliferation discussions traditionally focus on national implementation of CWC including legal and technical capacity building. They also emphasize the CWC verification mechanism through inspection of declared facilities. Specifically, according to Article VI of CWC, OPCW is tasked with verifying the declared facilities of Schedule 1, 2 and 3 chemicals[2] by conducting inspections. Imperfections in international agreements are a common outcome of multilateral discussion. Political and legal compromises made during negotiation often leave a treaty or regime with vagueness and flexibility in implementation. In the case of inspection, under CWC, any member state has the right to request the Director General of OPCW to launch a "challenge" inspection. Such an inspection may be conducted at any declared/undeclared facility of another member state that is suspect of violating CWC. This clause marked a success in the negotiation of an international disarmament treaty because of its intrusive nature and political ramifications. Yet, since the implementation of CWC, the practicality of this clause has triggered much discussion. Solutions for logistical, communications, and political issues in a large and complex facility are debated among scholars and practitioners.[3]

National implementation has been the focus of OPCW since its First CWC Review Conference in April 2003. The Secretariat has the mandate under Article XI to

[2] Schedule 1 chemicals include those that have been or can be easily used as chemical weapons and which have very limited, if any, uses for peaceful purposes. **Schedule 2** chemicals include those that are precursors to, or that in some cases can themselves be used as, chemical weapons agents, but which have a number of other commercial uses. **Schedule 3** chemicals include those that can be used to produce, or can be used as, chemical weapons, but which are widely used for peaceful purposes

[3] Tucker, Jonathan B. The Conduct of Challenge Inspections Under the Chemical Weapons Convention: Proceedings of an Expert Workshop Held on May 29-31, 2002 in Washington. Monterey Institute of International Studies, Center For Nonproliferation Studies, 2002.

engage in international cooperation since 1997. The Convention's provisions affect a substantial segment of the global chemical industry. All member states are required to undertake a comprehensive national implementation. The Convention emphasizes that not only production and processing, also consumption and trade of those scheduled chemicals are part of the national implementation. Much of the efforts are invested to increase national capacity for such implementation through programs such as training events, workshops, support for conferences and research, and facilitation of exchange between States.[4]

In sum, the traditional approach toward chemical nonproliferation primarily focuses on international and national level. There is a significant literature addressing nuclear nonproliferation. Some argue that in democratic systems, leaders may demonstrate different levels of support for nonproliferation multilateralism. Support is also a function of political ideologies, socialization and world view (Checkel 1999, Lantis 2015). Studies examining the motivations behind nuclear supply decisions conclude that some of the most important motivations behind nuclear technology sharing are enduring rivalries and militarized interstate dispute (Jo and Gartzke 2007). In essence, nuclear cooperation is viewed as a form of leverage in long strategic view (Lantis 2016).

Therefore, very few studies focus on the role of industries and understand its potential as a stakeholder in the realm of nonproliferation apparatus.

[4] On The Implementation of the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction. N.p.: Organization for the Prohibition of Chemical Weapons, 14 Jan. 2016. PDF. <www.opcw.org/fileadmin/OPCW/EC/83/en/ec8204_c21crp01_e_.pdf>.

1.4 My Research

This dissertation focuses on Multinational Corporations (MNCs) and their role in chemical nonproliferation. It seeks to understand the influence of MNCs on government commitment and implementation of chemical nonproliferation. It contributes to the IR literature by studying a specific type of business whose influence stems from its domestic operation and expands globally. My research integrates the economics, business management and organization behavior literature into the study of international affairs to understand the role of MNCs in this complex system.

Realists believe that world affairs should be examined at the systemic level, whereas domestic politics scholars believe IR is shaped by and rooted in domestic affairs. Similarly, in the International Organization literature, scholars study the relationship between the state and international institutions and debate whether institutions can influence state behavior. I, instead, focus on the explanation at a level beneath the conventional approach ---industry. An MNC is a corporation that has facilities and assets in at least one country other than its home country.[5] Global production and trade have diminished the economic boundary between nations. MNCs inevitably play a central role in such transition. Its business practices provide an opportunity to embed its corporate principles and norms in foreign institutions. Within their own industries, MNCs also lead in several fronts such as production, trade and influencing industry standards. Specifically, this dissertation ultimately answers the following questions, "Can MNCs influence nations' commitments and implementation with respect to chemical nonproliferation?" and "How can this influence be exerted?" I argue that MNCs can

[5] "Multinational Corporation - MNC." Investopedia. Investopedia, LLC, 05 Dec. 2014. Web. 01 Feb. 2017. <www.investopedia.com/terms/m/multinationalcorporation.asp>.

positively influence states' commitments and implementation with respect to chemical nonproliferation.

In order to test my hypothesis I employ both quantitative and qualitative methods in the form of a nested multi-method approach (Lieberman 2005). Within the quantitative framework, I adopt both Frequentist and Bayesian approaches in analyzing the data. I construct two models to examine the positive influence of MNCs on CWC ratification and implementation respectively. The measurement of CWC ratification and implementation is fairly straightforward. I extract data primarily from OPCW and UNSCR 1540 websites. But the explanatory variables require much more work. The key variable to indicate the level of MNC activity in a given country is extracted from public chemical companies listed in the US stock market. The aggregate number of their foreign subsidiaries in a given country reflects the level of MNC presence. I run logistic regression models with key explanatory variables as well as control variables to examine my hypothesis. Several data sources are used to collect data including US Security Exchange Commission (SEC) reports, international reports, public statements and various secondary sources. In addition to the Frequentist approach, I also employ Bayesian method to test my hypothesis because the Bayesian approach has a great advantage over the Frequentist approach in data treatment, particularly missing data (Western and Jackman 1994). Instead of imputing the missing data, I use priors and calculate the missing data from a posterior distribution. I am able to compare the model results between the two approaches. In the qualitative part, I use empirical evidence to illustrate the mechanism of how MNCs can influence state's chemical nonproliferation implementation. I analyze, compare and contrast national and corporate policies in three

case sets: Saudi Arabia/SABIC, China/SinoChem and Germany/BASF. I rely primarily on publicly available information from government, corporate websites as well as various secondary sources.

1.5 Dissertation Outline

The remainder of this dissertation is organized into eight chapters, a bibliography and appendices in the following manner. Chapter 2 reviews various theoretical perspectives in international relations, economics and business management. Chapter 3 delineates the formulated theory and casual mechanisms. This study integrates theoretical arguments from business into the international relations to help explain how corporate policies and activities can influence state behavior in chemical nonproliferation. Chapter 4 outlines the quantitative research design and operationalizes all variables. It also presents and discusses the findings of both Frequentist and Bayesian analysis. Chapter 5, 6 and 7 each present a case study. Each chapter examines both national policy in chemical regulations as well as corporate practices: Saudi Arabia/SABIC, China/SinoChem and Germany/BASF. Chapter 8 contains the summary, conclusions of both quantitative and qualitative analysis, and discusses limitations and future research.

CHAPTER 2

LITERATURE REVIEW

Kenneth Waltz in "Man, the State and War" (1959) modifies classic realism and creates another important concept in IR called three images analysis or three levels analysis. He establishes three levels of variables in analyzing the world events: individual leadership, the domestic level and the systemic level. Realists believe that the explanation for war rests upon the third systemic level instead of human nature. Liberalists argue that domestic politics matters in foreign policy decision making. Lindsay (1994) use anecdotal evidence to demonstrate that the U.S. congress has an enormous influence on foreign policy despite its focus on domestic issues. Allison (1969) and Krasner (1972) debate the extent of bureaucratic influence on foreign policy decision. Zaller (2003) stresses the important concept of latent opinion which is opinion that might exist at some point in the future in response to the decision-makers actions and may result in political damage or defeat at the polls. Entman (2004) argues that media framing is a salient influence on domestic politics issues. Baum (2004) emphasizes the importance of soft news.

Another major influence on domestic politics and foreign policy comes from special interest groups (Helpman & Grossman 2001). Within the literature of the International Organization, scholars study the relationship between the state and international institutions. Mearsheimer (1994) bluntly rejects the influence of IOs on state behaviors and suggests that institutions simply reflect the interests of powerful nations

and state behavior is independent of institutions. On the contrary, neoliberal institutionalists (Axelrod 1980, Keohane 1984, Martin 1995, Koremenos 2001, Abbott and Snydal 2000) maintain that institutions have a profound impact on state behavior. When we examine international affairs through the lens of domestic decision-making, we provide a way to think about how properties of the international system are shaped by local considerations as part of the larger strategic fabric of politics. It is long established that special interest groups are powerful in foreign policy decision (Helpman & Grossman 2001). Yet scholars in this area mostly focus on industry's domestic lobbying activities. This dissertation contributes to the debate by examining a specific group of companies: multinational corporations, understanding their influence on foreign policy through their corporate practices. Instead of lobbying, which is a well-organized and concerted activity by an entire industry for a specific purpose, I argue that powerful MNCs can impact state behavior through its own discourse because of their strong corporate philosophy and practices, which can be consistent with international objectives such as nonproliferation issue.

IO scholars offer different views on why states cooperate. The classic Prisoners' Dilemma story reflects the basic theoretical framework for cooperation. Axelrod's (1987) famous computer tournament suggested that TIT for TAT is the best strategy in winning the game. It illustrates that cooperation can occur when it is a repeated game and there is a credible penalty for violation. Realist scholar Greico (1999) states that nations join institutions because it is consistent with their interests. Once the institution deviates from the nation's core interest, it will defect from its membership. Bull (1990) indicates norms and expectations are the primary reason states join institutions. Abbott and Snidal (2001)

combine rationalist and constructivist approaches and suggest that non-state actors play an important role in international institutions.

In addition to membership participation, state cooperation is also reflected in the implementation of the international institution. There is a form of democratic participation in the process of introducing treaties into domestic law. Legislative approval has become a precondition for the implementation of treaties. As international institutions such as arms control and nonproliferation agreements are becoming more legalized and there is increasing precision and elaboration in commitments, the discourse associated with domestic legal systems has become common in world politics. International law scholars argue that domestic law can send a credible signal to markets in all states as well as legalization can validate the government's legitimacy in its commitment. Goldstein and Martin (2000) emphasize that domestic legal systems are important in trade politics. Simmons believes one of the best ways to increase respect for international law is to make it indistinguishable from domestic law (Simmons 1998) but Finnemore and Toope (2001) warn of the danger of generalization of its impact because of the significant variation in domestic legal systems.

As we can see from the preceding literature review, most of the IR discussion focuses the explanation of state participation and implementation of international treaties on either the regime itself or domestic politics. Since my argument emphasizes the role of industry, I would also like to use theories from business management such as discussions of corporate reputation and corporate social responsibility. Reputation is often described as a more analytical interpretive frame used by evaluators to understand an organization's ability to increase its value (Pfarrer 2013). There are three conceptualizations of

organizational reputation: being known, being known for something, and generalized favorability. An organization's reputation should be viewed as a multidimensional construct of the three concepts. The extent of awareness and knowledge of a company represents the first dimension. A level of confidence reflecting specific predictions about the company's future behavior and outputs is the second dimension. Favorability of judgement of the overall company in the industry is the third dimension (Lange et al 2011). MNCs have to manage the complex dimensional construct to maintain their corporate reputations. Any wrongdoing can generate negative media coverage, which can result in categorical delegitimization or negative spillover to the entire industry (Zavyalova et al 2012). Due to the sensitive nature of its products and technologies, companies are frequently labeled with certain 'stigma'. Today, stigma refers to a visible and discrediting attribute that prevents full social acceptance in most social contexts such as arms industry (Vergne, 2012). Companies adopt stigma management strategies to mitigate reputational threats and gain social approval. Companies announce public claims of corporate social actions to show its commitment to socially acceptable norms, beliefs and values to protect its image.

The chemical industry in general is considered as a stigma industry and is particularly susceptible to reputational damage due to the nature of its products such as the toxicity of chemicals, production hazards and their release into the environment etc. Thus, firms install extra preventive measures and practices to protect their assets and reputations.[6] This dissertation examines corporate practices from global leading MNCs and understands how their corporate social actions help safeguard their corporation

[6] Sammeck, Jan. A new institutional economics perspective on industry self-regulation. Wiesbaden: Gabler, 2012. 105. Books.google.com. Web. 01 Feb. 2017.

reputation and increase state cooperation in nonproliferation through its ability to normalize compliance practice among stakeholders.

Speaking of stakeholders, the stakeholder theory is an important concept that was raised in the 80s, matured in the 90s and still is debated today. The corporate system has become a prominent entity attracting to itself a combination of attributes and powers. It is considered as a major social institution.[7] One of the most important contributors to stakeholder theory is Edward Freeman.[8] He revitalized the concept of managerial capitalism, which argues that managers bear a special relationship to their stockholders. Instead, he suggests that there is a fiduciary relationship to stakeholders. They are groups who have a stake in the firm including suppliers, customers, employees, stockholders, and the local community (Freeman 1984).[9] Among these stakeholders, their interests and preferences can be conflicting from each other. For example, stockholders care about their investment return in the dollar amount; employees want higher salaries whereas the local community emphasizes the local social and environmental impact. The responsibility of management is to look after the overall health of the corporation and balance the multiple claims of such conflicts. When such balance is disrupted, the corporation can be in jeopardy.

Stakeholder theory is also controversial and under attack from advocates of shareholder primacy because it questions the conventional assumption that profit is the preeminent concern management holds (Jensen 2002, Margolis & Walsh 2003, Jones

[7] "Ed Freeman and his stakeholder theory." Spidermak: A Nicomat Solution. N.p., n.d. Web. 02 Feb. 2017. <www.spidermak.com/en/ed-freeman-and-his-stakeholder-theory>.
[8] "Ed Freeman and his stakeholder theory." Spidermak: A Nicomat Solution. N.p., n.d. Web. 02 Feb. 2017. <www.spidermak.com/en/ed-freeman-and-his-stakeholder-theory>.
[9] Freeman, R. Edward. Stakeholder Theory of Modern Corporation. N.p.: Business Ethics, 2012. PDF. <https://businessethics.qwriting.qc.cuny.edu/files/2012/01/Freeman.pdf>

1995). Proponents of the stakeholder theory praise the theory because it treats people by virtue of its emotional resonance (Weick 1999). Various arguments also center the discussion on "which stakeholders do managers really care about". Some suggest powerful, legitimate and urgent stakeholders (Agle, Mitchell, & Sonnenfeld 1999). Some argue it varies by stakeholder culture (Felps & Bigley 2007), by industry's politicized framing (Fineman & Clarke 1996) or by organizational life cycle stage (Jawahar & McLaughlin 2001). Laplume (2008) provides a comprehensive review of the evolution of stakeholder theory from 1984. It urges more empirical research from a broader set of organizations and a return of emphasis on the strategic benefits of stakeholder management instead of firm performance.[10]

The "New World Order, Incorporated" (Schmidt 1995)--the strengthening of business, with transnational corporations less tied to nations and national interests--saw the emergence of so called "stateless" multinational corporations manifests itself in a variety of ways: dispersion of operations through joint ventures, global production, financing, loss of loyalty of job creation at home country etc. All make MNCs part of a global web that increasingly defies the national origin of a corporation. However, such "statelessness" also invites a new host of issues and challenges that MNCs have to deal with. MNCs currently operate in a world in which regulations and policies are extremely diverse, rapidly changing and often in conflict with other national social and economic goals. The balance between government regulation and self-regulation has triggered many discussions within the academic community. The literature on regulation generally focuses on the conditions that make governmental regulation necessary or unnecessary

[10] Laplume, André O., Karan Sonpar, and Reginald A. Litz. "Stakeholder theory: Reviewing a theory that moves us." Journal of management 34.6 (2008): 1152-1189.

(Arrow 1974), different forms of governmental regulation (Daves 1977), the examination of the actual operation of government agencies (Wilson 1980), and firms' response to regulatory pressure (Mahon & Murray 1981).

The theoretical framework underpinning self-regulation is another important basis for my discussions. Industry self-regulation can take place only if firms in the industry decide to cooperate with each other. Understanding self-regulation is tantamount to understanding how industry operates as a cooperative formal organization (Gupta 1983). Transnational actors do not easily conform to abstract and open-textured principles because they do not prescribe a specific way of behaving and compliance is difficult to enforce. There are increasing numbers of industries supporting initiatives that prescribe specific guidelines and principles for its members. The establishment and endorsement of this type of program is believed to help reduce transaction costs due to the low costs of sharing information, the creation of economies scale, and the low costs of disseminating the know-how among the members (Nikolaou 2013). It creates a system that MNCs follow. They are structured to encourage corporations to socially learn and form norms among stakeholders within the regime. This is the foundation of my argument that MNCs establish normative behavior within their network of businesses, which creates behavioral changes among businesses. As a result, it influences the state implementation to its nonproliferation commitment.

Many studies answer the question whether self-regulation possible. The key to self-regulation is to structure incentives so that it is within the business' interest. Barkenbus (1983) provides an example of the nuclear industry and illustrates an antagonistic relationship between the Nuclear Regulatory Commission (NRC) and the

nuclear industry. He argues that NRC's increasingly prescriptive regulation can have a deleterious effect and may reduce public safety. There are already strong incentives for a utility not to shirk from safety responsibility due to direct financial loss and financial rating. Therefore, the opportunities to create heightened industry self-regulation deserve further examination.

Institutional theorists describe these phenomena as isomorphism. It is a form of imitation and legitimacy from companies. Stakeholder theory explains the adoption as an attempt to reconcile the objectives of different stakeholders (Evangelinos 2010). Scholars have long classified products into four categories: private goods, public goods, common-pool resources, and impure public goods (Ostrom & Ostrom 1977). Impure public goods can be further divided into toll and club goods provided by NGOs (Corner & Sandler 1996). For example, a globally well recognized chemical industry initiative Responsible Care (RC) is considered a club good. Its discrete consumption cannot be priced and their collective provision is financed by membership fees. Championing tough environmental codes could be attractive to firms advanced in environmental technology because it could raise rivals' cost of entry (Prakash 2000). Responsible Care will be discussed in greater detail in the qualitative case studies. But many studies have focused on the rationale for chemical companies' joining the organization. Some suggest that membership signals that a firm is superior to non-members and thereby allow it to obtain a premium for goods and services. Some argue that the RC strategy can achieve consistency between economic and social goals. It helps enhance a firm's financial performance while integrating stakeholders actively in the process (Niskanen 2012).

In sum, my theoretical approach is multidisciplinary and innovative. It stems from classic IR debate on three levels of analysis and focuses on the International Organization subfield. It then expands the theoretical support to the business literature, covering topics such as stakeholder theory, self-regulation, and corporate social responsibility. I also draw on literatures from public relations to integrate corporate reputation into the discussion. My approach is an attempt to examine a complex foreign policy issue from an economic perspective. In the following chapter this point will be developed in more depth.

CHAPTER 3

THEORETICAL FRAMEWORK AND HYPOTHESIS

The objective of my dissertation is to determine and explain how MNCs can positively influence states' commitment to and implementation of chemical nonproliferation. In order to operationalize this hypothesis, I use CWC ratification and implementation as my measurement in the quantitative analysis. I then focus on the implementation aspect in the qualitative part. But first, I would like to illustrate my theoretical explanations from both corporate and government perspectives.

Corporate Perspective

Reputational Concern

Chemical weapons typically rely on intermediate chemicals called "precursors." They have legitimate industrial applications, but can also be converted to military grade weapon agents such as sarin. For a long time in the history of war, many large chemical producers were associated with state weapons programs. As a result, they suffered a significant reputation loss. Furthermore, the disastrous accident in Bhopal in 1984 killed thousands within weeks and caused long-term damage to the region. The entire chemical industry lost its creditability and trust due to their safety and environmental practices. As a result, the chemical industry initiated self-regulating mechanisms such as Responsible Care to address environmental and safety issues. On the supply side, chemical warfare during the Iraq war in 1980 exposed chemical companies' entanglement in supplying

materials and technologies to this oppressive regime. Once again, the chemical industry was at the forefront of proliferation risks.

In 1995, Warren Buffet famously said: "It takes twenty years to build a reputation and five minutes to ruin it".[11] Safeguarding corporate reputations has been on the mind of all businesses, especially "stigmatized" industries such as chemicals. Stigma industry refers to a discrediting attribute that prevents an industry from full social acceptance in most social contexts. The chemical industry has long fought for its reputation with respect to safety and environment. Its vilifying label contaminates the entire group of similar peers (Vergne 2012). After 9/11, proliferation risks associated with non-state actors are more salient and challenging because of the globalization of production and trade.

Therefore, chemical MNCs develop risk management strategies to shield their public image from damage. Corporate image is a generalized perception that the actions of a company are desirable within a socially constructed system of norms, values, beliefs and definitions. Nonproliferation compliance is not only a legal responsibility for corporations, but also a way to gain social approval. An organization's endowment of social approval is an important source of information for stakeholders. Corporations are in permanent contact with their economic, political, societal, technological and legal environments. They have to satisfy not only shareholders, but also other stakeholders such as consumers, employees, governments, suppliers the local community, and media as well as NGOs (Maon et al, 2009). MNCs with higher social approval can have a buffer against loss as stakeholders either ignore or downplay negative information that is

[11] Tuttle, Brad. "Warren Buffett's Boring, Brilliant Wisdom" Time. Time, Inc., 01 Mar. 2010. Web. 02 Feb. 2017. <business.time.com/2010/03/01/warren-buffetts-boring-brilliant-wisdom/>.

incongruous with their prior positive social judgment (Elsbach 2003). Therefore, nonproliferation compliance practice is a valuable part of corporate risk management strategies for attracting and maintaining stakeholders and most evident in times of crisis such as unintentional violation. On the other hand, a mismatched compliance strategy may lead to a state of perpetual discord with stakeholders.

For MNCs in foreign markets, their success is also affected by their practices in corporate responsibility and governance (Tixier, 2003). Firms increasingly acknowledge the importance of Corporate Social Responsibility (CSR) in foreign market and leverage it as a strategic tool for communication to increase its corporate benefit (Polonsky & Jevons, 2009). The influence of top chemical MNCs in emerging markets can be explained by IO theory suggesting that hegemons are necessary for creating and maintaining regimes (Krasner 1983, Young 1997). Hegemons are not altruistic actors. They are driven by business interests. Dominant chemical MNCs often have the capability to exert their corporate principles and norms on local businesses and governments. Collective action logic also suggests that hegemons are more inclined to internalize the costs since they are the bigger beneficiaries of the actions. Of course, such influence hinges on firm level heterogeneity in term of their endowments (market share, sales) in the region. When a market is primarily dominated by MNCs, they will have greater influence on the regional industry practice because their practice is cohesive and consistent. Furthermore, their presence creates jobs and tax revenue and improves infrastructure. Such attributes have significant benefit for hosting government. Therefore, MNCs have more leverage in influencing government behavior.

Compliance Norm

Managing global organizations has been a challenge for centuries. But the nature of the task for most of MNCs is changing with the economic shift from Europe and North America to markets in Africa, Asia and Latin America. Globalization offers many opportunities to firms, but also poses new challenges and risks. Risks may include social, technological, economic, political, regulatory etc. John Ruggie suggests that each area of risk management is equivalent in strategic value for the global operation. It must be mainstreamed into the entire organization's value proposition.[12]

The discussion of nonproliferation falls into the category of regulatory risk. United Nation Security Council Resolution 1540 mandates all UN member states to establish export control systems to prevent WMD proliferation during export, re-export, transit, transshipment and other trading processes. As a result, each country promulgates legislation or regulations to regulate controlled items and technologies such as scheduled chemicals. However, countries vary significantly in the implementation of this resolution due to various reasons including national capacity, legal process and domestic politics etc. MNCs from states with stringent export control systems are under greater risk of violation and financial penalty.[13] Therefore, they are incentivized to invest financial and human resources in corporate compliance in order to mitigate such regulatory risk. Compliance costs can be high for businesses because a successful compliance program is reflected in its overall corporate culture. As we know, culture does not form overnight.

[12] Kytle, Beth, and John Gerard Ruggie. "Corporate social responsibility as risk management: A model for multinationals." (2005).

[13] United States. U.S. Department of Commerce. Bureau of Industry and Security. Don't Let This Happen to You! Actual Investigations of Export Control and Antiboycott Violations. U.S. Department of Commerce, Sept. 2016. Web. <www.bis.doc.gov/index.php/forms-documents/enforcement/1005-don-t-let-this-happen-to-you-1/file>.

Instead, it is a long-term commitment requiring companies to continuously invest, yet with intangible benefits. Corporate compliance culture must permeate throughout the entire operation in order to be effective. On the contrary, firms that are subject to weaker export control requirements, or have none, do not share the same obligations. Presumably, such differences in risk management and compliance costs can inevitably create an unleveled playing field among competitors.

However, I would argue that there is another aspect of globalization that can provide additional incentives for companies in a less developed export control environment to comply. The globalization of production has led to increasingly complex and dynamic supply networks. Sustainable supplier relationships have become crucial in companies' sustainability efforts. The sustainable performance of each and every chain link can have a significant impact on corporate image with respect to their economic, environmental, and social behavior. MNCs' intensive investment in managing sustainable supplier relationship goes even beyond corporate boundaries. The sustainability of this supply chain is critical for MNCs' global business operations. One of the key criteria in vetting suppliers is their regulatory compliance practice because any violation of compliance may result in a disruption in the entire chain and cause damage to corporate reputation. This rationale can be extended beyond suppliers. Therefore, MNCs with a strong, cohesive and consistent compliance culture have a spillover effect on its network of business partners and suppliers. As a result, a normative culture of compliance can be formed in an environment in which government export control system is not as sophisticated.

This phenomenon is captured in the discussion of Political Corporate Social Responsibility. The traditional CSR literature is based on an economic view that corporations implement CSR for strategic reasons and assumes the separation of government and business. It suggests that businesses should maximize profits, while government should assume responsibility for those issues that corporations cannot address due to their fiduciary responsibility to shareholders (Friedman 1970). However, globalization brings a completely new dynamic of corporation engagement. Managing global supply and value chains exposes firms to heterogeneous legal environments and social demands. Gaps in global governance restrict the ability of states to regulate adequately corporate behavior through judicial systems (Scherer & Palazzo 2011). Thus, MNCs are uniquely positioned to help address gaps in the global system. They are at the forefront of technological advancement. They are capable of collecting, analyzing, debating and disseminating information. They can form norms that cannot be achieved by international institutions. Firms increasingly provide resources to international organizations and thus indirectly assume a political role (Rasche & Kell, 2010).

In sum, political CSR emphasizes that MNCs become political actors due to the existence of gaps in global governance. MNCs begin to assume state-like functions and work with states in an attempt to find solutions to governance challenges. [14] My hypothesis focuses on the role of MNCs in improving countries' commitment in chemical nonproliferation.

[14] Rasche, Andreas. "The corporation as a political actor–European and North American perspectives." European Management Journal 33.1 (2015): 4-8.

To make this more explicit, I illustrate the casual mechanism in Figure 3.1.

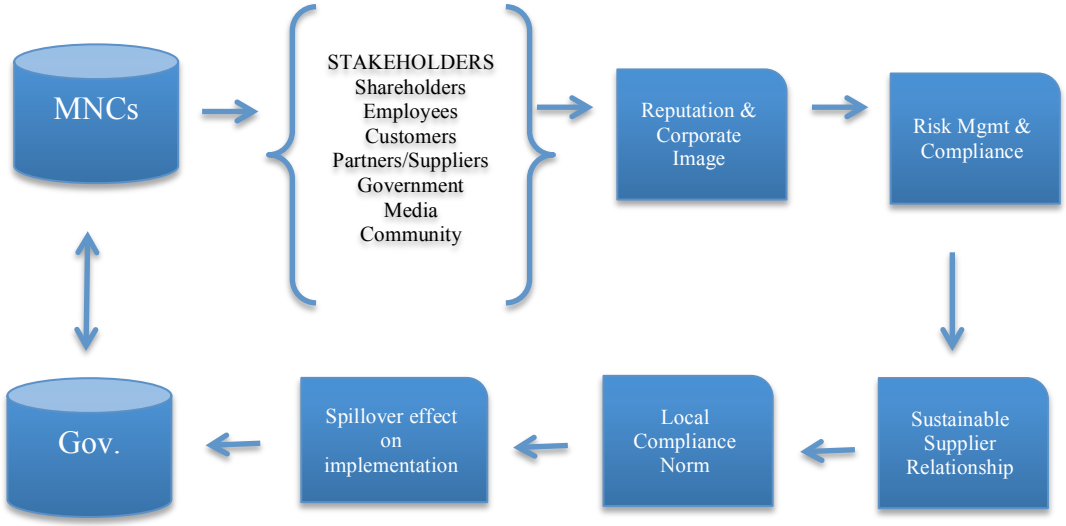

Figure 3.1: Theoretical framework for MNCs influence on States' Implementation of Chemical Nonproliferation

In the next chapter, chapter 4, I will discuss my quantitative methodology and explain the key variables and their operationalization. I also will test whether the expectations outlined here are borne out by the data.

CHAPTER 4

QUANTITATIVE METHODOLOGY

4.1 Frequentist Approach

This dissertation hypothesizes that MNCs can play a positive role in improving countries' chemical nonproliferation commitment. In order to operationalize the concept of chemical nonproliferation commitment, I use two manifest variables to construct my models. A country's CWC ratification and implementation status can signal a country's chemical nonproliferation commitment. Though two distinct variables, they represent a continuum of progress a country experiences in chemical nonproliferation activity. Therefore, I expect the same factors to push a country along the continuum. I use two logistic regression models to measure the influence of MNCs on countries' ratification and implementation of CWC to evaluate the extent to which the common factors influence outcomes. The first model (referred as "membership model") estimates the impact of MNCs on countries' decisions to ratify the CWC, whereas the second model (referred as "implementation model") estimates the impact of the same set of independent variables on country's implementation of CWC. Now I will discuss how to operationalize both models.

First, let me introduce the models in the mathematical format below:

CWC Membership Model

$$CWC_{it} = \beta_0 + \beta_1 SUB_{it} + \beta_2 EXP_{it} + \beta_3 GDP_{it} + \beta_4 POP_{it} + \beta_5 REGIME_{it} + \beta_6 NP_{it} + \beta_7 TIME + \beta_8 TIME^2 + \beta_9 TIME^3 + \beta_{10} SUB_{it} * EXP_{it} + \varepsilon_{rati}$$

CWC Implementation Model

$$CWCIMP_{ju} = \Gamma_0 + \Gamma_1 SUB_{ju} + \Gamma_2 EXP_{ju} + \Gamma_3 GDP_{ju} + \Gamma_4 POP_{ju} + \Gamma_5 REGIME_{ju} + \Gamma_6 NP_{ju} + \Gamma_7 TIME + \Gamma_8 TIME^2 + \Gamma_9 TIME^3 + \Gamma_{10} SUB_{ju} * EXP_{ju} + \varepsilon_{imp}$$

"CWC_{it}" is country i's ratification status with respect to CWC in a given year t, whereas "$CWCIMP_{ju}$" is a country's j's CWC implementation status in a given year u. I will explain each variable in greater detail in the following paragraphs.

Dependent Variables

"CWC_{it}": The CWC was adopted in Geneva on September 3 1992, opened for signature on January 13 1993 and finally went into force in 1997. CWC has 192 member states and all have ratified the Convention by 2013 except Israel.[15] The implementation body of the CWC is the Organization for the Prohibition of Chemical Weapons (OPCW), which provides information on state parties and the dates of their participation to CWC.[16] There are three dates for each member state: Signature, Deposit and Entry into Force. "Signature" indicates the date that a state party signed the convention. The majority of the signature dates were in 1993 when it was first opened for signature. "Deposit" is the date that a state party submitted its instrument of ratification to the Secretary-General of UN. According to the Article XXI,[17] the Convention shall enter into force 180 days after the date of the deposit of 65th instrument of ratification. For states whose instruments of ratification are deposited subsequent to the entry into force of this Convention, it shall

[15] Status of Participation in the Chemical Weapons Convention. N.p.: Organization for the Prohibition of Chemical Weapons, 13 Aug. 2015. PDF. <www.opcw.org/fileadmin/OPCW/S_series/2015/en/s-1304-2015_e_.pdf.>

[16] Status of Participation in the Chemical Weapons Convention as at 17 October 2015 . N.p.: Organization for the Prohibition of Chemical Weapons, 19 Oct. 2015. PDF. <www.opcw.org/fileadmin/OPCW/S_series/2015/en/s-1315-2015_e_.pdf>

[17] "Article XXI. Entry into Force." Organization for the Prohibition of Chemical Weapons. Organization for the Prohibition of Chemical Weapons, n.d. Web. 02 Feb. 2017. <www.opcw.org/chemical-weapons-convention/articles/article-xxi-entry-into-force/>.

enter into force on the 30th day following the date of deposit. In another words, for countries that deposited before 1997 (inclusive), their "entry into force" dates are the same: April 29 1997. For countries that deposited after 1997, their "entry into force" date is 30 days after the deposit date.

I use "deposit" date as my research data because it provides the most variation among states. I name this variable "CWCit", also known as the ratification variable. It is a dummy variable with "0" indicating no ratification at a given country in a given year, and "1" indicating ratification. Once a country ratifies, the value of this variable remains to be 1 thereafter. These data ranges from 1993 to 2015. For example, Sweden signed the Convention in the January 1993 and ratified in June 1993. On the contrary, Angola and Myanmar are the newest members of the Convention. They deposited their instruments in September 2015 and August respectively.[18] There are total of 192 countries in the dataset. The ratification year ranges from 1993 to 2015 with an average of 1999. The median year is 1997. **Table 4.1** below lists countries and their ratification years.

Table 4.1 CWC Member States and Their Ratification Year

Sweden	1993	France	1995	Turkey	1997	Bahrain	1997	Azerbaijan	2000	Montenegro	2006
Seychelles	1993	Finland	1995	Tunisia	1997	Viet Nam	1998	Zambia	2001	Liberia	2006
Mauritius	1993	El Salvador	1995	Trinidad and Tobago	1997	Tanzania	1998	Uganda	2001	Haiti	2006
Fiji	1993	Ecuador	1995	Togo	1997	Ukraine	1998	Nauru	2001	Djibouti	2006
Uruguay	1994	Denmark	1995	Macedonia	1997	Senegal	1998	Dominica	2001	Comoros	2006
Turkmenistan	1994	Croatia	1995	Suriname	1997	Panama	1998	Thailand	2002	Congo	2007
Sri Lanka	1994	Cì«te d'Ivoire	1995	St. Lucia	1997	Mauritania	1998	St. Vincent and the Grenadines	2002	Barbados	2007
Spain	1994	Canada	1995	Slovenia	1997	Malawi	1998	Samoa	2002	Lebanon	2008
Paraguay	1994	Austria	1995	Singapore	1997	Lithuania	1998	Tonga	2003	Guinea-Bissau	2008
Norway	1994	Armenia	1995	Russian	1997	Indonesia	1998	Timor-Leste	2003	Iraq	2009

[18] "Angola Joins Chemical Weapons Convention." Angola Joins Chemical Weapons Convention. Organization for the Prohibition of Chemical Weapons, 21 Sept. 2015. Web. 05 Feb. 2017. <https://www.opcw.org/news/article/angola-joins-chemical-weapons-convention/>.

Mexico	1994	Argentina	1995	Republic of Korea	1997	Gambia	1998	Sao Tome and Principe	2003	Dominican Republic	2009
Maldives	1994	Algeria	1995	Qatar	1997	Cyprus	1998	Palau	2003	Central African Republic	2009
Lesotho	1994	Uzbekistan	1996	Pakistan	1997	Burundi	1998	Kyrgyzstan	2003	Bahamas	2009
Greece	1994	UK	1996	Niger	1997	Botswana	1998	Guatemala	2003	Somalia	2013
Germany	1994	Swaziland	1996	Nepal	1997	Bolivia	1998	Cabo Verde	2003	myanmar	2015
Cook Islands	1994	Saudi Arabia	1996	Malta	1997	Benin	1998	Belize	2003	angola	2015
Bulgaria	1994	Moldova	1996	Mali	1997	Sudan	1999	Andorra	2003		
Australia	1994	Portugal	1996	Luxembourg	1997	San Marino	1999	Afghanistan	2003		
Albania	1994	Philippines	1996	Lao	1997	Nigeria	1999	Tuvalu	2004		
Tajikistan	1995	Papua New Guinea	1996	Kuwait	1997	Nicaragua	1999	St. Kitts and Nevis	2004		
Switzerland	1995	New Zealand	1996	Kenya	1997	Micronesia	1999	Solomon Islands	2004		
South Africa	1995	Latvia	1996	Jordan	1997	Liechtenstein	1999	Sierra Leone	2004		
Slovakia	1995	Ireland	1996	Iran	1997	Holy See	1999	Rwanda	2004		
Romania	1995	India	1996	Iceland	1997	Estonia	1999	Marshall Islands	2004		
Poland	1995	Hungary	1996	Guyana	1997	Yemen	2000	Madagascar	2004		
Peru	1995	Ethiopia	1996	Guinea	1997	UAE	2000	Libya	2004		
Oman	1995	Czech Republic	1996	Ghana	1997	Serbia	2000	Chad	2004		
Netherlands	1995	Costa Rica	1996	Equatorial Guinea	1997	Mozambique	2000	Vanuatu	2005		
Namibia	1995	Chile	1996	Cuba	1997	Malaysia	2000	Niue	2005		
Morocco	1995	Cameroon	1996	China	1997	Kiribati	2000	Honduras	2005		
Mongolia	1995	Brazil	1996	Burkina Faso	1997	Kazakhstan	2000	Grenada	2005		
Monaco	1995	Belarus	1996	Brunei Darussalam	1997	Jamaica	2000	Democratic Republic of the Congo	2005		
Japan	1995	Zimbabwe	1997	Bosnia and Herzegovina	1997	Gabon	2000	Cambodia	2005		
Italy	1995	Venezuela	1997	Belgium	1997	Eritrea	2000	Bhutan	2005		
Georgia	1995	US	1997	Bangladesh	1997	Colombia	2000	Antigua and Barbuda	2005		

Since I am only interested in the time until a country ratified CWC, it is essentially a discrete time hazard model where the outcome variable is the time until the occurrence of an event of interest (BS & Jones 1997). In this case, when CWC_{it} turns "1", the rest of observations in the given country will be dropped. Since most of countries

ratified CWC, this allows it to account for right censoring. In another words, as soon as a country joins its membership in CWC, the model will not consider the impact of MNCs in this country. This practice eliminates a potential concern with endogeneity because it is plausible to suggest that MNCs decisions about investment hinge on whether a country has made its commitment on international nonproliferation. Then the presence of MNCs would occur after a country joining nonproliferation agreement. However, since I eliminate all entries as soon as a country joins the international agreement, the regression no longer considers the scenario described earlier. This practice also addresses the concern of inter-year dependencies for the same reason. Since most of countries ratified CWC, the data set is right censoring. The same rule applies to the "**$CWCIMP_{ju}$**" variable introduced next.

"$CWCIMP_{ju}$": This variable measures the level of implementation of chemical nonproliferation agreements for a given country in a given year. Unlike ratification, there is no existing measurement on CWC implementation. Therefore, I have to create the data based on variety of sources and set of criteria I establish. Often, the concepts of implementation and compliance are interchangeable. Measuring the actual state compliance in nonproliferation is very difficult. There is no known scientific way to quantify such activities. Therefore, in the quantitative analysis, I define implementation as the legal framework a country has established with respect to chemical nonproliferation including legislation, domestic regulation, rules and other measures. Though one can argue that we cannot equate what is on the books and what is actually happening on the ground, this method remains a viable option for scholars to measure the

level of implementation a country has toward its international commitment. At least it is a very important first step.

The evaluation of the implementation level is less straightforward compared to the membership model. There is no unified standard on what type of laws and regulations are considered as implementation of chemical nonproliferation. Therefore, it is extremely important to establish a set of criteria beforehand to ensure consistency during coding process.

Foremost, all CWC member states are required to adopt necessary measures to prohibit the development, production, stockpiling, and use of chemical weapons and on their destruction. The adoption of national legislation is an important indication for CWC implementation. Under Article VII, all state parties are required to adopt necessary measures to implement the Convention. OPCW website publishes a legislation database with examples of legislation enacted by states to implement CWC.[19] For example, Albania promulgated "Law No. 9092 of 3 July 2003 for Implementation of the Convention". In this case, I consider the year of 2003 as Albania's implementation year. "$CWCIMP_{ju}$" is a dichotomous variable "0" indicating the absence of legal framework for chemical nonproliferation in a given year, whereas "1" indicates the existence of a framework. Therefore, Albania's implementation year is 2003. However, states sometimes provided more than one document to OPCW and these documents are not in English. I rely on google translator to identify the content of each document and determine which document truly reflects the earliest implementation of the Convention. For example, Andorra provided five documents including *Penal Code, Arms Code,*

[19] "Legislation Database." Legislation Database. Organization for the Prohibition of Chemical Weapons, n.d. Web. 05 Feb. 2017. <https://www.opcw.org/our-work/national-implementation/implementing-legislation/legislation-database/>.

Industry Safety and Quality, Data Protection Code and Implementation of CWC. The only document that is directly linked to the CWC implementation is the last, which was promulgated in 2002. Therefore, I record 2002 for Andorra as its implementation year.

OPCW website provides 56 countries in its legislation database. I use a second source to code implementation: United Nations Security Council Resolution 1540 (UNSCR 1540). It is an UN mandate requiring all member states to install export control systems to prevent the proliferation of dangerous products and technologies from non-state actors. UNSCR 1540 Committee Approved Country Matrices are a list of country reports prepared by a group of experts. Information in the matrices originates primarily from national reports provided by UNSCR 1540 member states.[20] In the matrix, there are specific questions addressing whether a country has adopted national legislation to prohibit person or entity to engage in CW activities. The challenge is that many regulations/laws a country refers are not for CWC implementation. For example, Afghanistan matrix submits that its Constitution Article 7 includes NBC related ratification law. I am able to find the original constitution promulgated in 2004 and article 7 states "The state shall observe the United Nations Charter, inter-state agreements, as well as international treaties to which Afghanistan has joined, and the Universal Declaration of Human Rights. The state shall prevent all kinds of terrorist activities, cultivation and smuggling of narcotics, and production and use of intoxicants".[21] I cannot count this law as CWC implementation because it is a general law to capture Afghanistan's obligation to international treaties. It is not specifically designed

[20] "1540 Committee." United Nations. United Nations, 2004. Web. 05 Feb. 2017. <http://www.un.org/en/sc/1540/national-implementation/matrix.shtml>.
[21] *The Constitution of Afghanistan*. Kabul: The Islamic Republic of Afghanistan, 26 Jan. 2004. PDF. <http://www.afghanembassy.com.pl/afg/images/pliki/TheConstitution.pdf>.

to address CWC implementation. Similar, Afghanistan also refers other laws/regulations within the context of CWC such as Environment Act, law on combating the financing of terrorism. I cannot credit these laws to CWC implementation either for a similar reason.

I manually review all documents within the Matrices to see if they are consistent with my criteria for implementation of CWC. Another source that I use is the UNSCR 1540 national report. Some countries are not listed under the Matrices, but I can find relevant information from its national report. For example, India is not on the 1540 matrix. However, its national report stated that the government of India has enacted the CWC Act in 2000 to give effect to the CWC and to provide a legal framework for implementation of the Convention.[22] I also use online searches to verify the year a country began implementing CWC. For example, Azerbaijan provided OPCW with a foreign language document including only regulations from different laws. Its 1540 country report also does not include specific information on CWC implementation. I am able to verify that it acceded to the Convention in 2004 from an alternative source.[23] However, if a country is not listed on either the UNSCR 1540 or OPCW database, I do not count them as implementer of CWC such as Algeria.

In sum, there are total of 89 countries in the dataset who have implemented CWC according to the criteria aforementioned. The implementation year ranges from 1994 to 2013 with an average of 2002. The median year is 2003. Please see **Table 4.2** for the implementation table.

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[22] *The Chemical Weapons Convention Act, 2000*. N.p.: n.p., 26 Aug. 2006. PDF.<http://indiacode.nic.in/amendmentacts2012/The%20Chemical%20Weapons%20Convention%20Act.pdf>

23 "Treaties, States Parties and Commentaries." International Committee of the Red Cross. International Committee of the Red Cross, n.d. Web. 06 Feb. 2017. <https://ihl-databases.icrc.org/ihl>.

Table 4.3 provides a summary of the criteria for acceptable and non-acceptable CWC implementation legal framework.

Country	Year	Country	Year	Country	Year
Australia	1994	Iceland	2000	Argentina	2007
Sweden	1994	India	2000	Belgium	2007
Canada	1995	Liechtenstein	2000	C[a]te d'Ivoire	2007
China	1995	Malta	2000	Mali	2007
Croatia	1995	Singapore	2000	Portugal	2007
Denmark	1995	Poland	2001	Spain	2007
Japan	1995	Thailand	2001	Sri Lanka	2007
Mongolia	1995	Zimbabwe	2001	Zambia	2007
Netherlands	1995	Andorra	2002	Indonesia	2008
Austria	1996	Greece	2002	Liberia	2008
Belarus	1996	Senegal	2002	Mexico	2008
Brazil	1996	Albania	2003	Burundi	2009
Germany	1996	Cuba	2003	Cambodia	2009
New Zealand	1996	Estonia	2003	Serbia	2009
Peru	1996	Ethiopia	2003	Antigua and Barbuda	2010
United Kingdom	1996	Guatemala	2003	Armenia	2010
Czech Republic	1997	Mauritius	2003	Pakistan	2010
Ireland	1997	Azerbaijan	2004	Morocco	2011
Italy	1997	Monaco	2004	Iraq	2012
Luxembourg	1997	Moldova	2004	Grenada	2013
Norway	1997	Uruguay	2004	Kenya	2013
Oman	1997	Finland	2005	Nigeria	2013
Republic of Korea	1997	Lesotho	2005	Qatar	2013
Romania	1997	Malaysia	2005		
Russian Federation	1997	Palau	2005		
South Africa	1997	Saudi Arabia	2005		
Switzerland	1997	Vietnam	2005		
France	1998	Bangladesh	2006		
Hungary	1998	Belize	2006		
Latvia	1998	Bosnia and Herzegovi	2006		
Lithuania	1998	Burkina Faso	2006		
Slovakia	1998	Costa Rica	2006		
United States	1998	Kiribati	2006		
Slovenia	1999	Macedonia	2006		
Ukraine	1999	Turkey	2006		
Bulgaria	2000	United Arab Emirates	2006		

Table 4.3 Coding Criteria for Implementation

Acceptable:	Non-Acceptable
• Precursor Chemical Act Law on Export Control of Dual Use • Chemicals Act • Law on Implementation of CWC • Poisons Act • National Monitoring Authority for Nonproliferation Act	• Antiterrorism Act • Environmental Act • Constitution observing all international treaties • Combatting money laundering and financing of terrorism • Decree on civil protection in the case of accident or chemical threat • Transport of Dangerous Goods Act • Firearms Act • CWC Ratification Law • Agrochemicals Act • Law approval of the CWC • Resolution relating to the implementation of 1540 • Pesticide Control • Act of Control of Firearms, Explosives, Ammunition • Public Health Law

Figure 4.1 illustrates the comparison between countries' CWC ratification and implementation from 1992-2015. For each given year, I aggregate the number of countries which score "1" for ratification and implementation respectively. As we can see from the blue (ratification) and red (implementation) lines, the number increases over time. Overall, the total number of countries with CWC implementation is significantly less than ratification. There is a steep increase on the number of countries to ratify CWC from 1993-1997.

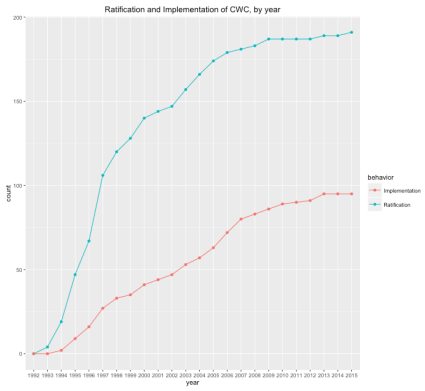


Figure 4.1 Comparisons Between Countries' CWC Ratification and Implementation from 1992-2015

Independent Variables:

"SUB": is a key variable in the explanatory variables. It is an integer variable that summarizes the total number of subsidiaries from 20 selected firms in a given country for a given year. Since my argument focuses on the influence of MNCs, it is imperative to establish that there is a strong presence of MNCs in a given country. This variable is selected as a latent variable to represent the presence of MNCs in a given country because it is measureable. It is created based on a database "Exhibit 21" created by Dr. Scott Dyreng from Duke University's Fuqua School of Business. The database contains information from every 10-K report available from the U.S. Security Exchange Commission (SEC) from 1994 to 2014. A "10-K" report is an annual report required by the SEC that provides a comprehensive summary of a company's financial performance. Within the report, "Exhibit 21" is a section that lists all registered subsidiaries. Within the database, I am interested in several variables: ISO3, DATADATE and COUNTRYCOUNT. ISO3 is a three digit ISO code for the country; DATADATE is the date of the 10-K; and COUNTRYCOUNT is the number of times the country name was found in Exhibit 21. In another word, COUNTRYCOUNT indicates the number of subsidiaries the company has registered at a given country in the DATADATE year. The date set has more than 600,000 entries. "Exhibit 21" offers significant advantages in data analysis because it contains

authentic financial information provided by publicly listed companies in the U.S. Its data are consistent and authentic. It is extremely difficult to collect reliable data from private firms over a large time span, particularly non-US firms. Therefore, I choose firms from "Exhibit 21" to conduct my quantitative analysis.

Since my research focus is multinational corporations and their influence on state decisions to cooperate on international nonproliferation agreements, I will choose a few influential chemical MNCs with pre-determined criteria as my research object. Chemical production is seen as a necessity to provide the products needed for continued economic expansion. Chemical products enhance the quality of life because they permeate deeply in our daily activities: synthetic fibers, pharmaceutical, clothing, paints, adhesives, tires, packing materials and so on. Many advanced industries rely on chemical innovation such as composite materials used in aircraft and spacecraft. Chemical industry represents a dynamic high technology sector that provides jobs for a growing population. Therefore, leading chemical companies have a significant business influence in local economy, particularly in fast-growing major emerging economies. The *Chemical & Engineer News* (C&EN) lists top 50 U.S. Chemical firms based on their sales, profits, profitability and stock prices. I first use the 2014 C&EN Top 50 ranking as the basis of my selection. I establish several criteria for the screening process.

Foremost is the industry segment (i.e. pharmaceuticals, basic, agrochemicals etc). Chemical industry offers a variety of chemical products with different industrial applications. Pharmaceuticals include prescription and over-the-counter drugs; vaccines, serums, plasmas and other biological products; Basic chemicals include inorganic chemicals, bulk petrochemicals, organic chemical intermediates, plastic resins, synthetic rubber, man-made fibers, dyes etc. They are also called c commodity chemicals produced in large volumes. Specialty chemicals are low-

volume, high-value compounds sold on the basis of what they do instead of what they are such as paint, adhesives, electronic chemicals etc. Agricultural chemicals include fertilizers and crop protection chemicals such as pesticides. Consumer products include soap, detergents, toothpaste etc. [24] Despite the diversity, in the context of chemical nonproliferation, I am only interested in a small percentage of chemicals that have WMD proliferation risks. For example, CWC control list has only 52 specific chemicals and 12 chemical groups, while AG has 64 specific compounds.[25] OPCW 2014 report published 49 most traded Schedule 2 and Schedule 3 chemicals within CWC list.[26] Among them, the most industrial uses are flame retardants, insecticides, herbicides, fungicides and pharmaceuticals.[27] Therefore, I am not going to select companies categorized as "Petrochemicals" and "Industrial Gases" on the C&EN list. Rather, I select companies from categories of "Diversified", "Specialty" and "Agrichemical".

The second criterion is international presence. Companies with small global footprint are less likely to influence foreign governments than firms with significant international presence. Therefore, I select companies with larger number of subsidiaries in the "Exhibit 21" database. For example, DOW Chemical is a top global chemical company with approximately 200-700 subsidiaries throughout the 20 years span.

In addition to the C&EN top 50 list, I also consider top producers of the most traded CWC scheduled chemicals. They are important because these traded chemicals are directly linked with chemical nonproliferation discussion. Flame retardant chemical accounts for a

[24] "News & Resources." American Chemistry Council. American Chemistry Council, LLC, n.d. Web. 08 Feb. 2017. <https://www.americanchemistry.com/News_and_Resources/>.
[25] CITS Presentation by Dr. Julie Thompson
[26] "A selection of the most traded Scheduled Chemicals." A selection of the most traded Scheduled Chemicals. Organization for the Prohibition of Chemical Weapons, 18 Nov. 2016. Web. 05 Feb. 2017. <https://www.opcw.org/our-work/non-proliferation/declarations-adviser/most-traded-scheduled-chemicals/>.
[27] "A selection of the most traded Scheduled Chemicals." A selection of the most traded Scheduled Chemicals. Organization for the Prohibition of Chemical Weapons, 18 Nov. 2016. Web. 05 Feb. 2017. <https://www.opcw.org/our-work/non-proliferation/declarations-adviser/most-traded-scheduled-chemicals/>.

significant portion of the 49 most trade chemicals in CWC. It is used extensively in construction, automobiles and electronic industries. The construction industry is the majority consumer of this product. Flame retardant chemical can lower the flammability of combustible substances and reduce flame accumulation. Due to the shortage and increased price of raw material used for the production of flame retardant chemicals as well as toxicity issues, it is a very competitive market that is difficult for firms to grow. The top producers in the U.S. are **Albemarle Corporation, Dupont, Chemtura Corporation and ICL**.[28] Agrichemical refers to a broad range of pesticides including insecticides, herbicides, fungicides and nematicides. It may also include synthetic fertilizers, hormones and etc. The top US agrochemical companies are **Dow AgroSciences, Monsanto, DuPont, CF Industries and Potash Corporation.**[29]

Based on aforementioned criteria, **Table 4.4** lists twenty (20) companies that I select for this study. They represent a diverse chemical industry with significant international presence and influence.

Table 4.4: Selected U.S. Chemical Companies in the Quantitative Analysis (ordered by Sales in 2013)

	Name	Sales in 2013 (million)	Segment	Chemical Sales as % of Total Sales	Year Listed in SEC	No. of Subsidiaries in 2014
1.	Dow Chemical	57,080	Diversified	100	1995	169
2	DuPont	31,044	Diversified	86.9	1994	22
3.	PPG Industries	14,044	Specialty Chemicals	93	1994	54
4.	Mosaic		Agrichemical	100	2005	11
5.	Lubrizol	6,400	Specialty Chemicals	100	1994	38 (2011)

[28] "Flame Retardant Market worth 12.81 Billion USD by 2021." Flame Retardant Market worth 12.81 Billion USD by 2021. Markets and Markets, n.d. Web. 05 Feb. 2017. <http://www.marketsandmarkets.com/PressReleases/flame-retardant-chemicals.asp>.

[29] *North America Agrochemicals Market*. Rep. N.p.: Mordor Intelligence LLP, 2016. Reportbuyer.com. Web. <https://www.reportbuyer.com/product/4244298/north-america-agrochemicals-market.html>.

6.	CF Industries	5,475	Agrochemicals	100	2011	21
7.	Momentive Specialty Chemicals	4,890	Specialty Chemicals	100	2011	41
8.	Monsanto	4,521	Agrochemical	30.4	2001	34
9.	FMC Corp.	3,875	Specialty Chemicals	100	1994	6
10.	W.R. Grace	3,061	Specialty Chemicals	100	1997	95(1998)
11.	H.B.Fuller	2,047	Specialty Chemicals	100	1995	171
12.	Momentive Performance Materials	2,398	Specialty Chemicals	100	2008	10
13.	Kronos Worldwide	1,943	Inorganic	100	1997	14(2007)
14.	Cytec Industries	1,935	Specialty Chemicals	100	1997	23
15.	Sigma-Aldrich	1,622	Specialty Chemicals	60	1994	114
16.	Stepan	1,881	Specialty Chemicals	100	1994	23
17.	Chemtura	2,231	Specialty Chemicals	100	2006	105
18.	Rockwood Specialties	1,378	Specialty Chemicals	100	2004	169 (2006)
19.	Potash Corp		Agrichemical		1997	39
20.	Albemarle Corp		Specialty Chemicals		1997	18

Sources: *http://pubs.acs.org/subscribe/cen/datatables/top502014.html*

Descriptive Statistics

After extracting 20 companies' data from "Exhibit 21", there are total of 6,150 entries for the dataset. Since the database is organized by firm-year rather than country-year, I create a new data frame, which summarizes the total number of subsidiaries from all 20 firms in a given country for a given year.[30] There are 1591 entries in this database[31] including "COUNTRY", "YEAR" and "TOTALSUBS" variables. The number of subsidiaries in a given country ranges

[30] R Code is available in the Appendix
[31] Dataset is "country_year_total.xlsx"

from 1 to 119 with an average of 13 from 1994 to 2014. There are a total of 110 countries with international subsidiaries from the selected 20 firms.

Example:

COUNTRY	YEAR	TOTALSUBS
Venezuela	1995	5
Uruguay	1995	6
Thailand	1995	8
Sweden	1995	4

Figure 4.2 illustrates the number of subsidiaries (of the 20 chemical firms) in a given country for a given year from 1994-2014 by order. It presents the geographic differences in chemical production. **Table 4.5** provides further details on the number of subsidiaries for each country from 1994-2014.

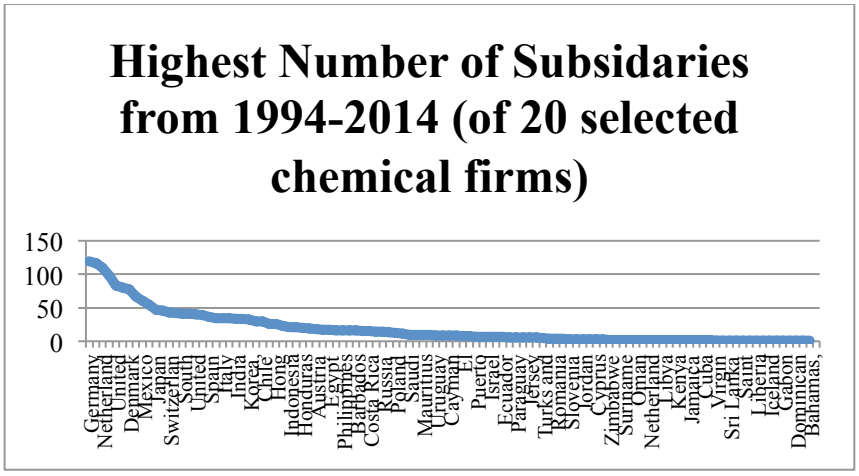


Figure 4.2 The Number of Subsidiaries of 20 Selected Chemical Firms (1994-2014) by Order

Table 4.5 The Highest Number of Subsidiaries from 1994-2014

Germany	119	Barbados	16	Greece	3
Canada	117	Hungary	16	Jordan	3
Netherlands	110	Philippines	16	Slovakia	3
China	97	Venezuela	16	Slovenia	3
United Kingdom	83	Costa Rica	15	Cote d'Ivoire	2
France	80	Portugal	15	Cuba	2
Denmark	77	Russia	14	Iran	2
Panama	67	Sweden	14	Jamaica	2
Mexico	60	New Zealand	13	Kazakhstan	2
Argentina	54	Poland	12	Kenya	2
Japan	47	Peru	11	Latvia	2
Australia	46	Georgia	10	Libya	2
Switzerland	43	Mauritius	10	Namibia	2
Brazil	42	Norway	10	Netherlands Antilles	2
Singapore	41	Saudi Arabia	10	Nigeria	2
South Africa	41	Bolivia	9	Oman	2
United States of America	40	Cayman Islands	9	Sierra Leone	2
Thailand	39	Trinidad and Tobago	9	Suriname	2
Spain	36	Uruguay	9	Swaziland	2
Bermuda	34	Czech Republic	8	Zimbabwe	2
Italy	34	El Salvador	8	Bahamas, The	1
Luxembourg	34	Ecuador	7	Cameroon	1
Belgium	33	Gibraltar	7	Dominican Republic	1
India	33	Israel	7	Estonia	1
Korea, South	32	Nicaragua	7	Gabon	1
Chile	30	Puerto Rico	7	Guadeloupe	1
Malaysia	30	Finland	6	Iceland	1
HKSAR	26	Jersey	6	Kuwait	1
Taiwan	26	Pakistan	6	Liberia	1
Ireland	23	Paraguay	6	Reunion	1
Colombia	21	Vietnam	6	Saint Vincent and the Grenadines	1
Indonesia	21	Turks and Caicos Islands	5	Seychelles	1
Honduras	20	Lebanon	4	Sri Lanka	1
Guatemala	19	Romania	4	United Arab Emirates	1
Austria	18	Ukraine	4	Virgin Islands (US)	1
Egypt	17	Bahrain	3		
Turkey	17	Cyprus	3		

"EXP": is another key independent variable representing chemical exports of a given country in a given year. Chemicals can be used for both domestic consumption and foreign trade.

When an industry is heavily relying on foreign trade, more specifically exports, it is more likely to be influenced by international norms. In the context of nonproliferation discussion, it focuses on "export" control which emphasizes the in/outbound movement of sensitive products. Therefore, "EXP" reflects how likely chemical exports can influence a government's decision to engage in nonproliferation. My data source is the World Trade Organization Statistics Database.[32] Time Series profile provides international trade data in merchandise and commercial services. According to the technical note from WTO, chemicals here include pharmaceuticals and other chemicals such as organic, inorganic chemicals, plastics and other chemicals. This will provide a general chemical industry profile in 180 economies. The panel date ranges from 1992 to 2014. Exports are valued at transaction value, including the cost of transportation and insurance to bring the merchandise to the frontier of the exporting country or territory.[33]

This data set comes with some challenges. Its missing values account for nearly 20% of the entire data. There are two types of missing values. Some countries are missing a few years. For example, Albania's data only ranges from 1996 to 2014. I tried different random imputation techniques to address these missing values. However, the imputed values are not consistent and not reliable. For example, sometimes its estimated value can be several hundred times greater than the average volume. In other cases, some countries are missing the entire entry such as Angola or only has a couple of values. Random imputation cannot provide reliable estimate. Therefore, I manually examine each country and make determination on the values based on further research.

[32] "Time Series." Time Series. World Trade Organization, n.d. Web. 05 Feb. 2017. <http://stat.wto.org/StatisticalProgram/WSDBViewData.aspx?Language=E

[33] "Time Series." Time Series. World Trade Organization, n.d. Web. 05 Feb. 2017. <http://stat.wto.org/StatisticalProgram/WSDBStatProgramTechNotes.aspx?Language=E#Def_Meth_TMV>.

Foremost, the majority of countries with complete missing data are in Africa. The chemical markets in Africa are largely targeted at meeting local needs for chemical feed stocks and intermediates rather than being export orientated. There are three areas in Africa though have stronger chemical industries than the rest: North Africa (Algeria, Egypt, Libya, Morocco and Tunisia), West Africa (Nigeria) and Southern Africa (South Africa). Therefore, I can reasonably assign "0" to missing values in African countries missing entire export entry such as Angola, Chad, Djibouti, Eritrea (partial), Liberia, Mauritania, Sierra Leone and Timor-Leste. In addition to those on the African continent, there are several countries with missing export variables. Myanmar has no large chemical factory due to its lack of investment and technical know-how. Its government is pushing for developing chemical industry, especially petrochemical industry.[34] However, its past chemical export is negligible. Tajikistan is regarded as one of the poorest former Soviet republics. Its nation is overly reliant on exports of aluminum and cotton. [35] Therefore, I assign "0" to their chemical export as well.

Several countries have only a couple of available data points. It is not desirable to use random imputation. So I examine them manually as well. Turkmenistan announced its plan to develop chemical facilities in order to expand its chemical production in 2015. It plans to construct 10 new industrial facilities and engage in 17 kinds of chemical products. It has moderate chemical infrastructure in place from the Soviet era. Therefore, instead of using "0", I assign the mean value of the available data (1999 & 2000) to its missing values. Uzbekistan is the only Republic in Central Asia being a producer of raw materials and has a growing chemical

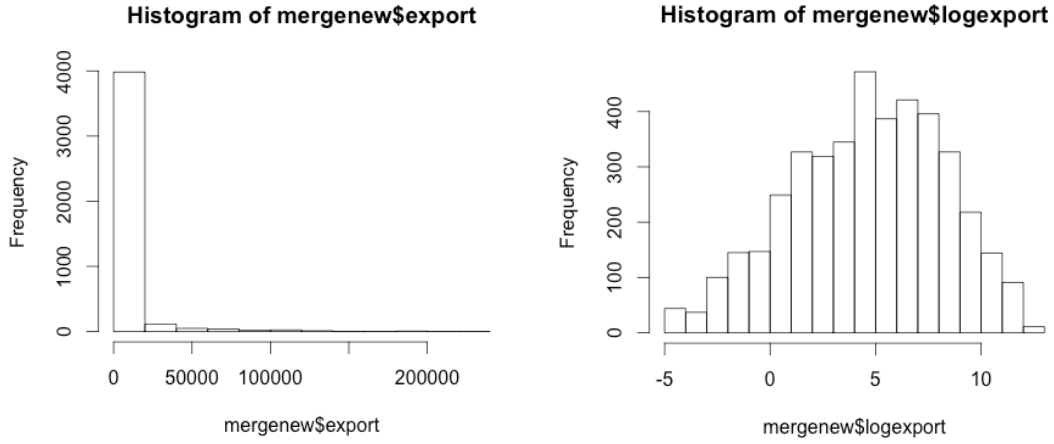
[34] "Myanmar calls for developing chemical industries at home." Myanmar calls for developing chemical industries at home - Xinhua | English.news.cn. English.news.cn, 19 Oct. 2014. Web. 05 Feb. 2017. <http://news.xinhuanet.com/english/world/2014-10/29/c_133751051.htm>.
[35] "Tajikistan Economy." Tajikistan Economy | Economy Watch. Economy Watch, 19 Jan. 2010. Web. 05 Feb. 2017. <http://www.economywatch.com/world_economy/tajikistan>.

industry including mineral fertilizers, protection agents, chemical fibers, synthetic resins etc.[36] Its chemical production capacity is much stronger than other countries in the region. Therefore, I assign the mean value of the available data (2012 & 2013) to missing values.

Another type of missing values is countries with a few values less than 1. They are mostly tiny economies with small population. Since chemical export requires significant chemical production capacity and economic scale, I can reasonably assume that these countries with fractional chemical export can be zero in missing values. For example, Samoa only began very limited export in 2001. It only made discernable progress throughout the last decade. Therefore, I assign "0" to its missing values in the previous years. Similar treatment applies to Sao Tome and Principe, Solomon Island and Vanuatu.

Data Treatment

I use histogram to examine if this variable has a normal distribution and find it mostly left skewed. I apply a log transformation [log(export+1)] to normalize it. Figure 4.3 are the graphs demonstrating before and after log transformation.



[36] *Chemical Industry of the Republic of Uzbekistan*. N.p.: Uzkimyosanoat State Joint-Stock Company, 2012. PDF. <http://www.ubtic.org/wp-content/uploads/2013/06/5-UBTIC-Uzkimyosanoat-Chemical-Industry-25102012.pdf>.

Control Variables:

I select several control variables to capture other factors, which may influence ratification process such as regime type. The section below will describe each independent variable.

"REGIME": an interval-level variable reflecting the level of democratization in a country in a given year. Studies have shown domestic determinants of ratification behavior (Von Stein 2008; Bernauer et al., 2010). For example, democracies are more likely to ratify international environmental agreements (Neumayer 2002). Therefore, I choose this variable as a controlled determinant in this study. The data source is Unified Democracy Score[37], which is a set of measures to provide a composite scale of democratic level. The updated version covers time period from 1946 to 2012. There are missing values for year 2013, 2014 and 2015.

"NP": the nonproliferation variable is the total number of international WMD treaties and multilateral regimes a country has ratified or joined by 2015. This variable reflects a general attitude and commitment one country has toward WMD nonproliferation. It is important to include this variable despite the potential diluting effect caused by endogenity with other independent variables. This variable can account for idiosyncratic involvement in the nonproliferation regime. To the extent if any that the endogenity issue introduces biasness, it would be against my hypothesis instead of supporting it. In short, this sort of model misspecification would not introduce a false positive. I include a list of international treaties and regimes in this calculation. The definition of treaty and regime varies. International treaty is a legally binding mechanism that requires member states to oblige the treaty through legalistic instruments. Multilateral regime refers to informal mechanism that is consisted with members

[37] "Project Description." Unified Democracy Scores. James Melton, Stephen Meserve, and Daniel Pemstein, 12 Mar. 2014. Web. 05 Feb. 2017. <http://www.unified-democracy-scores.org/>.

who agree upon a set of guidelines. It is not legally binding and in most case complement to a corresponding treaty.

Below is a list of treaties and regimes that I include in my data frame. I credit "1" point to countries with membership, "0.5" for signatories and "0" for non-member. Since there are a total of seven treaties and multilateral regimes that I consider, this variable ranges from 0-7. This is based on the assumption that they are equally important. Obviously, each international treaty and regime is negotiated separately with different background and complexity. For each country, the treaties and regimes might have different importance. However, within the context of my research, I am only interested in the general attitude of a country toward WMD nonproliferation and I am not differentiating between nuclear, chemical, biological and delivery system. Further, this variable is merely a control variable and not the key explainable variable that I focus on. Therefore, I weigh each treaty and regime equally in this analysis. A measurement model establishing the varying degree of difficulty in joining treaties will be a separate project.

- ***Nuclear Nonproliferation Treaty (NPT):*** is a landmark international treaty whose objective is to prevent the spread of nuclear weapons and technologies. It is to promote peaceful uses of nuclear energy and achieve the goal of nuclear disarmament. It opened for signature in 1968 and entered into force in 1970. A total of 190 state parties have joined the treaty.
- ***Biological and Toxin Weapons Convention (BTWC)***: is an international treaty designed to ban the development, production, stockpiling, acquisition and retention of microbial or other biological agents or toxins. The treaty was opened for signature in Moscow,

Washington and London in 1972 and entered into force in 1975.[38] There are total of 173 state parties and 9 signatories. There are 14 states that have neither signed nor ratified the Convention. [39]

- ***Nuclear Supplier Group (NSG):*** is a multilateral regime. It is a group of nuclear supplier countries that seeks to contribute to the nonproliferation of nuclear weapons through a set of guidelines for nuclear exports. NSG guidelines were published in 1978 and advanced in 1992 to regulate the transfer of nuclear related dual use equipment, material and technology. NSG currently have 49 member states.[40]
- ***Wassenaar Arrangement***: is a multilateral regime with 41 member states. It was established to promote the transparency and responsibility in transfers of conventional arms and dual use goods and technologies. Participating states control all items set forth in the control list of dual use goods and technologies and munitions list. They agree to adhere to a number of guidelines, elements and procedures.[41]
- ***Missile Technology and Control Regime (MTCR):*** is a multilateral regime with the objective of nonproliferation of unmanned delivery systems capable of delivering weapons of mass destruction. MTCR is an informal and voluntary regime that was

[38] "Status of the Convention." *Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction*. Biological and Toxic Weapons Convention, n.d. Web. 08 Feb. 2017. <http://www.opbw.org/convention/status.html>.
[39] "UNOG - The United Nations Office at Geneva." Where global solutions are shaped for you | Disarmament | Membership of the Biological Weapons Convention. The United Nations Office at Geneva, n.d. Web. 05 Feb. 2017. <http://www.unog.ch/__80256ee600585943.nsf/(httpPages)/7be6cbbea0477b52c12571860035fd5c?OpenDocument&ExpandSection=2#_Section2>.
[40] "Nuclear Suppliers Group - Participants." Nuclear Suppliers Group. Nuclear Suppliers Group, n.d. Web. 05 Feb. 2017. <http://www.nuclearsuppliersgroup.org/en/participants1>.
[41] "About us." The Wassenaar Arrangement. The Wassenaar Arrangement, 14 Dec. 2016. Web. 05 Feb. 2017.

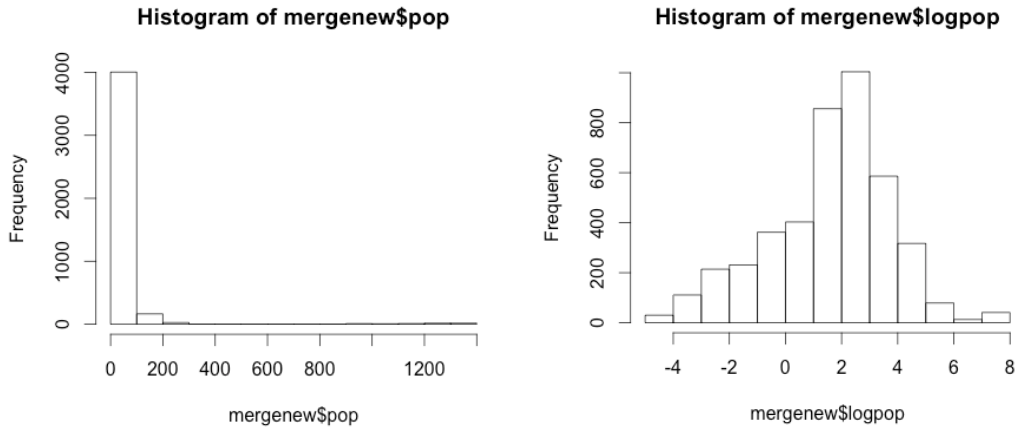
established in 1987. It currently has 34 member states who adhere to common export policy guidelines and control list.[42]

- ***Australia Group (AG):*** is an informal forum of countries seeking to prevent the spread of chemical or biological weapons. It is not a legally binding obligations. Its member states use licensing measures to ensure the exports of certain chemicals, biological agents and dual use chemical and biological manufacturing facilities and equipment do not contribute to CBW. AG was established in 1985 and has grown to 41 members plus EU.[43]
- ***Zangger Committee***: is an informal and not legally binding mechanism that was created in 1971. It was formed to implement the export control provisions of the NPT Article III(2). It has a "trigger list" of items in nuclear production. The controlled items developed by the Zangger Committee are known as the Trigger List because export of those items triggers IAEA safeguards. There are currently 39 member states.[44]

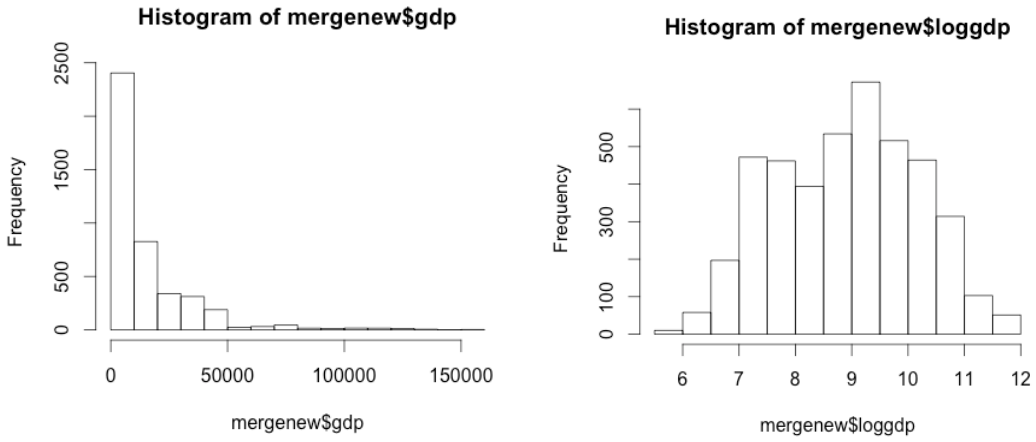
"POP": Chemistry plays an important role in feeding growing populations. Chemicals help increase food production to keep pace with growing population. Therefore, countries with larger populations are more likely to host chemical companies than those with small population. The World Bank Development Indicator database has a dataset for population in millions from 1992-2015.

[42] "MTCR Partners." *Missile Technology Control Regime*. Missile Technology Control Regime, 30 Dec. 2016. Web. 08 Feb. 2017. <http://mtcr.info/partners/>.
[43] "The Origins of the Australia Group." The Australia Group. AustraliaGroup.net, n.d. Web. 06 Feb. 2017. <http://www.australiagroup.net/en/origins.html>.
[44] "Zangger Committee (ZAC)." Nuclear Threat Initiative: Building a Safer World. Nuclear Threat Initiative, 20 Sept. 2016. Web. 06 Feb. 2017. <http://www.nti.org/treaties-and-regimes/zangger-committee-zac/>.

Similar to the data treatment aforementioned, **Figure 4.4** below is the graphs demonstrating before and after log transformation for population variable.



"GDP": GDP per capita (using Purchasing Power Parity) is a measure of a country's economic development. It can capture the influence of market demand for consumer goods, infrastructure establishment and technology development. These are important factors in MNCs' decision in FDI. I extract data from World Bank's World Development Indicators and select "GDP per capita, PPP (constant 2005 international $)" dataset. I apply log transformation to normalize the data. **Figure 4.5** below are the graphs demonstrating before and after log transformation. There are missing values in the data, of which mostly are in 2015.



The sampling year ranges from 1997 to 2015. CWC opened for signature in 1993 and there are 192 member states today. Only one country so far has not ratified or acceded to the treaty: Israel. In this study, we control the sample size to countries with population over 1 million[45] which reduces the number of countries to 122. Countries with population less than 1 million mostly do not have a viable chemical industrial base, thus are not relevant to this paper's emphasis on chemical industry.

Data Treatment and Model Analysis

After merging all variables into one dataset, there are missing values in different variables. The most problematic is the "EXP" variable, which misses 848 observations. It accounts for nearly 22% of the data. Elimination of missing values is not desirable. But if a country is missing all values in the "EXP" variable and has a population less than 200,000, I choose to delete this country from my dataset. The reason is that countries with a small population have very limited production capacity including chemical industry. Their absence will not affect my analysis. Below is a list of countries that I eliminate:

Andorra, Cook Islands, Equatorial Guinea, Haiti, Holy See, Kiribati, Liechtenstein, Marshall Island, Monaco, Nauru, Niue, Palau, San Marino, St. Lucia, Tuvalu, St. Kitts and Nevis. I also eliminate Afghanistan and Somalia because they have not had a functioning government. Their impact on my analysis is negligible.

Thus, I have 3816 observations in the dataset with 159 countries. Handling the remaining missing values becomes a challenge. Several logit regression models are run with different data treatment techniques. Since my dataset is country by year panel data, it creates an issue of correlated response. For example, GDP per capital for Albania in 1997 is correlated with

[45] "All countries by population." Researching Virtual Initiatives in Education. Researching Virtual Initiatives in Education, 21 Apr. 2014. Web. 06 Feb. 2017. <http://www.virtualcampuses.eu/index.php/All_countries_by_population>.

Albania in 1996. Therefore, I use a standard error cluster technique (Huber-White method) to adjust the variance-covariance matrix. Another issue is that my variables might share a similar trend which can be highly correlated when regress one on the other. Therefore, I add time trending variables in my model: linear, quadratic and cubic. I use the AIC test to compare different models because it is a goodness of fit measure that favors smaller residual error in the model, but penalizes for including further predictors and help avoiding overfitting. Lastly, I add an interaction variable between SUB and EXP so that I can observe how variations within chemical export and MNC subsidiaries can impact my dependent variables. Since chemical nonproliferation focuses on the flows of sensitive chemicals to avoid falling into the wrong hands, a country without active chemical exports does not pose as significant a threat as those with active chemical exports. Therefore, it is important to consider the interaction between MNC subsidiaries and chemical export.

I use different techniques to treat the missing values in the dataset, which generate different statistical results. For each technique, I run the logistic regression three times with three nested models for ratification and implementation respectively. The first model has 6 variables including two key independent variables and four controlled variables. The second model includes time trending variables from linear, quadratic to cubic. The AIC number decreases with time trending variables. The third nested model is the full model including the interaction variable between subsidiary and export. The AIC score achieves the lowest in the full model, which is the most fitted model.

Each technique has its flaws and is suboptimal. I would only focus on analyzing the statistical results of the strongest model in this group and list the alternative specification results in the Appendices for comparison purpose.

MODEL SPECIFICATION METHODS

First, I use listwise deletion. Since this technique deletes the entire record if any single value is missing, the total number of observations is reduced to 2848. Listwise deletion affects statistical power of the model and also is problematic when missing data may not be random. In this case, missing data in chemical export might be a result of limited chemical industrial activity which is not random. Therefore, the listwise deletion technique is not optimal in handing my model. Despite this weakness, I proceed to conduct the regression as an alternative specification for comparison purposes. **Table 4.6** lists the statistical results.

Table 4.6 Listwise Deletion Technique Model Result - Ratification Model

	Coef	Coef	Coef
Constant	-1.6592 (0.5517)	-6.3886*** (0.9187)	-6.1847*** (0.9112)
SUB_{it}	0.0358** (0.0103)	0.0179 (0.0081)	-0.0513 (0.0319)
EXP_{it}	0.0447 (0.0334)	-0.0167 (0.0475)	-0.0395 (0.0481)
GDP_t	0.2077 (0.0699)	0.3118 (0.0942)	0.3143 (0.0936)
POP_{it}	0.0758 (0.0429)	0.2016 (0.0574)	0.1935 (0.0576)
$REGIME_{it}$	-0.0416 (0.0768)	-0.1114 (0.0938)	-0.0692 (0.0943)
NP_{it}	0.1101 (0.0441)	0.3545*** (0.0547)	0.3352*** (0.0559)
TIME		0.3142*** (0.1596)	0.2908*** (0.1572)
$TIME^2$		0.0123 (0.0158)	0.0137 (0.0156)
$TIME^3$		-0.0007 (0.0005)	-0.0007 (0.0005)
$SUB_{it}*EXP_{it}$			0.0125*** (0.0051)
AIC	2960	2035	2027

Listwise Deletion Technique Model Result - Implementation Model

	Model 1	Model 2	Model 3
Constant	-3.8521*** (0.714)	-12.6186*** (1.1001)	-12.7293*** (1.1048)
SUB_{it}	0.0231** (0.0046)	0.0019 (0.0061)	-0.1629 (0.0461)
EXP_{it}	0.2325** (0.0417)	0.1164 (0.0453)	0.1009 (0.0443)
GDP_{it}	0.0362 (0.0915)	0.2105 (0.1053)	0.2252 (0.102)
POP_{it}	0.0041 (0.0486)	0.2296 (0.0565)	0.2359 (0.0555)
$REGIME_{it}$	0.1575 (0.0738)	0.2896 (0.0919)	0.3743 (0.0976)
NP_{it}	0.2794*** (0.0327)	0.5519*** (0.0455)	0.5194*** (0.0441)
TIME		1.1551*** (0.1741)	1.2178*** (0.1798)
$TIME^2$		-0.0634*** (0.0152)	-0.0685*** (0.0155)
$TIME^3$		0.0013*** (0.0004)	0.0014*** (0.0004)
$SUB_{it}*EXP_{it}$			0.0181 (0.0051)
AIC	2518	2006	1977

The second model set uses a different data treatment method. Instead of eliminating all missing data values, I use a multiple random imputation technique (R package "MICE") to perform random imputation on the missing variables. However, the results for "EXP" are not desirable. The average estimated "EXP" missing values appears to be overestimated. For example, Albanian export data in given years are consistently in the single digit range. Yet, the imputed data values are mostly in the hundred range. **Table 4.7** lists the result for regression models with random imputation (MICE). The results of this model set are not desirable due to the overestimated missing values in the "EXP" variable.

Table 4.7 Random Imputation Technique Model Results - Ratification Models

	Model 1	Model 2	Model 3
Constant	-2.1145*** (0.6267)	-5.5174*** (1.1232)	-5.4745*** (1.1252)
SUB_{it}	0.0243*** (0.0128)	0.01 (0.0109)	-0.0213 (0.0283)
EXP_{it}	0.0165 (0.0458)	0.0282 (0.0792)	0.0221 (0.0797)
GDP_{it}	0.2942*** (0.0893)	0.1474 (0.1525)	0.1504 (0.1528)
POP_{it}	0.1754*** (0.0622)	0.1341 (0.1052)	0.1323 (0.1054)
$REGIME_{it}$	0.242 (0.173)	-0.0377 (0.2481)	-0.0271 (0.2509)
NP_{it}	-0.0208 (0.107)	0.3125*** (0.1486)	0.2995*** (0.1518)
TIME		0.5067*** (0.1265)	0.5081*** (0.1264)
$TIME^2$		-0.0084 (0.0119)	-0.0088 (0.0119)
$TIME^3$		0 (0.0003)	0 (0.0003)
$SUB_{it}*EXP_{it}$			0.0045 (0.0037)

Random Imputation Technique Model Results - Implementation Model

	MODEL 1	MODEL 2	MODEL 3
Constant	-5.0233*** (1.2883)	-6.2467*** (1.9847)	-13.5656*** (0.843)
SUB_{it}	0.0176 (0.0104)	0.0016 (0.0167)	-0.1830 (0.04)
EXP_{it}	0.1852** (0.0699)	0.0567 (0.0803)	0.0392 (0.0293)
GDP_{it}	0.2173*** (0.1613)	0.3363 (0.2188)	0.3535** (0.0698)
POP_{it}	0.1487*** (0.0867)	0.3188*** (0.1125)	0.3285*** (0.0387)
$REGIME_{it}$	0.37** (0.0188)	0.2848 (0.2606)	0.3700 (0.0821)
NP_{it}	0.1851*** (0.0807)	0.5942*** (0.1334)	0.5635*** (0.0424)
TIME		1.0027*** (0.1891)	1.0628*** (0.1264)
$TIME^2$		-0.0426*** (0.0134)	-0.0506*** (0.0097)
$TIME^3$		0.0006*** (0.0003)	0.0007*** (0.0002)
$SUB_{it}*EXP_{it}$			0.0202 (0.0044)
AIC	3338	2527	2508

The third method is my best option among the group. I replace missing values in the "EXP" variable with zero. The theoretical argument is that chemical export reflects a country's chemical industrial production capability. Missing values are exclusively from low production capacity states. Some countries have single digit chemical export in some years. Therefore, it is much more plausible to have a close to zero value than the imputed overestimated values. For the remaining missing values in other variables, due to the small numbers of missing values, I use imputation technique to provide a better estimate.

Since this model provides the most reasonable estimation of missing values compared with other two alternative specifications, I will discuss in detail the statistical results from **Table 4.8** below.

Table 4.8 Replacement with Zero Technique Model Results - Ratification model

	Coef (No Trend)	Coef (Cubic Trend)	Coef (Interaction)
Constant	-1.3416*** (0.6604)	-5.3394*** (1.1703)	-1.7237*** (0.6602)
SUB_{it}	0.0204** (0.012)	0.0115 (0.0115)	-0.0159 (0.0271)
EXP_{it}	0.0972*** (0.0398)	0.0416 (0.0671)	0.0418 (0.0354)
GDP_{it}	0.194*** (0.0926)	0.1314 (0.1539)	-0.0023 (0.0716)
POP_{it}	0.1153*** (0.0566)	0.1173 (0.1019)	0.0133 (0.0498)
$REGIME_{it}$	0.2094 (0.1746)	-0.0577 (0.2446)	-0.0342 (0.1179)
NP_{it}	-0.0391 (0.1125)	0.3102*** (0.1475)	0.1539*** (0.0616)
TIME		0.5059*** (0.1267)	-0.3892*** (0.1775)
$TIME^2$		-0.0092 (0.0121)	0.0417*** (0.0200)
$TIME^3$		0 (0.0003)	-0.0011*** (0.0006)
$SUB_{it}*EXP_{it}$			0.0019 (0.0036)

Replacement with Zero Technique Model Results - Implementation model

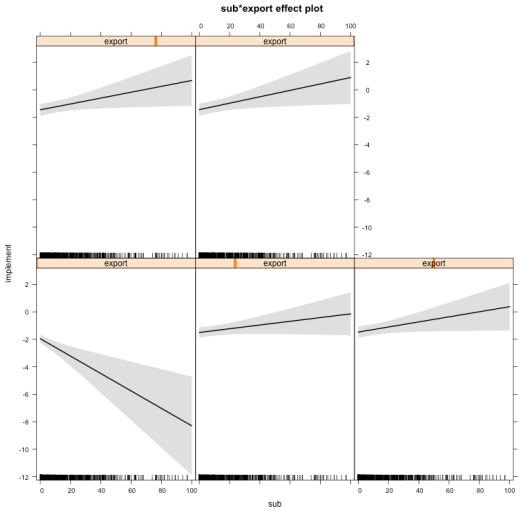
	Coef (No Trend)	Coef (Cubic Trend)	Coef (Interaction)
Constant	-6.7945*** (1.2536)	-14.0892*** (1.9256)	-8.9814*** (1.5983)
SUB_{it}	0.0162 (0.0107)	-0.0011 (0.0165)	-0.0985 (0.0607)
EXP_{it}	0.0652** (0.0378)	0.0665 (0.0614)	0.1580*** (0.0742)
GDP_{it}	0.4529*** (0.1441)	0.3439** (0.1993)	0.0986 (0.1710)
POP_{it}	0.2774*** (0.0715)	0.325*** (0.1041)	0.1935*** (0.0898)
$REGIME_{it}$	0.3198** (0.1875)	0.2661 (0.2553)	0.2454 (0.2040)
NP_{it}	0.2073*** (0.0818)	0.5909*** (0.1344)	0.2990*** (0.0781)
TIME		1.0865*** (0.2135)	0.5384*** (0.1937)
$TIME^2$		-0.0509*** (0.0161)	-0.0264*** (0.0180)
$TIME^3$		0.0009*** (0.0004)	0.0003 (0.0005)
SUB_{it}*EXP_{it}			0.0080 (0.0072)

It includes 3 models for ratification and implementation respectively. Because the observations are grouped into clusters by country, the model errors are correlated within the cluster though they are uncorrelated across clusters. In such settings, standard errors can be over estimated. Therefore, I use standard error cluster technique to control the clustered errors. Following the similar pattern from previous model set, the most fitted model is the third one with the interaction variable. However, there is no statistical significance among the key variables in the ratification model. The implementation model demonstrates sizeable statistical significance in most variables including the key variables SUB_{ju} and "SUB_{ju}*EXP_{ju}". All signs are positive except $SUB_{ju.}$ In addition to the sign of coefficients, it is also important to examine the size of the coefficients.

However, since the coefficients of the logit models are logodds, the coefficient cannot be interpreted as straightforwardly as linear regressions. First, the GDP and POP are log

transformed variables. The difference between maximum and minimum in GDP value is around 6. The coefficient is 0.3776. Therefore, the aggregate increase is approximately 2.26 (6*0.03776) which can be converted to odds as 9.58. It means that from the poorest country to the richest country, the odds of implementation increases by 9 fold. This is a substantial increase. Similarly, the population variable log value ranges from -4 to 8 and the coefficient is 0.3419. The aggregate increase is 4.10 and the odds is 60. This indicates that from the smallest population to the largest population, the odds of implementation increases by 60 fold, a large figure.

The SUB variable ranges from 0 to 119. It's coefficient is -0.06. The aggregated decrease for from a country with no foreign subsidiary in a given year to the one with the most subsidiaries is 7.14. It means the odds of ratification decreases by nearly 7 times which is also large. Though it is contrary to what I have initially predicted, it is more important to look at the impact of the interaction variable "SUB_{ju}*EXP_{ju}" through graphs instead of "SUB_{ju}" alone. However, due to the difficulty in interpreting standard error in logit model for interaction variable (Ai & Norton 2003), I choose to describe the out of sample predictions generated visually. Therefore, I use the "effect" package in R to create the interaction plot (**Figure 4.5**) for a better illustration of the impact.



This package uses the model results already estimated to visualize the impact of the covariates. The number from 0-100 on the bottom horizontal axis indicates the number of subsidiaries, whereas the vertical axis represents chemical exports. The slope indicates the impact of the interaction variable on ratification or implementation. The order of the plots is not an ordinal order by the size of EXP variable due to R package setting. When chemical export volume is zero, the graph indicates a consistent negative impact of MNC subsidiaries on implementation. In another words, when a country does not export any chemical product, the more chemical MNCs it has, the less likely it is to implement the CWC. On the contrary, when a country does have chemical export, the presence of chemical MNCs has a positive influence on country's implementation for CWC. The slope increases as the export volume picks up. This helps explain the negative sign in the "$SUB_{ju.}$" alone. The impact of MNC investment and chemical export volume is dynamic based on the volume of chemical export. Lastly, the confidence interval in Figure 4.5 gets bigger as the number of subsidiaries increases. This is the result of decreasing numbers of cases at the higher spectrum of subsidiaries. In another words, there are much less countries with over 60 subsidiaries at a given year.

I have used three different data treatment techniques to handle the missing values: eliminating data, random imputation with "MICE" program, assigning zeros to missing values in the "EXP" variable and random imputation for the rest of missing values. As I explained previously, the last model specification is the best choice among the three because it captures the most reasonable estimation of missing values. However, there are still issues with the frequentist approach to handling the missing data. Either imputation generates overestimated data or assigning zeros overlooks the uncertainty. Therefore, the section below will discuss a Bayesian alternative that I will use to impute the missing data and its results.

4.2 Bayesian Approach

The Bayesian theorem of inverse probability was created by the Reverend Thomas Bayes in 1763 and further developed by Laplace nearly a decade later. However, it did not have a significant impact on applied statistical analysis until the late 20th century when the Markov Chain Monte Carlo (MCMC) algorithm was introduced. MCMC is an iterative process that stimulates repeated draws from a probability distribution for given parameters from a defined space and eventually reaches convergence. Each draw depends only on the previous values of the distribution, which makes it conditionally independent. It encompasses a class of sampling techniques such as Gibbs Sampling (Gelfand and Smith 1990) and Metropolis-Hastings.

The Bayesian approach has great advantage over the frequentist approach in the treatment of data, particularly regarding missing data (Western and Jackman 1994). A key element of the frequentist approach is the randomization of data. However, it is a luxury to conduct repeated sampling in social science. For example, there are only a handful of states with nuclear weapons when we conduct research in nuclear nonproliferation. In any case, scholars ignore this assumption, instead using its entire population to conduct the research. Simply put, frequentists operate under the assumption that it has fixed parameters and random data. On the other hand, Bayesians use fixed data, but random parameters.

Missing data is a salient issue in social science study. Frequentists have the option of either dropping the data or imputing it as I did in the previous sections. However, either option is not optimal because it potentially affects model fit. Within the Bayesian context, the missing data can be calculated through a posterior distribution and appended to the dataset. The posterior distribution of the parameter is derived from a prior distribution multiplied by a likelihood function. This method provides a much firmer theoretical foundation. When the prior distribution

is set as the uniform distribution, there is no difference between Bayesian estimation and MLE. However, if the prior is not a uniform, the weight a prior places upon the posterior distribution depends on the sample size. The smaller the dataset is, the more weight a prior has on its posterior.

The Bayesian Model Result

First, since WinBUGS14 cannot handle data sets that are too large or too small, I scale my entire dataset by standardizing each data. I then create a Bayesian ratification model with the same set of variables including time trending variables and interaction variable.

*mu[i] <- beta[11]*1 + beta[1]*export[i] + beta[2]*sub[i] + beta[3]*gdp[i]+ beta[4]*pop[i] + beta[5]*regime[i] + beta[6]*np[i] + beta[7]*time[i] + beta[8]*time2[i] + beta[9]*time3[i] + beta[10]* sub[i]*export[i]*

Since my dependent variables are dichotomous, I choose the Bernoulli distribution for the ratification and implementation variables. I then introduce a hyper prior, which is a distribution of a parameter of the prior distribution. **Table 4.9** lists the Bayesian codes, in which I set 5000 iterations with 2 chains and thinning interval as 1. **Table 4.10** below is the ratification model with empirical mean, standard deviation for each variable, and standard error of the mean. **Table 4.11** is the Quantiles for each variable. As we can see from the table, the Bayesian results demonstrate sizable significance in key variables “sub” and “sub*export”. It means a unit increase in subsidiary can lead to an increase of 0.67 in the logodds in ratification at the mean level of the distribution of the parameter. The 95% credible interval of the posterior distribution of the parameter is [0.67-0.139*1.96, 0.67+0.139*1.96].

Table 4.9 Bayesian Codes for Ratification and Implementation Models

```
model

{

for (i in 1:2764) {

imp[i] ~ dbern( p.bound[i])

p.bound[i] <- max(0, min(1, p[i]))
logit(p[i]) <- mu[i]
mu[i] <- beta[11]*1 + beta[1]*export[i] + beta[2]*sub[i] + beta[3]*gdp[i]+ beta[4]*pop[i] + beta[5]*regime[i] +
beta[6]*np[i] + beta[7]*time[i] + beta[8]*time2[i] + beta[9]*time3[i] + beta[10]* sub[i]*export[i]

export[i] ~dnorm(mu.x.1,p.x.1)
regime[i] ~ dnorm(mu.x.2,p.x.2)
gdp[i] ~ dnorm(mu.x.3,p.x.3)
pop[i] ~ dnorm(mu.x.4,p.x.4)
sub[i] ~ dnorm(mu.x.5,p.x.5)

useless[i]<- year[i] + rat[i] + logtime[i] + SumImp[i] + SumRat[i]
}

mu.x.1~dunif(-10,10)
mu.x.2~dunif(-10,10)
mu.x.3~dunif(-10,10)
mu.x.4~dunif(-10,10)
mu.x.5~dunif(-10,10)

p.x.1<-1/pow(sd.x.1,2)
p.x.2<-1/pow(sd.x.2,2)
p.x.3<-1/pow(sd.x.3,2)
p.x.4<-1/pow(sd.x.4,2)
p.x.5<-1/pow(sd.x.5,2)

sd.x.1~dunif(0,1)
sd.x.2~dunif(0,1)
sd.x.3~dunif(0,1)
sd.x.4~dunif(0,1)
sd.x.5~dunif(0,1)


for (i in 1:11) {
beta[i] ~ dnorm(0,.01)
}
}
Iterations = 1000:5000
Thinning interval = 1
Number of chains = 2
Sample size per chain = 4001
```

Table 4.10 Bayesian Ratification Model with Empirical Mean, Standard Deviation for Each Variable, and Standard Error of the Mean

	Mean	SD	SE
export	-0.5256	0.2528	0.0151
sub	0.67	0.139	0.007
GDP	0.1563	0.071	0.002
pop	0.1243	0.0714	0.0019
regime	-0.1215	0.0682	0.0026
np	0.8488	0.0846	0.0037
time	3.9066	0.5856	0.0912
$time^2$	-2.9976	1.4561	0.4535
$time^3$	1.1337	0.9777	0.2393
sub*export	1.6228	0.4307	0.028
intercept	1.5996	0.0859	0.0043

Table 4.11 Bayesian Ratification Model Quantiles for Each Variable

	2.50%	25%	50%	75%	97.50%
export	-1.02295	-0.6971	-0.5335	-0.3529	-0.01303
sub	0.40657	0.5762	0.6706	0.7629	0.9499
GDP	0.01478	0.1085	0.1576	0.2039	0.2989
pop	-0.01298	0.07618	0.1242	0.171	0.2629
regime	-0.25749	-0.1657	-0.1237	-0.07643	0.01348
np	0.6907	0.7916	0.8452	0.90093	1.022
time	2.851	3.514	3.914	4.254	5.21787
$time^2$	-6.452	-3.744	-3.006	-2.166	-0.3691
$time^3$	-0.6473	0.5902	1.144	1.601	3.528
sub*export	0.85821	1.31	1.607	1.896	2.509
intercept	1.432	1.541	1.601	1.658	1.773

I use the Gelman-Rubin statistic to assess convergence. The Gelman-Rubin diagnostic uses an analysis of variance approach to assessing convergence. It essentially calculates both the between-chain variance and within-chain variance and assesses whether they are different enough to be concerned about convergence. The result of the Gelman-Rubin test (**Table 4.12**) indicates convergence for most of coefficients except beta 7,8 and 9. They are the time trending

variables with inherited autocorrelation. Other coefficients have a close to 1 confidence interval, which is an indication of convergence. Additionally, the PSRF is the square root of the ratio of the between-chain variance and within-chain variance. Its value 1.74 also confirms that the simulation has reached to its convergence. Figure 4.6. and Figure 4.7 demonstrate the Gelman Rubin diagnostic plots and traceplots.

Table 4.12 Gelman-Rubin Test Results

	Point est.	Upper C.I.
export	1.01	1.06
sub	1.08	1.31
GDP	1.02	1.08
pop	1	1.01
regime	1.01	1.03
np	1	1.01
time	2.17	4.26
time*2	2.42	4.99
time*3	2.07	4.09
sub*export	1.04	1.18
intercept	1.03	1.12

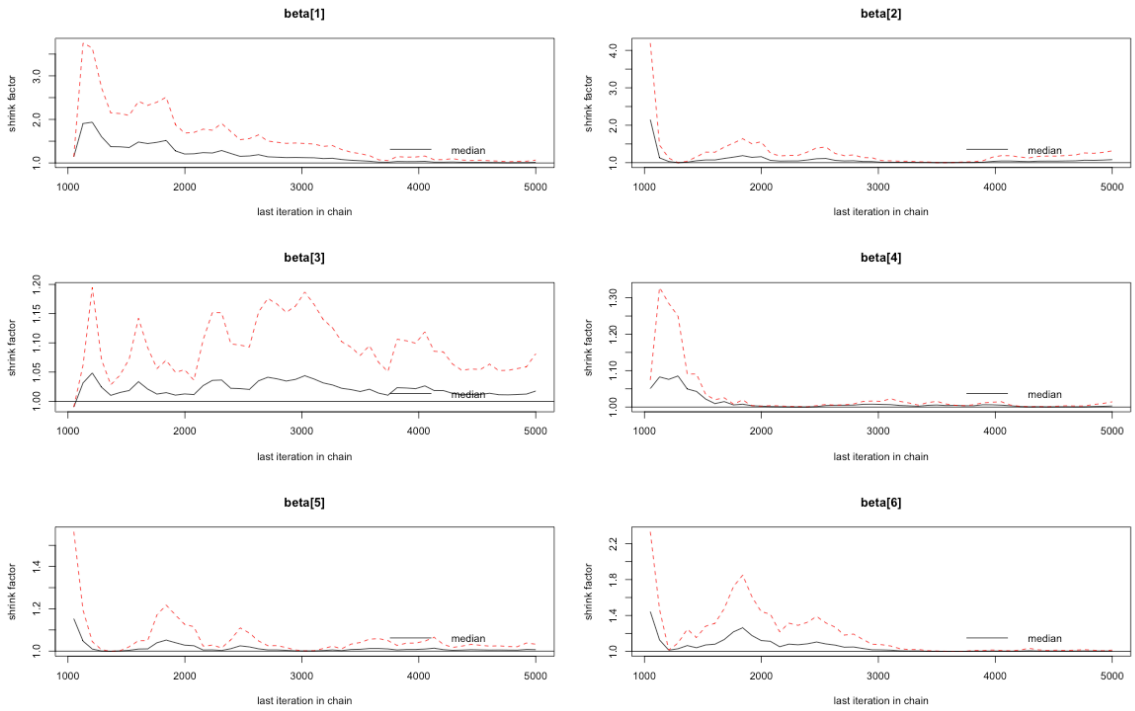


Figure 4.6 Gelman Rubin Diagnostic Plots

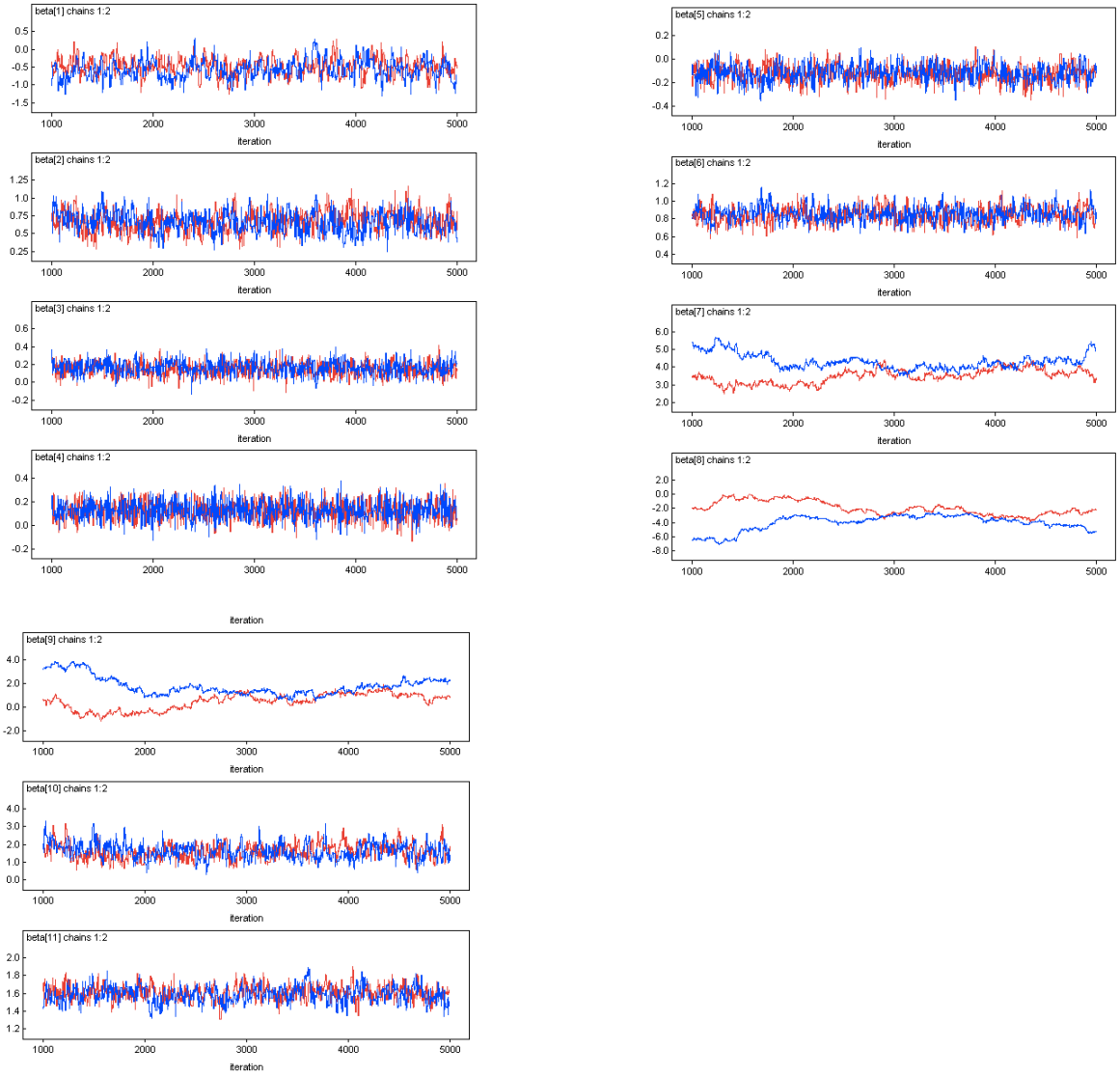


Figure 4.7 Traceplots for Ratification Model

Similarly, I run the implementation model with Bayesian method. The iteration is set to 10,000 with thinning interval at 1. In MCMC applications, there are a number of parameters to be determined including the number of iterations, the spacing between iterations and the number of initial burn-in iteration discarded. Studies show reasonable accuracy may often be achieved with 5000 iterations or less (Raftery & Lewis 1992). In this implementation model, traceplots

suggest convergence when it reached 10,000 iterations. **Table 4.13** and **Table 4.14** display the results. The export variable demonstrates statistical significance. A unit increase in export can lead to an increase of 0.3863 in the logodds in implementation at the mean level of the distribution of the parameter. The 95% credible interval of the posterior distribution of the parameter is [0.3863-0.15*1.96, 0.3863+0.15*1.96]. The sub and interaction variables are not statistical significant at the 95% credible interval, however, it is at 75%. Alternatively, if I used an informed prior, which would be defensible given the strength of the qualitative evidence, then the robustness of the effect would increase.

Table 4.13. Bayesian Implementation Model with Empirical Mean, Standard Deviation for Each Variable, and Standard Error of the Mean

	Empirical Mean	SD	SE of the mean
export	0.3863	0.15052	0.007772
sub	0.1329	0.08829	0.003774
GDP	0.1862	0.05341	0.001499
pop	0.5637	0.07488	0.003021
regime	0.1277	0.07185	0.00298
np	1.5410	0.089	0.004862
time	4.8460	0.9126	0.066326
time^2	-3.2420	1.90017	0.224216
time^3	0.3081	1.09879	0.107902
sub*export	0.0001	0.07632	0.003932
intercept	-1.6170	0.07923	0.005965

Iterations = 4000:10000; Thinning interval = 1; Number of chains = 2; Sample size per chain =6001

Table 4.14 Bayesian Implementation Model Quantiles for Each Variable

	2.50%	25%	50%	75%	97.50%
export	0.07112	0.2908	0.3907	0.4862	0.6708

sub	-0.04667	0.07732	0.13545	0.19207	0.31
GDP	0.08396	0.1513	0.186	0.222	0.2942
pop	0.422	0.511	0.5636	0.6143	0.7279
regime	-0.0122	0.08186	0.12565	0.17388	0.2757
np	1.377	1.482	1.539	1.596	1.723
time	3.339	4.034	4.951	5.635	6.32
time^2	-6.04692	-4.918	-3.3385	-1.366	-0.3809
time^3	-1.4548	-0.7278	0.5747	1.262	1.927
sub*export	-0.1127	-0.0601	-0.009791	0.04461	0.1863
intercept	-1.77	-1.665	-1.6185	-1.564	-1.469

Table 4.15 lists the Gelman Rubin Diagnostic Test result which is consistent with ratification model. Except for the time trending variables, all variables demonstrate convergence. The Multivariate psrf is 4.16. **Figure 4.8** and **4.9** are a Gelman Rubin Diagnostic plot and traceplot respectively.

Table 4.15 Gelman Rubin Diagnostic Test for Implementation Model

	Point est.	Upper C.I.
export	1	1
sub	1	1.01
GDP	1	1.02
pop	1	1.02
regime	1.01	1.05
np	1.01	1.02
time	5.91	13.06
time^2	6.64	15.54
time^3	5.69	14.06
sub*export	1.01	1.03
intercept	1.15	1.52

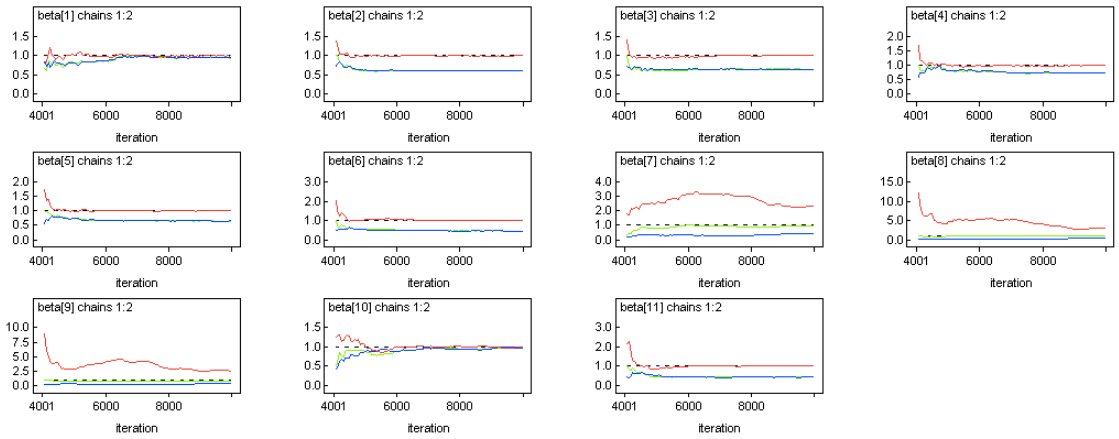


Figure 4.8. Gelman Rubin Diagnostic Plot for Implementation Model

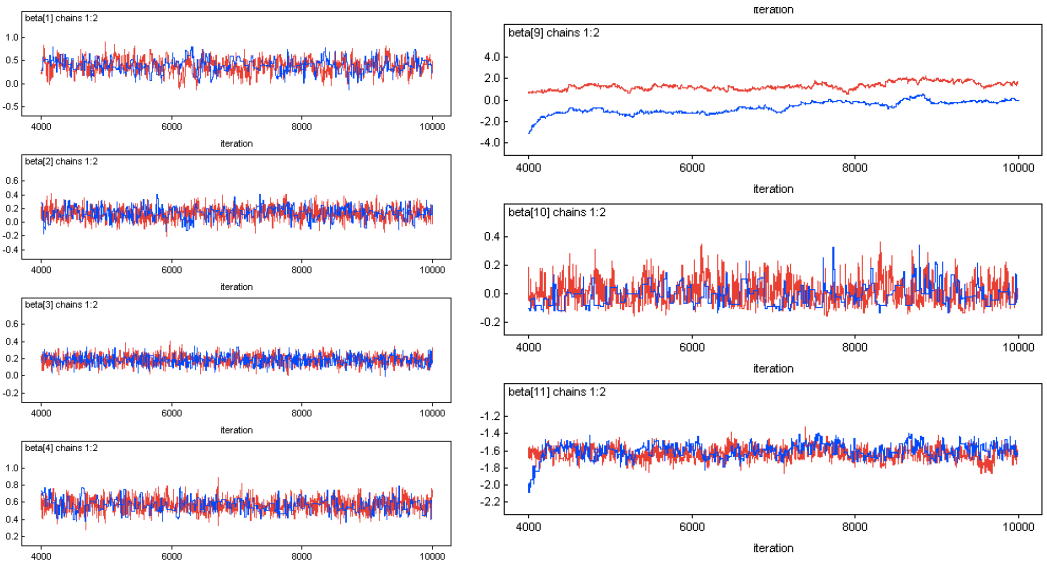


Figure 4.9 Traceplot for Implementation Model

In summary, the Bayesian approach is preferable in its data analysis. Instead of eliminating, imputing or arbitrarily assigning a number, Bayesian uses posterior distribution to estimate the missing values. It contributes to my hypothesis that MNCs play a significantly positive role in countries' commitment and implementation of chemical nonproliferation through the lens of CWC ratification and legal implementation.

In the following chapters, I use qualitative analysis to further examine my argument and understand the mechanism and rationale of MNCs' influence on government records in chemical nonproliferation. Though CWC ratification and implementation are important in evaluating a country's commitment in chemical nonproliferation, there are other aspects of the interaction between MNCs and government that can contribute to my hypothesis. I select three mini case studies and conduct research using several different sources of data including public statements, international reports, and various secondary sources. In chapter 5, the Saudi Arabia and SABIC case is discussed, chapter 6 examines China and SinoChem, and chapter 7 analyzes the German and BASF case.

When a MNC is engaged in a global operation, it has to respond to stakeholders from both within and outside of its host country. As the first line defense of an effective national export control system, corporations are critical in the implementation of the system. Yet, they face great challenges in complying with regulations in a complex and fast changing political and economic environment. Therefore, MNCs invest resources into their risk management and compliance program to help navigate through regulatory pitfalls. Any violation can cause significant damage to both its finances and reputation. Such motivation provides incentives for MNCs to exhibit trade compliance. For each case study, I select a leading chemical MNC from the country of my case study and examine their corporate policies, practices and culture to understand how its behavior can improve its hosting country's chemical nonproliferation implementation.

I select Saudi Arabia, China and Germany and pair each with a leading chemical corporation SABIC, SinoChem and BASF respectively. My case selection strategy combines

both diverse and typical techniques. Foremost, these three countries represent diverse political regimes, which helps achieve a wide variance of the case representation from different political background. Economically, they represent different levels and stages of economic development. Specific to nonproliferation, they have different levels of participation in international WMD nonproliferation regime as well as regulatory implementation. Despite these differences, the three cases also share a similar trait in that they each has a large chemical industrial base and the chemical industry contributes to a significant part of its economic growth. Each company selected is a leading global chemical company with a footprint across different continents. This is a typical case selection strategy, which provides insight into a broader phenomenon and exemplifies a typical set of values representing the general understanding of the theoretical argument. Together, my case studies will help explain how MNCs can make a positive contribution to chemical nonproliferation through their corporate practices which complements to the results of my quantitative analysis.

CHAPTER 5 THE KINGDOM OF SAUDI ARABIA AND SABIC

This chapter analyzes the Kingdom of Saudi Arabia (KSA) and its leading chemical company SABIC. Saudi Arabia is a monarchy regime and a key player in the Arab world. It is an oil based economy with strong government control. Saudi Arabia has been historically faced with WMD threats in the region, which directly impacted its nonproliferation policy. Specifically to chemical nonproliferation, Saudi Arabia has only a very limited legal framework for chemical export control. I first examine Saudi's overall engagement in WMD nonproliferation and commitment to CWC. I then turn to its existing chemical regulation framework including legal and administrative process. Lastly, I focus on the single largest chemical company in the Saudi Arabia: Saudi Arabia Basic Industries Corporation (SABIC). I analyze its corporate risk management and compliance program and determine its influence on Saudi's chemical nonproliferation implementation.

5.1 Background: KSA's WMD Nonproliferation Engagement

As the largest country in the Middle East, Saudi Arabia's geostrategic location determines its defense doctrine and strategic course. Saudi Arabia has a vast oil reserve and neighbors with Iraq, Jordan, Kuwait, Oman, Qartar, UAE and Yemen. Saudi Arabia has been traditionally a strategic ally of the US, which views the peninsula as an important oil supplier and a vital base for its troops in the region. Its strategic alliance also posits it as a target for regional radical states such as Sudan, Iran, Syria and Egypt. Saudi Arabia is a signatory to most international nonproliferation treaties. It joined the NPT in 1988 and reached a safeguard

agreement with IAEA in 2005. The country currently has extremely limited nuclear capabilities.[46] It has consistently supported the establishment of a weapons of mass destruction-free zone in the Middle East. It deposited the BWC in 1972 and ratified the CWC in 1996. Saudi Arabia is not a member of any of the export control multilateral agreements such as Australia Group.

5.2 KSA's Chemical Management Legal Framework

Saudi Arabia has a very limited legal infrastructure for controlling trade of sensitive chemicals. Its implementation of CWC did not begin until November 2005 when the "*Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction*" [47] was promulgated. This resolution prohibits the use of CW, restricts the production, acquisition, transfer, and use of Scheduled chemicals, and imposes penalties for illegal activities. The *Ministry of Commerce and Industry* is the government authority responsible for licensing and regulating activities involving dangerous chemicals. Its control lists, often cited within decrees and notifications, are unavailable in the open source from government website. There is little to no evidence of government engagement in licensing or authorizing transport/storage of hazardous chemicals. Further, there is no evidence of major licensed transactions involving hazardous chemicals.

Many factors can contribute to the delay and lack of CWC implementation including threat perception, geopolitics, bureaucracy and so on. Yet, I would like to focus on economic considerations. Saudi Arabia experienced a very slow growth in the controlled chemicals sector.

[46] "Saudi Arabia." Nuclear Threat Initiative: Building a Safer World. Nuclear Threat Initiative, July 2016. Web. 06 Feb. 2017. <http://www.nti.org/learn/countries/saudi-arabia/>.

[47] *1540 Committee Matrix of Saudi Arabia*. N.p.: 1540 Committee, 1 Nov. 2004. PDF. <http://www.un.org/en/sc/1540/docs/matrices/Saudi%20Arabia%20revised%20matrix.pdf>

Until today, it does not have any declared facilities for Schedule 1 and 2 chemicals. It began to declare schedule 3 facilities in 2012 with one facility only until today [48]. The facility is most likely the ethanolamine production site at Saudi Kayan in Jubail.[49,50] Although it is not listed under the CWC, Saudi Arabia also plans to begin producing sodium cyanide, a chemical listed by the Australia Group, in 2016. Comparing to Schedule 3 chemicals, KSA has a relatively longer history with discrete organic chemicals facilities. It began with a moderate amount (apx. 2-3) in 1998[51] and gradually grew to a relatively large amount (18 facilities) today.[52]

In general, Saudi Arabia has a very slow development of scheduled chemicals and with very limited quantities. On the quite contrary side, an interesting comparison within the chemical industry is Saudi Arabia's greater emphasis on chemical environmental, safety and import related regulations and government capacity. Championing tough environmental codes could be attractive to companies who are advanced in technology because it could raise the entry barrier. The chemical industry stands out from other sectors in valuing environmental issues. There is a distinct trend in the industry to integrate sustainability into its core business strategy. Technological solutions are critical in this endeavor. Often, existing players in the industry strive

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[48] *Report of the OPCW on the Implementation of the Convention on the Prohibition on the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction in 2014* . N.p.: Organization for the Prohibition of Chemical Weapons, 2 Dec. 2015. PDF. <https://www.opcw.org/fileadmin/OPCW/CSP/C-20/en/c2004_e_.pdf>.

[49] Staff, JUBAIL: Ibrahim Al-Ghamdiarab news. "SABIC ships its first consignment of ethanolamines and ethoxylates." Arab News. Arabnews, 03 June 2012. Web. 06 Feb. 2017. <http://www.arabnews.com/sabic-ships-its-first-consignment-ethanolamines-and-ethoxylates>.

[50] "Sabic Commissions Ethanolamines and Ethoxylates Complex, the First in the Mideast." IHS Markit Chemical Blog. IHS Chemical Weekly, 3 June 2012. Web. 06 Feb. 2017.<http://www.chemweek.com/home/top_of_the_news/43931.html >.

[51] *Report of the Organisation on the Implementation of the CONVENTION (1 JANUARY- 31 DECEMBER 1998)*. N.p.: Organization for the Prohibition of Chemical Weapons, 2 July 1999. PDF. <https://www.opcw.org/fileadmin/OPCW/CSP/C-IV/en/C-IV_5-EN.pdf>.

[52] *Report of the Organisation on the Implementation of the CONVENTION (1 JANUARY- 31 DECEMBER 1998)*. N.p.: Organization for the Prohibition of Chemical Weapons, 2 July 1999. PDF. <https://www.opcw.org/fileadmin/OPCW/CSP/C-IV/en/C-IV_5-EN.pdf>.

to create and maintain barriers such as stringent licensing and government regulations to keep out of new companies or make the entry into the market very difficult. In the case of Saudi Arabia, its government invests heavily in establishing advanced regulatory system to address these issues so that it can maintain the existing chemical investment and attract more technologically advanced businesses.

Here are some examples of laws, guidelines or decrees addressing different aspects of chemical production and trade. The "*Law of Chemical Materials Importing and its Management*" (MoCI Royal Decree – 38, 2006) mandates that all chemicals require an importing licenses going into the Kingdom. Depending on the end use, the license is submitted to different government agencies. For instance, chemicals used in explosives shall seek license from the Ministry of Interior, whereas chemicals with agricultural application will go to the Ministry of Agriculture. All licenses are required to provide a copy to the General Presidency of Meteorology and Environment Protection (PME). Chemical transportation also requires a license and the authorities are Ministry of Transportation and General authority of Civil Aviation pending on the mode of transportation. According to Article 8, the Ministry of Interior is specially tasked to handle the protection and the transportation of dangerous chemicals and to prevent accidents or any other risk. Article 10 articulates the responsibilities of the Presidency of Meteorology and Environment Protection (PME) pertaining to controlled chemical lists for import and chemical waste related policies.

Other than these import focused regulations, KSA has several legal instruments pertaining to environment. The "*Environmental Standards Prevention of Major Accidents, Environmental Standards Waste Transportation*" was promulgated in 2012 and designates the

Presidency of Meteorology (PME) to provide oversight on chemical safety. The regulation has specific guidelines for reporting requirement and strict enforcement.

One of the interesting features of KSA's chemical legal system is its emphasis on regional government. The Royal Commission for Jubail and Yanbu was established by a Royal Decree in 1975. It is Saudi's vanguard for developing the petrochemical and refinery industry. They are now the leading cities for petrochemical and energy intensive industries within the Kingdom. The Royal Commission puts environmental protection as a high priority (Al Shehai 2015). It formulates a unified *"Royal Commission Environmental Regulations (RCER)"* and implements several comprehensive programs to address sustainability, which is embedded in the core concept of industrial development by the Royal Commission. The Commission also is recognized internationally for its achievement such as the Sasakawa Prize by the United Nations in 1988, Arab Cities Award for Environmental Protection by Jubail Directorate in 1995 and most recently UN LivCom award in 2013.

Such sharp contrast on government policies towards different aspects of chemical industry regulation reflects the economic calculation of state's decision in policy preference. The development of Jubail and Yanbu attracted over 244 billion Riyal (USD $65.06 billion) and created over 100,000 jobs. Many chemical multinational companies have a footprint in this region such as Dow, Chevron, BASF, Sabic, Shell and so on.[53] Such massive economic incentives put KSA at high pressure to ensure its safety and environment regulatory coverage is consistent with international standard so that its industrial development is sustainable and prosperous. Therefore, it is valuable to examine the characteristics of KSA's chemical industry

[53] "Our Cities: Jubail and Yanbu Industrial Cities." Royal Commission for Jubail and Yanbu. RCJY, n.d. Web. 06 Feb. 2017. <https://www.rcjy.gov.sa/en-US/AboutUs/Pages/Our-Cities.aspx>.

and understand its preference and behavior. As I described in the earlier chapter, scholars from different theoretical paradigms have studied how industry structure impacts the adoption of self-regulation. The domestic politics literature suggests that dominant firms often initiate industry standards. IO theory suggests that hegemons are necessary for creating and maintain regimes (Krasner 1983) and they are not altruistic actors. Similarly, in the discussion of public goods and collective action, economist Mancur Olson (1965) theorized that privileged groups would gain more from a public good than it would cost them to provide unilaterally. Therefore, it is believed that dominant firms gaining disproportionately from self-regulation are more instrumental in advocating for universality. Not surprisingly, a few large corporations dominate KSA's chemical industry. The next section will discuss KSA's chemical industry and its most dominant player SABIC.

5.3. KSA's Chemical Industry

Although Saudi Arabia is well known as the world's leading producer and exporter of crude oil, it is uncommon knowledge that Saudi is also one of the world's largest producers and exporters of chemicals and polymers. Saudi's chemical industry is the largest export sector after oil. It accounts for 2% of the global chemical industry's sales.[54] Overall, Saudi Arabia has a sophisticated and substantial chemical industry. Its domestic scientific and technological level in chemistry and biology is leading developing world.[55] Saudi Arabia's entrance into chemical industry can be traced back to three milestones: the creation of the Master Gas System; the industrialization of Jubail and Yanbu; and the formation of SABIC.

[54] Alfaro, Laura, Yasser Aloadah, Guy ElKhoury, and Fahim Bashir. *Upgrading the Saudi Chemical Cluster: Microeconomics of Competitiveness*. N.p.: n.p., n.d. PDF. <http://www.isc.hbs.edu/resources/courses/moc-course-at-harvard/Documents/pdf/student-projects/Saudi%20Arabia%20Chemicals%202016.pdf>.

[55] Shoham, Dany. "Does Saudi Arabia have or seek chemical or biological weapons?." The Nonproliferation Review 6.3 (1999): 122-130.

In 1970, the Saudi Arabian Oil Company, also known as Saudi Aramco, created a pipeline network called the Master Gas System (MGS) to distribute previously unused gas from oil fields throughout Saudi Arabia. Prior to the MGS, most natural gas production associated with crude oil resulted in the majority of gas being flared at oil wells left unutilized. The MGS therefore allowed gas production from oil wells to be recovered, processed, and supplied for Saudi's non-associated gas resources and industries.[56] With the MGS, the chemicals industry was finally able to experience rapid growth. Today, Jubail and Yanbu are the two key industrial cities for the chemical sector.

With the extensive MGS underway and the precise location for industrial development selected, Saudi Arabia took the next step towards establishing its position in the chemicals industry. In order to attract investment from both foreign and domestic companies, a 1976 royal decree was set up to produce value-added products from crude oil for exports, creating the Saudi Arabia Basic Industries Corporation (SABIC). Among the top 11 chemical companies in Saudi Arabia, SABIC leads the second place by three folds. SABIC is the anchor of the Kingdom's chemicals industry in the world map.

Therefore, in order to understand Saudi Arabia's chemical industry, it is imperative to study the hegemonic actor SABIC and understand its corporate governance policy and culture.

5.4. SABIC

SABIC marked the first Saudi use of by-products via oil extraction to produce value-added commodities to spur the creation of new industries such as chemicals, plastics, agri-

56 Al-Helal, F. (1982). Saudi Arabia's master gas system - its overview and the corrosion control programs. Soc. Pet. Eng. AIME, Pap, vp.

nutrients, and metals.[57] Since its creation, Saudi's largest public company has become a global manufacturering powerhouse with a foundation in Saudi Arabia to produce basic chemicals, resources in Europe to produce basic and advanced polymers, and assets in North America to produce high performance products (Gerlowski 2014). SABIC is the world leading producer of polyethylene, polypropylene, advanced thermoplastics, glycols, methanol and agricultural nutrients. It is the world's fourth largest chemical company by sales and most profitable chemical company in the world. It is a publicly traded and 70% state owned company with operations in over 50 countries and a 40,000 plus workforce. SABIC partners with multinational companies such as ExxonMobil and Shell to create manufacturing affiliates, of which there are 18 in Saudi Arabia.[58]

This section studies SABIC's two corporate practices that are adhered to throughout its entire global operation: Sustainability and Code of Ethics. Together, they shape SABIC's corporate compliance culture. Scholars have used different theories to explain firm's behavior in self-compliance. Institutionalists focus on the impact of external institutions on firm policies. It suggests that firms are not profit maximizers; rather their policies reflect external pressure for legitimacy. For instance, industrial accidents prompt companies to demand an industry wide response. The worst industrial accident in history is the tragic chemical accident that occurred in Bhopal, India on December 3 1984. A gas leak resulted in 5,200 deaths and several thousand with permanent or partial disability.[59] The disaster prompted a need for enforceable international standards for environmental safety, preventative strategies to avoid similar accidents. The desire

58 Al-Jarbou, A. (2014). Basic industries development by SABIC: eight years' experience. J. Energy Dev, (2), 193.
58 "SABIC Manufacturing Affiliates." SABIC. Saudi Basic Industries Corporation, n.d. Web. <http://www.sabic.com/corporate/en/ourcompany/manufacturing-affiliates/sabic-manufacturing-affiliates>.
61 "Bhopal Gas Tragedy Information." Union Carbide Corporation. Union Carbide Corporation, n.d. Web. 06 Feb. 2017. <http://www.bhopal.com/>.

to win back trust and legitimacy was driven by concern with new laws and regulations (Prakash 2000). Corporate social responsibility scholars argue that firms have societal responsibilities that may or may not reinforce the profit objective. There are also several other forces that can incentivize companies to self-compliance such as the threat of direct regulation by government, supplier pressure, consumer boycotts etc.

SABIC's programs have far exceeded government requirements in KSA. It is important to understand the underlying reason that drives SABIC's business decision to pursue a higher standard of compliance and how this practice can in turn affect government regulations. I first begin the discussion with the Sustainability program.

Sustainability

Sustainability is identified as a foundational element in SABIC's 2025 strategy. Yousef Al-Benyan, the Vice Chairman and Chief Executive Officer of SABIC said that "sustainability promotes profitable initiatives in the short term and enhances our attention to long term risks"[60]. This statement is consistent with the economic theory that suggests the firm demands voluntary codes if it will maximize their profits. Of course, there are many external factors that determine company profitability such as the rate of market growth, barriers to entry, competition from substitute products, and the power of buyers and suppliers.[61] But sustainability is believed to help enable the company to meet the changing needs of markets, communities and other stakeholders. By placing sustainability at the heart of business, it creates value through building economic, natural, human and social capital.

62 "2015 Sustainability Report." SABIC Web. <https://www.unglobalcompact.org/system/attachments/cop_2016/287771/original/SABIC-Sustainability-Report-2015-ENG_tcm12-18246.pdf?1464238832>

63 Niskanen, Toivo. "A Finnish study of self-regulation discourses in the chemical industry's Responsible Care programme." *Business Ethics: A European Review* 21.1 (2012): 77-99.

SABIC's Sustainability Council is chaired by the CEO and ten leaders from throughout the company. The council establishes SABIC's sustainability vision, goals and approves recommendations from its Steering Committee and the Corporate Sustainability Department (CSD). The Steering Committee also includes executives from SABIC. The goals and milestones are integrated into business performance processes through linking executive compensation with sustainability targets. **Figure 5.1** below illustrates the administrative structure of sustainability governance.

Figure 5.1.

SABIC recognizes that its chemical products involve complex engineering challenges, energy-intensive processes, physical hazards, and chemical risks. Therefore, it maintains a culture of environmental awareness, health, safety and security (EHSS) that goes beyond compliance and emphasizes continuous improvement. Firms have more information, expertise and resources than government regulators. [62] Therefore, the chemical industry has strong incentives not to shirk its compliance obligation due to direct financial loss and financial rating.

[62] Gamper-Rabindran, Shanti, and Stephen R. Finger. "Does industry self-regulation reduce pollution? Responsible Care in the chemical industry." *Journal of Regulatory Economics* 43.1 (2013): 1-30.

SABIC works with employees at all levels to raise awareness of potential risks. It monitors EHSS key performance indicators and reviews as well as audits both internally and across its supply chain. The EHSS rate is measured by a range of incident types including environmental releases, process safety events, occupational health and safety injuries and illnesses, and security incidents. Since 2005, the rate has declined from 3.6 to 0.48 including a 30% improvement in 2015. SABIC observed strong safety and security performance and improvements including a 48% improvement in the total recordable incident rate for direct hires and a 32% overall improvement.

Specifically to security, global terrorism and conflicts using chemical weapons increase the security threats and highlight the importance of chemical security. SABIC designates a Security and Crisis Management function and considers it as a core competency of their business. It adopted the American Chemistry Council Responsible Care Security Code (RCSC) of Management Practices at SABIC US sites and uses equivalent RC program in their host countries worldwide. Responsible Care is a global, voluntary initiative developed by the chemical industry for the chemical industry. It is practiced in 60 national chemical manufacturing associations and thousands of chemical manufacturing sites worldwide. Responsible care initiative accounts for nearly 90% of global chemical production. It embraces the development and application of sustainable chemistry, helping industry contribute to sustainable development while meeting the world's growing need for essential chemicals and the products those chemicals make possible. Saudi Arabia as a country is not a Responsible Care® member because it does not have a national industry association. However, as a member of the Gulf Petrochemicals & Chemicals Association (GPCA), SABIC is a member of RC. The GPCA

represents the downstream hydrocarbon industry in the Arabian Gulf with more than 230 member companies from the chemical and allied industries, accounting for over 95% of chemical output in the Gulf region. The GPCA adopted the Responsible Care Initiative in 2009 and 35% of its members have obtained certification for Responsible Care Management System Standard or RC14001. SABIC chose to adopt the code of practice because it is considered as a best practice by international industry standard even though it far exceeds Saudi Arabia's government requirement.

SABIC's Security Program includes several key aspects: leadership commitment, analysis of threats & vulnerabilities, cyber security and information protection, personnel surety, documentation of processes & procedures, training, communications, response to threats and audit.[63] Each SABIC site maintains RC14001:2013 certification. SABIC also provides leadership for the Responsible Care initiative in the Middles East through GPCA. SABIC was awarded the 2015 Responsible Care Merit Award in China which marked the second time SABIC has received the prestigious industry recognition in sustainable business practices in communities.

SABIC actively promotes its EHSS standards throughout the Kingdom. It admits that its active participation and sponsorship of industry conference on EHSS is driven by its sense of national responsibility, the added value it provides to the Kingdom's growing economy and its position as a local and international industrial leader. For example, Mohamed Al-Mady, SABIC Vice Chairman and CEO received the honorary plaque from Gen. Saeed A. Al-Qahtani for SABIC's success in Security Code of Management Practices at a professional conference

[63] "Security & Crisis Management." SABIC. Saudi Basic Industries Corporation, n.d. Web. 06 Feb. 2017. <https://www.sabic-ip.com/gep/en/AboutUs/OurCommitmentSubDetail/security__crisis_management.html>.

organized by the Higher Commission for Industrial Security.[64] It is designed to protect its manufacturing complexes, operational sites and supporting facilities.

Externally, SABIC administers a supplier qualification program since 1998 with special focus on suppliers from emerging countries and contract manufacturers. All suppliers and service providers of SABIC are screened to avoid risk of non-compliance and subject to on-site audit. It is expected to comply with all SABIC principles including EHSS regulations. Since 1998, it has vetted over 2700 suppliers from over 50 countries. More than 700 on-site compliance audits have been completed.

Scholars recognize that the sustainability program is strongly consistent with CSR which investors and shareholders are very interested in. Stakeholder theory suggests that corporations are in permanent contact with their economic, legal, political, societal and technological environments. SABIC's adoption of a sustainability program is an attempt to reconcile the desires of different stakeholders such as shareholder investors, employees and general public. They have different levels of interest in environmental performance and financial viability. [65] Its sustainability program motivates responsible behavior as a corporate citizen and ongoing improvement in HES areas. Effective sustainability activities can improve stakeholder relations. It integrates its supply chain and carries the program out in cooperation with suppliers, customers and logistics providers. The sustainability program also promotes employee's professional development and provides safe and healthy working conditions. This is critical for chemical industry and SABIC because its competitiveness is based on personnel competence. The right

[64] "SABIC recognized for sponsoring International Conference and Exhibition for Industrial Security." AMEInfo. Mediaquest FZ LLC, 02 Dec. 2013. Web. 06 Feb. 2017. <http://ameinfo.com/money/economy/sabic-recognized-for-sponsoring-international-conference-and-exhibition-for-industrial-security/>.

[65] Evangelinos, K. I., I. E. Nikolaou, and A. Karagiannis. "Implementation of Responsible Care in the chemical industry: Evidence from Greece." *Journal of hazardous materials* 177.1 (2010): 822-828.

sustainability strategy achieves consistency between economic and social goals. A successful sustainability strategy can also enhance firm's financial performance while integrating stakeholders actively in the process (Niskanen 2012). When a company has few incidents and accidents, people will believe it can also handle other issues well. In the long run, the costs of compliance are expected to be offset by new business opportunities.

Code of Ethics

Successful businesses are in part affected by organizational ethical standards (Tixier, 2003). SABIC maintains a Code of Ethics, which underpins its compliance program and integrates its culture of compliance into daily business. In 2013, SABIC adopted a Code of Ethics to protect global environment, the workplace and its assets. The Code reflects a combination of principles from Responsible Care, UN Global Compact and World Business Council for Sustainable Development. The Code guides employees' behavior in working with stakeholders including its customers, suppliers, government officials, colleagues and communities. The business literature emphasizes that corporate success hinges on its ability to generate profit, value, or satisfaction for its primary stakeholders (Maon, Lindgreen, & Swaen, 2009). These relationships include consumers, internal managers and employees, government, suppliers and investors. (Maon et al, 2009).

The Code of Ethics publicly emphasizes SABIC's commitment from top leadership and requires all employees to read, understand and comply with the Codes. Each policy within the Codes is reviewed every year at a Bottoms Up Review conference. Each compliance concern that is raised is recorded by the Manager and addressed afterward. In 2011, SABIC initiated a

global Code of Ethics review for senior level employees and 2500 employees attended worldwide.

The Code covers four main areas: environment, workplace, protecting assets and reporting compliance concerns. Within the global environment chapter, there is a specific section "International Trade Controls (ITC)", which entails SABIC's policy, responsibility, risks and Q&A. Trade control is a corporate management practice directly addressing the critical issue of nonproliferation. It is an international best practice adopted by businesses to help mitigate regulatory risks in sensitive trade. Some countries such as Poland, South Korea, China require companies to have an Internal Compliance Program when apply for a particular license. However, Saudi Arabia does not have such requirement.

SABIC's ITC program exceeds the government requirement. In the policy statement, SABIC first recognizes that trade control laws exist in most of the countries SABIC operates and applies to products, technologies and services. It states that ITCs include customer rules for import, embargoes and export restrictions of controlled items. SABIC also emphasizes the importance of intangible technology transfer. More importantly, it emphasizes that failure to comply with ITC laws can have serious reputational and financial consequences for SABIC. [66]

In the section of responsibility, SABIC requires individuals to follow its ITC procedures designed to ensure compliance with regulations of all countries SABIC operates. It specifically lists compliance requirements, which are highly consistent with international best practices. Key elements include items such as license process, product classifications, cradle to grave export compliance security, deemed export controls, transaction screening, intangible technology

[66] "SABIC Code of Ethics." SABIC Corporate Website 01 Aug 2013. <https://www.sabic.com/en/Images/code-of-ethics-english_tcm1010-5717.pdf>

transfer, record keeping and so on. The Code also details "red flags" commonly used by international companies to encourage its employees to conduct due diligence for sensitive transactions. For example, it requires employees to contact with its legal counsel who is responsible for ITCs if a customer or supplier may be attempting to evade ITC laws, or any involvement or connects to any WMD activities. Finally, the Code also provides some examples of key export control concepts such as deemed control.[67]

Another important aspect of the Code is its emphasis on third party business dealing. It requires all SABIC customers, suppliers, distributors or agents to be lawful, ethical and fair in their practices. It emphasizes that SABIC only works with businesses that comply with applicable laws and the integrity of third party dealings is fundamental in building and preserving the reputation of SABIC and its people. The supplier relationship is part of the dynamic evolution of positive-sum strategies that create benefits over time. Scholars argue that suppliers, distributors or agents are important stakeholders. They are directly involved in economic processes, while being bound by explicit contracts with a company (Park 2015). Empirical evidence further indicates that power imbalances between partners can create important organizational outcomes. Firms that control critical resources needed by others can have power to *influence the practice of those who dependent on them.*

This is an important theoretical basis for my argument. SABIC can impose its power on its stakeholders including suppliers, distributors and agents. When SABIC requires its partners to adhere to the rule of compliance, it does directly influence their compliance practice. As a result, a compliance norm is formed within the supply chain network.

[67] "SABIC Code of Ethics." SABIC Corporate Website 01 Aug 2013. <https://www.sabic.com/en/Images/code-of-ethics-english_tcm1010-5717.pdf>

SABIC has a holistic training mechanism to ensure employee compliance with the Code of Ethics. The legal team developed a web based compliance training program. Four general awareness courses are mandatory for all employees and additional 31 advanced courses are used based on employee responsibility within the company. SABIC employees are required to take an average of about 15 advanced courses during a two year training cycle. Another feature is the executive level training delivered by senior leadership. The training is designed to train senior management on compliance responsibilities, emerging compliance risks and familiar them with SABIC compliance practice. In 2008, 98% of executive staff participated in this program.[68] SABIC keeps track of completion rate for training on International trade sanctions. It reached 95% of relevant population. In 2010, the training was expanded to SABIC global operation and over 3500 employees were trained in 2011.

The last important aspect of SABIC Code of Ethics is its emphasis on reporting compliance concerns. SABIC creates a system of preventing, detecting and responding to compliance issues and establishes a compliance culture through leading by example. It cultivates a culture of reporting and corrective mechanism to monitor violations. It recognizes that the core of a robust compliance culture is an effective mechanism that allows employees to speak up and raise actual or potential compliance concerns in a non-retaliatory environment so that they can be addressed quickly and effectively. SABIC has a global organization of Compliance Helpline Leaders who are responsible for receiving concerns and ensuring that all concerns are properly investigated and addressed. This is a critical element in a comprehensive compliance program and adopted by most of multinational corporations.

[68] "Our Compliance Processes." SABIC. Saudi Basic Industries Corporation, n.d. Web. 06 Feb. 2017. <https://www.sabic-ip.com/gep/en/AboutUs/OurCommitmentSubDetail/our_compliance_processes.html>.

5.5. Summary

SABIC's corporate governance addresses both trade compliance and chemical security through its Code of Ethics and Sustainability Development respectively. As the largest chemical company in the Saudi Arabia, SABIC adopts advanced international best practices that far exceed the requirement of Saudi Arabia government. Data from the quantitative chapter indicates that Saudi Arabia ratified CWC in 1996 and did not begin legal implementation until 2005. This chapter certainly helps us understand the possible explanation for such a gap between ratification and implementation from economic incentive perspective. Further, it elaborates the rationale of MNCs to comply beyond government requirements in Saudi Arabia. MNCs are no longer bounded by geographic borders, instead, they are global citizens that have to respond to global issues and responsibilities. Their behaviors are not driven solely by profit. Corporate image is an important asset that is aggressively protected by companies. This is an important theoretical basis to explain why SABIC's corporate practices exceed the government requirement in the KSA. MNCs are increasingly considered as solutions to global regulation and public goods problems. They are uniquely positioned to contribute to goals of international development because of their financial and technological capacity (Matten and Crane, 2005; Scherer and Palazzo, 2008). Firms recognize its strategy in public policy arena is not less important than its business success in the economic domain. As a result, there is growing consensus that firms have been generally expanding their efforts to affect public policy decisions (Hillman and Hitt, 1999). Influential corporations such as global MNCs constantly seek to shape the political and social conditions under which they thrive (Luo, 2006). Weidenbaum (1980, p. 46) suggested ‘‘public policy is no

longer a spectator sport for business'' and firms must be proactive to achieve the objectives and potential benefits from political behavior.

SABIC is a global MNC with significant financial and technological endowments. It is a leader in both domestic and international arena. It faces a wide range of potential risks and challenges in their global operation. The imminent threats of global terrorism and conflicts have drastically increased corporate vulnerability in their global operation. Therefore, global leading MNCs like SABIC can impact government policy in nonproliferation. They are no longer merely at the receiving end of the government industry relation. Such influence can be explained in two related ways.

First, global MNCs have to establish effective risk management and compliance program in order to compete in an increasingly complex legal and political environment. Such a system requires significant investment and commitment from corporate leadership and more importantly it has to be fully integrated within its corporate management practice in order to be effective. A successful risk management and compliance program hinges on a deeply rooted compliance culture throughout its operation. It is not a regional practice, but a corporate philosophy. Therefore, MNCs with such compliance culture play a positive role in their defense of a national export control system.

Second, when MNCs operate in a less developed export control environment where compliance requirement is weak, it creates disadvantages for global MNCs because their local competitors do not need to invest resources in such effort. Thus, the playground is not leveled for all players. Further, when MNCs impose its own compliance practice onto its stakeholders such as suppliers, partners, brokers and distributors, and more importantly the standard exceeds

government requirements, there is a spillover effect. Theoretically, it creates a normative behavior within the regional industrial supply chain to comply. Therefore, it also prompts a better implementation of chemical nonproliferation from the supply side.

Finally, this case study provides an illustration of how a MNC can improve a country's implementation of chemical nonproliferation through its own corporate influences. Though Saudi Arabia does not have a complex regulatory system in place to address the implementation of CWC, its industry leader has a system in place to mitigate the risk of proliferation, which indirectly helps improve Saudi Arabia's records in chemical nonproliferation. On the other hand, as Saudi Arabia continues its rapid development of chemical industry and the growing need for production and trade of controlled chemicals, its current regulatory framework for sensitive chemicals is neither sufficient nor sustainable. Therefore, it has to make improvements in its system in order to continue attracting foreign direct investment or joint ventures because MNCs expect a leveled playground for its competition. More importantly, weak national export control systems can lead to gaps in corporate compliance between large MNCs and small businesses. MNCs cannot afford any mishap within their supply chain. Without a healthy network of suppliers in the region, it is difficult to attract or maintain large MNCs. It is a dilemma that the Saudi Arabia government has to address in the near future.

CHAPTER 6 CHINA AND SINOCHEM

This chapter documents and analyzes a different case: China. Chinese MNCs play an important role in China's implementation of chemical nonproliferation regimes. China offers a different insight from the previous case due to its unqiue political and economic circumstances. I first examine the evolution of Chinese foreign policy towards WMD nonproliferation. I then study the current chemical nonproliferation apparatus including regulations, licensing and control list. China has a well-developed chemical nonproliferation and export control system compared to Saudi Arabia. Its chemical industry also represents more diversity and significance in the global market with a longer history. Lastly, I focus on the Sinochem Group, a state owned and the largest chemical company in China. It is also one of the only two chemical companies that are authorized to trade controlled chemicals in China. This case study will contribute to my argument that chemical MNCs can promote national implementation of chemical nonproliferation commitment through its corporate practices.

6.1. Background: China's WMD Nonproliferation Engagement

China's approach to international participation in global WMD nonproliferation regime has shifted from isolation to integration. Today, China has signed most major nonproliferation treaties and participated in some global initiatives designed to reduce the risk of proliferation. It signed or acceded to the following international treaties: the Nuclear Nonproliferation Treaty (NPT) in 1992, the Biological and Toxins Weapons Convention (BTWC) in 1984, International Atomic Energy Agency (IAEA) safeguards agreement in 1988, and the IAEA Additional

Protocol in 1998. Specifically to chemicals, China signed the CWC on January 13, 1993 and ratified it on April 25, 1997.

China's relationship with supplier side regimes - the Nuclear Suppliers Group (NSG), the Zangger Committee (ZC), the Missile Technology Control Regime (MTCR), the Australia Group (AG), and the Wassenaar Arrangement (WA) - has also shifted over the last three decades. It went from complete opposition to joining NSG and began dialogues with the rest. In the late 1980s and early 1990s, China's position was that these Multilateral Export Control Regimes (MECRs) were discriminatory "clubs" of supplier states and/or redundant with international treaties. However, starting in the late 1990s through to the present-day, China has gradually shown more interest and support for the major MECRs and aligned its national strategic control system accordingly. By the end of 2004, China had joined the ZG and the NSG, passing a series of new regulations and measures on controls of missile, chemical, and biological-related items. China has continued to build its relationship with the MTCRs and WA.

The shift of China's foreign policy towards WMD nonproliferation can be explained by various factors such as domestic politics, international influence etc. Yet, similar to the discussion of Saudi Arabia's chemical environmental regulation shift, I would like to focus on economic factors to explain the policy decision. China was under a so-called planned economy until 1978 when Deng Xiaoping announced its open door policy. It experienced drastic economic restructuring in the 80s and 90s. The shift from a planned economy to market economy also influenced China's foreign policy orientation in the international community. Isolation in politics no longer was sustainable or compatible with China's open door economy policy. As we further examine the Chinese chemical regulatory apparatus and chemical industrial development, we

will see more evidence of such transformation and its influence on the behavior of Chinese implementation of nonproliferation commitment.

6.2. China's Chemical Nonproliferation Legal Framework

China signed the CWC in 1993 and ratified the treaty in 1997. Before CWC entered into force in 1997, China already published regulations to manage the import/export of sensitive chemicals. The State Council promulgated *the Notice about Strictly Control of Import/Export of Sensitive Chemicals* in 1994. In the subsequent year, *the Regulations of the People's Republic of China on the Administration of Controlled Chemicals* (hereinafter as "the Controlled Chemicals Reg") was enacted along with the Controlled Chemicals List in 1996. Then it published the "*Implementation Details on the Regulations of the People's Republic of China on the Administration of Controlled Chemicals*" in 1997. State council approved an *amendment Circular No. 1* in June 1998 to add 10 additional chemicals (Table 6.1) to the Controlled Chemicals List Schedule 3. These newly added chemicals are listed under the AG control list even though China is not a member of AG. After 9/11 in 2001, countries began to enhance efforts in nonproliferation and antiterrorism cooperation. China promulgated the "*Measures on the Export Control of Certain Chemicals and Related Equipment and Technologies*" in 2002 (hereinafter as "the Certain Chemicals Measure"). It includes another 10 chemicals from AG list as well as equipment and technologies.[69] Collectively, these regulations serve as China's legal framework for regulating sensitive chemicals and implementing the CWC. As we can see from the timeline, most of the regulatory progress made was between 1997-2002.

[69] "Chinese Nonproliferation Policy." Chinese Controlled Chemicals Industry Association, n.d. Web. 03 Feb 2016 <http://www.zjhx.org/view.asp?id=2128>

Besides its legal and regulatory development, China's control list and licensing system also evolved throughout the period. The Chinese "*Controlled Chemicals List*" contains three Schedules of chemical agents: Schedule 1 includes chemical weapon chemicals, Schedule 2 covers chemical weapon precursors and Schedule 3 includes main materials to produce chemical weapons. There are a total of 65 controlled chemicals as of December 31 2015. Among them, while most are in the CWC control list, a few are listed under the AG. The second Chinese control list is the "*Certain Chemicals, Equipment and Technologies*" which includes 10 chemicals as of December 31 2015. All ten chemicals are listed under the AG. Its equipment and technology items also correspond to AG categories.[70] **Table 6.1** list AG chemicals covered under the Chinese "*Controlled Chemicals List*" and "*Certain Chemicals List*" respectively.

Table 6.1 AG Chemicals on the Chinese Controlled/Certain Chemicals List

AG Chemicals on the Controlled Chemicals List	
1.	3-Hydroxy-1-methylpiperidine
2.	Dimethylamine
3.	Dimethylamine hydrochloride
4.	Methyl benzilate
5.	3-Quinuclidone
6.	Pinacolone
7.	Potassium cyanide
8.	Sodium cyanide
9.	Phosphorus pentasulphide
10.	Triethanolamine hydrochloride
AG Chemicals on the Certain Chemicals List	
1.	2-Chloroethano
2.	Potassium fluoride
3.	Hydrogen fluoride
4.	Potassium bifluoride
5.	Ammonium bifluoride
6.	Sodium bifluoride
7.	Sodium fluoride
8.	Diisopropylamine
9.	Diethylaminoethanol
10.	Sodium sulphide

[70] "Measures on the Export Control of Certain Chemicals and Related Equipment and Technologies and its control list (2002)." Chinese Ministry of Foreign Affairs. http://www.fmprc.gov.cn/ce/cgvienna/eng/dbtyw/fks/t127629.htm>.

The Chinese chemical licensing system also carries quite unique characteristics. As we know, China has a large chemical industry. It manufactures and trades large quantities of Schedule 3 chemicals and covers 16 out of 17 kinds except Ethyldiethanolamine. China also produces 11 Schedule 2 chemicals (**Table 6.2** provides a list of declared schedule 2,3 and DOC plants in China). However, the licensing system of Chinese controlled chemicals is based on a so-called "designation" mechanism. In another word, trading controlled chemicals is a privilege and limited by the government to only a small number of players. According to Article 14 in the Controlled Chemicals Regulation, only designated companies are allowed to produce or trade CWC scheduled chemicals. Any company that wishes to import/export such controlled items has to trade these items through designated traders. This mechanism strongly resembles the mechanism used for Chinese defense trade, which represents a fusion of market and planned economy.

Table 6.2 Declared Schedule 2, 3 and Discrete Organic Chemicals Plants in China

	Declared Schedule 2 Plant Sites	Declared Schedule 3 Plant Sites	DOC
1997	15	228	
1998	na	Na	
1999	23	200	1500
2000	26	251	
2001	33	240	1320
2002	39	240	1200
2003	43	260	1600
2004	45	260	1600
2005	46	250	1700
2006	47	250	1700
2007	48	270	1600
2008	47	240	1500
2009	40	240	1400
2010	41	250	1310
2011	44	230	1280
2012	44	210	1280
2013	44	210	1280
2014	59	210	1280

At present only two Chinese companies have general trading privileges for CWC controlled chemicals: Sinochem Group and the China Haohua Chemical Group Corporation. In addition to the two companies, there are only a handful of chemical companies that are authorized to import or export several specific chemicals. It is important to mention that the designation system only applies to controlled chemicals. The "*Certain Chemicals and Equipment*" from the AG control list is subject to a different licensing requirement, which will not be discussed here.

The development of the Chinese chemical regulatory framework did not come without its fair share of problems. Let us look at the supply side of the story. The chemical industry experienced a period of chaos and turmoil in the late 90s and early 2000 when the Chinese economy went through a deeper reform. Several reports indicate that Chinese firms contributed to the Iranian chemical weapons program by supplying chemicals, equipment and assistance in the late 1990s. For example, in August 1993, the Chinese ship Yinhe allegedly was carrying a cargo of chemicals to Iran including two ingredients that can be used in chemical weapons: thiodiglycol and thionyl chloride.[71] The CIA indicated in late 1996 that China might have supplied Iran with up to 400 tons of chemicals for the production of nerve agent. Another report indicated that China supplied Iran with roughly two tons of calcium-hypochlorate in 1996. The Chinese firms that were sanctioned were Nanjing Chemical Industries Group and Jiangsu Yongli Chemical Engineering and Im/Ex corporation.[72] In February 1998, U.S. Deputy Assistant Secretary of State Robert Einhorn testified that Iran was obtaining "dual-use chemicals and

[71] Frantz, Douglas. "Chemicals on Chinese Ship Usable for Arms, U.S. Says : Diplomacy: Cargo is in Iranian waters. Beijing charges U.S. bullying in monitoring the vessel." Los Angeles Times. Los Angeles Times, 10 Aug. 1993. Web. 06 Feb. 2017. <http://articles.latimes.com/1993-08-10/news/mn-22365_1_chemical-weapons>.
[72] Cordesman, Anthony H. Iran's military forces in transition: conventional threats and weapons of mass destruction. Greenwood Publishing Group, 1999. 344. Books.google.com. Web. 01 Feb. 2017.

production equipment" from China. In April, the Iranian Defense Industry Organization took delivery from a Chinese corporation, the Tianjin branch of SinoChem, of 500 tons of phosphorus pentasulphide, a dual-use precursor on the Australia Group control list (used by Iraq to make VX nerve agent)[73].

The U.S. Department of State (DOS) sanctioned 11 different Chinese entities from 1995-1997 for their violation of the Chemical Biological Weapon Act. The number significantly reduced from 2002 to 2015 and there is only one new chemical related sanction in 2015 to Tianjin Flourish Chemical Co. **Table 6.3** provides a summary of entities sanctioned by DOS Nonproliferation Program.[74] We can observe that the Chinese chemical sector experienced the worst violation record from 1993-2002. It peaked in 1997 and 2002 respectively and went down after 2003. Interestingly, this timeline overlaps with the China's economic reform. As China began to develop its export control framework in the late 90s and early 2000, Chinese economic reform marched into another round of transformation. Companies, particularly state owned enterprises, were struggling to survive. The fierce market competition drove companies to search for any opportunity. It was a wild west. The concept of compliance did not exist in their pursuit of business survival. The growing pains resulted in serial violations in nonproliferation regime.

Table 6.3 List of Chinese Entities Sanctioned by US Department of States Nonproliferation Program

NAME	DATE	STATUS	REASON
Asian Ways	2/18/95	Active	CBW Act
World Co Ltd	2/18/95	Active	CBW Act
Mainway	5/19/95	Active	CBW Act

[73] Steinberg, Gerald. "Israel Looks Over the Horizon: Responding to the Threats of Weapons Proliferation." Jerusalem Center For Public Affairs. Jerusalem Center For Public Affairs, 01 July 2001. Web. 06 Feb. 2017. <http://jcpa.org/article/israel-looks-over-the-horizon-responding-to-the-threats-of-weapons-proliferation/>.
[74] "Nonproliferation Sanctions." U.S. Department of State. U.S. Department of State, 09 Aug. 2016. Web. 06 Feb. 2017. <http://www.state.gov/t/isn/226423.htm>.

Nanjing Chemical Industries Group (NCI)	5/21/97	Lifted on 02/24/2015	CBW Act
Pan Yongming	5/21/97	Active	CBW Act
Shao Xingsheng	5/21/97	Active	CBW Act
Tian Yi	5/21/97	Active	CBW Act
Liao Minglong	5/21/97	Active	CBW Act
Q.C. Chen	7/9/02	Active	CBW Act
	5/21/97		
Cheong Yee Limited	5/21/97	Active	CBW Act
Jiangsu Yongli Chemical Engineering and Technology Import/Export Corp.	7/9/02	Lifted on 02/24/15	CBW Act
	5/21/97	2/24/15	
Jiangsu Youngli Chemicals and Technology Import/Export Corp.	7/9/02	Lifted on 02/24/15	Iran-Iraq Arms NP Act of 1992
	6/14/01	6/14/03	INPA
Wha Cheong Tai Co Ltd	7/9/02	Active	CBW Act
China Machinery and Electric Equipment Import and Export Co.	7/9/02	Lifted on 06/27/2013	CBW Act
	4/1/04	4/1/06	CBW Act
Zibo Chemical Equipment Plant	6/26/03	6/26/05	
	5/9/02	5/9/04	**INPA
Liyang Yuniong Chemical Equipment Group Co.	6/23/03	6/26/05	INPA
Dalian Zhongban Chemical Industries Company	5/23/11	5/23/13	INKSNA
Tianjin Flourish Chemical Co	8/28/15	Active	*INKSNA

**Note: "INKSNA" as Iran, North Korea, and Syria Nonproliferation Act (INKSNA)*

*** "INPA" as Iran Nonproliferation Act*

As the Chinese economy continued to grow and mature, so did the Chinese chemical industry. The development of chemical regulatory policy stayed abreast with industrial and economic reality. As I mentioned earlier, Chinese chemical industry is led by only few large chemical companies and filled with hundreds of small production facilities spread across the country. China's sheer size makes it a daunting task to effectively monitor the trade of these

sensitive chemicals. Therefore, the government only authorizes a handful of trusted companies to trade controlled chemicals. It centralizes the trading privilege to only a few players. This arrangement significantly reduces the administrative burden for government and makes it easier to control and monitor the transaction of controlled chemicals.

Several examples can help further illustrate this argument. One specific example is the control of Chloropicrin (CAS: 76-06-2), a highly toxic chemical listed in the CWC Schedule 3 as well as Chinese controlled chemicals list. Since there is only one producer in China: Dalian Dyechem International Corporation[75], it became the only authorized company in China for producing and exporting Chloropicrin in 1999. Another example is Triethanolamine (CAS: 102-71-6), an organic compound listed in CWC schedule 3. It is a precursor chemical for nitrogen mustard agent, also found in a variety of detergents (shampoos, bubble baths, household cleaners). It was one of the most imported controlled chemicals in China due to its wide industrial applications. Most of businesses using this chemical are small and medium size companies. An important fact is that Triethanolamine is primarily used as a supplementary material. So the quantity that businesses purchase is small. Due to the lengthy process and costs for importing this product from only two designated importers, a black market was formed. When the Chinese authority found out the black market, CWCIO published the *Notice No. 28 on Management of Import/Export of Triethanolamine* in October 1998. It issued a temporary authorization to five additional chemical companies to import Triethanolamine in order to solve the shortage of legitimate providers for this product. The list was extended to eight by 2006. As a result of the expansion, demands for illegitimate purchase decreased and eventually three

[75] "Product Details." Dalian DyeChem International Corporation. <http://www.daliandc.com/product_detail_en/1.html>

companies were awarded import privilege of Triethanolamine in addition to the two existing ones. Today, there are five companies in China that are allowed to apply for license from CWCIO to import Triethanolamine for its end users. Similar mechanism applies to import of both Thionyl chloride and Dimethylethanolamine.[76]

It is true that the government authority ultimately determines which companies are authorized for sensitive chemicals production and trade. Yet, these examples demonstrate that Chinese government policies are very responsive to the economic structure, market condition and industry needs. Industry activities inevitably play an influential role in shaping the Chinese chemical regulatory structure. As China's economy continued to grow and more integrated into the global market, Chinese companies also began to complete its transformation. As it stabilized its market position in the global economy, its corporate governance also began to adapt to the international norm. Now let us take a brief look at the Chinese chemical industry.

6.3 China's Chemical Industry

The Chinese chemical market has reached 33% of global market share in 2013. It maintained an annual growth rate of 23% from 2005 to 2013.[77] Now that the overall economic growth is no longer in double digits, the chemical industry still generated total revenue of US $1445.8 billion in 2014 with a 9.4% growth that year. Commodity chemicals are responsible for 66.8% of that total. Specialty and agricultural chemicals take up 8.9% and 6.4% respectively. China has the largest market value (64%) in of the Asia-Pacific area followed by Japan (9.7%),

[76] "Chinese Controlled Chemicals Import Export Regulation." Chinese Controlled Chemicals Industry Association 03 Feb 2016. <http://www.zjhx.org/view.asp?id=2129>

[77] Pflug, Kai. "Market Outlook: Thriving in China´s competitive chemical market." ICIS. RELX Group, 26 May 2016. Web. 06 Feb. 2017. <http://www.icis.com/resources/news/2016/05/26/10002360/market-outlook-thriving-in-china-s-competitive-chemical-market/>.

South Korea (7.2%) and India (4.8%).[78] Chinese chemical industry is divided among several type of businesses: a few large state owned enterprises with over 50% market share at a declining rate; private businesses expanding quickly with nearly 40% market share, and the remaining 10% with foreign firms and local provincial companies.[79]

Today, Chinese companies are much more sophisticated in their operation, particularly for those large multinational corporations with businesses operations across the global. Warren Buffet has famously said "it takes decades to build a reputation and 5 minutes to ruin it". As industry leaders and key players in the global market, Chinese MNCs have a high stake in securing their position. Corporate reputation and image is critical for its success. Therefore, the pressure of risk management and industry compliance is not merely driven by Chinese government regulation, rather from within. Therefore, Chinese MNCs invest significant resources in developing risk management system and compliance program to protect its assets. Most adopt their practices from international standard. As we discussed in the previous case study, industry compliance is the first line defense of an effective export control system. Now let us examine in details one of the only two authorized chemical companies in China for controlled chemicals: Sinochem Group. It exemplifies the development of Chinese chemical industry and the aspiration and challenges Chinese MNCs face in the complex global environment. Its recognition and support of compliance is a very important part of Chinese implementation of CWC.

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[78] "What's next for international chemical companies in China?." McKinsey & Company. < http://www.mckinsey.com/industries/chemicals/our-insights/whats-next-for-international-chemical-companies-in-china >

[79] "Market Outlook: Thriving in China´s competitive chemical market." ICIS Chemical Business, 26 May 2016. <https://www.icis.com/resources/news/2016/05/26/10002360/market-outlook-thriving-in-china-s-competitive-chemical-market/>

6.4 SinoChem Group

Sinochem Group is a state owned conglomerate under the supervision of State Owned Assets Supervision and Administration Commission of the State Council (SASAC). It is headquartered in Beijing with five core businesses spanning energy, agriculture, chemicals, real estate and financial services. Sinochem Group is China's biggest agricultural input company (fertilizer, seed and agrochemicals) and leading chemical service company. Sinochem Group has more than 300 subsidiaries globally. It is the parent company of four public listed companies: Sinochem International (SH, 600500), Sinofert (HK, 00297), Franshion Properties (HK, 00817), and Far East Horizon (HK, 03360). In June 2009, Sinochem Group established Sinochem Corporation as the vehicle for potential group IPO. In 2014, Sinochem revenue reached RMB 500 billion and was a global fortune 500 company. The brand "SINOCHEM" was listed in the top 10 of "China's 500 Most Valuable Brands" selected by the World Brand Lab, ranking 7th with a brand value of 142.5 billion Yuan in 2014.

SinoChem's portfolio puts its corporate reputation at a very critical position. It is a vanguard of the Chinese chemical industry and a key player in the Chinese economy. Its objective can no longer be limited to revenue and profit, more importantly it has the obligation to satisfy all stakeholders including its shareholders, the public, government, employees and suppliers etc. Before we look any further into this conglomerate, I would like to briefly discuss its past because its development is a representation of the Chinese economic reform and chemical regulatory development.

Sinochem Group was first established as *the China Import Corporation* in 1950 under the backdrop of the Korean war. It was the very first trading company in China and tasked with

importing strategic items such as fertilizers, rubber etc. from the west. As China began to diversify its trade, more trading companies joined the competition and *China Import Corporation* began to specialize in oil, chemicals and pharmaceutical products. By 1957, its exports reached US$ 60 million in 40 countries and regions. In 1961, *China Import Corporation* was renamed *China Chemical Im/Ex Co.* to reflect its specialization. Its export expanded to USD $80 million with 300 products in 1965 and its imports increased to agricultural products, organic chemical raw materials and plastics. Oil accounted for the majority of its export in the 70s and mostly to Brazil, Singapore and US. Agrochemicals including fertilizers, pesticides etc. accounted for 70% of imports and reached USD $1.1 billion in 1975.[80]

China began its economic reform in 1978 by introducing market economy principles. The first stage of the reform in the early 1980s included the opening up of the country to foreign investment and permission for entrepreneurs to start businesses. The second stage of the reform in the late 1980s and early 1990s deepened privatization and transformation of state owned enterprises to compete in a market economy. The economic reform had a great impact on state owned companies. In order to adapt to the economic restructuring, *China National Chemicals Import and Export Corporation* (renamed in 1965) began to set up oversea offices and joint ventures. Its trading volume reached USD $10 billion in 1984 and became one of the largest trading companies in China.

In 1998, along with many other Chinese companies, *China National Chemicals Import and Export Corporation* experienced a major economic earthquake. The Asia financial crisis severely challenged many companies' financing capability. *China National Chemicals Import*

[80] "Break The Blockade, Have A Difficult Take-off." Sinochem Group. Sinochem Group, n.d. Web. 06 Feb. 2017. <http://www.sinochem.com/english/1260.html>

and Export Corporation faced debt payment and was at edge of bankruptcy.[81] At the same time, market reform also took away its monopoly over the importing and exporting of crude oil, fertilizer and other chemicals in China. More players are in the competition such as PetroChina （中石油）and Sinopec (中石化). Interestingly, this period was also marked with the peak of nonproliferation violation records from Chinese entities in the late 90s. As we discussed in the earlier section, it is not a coincidence, rather it can be explained by the economic environment faced by Chinese enterprises during that time. Particularly, state owned enterprises had to adapt to market competition from planned economy and survival was the objective. Corporate image, reputation or sustainability were not in the mind of managers when their primary focus was to stay alive.

China National Chemicals Import and Export Corporation survived from the most difficult time and was reborn as ***Sinochem Group*** in 2003 to reflect its drastic business transformation. Sinochem Group aggressively began to invest in oversea acquisition of oil and gas field. By 2011, it owned 23 oil and gas fields in 10 countries in South America and the Middle East. It then expanded to downstream business including refinery and sales. [82] In the agrochemical industry, Sinochem focuses on fertilizer sales network. It established a supply chain from R&D, production, sale to service. In 2005, Sinochem bought China Fertilizer (Holdings) Company Limited and went public in the HK stock market. It solidified its leadership position in Chinese fertilizer business. Sinochem's chemical business is based on the international trade and circulation services for chemical products. It accounted for US 27.24

[81] "Sinochem's Consolidation of its Listing Companies." Phoenix Finance News. 7 Nov. 2015. <http://finance.ifeng.com/a/20151107/14059804_0.shtml>

[82] "The Transition from President Liu, Deshu to Ning,Gaoning", Sinochem Group. 2nd Volume, 2016, China Economy Weekly. <http://paper.people.com.cn/zgjjzk/html/2016-01/11/content_1649461.htm>

billion in total imports and exports in 2015 and ranked 5th in "China's Top 500 Businesses in Foreign Trade".[83] It is China's leading chemical service company with complete industrial chain for fluorine chemicals, fine chemicals, rubber and exporter of pharmaceutical intermediate businesses. With 50,000 employees, today Sinochem Group positions itself as a respected world class company and delivers financial and social benefits to its stakeholders and society.[84]

From the 1950s untill today, Sinochem Group demonstrates a classic example of a Chinese state owned enterprise's transformation. It went from a so-called "Iron Bowl" factory under the planned economy into a global modern multinational corporation. Its ups and downs during the transformation parallel the progress of China's economic reform. Similarly, the shift of Chinese foreign policy towards WMD nonproliferation followed closely with the economic reform. When China was a closed-door planned economy, its attitude towards nonproliferation policy was antagonistic. As the door began to open and the economy gradually integrated into the international community, the attitude became more welcoming. In the early 2000s, China finally promulgated a series of chemical regulations, measures and rules to implement its CWC ratification.

This is also the time when Sinochem Group was able to reestablish itself and complete its business transformation. It appeared that both government and industry efforts to integrate into the international community synchronized nicely. As I suggested in the Saudi Arabia chapter, government is incentivized to provide a sufficient and internationally accepted regulatory framework in order to maintain and attract investment. A similar rationale applies to the industry

[83] "Sinochem Group Ranks the 5th on "China's Top 500 Businesses in Foreign Trade" List." Sinochem Group . Sinochem Group, 21 Sept. 2015. Web. 06 Feb. 2017. <http://www.sinochem.com/english/s/1569-5518-18036.html>.

[84] "2013 Sustainable Development Report." Sinochem Group Web. <http://english.sinochem.com/portals/4/pdf/csrReport/2013CSRen.pdf>

side. As major Chinese chemical companies became more integrated into the global supply chain such as SinoChem Group, they are more likely to accept international norms and comply with government regulation. Sinochem Group is a vital force in the Chinese chemical industry. Its success hinges on its ability to excel in the global market. It has to submit its corporate governance to international standards and global practices in order to compete in the global environment and safeguard their reputation and assets. When SinoChem Group's subsidaries went public in the HK market, it was no longer merely responsible to stockholders in China, instead it had a global audience to satisfy. Therefore, Sinochem Group has sufficient incentives to develop a compliance norm that is internationally accepted in order to address regulatory risks though Chinese regulation does not require it. The section below will exam Sinochem's corporate practice and evaluate its consistency with international standards of compliance practice.

Sinochem Group has been publishing its annual *Corporate Social Responsibility Report* since 2007. It then changed to *Sustainability Development Report* in 2010 during its 60th anniversary. Similar to SABIC, SinoChem also emphasizes the importance of green development, safety culture and risk management and puts sustainability at the top tier of its development strategy. Sinochem first began to build a risk management system in 1998 when it experienced the disastrous Asian financial crisis and China's restructuring of the petro and fertilizer sectors. It gradually established a comprehensive risk management and internal control framework that includes one system, two mechanisms and three guarantees. It is designed to minimize risks within both the Group and its massive network of subsidiaries. The one system refers to internal control and comprehensive risk management system. The system is integrated within the

management system and is consistent with rules, regulations and international best practices. The two mechanisms consist of risk monitoring and risk examination. It monitors risks from key units and businesses, establishes risk examination standards with 2 dimensions, 68 indicators, and 165 grade points.[85] This system allows Sinochem to assess the risk management capacity of all its subsidiaries. The results provide justification for the amount of authorization the headquarter can issue to a subsidiary. Lastly, the three guarantees refer to the implementation of risk management. It maintains a "three tiered checks and balances" principle.[86] Essentially, it serves a double verification function to ensure the effectiveness of risk management.

Of course, this system is not solely designed for nonproliferation purposes. It covers five categories including finance, market, strategy, operations and laws and regulations. The proliferation threat lies within the last category of regulatory risk. Specifically, the "laws and regulations" risk has four subcategories: legal compliance, contract management, legal friction and intellectual property rights. Among them, legal compliance is marked the highest priority in the 2014 report. Sinochem's legal department is the key office for regulatory compliance. It is responsible for reviewing and rationalizing management rules and regulations. It brings "running companies by law" into performance appraisal and develops rewards and penalties. Further, the legal team compiles risk management manuals and conducts legal training to increase the awareness of legal requirement to its employees.

Sinochem Group has four public listed companies and one of them is *Sinochem International (holding) Co. Ltd*. (abbreviated as "Sinochem International"). It is the first listed

[85] "2012 Sustainable Development Report." Sinochem Group Web. <http://english.sinochem.com/portals/4/pdf/csrReport/2012 中化集团社会责任报告.pdf>
[86] "2014 Sustainable Development Report." Sinochem Group Web.

company of Sinochem Group. This subsidiary has an important role in the Sinochem Group's compliance with chemical nonproliferation because it is the only authorized trader within the Sinochem Group to import and export controlled chemicals. It began its business in 1998.[87]

Sinochem International provides chemical product distribution for major domestic and foreign manufacturers. It covers styrene, diethylene glycol, acetone, phenol, bisphenol A, methanol, polyethylene, polypropylene, PVC, base oils, liquefied petroleum gases and controlled chemicals. It works closely with foreign suppliers such as DOW, Exxon Mobil, Chevron, BASF, SABIC etc[88]. It has customers from over 100 countries. The import and export division of Sinochem International is responsible for exporting of controlled chemicals and trade in Cuba.

Sinochem Group has an internal compliance program [ICP] that is used to address trade compliance risks. Its organizational structure has three levels from decision making, reviewing, to operations. Group executive leaders are the top decision making body. The planning department is the second tier for review and approval. It is staffed with people from risk, legal and audit offices. Each office has its own responsibilities. The planning department is responsible for developing administrative procedures, guidelines and ensuring their implementation. It also monitors the controlled chemicals operation audit. It examines and approves export contracts before signing and reviews and reports on export license application materials. The planning department also monitors contract implementation and keeps records. The audit department screens customers and audits the compliance activities of its subsidiaries.

[87] "OPCW's Visit led by Mark Albon". Sinochem International, Press Release 16 May 2014. <http://www.sinochemintl.com/NewsCentre/NewsDetails/617>

[88] "Business Overview." Sinochem Group. Sinochem Group, n.d. Web. 06 Feb. 2017. <http://www.sinochemintl.com/Business/TIntro>.

The ICP maintains a principle of dual examination: self-assessment by subsidiary and review by the headquarters.

As the designated trading company within the Group, Sinochem International plays a key role in implementing the ICP. All managers, sales involving controlled chemicals are required to be registered at the Planning department. A copy of the record is also shared with CWCIO. All transaction must strictly follow license approval requirement and guarantee no re-export nor transit/transshipment. Personnel are required to be familiar with their customers and monitor any change. Each office is subject to inspection from local CWCIO.

Sinochem's ICP highlights the importance of end use/end user screening. It requires to fill out all necessary information about end user such as name, address, telephone, fax and letter head. It must mark product name and quantity which must be consistent during the actual import transaction. The end use certificate must guarantee that the product will NOT be used in any WMD purpose, nor it will be transferred to a third party or re-exported. The end user certificate must be signed by the end user with a notarized witness and the original document.

Sinochem has different training programs for all employees and targeted training for trade specific employees. The general training raises the awareness among its employee of government regulation and company policy, whereas the specific training focuses on license requirements, red-flags, sensitive countries, regions and so on.

In addition to implement internal compliance programs within its operations, Sinochem also takes advantage of its industrial strength and makes an impact on industry standards and policy formation. By the end of 2014, it took part in formulating and amending 861 national and industry standards. Sinochem International undertook the "2012 Forum for China Responsible

Care in Storage and Transportation Security Management." It contributed to increasing the publicity of Responsible Care codes and strengthening security management work in the storage and transportation sector. Sinochem is member of the drafting entity for the Responsible Care Codes for Storage and Transportation Security Management.[89]

6.5 Summary

As I wrap up the second case study, it is important to reflect on the similarities and differences between the China and Saudi Arabia cases. Foremost, both countries have ratified CWC and neither is a member of the Australia Group. Both have a significant and growing chemical industry with large MNC presence. Both governments are eager to maintain existing and attract new investment to promote economic growth. However, their differences are quite drastic and cause significantly different policy implementation in chemical nonproliferation. China has a much bigger portfolio in the production and trade of sensitive chemicals comparing with Saudi Arabia. As I discussed in both chapters, government is incentivized to provide a sufficient regulatory framework in order to maintain a sustainable business environment for both domestic companies and foreign corporations. Policies are partially driven by economic calculation. We have seen the evidence of Saudi Arabia's heavy focus on environmental and safety regulations in comparison to export control. The differences in the controlled chemicals sector understandably result in different levels of CWC implementation in respective countries. China has a relatively well-developed system to control these sensitive chemicals and equipment, whereas Saudi Arabia's system is quite limited.

[89] "2012 Sustainable Development Report." Sinochem Group Web. <http://english.sinochem.com/portals/4/pdf/csrReport/2012 中化集团社会责任报告.pdf>

Interestingly, despite the differences in government regulation, the two primary MNCs selected from respective countries, SABIC and Sinochem Group, share a striking similarity in their corporate practice with respect to compliance and risk management. From the analysis of Sinochem Group's corporate practice, we can observe a strong risk management system to address risks from different dimensions of their operation including regulatory compliance. Regulatory compliance is a very important segment in the overall corporate risk portfolio because of the increasing complexity in global affairs and eminent threats from terrorism. Companies have to stay vigilant in trading sensitive chemicals. Any violation can cause significant damage to both its finances and reputation, which large multinationals simply cannot afford. This rationale applies to SABIC as well.

Both companies have clients in all major markets. They have to comply with export control regulations from different countries and many have well advanced national control system and stringent enforcement mechanism such as the U.S and EU. This serves as a great incentive for Sinochem and SABIC to retain an effective compliance program in order to be effective in its handling with controlled chemicals. Most of reputable chemical MNCs value compliance because trading such sensitive chemicals is a privilege instead of a right and it can be taken away by government should any violation occurs.

As the leading chemical company in China, Sinochem Group has positioned itself as a multinational corporation that excels in the global market. It shares a forward thinking world vision, which makes its corporate practice consistent with international standards. Its risk management system is the vanguard for protecting its reputation and assets. However, there is a significant difference in corporate compliance practice between Sinochem and SABIC.

Sinochem lacks an emphasis on its supplier compliance requirement. In comparison, SABIC has a well documented and publicized supplier vetting process which serves a critical function in ensuring that all SABIC suppliers are in full compliance with SABIC's overall compliance culture. This is not emphasized within the Sinochem compliance apparatus.

Experts in the trade control field increasingly recognize that corporate compliance is the first line defense of a national export control system. Well-developed corporate compliance can help improve national implementation of nonproliferation commitments. As one of the only two authorized companies in China to trade controlled chemicals, Sinochem Group's compliance performance is directly linked with the performance of Chinese chemical nonproliferation record. Successful MNCs care deeply about their reputations because they are tied directly to their business success. When a MNC engages in global operations, it is at risk of regulatory pitfalls. Therefore, Chinese chemical MNCs with global vision and ambition will have to follow the footsteps of their international counterparts/competitors in trade compliance. The motivation is created from within, rather than by government pressure. Both SABIC and Sinochem Group share a practice that exceeds government requirements in export control compliance. They are the representations of MNCs in the front line defense of a nonproliferation network. The same argument can apply to other corporations that are in the global supply chain and share the same value of sustainability and corporate compliance. It does not matter in which country the business resides, it matters to whom the company is responsible. Together, the spillover effect of compliance norm improves the overall implementation of government's nonproliferation commitment from bottom up. Again, this case study provides another example of how MNCs can positively impact a country's chemical nonproliferation efforts through its corporate practice.

The anecdotal story brings a visualization effect of the quantitative analysis and allows us to understand the specifics beyond conceptualization and numbers.

However, new challenges arise for Chinese government as the Chinese chemical sector continues to grow. China has seen a rapid growth in the number of declared facilities with controlled chemicals. It is no longer feasible to have such few choices for import and/or export controlled chemicals. The market is demanding an expansion of authorized companies with such trading privileges. At the same time, the government authority has to figure out an effective way to address the management of these companies and make sure such policy will not affect China's chemical nonproliferation record. Industry outreach becomes increasingly important and salient. Companies need to be trained and qualified for trading such sensitive chemicals. As more smaller and private companies emerging in this market, it is important to monitor how this change will influence the large MNCs and the overall compliance behavior among companies.

CHAPTER 7 GERMANY AND BASF

The discussion of German chemical nonproliferation and the role of its chemical industry is quite different from the previous cases of China and Saudi Arabia. Foremost, The German chemical industry has a much longer history beginning in the late 19th century. It has always maintained a close relationship with the German government. I will discuss this topic in details in this chapter. Second, as a democratic regime with an advanced economy, Germany has a well-developed regulatory system compared with the other two. Not only it is a member of all international WMD nonproliferation treaties and agreements, also in many cases it is a founding member of these multilateral regimes. However, Germany's nonproliferation record has not always been positive. Its industry involvement in this regard has not always been constructive either. Over the 100 plus years of Germany's chemical industrial development, the role of its chemical industry transitioned from accomplice in war crimes to suppliers to suppressive regimes before eventually becoming a constructive power in the world economy. This chapter will continue investigating the role of MNCs in countries' implementation of chemical nonproliferation commitment. Two previous case studies have demonstrated that leading MNCs in emerging economies play an important and positive role in defending and promoting a country's chemical nonproliferation records. This case will contribute to my argument by examining the advanced economy Germany in a time sequence to understand the evolution of its industry engagement in nonproliferation, more importantly, the underlying reason for such change. The first part of this chapter briefly introduces Germany's WMD nonproliferation and

chemical export control framework today. The second part focuses on the historical aspect of German chemical industry's entanglement in wars: WWI, WWII, Iraq and Syria. The last section examines in detail the German chemical company BASF and its corporate compliance culture.

7.1 Germany's WMD Nonproliferation Engagement and its Current Export Control Apparatus

As one of the most technologically advanced countries in the world, Germany's foreign policy has a deep impact on the world effort against WMD proliferation. It is a member of all WMD nonproliferation international treaties and regimes. Germany ratified the Geneva Protocol on 25 April 1929, the Nuclear Non-Proliferation Treaty on 2 May 1975, the Biological Weapons Convention on 7 April 1983 and the Chemical Weapons Convention on 12 August 1994. Unlike China and Saudi Arabia, Germany is a member of all multilateral regimes, mostly as a founding member. It became a member of the Australia Group in 1985, Missile Technology Control Regime in 1987, Wassenaar Arrangement in 1995 and Nuclear Supplier's Group in the 1977.

Germany has a well-established chemical nonproliferation framework. It published "*Regulation Implementing the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction*" in November 1996 with several amendments in 2000, 2001 and 2011. On a broader term, the "*Foreign Trade and Payment Act (AWG)*" is an overarching piece of legislation governing the freedom of foreign trade for all German corporations. Its section 7 reserves the federal government's right to restrict trade in certain strategic goods. The specific prohibitions and licensing requirements allowed by

section 7 of AWG are defined in the *Foreign Trade and Payments Regulation (AWV)*.[90] The AWV targets the exportation of military weapons and equipment, allowing *EC REG 428/2009* to regulate the export of dual-use goods. The *EC REG 428/2009* governs the EU export control regime and provides common EU control rules, list of dual use items as well as coordination and cooperation to support consistent implementation and enforcement throughout EU. While licensing and enforcement authority lies with the competent German authorities, authority over the list of controlled dual-use goods lies with the European Commission.

Germany's key license authority for controlled exports is the German Supervisory Board for Export Control (Bundesamt fur Ausfuhrkontrolle- BAFA). It is responsible for licensing, maintenance of the control lists, and embargo enforcement. The Federal Export Office is the central authority for exports and imports. While BAFA has the authority to license exports of dual-use goods and military goods, the Federal Ministry of Economics and Technology also has the authority to deny the export of military goods. BAFA does have the administrative responsibility of monitoring manufacturers' stockpiles of military goods, and performing company audits to ensure their compliance. The Federal Foreign Office is responsible for the administrative implementation of embargoes adopted by any international organization. The Federal Ministry of Economics and Technology is responsible for overseeing and ensuring the prohibition of items listed in the War Weapons Control Act. BAFA is also in charge of verification measures for its international treaties relating to the control of strategic exports. BAFA is the national authority responsible for ensuring industry compliance with CWC, and is

[90] "Foreign Trade and Payments Ordinance." Bundesministerium der Justiz und fur Verbraucherschutz. <http://www.gesetze-im-internet.de/englisch_awv/>

tasked with monitoring stockpiles of chemicals.[91] It also acts as a liaison for the OPCW in its verification measures on the German chemical industry.

Specific to licensing, there are three types of licenses concerning German export controls. Each exporter is issued a customs number by the Customs Information Management Centre that is required on the application for a license. Additionally, one representative from each exporting corporation must be put personally accountable for export compliance should a license be authorized. This representative must be on the Board of Directors or in an executive management position. This is a very important and unique feature of the German export control system. It signifies the government's attitude toward industry compliance. It literally puts individuals at legal liability risk for any violation within a corporation. It also raises the profile of the compliance officer within the corporate apparatus.

Simply put, Germany has a comprehensive export control system with a strict enforcement mechanism. It values corporate compliance greatly and puts corporate at the front and center of the compliance responsibility. However, the road leading to this stage has not been easy. The relationship between the German authorities and the chemical industry has been close, but was not always cohesive and constructive with regard to Germany's nonproliferation record. This leads us to the next discussion of the historical aspect of German chemical industry's entanglement in wars: WWI, WWII, Iraq and Syria.

7.2. Germany's Chemical Warfare and its Chemical Industry Entanglement

As I discussed earlier, Germany is different from previous cases due to its long history of chemical industrial development and entanglement in wars. This is an important part of

[91] Brief Outline on Export Controls Licensing requirements, application procedure, information sources. N.p.: Bundesamt fur Ausfuhrkontrolle, n.d. < http://www.bafa.de/EN/Home/home_node.html>.

Germany's nonproliferation discussion because the transition from destructive to constructive engagement carries significant information and has significant implications for my research and policy recommendations. In previous chapters, we have centered the discussion of corporate culture on "social responsibility." However, the discussion of German's chemical industry can only begin with "social callousness" because it was the protagonist in Germany's chemical weapon production in the early 20th century. The first chemical agents used in WWI were respiratory irritants, followed by the lung-damaging agents chlorine and phosgene. Then the introduction of sulfur mustard (SM) and highly toxic nerve agents drastically increased injuries and deaths. The first use of SM on the battlefield was conducted by German Forces in 1917. Sadly, the creation of these deadly chemical weapons came from Germany companies and one of the most infamous is the German economic corporate emporium **IG Farben**. Its name stands for "Association of Common Interests" which was a powerful cartel consisting of BASF, Bayer, Hoechst, and other German chemical and pharmaceutical companies.

In 1934, the powerful company IG Farben started a project to produce synthetic insecticides. It was led by the German industrial chemist Otto Bayer whose work produced more than 2000 compounds including the highly toxic ethylN,N-dimethylphosphor-amidocyanidate (tabun) in 1936 and isopropyl methylphosphonofluoridate (sarin) in 1937. In 1937, samples of tabun and sarin were sent to the CW section of the German Army Weapon Office where their value for military purpose was immediately recognized. During WWII, IG Farben used thousands of forced laborers from the Auschwitz-Monowitz camp at its factory. One of its subsidiaries produced Zyklon B, which was used to kill men, women, and children in gas

chambers. [92] The Nuremberg War Criminal Tribunal convicted 24 IG Farben board members and executives for their crime against humanity during WWII.[93] The company IG Farben was then dissolved into Bayer, Hoechst and BASF. Today, each of the three companies of the IG Farben is 20 times greater than IG Farben was at its height in 1944.

The history of chemical weapon production in Germany was driven by corporate innovation and production from the very beginning. The war ministry did not manufacture chemical weapons. Instead, it was the German chemical companies that first proved their capacity to produce chemical weapons during WWI. After WWII, German companies returned to civilian chemical production. However, in the late Cold War, German businesses began exporting their products and technologies to repressive regimes such as Iraq, Iran and Libya. The proliferation of sensitive chemical products and technologies by its industry once again cast a shadow on Germany's nonproliferation record. The next section focuses on its proliferation activities during the Iraq war.

First, I should mention that German law prohibited transfers of these chemical products and technologies to conflict regions such as Iraq. However, the enforcement was lax because the German Federal Economic Authority was a stepchild of the Economic Ministry led by politicians from the business friendly Free Democratic Party from 1969-1998. [94] Their priority was to

[92] Schneibel, Gerhard. "Stock of former Nazi chemicals giant to be delisted." DW: Made for Minds. Deutsche Welle, 19 Aug. 2011. Web. 06 Feb. 2017. <http://www.dw.com/en/stock-of-former-nazi-chemicals-giant-to-be-delisted/a-15327052>.
[93] "IG Farben and the History of the "Business With Disease"." Dr. Rath Health Foundation: Responsibility for Health, Peace, and Social Justice. Dr. Rath Health Foundation, n.d. Web. 06 Feb. 2017. <http://www4.dr-rath-foundation.org/PHARMACEUTICAL_BUSINESS/history_of_the_pharmaceutical_industry.htm>.
[94] Schneibel, Gerhard. "Stock of former Nazi chemicals giant to be delisted." DW: Made for Minds. Deutsche Welle, 19 Aug. 2011. Web. 06 Feb. 2017. <http://www.dw.com/en/stock-of-former-nazi-chemicals-giant-to-be-delisted/a-15327052>.

promote exports and prevent controls from being applied. [95] It simply did not have capacity nor the will to catch potential violators. In December 2002, Iraq produced a 12,000 page weapons declaration which included a list of companies that supplied Saddam with chemicals and equipment for its chemical weapons program. The *New York Times* was able to confirm the identity of most of the companies on the list. Of the 31 companies named in 1996, 14 are from Germany, which accounted for significant portion of the companies. Among them, there were two German conglomerates of the 1980s: Preussag and Hoechst. The former provided Iraq with 30 tons of phosphorous oxychloride, a chemical to make nerve agent sarin and equipment for its laboratories. Hoechst sold 10 tons of phosphorous oxychloride. Karl Kolb and Pilot Plant were major suppliers to the infrastructure of Iraq's chemical weapon program.[96] Specifically, they built six manufacturing lines at the massive Samarra compound, one of the largest chemical weapon production facilities in the world in the mid-1980s.[97] The recent chemical weapons used during Syria's civil war once again raised the question of who supplied the Syrian regime with its chemical weapon program. The Assad Regime turned over a list of participating companies to OPCW and the German Foreign Ministry promised to investigate the participation of German companies. It turned out that German companies played a large role in the building of Syria's

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[95] Latsch, Gunther, Fidelius Schmid, and Klaus Wiegrefe. "Decades of Suspicions: Did German Companies Aid Syrian Chemical Weapons Program?" SPIEGEL ONLINE. SPIEGEL ONLINE, 23 Jan. 2015. Web. 06 Feb. 2017. <http://www.spiegel.de/international/germany/german-companies-suspected-of-aiding-syrian-chemical-weapons-program-a-1014722.html>.

[96] Shenon, Philip. "Declaration Lists Companies That Sold Chemicals to Iraq." The New York Times. The New York Times, 20 Dec. 2002. Web. 06 Feb. 2017. <http://www.nytimes.com/2002/12/21/world/threats-responses-suppliers-declaration-lists-companies-that-sold-chemicals-iraq.html>.

[97] Schneibel, Gerhard. "Stock of former Nazi chemicals giant to be delisted." DW: Made for Minds. Deutsche Welle, 19 Aug. 2011. Web. 06 Feb. 2017. <http://www.dw.com/en/stock-of-former-nazi-chemicals-giant-to-be-delisted/a-15327052>.

chemical weapons stockpile. The report indicated that German firms had made 50 shipments of products and technologies between 1982-1993 including monitoring and control systems, pumps, ventilators, gas detectors etc.[98] For example, German companies provided equipment for the manufacture of methylphosphonyl difluoride, which can be combined with isopropanol for the production of sarin.

All evidence points to the fact that German chemical companies played a significant yet destructive role in Germany's chemical proliferation record during several war periods. It severely damaged Germany's credibility in chemical nonproliferation. Violators were driven completely by profit and greed. Corporate culture was dominated by "social callousness" rather than "social responsibility."

Having said that, as the world leader in chemical research and product creation, German chemical companies are extremely responsive to public opinion concerning chemical developments since WWII. Public concerns about energy shortages and environmental pollution have driven the chemical industry to focus on "Green Chemistry" today. Such public demands continue to push the chemical industry to reshape and redefine its corporate image and reputation (Lesch 2000). With the emerging globalization of production in the late 20th century, German chemical companies also became more integrated into the global market and adapted to the increasing capability and capacity of emerging economies. Interestingly, the industry's role in nonproliferation also shifted. For example, German industry played an important and

[98] Aderet, Ofer, and Reuters. "German firms played larger role in Syria's chemical weapons program - Middle East." Haaretz. Haaretz Daily Newspaper Ltd, 19 Mar. 2014. Web. 06 Feb. 2017. <http://www.haaretz.com/middle-east-news/.premium-1.580841>.

constructive role in supporting its government's ratification of the CWC treaty. Germany deposited its instrument of ratification to the Convention in August 1994 as one of the first countries with a significant chemical industry. The German government acknowledged publicly that its success in ratification and implementation of CWC was due to the excellent and intensive cooperation between the government and chemical industry. [99] There was a close communication mechanism between different government ministries and the Chemical industry Associations. Industry engagement was integrated into the Geneva negotiation process from the beginning and industry took an active role in the preparing for national implementation.

The Chemical Industry Association worked in close cooperation with the government in drafting the implementation law. The German chemical industry provided input into draft legislation, which led to manageable, workable and efficient legislation. The *Act Implementing the Chemical Weapons Convention* was promulgated in August 1994. It empowers The German Foreign Ministry as the national authority and focal point for OPCW and other state parties. While the Federal Export Control Office (BAFA) implements all industry related CWC provisions, the Verification Center of the Federal Armed Forces is in charge of data collection and verification measures in the military realm.[100] Industry experts also were involved during the drafting process of decree legislation, implementing the framework regulations of the

[99] Effective Implementation of the Chemical Weapons Convention. Bad Homberg: SIPRI-Saskatchewan-Frankfurt Group, Dec. 1995. PDF. <https://www.peacepalacelibrary.nl/ebooks/files/356377148.pdf>.
[100] Kelle, Alexander. "Preventing the proliferation of weapons of mass destruction: Implementing the Chemical Weapons Convention." Friedrich Ebert Stiftung. Friedrich Ebert Stiftung, n.d. Web. 06 Feb. 2017. <http://library.fes.de/fulltext/id/00714008.htm#E10E27>.

Implementation Act. The industry association provided training courses for future inspectors so that they are qualified with a good knowledge of the chemical industry.[101]

From the behavior of German chemical industry throughout the 20th century in the context of nonproliferation, we have observed a significant transition from being "socially callousness" to "socially responsible." In the next section, I will use the leading German chemical company BASF to exemplify this transition and analyze the rationales behind such change. This example can further contribute to our understanding of the impact of MNCs in countries behavior in chemical nonproliferation.

7.3. BASF

BASF Corporation is the largest chemical producer in the world and is headquartered in Ludwigshafen, Germany. The company has operations in over 80 countries with 390 production sites across continents. It has over 112,000 employees worldwide. In 2015, BASF posted sales of EURO 70.4 billion. It is listed in several stock markets including the Frankfurt Stock Exchange, London Stock Exchange, Zurich Stock Exchange and New York Stock Exchange.

BASF is a company with over a 150 year history starting as early as 1865. Its business began with dye manufacturing in the late 19th century. In 1925, BASF merged with five other companies (including Hoechst and Bayer) to form the infamous IG Farben in order to consolidate resources due to the political and economic unrest after WWI.[102] In the previous section, I have discussed in detail the entanglement of IG Farben in WWII. Its despicable

[101] Effective Implementation of the Chemical Weapons Convention. Bad Homberg: SIPRI-Saskatchewan-Frankfurt Group, Dec. 1995. PDF. <https://www.peacepalacelibrary.nl/ebooks/files/356377148.pdf>.

[102] "1925-1944: New Forms of High-Pressure Synthesis." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/about-us/history/1925-1944.html>.

contribution to the war led to the dismantlement of this company. More importantly, its corporate reputation was forever damaged.

After protracted demerger negotiations, Badische Anilin- & Sodafabrik Aktiengesellschaft (BASF) was founded as one of the three successor companies of IG Farben in 1952. A new company philosophy was needed at that point. Particularly, it was recognized that the export market needed to be developed. The Annual Report **1954** stated that "*We must be prepared to carry out certain manufacturing projects abroad in the near future in order to keep pace with developments. We assume that such measures will also benefit our international business over the long term*." BASF began to expand on a global basis by building or acquiring new production sites at home and abroad, and thus moving its production closer to its markets.

This is an important landmark for BASF's future development and its corporate culture today. The more a company integrates its business into the global market, the more responsibilities and limitations it bears. BASF continued its global expansion strategy in the 70s and 80s. Its board of directors recognized worldwide product stewardship as the company's guiding principle during its 1980 annual meeting.[103]

The notion of sustainability and responsible investment became more salient as it continued its expansion to Asia in the 90s. During the 125th anniversary celebration in **1990,** its Chairman of the Board highlighted that BASF was adjusting to the challenges of growth and changing demand. By means of responsible action, it has a duty to prove that chemistry and nature are not incompatible but instead form a whole.[104] Sustainability became front and center

[103] "1965-1989: The Road to Becoming a Transnational Company." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/about-us/history/1965-1989.html>.
[104] "1990-2014: Sustainable Start to the New Millenium." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/about-us/history/1990-2014.html>.

in BASF corporate culture. Bear in mind, this timeline is quite consistent with the overall German chemical industry's support for Germany's nonproliferation policies in the 80s and 90s. Similar to China's story, this is an indication that government policy in nonproliferation is rather reflective of the development and direction of its industry development. The more globalized its industry becomes, the more integrated its policy has toward international norms.

Since then, BASF invested heavily into initiatives in such regard. In February **1999**, BASF help found the German industry's Foundation Remembrance, Responsibility and Future.[105] It introduced eco-efficiency analysis to balance economic and environmental considerations. In July **2000**, BASF becomes a founding member of the Global Compact, a United Nations initiative in which NGOs, corporations, international businesses, labor representatives, and key figures in science and politics join forces to develop strategies for responsible growth. In June **2001**, BASF became one of the first companies to establish a Sustainability Council, which ensures that the principles of sustainable development are implemented throughout the Group. During the **2004** annual meeting, its Chairman of the Board laid out BASF's future roadmap with four strategic guidelines. One of the guidelines is to ensure sustainable development for a future worth living.

Since its international market expansion in the 70s, BASF's corporate philosophy has shifted its focus and put more emphasis on sustainability and social issues. BASF integrates compliance into its corporate strategy *"We create chemistry"* and uses its employee Code of

[105] the Law on the Creation of a Foundation "Remembrance, Responsibility and Future" was passed on 2 August 2000 with the support of all parliamentary parties in the German Bundestag. The law provided for individual humanitarian payments to be made to former slave and forced laborers and other victims of National Socialism. The disbursement of these payments commenced in 2001 and was completed in 2007

Conduct to mandate standard practices in its daily business.[106] BASF was ranked in the world renowned Dow Jones Sustainability World Index for 15 years.[107] Such inclusion in sustainability indices and rankings is a confirmation of excellent performance in environmental, social and governance areas. Studies have shown that companies that increasingly incorporate social and environmental factors into decision-making and value their inputs experience a positive financial impact.[108] High sustainability companies significantly outperform their counterparts over the long-term in the stock market.[109]

Specific to compliance practice, BASF has a "*One company, One Code of Conduct*" policy. It summarizes laws and corporate policies that govern the behavior of BASF employees in their dealings with all stakeholders. The Code of Conduct is not intended to describe every law and internal policy that may apply to its employees, but it defines basic, globally applicable standards of conduct and what is expected from its employees. It requires that each employee understand the standards of the Code of Conduct as well as the respective local laws and corporate guidelines, and always abide by them and attend all mandatory and necessary training sessions. The Code of Conduct also emphasizes that the company does not tolerate any

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[106] "Corporate governance and compliance." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/microsites/factbook-2016/basf-group/corporate-governance.html>.

[107] "Sustainability Ratings and Rankings." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/investor-relations/sustainable-investments/sustainability-ratings-and-rankings.html>.

[108] The Prince of Wales. Future proofed decision making – Integrating environmental and social factors into business decisions. <http://globe-net.com/future-proofed-decision-making-integrating-environmental-and-social-factors-into-business-decisions-2/>

[109] Eccles, Robert G., Ioannis Ioannou, and George Serafeim. The Impact of Corporate Sustainability on Organizational Processes and Performance. N.p.: n.p., n.d. PDF. <http://www.hbs.edu/faculty/Publication%20Files/SSRN-id1964011_6791edac-7daa-4603-a220-4a0c6c7a3f7a.pdf>.

violations and will not protect those responsible for sanctions imposed by authorities. Any violation of law can seriously damage BASF's corporate reputation and inflict considerable financial damage. Therefore, BASF implements disciplinary actions against any violations of laws and regulations including termination of employment, or subjecting violators to civil or criminal action.

These terms are very similar to SABIC and SinoChem in their corporate practice. It represents common characteristics of global MNCs with investments across different continents. Regulatory risk increasingly becomes a challenge for MNCs operating in different legal environments. Therefore, it is important to maintain a consistent code of conduct throughout its operation to help mitigate gaps in complying with local legal requirements. A credible punitive mechanism against violations can enhance the implementation of compliance.

There are several subcategories within BASF's Code of Conduct: human rights, environment protection, corruption, antitrust, money laundering, conflicts of interest, gifts, data protection, insider trading, and imports/exports. I would like to focus on the category of "Imports and Exports" because that is directly related to the discussion of export control. This section states that there are national and international laws and regulations that prohibit or restrict the products or services BASF sells. Foremost, this statement recognizes the scope of the issue that BASF is facing. BASF has operations in over 80 countries. The complexity of trade regulatory environment inevitably increases the challenges during transaction screening. The Code then explains an important difference between end use and end user. Not only can these restrictions be placed on the product, but also on the country of origin or destination or customer. This specifies the key elements within a screening process, which includes end use, end user, and its

destination. The Code finally raises the importance of CWC provisions to BASF and requires employees not to violate any of the regulations. It mandates that "all employees must comply with the control regulations when buying, producing or marketing goods or when transferring or acquiring technology".

BASF's Code of Conduct is not as detailed as SABIC's guidelines for its own export control requirements. It does not entail all specifics pertaining to its compliance standard operating procedures. However, the key is to raise the awareness of employee compliance obligations in this regard. It is an important part of an internal compliance program. [110] Another essential aspect of awareness building is training. BASF employees are required to take part in basic compliance training, refresher courses and special tutorials for trade control regulations. It introduced an e-learning program on trade control in 2015 focusing on export controls and embargoes. Its open record indicates that over 64,000 employees worldwide participated. 70K hours of compliance training in 2015.[111] Training is the foundation of a strong compliance culture. An effective compliance program is built upon human factor.

Similar to SABIC, BASF also implements a Code of Conduct for its suppliers. It mandates all suppliers to comply with BASF principles regarding environmental, labor, social and legal standards. It highlights the importance of sustainable development in its corporate culture and ensures suppliers that BASF shares the same philosophy. BASF trained over 900 procurement employees worldwide on sustainability-oriented supplier management. It is an

[110] One Company One Code of Conduct: The BASF Compliance Program. N.p.: BASF SE, n.d. PDF. <https://www.basf.com/documents/corp/en/about-us/publications/reports/2016/BASF_The_Compliance_Program.pdf>.

[111] "Supplier Code of Conduct." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/about-us/suppliers-and-partners/sustainability-in-procurement/supplier-code-of-conduct.html>.

effort to minimize its management risks along the supply chain.[112] This is another significant characteristic of global MNCs. Not only does an MNC establish a corporate compliance requirement within its own operation, it also extends its practices to its entire supply chain. Due to the variation in interpreting and implementing regulatory requirements in less developed legal systems, MNCs adopt the supplier code of conduct to help mitigate risks from violations by suppliers and ensure a healthy supply chain network. In both cases, when operating in a country with a weak export control system, local companies are not obligated by local law or regulation to establish an internal compliance program. However, in practice, many local businesses are incentivized to adopt an equivalent compliance practice simply because they would like to be qualified as suppliers to a large company like BASF. Powerful multinational corporations like BASF and SABIC are influential in this regard because they are reliable and attractive business partners for many local suppliers. Therefore, having a policy such as the supplier Code of Conduct indirectly helps improve the local business compliance culture. It inevitably brings more local businesses in conformity with international standards of practice and shapes a compliance culture among businesses in countries where the export control system is weak.

7.4. Summary

Germany presents a quite different story from China and Saudi Arabia, yet they share plenty of similar traits. Aside from the political regime difference, as the world leading technologically advanced economy, Germany's chemical industry has been playing a significant role in shaping German's nonproliferation records since WWI. It transitioned from an

[112] "Supplier Code of Conduct." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/about-us/suppliers-and-partners/sustainability-in-procurement/supplier-code-of-conduct.html>.

accomplice of wars to the defender of nonproliferation network, from "social callousness" to "social responsibility". Germany chemical firms were entangled in the production of chemical weapons during WWI and WWII and then contributed to chemical WMD programs in suppressive regimes during Iraq, Syria wars in the 80s. The German chemical industry was strongly influenced by domestic considerations until well into the 90s.

With the deepening of the globalization of production and the growing prevalence of technological capabilities in emerging economies, Germany's chemical industry has undergone a major structural transformation. From the annual report statements of BASF's Chairman of the Board since the 90s, we can observe the gradual change in its corporate strategy to adapt to such change and put more focus on sustainability. This is a common theme among all three MNCs discussed in the dissertation. Chemical companies are increasingly responsive to public opinion on environmental sustainability, social responsibility and governance. This is also a reflection of the behavior change of shareholders. Studies have shown that financial market participants increasingly integrate environmental, social, and governance criteria into their investment decisions.[113] Research data indicates that financial analysts increasingly are sensitive to corporate social performance information and factor it into their recommendations to general investors.[114] A large number of reports find that the positive ESG impact on corporate financial performance appears stable over time.[115] Therefore, there is a strong incentive for companies to align their

[113] Busch, Timo, Rob Bauer, and Marc Orlitzky. "Sustainable Development and Financial Markets: Old Paths and New Avenues." Business & Society 55.3 (2015): 303-29. Sage. Web. 06 Feb. 2017. <http://journals.sagepub.com/doi/abs/10.1177/0007650315570701>.

[114] Luo, Xueming, Heli Wang, Sascha Raithel, and Qinqin Zheng. "Corporate social performance, analyst stock recommendations, and firm future returns." Strategic Management Journal 38.1 (2015): 123-36. Wiley Online Library. Web. 06 Feb. 2017. <http://onlinelibrary.wiley.com/doi/10.1002/smj.2219/full>.

[115] Friede, Gunnar, Timo Busch, and Alexander Bassen. "ESG and financial performance: aggregated evidence from more than 2000 empirical studies." Journal of Sustainable Finance & Investment 5.4 (2015): 210-33. Taylor & Francis Group. Web. 06 Feb. 2017. <http://www.tandfonline.com/doi/abs/10.1080/20430795.2015.1118917>.

corporate culture from "social callousness" to "social responsibility." Compliance culture is an integral part of a corporate culture. A strong compliance culture is a representation of corporate responsibility.

At the government level, when companies value compliance culture, it translates to better implementation of the national commitment. Germany had an export control law and administration in place during the serial of industry proliferation period. An export control system cannot be effective without industry endorsement and compliance. It has been an obvious case for Germany. Without its industry involvement and endorsement, Germany would not have ratified the CWC treaty so early and readily. Germany's chemical industry plays a critical role in its government's ability to implement its nonproliferation commitment. Further, German chemical MNCs' global footprint brings its compliance best practices to places where the export control system is weak. Its code of conduct requirement for suppliers inevitably raises the compliance practice among businesses under weaker regulatory systems. There is a strong business incentive for local firms to adopt sufficient compliance practices in order to be qualified as partners/suppliers of the powerful MNCs. Such spillover effect creates a normative compliance behavior within a region with less advanced export control systems. As a result, it helps improve the overall implementation of nonproliferation at that given government.

Overall, the German case once again contributes to my analysis that powerful chemical MNCs have a positive impact on countries implementation of chemical nonproliferation commitment.

CHAPTER 8 CONCLUSION

This dissertation seeks to understand the impact of leading MNCs on chemical nonproliferation. Specifically, it suggests that MNCs have a positive influence on countries' commitment to and implementation of chemical nonproliferation. Traditionally, literature in International Relations explains state behaviors from three analytical levels: systemic level, domestic level and individual level. Building upon this theoretical framework, scholars use the International Organization (IO) paradigm to examine state cooperation and the role of international institutions. Most studies focus on the debate over whether international institutions have an impact on state behavior in international cooperation. Yet, my dissertation contributes to the ongoing debate by addressing the importance of a specific type of non-state actor: MNCs. My study demonstrates that, in the context of globalization, powerful chemical MNCs can make a positive impact on countries' commitment to and implementation of chemical nonproliferation through their strong corporate compliance practices.

In order to test my theory, I employed a nested analysis of both quantitative and qualitative analyses. These approaches complement each other by addressing two different aspects of the nonproliferation issue. First, the participation in international treaties and multilateral regimes is an important indication of a country's commitment to the nonproliferation issue. Within the realm of chemical nonproliferation, CWC is the cornerstone of all related, international agreements. Therefore, in the quantitative section, I used CWC ratification and implementation as my measurement to test my hypothesis. I conducted the development and

analysis of CWC membership and implementation models with both Frequentist and Bayesian techniques. For my study, I used the year in which a country ratifies and implements CWC as the measurement of its commitment to chemical nonproliferation. The dataset is a large N sample with 89-193 countries ranging from 1993 to 2015. In addition to several control variables, I selected two key, independent variables to measure the presence of MNCs in a given country for a given year. The first variable represents the total number of subsidiaries from 20 selected firms, and the second variable is the chemical export in a given country for a given year. I also created an interaction variable to capture the variations within chemical exports and MNC subsidiaries along with its impact on the dependent variables.

However, my dataset has a missing value issue primarily in the chemical export variable. I used three techniques to treat the missing values: listwise, random imputation, and the replacement of missing values with zero. For each technique, I respectively ran three models for ratification and implementation. The model got more complicated as I gradually increased explanatory variables to capture time trending and interaction effects. The model in which missing values were replaced with zero had the strongest theoretical argument and demonstrated the most reasonable estimation of missing values. Therefore, I focused my analysis on this model's regression results. Statistical significance was found in the key variables in the implementation model. It suggests the presence of chemical MNCs has a positive influence on a country's CWC implementation when there are chemical exports involved.

Despite multiple experiments with the data treatment issue, the Frequentist approach of handling missing data is not optimal and affects the results. The imputation technique generates overestimated data, whereas arbitrarily assigning zeros overlooks the uncertainty. Therefore, I

chose a completely different approach to examine the models. The Bayesian approach has a great advantage over the Frequentist approach in data treatment, particularly regarding missing data (Western and Jackman 1994). In this method, the missing data is estimated through a posterior distribution and appended to the dataset. I used the Bernoulli distribution for the dependent variables and introduced a hyper prior as my prior distribution. After testing with multiple diagnostic tools (Gelman-Rubin, Traceplot), I concluded that there is a convergence in all key variables. The key variables demonstrate statistical significance in ratification model, but less optimal in implementation model.

However, the quantitative analysis alone is limited in its ability to explain how exactly MNCs can make the industry compliance a reality beyond the legalistic discussion of CWC. Therefore, the qualitative case study complements nicely with the quantitative analysis. Chapter 5,6 and 7 are three case examples to illustrate the posited causal mechanisms. For each country, I outlined the general WMD nonproliferation overview followed by its chemical-specific regulatory apparatus. I then discussed the development of the country's chemical industry and concluded with a detailed discussion of the selected MNC. In the case of China and Saudi Arabia, though based on completely different economic structures, both began economic reform in the late 70s, which, in turn, led to the significant development of the chemical industry. In contrast, Germany has a lengthier history in its leading role as the world's technological pioneer in chemical development. Its industry has always maintained a close relationship with its government, particularly during times of war. All cases suggest that economic development plays an important role in shaping a country's attitude toward nonproliferation. This is particularly evident in China. The attitude towards international nonproliferation regime shifted

from complete opposition to support as China's economy developed with the open door policy. In regards to the chemical regulatory framework, Saudi Arabia, specifically, presents a contrast within its own regulatory apparatus. It puts much greater emphasis on chemical safety and environmental regulations than on export control issue. The reality is that Saudi Arabia's production and trade of controlled chemicals is insignificant compared to its regular petrochemical businesses.

Nevertheless, the three selected MNCs present strikingly similar traits with respect to their approach to compliance. Despite different backgrounds and developmental processes, each company began focusing on sustainability and social responsibility issues when its business became more integrated into the global market. This timeline also coincided with the overall trend in globalization and national economic development. Different theories also help explain such a shift of strategy. Stakeholder theory suggests that MNCs are no longer solely responsible for stockholders; rather, they are obliged to respond to stakeholders such as partners, suppliers, government, media, community and employees. Furthermore, the business management literature finds that financial performance is linked with corporations' rank in social responsibility and sustainability. Higher achievement in corporate governance, in this regard, can lead to more recommendations from investment analysts. As a result, MNCs share a common practice of implementing compliance practices throughout its global operations. In the case of SABIC and BASF, they even extend such requirements to the entire supply network. Together, a compliance norm is formed in countries where chemical MNCs cluster.

In sum, the three within-case analyses lend credence to the conclusion that MNCs are playing an important and positive role in countries' implementation of chemical nonproliferation

through their corporate practices. Quantitatively, we have measured the impact of MNCs on CWC ratification and legal implementation. Qualitatively, each case set illustrates the mechanism of how a leading MNC can influence a country's implementation in chemical nonproliferation beyond legal boundary. All three cases have clearly demonstrated that countries' policy is reflective of its economic reality. As members of CWC regime, all three countries have sensitive chemicals placed under government regulation. Companies engaging in trading and production of these chemicals are subject to government regulations. However, the level of restrictions and controls varies between countries. The quantitative analysis only captures the notion that MNCs have a positive impact on countries' commitment in CWC through legal procedure, whereas the qualitative study elaborates on the specifics of MNC business practices that contribute to the implementation of CWC at practical level. The three MNC case examples in my qualitative analysis may operate seemingly independently from government or beyond government constraint. But, one must keep in mind that they are still operating within the peripheral of government control even though their business practices have far exceeded government requirements. This is particularly evident in the case of Saudi Arabia. Companies are the frontline defense of a country's chemical nonproliferation record. The normative behaviors among MNCs in compliance as well as their spillover effect form a defensive shield. As a result, a country with significant chemical industrial activity and MNCs presence tends to have a better implementation of chemical nonproliferation. This complements nicely with my quantitative study because it addresses the second aspect of the nonproliferation discussion: compliance. Ratification of CWC and legal implementation are not sufficient to complete the entire story of nonproliferation discussion. Industry compliance is a critical part of

nonproliferation commitment. Table 8.1 and 8.2 summarize the case analysis by country and company respectively.

This study comes with several caveats. Foremost, the research findings are limited to the chemical silo of the nonproliferation regime. I would like to generalize the theoretical argument to a broader nonproliferation discussion. However, nuclear and biological industries present quite different sets of challenges as proliferation threats. For example, most nuclear companies have either strong ties with governments or are government assets. Due to the sensitive nature of nuclear materials, any business activity in the nuclear field is under strict governmental scrutiny. The basic economic assumption of supply and demand does not apply thoroughly to this industry. Nuclear power is clean energy and can help solve a country's energy need. However, such demand does not result in supply, necessarily, because there are political considerations in play such as security risks, geopolitical dynamics and technological capabilities etc.

On the contrary, biotechnology is a highly privatized and fragmented industry. Modern biological research is unavoidably dual use by nature. New molecular biological technologies promise great benefits. On the other hand, they also can be used to create, for example, hypervirulent microorganisms resistant to vaccines and antibiotics (Friedman 2010). Dramatic advances in the life sciences and the dissemination of related technology could enable terrorist organizations to develop biological weapons. In summation, my study is limited in terms of its generalizability. Future research on how to integrate more industry participation in WMD nonproliferation would be desirable.

A second caveat to consider is my qualitative research method primarily draws from web publications, company reports and other open source information. Annual reports are prepared

for investors with established industry guidelines and legal obligations. This provides a fair confidence about the accuracy of information. However, it cannot replace the value of in person interviews. Interviews with company executives and personnel who are directly responsible for compliance work can not only help validate written records but also provide a greater understanding of the implementation and effect of compliance decisions. Perhaps, in person interviews could also help to shed more light on the challenges of creating a compliance norm both within and outside of the MNC. Due to financial and personal constraints, I could not incorporate this method in this study.

Finally, my argument about MNCs' role in promoting countries' implementation of chemical nonproliferation is limited to the MNCs' more passive role. In another word, the compliance culture shaped within the industry serves as a defense mechanism against proliferation threats. Theoretically, industry should have an incentive to advocate for a sufficient regulatory system to ensure a leveled playing field among businesses. However, it is difficult to validate such argument through public information platforms. For countries without advanced legal systems, lobbying and government relation types of activities are conducted behind closed doors, and information is not shared in the public domain. It requires a close relationship with individuals from the corporate sector and the government to conduct in-depth interviews to understand the extent of MNCs' influence on policy change. Similar reason applies for the lack of qualitative analysis on MNCs' role in CWC ratification. In all three cases, we have observed that countries became more willing to accept the international nonproliferation norm as their economy and industrial development became increasingly dependent on global trade and production. At the industry level, when MNCs begin to shift its corporate strategy to

international market, their corporate practices understandably become more aligned with the international norm in compliance. Therefore, their preferences in national policy for international nonproliferation agreement become cohesive and supportive. These discussions will require a different project with resources to do fieldwork and conduct in-depth interviews to account for the historic aspect of industry involvement in CWC ratification.

The outlined caveats suggest that further research should incorporate in-country studies and interviews with government agencies and corporate executives. My study provides the groundwork to open more discussions on the role of MNCs in nonproliferation within the context of globalization. The fundamental concern for proliferation is the spread of sensitive technologies and products in to the wrong hands. Therefore, as access to advanced manufacturing capacity becomes globalized, it is imperative to consider the role of industries in the future development of WMD nonproliferation policy at both the domestic and international levels.

Table 8.1 Case Comparisons by Country

	Saudi Arabia	**China**	**Germany**
Regime	Monarchy	Communist	Democracy
GDP (Purchasing Power Parity)[116]	15th	1st	6th
Population[117]	41th	1st	18th
Chemical Exports[118]	14th	1st	3rd
No. of NP/CWC Implementation year	2/2005	4/1995	7/1996
Declared Schedule 2 and 3 Facilities[119]	0/1	58/210	35/22
Chemical Export Control Regulations	Minimum	Medium	Well
History of Chemical Industrial Development	MGS in 1970	1978 and 80s	After WWII

[116] 2016 est. by CIA World Factbook
[117] 2017 Worldometers Website
[118] 2015 International Trade Center
[119] 2015 OPCW Report

Table 8.2 Case Comparisons by Company

	SABIC (Chemistry that Matters)	**SINOCHEM (Creating Values and Pursuing Excellence)**	**BASF (We Create Chemistry)**
Profile	It is a publicly traded and 70% state owned company with operations in over 50 countries and a 40,000 plus workforce; . It is the world 4th largest chemical company by sales and most profitable chemical company in the world. Chemicals, Polymers, Specialties, Agri-Nutrients and Metals	One of China's four state oil companies and China's leading chemical service provider. It has more than 300 subsidiaries around the world with over 50,000 employees. It has four subsidiaries listed under Chinese stock market. Agricultural input (fertilizer, seed and agrochemicals), real estate, financial service.	114,000 employees worldwide; operate six verbund sites as well as 352 production sites globally; listed in several stock markets including Frankfurt, London, Zurich and NY stock exchange.
History	1976	1950	1865
Sustainability	EHSS (Security Program)	CSR reports/Sustainability Development Reports	Annual Reports
Responsible Care	Yes	Yes	Yes
Supplier program	Yes	No	Yes
Code of Ethics	Yes	Risk Management System "One system, two mechanism, three guarantees"	"One Company, One Code of Conduct"
Internal Compliance Program	Under Code of Ethics/ITC	Under RMS	Under Code of Conducts – "Imports/Exports"

REFERENCES
(By Alphabetical Order)

Abbott, Kenneth W., and Duncan Snidal. "Hard and soft law in international governance." *International organization* 54.03 (2000): 421-456.

Agle, Bradley R., Ronald K. Mitchell, and Jeffrey A. Sonnenfeld. "Who matters to Ceos? An investigation of stakeholder attributes and salience, corpate performance, and Ceo values." *Academy of management journal* 42.5 (1999): 507-525.

Agle, Bradley R., Ronald K. Mitchell, and Jeffrey A. Sonnenfeld. "Who matters to Ceos? An investigation of stakeholder attributes and salience, corpate performance, and Ceo values." *Academy of management journal* 42.5 (1999): 507-525.

Ai, Chunrong, and Edward C. Norton. "Interaction terms in logit and probit models." *Economics letters* 80.1 (2003): 123-129.

Al Shehai, Ayedh. "Royal Commission at Yanbu Environmental Regulations." *Procedia Engineering* 125 (2015): 193-198.

Allison, Graham T. "Conceptual models and the Cuban missile crisis." *American political science review* 63.03 (1969): 689-718.

Arrow, K. E. "The limits of organization." (1974).

Axelrod, Robert. "More effective choice in the prisoner's dilemma." *Journal of Conflict Resolution* 24.3 (1980): 379-403.

Axelrod, Robert. "The evolution of strategies in the iterated prisoner's dilemma." *The dynamics of norms* (1987): 1-16.

Barkenbus, Jack N. "Is self-regulation possible?." *Journal of Policy Analysis and Management* 2.4 (1983): 576-588.

Bernauer, Thomas, et al. "A comparison of international and domestic sources of global governance dynamics." *British Journal of Political Science* 40.03 (2010): 509-538.

Box-Steffensmeier, Janet M., and Bradford S. Jones. "Time is of the essence: Event history models in political science." *American Journal of Political Science* (1997): 1414-1461.

Bull, Hedley. "The importance of Grotius in the study of international relations." *Hugo Grotius and international relations* (1990): 65-93.

Checkel, Jeffrey T. "Norms, institutions, and national identity in contemporary Europe." *International Studies Quarterly* 43.1 (1999): 83-114.

Cornes, Richard, Roger Hartley, and Todd Sandler. "Equilibrium existence and uniqueness in public good models: An elementary proof via contraction." *Journal of Public Economic Theory* 1.4 (1999): 499-509.

Elsbach, Kimberly D., and Roderick M. Kramer. "Assessing creativity in Hollywood pitch meetings: Evidence for a dual-process model of creativity judgments." *Academy of Management journal* 46.3 (2003): 283-301.

Entman, Robert M. *Projections of power: Framing news, public opinion, and US foreign policy*. University of Chicago Press, 2004.

Evangelinos, K. I., I. E. Nikolaou, and A. Karagiannis. "Implementation of Responsible Care in the chemical industry: Evidence from Greece." *Journal of hazardous materials* 177.1 (2010): 822-828.

Fineman, Stephen, and Ken Clarke. "Green stakeholders: Industry interpretations and response." *Journal of Management studies* 33.6 (1996): 715-730.

Fineman, Stephen, and Ken Clarke. "Green stakeholders: Industry interpretations and response." *Journal of Management studies* 33.6 (1996): 715-730.

Finnemore, Martha, and Stephen J. Toope. "Alternatives to “legalization”: richer views of law and politics." *International Organization* 55.03 (2001): 743-758.

Friedman, David, et al. "The bioterrorism threat and dual-use biotechnological research: An Israeli perspective." *Science and engineering ethics* 16.1 (2010): 85-97.

Friedman, Milton. "A theoretical framework for monetary analysis." *journal of Political Economy* 78.2 (1970): 193-238.

Gamper-Rabindran, Shanti, and Stephen R. Finger. "Does industry self-regulation reduce pollution? Responsible Care in the chemical industry." *Journal of Regulatory Economics* 43.1 (2013): 1-30.

Gelfand, Alan E., and Adrian FM Smith. "Sampling-based approaches to calculating marginal densities." *Journal of the American statistical association* 85.410 (1990): 398-409.

Gerlowski, Leonard E., and Ahmad M. Al Othman. "Saudi Arabia's Chemicals Industry Continues to Grow." *Chemical Engineering Progress* 110.8 (2014): 64-68.

Goldstein, Judith, and Lisa L. Martin. "Legalization, trade liberalization, and domestic politics: a cautionary note." *International organization* 54.03 (2000): 603-632.

Grieco, Joseph M. "Anarchy and the limits of cooperation: a realist critique of the newest liberal institutionalism." *Theory and Structure of International Political Economy: An International Organization Reader* (1999).

Grossman, Gene M., and Elhanan Helpman. *Special interest politics*. MIT press, 2001.
Gupta, Anil K., and Lawrence J. Lad. "Industry self-regulation: An economic, organizational, and political analysis." *Academy of Management Review* 8.3 (1983): 416-425.

Hannan, Michael T., and John Freeman. "Structural inertia and organizational change." *American sociological review* (1984): 149-164.
Hannan, Michael T., and John Freeman. "Structural inertia and organizational change." *American sociological review* (1984): 149-164.

Hillman, Amy J., and Michael A. Hitt. "Corporate political strategy formulation: A model of approach, participation, and strategy decisions." *Academy of management review* 24.4 (1999): 825-842.

Jawahar, I. M., and Gary L. McLaughlin. "Toward a descriptive stakeholder theory: An organizational life cycle approach." *Academy of management review* 26.3 (2001): 397-414.

Jawahar, I. M., and Gary L. McLaughlin. "Toward a descriptive stakeholder theory: An organizational life cycle approach." *Academy of management review* 26.3 (2001): 397-414.

Jensen, Michael C. "Value maximization, stakeholder theory, and the corporate objective function." *Business ethics quarterly* 12.02 (2002): 235-256.

Jo, Dong-Joon, and Erik Gartzke. "Determinants of nuclear weapons proliferation." *Journal of Conflict Resolution* 51.1 (2007): 167-194.

Jones, Charles I. "R & D-based models of economic growth." *Journal of political Economy* 103.4 (1995): 759-784.

Jones, Thomas M., Will Felps, and Gregory A. Bigley. "Ethical theory and stakeholder-related decisions: The role of stakeholder culture." *Academy of Management Review* 32.1 (2007): 137-155.

Keohane, Robert O., and Lisa L. Martin. "The promise of institutionalist theory." *International security* 20.1 (1995): 39-51.

Keohane, Robert. "Neoliberal Institutionalism." *Security Studies: A Reader* (2011).

Koremenos, Barbara, Charles Lipson, and Duncan Snidal. "The rational design of international institutions." *International organization* 55.04 (2001): 761-799.

Krasner, Stephen D. "Are bureaucracies important?(or Allison Wonderland)." *Foreign Policy* 7 (1972): 159-179.

Krasner, Stephen D. *International regimes*. Cornell University Press, 1983.

Lange, Donald, Peggy M. Lee, and Ye Dai. "Organizational reputation: A review." *Journal of Management* 37.1 (2011): 153-184.

Lantis, Jeffrey S. "Agentic constructivism and the Proliferation Security Initiative: Modeling norm change." *Cooperation and Conflict* 51.3 (2016): 384-400.

Lantis, Jeffrey S. "Nuclear Technology and Norm Stewardship: US Nonproliferation Policies Revisited." *International Studies Perspectives* 16.4 (2015): 423-445.

Laplume, André O., Karan Sonpar, and Reginald A. Litz. "Stakeholder theory: Reviewing a theory that moves us." *Journal of management* 34.6 (2008): 1152-1189.

Lesch, John, ed. *The German chemical industry in the twentieth century*. Vol. 18. Springer Science & Business Media, 2000.

Lieberman, Michael A., and Alan J. Lichtenberg. *Principles of plasma discharges and materials processing*. John Wiley & Sons, 2005.

Lindsay, Ronald M., et al. "Neurotrophic factors: from molecule to man." *Trends in neurosciences* 17.5 (1994): 182-190.

Luo, Xueming, and Chitra Bhanu Bhattacharya. "Corporate social responsibility, customer satisfaction, and market value." *Journal of marketing* 70.4 (2006): 1-18.

Mahon, John F., and Edwin A. Murray. "Strategic planning for regulated companies." *Strategic Management Journal* 2.3 (1981): 251-262.

Maon, François, Adam Lindgreen, and Valérie Swaen. "Designing and implementing corporate social responsibility: An integrative framework grounded in theory and practice." *Journal of Business Ethics* 87 (2009): 71-89.

Margolis, Joshua D., and James P. Walsh. "Misery loves companies: Rethinking social initiatives by business." *Administrative science quarterly* 48.2 (2003): 268-305.

Matten, Dirk, and Andrew Crane. "Corporate citizenship: Toward an extended theoretical conceptualization." *Academy of Management review* 30.1 (2005): 166-179.

Mearsheimer, John J. "The false promise of international institutions." *International security* 19.3 (1994): 5-49.

Neumayer, Eric. "Do democracies exhibit stronger international environmental commitment? A cross-country analysis." *Journal of peace research* 39.2 (2002): 139-164.

Nikolaou, Ioannis E., and Konstantinos I. Evangelinos. "Classifying current social responsibility accounting methods for assisting a dialogue between business and society." *Social Responsibility Journal* 6.4 (2010): 562-580.

Nikolaou, Ioannis E., and Thomas A. Tsalis. "Development of a sustainable balanced scorecard framework." *Ecological indicators* 34 (2013): 76-86.
Niskanen, Toivo. "A Finnish study of self-regulation discourses in the chemical industry's Responsible Care programme." *Business Ethics: A European Review* 21.1 (2012): 77-99.

Olson, Mancur. "Dictatorship, Democracy, and Development." *American Political Science Review* 87.03 (1993): 567-576.

Ostrom, Vincent, and Elinor Ostrom. "Public goods and public choices." *1977* (1977): 7-49.

Palazzo, Guido, and Andreas Georg Scherer. "Corporate social responsibility, democracy, and the politicization of the corporation." *Academy of Management Review* 33.3 (2008): 773-775.

Park, Byung Il, and Pervez N. Ghauri. "Determinants influencing CSR practices in small and medium sized MNE subsidiaries: A stakeholder perspective." *Journal of World Business* 50.1 (2015): 192-204.

Petty, Ross E., et al. "International League of Associations for Rheumatology classification of juvenile idiopathic arthritis: second revision, Edmonton, 2001." *The Journal of rheumatology* 31.2 (2004): 390.

Pfarrer, C. "Zur Anatomie des äußeren, mittleren und inneren Ohres." *Proc. Tiermedizinische Fortbildung „Ganz Ohr* 2 (2013).

Polonsky, Michael, and Colin Jevons. "Global branding and strategic CSR: an overview of three types of complexity." *International Marketing Review* 26.3 (2009): 327-347.

Prakash, Aseem. "Responsible care: An assessment." *Business & Society* 39.2 (2000): 183-209.

Prakash, Aseem. *Greening the firm: The politics of corporate environmentalism*. Cambridge University Press, 2000.

Raftery, Adrian E., and Steven Lewis. "How many iterations in the Gibbs sampler." *Bayesian statistics* 4.2 (1992): 763-773.

Rasche, Andreas, and Georg Kell. *The United Nations global compact: Achievements, trends and challenges*. Cambridge University Press, 2010.

Scherer, Andreas Georg, and Guido Palazzo. "The new political role of business in a globalized world: A review of a new perspective on CSR and its implications for the firm, governance, and democracy." *Journal of management studies* 48.4 (2011): 899-931.

Schmidt, Vivien A. "The new world order, incorporated: The rise of business and the decline of the nation-state." *Daedalus* (1995): 75-106.

Tixier, Maud. "Soft vs. hard approach in communicating on corporate social responsibility." *Thunderbird International Business Review* 45.1 (2003): 71-91.

Vergne, Jean-Philippe. "Stigmatized categories and public disapproval of organizations: A mixed-methods study of the global arms industry, 1996–2007." *Academy of Management Journal* 55.5 (2012): 1027-1052.

Von Stein, Jana. "The international law and politics of climate change: Ratification of the United Nations Framework Convention and the Kyoto Protocol." *Journal of Conflict Resolution* 52.2 (2008): 243-268.

Waltz, Kenneth Neal. *Man, the state, and war: A theoretical analysis*. Columbia University Press, 1959.

Weick, Karl E., and Robert E. Quinn. "Organizational change and development." *Annual review of psychology* 50.1 (1999): 361-386.

Weidenbaum, Murray L. "Public policy: No longer a spectator sport for business." *Journal of Business Strategy* 1.1 (1980): 46-53.

Western, Bruce, and Simon Jackman. "Bayesian inference for comparative research." *American Political Science Review* 88.02 (1994): 412-423.

Wilson, Robert W., Peter K. Ashton, and Thomas P. Egan. *Innovation, competition, and government policy in the semiconductor industry*. Free Press, 1980.

Young, Iris Marion. "Difference as a resource for democratic communication." *Deliberative democracy: Essays on reason and politics* 399 (1997).

Zaller, John. "A new standard of news quality: Burglar alarms for the monitorial citizen." *Political Communication* 20.2 (2003): 109-130.

Zavyalova, Anastasiya, et al. "Managing the message: The effects of firm actions and industry spillovers on media coverage following wrongdoing." *Academy of Management Journal* 55.5 (2012): 1079-1101.

FOOTNOTES
(In Order of Appearance)

"Report reaffirms Syria chemical weapons use." Report reaffirms Syria chemical weapons use - Al Jazeera English. Al Jazeera Media Network, 7 Jan. 2015. Web. 01 Feb. 2017. <www.aljazeera.com/news/middleeast/2015/01/report-reaffirms-syria-chemical-weapon-use-201516223545804947.html>.

Tucker, Jonathan B. The Conduct of Challenge Inspections Under the Chemical Weapons Convention: Proceedings of an Expert Workshop Held on May 29-31, 2002 in Washington. Monterey Institute of International Studies, Center For Nonproliferation Studies, 2002.

ON THE IMPLEMENTATION OF THE CONVENTION ON THE PROHIBITION OF THE DEVELOPMENT, PRODUCTION, STOCKPILING AND USE OF CHEMICAL WEAPONS AND ON THEIR DESTRUCTION. N.p.: Organization for the Prohibition of Chemical Weapons, 14 Jan. 2016. PDF. <www.opcw.org/fileadmin/OPCW/EC/83/en/ec8204_c21crp01_e_.pdf>.

"Multinational Corporation - MNC." Investopedia. Investopedia, LLC, 05 Dec. 2014. Web. 01 Feb. 2017. <www.investopedia.com/terms/m/multinationalcorporation.asp>.

Sammeck, Jan. A new institutional economics perspective on industry self-regulation. Wiesbaden: Gabler, 2012. 105. Books.google.com. Web. 01 Feb. 2017.

"Ed Freeman and his stakeholder theory." Spidermak: A Nicomat Solution. N.p., n.d. Web. 02 Feb. 2017. <www.spidermak.com/en/ed-freeman-and-his-stakeholder-theory>.

Freeman, R. Edward. Stakeholder Theory of Modern Corporation. N.p.: Business Ethics, 2012. PDF.

Laplume, André O., Karan Sonpar, and Reginald A. Litz. "Stakeholder theory: Reviewing a theory that moves us." Journal of management 34.6 (2008): 1152-1189.

Tuttle, Brad. "Warren Buffett's Boring, Brilliant Wisdom" Time. Time, Inc., 01 Mar. 2010. Web. 02 Feb. 2017. <business.time.com/2010/03/01/warren-buffetts-boring-brilliant-wisdom/>

Kytle, Beth, and John Gerard Ruggie. "Corporate social responsibility as risk management: A model for multinationals." (2005).

United States. U.S. Department of Commerce. Bureau of Industry and Security. Don't Let This Happen to You! Actual Investigations of Export Control and Antiboycott Violations. U.S. Department of Commerce, Sept. 2016. Web. <www.bis.doc.gov/index.php/forms-documents/enforcement/1005-don-t-let-this-happen-to-you-1/file>.

Rasche, Andreas. "The corporation as a political actor–European and North American perspectives." European Management Journal 33.1 (2015): 4-8.

Status of Participation in the Chemical Weapons Convention. N.p.: Organization for the Prohibition of Chemical Weapons, 13 Aug. 2015. PDF. <www.opcw.org/fileadmin/OPCW/S_series/2015/en/s-1304-2015_e_.pdf.>

Status of Participation in the Chemical Weapons Convention as at 17 October 2015 . N.p.: Organization for the Prohibition of Chemical Weapons, 19 Oct. 2015. PDF. <www.opcw.org/fileadmin/OPCW/S_series/2015/en/s-1315-2015_e_.pdf>

"Article XXI. Entry into Force." Organization for the Prohibition of Chemical Weapons. Organization for the Prohibition of Chemical Weapons, n.d. Web. 02 Feb. 2017. <www.opcw.org/chemical-weapons-convention/articles/article-xxi-entry-into-force/>.

"Angola Joins Chemical Weapons Convention." Angola Joins Chemical Weapons Convention. Organization for the Prohibition of Chemical Weapons, 21 Sept. 2015. Web. 05 Feb. 2017. <https://www.opcw.org/news/article/angola-joins-chemical-weapons-convention/>.

"Legislation Database." Legislation Database. Organization for the Prohibition of Chemical Weapons, n.d. Web. 05 Feb. 2017. <https://www.opcw.org/our-work/national-implementation/implementing-legislation/legislation-database/>.

"1540 Committee." United Nations. United Nations, 2004. Web. 05 Feb. 2017. <http://www.un.org/en/sc/1540/national-implementation/matrix.shtml>.

The Constitution of Afghanistan. Kabul: The Islamic Republic of Afghanistan, 26 Jan. 2004. PDF. <http://www.afghanembassy.com.pl/afg/images/pliki/TheConstitution.pdf>.

The Chemical Weapons Convention Act, 2000. N.p.: n.p., 26 Aug. 2006. PDF.<http://indiacode.nic.in/amendmentacts2012/The%20Chemical%20Weapons%20Convention%20Act.pdf>

Treaties, States Parties and Commentaries." International Committee of the Red Cross. International Committee of the Red Cross, n.d. Web. 06 Feb. 2017. <https://ihl-databases.icrc.org/ihl>.

"News & Resources." American Chemistry Council. American Chemistry Council, LLC, n.d. Web. 08 Feb. 2017. <https://www.americanchemistry.com/News_and_Resources/>.

"A selection of the most traded Scheduled Chemicals." A selection of the most traded Scheduled Chemicals. Organization for the Prohibition of Chemical Weapons, 18 Nov. 2016. Web. 05 Feb.

2017. <https://www.opcw.org/our-work/non-proliferation/declarations-adviser/most-traded-scheduled-chemicals/>.

"Flame Retardant Market worth 12.81 Billion USD by 2021." Flame Retardant Market worth 12.81 Billion USD by 2021. Markets and Markets, n.d. Web. 05 Feb. 2017. <http://www.marketsandmarkets.com/PressReleases/flame-retardant-chemicals.asp>.

North America Agrochemicals Market. Rep. N.p.: Mordor Intelligence LLP, 2016. Reportbuyer.com. Web. <https://www.reportbuyer.com/product/4244298/north-america-agrochemicals-market.html>.

"Time Series." Time Series. World Trade Organization, n.d. Web. 05 Feb. 2017. <http://stat.wto.org/StatisticalProgram/WSDBViewData.aspx?Language=E>

"Time Series." Time Series. World Trade Organization, n.d. Web. 05 Feb. 2017. <http://stat.wto.org/StatisticalProgram/WSDBStatProgramTechNotes.aspx?Language=E#Def_Meth_TMV>.

"Myanmar calls for developing chemical industries at home." Myanmar calls for developing chemical industries at home - Xinhua | English.news.cn. English.news.cn, 19 Oct. 2014. Web. 05 Feb. 2017. <http://news.xinhuanet.com/english/world/2014-10/29/c_133751051.htm>.

"Tajikistan Economy." Tajikistan Economy | Economy Watch. Economy Watch, 19 Jan. 2010. Web. 05 Feb. 2017. <http://www.economywatch.com/world_economy/tajikistan>.

Chemical Industry of the Republic of Uzbekistan. N.p.: Uzkimyosanoat State Joint-Stock Company, 2012. PDF. <http://www.ubtic.org/wp-content/uploads/2013/06/5-UBTIC-Uzkimyosanoat-Chemical-Industry-25102012.pdf>.

"Project Description." Unified Democracy Scores. James Melton, Stephen Meserve, and Daniel Pemstein, 12 Mar. 2014. Web. 05 Feb. 2017. <http://www.unified-democracy-scores.org/>.

"Status of the Convention." *Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction*. Biological and Toxic Weapons Convention, n.d. Web. 08 Feb. 2017. <http://www.opbw.org/convention/status.html>.

"UNOG - The United Nations Office at Geneva." Where global solutions are shaped for you | Disarmament | Membership of the Biological Weapons Convention. The United Nations Office at Geneva, n.d. Web. 05 Feb. 2017. <http://www.unog.ch/__80256ee600585943.nsf/(httpPages)/7be6cbbea0477b52c12571860035fd5c?OpenDocument&ExpandSection=2#_Section2>.

"Nuclear Suppliers Group - Participants." Nuclear Suppliers Group. Nuclear Suppliers Group, n.d. Web. 05 Feb. 2017. <http://www.nuclearsuppliersgroup.org/en/participants1>.

"About us." The Wassenaar Arrangement. The Wassenaar Arrangement, 14 Dec. 2016. Web. 05 Feb. 2017.

"MTCR Partners." *Missile Technology Control Regime*. Missile Technology Control Regime, 30 Dec. 2016. Web. 08 Feb. 2017. <http://mtcr.info/partners/>.

"The Origins of the Australia Group." The Australia Group. AustraliaGroup.net, n.d. Web. 06 Feb. 2017. <http://www.australiagroup.net/en/origins.html>.

"Zangger Committee (ZAC)." Nuclear Threat Initiative: Building a Safer World. Nuclear Threat Initiative, 20 Sept. 2016. Web. 06 Feb. 2017. <http://www.nti.org/treaties-and-regimes/zangger-committee-zac/>.

"All countries by population." Researching Virtual Initiatives in Education. Researching Virtual Initiatives in Education, 21 Apr. 2014. Web. 06 Feb. 2017. <http://www.virtualcampuses.eu/index.php/All_countries_by_population>.

"Saudi Arabia." Nuclear Threat Initiative: Building a Safer World. Nuclear Threat Initiative, July 2016. Web. 06 Feb. 2017. <http://www.nti.org/learn/countries/saudi-arabia/>.

1540 Committee Matrix of Saudi Arabia. N.p.: 1540 Committee, 1 Nov. 2004. PDF.<http://www.un.org/en/sc/1540/docs/matrices/Saudi%20Arabia%20revised%20matrix.pdf>

Report of the OPCW on the Implementation of the Convention on the Prohibition on the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction in 2014 . N.p.: Organization for the Prohibition of Chemical Weapons, 2 Dec. 2015. PDF. <https://www.opcw.org/fileadmin/OPCW/CSP/C-20/en/c2004_e_.pdf>.

Staff, JUBAIL: Ibrahim Al-Ghamdiarab news. "SABIC ships its first consignment of ethanolamines and ethoxylates." Arab News. Arabnews, 03 June 2012. Web. 06 Feb. 2017. <http://www.arabnews.com/sabic-ships-its-first-consignment-ethanolamines-and-ethoxylates>.

"Sabic Commissions Ethanolamines and Ethoxylates Complex, the First in the Mideast." IHS Markit Chemical Blog. IHS Chemical Weekly, 3 June 2012. Web. 06 Feb. 2017.

Report of the Organisation on the Implementation of the CONVENTION (1 JANUARY- 31 DECEMBER 1998). N.p.: Organization for the Prohibition of Chemical Weapons, 2 July 1999. PDF. <https://www.opcw.org/fileadmin/OPCW/CSP/C-IV/en/C-IV_5-EN.pdf>.

"Our Cities: Jubail and Yanbu Industrial Cities." Royal Commission for Jubail and Yanbu. RCJY, n.d. Web. 06 Feb. 2017. <https://www.rcjy.gov.sa/en-US/AboutUs/Pages/Our-Cities.aspx>.

Alfaro, Laura, Yasser Aloadah, Guy ElKhoury, and Fahim Bashir. UPGRADING THE SAUDI CHEMICAL CLUSTER: Microeconomics of Competitiveness . N.p.: n.p., n.d. PDF. <http://www.isc.hbs.edu/resources/courses/moc-course-at-harvard/Documents/pdf/student-projects/Saudi%20Arabia%20Chemicals%202016.pdf>.

Shoham, Dany. "Does Saudi Arabia have or seek chemical or biological weapons?." The Nonproliferation Review 6.3 (1999): 122-130.

“SABIC Manufacturing Affiliates.” SABIC. Saudi Basic Industries Corporation, n.d. Web. <http://www.sabic.com/corporate/en/ourcompany/manufacturing-affiliates/sabic-manufacturing-affiliates>.

"Bhopal Gas Tragedy Information." Union Carbide Corporation. Union Carbide Corporation, n.d. Web. 06 Feb. 2017. <http://www.bhopal.com/>.

"Security & Crisis Management." SABIC. Saudi Basic Industries Corporation, n.d. Web. 06 Feb. 2017. <https://www.sabic-ip.com/gep/en/AboutUs/OurCommitmentSubDetail/security__crisis_management.html>.

"SABIC recognized for sponsoring International Conference and Exhibition for Industrial Security." AMEInfo. Mediaquest FZ LLC, 02 Dec. 2013. Web. 06 Feb. 2017. <http://ameinfo.com/money/economy/sabic-recognized-for-sponsoring-international-conference-and-exhibition-for-industrial-security/>.

“SABIC Code of Ethics.” SABIC Corporate Website 01 Aug 2013. <https://www.sabic.com/en/Images/code-of-ethics-english_tcm1010-5717.pdf>

"Our Compliance Processes." SABIC. Saudi Basic Industries Corporation, n.d. Web. 06 Feb. 2017. <https://www.sabic-ip.com/gep/en/AboutUs/OurCommitmentSubDetail/our_compliance_processes.html>.

“Chinese Nonproliferation Policy.” Chinese Controlled Chemicals Industry Association, n.d. Web. 03 Feb 2016 <http://www.zjhx.org/view.asp?id=2128>

“Measures on the Export Control of Certain Chemicals and Related Equipment and Technologies and its control list (2002).” Chinese Ministry of Foreign Affairs. <http://www.fmprc.gov.cn/ce/cgvienna/eng/dbtyw/fks/t127629.htm>

Frantz, Douglas. "Chemicals on Chinese Ship Usable for Arms, U.S. Says : Diplomacy: Cargo is in Iranian waters. Beijing charges U.S. bullying in monitoring the vessel." Los Angeles Times. Los Angeles Times, 10 Aug. 1993. Web. 06 Feb. 2017. <http://articles.latimes.com/1993-08-10/news/mn-22365_1_chemical-weapons>.

Cordesman, Anthony H. Iran's military forces in transition: conventional threats and weapons of mass destruction. Greenwood Publishing Group, 1999. 344. Books.google.com. Web. 01 Feb. 2017.

Steinberg, Gerald. "Israel Looks Over the Horizon: Responding to the Threats of Weapons Proliferation." Jerusalem Center For Public Affairs. Jerusalem Center For Public Affairs, 01 July 2001. Web. 06 Feb. 2017. <http://jcpa.org/article/israel-looks-over-the-horizon-responding-to-the-threats-of-weapons-proliferation/>.

"Nonproliferation Sanctions." U.S. Department of State. U.S. Department of State, 09 Aug. 2016. Web. 06 Feb. 2017. <http://www.state.gov/t/isn/226423.htm>.

Sustainable Development Report. N.p.: Sinochem Group, 2012. PDF. <http://english.sinochem.com/portals/4/pdf/csrReport/2012 中化集团社会责任报告.pdf >.

Sustainable Development Report. N.p.: Sinochem Group, 2013. PDF. <http://english.sinochem.com/portals/4/pdf/csrReport/2013CSRen.pdf>.

“Product Details.” Dalian DyeChem International Corporation. <http://www.daliandc.com/product_detail_en/1.html>

“Chinese Controlled Chemicals Import Export Regulation.” Chinese Controlled Chemicals Industry Association 03 Feb 2016. <http://www.zjhx.org/view.asp?id=2129>

Pflug, Kai. "Market Outlook: Thriving in China´s competitive chemical market." ICIS. RELX Group, 26 May 2016. Web. 06 Feb. 2017. <http://www.icis.com/resources/news/2016/05/26/10002360/market-outlook-thriving-in-china-s-competitive-chemical-market/>.

“Market Outlook: Thriving in China´s competitive chemical market.” ICIS Chemical Business, 26 May 2016. <https://www.icis.com/resources/news/2016/05/26/10002360/market-outlook-thriving-in-china-s-competitive-chemical-market/>

"Break The Blockade, Have A Difficult Take-off." Sinochem Group. Sinochem Group, n.d. Web. 06 Feb. 2017. <http://www.sinochem.com/english/1260.html>.

“Sinochem’s Consolidation of its Listing Companies.” Phoenix Finance News. 7 Nov. 2015. <http://finance.ifeng.com/a/20151107/14059804_0.shtml>

“The Transition from President Liu, Deshu to Ning,Gaoning”, Sinochem Group. 2nd Volume, 2016, China Economy Weekly. <http://paper.people.com.cn/zgjjzk/html/2016-01/11/content_1649461.htm>

"Sinochem Group Ranks the 5th on "China's Top 500 Businesses in Foreign Trade" List." Sinochem Group . Sinochem Group, 21 Sept. 2015. Web. 06 Feb. 2017. <http://www.sinochem.com/english/s/1569-5518-18036.html>.

“OPCW’s Visit led by Mark Albon”. Sinochem International, Press Release 16 May 2014. <http://www.sinochemintl.com/NewsCentre/NewsDetails/617>

"Business Overview." Sinochem Group. Sinochem Group, n.d. Web. 06 Feb. 2017. <http://www.sinochemintl.com/Business/TIntro>.

Brief Outline on Export Controls Licensing requirements, application procedure, information sources. N.p.: Bundesamt fur Ausfuhrkontrolle, n.d. PDF.

Schneibel, Gerhard. "Stock of former Nazi chemicals giant to be delisted." DW: Made for Minds. Deutsche Welle, 19 Aug. 2011. Web. 06 Feb. 2017. <http://www.dw.com/en/stock-of-former-nazi-chemicals-giant-to-be-delisted/a-15327052>.

"IG Farben and the History of the "Business With Disease"." Dr. Rath Health Foundation: Responsibility for Health, Peace, and Social Justice. Dr. Rath Health Foundation, n.d. Web. 06 Feb. 2017. <http://www4.dr-rath-foundation.org/PHARMACEUTICAL_BUSINESS/history_of_the_pharmaceutical_industry.htm>.

Latsch, Gunther, Fidelius Schmid, and Klaus Wiegrefe. "Decades of Suspicions: Did German Companies Aid Syrian Chemical Weapons Program?" SPIEGEL ONLINE. SPIEGEL ONLINE, 23 Jan. 2015. Web. 06 Feb. 2017. <http://www.spiegel.de/international/germany/german-companies-suspected-of-aiding-syrian-chemical-weapons-program-a-1014722.html>.

Shenon, Philip. "Declaration Lists Companies That Sold Chemicals to Iraq." The New York Times. The New York Times, 20 Dec. 2002. Web. 06 Feb. 2017. <http://www.nytimes.com/2002/12/21/world/threats-responses-suppliers-declaration-lists-companies-that-sold-chemicals-iraq.html>.

Aderet, Ofer, and Reuters. "German firms played larger role in Syria's chemical weapons program - Middle East." Haaretz. Haaretz Daily Newspaper Ltd, 19 Mar. 2014. Web. 06 Feb. 2017. <http://www.haaretz.com/middle-east-news/.premium-1.580841>.

Effective Implementation of the Chemical Weapons Convention. Bad Homberg: SIPRI-Saskatchewan-Frankfurt Group, Dec. 1995. PDF. <https://www.peacepalacelibrary.nl/ebooks/files/356377148.pdf>.

Kelle, Alexander. "Preventing the proliferation of weapons of mass destruction: Implementing the Chemical Weapons Convention." Friedrich Ebert Stiftung. Friedrich Ebert Stiftung, n.d. Web. 06 Feb. 2017. <http://library.fes.de/fulltext/id/00714008.htm#E10E27>.

"1925-1944: New Forms of High-Pressure Synthesis." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/about-us/history/1925-1944.html>.

“1965-1989: The Road to Becoming a Transnational Company.” BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/about-us/history/1965-1989.html>.

“1990-2014: Sustainable Start to the New Millenium.” BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/about-us/history/1990-2014.html>.

"Corporate governance and compliance." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/microsites/factbook-2016/basf-group/corporate-governance.html>.

"Sustainability Ratings and Rankings." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/investor-relations/sustainable-investments/sustainability-ratings-and-rankings.html>.

The Prince of Wales. Future proofed decision making – Integrating environmental and social factors into business decisions. <http://globe-net.com/future-proofed-decision-making-integrating-environmental-and-social-factors-into-business-decisions-2/>

Eccles, Robert G., Ioannis Ioannou, and George Serafeim. The Impact of Corporate Sustainability on Organizational Processes and Performance. N.p.: n.p., n.d. PDF. <http://www.hbs.edu/faculty/Publication%20Files/SSRN-id1964011_6791edac-7daa-4603-a220-4a0c6c7a3f7a.pdf>.

One Company One Code of Conduct: The BASF Compliance Program. N.p.: BASF SE, n.d. PDF. <https://www.basf.com/documents/corp/en/about-us/publications/reports/2016/BASF_The_Compliance_Program.pdf>.

"Supplier Code of Conduct." BASF. BASF SE, n.d. Web. 06 Feb. 2017. <https://www.basf.com/en/company/about-us/suppliers-and-partners/sustainability-in-procurement/supplier-code-of-conduct.html>.

Busch, Timo, Rob Bauer, and Marc Orlitzky. "Sustainable Development and Financial Markets: Old Paths and New Avenues." Business & Society 55.3 (2015): 303-29. Sage. Web. 06 Feb. 2017. <http://journals.sagepub.com/doi/abs/10.1177/0007650315570701>.

Luo, Xueming, Heli Wang, Sascha Raithel, and Qinqin Zheng. "Corporate social performance, analyst stock recommendations, and firm future returns." Strategic Management Journal 38.1 (2015): 123-36. Wiley Online Library. Web. 06 Feb. 2017. <http://onlinelibrary.wiley.com/doi/10.1002/smj.2219/full>.

Friede, Gunnar, Timo Busch, and Alexander Bassen. "ESG and financial performance: aggregated evidence from more than 2000 empirical studies." Journal of Sustainable Finance & Investment 5.4 (2015): 210-33. Taylor & Francis Group. Web. 06 Feb. 2017. <http://www.tandfonline.com/doi/abs/10.1080/20430795.2015.1118917>.