Crude Crime:
An analysis of energy prices and crime in Alberta

by

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Abstract

The relationship between energy prices and levels of crime in Canada is under-researched, despite Canada's dependency on its natural resources. There have been numerous media reports on the high level of crime and revenue from resource-based communities, such as Fort McMurray. However, these conclusions have not been substantiated by research. In this thesis, social disorganization theory and routine activity theory are used to examine crime patterns in Alberta. The current study explores the relationship between fluctuations in energy prices and crime rates in Alberta between the years 1998 to 2006. A fixed effects linear regression analysis is used to determine the association between crime rates and changes in both oil and natural gas prices while accounting for a number of variables. A statistically significant negative relationship was found between energy prices and break and enter, as well as theft from auto. In light of these findings, implications for future research and theoretical development are discussed.

Keywords: Alberta; crime; oil and gas industry; panel data; fixed-effects estimation

“Study hard, struggle hard.”

Anonymous

Dedication

I dedicate my efforts to my mom and grandma. They have taught me the importance of strength, resiliency and gratitude. They are the main pillars in my life without whom I could not stand.

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List of Acronyms

GDP	Gross domestic products
OPEC	Organization of the Petroleum Exporting Countries
NAFTA	North American Free Trade Agreement
NEB	National Energy Board
NYMEX	New York Mercantile Exchange
RMWB	Regional Municipality of Wood Buffalo
RCMP	Royal Canadian Mounted Police
US EIA	United States' Energy Information Administration
WCS	Western Canada Select
WTI	West Texas Intermediate

Chapter 1.

Introduction

Alberta is most recognized, though some may argue controversially, for the bitumen sands located in the northeastern region of the province. The majority of Canada's oil production is derived from bitumen sands, predominantly located in Alberta but also present in Saskatchewan. The bitumen sands production in Alberta has been a significant contribution to the Canadian economy. In fact, 2.2 million barrels of oil per day were produced from bitumen sands alone in 2014 and this formation represents approximately 97 percent of the nation's oil reserve (Natural Resources Canada, 2017a). The high production rate of oil well surpassed the expectations by the National Task Force on Oil Sands Strategies (1995), who estimated that the oil industry in Alberta could achieve up to 1.2 million barrels of bitumen and crude oil by 2020. With this high acceleration in oil production, the bitumen sands were one of the largest petroleum resources giving high potential for the oil industry in Canada (The National Task Force on Oil Sands Strategies, 1995). In addition to oil, Canada is the fifth largest producer of the world's natural gas (National Energy Board [NEB], 2017a). In fact, Alberta produces two-third of the Canada's natural gas.

With the growth in demand for workers in resource extraction communities, the majority of the population entering are young males (Ruddell, 2011). Though boomtowns can be generalized by a number of characteristics, it is important to note that not every boomtown has experienced the same levels of crime and disorder (Jayasundara et al, 2016; O'Connor, 2017). This is namely due to a number of characteristics including, geographical location, source of the prosperity, policing resources and community features (Ruddell, 2011). For example, the experiences with crime may differ in places with off-shore oil extractions versus rural or remote communities because the location of extraction sites (Ruddell, 2011).

In general, the research on the impact of boomtowns and crime often is derived from journalistic accounts that do not utilize police or crime data within the news article (Ruddell, 2011). There have been many news reports and anecdotal claims of workers' high salaries resulting in the arrival of different illicit markets into these communities,

including prostitution and drugs (Ruddell, 2011). For this reason, studies have been done to determine whether there is a boom-crime relationship and the nature of the relationship. Ruddell (2017) explains that crime does increase when there is a resource boom, but tends to stabilize over time. Additionally, it was discovered that crime rates in American boomtowns were sometimes higher than neighbouring towns that were neighbouring them (Jayasundara et al, 2016). This is no different in other countries like Canada and Australia.

As revealed, the consequences of the boom in the oil and gas industry include a lowered quality of life for existing residents, as well as the incoming population (O'Connor, 2015; Ruddell, Jayasundara, Mayzer & Heitkamp., 2014; Ruddell & Ortiz, 2015). With regular separation from informal social support, there were increases of alcohol and substance use, mental and physical health issues, and violence (Carrington & Pereira, 2011; Government of New Brunswick, 2012). This further impacts their willingness to invest in the community. Newcomers are seen to have little regard and engagement with the community, as they tend to be enticed by the high earnings and only view it as so (Ruddell, 2011). Filteau (2015) argues that workers in the oil and gas industry are more likely to self-identify with the stigma that is supported by community residents, which reinforces the identity of a "dirty worker." Consequently, a vicious cycle of reprimanding between the non-resident workers and the community occurs, creating tensions and volatility within the community (Filteau, 2015).

Although there have been multiple studies that have examined boomtown residents' perceptions, both long-term and short-term, little has been done to measure the short-term population quantitatively. One reason for this is that there has been a lack of measure to capture this population. Moreover, it can be near impossible to measure this population (Ruddell, 2017). This is a repercussion of the industry that is based on a rotational shift schedule. In many cases, those who work rotational shiftwork tend to stay in camps that are designed for those who fly-in and fly-out (or drive-in and drive-out), or other short-term arrangements like hotels and private dwellings (Laporte, Lu & Schellenber, 2013; Ruddell et al., 2014).

The current study examines whether fluctuations in energy prices have an impact on crime in Alberta from 1998 to 2006. The study period ended in 2006 due to the changes in the Canadian census. The 2011 census forms were modified to short-forms and the long-form surveys were done on a voluntary basis, called the National Household Survey.

This decision was made by the Conservative government due to privacy reasons (Government of Canada, 2010). This decision limited the amount of data that could be collected in the 2011 census, resulting in relevant data collection ceasing in 2006. Due to the lack of accurate data in measuring the shadow population, energy prices are used to capture some aspect this population as it is expected that as the prices increases, as will the employment opportunities within the oil and gas industry, thus bringing more people into the province. To date, there have only been studies that examined the resource production levels and crime in boomtowns (see Luthra, Bankston, Kalich and Forsyth, 2007; Ruddell et al. 2014). By using energy prices, it brings a different aspect of the economy as the prices will have an impact on the supply and demand of the resource and can be indicative of employment opportunities in the industry. This research is guided by the theoretical underpinnings of social disorganization theory (Sampson & Groves, 1989; Shaw & McKay, 1969) and routine activity theory (Cohen & Felson, 1979). Both theories are used in tandem in explaining crime and disorder across the province of Alberta.

Chapter 2.

The Context of Alberta

Alberta is one of the western provinces in Canada, located between British Columbia and Saskatchewan, and borders the United States. It is the fourth largest province in Canada in terms of population density and land mass, following Quebec, Ontario and British Columbia (Statistics Canada, 2012a). There are 435 municipalities in Alberta, with Calgary and Edmonton as the largest both in land mass and population density (Statistics Canada, 2012b). Alberta is predominately policed by the Royal Canadian Mounted Police (RCMP), and are deployed in 118 police jurisdictions (Royal Canadian Mounted Police, 2017), 10 independent police forces, and 3 First Nations police forces (Alberta Justice and Solicitor General, n.d.). With the exception of 2014 and 2015, the period of the oil bust in Alberta, crimes have been on a general downward trend, following the national trend (Statistics Canada, 2017a). The crimes reported to the police are considered as more serious in Alberta than in Canada, as the provincial crime severity index has been higher than the national average. However, the crime severity index has been on a general downward trend, again, with the exception of 2014 to 2015, indicating that the crimes reported have been less serious over time (Statistics Canada, 2017b).

There are a number of landscape features that Alberta is well-known for, including the Rocky Mountains, the badlands, and prairies. One of the most prominent features of the province is the bitumen sands located in the northeast quadrant of the province (Alberta Energy, 2017a). Natural gas in Alberta was first uncovered in 1883 near the city of Medicine Hat, located in the Southern region. Over half a decade later, the petroleum industry was changed in Canada when the first major oil drilling in Alberta was discovered in 1947 (Alberta Energy, 2017b)

The current population of Alberta is approximately 4.2 million (Government of Alberta, n.d.). The majority of Albertans reside in urban areas (approximately 80 percent of the total population), whereas only 20 percent of the population live in rural areas (Government of Alberta, 2015). Because Edmonton and Calgary are the largest metropolitan areas in Alberta, it is not surprising that the majority of urban residents reside in either city (Statistics Canada, 2012c). The latest census reports that Alberta has a

relatively large working age population (ages 15 to 64) making up about 69 percent of the total population (Statistics Canada, 2017c). Only a small percentage of Alberta's population consists of Aboriginals, roughly six percent, which is higher than the national average (approximately five percent) (Statistics Canada, 2016). And approximately 15 percent of Albertans identify as a visible minority, with a large number identifying as south Asian or Chinese (Statistics Canada, 2007).

Alberta's population has been increasing by approximately 10 percent every census year, which is completed every five years. In fact, Statistics Canada reports that Alberta has been the forerunner in population growth, with a growth rate of 1.8 percent, compared to the entire country, which has a growth rate of 1.1 percent (Liu, 2011). The changes in population are usually driven by economic factors, such as the expansion in the oil and gas industry. Consequently, the population growth can also be attributed to the interprovincial migration patterns (Alberta Treasury Board and Finance, 2009). Although there have been fluctuations in the pattern of interprovincial migrants, Alberta has had a positive net migration over the past three decades. A large portion of the net migration is, once again, a consequence of the oil and gas sector, as well as a stagnant manufacturing industry in Central Canada (Alberta Treasury Board and Finance, 2009). The 2006 census year reported that the population growth in Calgary and Edmonton, the largest municipalities in Alberta, was due to interprovincial migration. Edmonton had a higher rate of interprovincial migrants than Calgary, at 55 percent, with 66 percent (Alberta Treasury Board and Finance, 2009). This is not surprising due to the geographical location of Edmonton, that is closer to the oil and gas extraction sites. However, when examining smaller census units, at the census agglomeration level, Red Deer, Grand Prairie and Wood Buffalo received a higher proportion of interprovincial migrants than the provincial average (Alberta Treasury Board and Finance, 2009). The latter two census agglomerations contain some of the oil and gas extraction sites.

2.1. Alberta Oil and Gas Industry

Alberta's oil and gas industry has been one of the largest contributors in both the Albertan and Canadian economies (Alberta Energy, 2017c). The oil industry, specifically, has been an imperative aspect of Alberta since the early 1900s (Alberta Treasury Board and Finance, 2017). The majority of Alberta's oil was exported to the United States making up for a total of 60 percent, and approximately 40 percent of the crude oil remained in

Canada, predominately in Alberta (Government of Alberta, 2014). Located in the northeast part of the province, there are four major bitumen sands, or oil sands, deposits in Alberta: Athabasca, Wabasca, Cold Lake and Peace River, which covers 142,000 square kilometres. This makes Canada the third largest crude oil reserve in the world after Saudi Arabia and Venezuela (The National Task Force on Oil Sands Strategies, 1995; Alberta Energy, 2017c). In fact, one of the largest exports for Canada is crude petroleum, a derivative of fossil fuel, which is refined into usable petroleum products (U.S. Energy Information Administration [US EIA], 2015a; NEB, 2017b). Geographically speaking, Alberta provides the most efficient path for transporting oil and, at the time, had the most reliable reserves given to the United States. Furthermore, given the North American Free Trade Agreement (NAFTA), both Canada and the United States have a strong trading relationship, in which both countries benefit from one another (Pasqualetti, 2009).

Natural gas, also extracted from fossil fuels, is one of the cheapest alternative fuels produced and used in Alberta, as well as Canada. Alberta produces about 68 percent of the nation's natural gas (Alberta Energy, 2017d), and Canada is the fourth largest natural gas producer in the world (Natural Resources Canada, 2015a). Moreover, over 80 percent of Alberta's natural gas is used for the production and refinery of bitumen sands and petroleum products, making it an important commodity in the Alberta oil industry (Alberta Energy, 2017d). In 2011, approximately 42 percent of Alberta's natural gas was exported to the United States (Government of Alberta, 2014). In fact, majority of the United States' imported natural gas came from Canada, while only a small percentage is exported to Mexico (US EIA, 2015b). The rest remains in Alberta and the rest of Canada.

2.1.1. Crude oil prices

There are three price benchmarks that are considered for Alberta's oil. These include West Texas Intermediate (WTI), Brent, and Western Canadian Select (WCS). WTI oil is light and sweet oil that is produced in the United States. It is also considered the price benchmark for the North American oil marketplace. WTI is traded on the New York Mercantile Exchange (NYMEX), having the largest crude oil trading contracts in the North American oil market (Alberta Energy, 2016). Furthermore, Canada and United States have similar business cycles due to the trading relationship that both countries share. The growth rate of the Canadian and American gross domestic products (GDP) are comparable due to the similar volatilities that both economies have faced (Voss, 2010).

However, it is important to note that the American economy does not necessarily lead the Canadian economy. Rather, the American economy can provide the external shocks to the Canadian economy due to the nature of the strong trading relationships between these two countries (Voss, 2010). An external shock, though there is no consistent definition, is known as a considerable change or deviation from the underlying trend (Varangis, Varma, dePlaa & Nehru, 2004). Similarly, Brent oil is a price benchmark used in the global oil market. The prices of Brent crude oil best reflect the supply and demand of light sweet oil on a global scale (Alberta Energy, 2016). Finally, WCS oil prices differ from WTI oil prices in that it reflects the supply and demand of heavy crude oil in North America. This oil is more difficult to refine than WTI oil, which gives it a lower price on the oil marketplace (Alberta Energy, 2016). Although this oil is produced in the bitumen sands in Alberta and would be better reflective of the energy prices in Canada, the prices of WCS oil will not be used for this current research. WCS oil prices were not established until the mid-2000s. However, the prices follow a similar trend as WTI oil prices due to the fact that WTI oil prices are a benchmark for the North American oil market.

The oil production rates in Alberta are further influenced by factors beyond oil price benchmarks. One important element that drives the oil prices is the Organization of Petroleum Exporting Countries (OPEC). OPEC manages the petroleum policies for the member countries involved and ensures that the oil marketplace is stable from unnecessary fluctuations (OPEC, 2012). Furthermore, this cartel guarantees that the countries involved in the organization receive a fair return on their capital invested in the petroleum industry (OPEC, 2012). Currently, there are 12 countries involved in OPEC. The countries involved in OPEC produce about 40 percent of the world's oil and 60 percent of the world's export, which greatly influences the international oil prices. Previously when OPEC production targets were reduced, crude oil prices increased (US EIA, n.d.-a). Saudi Arabia, being the largest oil producing country involved with OPEC, historically has had a large impact on the oil prices (US EIA, n.d.-a). Canada, on the other hand, is not involved with OPEC. Therefore, non-OPEC countries do not influence prices but they respond to market prices in terms of production.

2.1.2. Natural gas prices

Unlike crude oil prices, natural gas prices are not determined by the NYMEX. Instead, the future prices of natural gas are determined on the trading floor of the NYMEX

and are used as an international price benchmark (Alberta Energy, 2017e). It is important to note that NYMEX determines its future price from the delivery of Henry Hub in Louisiana[1]. However, future prices determined by the NYMEX influences the daily spot prices and vice versa (Alberta Energy, 2017e). In Alberta, natural gas trading prices are determined by Natural Gas Exchange, also known as AECO, which sets the prices in Alberta (Alberta Energy, 2017e). In examining the commonalities between Henry Hub and AECO Alberta market prices, Serletis and Rangel-Ruiz (2004) found that Henry Hub defined the North American market. This is not surprising especially given the futures contracts of natural gas is determined based on Henry Hub. Moreover, Henry Hub and AECO natural gas prices followed a similar price cycle (Serletis & Rangel-Ruiz, 2004). In fact, the natural gas market in Canada and the United States are greatly integrated with one another and the surplus of natural gas in Canada is exported to the United States (NEB, 2017a). For the purposes of this research and the study area only AECO Alberta market prices will be used.

There has been an increase in production of natural gas in North America, which results in oversupplying the market. During summer months, when the demand for natural gas is lower, natural gas is stored in underground storage facilities. This makes it easily accessible for winter months when the demand is significantly higher (Natural Resources Canada, 2015b). According the U.S. Energy Information Administration (US EIA) (2015c), natural gas market is driven by three factors which can have an influence on the supply of the market. These include the production levels, net imports and underground storage levels. The increases in prices tend to lead to increases in production, imports and sales from the depositories, whereas falling natural gas prices have the opposite effect (US EIA, 2016). Demand, on the other hand, is influenced by weather, economic conditions and competing energy sources. Petroleum prices can also moderate the demand of natural gas as it can be used as a substitute in power generators (Natural Resources Canada, 2015b). As the demand for natural gas increases, the prices increase as well. The fluctuations in prices can also influence the demand levels of natural gas (US EIA, 2015c). Furthermore, large volume consumers, such as electricity producers, can switch between different fuel sources depending on the cost of the fuel at the time (US EIA, 2015c).

[1] Henry Hub is a pipeline owned and operated by Sabine Pipe Line allowing the transportation of natural gas from Erath, Louisiana to Port Arthur, Texas (Sabine Pipeline LLC, n.d.).

Altogether, with the various influences of supply and demand, monthly volatilities are expected to occur, where natural gas prices peak during the winter heating months and decline over summer months (NEB, 2002). In addition to the seasonal trends, underground storage capacity has an impact on the level of volatility of the market prices. However, natural gas prices are also impacted by external shocks beyond the scope of the market. Due to the fact that the North American natural gas markets are integrated with one another, external shocks from the United States' markets can be felt in the Canadian markets. For instance, in 2001, California experienced an energy crisis due to a shortage of electricity and a shutdown of a natural gas pipeline, resulting in a substantial price increase (NEB, 2002; 2011). The natural gas market in Alberta was also impacted by the 9/11 attacks, which had influenced the overall American economy (NEB, 2011). As well, in 2005, Hurricanes Katrina and Rita also had a significant impact on the natural gas markets due to the damages to the offshore production in the Gulf of Mexico (NEB, 2011).

2.1.3. The relationship of crude oil and natural gas prices

Historically, the commodity prices of crude oil and natural gas have been related, namely due to similar patterns of consumption and production. The commodity prices are linked by economic theory of supply and demand (Villar & Joutz, 2006). Previously, oil market prices have been highly correlated with natural gas prices (Villar & Joutz, 2006; Hartley, Medlock & Rosthal, 2007). There are several reasons as to why changes in oil prices can impact the natural gas market. Firstly, when there is a demand in the oil market, oil prices increase as well. This subsequently prompts consumers to substitute natural gas while petroleum costs increase (Villar & Joutz, 2006). Some electric generators that are petroleum fuelled can have a small percentage substituted with natural gas instead (Villar & Joutz, 2006; Brown & Yüchel, 2008). Secondly, also related to the oil price increases, the natural gas supply can increase, as it can be a by-product of oil. This is predominately due to the similarities in the extraction process between oil and natural gas, which can prompt a fall in natural gas prices (Villar & Joutz, 2006).

This has led to further investigation into the relationship between crude oil and natural gas prices. In United States, crude oil (WTI) and natural gas (Henry Hub) have maintained a 10 to 1 ratio, where one barrel of WTI oil is priced approximately 10 times greater than 1 million British thermal units of natural gas (Hartley et al., 2007; Brown & Yüchel, 2008). However, evidence has found that ratio decreased over time, indicating

that crude oil and natural gas prices are not as co-integrated as it once was. Other analysts have used a 6 to 1 ratio, which indicates that the price of natural gas is one-sixth of oil (Brown & Yüchel, 2008). Both ratios (10 to 1 and 6 to 1) have not been good indicators for oil and natural gas prices since 2000. In fact, the 10 to 1 ratio over-forecasts prices, whereas the 6 to 1 ratio under-forecasts (Brown & Yüchel, 2008). A reason for this asymmetric relationship to emerge is due to the relative market size of each commodity prices. For example, crude oil prices at determined at the global level, while natural gas prices are determined regionally (Villar & Joutz, 2006). Additionally, the natural gas market has been on an upward trend, whereas crude oil prices have had independent movement (Brown & Yücel, 2008).

Nevertheless, a number of scholars have found a co-integration between the two commodity prices. For instance, Hartley and colleagues (2007) found there was a long-term relationship between crude oil prices and natural gas despite differences that existed over time from shocks. Moreover, Villar and Joutz (2006) have argued that although the prices of oil and natural gas have become disengaged, their co-integration has slowly evolved into a long-run relationship rather than remaining constant. The researchers found that the natural gas prices lagged with changes in oil prices. Natural gas prices were able to recover from any deviations from the long-run relationship, but such deviations did not have an impact on oil prices (Villar & Joutz, 2006). Brown and Yüchel (2008) found that oil prices do have a strong association with natural gas prices, as commodity products can be substitutes for one another. Similarly, Nick and Thoenes (2014) found that the long-run development of crude oil prices and coal prices were closely linked to natural gas prices in European markets due to their capabilities for substitution between these commodities. Prior to 2008, the natural gas prices trend followed oil prices. However, since 2008, it appeared that the oil prices had less influence on the natural gas market (NEB, 2011).

2.2. “Fort McMoney”

The heart of the bitumen sands is located in the Regional Municipality of Wood Buffalo (RMWB), which is an amalgamation of the City of Fort McMurray and its surrounding district in a specialized municipality (Alberta Municipal Affairs, 2017). RMWB is considered a specialized municipality because it requires the needs of a larger municipality despite being rurally located with a smaller population (Alberta Municipal Affairs, 2017). The population in Fort McMurray and RMWB, the most well-known

municipalities in the bitumen sands regions, have been growing since 1999. Within a span of 10 years, the population size of Fort McMurray went from a small town to a large municipality (O'Connor, 2015). From 1999 to 2013, over $201 billion was invested in the bitumen sands projects in Alberta. Unfortunately, the ability for these communities to accommodate a decent quality of life for their residents peaked in 2006 (Brownlee Barristers and Solicitors, 2006).

In addition to the major growth in the economy, increasing level of production have created an abundance of job opportunities (Gabinet & Associates Inc., 2006). Not only that, most of the job opportunities available had appealing salaries. The average annual salary of a person employed in resource extraction[2] sector was $123,580, while the average annual salary in Alberta of all industries, including oil and gas industry, was $59,384 (Statistics Canada, 2017d). Salaries also vary depending on the level of education and experience, where a professional engineer can make upwards of $215,000 annually ("Pay & Salary Information", n.d.). It is without a doubt that these high-paying jobs can attract potential employees from different places. Even so, the reality of the job market goes beyond that oil and gas industry. With employment opportunities growing in the oil and gas sector, an increase of one job from an bitumen sand project can lead to an increase of three jobs in "oilfield service, business and service industry" (Gabinet & Associates Inc., 2006, p. 6). Despite this, many of these resource-based communities did not anticipate a considerable influx of people within a short amount of time, which led to a high demand on municipal services. Additionally, it resulted in increase of crimes and social disorder in these regions and this is known as the "boomtown effect" (Ruddell & Ortiz, 2015, p. 130). One consequence of a boomtown effect is the overextension of police resources in order to adapt to the large influx of people in a given community (Archbold, Dahle & Jordan, 2013; Ruddell et al., 2014).

Like many boomtowns, Fort McMurray and RMWB, have been subjected to sensationalized media reports on the community conditions. With headlines like, "Sex, drugs and alcohol stalk the streets of Fort McMurray" (2005) and "Boomtown on a bender" (2007), little is left to the imagination about the social disorder and crime in Fort McMurray and RMWB. For example, MacQueen, Cosh and Treble (2010) described, in *MacLean's*

[2] Natural resource sector also includes oil and gas extraction, forestry, mining, quarrying and fishing (Statistics Canada, 2017e).

magazine, the high crime levels in Fort McMurray attributes to the transient population, specifically the “displaced young men” (para. 16). Local newspapers have also reported the accessibility to purchase drugs within these areas (e.g., “In Alberta, cocaine easer to buy than pizza,” 2007). Journalistic accounts of crime and drug ridden conditions of the Albertan bitumen sands region has even received international attention. For instance, *The Economist* (2007) described the oil and gas region as crime and drug ridden, explaining that drug abuse was four times the national average. And although oil companies do provide drug tests, it was explained that many smaller contractors choose to disregard them due to the nature of labour market (“Boomtown on a bender”, 2007). Additionally, the Alberta Crime Reduction and Safe Communities Task Force (2007) reports resource prominent communities were found to have higher rates of violent crime in 2006.

Despite anecdotal accounts of crime in Fort McMurray, Boyd (2014) investigated whether Fort McMurray was considered as one of the most dangerous cities in Canada. This study was done as a counterargument to the aforementioned *Maclean’s* article which discussed the high crime rates in Fort McMurray. Boyd (2014) argued that when using population data collected at the federal census level, it provides a different depiction than what is reported at the provincial and municipality level. For example, the 2011 Canadian census reported a population of 65,656, but the municipal census recorded 116,407 (Boyd, 2014). To further supplement their analysis, a cross-comparison was done with other Canadian cities. Overall, the findings suggest that RMWB was not more crime rampant than other Canadian cities once the increased population was considered (Boyd, 2014). The violent crime rates, like robbery and sexual assault, were lower than both the national and provincial average. In fact, when examining the top 10 calls for services, most calls are traffic related. Despite these findings and in response to community outcries, Wood Buffalo RCMP, the local police service, developed specialized units to help combat the illicit activities that were indirectly related to the energy development. However, there are a few issues with employment of such units. However, Ruddell (2017) noted that there was a lack of evaluation of the specialized unit, therefore it cannot be determined whether these units were actually effective or not.

2.3. Shadow Population

As demonstrated, there are discrepancies in recording population numbers at different levels. What has been brought to the attention of the Alberta government is the need to measure the shadow population. The increase in oil and gas employment led to the Alberta government to attempt in determining the shadow population of the province. The 2001 Official Population List of Alberta defined a shadow population as, "[a] person who resides in a municipality on a seasonal basis for a given period of time but has permanent residence elsewhere" (Alberta Municipal Affairs, 2001, p. 10). However, it is important to note that this definition is not exclusive to only interprovincial workers. It also includes temporary foreign workers as well as out-of-province students and others populations like refugee claimants (Laporte, Lu & Schellenberg, 2013). This definition poses many issues in how this data could be captured. Multiple sources are required in order to undertake the measurement of a shadow population in Alberta (Laporte, Lu & Schellenberg, 2013).

During the 2000s, Alberta had the highest interprovincial net migration than any other province or territory in the country (Laporte, Lu & Schellenberg, 2013; Statistics Canada, 2012b). However, the shadow population was not included until the 2000 Official Population List (Alberta Municipal Affairs, 2000). This can result in problems in infrastructure and program planning, especially in municipalities with a smaller number of residents but large numbers of transient people like Fort McMurray (Laporte, Lu & Schellenberg, 2013). To account for the shadow population, the Government of Alberta implemented a regulation that the municipal census must include the shadow population "if the shadow population in a municipality is (a) greater than 1000 persons, or (b) less than 1000 persons but great in number than 10% of the permanent population" (*Municipal Government Act*, 2001). According to the *Alberta Determination of Population Regulation*, municipal governments must submit an application to include in the shadow population within their census, which is then determined by the Minister of Municipal Affairs whether the shadow population is indicated in municipal census. With the new provisions put in place by the Government of Alberta, municipalities like RMWB were required to collect census information on the permanent and shadow population. In 2015, RMWB determined that over 65 percent of the population were permanent residents (Regional Municipality of

Wood Buffalo [RMWB], 2015). The census was collected with a primary focus on population and dwelling information.

However, in many cases temporary housing and camps are constructed to allow workers who “drive-in and drive-out” (DIDO) or “fly-in and fly-out” (FIFO) into their worksites (Ruddell et al., 2014, p. 3). This is also known as the rotational workforce. Given the nature of the employment within the oil and gas sector, where oil and gas extraction occurs 24/7, it is more beneficial and efficient to have a rotational workforce to ensure that oil and gas extractions can run at a greater capacity (Petroleum Labour Market Information [PetroLMI], 2015). Those who are highly mobile tend to stay in rural areas and short-term accommodations like hotels, recreational vehicles, work camps, which can house several thousand residents, and private residences (Laporte, Lu & Schellenberg, 2013). This further contributes to the issue of missing data and information about this population.

Chapter 3.

Boomtown and Crime

There are two distinctive factors that defines a boomtown: economic activity growth and a rapid increase in population (Little, 1977). However, there are consistent issues in defining boomtown communities. Various studies have indicated that for a boomtown to exist, there must be an increase in population concurrent with a resource boom. Some scholars define boomtowns in terms of specific percentage increases in population over a given time period, while others define in terms of the characteristics of the population growth (Archbold, Dahle & Jordan, 2014). Gilmore (1976) asserted that rapid population growth from economic development can result in a breakdown of services within the community. However, only considering population growth is problematic in its definition and consequently has a number of limitations.

First and foremost, the exact number of those living in boomtowns is not accurately captured, or even at all, in the census (Ruddell, 2017). Given the nature of rotational shiftwork, where workers are only required to work a number of days during the week followed by a number of days off, it is near impossible to capture this number. Ruddell (2017) argued that the definition should also include the turnover of the worker population. This would better encompass the resident population of the boomtown or region despite what is recorded in the census population. A turnover in population is expected because of the amount of activity during the extraction process. In other words, the more of the resource is extracted, the more workers are needed (Ruddell, 2017). Ruddell (2017) argued that there is value in including the out-migration population within the definition. Further, the capability of the municipality to respond to such growth tends to be lagged. The social strains from resource development have a larger impact on smaller municipalities, whereas large municipalities are unlikely to endure the same impact and are better in coping with such strains (Little, 1977). Lastly, Ruddell (2011) stated that the characteristics of the population growth is another important factor to consider (i.e., rapid growth of families versus rapid increase of young males in the community).

Furthermore, the remoteness of some resource-based communities leaves very little for the oil workers to do, resulting in a higher level of alcohol consumption, which has

contributed to the increase of violence (Carrington & Pereira, 2011; Archbold, Dahle & Jordan, 2014). Prior studies have demonstrated that problems in alcohol consumption could be related to the increase in population (Lantz & Halpern, 1982). This could be reflected back to how newcomers do not establish roots in worksites because many may see it as a temporary relocation. Excessive alcohol consumption could also be attributed to the culture shock. There are many migrants who come from large urban centres and are relocated to remote communities or it could be a culture shock of the worksite as well (Lantz & Halpern, 1982). Gibson and Papa (2000) further explain that higher alcohol usage among workers can be due to the "organizational osmosis," resulting in newcomers to naturally embrace established values, culture and ideals to increase socialization and identification with the working group (p. 68). The increase in violence is not only limited to overconsumption in alcohol. There has also been a reported increase in illicit drug and prescription drug use in boom communities due to competition in the drug markets (Jacobs, 2016; Ruddell, 2017). Furthermore, abuse with prescribed opioids was a consequence of a 'quick fix' for worksite injuries (Jacobs, 2016). Dependent use of drugs can also lead to more crimes as a way to support addictions (Ruddell, 2017).

There are a number of studies that have contributed in boomtowns and crime research. The first wave of boomtowns research was done during the 1970s to the 1990s, and with the most recent wave, which mainly focused on oil extraction sites in Canada, Australia and the United States and its impact on crime within the community.

3.1. Early Boomtown Research

The first wave of boomtown literature did not necessarily examine crime and disorder, but explored the "social disruption hypothesis" of boomtown communities (see Cortese and Jones, 1977; Gilmore, 1976; Kohrs, 1974). It was argued that resource-based communities entered a crisis due to a loss of identity and disruption in routines (England & Albrecht, 1983, p. 231). This was commonly known as what Kohrs (1974) called, the "Gillette syndrome." The notion of Gillette syndrome, coined after the study of Gillette, Wyoming, is that most social problems are a result of a rapid increase in population in the community (Covey & Menard, 1983; Kohrs, 1974). Scholars believed that a large influx of newcomers would decrease the level of social capital, resulting a lack of trust and informal social control among community members (Ruddell, 2017). Janowitz (1975) described social control as "the capacity of the society to regulate itself according to desired

principles and values" (p. 82). The notion of social control derives from *Gemeinschaft-Gesellschaft*, which defines the differences between rural environments, or cohesive communities, and urban environments, which is the antithesis of rural environments (Janowitz, 1975). Further examination of the urban-rural dichotomy is discussed later in this chapter. Social control is strongest in communities that are more homogeneous, or people who share common values. When a community lacks social capital and informal social control, it can contribute to social problems (Ruddell, 2017). Some social problems include crime and delinquency, family tensions (including divorce), emotional distress, and alcoholism (Kohrs, 1974). Kohrs (1974) highlighted that the social implications of a resource-based community should be addressed during the planning stages.

Early boomtown research has shown that a number of western rural communities in the United States do, in fact, experience the boomtown phenomenon (Freudenburg, 1984; Frickel and Freudenburg, 1996). There are two problems that stem from boomtowns: economic and social. Unlike social strains, economic strains tend to be experienced immediately and can easily be measured through taxation. Social strains and impacts, on the other hand, are endured much later, if at all, by community residents (Little, 1977). However, one important distinction that should be noted is that the social environments of each boomtown are different in various degrees, including the source of prosperity, geography and community characteristics, which can contribute to the issues in understanding the boomtown phenomenon (Little, 1977).

Boomtowns during the 1970s and 1980s were also plagued by sensational journalistic and anecdotal accounts and perceptions with little evidence to support these views (Krannich, 2011). Most of the research comprised during this period were focused on the socioeconomic aspect, namely the inability of rural communities to accommodate a large influx of people (Freudenburg, 1976). For instance, Gilmore (1976) asserted that an increase in population resulted in a reduction of municipal services available as well as the quality of services. This could pose as an issue in attracting newcomers to resource-based communities, which could hinder development (Gilmore, 1976). And with a lack of resources, it can lead to a higher population and worker turnover and absence, which has a potential negative impact on local infrastructure and development politically, socially and economically. Freudenburg (1976) argued that it is important to explore the changes in population as it is pertinent in every stage of an energy development project, though other social consequences tend to be neglected or overlooked. Moreover, Freudenburg (1976)

maintained that the long-term residents' perceptions of the changes within such communities were overlooked and that there was value in looking at the strains that such social changes have caused. Later research questioned the social disruption hypothesis, putting forth that prior research neglected to notice the adaptability of such communities and failed to see the prosperous benefits that resource development brought to the community (see Albrecht, 1978; England and Albrecht, 1984; and Murdock and Leistritz, 1979).

To further highlight the inconsistencies in findings, Freudenburg and Jones (1991) conducted a meta-analysis of all boomtown and social disruption research available at that time. There were two main findings emerged in their meta-analysis: rapid population growth from energy development communities can either contribute to an increase and crime and disorder, or there a little to no differences found from the consequences of energy development (Freudenburg & Jones, 1991). Though it was noted the reason for inconsistent results could be due to differences in methodology and data limitations, Freudenburg and Jones (1991) maintained that there should be further examination of the incoming population and the community at the disaggregate level to further understand the phenomenon.

3.2. Contemporary Boomtown Research

The second wave of boomtown literature extends the social disruption hypothesis by looking at the crime and disorder may arise with newcomers into the community (Ruddell & Ortiz, 2015). The relationship between of crime and disorder is that resource-based communities offer little to nothing to do when oil and gas workers have their days off during their rotational shiftwork. And because the newcomers are there for the purposes of work, they tend to participate less within the community (Ruddell, 2017). However, there are distinctions found between blue-collar and white-collar workers. Blue-collar workers, frontline workers, and oilfield workers typically participate less in the community. This is understandable given the rotational shiftwork they are expected to do. White-collar workers, or engineers, on the other hand, tend to have higher levels of participation in the community and are accepted by other residents in the community (Ruddell, 2017). In most cases, boomtown research tends to focus on the blue-collar workers and their impact on the community.

There are differences between present boomtowns and existing boomtowns in during the first wave of boomtown research. Ruddell (2017) explains that the impacts of the resource boom in some places are more likely to have an impact on the entire region instead of just a single town. Moreover, today's rural communities have more diverse socio-demographic characteristics than historical counterparts. For instance, Western U.S. rural communities in the 1970s and 1980s were predominately White (Ruddell, 2017). Hence, there is value in examining the sociodemographic characteristics of the newcomers. And there are arguably many economic benefits that a resource boom may bring to a community as well as surrounding areas. Despite having inconsistent boom-crime findings, with any boomtown effect, resource-based community members suffer from a lower quality of life as a result (Ruddell, 2017). However, Ruddell (2017) found that a key question addressed in much of the boom-crime literature was "whether the higher levels of boomtown crime exceed the population increase" (p. 44). There is a general finding that most studies found, wherein crime increases after a boom. Whether that finding is statistically significant, however, is a different story (Ruddell, 2017). Keeping in mind that there is a lack of completeness in data, interpretations of findings should be taken with caution. And although there may be an insignificant finding in some studies, there is "operational significance" on the impact of the social services available in that boomtown (Ruddell, 2017, p. 48).

There is some evidence to suggest that boom-crime relationship stabilizes after an initial increase. In fact, crime is more likely to decrease over time as the boom matures (Ruddell, 2017). The number of workers involved in an oil and gas project is expected to decrease once the construction phase has ended. Additionally, local government services eventually meet the changes from the population growth. Finally, there may be a change in population characteristics as transient workers are replaced by established, older residents with families (Ruddell, 2017). Although there are many similarities between boomtowns (i.e., rapid population growth, inadequate resources for services), there are a number of various characteristics that each boomtown has that further contributes to the variation between sites. In other words, not all boomtowns share the same experiences, including geographical location, source of prosperity, as well as police and community attributes, thus making it difficult to generalize findings (Little, 1977; Ruddell, 2011; 2017).

Boomtown and crime research has been explored in other parts of the world, including Australia (see Carrington, Hogg, McIntosh and Scott, 2011; Carrington and

Pereira, 2011; Petkova, Lockie, Rolfe & Ivanova, 2009; Scott, Carrington, Hogg and McIntosh, 2012); Canada (see O'Connor, 2015; 2017; Ruddell, 2011; 2014) and the United States (see Brown, Forsyth and Berthelot, 2014; Forsyth, Luthra and Bankston, 2007; Heitkamp and Jayasundara, 2012; Kowalski and Zajac, 2012; Luthra, Bankson, Kalich and Forsyth, 2007; Seydlitz, Jenkins and Gunter, 1999). However, there have been mixed findings in whether a boom-crime relationship exists. As previously mentioned, prior research has found that there are multiple methodological issues, which only somewhat contributes to the complexities of the body of research and cannot be used to fully explain boomtown communities and crime (Freudenburg & Jones, 1991; Ruddell et al., 2014).

Media depictions of boomtown communities, especially in the Bakken oil region in Montana and North Dakota, portray these places as the "wild west" (Ruddell et al., 2014). Similar to the early literature, many of these claims are not substantiated. Ruddell and colleagues (2014) examined whether such depictions were quantitatively accurate in looking at the changes in UCR Part I index crime trends in relation to the Bakken oil boom from 2006 to 2012. In their initial findings, Ruddell and colleagues (2014) found there was an increase in violent crimes in oil producing counties during the post-boom period, however, a decrease in non-oil producing counties post-boom. Interestingly, for property crimes, there was a decrease in rates in both periods. As for violent crimes, there was a slight rise in both periods (Ruddell et al., 2014). A subsequent analysis was used to examine the relationships between oil production and violent and property crime. Overall, there was a non-significant relationship between oil and gas production with violent and property crimes (Ruddell et al., 2014). This was similar to the finding of Luthra, Bankston, Kalich and Forysth (2007), who found there were no significant relationships between oil production of Louisiana offshore oil and crime. Another study examined the impact of oil extraction, pre- and post-boom, on crime and disorder in North Dakota. In O'Connor's (2017) findings, it was demonstrated that there were significant increases in violent crime rates in the post-boom period, though there were no significant changes in property crimes (O'Connor, 2017). Additionally, oil producing counties were compared with non-oil producing counties, by which oil producing counties were found to be more susceptible to crime and disorder than non-oil producing counties (O'Connor, 2017).

Many studies have examined the community perception with crime and disorder in relation to energy industry development through qualitative means. For instance, Forsyth, Luthra and Bankston (2007) discovered that some residents in a Louisiana oil parish

community felt that there was an increase in crime and social disorder and this was mainly due to the oil development and presence of newcomers employed in the industry. However, other respondents in the study reported that there was little to no disruption in the community or that any disruption was caused by a small number of individuals rather than the structure of the community. In fact, a large proportion of respondents actually found that the industry improved the conditions of the community as well as other industries in the parish (Forsyth et al., 2007).

Similar to Canada and the United States, Australia has experienced mining booms particularly due to supplying Asian markets (Carrington & Pereira, 2011). The Australian mining industry was refurbished from being government regulated to having sub-contractors heavily involved in lobbying (Carrington, Hogg & McIntosh, 2011; Carrington & Pereira, 2011). For this reason, rural communities in Australia have faced comparable experiences to North American boomtowns, in that there is an over-reliance on non-resident workers to work in these communities. In Queensland and Western Australia, there was a large portion of community residents that felt the resource employment opportunities had a negative impact on the community (Carrington & Pereira, 2011). This, arguably, can create social tension and instability among residents and non-residents (Carrington & Pereira, 2011). Furthermore, approximately half of the respondents felt unsafe with non-resident employees, and about 50 percent of the respondents felt that the non-resident employees lived a negative lifestyle (Carrington & Pereira, 2011).

Although there have been a number of studies that have found that community members experience a lower quality of life in boomtown communities, little has been studied on the community perception over time (Ruddell & Ortiz, 2015). Ruddell and Ortiz (2015) examined the long-term community perceptions of personal safety and crime in Regional Municipality of Wood Buffalo over a 5-year period. In terms of personal safety, almost half (49 percent) of respondents reported that there was an increase of crime in 2008. However, that percentage decreased to 25 percent in 2012 (Ruddell & Ortiz, 2015). Interestingly, respondents found non-violent offences to be of concern like aggressive driving, drug use, delinquent behaviours, theft and residential burglary. This went against the expectation that violent offences were a primary concern (Ruddell & Ortiz, 2015).

O'Connor (2015) further contributed to the literature of boomtown community perceptions by examining the differences between resident types: long-term and transient.

In other words, those who contribute to the community and those who view the community simply as a place to collect their paycheques. Long-term residents of the community reported that deviance occurred most with the transient population, which contributed to the stereotypical image of boomtowns as portrayed by the media (O'Connor, 2015). This is what O'Connor (2015) described as the "insiders and outsiders" of the community. The insiders were seen as residents who contributed to the community, whereas the outsiders had little stake in the community. Given the nature of the boomtown, long-term residents of Fort McMurray saw that there was a loss of social cohesion within the community due the influx of outsiders (O'Connor, 2015). The perceptions of youths living in Fort McMurray were also examined. The respondents in the study found that there was an apparent transition from a small town to a larger city due to the large influx of people moving from different places in Canada and other countries (O'Connor, 2015). In his findings, young people viewed long-term migrants as a positive addition to the community. However, there were negative views for short-term migrants as it was believed that they did little to participate to the community and were perceived to strain the public services. In fact, many of the respondents believed the short-term migrants contributed in the disorder and crime in Fort McMurray (O'Connor, 2015). Although Fort McMurray had growing pains due to rapid growth, O'Connor (2015) found that these issues of social disruption were not unique to the community despite the negative connotations and media imagery. O'Connor (2015) argued that Fort McMurray did not necessarily face only social disruption, rather it faced social change. The social disruption was seen as a normal for the residents instead of being temporary, which had an impact to how the residents of the community navigated around the community.

Although there has been research focusing on community perceptions of social disruption, little has been done on examining the impact on law enforcement agencies. Unfortunately, due to the geographic location of some resource-based communities, governmental efforts spent on protective services to accommodate population growth is underwhelming (Ruddell, 2011). One of the recurring issues with boomtowns is the inability to recognize the need for certain infrastructure and services to accommodate a rapid influx of people (Ruddell, 2011). Ruddell (2011) specifically explored police response in Fort McMurray. Priorities in police leadership may vary depending on location, which can have an impact on the allocation of resources (Ruddell, 2011). According to the findings on boomtown policing, police officers have found that crimes that occur during the

boom cannot be completely blamed on newcomers, as crime in those communities have been occurring prior to the boom (Archbold et al., 2014).

3.3. Understanding Rural Crimes

Though some boomtown research has addressed the rural aspect of boomtowns, some scholars have only alluded to the issue of rurality without addressing the complexities. Given that most boomtowns are located in rural and remote locations; it is necessary to understand that such locations do not always fall under the urban-rural dichotomy. Prior research on rural crime have focused on this dichotomy, predominately on the structural and social features of each area (Donnermeyer & DeKeseredy, 2014). This dichotomy was evolved from Ferdinand Tönnies' distinction of *Gemeinschaft-Gesellschaft*. *Gemeinschaft* assumes that people are able to coexist together in society regardless of the differences that they may have (Tönnies, 1887/2001). The rural milieu is presumed to be idyllic and there is a strong sense of collective efficacy among community members (Donnermeyer & DeKeseredy, 2014). *Gesellschaft*, on the other hand, conflicts with the premise of *Gemeinschaft*. Under *Gesellschaft* people are not united because of community attachments, rather each person is self-serving, resulting in tense conditions (Tönnies, 1887/2001). Wirth (1938) argued urbanism contributes the degradation of societal solidarity due to population heterogeneity that weaken bonds within the community. In other words, disorder and crime tend to increase as anonymity increases as well informal social control in a city.

Due to industrialization, research on urbanism and its impact on deviance and crime grew. Scholars and journalists still use the urban-rural dichotomy to depict the changes in society from industrialization. Donnermeyer and DeKeseredy (2014) indicate that myths about rural crime have been discredited since the first understanding of modern cities in the early 20th century. It is assumed that if there is a high level of collective efficacy in the community than there will be lower crime rates. Rural communities are assumed to have higher levels of collective efficacy whereas urban environments are assumed to have a higher level of social disorganization (Donnermeyer & DeKeseredy, 2014). Stated briefly, collective efficacy, also known as social cohesion within the community that share common goals, can reduce crime levels (Sampson, Raudenbush & Earls, 1997). However, rural criminology research has found this not to be the case. Scholars have found that collective efficacy can take up different forms in rural environments (see Barclay,

Donnermeyer & Jobes, 2004). In fact, some rural communities may have collectively adapted a certain ideology, like hypermasculinity, where certain deviant or criminal behaviour is condoned or even unrecognized as deviant behaviour (Barclay et al., 2004). This, however, goes beyond the scope of this thesis, and could further be explained by subcultural theories.

Some sociologists question whether the *Gemeinschaft-Geselleschaft* dichotomy can be applied to present day rural communities. The issue of isolation in these communities are questionable due to dramatic changes in social, cultural, economic and technological structures (Jacquet & Kay, 2014). Researchers have found that rural and urban communities share similar experiences despite the geographical location of these places (Lichter & Brown, 2011). In fact, the data from the General Social Survey (GSS) indicate that there are more similarities in attitudes and behaviour among urban and rural residents than differences. With urbanization, boundaries between urban-rural contexts are more symmetrical and less distinctive than originally assumed (Lichter & Brown, 2011). Moreover, Jacquet and Kay (2014) argue that rural communities are more resilient to cultural changes, to which the impact of such changes should be examined. This brings to question whether the existing boomtown model for measuring social changes should still be utilized. Recent scholars have argued that there is a need to explore the measures of boomtown model and its applicability to today's context (Jacquet & Kay, 2014).

Chapter 4.

Theoretical Background

Wilkinson, Thompson, Reynold, Jr. and Ostrech (1982) explain that the relationship between local growth and changes in resource-based communities are based on human ecology, which examines the "social organization" of the population and its ability to adjust to a changing environment (p. 243). Some scholars have used Durkheim's (1933/2011) notion of division of labour, where it is argued that societal development contributes to higher levels of crime and deviance (see Messner, 1982; Webb, 1972). Under this view, there are two types of social integrations that exist within society: mechanical and organic solidarity. Mechanical solidarity, which Durkheim (1933/2011) explained social order was achieved through the collective conscience, whereas organic solidarity was the integration of society through individualism that fosters social disorder. Under organic solidarity, crime would increase as the society further develops (Durkheim, 1933/2011). This is namely due to the fact that the normative consensus would diminish, thus increasing crime and deviance. Webb (1972) found evidence that there was a positive relationship between crime and division of labour, however, he found there was no significant relationship between division of labour as an intervening variable for population size, as well as physical and social density with crime. Webb (1972) further indicated there must be modifications made to the division of labour explanations for better measure. As well, Messner (1982) found partial support for division of labour in that organic solidarity, or society further developing toward social equality, does not result in an increase of homicide. Most scholars have used the latter to explore boomtown communities, namely, social disorganization theory.

Social disorganization theory was developed due to the primary interest in the variations in delinquency rates by geographic areas in American cities. Previous ecological studies found there was utility in looking at the geographical components in examining crime and delinquency (see Guerry, 1833). Shaw and McKay's (1969) first study in 1929 was focused in Chicago, and examined geographic development and crime throughout the city. The authors found that Chicago followed a concentric zone model, as proposed by Burgess and Park in 1925 (Shaw & McKay, 1969). The concentric zone model was a radial expansion that was found in many major American cities at the time,

where the different physical, social and cultural city characteristics fell in five zones. The first zone, in the center of the city, was the central business or industrial district and the second was the zone in transition, or the zone that changed from industrial to residential; the third zone included the residences of the working class; the fourth zone was home to those with a higher socio-economic status residential zone; and the fifth zone was the outer commuter, which tended to be outside the city limits (Shaw & McKay, 1969). Shaw and McKay (1969) argued that people slowly encroached zones, that had more desirable living conditions. Due to the differences in the zones, there were socio-economic status segregation among residents. For instance, people who were living in the zone in transition tended to have the lowest socio-economic status due to their proximity to the industrial district (Shaw & McKay, 1969). This segregation resulted in some form of racial segregation. It is important to note at this time this was called racial, based on ancestry as they were almost all of European descent. In other words, immigrants moved to neighbourhoods because housing was affordable. However, this caused issues in building community cohesion due to language and cultural barriers, also known as ethnic heterogeneity (Shaw & McKay, 1969).

Cohen and Felson (1979), however, argued that social disorganization theory overlooked the human ecology aspect by focusing on social ecology. Specifically, social disorganization theory focused on the spatial component of ecology and not the temporal aspect, arguing that criminal events is dependent on the space and time (Cohen & Felson, 1979). By examining people's social activities and understanding in how space and time matters, this can help understand criminal behaviour.

It has been maintained that social disorganization theory and routine activity theory can be used in tandem when explaining neighbourhood outcomes (Smith et al., 2000). Social disorganization theory views crime in at a neighbourhood level, whereas routine activity theory is often used to examine crime at a micro level, though the original use of the theory was at the national level. Prominent studies have tested and applied social disorganization and routine activity through spatial analysis, providing compelling evidence for the application of these two theoretical rationales in explaining neighbourhood crime (see Meithe and Meier, 1994; Rice and Smith, 2002; Smith et al., 2000).

4.1. Social Disorganization Theory

Social disorganization theory uses a social ecological approach in observing the stability of crime patterns. Communities become socially disorganized when residents are unable to recognize common goals, thus generating inadequate social controls (Sampson & Groves, 1989). This allows for more delinquency and crimes to occur within those specific areas (Smith, Frazee & Davison, 2001). Shaw and McKay (1969) found poverty was the most highly influential factor of crime and place. Additionally, they found population stability was positively correlated with decreasing delinquency rates (Cahill & Mulligan, 2003). This could be related to the many resource-based communities, like Fort McMurray, that have experienced substantial social changes in terms of high population turnover, which can contribute to high crime rates (Ruddell, 2017). From these findings, social disorganization theory was developed.

Shaw and McKay (1969), the originators of the theory, examined the breakdown informal social control and delinquency patterns, that persisted in early 20th century Chicago. Like many other major cities during that time, Chicago was experiencing growth and urbanization that impacted levels of crime (Andresen, 2014). By examining neighbourhood characteristics, as well as their respective patterns, Shaw and McKay argued communities that were more cohesive were better able to control juvenile peer groups within their community. Communities with poorer cohesion were not able to control such groups and experienced greater rates of delinquency (Sampson & Groves, 1989). According to Shaw and McKay (1969), three structural influences can lead to the disruption of community social organization including physical conditions of the neighbourhood, economic conditions of the neighbourhood, as well as the population characteristics that of neighbourhood. They argued those who lacked economic resources were unable to be involved or participate with the community, leading to the weaker organization of the community (Sampson & Groves, 1989). However, one of the most prominent misconceptions of economic conditions is the notion that if economic conditions are improved, then crime rates will decrease. This was not the original claim that Shaw and McKay made, rather that poor economic conditions led to higher levels of population turnover as people sought out neighbourhoods with better economic conditions that were more desirable (Andresen, 2014; Bursik, 1988).

To measure physical condition, Shaw and McKay (1969) developed indicators that measured the characteristics of commercial and industrial areas, as well as proximity to these areas. They also considered the distribution of condemned buildings, other physical properties and population changes (Andresen, 2014). Shaw and McKay (1969) explained that a slight change in population can have considerable influence on the rate of delinquency. Generally, when there is a small decrease in the population, a substantial variation in delinquency occurs. However, if the population rate is increased greatly can lead to little or no variation in delinquency rates because over a certain period of time, it is hypothesized that delinquency rates will no longer be impacted by the changes in population (Shaw & McKay, 1969). When assessing economic status, families on government aid, median rental cost and homeownership were analyzed. Finally, to measure population composition, Shaw and McKay (1969) examined percentage of delinquents who were foreign-born and African-American families.

From this study, Shaw and McKay (1969) established a direct and dynamic relationship between specific neighbourhood characteristics and juvenile delinquency. Their research validates the proposition that the development of American cities embodies such characteristics, including delinquency. Furthermore, the differences that exist between neighbourhoods are due to the social values and norms that children are introduced to (Shaw & McKay, 1969). Shaw and McKay (1969) discovered that there was a lower proportion of delinquents and criminals in neighbourhoods with higher economic and social status. These neighbourhoods afforded more security, physically and socially. On the other hand, neighbourhoods with lower socioeconomic status had higher levels of delinquency and crimes. Although many residents in these neighbourhoods attempt to provide the same resources as those of higher economic status, they may be unsuccessful. As a consequence, success for some is achieved through criminal means (Shaw & McKay, 1969).

Sampson and Groves (1989) tested Shaw and McKay's original model but added two structural factors, from systemic theory and social-network theory: family disruption and urbanization. Family disruption was grounded in Cohen and Felson's (1979) routine activity theory, more specifically, a lack of capable guardianship (as cited in Sampson & Groves, 1989). These concepts explain juvenile delinquency can occur when youth are inadequately supervised by their family and the collective community. As for urbanization, Shaw and McKay's main concerns were delinquency patterns within the city. Sampson

and Groves (1989) argued that urbanization can weaken informal relationships and social networks while also obstructing community participation. The data analyzed in this study were derived from the British Crime Survey, which allowed Sampson and Groves (1989) to effectively measure each structural factor due to its comprehensive measures of community variables.

Using BCS data, Sampson and Groves (1989) measured social control by the average social ties within a community, the extent of these relationships, and the level of community participation. Community participation specifically referred to the leisure activities of residents, youth supervision and peer groups. The three main aspects of Shaw and McKay's model of social disorganization measured socioeconomic status, residential stability and ethnic heterogeneity. Sampson and Groves (1989) assessed socioeconomic status using social class variables including education, specifically those who have post-secondary education, occupation and income. The percentage of residents who were raised within their community was an indicator of residential stability. Finally, to determine ethnic heterogeneity, race was measured across five categories including: "white, West Indian or African black, Pakistani or Bangladeshi Indian, other non-white and mixed" (Sampson & Groves, 1989, p. 784). To measure family disruption, Sampson and Groves (1989) used the portion of those who were divorced or separated with those who were married as well as the percentage of household with single parent families. Finally, urbanization was evaluated based on the location of the communities, whether they were located in central-city locations or not.

With respect to dependent variables, Sampson and Groves (1989) measured crimes against persons and crimes against property. Their findings reaffirmed the hypotheses from Shaw and McKay's theory of social disorganization. Furthermore, their study validated the proposition that communities characterized by sparse friendship networks, unsupervised teenage groups and low organizational participation had disproportionately high rates of crime and delinquency. Their results validated the pertinence of social disorganization theory when explaining disproportionate levels of crime in urban neighbourhoods. These results were subsequently confirmed by Loewenkamp, Cullen and Pratt (2003) using newer data from the British Crime Survey.

4.2. Routine Activity Theory

Cohen and Felson (1979) defined routine activity as “any recurrent and prevalent activities which provide basic population and individual needs, whatever their biological or cultural origins” (p. 593). This definition also encompassed activities that may be beyond the scope of basic need, but are frequent and persistent to individual’s daily lives. Daily activities can have an impact on the availability of criminal opportunities due to the specific time and locations of these activities (Cohen & Felson, 1979). Routine activities can occur at the home or outside of the home, including work and leisure activities. Cohen and Felson (1979) argued there was an increase of routine activities away from the home after World War II, due to higher education enrolment and greater labour force participation (particularly by women) and more general increases in disposable income that led to criminal opportunities being more available.

This theory is based on the risk of criminal victimization from a person’s routine activities, criminally related or not (Andresen, 2006). Cohen and Felson (1979) argued the likelihood of crime is due to the convergence of a lack of capable guardianship, a vulnerable or suitable target and a motivated offender through space and time; without one of these factors, most crimes will not occur. The notion of capable guardianship extends beyond the presence of formal social control, such as police or hired security personnel, to include residents and visitors who go about their routine activities (Cohen & Felson, 1979). Routine activities can bring different groups of people together at different times of the day that can alter the availability of opportunities for motivated criminals. Target suitability is determined by the value of target, whether it is property or personal. Cohen and Felson (1979) noted these concepts are not new in criminological theories, but they tend to be overlooked.

Routine activity theory was also developed from the notion that humans are rational beings who make decisions with a cost-benefit analysis. Following this principle, it is argued that crimes are more likely to occur in areas where routine activities create more criminal opportunities with the least chance of detection and the most profitability (Rice & Smith, 2002). Cohen and Felson (1979) argued fluctuations in crime rates can be attributed to alterations in routine activities. Routine activities outside of the home are more likely to increase victimization because a person is displaced from his or her “protective environment” (Andresen, 2007; Cohen & Felson, 1979).

As mentioned, Cohen and Felson (1979) presumed that due to changes in society post-WWII, routine activities had shifted towards non-household activities. Based on this notion, Cohen and Felson (1979) argued that there would be a dramatic increase in crime because the availability in targets increasing as well as the guardianship has been decreasing. There were significant changes between 1960s and 1970s that led to more activities outside of the household. For one, there was a growth in the number of females in post-secondary institutions. Additionally, there was a rise in married females in the labour force. This resulted in an increase of households being unoccupied from early mornings to late afternoons (Cohen & Felson, 1979). Furthermore, during this time, more Americans were taking vacations as they had more disposable income. Due to these changes, Cohen and Felson (1979) expected an increase in personal and household victimizations, as well as business victimizations. In addition, they anticipated an increase in victimizations by a stranger rather than non-strangers.

In their study, Cohen and Felson (1979) found considerable fluctuations among risk of victimizations due to the situation and environment in which people or properties were located. They discovered that crime is reflective of household activities as well as one's proximity to potential offenders. Despite this, those who looked after their house were less likely to have their property victimized than those who worked, attended school or served in the military (Cohen & Felson, 1979). Household victimization rates tend to vary directly with household size. In other words, the higher the number of residents within a household, the less likely they will be victimized. Additionally, the age of the household head had an impact on the victimization rates. It was found that with households headed by persons under 20, the motor vehicle theft rate was nine times as high, and the burglary and household larceny rate as those for households headed by persons 65 and over was four times as high (Cohen & Felson, 1979).

Cohen and Felson (1979) used aggregate official crime trends in the United States to measure their crime rates. They also used results from the Current Population Survey that provides a related time series on labour force and household structure. In doing so, they measured the relationship of household activity ratio to crime rates, using age and unemployment rate as their control variables. The results from this longitudinal analysis demonstrated a positive and significant relationship between household activity and the change in crime rate. These results suggested routine activities influenced opportunities for criminal activity (Cohen & Felson, 1979). The authors highlighted the importance that

crime may not necessarily occur due to a breakdown of social controls but rather a repercussion stemmed from people's routine activities.

Cohen, Klugel and Land (1981) have argued that routine activity theory can be seen as an opportunity model (as cited in Sampson & Wooldredge, 1987). The idea of the opportunity model, derived from Cohen, Felson and Land (1980), explains that ample criminal opportunities are associated with a drop in population densities (as cited in Cohen et al., 1985). Previous research has found that both influences at the individual and he community levels have an impact on victimization (Boggs, 1965). One important aspect of the opportunity model is how the lifestyle and routine activities of individuals has an impact on the community which, in turn, impacts victimization opportunities. This, however, does not suggest the macro dimensions should be overlooked. Instead, Cohen et al. (1981) argued that potential targets that are in closer proximity to motivated offenders are more likely to be victimized. Additionally, community is another imperative aspect in potential victimization, as a motivated offender may be more inclined to offend due to the household and individual targets, as well as the neighbourhood structure (Sampson & Wooldredge, 1987).

Cohen, Kaufman and Gottfredson (1985) broadened the scope of routine activities by adding the notion of "exposure of risk" (p. 447). These scholars explain that the exposure of risk occurs when the accessibility and visibility of targets (i.e., people or objects) to possible offenders (Cohen et al., 1985). When a target is frequently exposed to risk, this increases the likelihood of victimization. For a crime to occur, however, an offender must be in "direct physical contact" with his or her target by which the more contact that takes place, the more likely the motivated offender will offend (Cohen et al., 1985). Cohen and colleagues (1985) explained that the size of a population has an influence on the levels of opportunity for crime. In particular, as the size of the population at risk increases, so does the opportunity for crime.

4.3. Theoretical Integration

There is an overlap in variables between social disorganization and routine activity theories. Meithe and Meier (1994) and other theorists have suggested a cohesive integration of these two theories. Specifically, notions of criminal motivation, or criminality, and criminal opportunity can be considered as parallel (Meithe & Meier, 1994; Rice &

Smith, 2002; Smith et al., 2000). One method of integrating these variables is to interrelate the two theories as “conditional” or the interaction properties (Smith et al., 2000). In other words, the relationships between variables from one theory rely on the principles of another theory (Smith et al., 2000). Two commonalities of these theories include the consideration of social control at the community level, as well as the assumptions about criminal motivation (Rice & Smith, 2002, p. 307). By integrating both social disorganization and routine activity theory, Meithe and Meier (1994) argued that individual activity is grounded in sociological theory in that social conditions influences individual behaviour. Likewise, the individual behaviours are dependent from the neighbourhood. In order for a successful integration of the two theories, there must be a foundation for the interaction effects between individual risk factors and type of neighbourhood (Smith et al., 2000).

Although both theories stress control concepts, they differ at which level control operates. Routine activity theory is often used to understand crime at the micro level – specifically capable guardianship, as this component looks at the various informal social control that surround a criminal event. Social disorganization theory, on the other hand, explains crime at the neighbourhood level, such as examining informal social control that helps prevent crime and delinquency within a neighbourhood (Rice & Smith, 2002). Furthermore, routine activity theory assumes the presence of motivation, while motivation is derived from the neighbourhood’s level of social disorganization (Rice & Smith, 2002). Rice and Smith (2002) further argued that social disorganization theory examines the origins of opportunity more accurately than routine activity, as it is the environmental factors that have an influence on the motivation for criminal activity. However, Rice and Smith (2002) claimed that social disorganization theory does not provide an in-depth understanding into the opportunity of crime like routine activity theory is able to do. Supporters of social disorganization theory assume there is constant level of opportunity provided within the socially disorganized neighbourhood, while proponents of routine activity argue that opportunity is contingent on the spatial and temporal convergence of a motivated offender, suitable target and lack of capable guardianship (Rice & Smith, 2002).

It is important to note there are further conflicts with these theories by which the differing explanations variables provides. For example, higher levels of economic deprivation can lead to increased levels of social disorganization, but higher levels of economic deprivation can lead to lower levels of risk due to reduced criminal opportunities;

similarly, higher levels of socioeconomic status increase social organization, but also increase the suitability of a target (Andresen, 2006).

Both Smith and colleagues (2000), as well as Rice and Smith (2002) using street blocks as a unit of analysis. Smith et al. (2000) examined the integrated theories to measure different levels of street-level robberies, while Rice and Smith (2002) analyzed automotive thefts. Smith and colleagues (2000) found support for the integration of social disorganization and routine activity theories to explain street-level robberies. Additionally, they found street block an appropriate unit of analysis when examining street robberies, as there was strong support from both theories. Similarly, Rice and Smith (2002) confirmed the utility of an integrated theoretical model in describing spatial patterns of auto theft. The individual applications of routine activity theory and social disorganization theory indicates they both have their own distinct, yet imperative, contributions to understanding of spatial distribution the auto theft. Their study validates the relationship between both social disorganization and routine activity theories and, more importantly, the results imply that the influences of the variables are contingent on the values derived from each theory. A socially disorganized street block in convergence with a motivated criminal and opportunity is more likely to result in more criminal interactions (Rice & Smith, 2000).

4.4. Theoretical Expectations

Based on social disorganization theory, crime is expected to the have a positive relationship with ethnic heterogeneity, social and economic deprivation, family disruption and population turnover (Shaw & McKay, 1969). While routine activity theory indicates that an increased population will result in more crime because it allows for more suitable targets. However, an influx of population can also increase the level of guardianship within an area, thus it can reduce the level of crime. Cohen and Felson (1979) also argue that increased family incomes allows for a larger disposable income, which results in a greater risk of victimization. A greater risk in victimization increases levels of crime in a given area. There are apparent overlaps when measuring each theory with conflicting expectations. For example, under social disorganization, an increase of income decreases crime, however, routine activity argues that an increase in income actually increases crime because there are more available and potential suitable targets (Cohen & Felson, 1979).

It is expected that ethnic heterogeneity will not have a prominent relationship with crime in this study due to the ethnic makeup of the population of Alberta. As previously noted, visible minorities, both Aboriginal and non-Aboriginal, constituted a small percentage of the total population (Government of Alberta, n.d.-a). Furthermore, due to the nature of the industry, only a small number of immigrants are able to obtain such opportunities for a number of reasons including language barriers (PetroLMI, 2015). Moreover, those who come are attracted to the employment opportunities are well-educated (Alberta Treasury Board and Finance, 2009). It is then expected that there will be a negative association with crime. Although economic deprivation is expected to positively relate to crime, this may not be measured in the current study. As Figure 4.1 exhibits, as the price oil increases, as do the production rates. Because of this, unemployment may not necessarily have a significant association with crime.

The main expectation of this study follows under the logic of population turnover. It is expected, however, that population turnover will have a positive and significant relationship with crime. As discussed earlier, high population turnover will have an impact on crime as the community is unable to establish strong social relationships with one another in the short term. This also has an impact on guardianship because community residents are unable to determine who are residents and non-residents. When considering the current study area, as previous research has demonstrated that there are distinct differences between long-term residents and short-term residents in rapid growth resource-based communities. This is particularly the case as short-term residents follow a rotational shiftwork, thus inhibiting them from investing time and effort into the community endeavours. Additionally, people employed in the oil and gas industry are likely to have larger incomes, which would increase their likelihood of target suitability, in terms a higher risk of victimization for property and violent crimes. However, a conflicting expectation is because people with larger incomes will have a negative relationship with crime because crimes do not have to be committed to make ends meet.

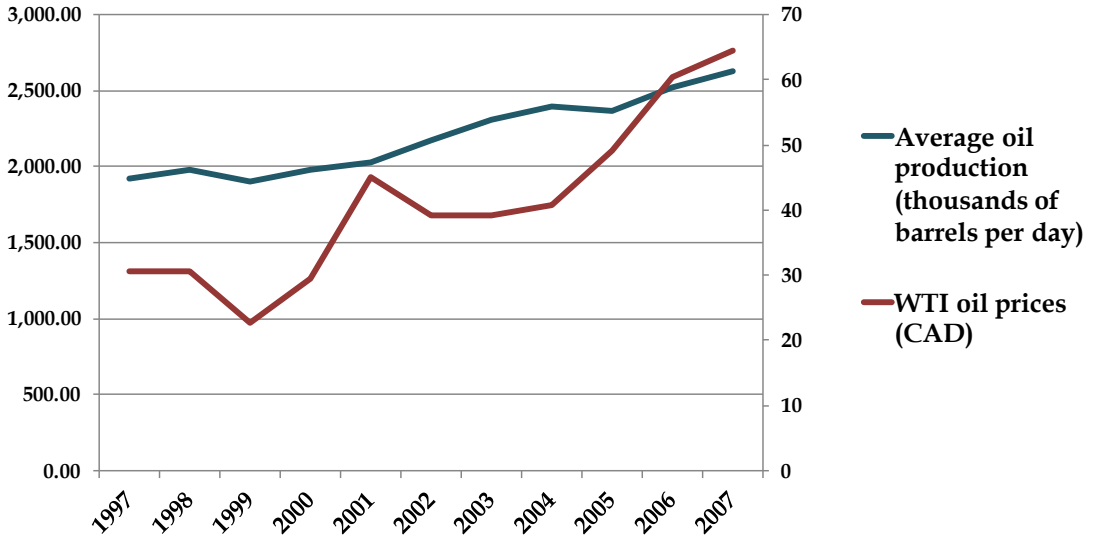

Figure 4.1 Oil production rates and WTI oil prices (1997-2007)

Note: Oil production rates retrieved from IndexMundi (2017); WTI oil prices retrieved from Government of Alberta (n.d.-b). WTI prices were converted from USD to CAD, all prices were adjusted for inflation based on the Canadian Price Index.

Chapter 5.

Data and Methodology

5.1. Data

Longitudinal data is used to examine if there is a relationship between crime and energy prices between 1998 and 2006. The decision for this time frame was made due to the availability of the data, both crime and census. The Canadian census was used to collect information regarding the population residing in Alberta. Three census years were selected, which included, 1996, 2001 and 2006. The study period concluded in 2006 due to changes in data collection in the 2011 census. In 2011, the census forms were modified in that the long-form surveys were done on a voluntary basis (Government of Canada, 2010). Because of this, there are different measures that exist in the 2011 census and, thus, these data were excluded from the study period. The crime and census data were retrieved from the Canadian Socioeconomic Information Management Systems, or CANSIM, by Statistics Canada. The crime data were collected at the police jurisdictional level. Due to the fact that the census data were collected at dissemination or enumeration area level, each dissemination area was transformed and was placed accordingly within each police jurisdiction. The police jurisdiction shapefile was provided by RCMP “K” Division. This procedure was done using ArcMap 10.3, where each dissemination area was transformed into a centroid and matched to its respective police jurisdiction boundaries, and aggregated accordingly. As noted earlier, there are 131 police jurisdictions in Alberta, however, only 102 jurisdictions were included in the analysis. A few jurisdictions were amalgamated with their surrounding jurisdiction due to the way the crime data were collected. All national railway police incident data was removed from the analysis as they did not fall under a specific jurisdiction. Lastly, energy prices were collected from the Government of Canada and Alberta Economic Dashboard, which provides information on the current and historical state of the economy in Alberta (Government of Alberta, n.d.-c).

5.1.1. Energy prices

For the purpose of this study, both natural gas and oil prices were used. As discussed in Chapter 2, previous studies have determined a relationship between oil and natural gas prices due to the interdependent uses (see Brown and Yüchel, 2008; Hartley et al., 2007; Villar and Joutz, 2006). Natural gas prices are set in Canadian dollars per gigajoule (Government of Alberta, n.d.-d, "Natural gas prices"). Oil prices, however, are based from West Texas intermediate (WTI) in US dollars per barrel. In keeping the currency of the energy prices consistent, oil prices were converted into Canadian dollars for their respective years. Both energy prices were then adjusted for annual changes in the Canadian Consumer Price Index to represent constant dollars. Although WTI oil is produced in the United States, it has one of the largest traded crude oil contracts in the world, which is one of the largest oils to influence the crude oil marketplace (Alberta Energy, 2016). As discussed above, WTI oil price is considered the price benchmark in the North American oil marketplace (Alberta Energy, 2016). In other words, crude oil sales into the United States, including sales from Canada, are based on WTI oil prices. This is due to the WTI oil price being traded on the New York Mercantile Exchange (NYMEX), making it one of the largest crude oil trading contracts on the market (Alberta Energy, 2016). Despite the fact that oil produced in Alberta is currently based on the Western Canada Select (WCS) prices, the decision to select WTI prices over WCS was made because, WCS prices were not available until 2004.

The overall trend for oil prices demonstrates that there is a slow inflation over the study period with annual price per barrel starting at $22.64 and increasing to $60.35 in 2006. Following a similar trend, natural gas prices had a gradual inflation throughout the study period with the exception of 2001, when the 9/11 attacks had a significant negative impact on the North American natural gas market (US EIA, 2016).

The original data, both oil and natural gas prices, was collected monthly then aggregated to the annual level to correspond with the crime and census data. A lagged effect was used in the analysis. Nerlove (1958) explains the impact from economic changes, like a price change, is not felt immediately; rather it is distributed over time. For this reason, the oil and natural gas prices from the previous year were also included in the current analysis to account for the lagged effect.

Table 5.1 Descriptive statistics: Energy prices in Alberta, 1998-2006

	Minimum	Maximum	Mean	Std. Deviation
WTI oil prices – current year (per barrel, CAD)	22.64	60.35	43.32	12.53
Natural gas prices – current year (per gigajoule, CAD)	1.92	7.02	4.49	1.53
WTI oil prices – previous year (per barrel, CAD)	22.64	60.35	39.61	10.66
Natural gas prices – previous year (per gigajoule, CAD)	1.92	7.02	4.10	1.68

Note: WTI prices were converted from USD to CAD, all prices were adjusted for inflation based on the Canadian Price Index.

5.1.2. Crime data

Violent crime and property crimes, both at the aggregate and disaggregate level, were examined. Assault (types one, two and three), sexual assault (types one, two and three), thefts (over and under $5000) and theft from automotive vehicle (over and under $5000) were aggregated respectively. These crime types with multiple levels were aggregated for ease of interpretation. Crime types at the disaggregate level were examined as each police jurisdiction varies in sociodemographic and socioeconomic characteristics, which leads to different opportunities for crime. Consequently, any distinct clustering could be hidden at the aggregate level (Andresen & Linning, 2012). Violent crimes at the aggregate level, homicides, assault, sexual assault and robbery were also measured against oil and gas prices. As well as property crimes at the aggregate level, break and enters, theft, auto theft and theft from automotive vehicle were examined. Due to the fact that the crime incident data was collected at policing jurisdictions to explore the relationship, and because some have a smaller population than others, crime rates were reported at a rate per 1000 persons. The average for the total property crime rate was higher than the total violent crime rate. Assault rates, at all levels, had a higher average than other violent crime types; and the mean for theft, for both over and under $5000, was the highest property crime types.

Table 5.2 Descriptive statistics: Crime rates, 1998-2006

	Minimum	Maximum	Mean	Std. Deviation
Violent crimes				
Total violent crimes	0.00	2600.92	28.22	93.96
Assault (all levels)	0.00	1404.268	16.77	54.31
Homicide	0.00	2.26	0.03	0.14

Robbery	0.00	72.09	0.37	2.65
Sexual assault (all levels)	0.00	92.27	1.36	3.38
Property crimes				
Total property crimes	0.00	2919.65	91.48	253.06
Break and enter	0.00	429.64	11.92	21.89
Theft of auto	0.00	129.76	5.20	8.72
Theft (over and under $5000)	0.00	547.87	25.34	32.11
Theft from auto (over and under $5000)	0.00	113.64	6.15	8.04

All rates are per 1,000 persons; n = 918

5.1.3. Ecological data

The Canadian census was used to gather information regarding the population residing in Alberta. Three census years were included in the analysis: 1996, 2001 and 2006. The census data were collected at the dissemination area (DA) and enumeration area (EA) levels, which is comprised of a population of 400 to 700 persons (Statistics Canada, 2015). In 2001, DA delineations replaced EA disseminations, which makes the DA the smallest geographical unit at which the census is disseminated. The DA level was selected due to the fact that it is the most stable geographical unit over time as the DA boundaries respect the boundaries of the census subdivision and census tracts (Statistics Canada, 2015). The only exceptions of variables that were not collected at the DA or EA level were the percent of interprovincial males, percent interprovincial young males and alcohol GDP. These variables were collected at the provincial level due to unavailable data at the smaller unit of analysis.

The ecological variables selected were influenced by the extant research using the framework of Shaw and McKay's (1969) social disorganization theory and Cohen and Felson's (1979) routine activity theory. Both social disorganization theory and routine activity are ecologically grounded, allowing both theories to be used in tandem for empirical analysis. Due to success in their predictive power in previous studies (see Rice & Smith, 2002; Smith et al., 2000), a hybrid approach is used for the selection of ecological variables used this study. Previous research examining social disorganization variables employ a similar framework including ethnic heterogeneity, population turnover, social and economic deprivation and family disruption. Empirical tests of routine activity theory, on the other hand, variables that measure routine activities outside the home. Although some variables cannot be measured in a conventional manner, the Canadian census provides information that measures variables from both frameworks as seen in Table 4.3. To

examine social or economic deprivation (or lack thereof), average family income, average dwelling value, unemployment and university graduation rates were used. Family disruption was measured by percentage of lone parents. Population turnover, an important measure in both social disorganization theory, routine activity theory and boomtown research, was measured by the rate of those who moved in one year or five years, interprovincial migrants, as well as interprovincial migrants of young males aged 15 to 24. To measure ethnic heterogeneity, immigrant and recent immigrant rates, visible minority rates and Aboriginal rates were used. Lastly, Cohen and Felson (1979) state that victimizations are more likely to occur to those who are young and single. In 2014, young males in Canada were 2.5 times more likely to be accused for a criminal offence than their female counterparts (Allen & Superle, 2016). To capture victimizations, young males from 15 to 29, single, lone parent and the rate of those employed in the oil and gas industry were used to capture this victimization.

One limitation of this study is the census information does not account for the working population (i.e., those who are considered as FIFO or DIDO), or the shadow population. However, given the lack of available data on the transient working population, the current analysis attempts to account for this by using percentage of inter-provincial migrants and percentage inter-provincial migrants of young males as previous explanations found there were a larger number of inter-provincial migrants who moved for oil and gas employment opportunities (Alberta Treasury Board and Finance, 2009). There are issues with using these variables in that it is not exclusive to only the population employed in the oil and gas industry, thus any interpretation of either interprovincial migrants' variable should be taken with caution. Lastly, as discussed earlier, the use of oil and gas prices is posited to capture the oil and gas activity due as the influx of people can be attributed to the employment opportunities within such industry.

Table 5.3 Descriptive statistics: Independent variables, 1998-2006

	Minimum	Maximum	Mean	Std. Deviation
Males, aged 15-24 (percentage)	0.00	24.16	7.42	1.84
Single – marital status (percentage)	0.00	80.90	31.15	10.17
Lone parents (percentage)	0.00	36.07	11.78	4.67
Rented – dwellings (percentage)	0.00	89.58	21.95	11.92
Apartment – dwellings (percentage)	0.00	100.00	7.32	9.81
Moved within 1 year (percentage)	0.00	39.63	14.51	5.14
Moved within 5 years (percentage)	0.00	78.09	36.67	10.09
Immigrants (percentage)	0.00	24.52	6.57	3.75

Recent immigrants (percentage)	0.00	5.70	0.80	0.83
Interprovincial migrants (percentage)	0.00	2.80	2.39	0.29
Interprovincial migrants, young males (percentage)	0.00	0.65	0.54	0.07
Visible minorities (percentage)	0.00	23.49	2.48	3.20
Aboriginal (percentage)	0.00	100.00	11.71	17.35
Unemployed (percentage)	0.00	20.08	5.28	3.23
Employed in oil and gas industry (percentage)	0.00	32.77	7.90	6.19
Post-secondary education (percentage)	0.00	79.92	50.90	9.56
Rent – hundreds (CAD)	0.38	8.01	2.71	1.39
Average family income – thousands (CAD)	24.59	132.89	60.68	66.32
Average dwelling value – thousands (CAD)	29.30	535.70	135.40	15.91
Alcohol GDP – billions (CAD)	1.31	1.42	1.34	3.50e+07

5.2. Methodology

Criminologists, as well as economists, have found the utility of using panel data for analysis changes over time. Although many researchers have investigated the effect of changes over time, like the impact of crime rates due to policy changes, many of these studies tend to overlook the temporal element (Dugan, 2010). In other words, such studies have only examined the effects over one period, which, as previously discussed, creates problems in making inferences about changes. By using longitudinal data, or data over a long period of time, better generalizations could be made without the temporal restrictions that come with cross-sectional data (Dugan, 2010).. Panel data has two dimensions: a cross-section dimension, *N*, and a time-series dimension, *T*, are used in the analyses (Hsaio, 2003).

One of the noteworthy criminological studies that used panel data methods was Nagin and Paternoster's (1991) examination of prior delinquency on future delinquency. They found there was a positive relationship between past and future criminality, was namely due to state dependence explanations, or previous participation that encourage delinquency (Nagin & Paternoster, 1991). Other scholars have used panel data in exploring the relationships between unemployment and crime. For instance, Levitt (2001) used panel data to observe the relationship with the lagged unemployment rates to crime rates from 1950 to 1990. Although there was no statistically significant impact with the

lagged unemployment rate and property crime rates, there was a negative association between unemployment rates and crime, which was contradictory to previous conclusions (Levitt, 2001).

In order to examine the relationship between crime rates from energy prices, panel data were used for the current study. Panel data account for time, which unlike cross-sectional data only provides data within a single time point, thus allowing for repeated observations of a number of units measured over time (Dugan, 2010; Hsaio, 2003; Kennedy, 2008). There are a number of benefits in using panel data. For example, models are better estimated using panel data as unobserved variables can be controlled for, even if such variables are not clearly quantifiable (Hsaio, 2003; Levitt, 2001). Panel data address the issue of heterogeneity in micro units by correcting for any bias that may exist in the data and control any differences among the units of measure (Kennedy, 2008; Levitt, 2001). Additionally, because panel data have a larger number of data points, issues of collinearity are reduced which improves “efficiency of econometric estimates” (Hsaio, 2003). By having more units of measures, the generalizability and efficiency of the model can be improved (Kennedy, 2008; Dugan, 2010). Furthermore, the dimension of the time gives the researcher more flexibility, as there are more degrees of freedom, which controls for time-varying influences that can result in spurious coefficients (Andresen, 2009; Hsaio, 2003; Levitt, 2001). Lastly, panel data models allow for a better measurement of dynamic adjustment, which is important when considering economic influences (Kennedy, 2008).

The use of random or fixed-effects estimation is employed to control for the heterogeneity and statistical bias that may occur in panel data (Andresen, 2009; Kennedy, 2008). The main difference between the two approaches is that fixed-effects adds group-specific constant terms, while random-effects adds a group-disturbance term (Andresen, 2009). However, there are limitations with fixed effects estimations. For instance, there is a greater loss of degrees of freedom, which has an impact in the efficiency of the estimation. Additionally, any explanatory variable that is time-invariant must be removed, limiting model specification (Kennedy, 2008). Random-effects estimation, on the other hand, addresses the two limitations that comes with using fixed-effects estimation, but is only used in certain circumstances. Kennedy (2008) explains that random-effects modeling produces a more efficient estimation than fixed-effects modeling. Furthermore, the explanatory variables are not removed that are time-invariant.

Although it may appear that random-effects estimation is preferable to fixed-effects estimation, the model itself requires the satisfaction of an assumption. For instance, Andresen (2009) explains that because random-effects estimation adds the group-specific disturbance term, this term cannot be correlated with any independent variables in the model. With many ecological studies in crime, this correlation tends to exist, because sociodemographic and socioeconomic variables tend to have statistically significant relationships with one another. This occurs when one independent variable is absent from the regression equation and the variation is forced into the disturbance term, resulting in correlations with other independent variables (Andresen, 2009). This creates a bias in random-effects estimation but not in fixed-effect estimation (Kennedy, 2008). As a result, random-effects estimation should only be used when it is certain that the disturbance term is not correlated with any independent variables in the model. In other words, random-effects estimation is most suitable when the model is unbiased (Kennedy, 2008; Andresen, 2009).

An additional consideration should be made when deciding on whether fixed-effects or random-effects estimation is most appropriate. Fixed-effects estimations examine the short-run effects, whereas random-effects estimations consider both the short- and long-run effects to be the same (Kennedy, 2008). As Andresen (2009) has indicated, fixed-effects estimations use short-run variations, like changes in policy, to examine its impact on the dependent variable. Given the objective of the study, which is examining the impact of energy prices' impact on crimes in Alberta police jurisdictions, fixed-effects estimation is the most appropriate statistical procedure to use.

For the purpose of this study, fixed-effects panel estimation is used in the analysis presented below. In order to see whether fixed-effects estimation or random-effects estimation is appropriate for the regression model, the Hausman test is used (Kennedy, 2008; Andresen, 2009). The Hausman test, which is calculated as an *F* test, is based on seeing if the random-effects estimates are insignificantly different from the unbiased fixed-effects estimate (Kennedy, 2008). The results of the Hausman test, the results revealed that random-effects estimation was not appropriate, which was expected. The statistical software package that was used was plm, or Linear Models for Panel Data, within the R Project for Statistical Computing (Croissant et al., 2016). This package allows for "straightforward" estimation of linear panel models and for robust inferences to be made throughout a number of models (Croissant et al., 2016, p. 3).

The fixed-effects estimation is shown in the following equation:

$$y_{ijt} = \alpha + \gamma_j + \sum_{k=1}^{20} \beta_k x_k + \varepsilon_{ijt},$$

where y_{ijt} is crime i in police jurisdiction j at time t, α is the common intercept, γ_j represents the fixed effects (police jurisdictions), β_k is the matrix of the parameter estimates for the k independent variables, x_k is the matrix of k independent for the impact of the energy prices, and ε_{ijt} is the iid error term.

As previously discussed, the number of crimes were transformed into a rates per 1000 persons. Most of the independent variables were transformed into percentages, with the exception of rent, income and dwelling values, and GDP of alcohol, allowing for a simpler interpretation of the estimated parameters. The final model is specified by a general-to-specific methodology, by which variables that do not meet predetermined the significance level of $p \leq .05$ are removed. However, using this methodology leads to a small number of the independent variables remaining in the final models. As a result, all variables are shown with their estimated parameters and standard errors to avoid statistical bias from omitted variables. Lastly, White's heteroskedastic-consistent standard errors are used for all statistical significance testing. Joint-significance testing was employed at various stages when moving from the full to final model to ensure that omitted variable bias was avoided. Full models are provided in the appendices.

Chapter 6.

Results

6.1. Bivariate Results

To explore the relationship of the variables, Pearson's correlation was used. Generally speaking, the correlation coefficients for the independent variables do not reveal any surprising relationships. For instance, males between the ages of 15-24 have a strong positive association with those who are single, as well as those who rent. Likewise, those who moved within one-year and five-years have positive significant relationships with those who live in apartment dwellings. Interestingly, those who have moved within one-year has a weak significant relationship with those who rent, but those who moved within five-years do not have a significant relationship with those who rent.

The most notable significant associations that the energy price variables have are with interprovincial migrants, interprovincial migrants of young males, population employed in oil and gas industry and GDP of alcohol sales. Although the positive associations between energy prices and population employed in oil and gas industry are weaker in magnitude, the two variables that have a stronger relationship are interprovincial migrants and interprovincial migrants of young males. An explanation as to why there may be stronger relationships could be due to families and other workers supporting the energy industry beyond oil and gas extraction (Ruddell, 2017). Additionally, there were strong positive associations with GDP of alcohol sales at the provincial level and energy prices, which can be indicative of the lifestyle of that comes with the oil and gas industry.

The variable measuring those who are employed in the oil and gas industry demonstrate intriguing relationships with other independent variables. Interestingly, the percentage of these workers had non-significant relationships with young males between the ages 15-24, unmarried and those who rent. Because there is a non-significant relationship with rent and those employed in the oil and gas industry, it is not surprising that there is a negative significant relationship with those who are employed in the oil and gas industry and percentage of those living in apartments. Furthermore, there is a positive significant relationship between those employed in the energy industry and those who moved within one year, but there is a non-significant relationship for those who moved

within 5 years. This could be indicative of the nature of the employment market as explained by Ruddell (2017), in that those considered as blue collar employees are there for a shorter term like for the construction phase of an oil or gas project. A similar explanation could be used to explain unemployment and those employed in the oil and gas industry as a positive significant relationship that emerged. However, average dwelling value and those employed in the industry had a negative relationship, which may indicate that the oil and gas population is not necessarily higher the dwelling prices as previously suggested (see Government of New Brunswick, 2012). However, further investigation is needed before fully understanding the nature of the relationship.

Overall, most of the correlation coefficients are well below the typical threshold for multicollinearity concerns of 0.80. There are only a small number of variables that raise concern for multicollinearity, which includes WTI prices for the current year and for the previous year; natural gas prices for the current year and for the previous year; the percentage of those who moved within one year and moved within five years; percentage of recent immigrants and percentage of recent immigrants; as well as the percentage of Aboriginal persons and the unemployment rate. However, in minimizing any omitted variable bias, all ecological variables are maintained, as the concern of the current analysis is with the theoretical understanding of the impact of oil and gas prices. The correlation table is provided in Appendix A.

6.2. Aggregate Crimes

The adjusted-R^2 values for all statistical models are quite small in magnitude, however this was expected to due to the dummy variables encompassing the police jurisdictions that are not included in the calculation of the adjusted-R^2 values. One limitation is that not all cross-sections were tested to examine whether these were same over a nine-year period. This was due to the large number of police jurisdictions that were studied, which would have been an impractical method and may have not changed the qualitative nature of the results. It was surprising to see that both violent and property crimes at the aggregate level did not have a significant relationship with oil and gas prices. However, what was interesting was that the percentage of those who were employed in the oil and gas industry held a significant negative relationship with aggregate violent crime (b = -7.03, p < 0.05). Consistent with expectations, by contrast, the percentage of those who are single (b = 11.17, p < 0.05) as well as percentage of inter-provincial

migrants (b = 21.92, p < 0.05) were found to have positive significant relationships with aggregate violent crime.

Table 6.1 Fixed effects model results for aggregate violent crime

	Estimate (*SE*)
Single – marital status (%)	11.17*** (2.32)
Immigrants (%)	-13.80*** (3.70)
Interprovincial migrants (%)	21.92* (10.84)
Employed in oil and gas (%)	-7.03** (2.69)
Post-secondary education (%)	3.05** (0.95)
Rent – hundreds (CAD)	11.38+ (6.40)
Average family income (CAD)	-2.51** (0.82)
Average dwelling value (CAD)	0.56** (0.18)
Adjusted-R^2	0.08

n = 918, + p < *0.1*; * p < 0.05; ** p < 0.01; *** p < 0.001

As previously mentioned, there was a non-significant relationship between aggregated property crimes and energy prices, as was the relationship between the population employed in the oil and gas industry and property crimes. It was expected that there would be a stronger and a significant relationship with property crime than violent crime. Interestingly, the characteristics that generally make up for the population employed in the energy industry have significant and positive findings. For instance, percentage of young males between the ages 15 to 24 (b = 22.29, p < 0.05) as well as percentage of inter-provincial migrants (b = 18.49, p < 0.05) were found to have significant and positive relationship with aggregate property crimes. In addition, the percentage of those with post-secondary education (b = 1.45, p < 0.1), which is a defining characteristics of the population. Interestingly, at the disaggregate level there were only two crime types that had a significant relationship with property offences: break and enter and theft from auto.

Table 6.2 Fixed effects model results for aggregate property crime

	Estimate (*SE*)
Males, aged 15-24 (%)	22.29*** (6.74)
Single – marital status (%)	5.75* (2.25)
Immigrants (%)	-10.17** (3.17)
Interprovincial migrants (%)	18.49* (8.75)
Post-secondary education (%)	1.45+ (0.76)
Rent – hundreds (CAD)	9.01+ (5.26)
Average family income (CAD)	-2.17*** (0.62)
Average dwelling value (CAD)	0.42** (0.15)
Adjusted-R^2	0.08

n = 918, + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

6.3. Disaggregated Crimes

There is value in looking at crime patterns at the disaggregate level as there are different results that may emerge at different level of analysis (Andresen & Linning, 2012). As previously demonstrated, at the aggregate level, violent crimes had a relationship with the population employed in the oil and gas industry. However, at the disaggregate level, only property crime types had significant relationships with energy prices. Only two crime types were found to have a significant relationship: break and enter and theft from auto. Ruddell (2017) found that property crimes tend to have a relationship in boomtown counties, so it was very surprising to find that there were only two significant findings. Given the fact that different relationships emerged at the disaggregate level than with aggregated crimes, this demonstrates the importance in analyzing specific crime types. Furthermore, the location of the boom, and the time period examined, may also influence findings.

6.3.1. Break and enter

The only energy variable that had a statistically significant relationship with break and enter rates were oil prices for the previous year. This relationship was negative (b = -0.18, $p < 0.05$) and the magnitude of effect size of the previous year oil prices is quite small, which indicates that oil prices has a smaller impact than expected. There is a similar trend when considering oil and gas sector employees (b = -1.18, $p < 0.05$), which also has a negative significant relationship with break and enters. Another interesting finding is the percentage of interprovincial migrants who are young males (b = 14.35, $p < 0.1$) where there is a positive and significant relationship exists the rates of break and enter. In other words, with an increase in percentage of interprovincial young male migrants is associated with higher rates of break and enter offences.

Table 6.3 Fixed effects model results for break and enter rates

	Estimate (*SE*)
Energy prices	
WTI oil prices – lagged 1 year (CAD)	-0.18* (0.07)
Census variables	
Single – marital status (%)	1.70*** (0.40)
Moved within 5 years (%)	0.48* (0.20)

Immigrants (%)	-2.58*** (0.71)
Interprovincial migrants, young males (%)	14.35+ (7.82)
Employed in oil and gas industry (%)	-1.18** (0.44)
Post-secondary education (%)	0.33+ (0.18)
Average dwelling value (CAD)	0.07** (0.02)
Adjusted-R^2	0.07

n = 918, + *p* < *0.1*; * *p* < 0.05; ** *p* < 0.01; *** *p* < 0.001

6.3.2. Theft from auto

Theft from auto was significantly associated with multiple variables including a negative relationship with natural gas prices for the current year (*b* = -0.65, *p* < 0.05). A similar result was found for percentage of interprovincial young males and rates of theft from auto (*b* = -6.58, *p* < 0.05). Interestingly, when looking at the relationship between interprovincial males and property, as well as violent crimes at the aggregate level, they are both positive and significant. The discrepancies in the results could indicate that the population of interprovincial young males are not necessarily as crime prone as the rest of the interprovincial migrants, which contradicts previous findings on young males and crime. Further investigation is needed to examine why this may occur. It is also important to note that reasons beyond interprovincial migration goes beyond the employment market within the oil and gas sector, though it is mostly influenced by labour market opportunities (Amirault, de Muunik & Miller, 2013). As well, there was a negative significant relationship for percentage of those who were immigrants (*b* = -0.93, *p* < 0.05). It was also the case for the percentage of those who rent their housing (*b* = -6.57, *p* < 0.05). These findings suggest that the population of those employed in the oil and gas industry are not responsible for theft from autos in Alberta.

Table 6.4 Fixed effects modeling results for theft from auto rates

	Estimate (*SE*)
Energy prices	
Natural gas prices – current year (CAD)	-0.65** (2.20)
Census variables	
Males, aged 15-24 (%)	2.15*** (0.65)
Single – marital status (%)	-4.08+ (0.23)
Lone parents (%)	-0.38* (0.19)
Dwellings – rented (%)	-0.29*** (0.08)
Moved within 5 years (%)	0.33*** (0.09)
Immigrants (%)	-0.93** (0.31)
Interprovincial migrants, young males (%)	-6.58* (3.14)
Post-secondary education (%)	0.15+ (0.02)

Unemployed (%)	-0.83** (0.29)
Alcohol sales (GDP)	-1.59e-08* (0.00)
Average dwelling value (CAD)	-0.02* (0.01)
Adjusted-R^2	0.07

n = 916. $^{+}$ $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

However, the opposite trend exists for young males, where the increase in percentage of young males is associated with increase in theft from autos ($b = 2.15$, $p < 0.05$). Additionally, there is a significant positive relationship with the percentage of those who moved in the past five years and thefts from autos ($b = 0.32$, $p < 0.05$). Following this trend is the percentage of those who are lone parents ($b = 0.38$, $p < 0.05$). Percentage of those who are unemployed, however, has a negative relationship with thefts from autos ($b = -0.08$, $p < 0.05$). This suggests as the percentage of unemployment increases, the rates of theft from auto decreases. A similar pattern was found for the gross domestic product of alcohol sales, although it is a smaller measure ($b = 2.15$, $p < 0.05$). The average dwelling value has a significant positive relationship with theft from auto rates ($b = 0.02$, $p < 0.05$).

Chapter 7.

Discussion

Inconsistent with expectations, an examination of property and violent crimes at the aggregate level in Alberta demonstrated no relationship with oil and gas prices between 1998 to 2006. It was expected there would be a positive relationship with oil and gas prices and crime, as more employment opportunities will be available, thus resulting in a high population turnover in the province. The only significant finding that did emerge at the disaggregate level, was that break and enter and theft from auto. Both crime types were shown to had a negative relationship with energy. However, this is not surprising based on the theoretical expectations, which can be explained by social disorganization theory and routine activity theory. An increase in energy prices leads to more employment opportunities, and increased in wages. As previously discussed, many people, especially young males, are attracted to the higher wages (Ruddell, 2011). This results in a lower level of motivation for property crime. And although it is arguable that having an influx of young males in the community would lead to an increase in crime, given that this is the prime group for offending, this appears to be not the case for the time period examined. Rather, the standard sociological explanation can be applied: an increased income leads to less crime. By controlling for income, this gives a better proxy for areas that have more people employed in the oil and gas industry. However, the general trend during the oil prices of the study period were increasing. In this case, crimes are expected to decrease because there are lower levels of social disorganization. Similar to previous findings on resource production and crime, these results are not consistent with other boomtown and crime research.

It was surprising to see that there were only two crime types that had significant relationships with oil and gas prices. The lack of significant relationships in this study could be explained by a myriad of reasons. First and foremost, the time-frame of the research does not account for any major volatility in the energy prices. This is namely due to the collection period of the data. As shown in Figure 2, oil prices had a general upward trend. Apparent volatilities existed after the 2008 economic recession, when oil prices dropped from $134.02 USD per barrel to $42.04 USD per barrel over a six-month period, and again in 2014. Any existing volatilities were minor and energy prices slowly increased during the

study period. Natural gas prices, on the other hand, were more volatile in nature. This was due to the seasonality of supply and demand within the natural gas market. The lack of a significant relationship between most crime types is not surprisingly given the previous qualitative research on boomtown effects and crime. Ruddell and colleagues (2014) found that long-term boomtown citizens were not necessarily concerned with UCR part I crime types, rather they were more concerned with UCR part II crime types, like drug offences, disorderly conduct, and driving under the influence. In other words, citizens were more concerned with offenses that contributed to the social disorder and community disruption (see Ruddell and Ortiz, 2015). Subsequent research should consider examining less serious crimes types to better understand the relationship of boomtown effects and community disruption. Examination in less serious crime types can also determine whether there is validity in sensationalized headlines on illicit activities in resource extraction communities.

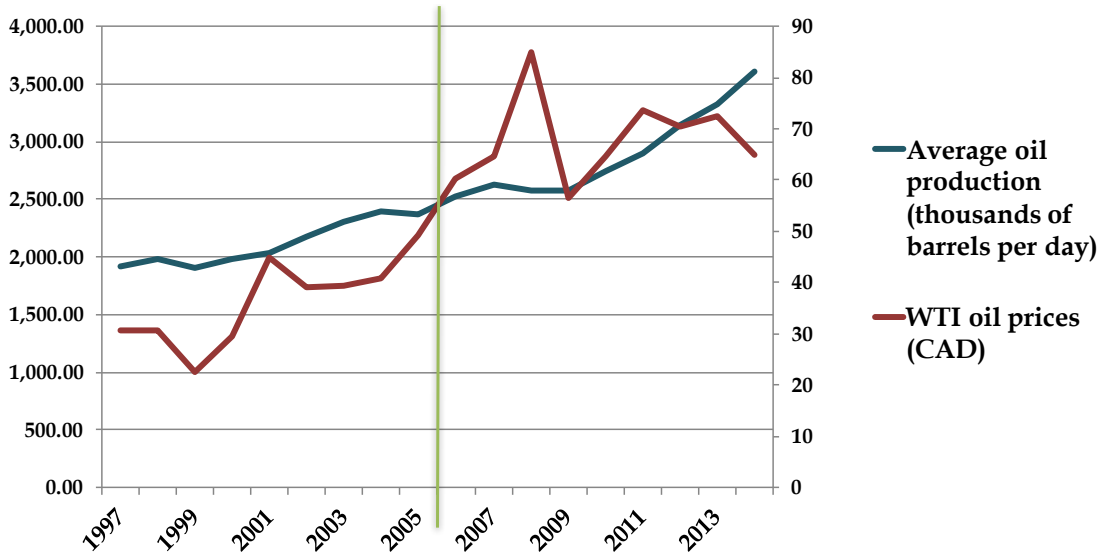

Figure 7.1 Oil production rates and WTI oil prices (1997-2014)
Note: Green line indicates the end of study period. Oil production rates retrieved from IndexMundi (2017); WTI oil prices retrieved from Government of Alberta (n.d.). WTI prices were converted from USD to CAD, all prices were adjusted for inflation based on the Canadian Price Index.

Contrary to the anecdotal accounts of violence in Alberta, there were no statistically significant relationships that emerged when energy prices and violent crime types were examined. Wilkinson, Reynolds, Thompson and Ostresh (1984) have previously questioned whether social disruption influences levels of violence. These scholars maintain that the disruption associated with energy developments may not

necessarily be accurate predictors of violent crime. Rather increased levels of violence contributed to extended structural issues in the community (Wilkinson et al., 1982). Moreover, due to the nature of the work in the oil fields, violent crimes may not occur given that some oil and gas production sites require a “dry camp.” Employers do not allow for alcohol in company supplied housing, mainly for safety and liability reasons (PetroLMI, 2015). However, the decision for camps to allow alcohol is dependent on camp owners, though they tend to follow closely to company policy (PetroLMI, 2015). If there is a relationship between non-dry camps and violence then these that are dry and have much less violence, they could cancel each other out in the regression analysis. Some oil and gas companies administer random drug tests, in order to increase safety. Cenovus Energy, for example, has implemented a drug and alcohol program for all contractors for preventative and testing purposes (Cenovus Energy, 2011). Furthermore, the spending on alcohol did not have a significant relationship with any crimes, with the exception of homicides. However, homicide did not have significant relationship with any of the variables related to the oil and gas industry. This result should be interpreted with caution as it was measured at the provincial level due to the lack of available data at the jurisdictional level.

This research reveals that economic factors, such as oil and gas prices, may not necessarily be the best indicator of the population in oil and gas industry. The variable that best predicted higher levels of most crime types, with the exception of homicide, was the population employed in the oil and gas industry. This was an interesting finding as it was expected that energy prices would have an indirect relationship with this variable. As noted earlier, fluctuations in energy prices impact the number of oil and gas projects, thus employment opportunities in this sector would also fluctuate. If energy prices were to increase over time, more investments would be made to oil and gas projects. Ruddell (2017) explains that new oil and gas projects increase employment opportunities due to the construction of projects. However, employment opportunities tend to decrease after the construction phase ends. This could contribute to the mixed findings at different points in the time period examined. Additionally, as Ruddell (2017) indicated there are differences involvement in crime in blue-collar, and white-collar occupations. Generally speaking, those who have rotational shiftwork, or what is considered as blue-collar employment, are less likely to make a contribution to the community. Again, this is due to the nature of the blue-collar jobs where employment is considered DIDO/FIFO, thus

making them likely to invest in the community. This relates back to how employment opportunities increase when construction of a new oil or gas project commences then decreases after the project has been established (Ruddell, 2017). Because blue-collar employment opportunities can be seen as short-term employment, or project dependent, they have less stake in the community (see O'Connor, 2015). Considerations for future research should further explore this population, especially given that there are different types of employment within the oil and gas sector. This can include, but not limited to field workers, geologists, engineers, as well as executive levels of the industry and many other types of job positions in this industry (PetroLMI, n.d.). Further examination of this population, as well as families and workers who support oil field activities, may demonstrate results that may not have been captured by looking at oil and gas production and prices.

Although the population of interprovincial migrants could be used to help account for the shadow population in Alberta, it still lacks the ability to represent those who moved within the country for specific employment reasons. As previously discussed, there are apparent differences between the federal and municipal census (Friesen, 2015; Reid & Boyd, 2015). In 2011, the federal census reported that the population of RMWB was around 65,000, however, the municipal census indicated that the population was about 73,000. This number did not include the shadow population, which would increase the population count to 116,000 (Friesen, 2015). Similarly, Reid and Boyd (2015) found there was a vast contrast between the federal reported census and the municipal reported census population in 2012. The federal reported census population for RMWB was 73,321, while the municipal reported census population was 58 percent higher (116,407 residents) (Reid & Boyd, 2015). With recent economic projections anticipating that oil and gas prices will improve, leading to an increase in drilling projects (Petroleum Services Association of Canada, 2017), as well as the approval of new pipeline projects, the Government of Alberta should consider strategies enabling them to collect data that captures shadow population. It would beneficial in allowing for a better understanding this population as well as future research examining the social impact on boomtowns. Additionally, provincial and federal funding is often based on the population.

Another indicator that was consistently associated with most crime types was the population of immigrants, which was surprising. For the most part, the immigrant population had a significantly strong and negative relationship with crime types, consistent

with the more recent research on the relationship between immigration and crime (Andresen, 2013). This is primarily due to the fact that a large proportion of immigrants moved to larger metropolitan areas, like Calgary, Edmonton and Lethbridge, or surrounding areas. There are also lower participation rates of immigrants in the oil and gas workforce despite industry efforts made to recruit them. However, there are also many limitations that immigrants trying to enter into the industry including lack of work and professional credentials, limited understanding of the work culture in Canada, the inability to adapt in a remote location and, most simply, language and cultural barriers (PetroLMI, 2015).

As briefly mentioned, the current research does not account for the 2014 oil crisis in Canada (Mouallem, 2015). The concurrent oil production of Canada, Saudi Arabia, Iraq and Russia further contributed to the overproduction in early 2014 (NEB, 2015b). This resulted in Alberta's energy sector suffering a 75 percent drop in crude oil prices (Lampher, 2016). As the prices in oil were declining, so were the oil production rates (NEB, 2015b). There were a number of implications in the Canadian economy that were of a result of decline in oil prices. In 2015, approximately 40,000 jobs in Alberta were lost due to the plummeting oil prices. Furthermore, it was projected that the total number of job losses would be about 185,000 jobs (Moullem, 2015). Given these changing economic conditions, it can be expected that a bust would result in higher levels of unemployment and crime. There is a substantial amount of research focusing on the relationship between unemployment and crime (Andresen & Linning, 2015). Based on the theoretical understanding of routine activities, Cohen and Felson (1979) have argued that social changes in a criminal's routine activities can change their exposure to criminal opportunities. Furthermore, Cantor and Land (1985) maintained that most research on unemployment and crime focused on the motivated offender aspect of routine activities, but examination of the suitability of targets and capable guardianship. However, the recent changes in the marketplace had a significant effect on the oil market and not necessarily was concerning to the natural gas market. Natural gas remained steady during this time. This was due to the unusual colder weather experienced in both Canada and United States, which resulted in an increase in demand and more natural gas retrieved from storage (NEB, 2015a). The prices of natural gas remained higher to continue production to displace these demands for future winters.

This research was limited in that only a specific time frame was examined. Specifically, this time frame was focused during the early stage of a boom in the oil and gas industry, which may possibly explain why the results were not as strong as expected based on the number of crime types and magnitude of the estimated parameters. However, when examining an extended boom period, different relationships may emerge. For this research, the boom period was examined due to a lack of data collected in the 2011 Census. As a result, the same variables could not be included in the analysis as the study could be non-parsimonious. Future research should also consider examining the bust period after the oil and gas revenues decrease whether the cause is economic or related to natural disasters.

Another recent setback to the oil and gas industry were the wildfires that occurred in the Fort McMurray area which, as previously mentioned, the largest resource-based community in Alberta. The wildfires caused an evacuation of the entire municipality. It also led to many oil companies to reducing their production rates or shutting down their projects (Cattaneo, 2016). Approximately 14 percent of the national oil and gas workforce were located in the Fort McMurray area at this time. There was over 266,800 hours of work lost in the natural resource sector[3], which resulted in 20 percent decrease in gross domestic products of non-convention oil extraction industry (Statistics Canada, 2017e). This caused a seven percent decrease in crude oil exports and a 16 percent decrease in refined energy exports (Statistics Canada, 2017e). Although this goes beyond the scope of this thesis, the impact of a natural disaster could have an impact on crime. People are more displaced, and their routine activities change. Moreover, there could be a potential increase in different types of economic crimes, not necessarily the traditional crime types examined in this study. According to Statistics Canada (2017e), the Alberta wildfire was “the most expensive natural disaster in Canadian history” (“The Fort McMurray wildfire”), costing insurance companies over 3.5 billion dollars. These types of disasters could serve as a natural experiment in the study of crime and residential instability, unemployment and economic stress.

Future research should consider the development of model that will assist in predicting of crime and community disruption in rapid growth cities such as Fort McMurray.

[3] Natural resource sector also includes oil and gas extraction, forestry, mining, quarrying and fishing (Statistics Canada, 2017e).

However, caution should be taken for when developing a model, as it was found that social, economic population-related and geographic differences can lead to variation. Despite the attempts made by Fort McMurray to predict the growth of population, the municipality was still unable to accommodate for such changes. However, it is not unusual for cities facing economic growth to poorly anticipate such changes (Park & Stowkowski, 2008). Future research should further explore the impact of a resource-based boom beyond the social interactions among community members. Other aspects including infrastructure, resource and service availability should also be examined. These findings can better assist such communities to anticipate structural and social changes from a population influx.

Chapter 8.

Conclusions

The need to better understand the boom-crime relationship is apparent when examining the oil and gas industry in Alberta. This industry is very prominent in this province to the point where it has an impact on entire province socially, economically and culturally. Although there have been multiple studies examining resource-based communities and crime, there are more challenges that emerge from these mixed findings revealed in this research. This study incorporates another factor used to measure the impact of the resource boom, energy prices. Although there were only two crime types that have significant relationships with energy prices, both findings were negative. Caution should be taken when interpreting these results because of the limitations outlined above, however, consistent results are important in understanding the relationship of crime and the oil and gas industry. Moreover, one variable that emerged in almost all crime types was the variable measuring those who are employed in the oil and gas industry. This highlights the need to be more creative in measuring this population, especially those who are not captured at the census level. Better quantifying this population can provide a more thorough understanding of the impact of the oil and gas industry and criminal behaviour in Alberta.

The growing body of literature demonstrates that this phenomenon should not be taken at face value and that it is complex and multi-faceted. Previous research investigating the impact of resource boom and communities have demonstrated the importance of examining different aspects. Continual research in this area is needed to better our understanding of the boom-crime relationship.

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Appendix A. Pearson's correlations table of independent variables

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
WTI oil prices – current year (CAD), X1	1	0.862***	0.816***	0.842***	-0.015	0.047	0.078*	-0.083**
Natural gas prices – current year (CAD), X2		1	0.737***	0.711***	-0.008	0.047	0.094**	-0.070*
WTI oil prices – lagged 1 year (CAD), X3			1	0.924***	-0.016	0.043	0.068*	-0.082*
Natural gas prices – lagged 1 year (CAD), X4				1	-0.015	0.047	0.080*	-0.085**
Males, aged 15-24 (percentage), X5					1	0.749***	0.049	0.751***
Single – marital status (percentage), X6						1	0.505***	0.712***
Lone parents (percentage), X7							1	0.091**
Rented – dwellings (percentage), X8								1
Apartment – dwellings (percentage), X9								
Moved within 1 year (percentage), X10								
Moved within 5 years (percentage), X11								
Immigrants (percentage), X12								
Recent immigrants (percentage), X13								
Interprovincial migrants (percentage), X14								
Interprovincial migrants, young males (percentage), X15								
Visible minorities (percentage), X16								
Aboriginal (percentage), X17								
Unemployed (percentage), X18								
Employed in oil and gas industry (percentage), X19								
Post-secondary education (percentage), X20								
Rent – hundreds (CAD), X21								
Average family income – thousands (CAD), X22								
Average dwelling value – thousands (CAD), X23								
Alcohol GDP – billions (CAD), X24								

Note: + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}
WTI oil prices – current year (CAD), X_1	0.019	-0.021	-0.113***	-0.020	0.079*	0.496***	0.468***	0.063+
Natural gas prices – current year (CAD), X_2	0.027	-0.028	-0.094**	-0.024	0.063*	0.324***	0.301***	0.055+
WTI oil prices – lagged 1 year (CAD), X_3	0.010	-0.022	-0.109***	-0.019	0.074*	0.542***	0.539***	0.059+
Natural gas prices – lagged 1 year (CAD), X_4	0.013	-0.025	-0.112***	-0.022	0.076*	0.508***	0.426***	0.061
Males, aged 15-24 (percentage), X_5	0.559***	0.584***	0.440***	0.117***	0.210***	-0.014	-0.014	0.267***
Single – marital status (percentage), X_6	0.458***	0.521***	0.344***	-0.042	0.132***	0.018	0.014	0.269***
Lone parents (percentage), X_7	0.108***	0.086**	0.035	-0.187***	-0.025	0.000	-0.011	0.039
Rented – dwellings (percentage), X_8	0.711***	0.694***	0.535***	0.270***	0.284***	-0.039	-0.034	0.451***
Apartment – dwellings (percentage), X_9	1	0.580***	0.469***	0.416***	0.424***	0.012	0.010	0.569***
Moved within 1 year (percentage), X_{10}		1	0.895***	0.361***	0.337***	0.013	0.016	0.530***
Moved within 5 years (percentage), X_{11}			1	0.427***	0.347***	-0.072*	-0.065*	0.512***
Immigrants (percentage), X_{12}				1	0.806***	0.001	0.003	0.758***
Recent immigrants (percentage), X_{13}					1	0.057+	0.053	0.720***
Interprovincial migrants (percentage), X_{14}						1	0.972***	0.036
Interprovincial migrants, young males (percentage), X_{15}							1	0.032
Visible minorities (percentage), X_{16}								1
Aboriginal (percentage), X_{17}								
Unemployed (percentage), X_{18}								
Employed in oil and gas industry (percentage), X_{19}								
Post-secondary education (percentage), X_{20}								
Rent – hundreds (CAD), X_{21}								
Average family income – thousands (CAD), X_{22}								
Average dwelling value – thousands (CAD), X_{23}								
Alcohol GDP – billions (CAD), X_{24}								

Note: + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

	X_{17}	X_{18}	X_{19}	X_{20}	X_{21}	X_{22}	X_{23}	X_{24}
WTI oil prices – current year (CAD), X_1	0.036	-0.168***	0.125***	0.010	0.209***	0.401***	0.342***	0.497***
Natural gas prices – current year (CAD), X_2	0..037	-0.152***	0.107***	0.051	0.157***	0.350***	0.295***	0.098**
WTI oil prices – lagged 1 year (CAD), X_3	0.033	-0.162***	0.117***	0.005	0.195***	0.375***	0.321***	0.538***
Natural gas prices – lagged 1 year (CAD), X_4	0.036	-0.170***	0.122***	0.018	0.199***	0.395***	0.336***	0.566***
Males, aged 15-24 (percentage), X_5	0.097**	0.015	-0.026	0.355***	0.087**	0.148***	0.073*	-0.017
Single – marital status (percentage), X_6	0.587***	0.486***	0.000	0.146***	-0.022	-0.005	0.020	0.019
Lone parents (percentage), X_7	0.788***	0.774***	0.074*	-0.102**	-0.060+	-0.091**	-0.117***	0.005
Rented – dwellings (percentage), X_8	0.030	0.030	-0.042	0.325***	0.182***	0.015	0.064*	-0.057+
Apartment – dwellings (percentage), X_9	-0.156***	-0.143***	-0.080*	0.460***	0.387***	0.295***	0.357***	-0.009
Moved within 1 year (percentage), X_{10}	0.007	0.014	0.107***	0.551***	0.531***	0.379***	0.380***	-0.001
Moved within 5 years (percentage), X_{11}	-0.078*	-0.022	0.087**	0.667***	0.608***	0.491***	0.449***	-0.077*
Immigrants (percentage), X_{12}	-0.420***	-0.322***	-0.286***	0.501***	0.513***	0.345***	0.489***	-0.005
Recent immigrants (percentage), X_{13}	-0.200***	-0.195***	-0.154***	0.330***	0.419***	0.317***	0.410***	0.055+
Interprovincial migrants (percentage), X_{14}	0.013	-0.076*	0.078*	-0.069*	0.178***	0.233***	0.207***	0.399***
Interprovincial migrants, young males (percentage), X_{15}	0.009	-0.064*	0.070*	-0.077*	0.166***	0.203***	0.182***	0.373***
Visible minorities (percentage), X_{16}	-0.174***	-0.145***	-0.110***	0.482***	0.484***	0.357***	0.413***	0.038
Aboriginal (percentage), X_{17}	1	0.870***	0.117***	-0.297***	-0.331***	-0.274***	-0.291***	0.015
Unemployed (percentage), X_{18}		1	0.076*	-0.268***	-0.263***	-0.336***	-0.326***	-0.099**
Employed in oil and gas industry (percentage), X_{19}			1	-0.202***	0.003	0.195***	-0.115***	0.078*
Post-secondary education (percentage), X_{20}				1	0.514***	0.589***	0.599***	-0.053+
Rent – hundreds (CAD), X_{21}					1	0.655***	0.606***	0.161***
Average family income – thousands (CAD), X_{22}						1	0.794***	0.245***
Average dwelling value – thousands (CAD), X_{23}							1	0.213***
Alcohol GDP – billions (CAD), X_{24}								1

Note: + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Appendix B. Fixed effects model results for aggregate violent crime – full model

	Estimate (*SE*)
Energy prices	
WTI oil prices – current year (CAD)	-1.06 (1.35)
Natural gas prices – current year (CAD)	11.72 (9.55)
WTI oil prices – lagged 1 year (CAD)	-2.74 (2.41)
Natural gas prices – lagged 1 year (CAD)	14.43 (15.77)
Census variables	
Males, aged 15-24 (%)	17.02^{+} (10.32)
Single – marital status (%)	6.84^{+} (3.68)
Lone parents (%)	-0.55 (2.90)
Dwellings – rented (%)	-0.61 (1.54)
Apartments – dwellings (%)	-0.30 (1.02)
Moved within 1 year (%)	-0.60 (2.71)
Moved within 5 years (%)	1.87 (1.81)
Immigrants (%)	-20.53*** (5.74)
Recent immigrants (%)	15.29 (11.68)
Interprovincial migrants (%)	-93.86 (132.03)
Interprovincial migrants, young males (%)	501.71 (563.50)
Visible minority (%)	-1.37 (5.98)
Aboriginal (%)	0.49 (1.04)
Unemployed (%)	4.89 (4.40)
Employed in oil and gas industry (%)	-7.88** (2.90)
Post-secondary education (%)	1.80 (1.19)
Rent (CAD)	11.85^{+} (6.50)
Average family income (CAD)	-2.10* (1.03)
Average dwelling value (CAD)	0.64** (0.20)
Alcohol sales (GDP)	1.72e-07 (1.96e-07)
Adjusted-R^2	0.09

n = 918, $^{+}$ $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Appendix C. Fixed effects model results for aggregate property crime – full model

	Estimate (*SE*)
Energy prices	
WTI oil prices – current year (CAD)	0.12 (1.10)
Natural gas prices – current year (CAD)	2.51 (7.78)
WTI oil prices – lagged 1 year (CAD)	-0.14 (1.97)
Natural gas prices – lagged 1 year (CAD)	-1.82 (12.86)
Census variables	
Males, aged 15-24 (%)	21.92** (8.41)
Single – marital status (%)	5.01+ (3.00)
Lone parents (%)	0.74 (2.37)
Dwellings – rented (%)	0.65 (1.25)
Apartments – dwellings (%)	-1.48+ (0.83)
Moved within 1 year (%)	-0.12 (2.21)
Moved within 5 years (%)	0.66 (1.48)
Immigrants (%)	-12.67** (4.68)
Recent immigrants (%)	6.27 (9.52)
Interprovincial migrants (%)	45.54 (107.62)
Interprovincial migrants, young males (%)	-102.02 (459.29)
Visible minority (%)	-1.18 (4.87)
Aboriginal (%)	0.63 (0.85)
Unemployed (%)	-0.41 (3.58)
Employed in oil and gas industry (%)	-2.50 (2.37)
Post-secondary education (%)	0.83 (0.97)
Rent (CAD)	8.94+ (5.30)
Average family income (CAD)	-1.84* (0.84)
Average dwelling value (CAD)	0.44** (0.16)
Alcohol sales (GDP)	-1.12e-08 (1.60e-07)
Adjusted-R^2	0.08

n = 918, + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Appendix D. Fixed effects model results for break and enters – full model

	Estimate (*SE*)
Energy prices	
WTI oil prices – current year (CAD)	-0.17 (0.02)
Natural gas prices – current year (CAD)	1.50 (1.66)
WTI oil prices – lagged 1 year (CAD)	-0.42 (0.42)
Natural gas prices – lagged 1 year (CAD)	1.67 (2.74)
Census variables	
Males, aged 15-24 (%)	1.74 (1.79)
Single – marital status (%)	1.32* (0.63)
Lone parents (%)	0.07 (0.50)
Dwellings – rented (%)	0.07 (0.27)
Apartments – dwellings (%)	-0.18 (0.18)
Moved within 1 year (%)	0.11 (0.47)
Moved within 5 years (%)	0.39 (0.32)
Immigrants (%)	-2.76* (0.99)
Recent immigrants (%)	0.15 (2.03)
Interprovincial migrants (%)	-11.09 (22.96)
Interprovincial migrants, young males (%)	61.17 (99.80)
Visible minority (%)	-0.38 (0.18)
Aboriginal (%)	0.03 (0.02)
Unemployed (%)	0.05 (0.08)
Employed in oil and gas industry (%)	-1.23* (0.05)
Post-secondary education (%)	0.03 (0.02)
Rent (CAD)	1.09 (1.13)
Average family income (CAD)	-0.04 (0.18)
Average dwelling value (CAD)	0.09* (0.03)
Alcohol sales (GDP)	1.20e-08 (3.41e-08)
Adjusted-R^2	0.08

n = 918, + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Appendix E. Fixed effects model results for theft from auto – full model

	Estimate (*SE*)
Energy prices	
WTI oil prices – current year (CAD)	0.13 (0.10)
Natural gas prices – current year (CAD)	-1.47* (0.69)
WTI oil prices – lagged 1 year (CAD)	0.35* (1.13)
Natural gas prices – lagged 1 year (CAD)	-1.95^{+} (1.14)
Census variables	
Males, aged 15-24 (%)	1.98** (0.74)
Single – marital status (%)	-0.33 (0.27)
Lone parents (%)	0.42* (0.21)
Dwellings – rented (%)	-0.34** (0.11)
Apartments – dwellings (%)	0.04 (0.07)
Moved within 1 year (%)	0.16 (0.20)
Moved within 5 years (%)	0.33* (0.13)
Immigrants (%)	-0.59 (0.41)
Recent immigrants (%)	-0.99 (0.84)
Interprovincial migrants (%)	20.69* (9.50)
Interprovincial migrants, young males (%)	-94.70* (40.61)
Visible minority (%)	-0.21 (0.43)
Aboriginal (%)	-0.09 (0.07)
Unemployed (%)	-0.65* (0.32)
Employed in oil and gas industry (%)	-0.12 (0.21)
Post-secondary education (%)	0.14 (0.09)
Rent (CAD)	0.16 (0.47)
Average family income (CAD)	-0.06 (0.07)
Average dwelling value (CAD)	0.03^{+} (0.01)
Alcohol sales (GDP)	-3.03e-08 (1.41e-08)
Adjusted-R^2	0.09

n = 918, $^{+}$ $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$