

Disclosure Regulation and Competition between Multinational and Domestic Investment

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ABSTRACT

What is the role of the information environment in foreign investment? Do foreign multinationals gain from host-country transparency regulation? This paper explores the informational aspects of liability of foreignness, taking advantage of a natural experiment in the petroleum industry. Canadian securities regulations since 2004 mandate that oil and gas companies include the estimated size and value of underground reserves in their financial reporting. Using gas and oil field acquisition data, the paper examines whether this change affects the asset valuations of reserve acquirers, and whether the valuation effect is different between foreign and domestic firms. Analysis of 2299 oil reserve deals finds that greater transparency has a positive effect on valuation, and the effect is stronger for domestic investment than for FDI, suggesting that domestic firms gained in competition with foreign MNCs for supply sources. The paper draws on economic theories of adverse selection and knowledge perspectives on economic geography to explain its findings.

Keywords:

Accounting standards; Liability of foreignness; Foreign direct investment; Oil; Information asymmetry

INTRODUCTION

The ‘liability of foreignness’ (LOF) describes the additional cost that multinational corporations (MNCs) firms face abroad, above those incurred by domestic firms (Hymer, 1976; Zaheer, 1995). The sources of such liability include relational costs (e.g., transportation and coordination, local-network access), discrimination (by consumers or host governments), and information costs (unfamiliarity with markets, consumer preferences, labor practices) (Eden and Miller, 2004).

Substantial research in corporate finance (Gomes-Casseres et al, 2006; Zhu et al, 2011) capital markets (Gu et al, forthcoming), and international business (Zaheer, 1995; Mezas, 2002; Taussig, 2017), examines consequences of LOF. Less attention has been devoted to disentangling its causes, which are often grouped together under institutions in empirical work. This study draws on perspectives from finance and accounting, strategy, economic geography, and knowledge to explore the information dimension of LOF.

Although informational disadvantage is widely cited in the literature as a dimension of LOF (see survey by Denk, Kaufmann, and Roesch, 2012), studies of informational influences on foreign direct investment (FDI) do not compare MNCs with domestic firms, and hence cannot address LOF (e.g., Kingsley and Graham, 2017). Research on transparency and FDI focuses on emerging markets; but as Glennerster and Shin (2008) note, “the level of transparency across countries is highly correlated with other institutional characteristics that are, in the long run, likely to be codetermined.”

Information available to domestic firms and MNCs is difficult to measure or compare, and differences in behavior and performance among firms have multiple causes, making informational dimensions difficult to isolate. Moreover, MNC unfamiliarity is likely too broad a concept to be effective in explaining differences between foreign- and domestic-firm investment.

In tackling these challenges, both the theoretical focus and empirical design depart from traditional analysis at country, industry, and firm levels. Instead, the paper applies asymmetric-information theory from economics to examine individual asset acquisitions, in an arena where investment valuation is difficult because sellers possess better information than buyers, and asset quality

is hard to ascertain.¹ Akerlof's (1970) lemons model suggests that under these circumstances, adverse selection leads all acquirers to discount the value of target assets.²

The paper applies the lemons model to LOF. Its insight is that in the presence of informational LOF, foreign firms value assets less than do domestic firms, because domestic firms' superior access to local knowledge reduces information asymmetry. In principle, tests for informational LOF could be based on comparison of prices of assets acquired by domestic and foreign firms. However, a major obstacle in comparing FDI and domestic investment is that MNCs may value investments differently from domestic firms for reasons other than informational LOF. For example, they may possess technological or managerial advantages, enabling them to operate assets more effectively. They may also face greater political hazards than domestic firms, have more operating experience, encounter more challenges in different cultures, etc. Moreover, these reasons are not limited to value creation. For example, managerial empire-building through international expansion may lead to overpayment for foreign acquisitions.

Separating information from other dimensions of LOF presents research challenges. Here, strategy for identifying relationships between the information environment and investment relies on a single regulatory change in a single country, trading off generalizability for traction in identification and institutional richness. The laboratory is the upstream (exploration and production) petroleum industry, where assets are underground, and information asymmetry is a central issue.³ Petroleum accounts for the largest single item by value in international trade, and is one of the largest for FDI (Weiner, 2005).

The paper relies on a change in financial-statement reporting introduced in Canada in 2003.⁴ National Instrument 51-101 mandated disclosure of firms' estimates of size, aggregate value, and extraction cost of petroleum reserves, defined as underground oil and gas reservoirs ("fields") extractable

¹ *Asset acquisition* is used for both company takeovers (M&A) and factor purchases for greenfield investment.

² *Lemons* refers to used automobiles of low but unobservable quality. Used automobiles offered for sale are likely to be of below-average quality (referred to as adverse selection). Because buyers cannot observe quality, they discount the value of all used automobiles.

³ For example, for many years the New York Stock Exchange did not allow listing of mining and petroleum securities (Michie, 1986), due to investors' inability to verify corporate assets.

⁴ Canada is the 10th largest FDI recipient, with a significant share targeting natural resources (Gowans, 2016).

economically under current government policies and regulation, at current prices and costs.⁵ The regulation altered the information environment in a country with strong institutions, potentially reducing information asymmetry while leaving potentially confounding factors unchanged, thereby enabling identification of information effects. The paper exploits this regulatory change to examine consequences for FDI and domestic investment, focusing on managers' willingness to pay to acquire assets.

With data on petroleum reserves acquisitions in North America from 1990 to 2009, the paper investigates the valuation effect of the introduction of mandatory reserve disclosure. Limiting host countries to Canada and the USA provides an empirical setting with little institutional and economic variation over time or space, as well as substantial MNC activity.⁶ North America's low political risk and strong property-rights institutions provide comfort that LOF is informational, rather than discrimination against foreigners.⁷ It also renders unlikely 'advantages of foreignness' stemming from domestic institutional voids, superior foreign technology, consumer-reputation effects, etc. (Nachum, 2010; Kingsley & Graham, 2017; Taussig 2017).

It is important to note that these regulations govern corporate-level disclosures, while the analysis looks at individual investments. Corporate-level financial statements are periodic snapshots, reflecting outcomes of managerial decisions over time, and need not include information about size or value of individual reserves. Project-level disclosures are not legally mandated, and depend on the voluntary practice of individual firms (Cannizzaro & Weiner, 2015); moreover, reducing asymmetric information may not be in asset-owners' interests.⁸

⁵ Following industry practice, *reserves* is a shorthand for *leases with reserves*; e.g., "Each year Alberta Energy holds an average of twenty-four sales (*Public Offerings*). The word 'sale' is used by tradition, although it is a misnomer, since the Crown always retains title to its minerals" (Alberta Energy Regulator, 2016). FDI and domestic investment entail purchase and development of leases, which give leaseholders rights to extract and sell oil and gas from reservoirs.

⁶ For example, foreign MNCs are a majority of producers in the US offshore, the most capital-intensive industry segment (IHS Markit, 2018). In Canada, foreign MNCs account for about 40% of industry assets and operating income (<https://www150.statcan.gc.ca/t1/tb1/en/tv.action?pid=3310003301>).

⁷ This is particularly important for real property (e.g., land, buildings, natural resources), which in many countries has more FDI restrictions than other sectors, as well as less-clear property rights (Glen, 2011).

⁸ For example, when the US firm Apache purchased BP's Forties field in the UK North Sea in 2003, its managers reported "significant in terms of capturing value in the first year was the unexpected backlog of corrosion and

Nonetheless, financial statements may be helpful in valuation of reporting-firm assets, and potentially for other firms' assets as well.⁹ Stricter disclosure regulation potentially alters the information environment in three ways. At the country level, greater transparency may build investor confidence in data accuracy. At the firm level, managers who must file regulatory reports are likely to be more careful and accurate regarding individual assets.

Moreover, investors may be able to make inferences about assets from aggregate reports. For example, target accounting information quality is associated with profitability of M&A deals (McNichols & Stubben, 2015; Humphery-Jenner et al., 2017).Badia et al (2018) find that increases in a firm's reported reserves results in additional investment by its competitors,

In order to isolate the effect of disclosure changes from other influences on asset value, tests employ a difference-in-differences (DiD) design, with reserve investments in the USA as control group.¹⁰ US reserves-disclosure regulation has been promulgated and enforced by the Securities and Exchange Commission (SEC) since 1978.¹¹ The paper then employs a triple-difference (difference-in-difference-in-differences, or DDD) design to distinguish the impacts on foreign MNCs from those on domestic firms. This design has the advantage of avoiding comparisons of US and Canadian asset values, which may be affected by exchange-rate changes and country-specific factors.

Consistent with the lemons model, the paper finds positive valuation effects from heightened transparency. However the findings on FDI run contrary to both the scholarly literature and policy advice, which focus on host countries with weak institutions (e.g., high corruption, poor investor protection, lack of independent judiciary and media). Researchers view FDI as facilitated by both private (Shroff, Verdi, and Yu, 2014) and government (Kingsley and Graham, 2017) transparency; policymakers recommend

maintenance work needed prior to starting up ... operations in order to reverse natural production decline.”

<http://gaffney-cline-focus.com/creating-long-term-value-in-upstream-mergers-and-acquisitions>

⁹ Badertscher et al (2013) find industry spillover effects from public corporate reporting to investment choices made by privately-held firms.

¹⁰ In Canada, reserves *in situ* are owned mostly by governments, in the USA mostly by private landowners. Apart from government restrictions on leaseholder eligibility, mineral leases confer similar cashflow and control rights.

¹¹ See <https://www.sec.gov/divisions/corpfin/guidance/oilandgas-interp.htm>

greater transparency to attract foreign MNCs (Glennerster and Shin, 2008). The opposite results hold in Canada, where institutional quality is high. Valuation increases are larger for reserves acquired by domestic firms than for those purchased by foreign MNCs, suggesting that informational LOF is exacerbated by transparency-enhancing regulation. The paper draws on knowledge dimensions of economic geography and the management-learning literature to explain its findings.

This study makes several contributions. First, it provides a rare empirical test of informational LOF. The dearth of empirical tests for information disadvantages stems from data limitations, lack of appropriate measures, and difficulty in finding settings with varied information environments across countries. FDI stocks and flows have been widely used to understand cross-national differences in activities of MNCs' foreign affiliates, but recent literature questions whether they constitute accurate measures of firms' multinational activities (Beugelsdijk et al, 2010). Moreover, while FDI flows can provide insight into the role of the information environment, assessing LOF requires domestic benchmarks. Firm-level investment data have been suggested as an alternative, but data availability limits studies (Leino & Ali-Yrkkö, 2014). The oil and gas field acquisition data used in this paper allow us to observe corporate investment valuation effects at the transaction level.

Second, it extends to FDI the literature on the effects of changes in disclosure regulation. Previous empirical studies have primarily looked into securities-market settings to analyze investor response to disclosure mandates (Easley and O'Hara, 2004; Lambert, Leuz, and Verrecchia, 2007); evidence from corporate investment is sparse (Chen, Young, & Zhuang, 2013; Bell, Filatotchev, and Rasheed, 2012).

Third, it illuminates consequences of institutional change for firm competition and performance. While market-facilitating institutions (e.g., societal, public-sector, and regulatory transparency) are viewed as beneficial at country level, theory and evidence at firm level is both limited and confined to emerging markets (Banalieva et al, 2018). Indeed, US oil companies have lobbied against increased disclosure, on grounds of competitive disadvantage (Hughes & Pendred, 2014).

This paper's contribution is illuminating effects on competition between domestic and foreign firms. Research finds that market-facilitating government policies confer advantages on foreign MNCs, as domestic firms' institution-specific and relationship-specific capital depreciates (Perez-Batres and Eden, 2008; Sun et al, 2010). Adverse-selection-reducing policies may aid not only market functioning, but foreign MNCs as well.

Fourth, it offers a new perspective on the literature on informational environments. Information quality and availability is often viewed as closely related to, or even a dimension of, country-level institutions (Glennerster & Shin, 2008; Shroff et al, 2014; Cannizzaro & Weiner, 2015; Kingsley & Graham, 2017), rendering it difficult to isolate from other institutional effects. North America proves a setting where information can be studied while controlling for institutions.

Finally, it adds to the literature applying economic geography and knowledge perspectives to FDI (Gertler 2003; Pinch et al, 2003; Tallman et al, 2004). Effects of geographically-concentrated knowledge on performance is a central question. The natural experiment that increased information availability occurred in an environment where this literature suggests that domestic firms were likely better-informed than foreign MNCs.

Industry Setting – Petroleum Reserves Investments

Gaining empirical traction on the informational dimensions of LOF requires a setting where information is both measurable and potentially asymmetric. Satisfying both presents a research challenge: if scholars can readily measure information accurately, so can MNC managers, hardly prospective for examining LOF. Moreover, the information should be essential to firm performance to be of interest.

The setting is competition at the beginning of the value chain. As in other natural-resource industries, access to raw-material supplies is a central aspect of firm strategy and performance. As an inventory of future production (and hence a predictor of future earnings), reserves are critical to firm

value.¹² Moreover, reserves influence firms' borrowing capacity (Chung, Ghicas, & Pastena, 1993; Muñoz, 2009; Marek & Wilson, 2014)¹³. The accounting literature demonstrates that oil and gas reserve disclosures are value-relevant (Misund & Osmundsen, 2015; Taylor, Richardson, Tower, & Hancock, 2012), and informative to investors (Harris & Ohlson, 1987).

Several factors make reserves a propitious laboratory for examining the effects of disclosure regulation. First, because they are underground, their size is neither public information nor directly observable; instead, probabilistic estimates are reported.¹⁴ These estimates entail substantial judgment by technical experts, managers, and regulators,¹⁵ and can vary significantly.¹⁶ Reserve size and quality are not part of firms' balance sheets,¹⁷ and hence estimates are not audited.¹⁸ Moreover, managers may have incentives to overestimate reserves as a result of their compensation structures.¹⁹

More broadly, reserves have two advantages in FDI research. First, because they constitute most of firm value, they provide an investment-valuation measure independent of securities-market conditions. The literature (e.g., Weitzel and Berns, 2006) typically employs abnormal returns or takeover premia, which likely reflect these conditions, biasing results towards statistical significance. Moreover, they

¹² Reserves are estimated to comprise over 70% of firm value in the upstream petroleum industry (Dharan, 2004).

¹³ For example, "On December 4, 2014, Touchstone Trinidad and Primera Oil and Gas Limited [Touchstone's Trinidadian subsidiary] (*the "Borrowers"*) entered into an agreement with The Bank of Nova Scotia, as administrative agent, collateral agent and initial lender, for a credit facility maturing on December 2, 2017. US\$15 million was available immediately, with the remaining balance available following the periodic redetermination of **the borrowing base calculated by the value assigned to the net proved reserves attributable to Touchstone's onshore properties located in Trinidad.**" Touchstone Exploration (2016), emphasis added.

¹⁴ *Proved reserves* refer to the quantities of oil and gas underground that are commercially extractable with at least 90% probability. *Proved + probable reserves* are similarly defined, but with at least 50% probability, and *Proved + probable + possible reserves* are those with at least 10% probability. See Society of Petroleum Engineers, *Petroleum Reserves Definitions*, <http://www.spe.org/industry/petroleum-reserves-definitions.php>

¹⁵ "The accuracy of any reserve estimate is a function of the quality of available data, engineering and geological interpretation, and professional judgment" (Akin Gump, 2004). Roesle (2007) provides a list of 20 questions for investors to ask to interpret reserves reporting. Tennent (1915) discusses oil-well information-gathering by oil scouts in the industry's early days as a form of corporate espionage

¹⁶ Click and Weiner (2010) find that reported reserve estimates are significantly more optimistic in acquisitions announced by buyers than by sellers.

¹⁷ Book values of reserves are reported with firm assets based on historical costs, which are typically not closely related to reserve size or quality.

¹⁸ As discussed below, Canada since 2004 is an exception. Companies' reserves reports must be accompanied by an independent audit.

¹⁹ Over half of the 100 largest listed US upstream petroleum companies use reserves as a performance measure in CEO annual incentive plans. https://www.alvarezandmarsal.com/sites/default/files/am_tax_ep_2017_report_final.pdf

allow examination of corporate investment beyond takeover of traded firms, which constitute a small part of FDI targets.

Second, reserves are similar and comparable across transactions and firms. They are largely homogeneous except for cost differences, which facilitates managerial investment valuation if reserve size and extraction costs (including environmental costs such as decommissioning and infrastructure removal) can be estimated accurately. Valuation is further facilitated by the fact that reserves are both tangible and raw-material inventory; managers (and researchers) need not make judgements about values of intangible assets such as brand name.

Asset homogeneity also facilitates secondary markets for physical capital such as petroleum reserves, commercial buildings, and aircraft. These markets are decentralized, with prices negotiated privately and reported voluntarily; private information is thus more likely to have observable consequences.²⁰ Reserves trading is further enhanced by the exhaustible nature of the resource – when a firm depletes its existing reserves through oil and gas production, its survival requires exploration and development, reserve purchase, or both (Coleman, 2005; Sabet & Heaney, 2016). Secondary markets for petroleum leases in North America date back at least a century (Warren, 1956), data collection on reserve acquisitions to the 1980s (Adelman and Watkins, 1995, 2005). Like other real-asset markets, trading involves third-party brokers and information vendors.²¹ Some vendors maintain databases of reserves transactions; here, data are from IHS Markit; others include Derrick Petroleum Services, and GlobalData.²²

Regulatory Change

²⁰ Effects of information-asymmetry on asset value are observable in centralized markets only when barriers obstruct access, e.g. Chinese A and B share trading (Tang, 2011); otherwise, all buyers pay the same price.

²¹ Examples of brokers and information sources respectively can be found at <http://www.gbm.scotiabank.com/IndustrySpecializations/gib-energy/completed-ma-transactions/year-ma-current.htm> and https://ihsmarkit.com/pdf/SEAM2015_217201110913060132.pdf

²² Other studies analyzing petroleum-reserve transactions include Click and Weiner (2010) and Sabet and Heany (2016), who use IHS; and Bass and Chakrabarty (2014) and Hsu et al (2017), who use Petroleum Listing Service.

In 2003, the Canadian Securities Administrators approved National Policy Instrument 51-101 (NI 51-101), *Standards of Disclosure for Oil and Gas Activities*, which mandated baseline governance measures regarding estimation and disclosure of the size and value of reserves a firm possesses. The Ontario Securities Commission (2003) Notice sets out its objective - information-asymmetry reduction to benefit managers and investors:

“The purpose of the new regulation is to enhance the quality, consistency, timeliness and comparability of public disclosure by reporting issuers concerning their upstream oil and gas activities. The new disclosure standards are designed to enhance investor confidence in Canadian capital markets and facilitate the raising of new capital by oil and gas reporting issuers... information about oil and gas reserves and activities is essential to enable investors to make informed investment decisions”

The regulations were arguably an exogenous shock to the industry, adapting analogous disclosure rules from mining, where they were in response to the 1990s Bre-X gold-mining fraud.²³

The new regulatory framework required firms listed in Canada to disclose the estimated size and value of proved and probable reserves, starting in 2004.²⁴ Estimation must follow procedures detailed in the Canadian Oil and Gas Evaluation Handbook. Managers and directors must review and approve the content of reserve estimates and filings, and the regulation encouraged the establishment of a majority-independent reserves committee of the board charged with overseeing reserve estimation and disclosure. Both reserve estimates and management and board approvals must be reported on forms filed annually with Canadian securities regulators, and available to the public through the System for Electronic Document Analysis and Retrieval (SEDAR).

²³ National Instrument 43-101, effective 2001, tightened disclosure rules in the mining industry (Roberts, 2015).

²⁴ For an example, see Touchstone Exploration (2016).

In contrast, reserve reporting was not mandated prior to NI 51-101, except in prospectuses.²⁵ Such a change to mandatory disclosure law provides a natural experiment for analyzing buyer valuations in reserve acquisition as a result of a change in financial reporting standards. The change also effectively rules out alternative explanations for differences between domestic and foreign investment, such as political, institutional, and cultural distance (Ahern et al, 2015). These distances change gradually, if at all.

THEORY DEVELOPMENT AND HYPOTHESES

A major source of LOF is MNC managers' unfamiliarity with host country institutions, culture, tastes, etc. (Eden and Miller, 2004). Information asymmetry takes a step beyond unfamiliarity to arenas where agents with private information interact directly with those who do not (Bergh et al, 2019). For example, sellers of securities are better informed about firm value, while investors are at risk of overpaying for 'lemons', and respond to the adverse selection problem by reducing their offer price (Akerlof, 1970).

The concept of adverse selection provides insight into the broader informational LOF arising in cross-border investment settings. Whereas adverse selection stems from unequal distribution of information between sellers and buyers, informational LOF describes broader differences between foreigners and host-country firms in the information environment. The question is whether and how a change in the external information environment that influences information asymmetry between sellers and buyers can also affect LOF.

Applying the lemons model to transactions involving FDI suggests that there could be differential informational asymmetry among buyers. Foreign MNCs experience information asymmetry more than domestic firms because they have both less access to local information, and less ability to interpret it (Bell

²⁵ Prior to 2004, reserve reporting was governed by NP Statement 2-B, "Guide for Engineers and Geologists Submitting Oil and Gas Reports to Canadian Provincial Securities Administrators" (Stikeman 2003); Schlumberger, 2003).

et al., 2012). If information asymmetry is reduced through regulatory change, foreign MNCs may react differently from domestic firms.

While the concept of information asymmetry is widely used in management research, adverse-selection models are not (Bergh et al, 2019). The paper instead draws on scholarship in two areas of the finance and accounting literature. First, corporate-finance research (Badertscher et al, 2013; Shroff, et al, 2014) examines the role of the information environment in investment decisions and valuation. M&A studies have also explored information asymmetries between various market actors (Reuer et al, 2004; Martin and Shalev, 2016; McNichols and Stubben, 2015; Humphery-Jenner, Sautner, and Suchard, 2017), and how information quality (Capron and Shen, 2007; Shen and Reuer, 2005) can reduce these asymmetries.

Second, the securities-markets literature (surveyed in Leuz and Wysocki, 2016) is relevant because it studies disclosure regulation, despite its focus on measuring and explaining information asymmetry between managers and shareholders.²⁶ Disclosure standards are important components of the information environment, and stricter reporting regulation enhances the level of transparency by making more value-relevant information publicly available.

Disclosure is likely especially important for Canadian firms. The country's minimal listing requirements result in a large number of small, early-stage companies.²⁷ Many have little earnings track record, hindering financial-model valuation and increasing investor need for non-financial (e.g., reserves) reporting. Carpentier and Suret (2018) describe Canadian IPOs as a lemons market, with the median (mean) natural-resource-company IPO raising only C\$0.7 million (C\$12.6 million). In contrast, in the USA median (mean) IPO proceeds were US\$100 million (US\$229 million). In Canada, 78 percent of

²⁶ This literature includes a study of reserve-disclosure regulation in Canada and the USA. Badia et al (forthcoming) examine effects of regulatory changes on securities prices and trading liquidity, and provide more detail on accounting changes. Our work complements theirs in its focus on real investment, domestic as well as FDI.

²⁷ In 2008 over half of Canadian petroleum companies employed fewer than five people (Mansell et al (2012:11)

natural-resource-company issuers had no revenues at the time they went public; the USA requires revenues to list.²⁸

Reserve acquirers need credible information in order to evaluate the quality and quantity of the resource, as well as to estimate its costs of development and retirement. As target information becomes more readily available, they can draw a clearer picture of its value. Greater transparency in the information environment associated with disclosure quality thus reduces adverse selection problems (Humphrey-Jenner et al 2017; Shroff et al., 2014). If information asymmetries and the problem of adverse selection can be mitigated through tightening mandatory disclosure, then:

Hypothesis 1. More-transparent information environments raise asset value

Use of reserve disclosure to examine LOF is merited only if Hypothesis 1 is supported. It may not, however, either (1) because light-touch securities-regulation enforcement (Puri, 2012; Anand and Green, 2018) could affect compliance with NI 51-101 reporting, reducing investor confidence in disclosure reliability; or (2) because companies' information disclosure may be unimportant or redundant. For example, asset sellers provide potential acquirers copious private information through 'data rooms.' While not public, data rooms are central to M&A markets, and accessible to qualified acquirers for a fee (Haag and Wiggins, 2016).²⁹ Alternatively, government reporting may substitute for company disclosure.³⁰ If reserves disclosure is viewed by investors as uninformative or redundant, or public information is much less important than private information, Hypothesis 1 will not find support.

In addition, to provide comfort that valuation increases are due to information-asymmetry reduction rather than omitted-variable bias, the paper examines variation in seller size. Smaller firms lack

²⁸ Natural-resource-companies account for the majority of Canadian IPOs. Canadian statistics refer to 1986-2016, US statistics to 2000-2016 (Carpentier and Suret, 2018).

²⁹ See <https://www.azu.hr/en/exploration-and-production/data-room/data-room-offshore> for an example of data room description.

³⁰ For example, the Alberta Energy Regulator provides detailed reserves reports, the accuracy and usefulness of which is difficult to ascertain. <https://www.aer.ca/providing-information/data-and-reports/statistical-reports/archives>

reputations to protect, and receive less (if any) coverage by information intermediaries such as trade press and analysts. As a result, they are less known to the market, and more subject to adverse selection, diminishing the value of their assets (Black, 2001).³¹ Therefore, smaller asset owners are expected to gain more from a more transparent informational environment.

Hypothesis 1'. The valuation effect of transparency regulation is greater for assets of small firms than large firms.

In addition to the reasons above, Hypothesis 1' may not be supported, because firms utilizing reserves as collateral for bank loans must provide reserve reports by credible independent auditors. Such “reserve-based lending” is the financing mainstay for smaller upstream-petroleum firms (Marek & Wilson, 2014).

FDI and the information environment

If transparency helps reduce information asymmetries, the imposition of stricter disclosure rules in the host country should increase value for all investors, but some firms may gain more than others. The second hypothesis deals with the question of who gains more from transparency in the information environment. The third hypothesis concerns effects on competition for investment.

Information asymmetry is likely more severe when buyer and seller are from different countries, because domestic managers have better access to local knowledge than their foreign counterparts. Thus mandated improvements in disclosure of reserve size and quality should reduce MNCs' informational LOF, leading MNCs managers to raise their valuations more than managers of domestic firms.

The literature focuses on information asymmetry between managers and portfolio investors in securities markets. Findings include firms listing on US markets experience lower information asymmetry (Herrmann, Kang, & Yoo, 2015). Domestic investors earn higher trading returns than foreigners because they have better knowledge about fundamentals of local companies, and can leverage that information in securities pricing (Hau, 2001; Kalev, Nguyen, & Oh, 2008; Baik, Kang, Kim, & Lee,

³¹ Barth et al (2017) find greater underpricing in US IPOs by smaller firms.

2013). Initial public offerings (IPOs) on foreign markets are underpriced relative to domestic IPOs, reflecting greater information asymmetry (Francis, Hasan, and Li, 2001). Asymmetric information is a major source of ‘home bias’; portfolio investors tend to invest disproportionately in domestic securities, and trade more in those in more-transparent information environments, where they can better assess risk and earnings prospects (Kang, 1997; Kalev et al., 2008). Similarly, Du et al (2017) find that ethnic-Chinese analysts in the USA produce more accurate forecasts of Chinese companies than other analysts.

Heterogeneous information asymmetries between foreign and domestic firms are also likely in corporate investment. Foreign firms likely face a greater challenge in interpreting regulated information disclosures due to informational LOF, as they typically know less about the host country than do local investors in ways that affect investment valuation. Cross-border M&A deals fare worse than domestic deals for US-acquirer value (Moeller and Schlingemann, 2005); this result arises from deals where the target is unlisted, and hence informational disadvantages of foreign acquirers are more acute (Meng and Sutton, 2017). Thus, changes in the information environment may produce differential valuation effects.

The mainstream finance and accounting view suggests that corporate reporting conveys similar information to all investors. A large literature (surveyed in Leuz & Wysocki, 2016) finds that stricter disclosure reduces information asymmetry between managers and shareholders, raising firm value. For example, publicly-held firms are worth more when they are listed in countries with stricter financial-reporting rules.

Applying this logic here, a more transparent information environment will likely benefit foreign firms more than it does domestic firms. Because they are less informed than local competitors, they are likely to increase the amount they value reserves by more than domestic firms under stricter regulation. In other words, foreign firms will be more sensitive than domestic firms to changes in the information environment.

Hypothesis 2. Foreign firms increase their valuation of assets more than domestic firms do in more transparent information environments.

This boost to foreign MNCs should make them more competitive in the acquisitions market:

Hypothesis 3. Foreign firms increase their share of the M&A market as a result of reducing their liability of foreignness.

Findings from securities markets may not extend to corporate investment, however. Shareholders hold diversified portfolios, relying on accounting data as a basis for holding small positions in a large number of securities. In contrast, managers undertaking periodic large corporate investments dedicate financial and human resources to information-gathering beyond knowledge codified in financial reporting.

The paper looks to scholarship on knowledge perspectives on economic geography in developing theory suited to corporate, rather than portfolio investment. This perspective suggests that insiders – local firms with greater tacit knowledge (private knowledge not obtainable from written documents) – are able to utilize their private information to exploit additional mandated disclosure more effectively than outsiders, such as foreign MNCs. Pinch et al (2003) point out that codified and tacit knowledge interact in providing competitive advantage: “Not only is codified knowledge effective when interpreted through a variety of tacit measures, but tacit knowledge often relies on codified knowledge,” (p. 376). Gertler (2003) notes that tacit knowledge transmission is context-dependent, involving informal interaction and trust, and hence is concentrated locally. Like Pinch et al (2003), he characterizes tacit and codified knowledge as complements.³²

Cohen and Levinthal (1990) develop the theory of absorptive capacity, which implies that tacit and codified knowledge are complements. They note “the ability to exploit external knowledge is ... a

³² Similarly, the accounting literature explores whether private and public information are substitutes or complements in securities trading (Kim and Verrecchia, 1994) Unlike LOF, these affects are transitory, and do not affect corporate investment (Amiram et al, 2016).

critical component of innovative capabilities. The paper argues that the ability to evaluate and utilize outside knowledge is largely a function of the level of prior related knowledge” (p. 128). The theory has been extended to cross-border M&A (Reus & Lamont, 2009).

Here knowledge in two distinct areas is tacit and context-specific. First, familiarity with local geology, coming from firm experience (oil and gas fields typically cover multiple leases), or from informal networks of firms operating nearby.³³ Canadian petroleum reserves are geographically concentrated. Of the 863 Canadian acquisitions in the sample, the primary locations of only 96 are outside the western provinces of Alberta and British Columbia, and only 5 are outside these two provinces and neighboring Saskatchewan.³⁴ Moreover, within these three provinces, petroleum areas are concentrated (see Figure 1).

Insert Figure 1 about here.

Canadian petroleum companies are also tightly clustered, near both reserve locations and each other. Of the 74 Canadian-headquartered companies listed on the Toronto Stock Exchange 68 are in Alberta and 5 in British Columbia. On the Toronto Stock Exchange Venture for small companies, the corresponding figures are 114 Canadian-headquartered companies, of which 57 are in Alberta and 45 in British Columbia.³⁵ With few exceptions, the former are clustered in Calgary, the latter in Vancouver.

The second area is interpretation of the judgment-calls behind reserves reporting, such as those described above. Some reporting companies may have a higher level of trustworthiness or capability, as well as reputation for conservative vs. aggressive booking of reserves, stemming from corporate culture,

³³ Private information about petroleum leases is so important in Alberta that firms seek to conceal their identities in lease-auction bidding (Winter, 2011). On the US Outer Continental Shelf, firms operating in neighboring areas bid higher in auctions for leases, consistent with local informational advantage (Haile, Hendricks, and Porter, 2010).

³⁴ Another 250 acquisitions do not include primary-province information.

³⁵ Exchange-listing Information as of February 2018; see <https://www.tsx.com/resource/en/713>

compensation incentives, managers' personalities, etc.³⁶ This reputation may be known in local networks, but not to foreign firms. Such knowledge is likely helpful in interpreting mandated disclosures.³⁷

From the knowledge and learning perspective, the finance and accounting view in Hypothesis 2 above effectively assumes tacit and codified information do not interact, making them substitutes in investment.³⁸ MNC managers are helped more than managers of domestic firms by the mandated increased level of codified knowledge because it helps offset their lack of private information, via a reduced need to invest in information-gathering (e.g., by seeking entry into local networks).

The knowledge-management literature suggests an alternative hypothesis – that local firms' private information helps their managers interpret mandated disclosures, providing advantage in competition with foreign MNCs for investment opportunities:

Hypothesis 2a. Foreign firms increase their valuation of assets less than domestic firms do in more transparent information environments.

Hypothesis 3a. Domestic firms increase their share of the M&A market as a result of their heightened knowledge advantage.

Hypotheses 1 and 2 are diagrammed in Figure 2.

Insert Figure 2 about here.

³⁶ “Attributes of the asset class— miles below the surface, significant natural variability within the oil and gas reservoir—make conventional engineering precision ... impossible ... lack of precise definitional and engineering standards can naturally lead to a range of interpretive outcomes, both conservative and aggressive” (Meyer and Zorn, 2004).

³⁷ UBS Investment Research (2005) discusses the importance of conservative vs. aggressive reserves reporting, and provides survey results of US petroleum companies' reputations, based in part on whether they utilize external reserve audits, and if so, whether the audits are performed by well-regarded reservoir-engineering firms.

³⁸ “When local public information ... is unavailable, capable firms can use private information ... to make up for the missing public information. To the extent this privately-held information is a substitute for local public information, investors with these capabilities have a competitive advantage” (Kingsley & Graham, 2017: 328).

EMPIRICAL DESIGN

The DiD method is used to identify the causal effect of a specific intervention, such as a regulatory change, by examining the difference in outcomes before and after the intervention for the group affected by the intervention, and for an unaffected group (Reeb et al, 2012). Here, the enactment of the disclosure law in Canada is the treatment, allowing us to compare the change in reserve valuations for Canadian reserves, compared to similar reserves acquired in the USA.

Following studies using a DiD design, the paper conducts both univariate comparisons of means and multivariate regressions (Glendening et al., 2016; Cumming & Knill, 2012; Brockman, 2013). The univariate analyses compare the mean value of the dependent variable across the treated group and control group. The difference-in-differences estimation in the univariate test presents the overall change in investment valuations of acquired reserves in Canada vs. the USA across the two time periods. Therefore, the estimated model must specify two groups including the treated and control groups and two periods that separate before and after the regulatory change, as following:

$$\hat{\delta}_{DiD} = (\bar{y}_{T,P2} - \bar{y}_{T,P1}) - (\bar{y}_{NT,P2} - \bar{y}_{NT,P1})$$

In the equation above, T and NT subscripts refer to the treated and control countries; P1 and P2 subscripts indicate the groups of observations under the time periods separated by when the policy takes an effect. P1 indicates the period before the policy applies, and P2 indicates the period after.

The multivariate regression analyses seek to isolate the valuation effect of the regulatory change, by including a number of control variables.

The generic model for the multivariate DiD regression analysis is

$$y = \beta_0 + \beta_1 dT + \delta_0 dP + \delta_{DiD} dT * dP + u$$

where y is the outcome of interest and dP is a dummy variable for the time period after treatment. The dummy variable dT captures possible differences between the treatment and control groups before the change of the disclosure rules. The time period dummy dP is the factor that would cause changes in the outcome variable. δ_{DiD} is the coefficient of interest on the interaction term $dT * dP$. The term is

equivalent to a dummy variable equal to one for those observations in the treatment group in the post-treatment period and zero otherwise.

Applying this model, the treatment here is the change of rules to mandate disclosure of the estimated value of the reserves at the corporate level. There are two groups of acquisitions, the treated group of reserves located in Canada and the control group of reserves in the USA, as well as two periods – before and after 2004 when the new disclosure law was enacted in Canada. In addition, the 2004 Shell reserves-overbooking scandal led to increased SEC scrutiny of US-listed petroleum firms’ reserve reporting (Akin Gump; 2004, Olsen et al, 2011).³⁹ Any resulting violation of the DiD parallel-trends assumption due to potential reduction in asymmetric information in the USA should bias the results against statistical significance. Starting in 2010, US firms were subject to changes in SEC reserve-reporting requirements, and cannot function as an untreated control group; out sample period thus ends in 2009.⁴⁰

The univariate analysis focuses on the within-group variation of reserve valuations in dollars between deals made before and after the new regulation in Canada across the two countries. In the multivariate model, the DiD estimation is captured by the interaction term of the treatment and period. The regression model to test Hypothesis 1 is as below:

$$y = \beta_0 + \beta_1 Canada + \delta_0 RegulatoryChange + \delta_{DiD} Canada * RegulatoryChange + \sum \gamma_i controls_i + \varepsilon$$

In the equation above, y is the outcome variable, a measure of the reserve value of completed acquisitions, $Canada$ is a dummy variable for acquisitions located in Canada where the mandatory disclosure rule is introduced. δ_{DiD} captures the information effect from acquisition deals under the stricter disclosure regulation.

³⁹ Several companies restated their estimated reserves downward (Meyer & Zorn, 2004).

⁴⁰ Schwall (2018) summarizes SEC reserve-reporting evolution. See also US Securities and Exchange Commission, “Modernization of Oil and Gas Reporting” July 15, 2008. <https://www.sec.gov/rules/final/2008/33-8995.pdf>

Hypothesis 2 focuses on informational LOF, which can be identified by the differential effects of a change in the information environment depending on whether the acquirer firm originates from a foreign country. To test this, acquirers are divided into foreign firms and domestic firms to see if the information effect under the mandatory disclosure regime differs across those two groups, and use a DDD design (Wooldridge, 2007). The DDD method is intended to control for potentially confounding trends from changes in the acquisition valuation across the transactions that are unrelated to the new disclosure regime as well as changes in reserves valuations within Canada. Again, the paper conducts both univariate mean comparisons and multivariate regression analyses.

The estimation for Hypothesis 2 compares two treated groups. The DDD model begins with change in averages over the two periods in time for the specific group of interest within the treatment country and then subtracts the change in means for the identified group in the control country and the change in means for the non-specified group in the treatment country. Separating a specific group S under the treatment,

$$\hat{\delta}_{DDD} = (\bar{y}_{T,S,P2} - \bar{y}_{T,S,P1}) - (\bar{y}_{NT,S,P2} - \bar{y}_{NT,S,P1}) - (\bar{y}_{T,NS,P2} - \bar{y}_{T,NS,P1})$$

where T and NT subscripts mean the treated country where the policy change took place and the non-treated control country, respectively. S subscript means the specific group with a particular characteristic that is potentially affected by the policy differently from the rest among the sample without such characteristics. NS subscript designates the latter group.

Sample

The oil and gas reserve acquisitions database is from the energy-industry research firm IHS Markit. The sample is limited to acquisitions of at least \$10 million with reserves in Canada or the USA, made between 1990 and 2009, a total of 2711 deals.⁴¹ Dropping 412 deals missing information on acquiring firm's home country or reserve size reduces the number of observations to 2299, of which 863 in Canada, 1436 in the USA.

⁴¹ Transactions under \$10 million are less well documented in the database. Average deal value is \$299.8 million.

Variable Descriptions

Dependent Variable

In_Deal—natural logarithm of the *Deal_Value* that acquirers paid for a reserve in US\$ per barrel. Oil and natural gas aggregated on the basis of one barrel of oil equivalent (boe) equals six mcf of natural gas, following industry practice. Canadian \$ converted to US \$ at prevailing FX rate.

Independent Variables.

Canada—indicator variable for acquisitions of reserves located in Canada.

Regulatory Change—indicator variable for acquisitions in 2004 and afterward.

Disclosure_Canada—interaction term of *Canada* and *Regulatory Change*. The coefficient for this variable is the DiD estimator that shows the effect of changed disclosure regulation on the valuation of Canadian oil and gas field acquisitions.

Foreign Buyer—indicator variable for buyer with headquarters are outside the country where reserves are located. Deals with multiple acquirers are coded as 1 if one or more are foreign.

Canada_Foreign—interaction term of *Canada* and *Foreign Buyer*.

Regulatory_Foreign—interaction term of *Regulatory Change* and *Foreign Buyer*.

DDD_H2—triple interaction term of *Canada*, *Regulatory Change*, and *Foreign Buyer*. The coefficient is the difference-in-difference-in-differences estimator that shows how the information environment of the country after the regulatory change in disclosure affected acquisition values made by acquirer firms originating from foreign countries. If the coefficient is positive and significant, it indicates that foreign acquirers value the deals under a more transparent information environment more highly than domestic acquirers, as predicted under H2.

Seller Size— because many firms are privately-held, no financial measure is available; instead, IHS Markit’s categorization of firm size based on its total reserves is employed.

Control variables.

ln_Price—logarithmic of the expected price of petroleum, proxied by 12 month futures quoted on the New York Mercantile Exchange (NYMEX). Higher expected prices raise reserve values, as reserves are inventories of future production.

Technology—indicator for reserves with development costs. Coded 0 if the development type is “Conventional” and 1 if otherwise (offshore deep water, offshore shallow water, liquefied natural gas, coal-bed methane, other unconventional gas, synthetic crude oil, frontier, and enhanced recovery). Because the reserve development requiring more sophisticated technology costs more, reserve value of is expected to be lower.

Trust—indicator variable for Canadian income-tax-advantaged organizational form, eliminated in 2007. Trusts headquartered in Canada before 2007 are coded 1. Data are from S&P Capital IQ and SEDAR. Trusts are expected to value reserves higher.

Tables 1 and 2 present descriptive statistics and correlations among variables. Deal counts are broken down in Table 3. Just under 10 percent of reserve deals are cross-border.

Insert Tables 1-3 about here

RESULTS

The DiD analysis begins with comparison of the valuation of reserves purchased by foreign firms and domestic firms, and testing for differences in the effect of regulatory change. Table 4 reports bivariate DiD estimates based on mean differences in the per-barrel reserve values in dollar terms (*Deal_Value*) between each group identified on each axis. The top panel compares changes in the deal values for the reserves located in Canada, and the second row panel compares changes for the reserves located in the USA. The bottom row indicates the mean difference between Canadian and US transactions, while the third column indicates the difference between pre- and post-regulatory change, which took place at the beginning of 2004. Between the two periods, acquisition values increased by \$20.19 per barrel in Canada and by \$8.13 per barrel in the USA. The deals located in Canada increased much more than the deals in

the USA across the two periods, as the DiD estimate of \$12.06 per barrel indicates. This estimate provides insight into the positive effects on valuation of Canada’s change in disclosure standards.

Insert Tables 4 and 5 about here

Regression results are presented in Table 5. Model 1 includes estimates for control variables only. Models 2 and 3 are the DiD estimations to test Hypothesis 1. The coefficients on the interaction terms are positive and statistically significant in both models, supporting Hypothesis 1. The deals made after the regulatory change were significantly more highly valued for both treated and non-treated countries, but the effect was larger in the treated country.

Figure 3 depicts yearly-average of petroleum-reserve values. Although our analysis does not compare countries, the Figure reveals that Canadian reserve values overtook those in the USA, likely due in part to the reduced information asymmetry stemming from stricter disclosure. Figure 4A and 4B depict relationships between reserve value and expected petroleum price for the period before and after the regulatory change in Canada.

Insert Figure 3, 4A, and 4B about here

Hypothesis 1’ postulates that informational effects vary with selling-firm size, as smaller sellers benefit from increased transparency more than large firms with greater public information availability. The bivariate and multivariate analyses are repeated to examine this argument. The IHS Markit database categorizes firms based on total reserves, as large, medium, small, and smallest.⁴²

Table 4A reports univariate results, which support Hypothesis 1’: the increase in value in Canada was largest for reserves sold by the smallest firms, consistent with information-asymmetry interpretations. Further support comes from US reserves sales, where smaller firms gained less. This pattern is echoed in

⁴² 883 deals are missing firm-size information.

the multivariate results (Table 5A); the disclosure_canada coefficients capturing the effect of disclosure regulations are larger in regressions run on smaller firms.

Insert Tables 4A and 5A about here

Table 6 reports trivariate DDD estimates of the effect of the regulatory change on acquisition valuations. The top panel compares the changes in deal valuation for foreign acquirer firms and domestic acquirer firms in oil fields located in Canada, where the law changed to mandate firms to disclose their reserves. The bottom panel is the same difference calculated for the transactions in the USA. Among 2,299 transactions in total, 1,436 took place in the USA, and 863 deals took place in Canada. Each cell contains the mean values of per-barrel reserves for the transactions labeled on the axes, along with the standard error.

Insert Table 6 about here

There was an increase of \$14.98 per barrel for the fields in Canada acquired by foreign firms across the period, compared to a \$12.90 per barrel increase in the USA. During the period under study, the perceived gains of the information effect was larger for domestic buyers in Canada, compared to foreign buyers, by \$5.45 per barrel. In the mean time, foreign buyers in the USA, with no regulatory change, increased their valuations by \$5.22 per barrel, more than US acquirers did. Taking the difference between the two panels of Table 3, a \$10.67 per barrel decrease exists in the relative value of reserves acquired by foreign firms under the new rules in Canada, compared to the change in the relative value of reserves in the USA without such rules.

The multivariate DDD regression analysis adds an indicator variable *Foreign Buyer* that has the value of 1 if the acquiring firm's headquarters is not in the country where the reserve is located.

Following prior studies (e.g., Bradley et al, 2016), The DDD specification is:

$$y = \beta_0 + \beta_1 \text{Canada} + \beta_2 \text{Foreign Buyer} + \beta_3 \text{Canada} * \text{Foreign Buyer}$$

$$\begin{aligned}
& + \delta_0 \text{Regulatory Change} + \delta_1 \text{Canada} * \text{Regulatory Change} \\
& \quad + \delta_2 \text{Regulatory Change} * \text{Foreign Buyer} \\
& + \delta_{DDD_H2} \text{Canada} * \text{Regulatory Change} * \text{Foreign Buyer} \\
& \quad + \sum \gamma_i \text{controls}_i + \varepsilon
\end{aligned}$$

Insert Table 7 about here

where *Foreign_Buyer* is a dummy variable that indicates whether acquiring firms originate from countries outside the transaction they agree on. *Disclosure_Canada* is an interaction between *Canada* and *Regulatory_Change*, defined as in Models 2 and 3. *Canada*Foreign* is the interaction term of *Canada* and *Foreign_Buyer*, indicating all transactions acquired by foreign firms for reserves located in Canada. *Reg_Change*Foreign* is the interaction of *Regulatory_Change* and *Foreign_Buyer*, which indicates all transactions of reserves acquired by foreign buyers that took place after 2003 when the Canadian government changed the disclosure regulation.

Our interest is in δ_{DDD_H2} , the coefficient on the triple interaction term *DDD_H2*, which captures variation in reserves specific to the deals acquired by *Foreign Buyers* relative to domestic acquirers, in the treatment country *Canada* relative to the control country, and in the period when the disclosure regulation is in effect.

Table 7 presents regression results to determine whether there is a differential effect of the regulatory change in Canada between foreign acquirer and domestic acquirers. Model 4 has no control variables but includes all explanatory variables and their interaction terms for Hypothesis 2. Model 5 has all explanatory variables as well as control variables. *Disclosure_Canada* is positive and significant, which implies that, in general, acquirer firms gained from the changed information environment after the regulatory change in Canada. The result is consistent with the findings from Models 2 and 3.

DDD_H2 is negative and statistically significant in both models, indicating that gains from the changed information environment were smaller for foreign than domestic acquirers. This finding supports

Hypothesis 2a, rather than Hypothesis 2; the benefit of increased transparency was greater for domestic firms than for foreign MNCs, implying that LOF is exacerbated under the mandatory-disclosure regime. Both foreign and domestic acquirers gained from the regulatory change in Canada; the full model (column 5) yields an estimate of 76.2% higher values for domestic firms. The positive gains by foreign MNCs were only 15.8% [$0.762-0.604=0.158$],

Results for the market-share hypotheses are consistent. From the deal-count breakdown in Table 3, foreign MNCs accounted for 16 percent of acquisitions in Canada before the regulatory change, 5 percent afterward. A nonparametric χ^2 test reveals the drop in foreign MNCs' market share is highly significant (p-value < .001), supporting Hypothesis 3a, rather than Hypothesis 3. This drop is not due to a broader decline in FDI in reserves; indeed, in the USA foreign MNCs' market share actually rose, from about 6 percent to about 8 percent (p-value for difference = .037). Yet both Canadian and US FDI policy were unchanged. Increased informational LOF may result in foreign MNCs' not entering the market (Capron & Shen, 2007; Martin & Shalev, 2016). Not surprisingly, Canadian oil companies did not oppose stricter reserve-disclosure regulation.⁴³

DISCUSSION & CONCLUSION

The finding that improvements in the information environment stemming from mandatory reserves disclosure actually magnified informational LOF challenges consensus among scholars and policymakers that FDI is facilitated by host-country transparency, whether in the private sector (e.g., accounting systems, analyst coverage) or the public sector (e.g., corporate-disclosure regulation, press freedom, macro-data reporting).⁴⁴ It also runs counter to findings that market-enhancing policies advantage foreign MNCs competing with domestic firms, as the value of local networks diminishes.⁴⁵

⁴³ Interview with Craig Burns, Alberta Securities Commission, November 2018.

⁴⁴ Greater transparency attracts international portfolio investment as well (Gelos and Wei, 2005; Kingsley and Graham, 2017)

⁴⁵ E.g., Perez-Batres & Eden (2008) on México, Sun et al (2010) on China. An exception is Cuervo-Cazurra & Dau (2009), who find large domestic firms in Latin America gained from pro-market reforms more than foreign MNCs.

This literature focuses on emerging markets; in contrast, these findings suggest that where institutions and domestic competition are strong, transparency need not attract FDI.⁴⁶

The paper's limitations are several. On the theory side, while the adverse-selection model yields powerful predictions and has great research potential, its focus on buyer-seller interaction restricts its applicability to value-chain settings. On the empirical side, the database has several drawbacks. First, with information at investment level but not firm level (beyond size and home country), it is impossible to relate managers' investment valuations to firm attributes. Second, because cross-border transactions account for slightly below 10 percent of the total, and the USA is the home country for most Canadian FDI, there is insufficient variation to test hypotheses about country-of-origin effects. Finally, reserves are extracted over many years; without operating data, so it is not possible to ascertain which turn out to be "lemons" ex post.

Single-industry studies also raise questions of external validity. Hopefully any loss of generality is offset by gains from (1) focusing the broad concept of information LOF enough to employ powerful theoretical frameworks that make specific predictions; (2) exploitation of a natural experiment to disentangle information from other factors affecting MNCs' competitiveness; and (3) the specificity, importance to investment, and dissemination channels of reserves information.

Finally, Reuer et al (2004) note that the lemons problem in M&A markets is likely least severe when acquirers and targets are in the same industry, and in industries with tangible assets, both true here. The findings of statistical significance and support for our hypotheses make it likely that LOF associated with information asymmetry is present in a broad range of settings.

⁴⁶ Recent research in US securities markets is consistent with the finding that investors with private information benefit from public announcements. Swem (2017) finds that hedge funds trade on anticipated analyst reports. Dyer (2018) finds public disclosure helps local investors obtain higher returns.

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FIGURE 1: Western Canadian petroleum areas

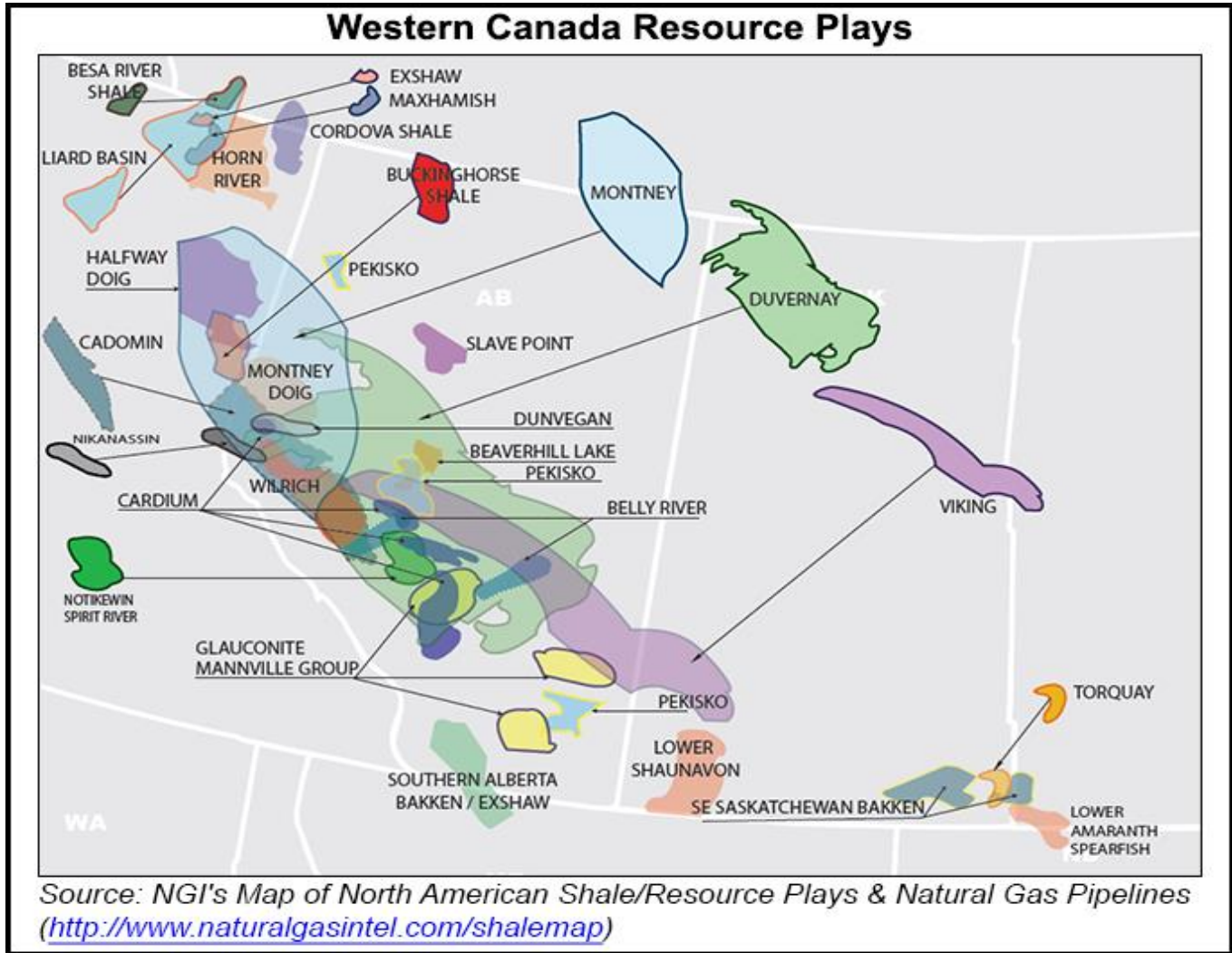


FIGURE 2: Information environment and target asset valuation

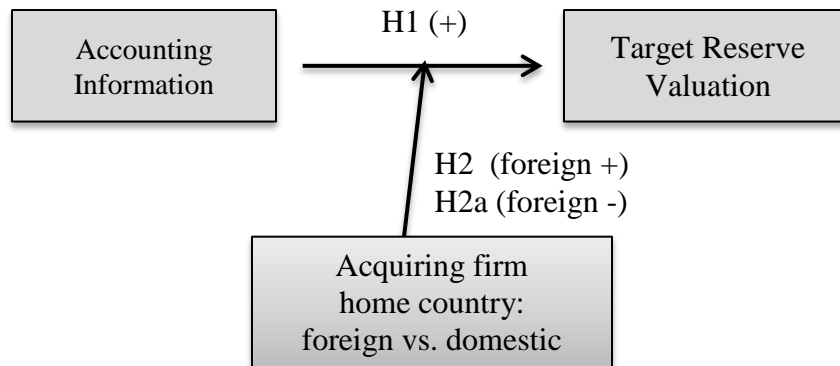


TABLE 1. Summary Statistics

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|-------------------|-------|-------|-----------|-------|--------|
| Deal_Value | 2,299 | 10.55 | 9.88 | 0.58 | 122.86 |
| ln_Deal | 2,299 | 2.04 | 0.77 | -0.54 | 4.81 |
| Price_Expected | 2,299 | 33.78 | 22.48 | 3.86 | 142.18 |
| ln_Price | 2,299 | 3.32 | 0.63 | 1.35 | .96 |
| Technology | 2,299 | 0.22 | 0.41 | 0 | 1 |
| Trust | 2,299 | 0.06 | 0.23 | 0 | 1 |
| Canada | 2,299 | 0.38 | 0.48 | 0 | 1 |
| Regulatory_Change | 2,299 | 0.39 | 0.49 | 0 | 1 |
| Foreign_Buyer | 2,299 | 0.09 | 0.28 | 0 | 1 |

TABLE 2. Correlations

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|-----------------------|--------|--------|--------|--------|-------|--------|--------|-------|-------|-------|----|
| 1 ln_Deal | 1 | | | | | | | | | | |
| 2 ln_Price | 0.71* | 1 | | | | | | | | | |
| 3 Technology | 0.12* | 0.21* | 1 | | | | | | | | |
| 4 Trust | 0.10* | 0.05* | -0.08* | 1 | | | | | | | |
| 5 Canada | 0.20* | 0.06* | -0.18* | 0.32* | 1 | | | | | | |
| 6 Regulatory_Change | 0.71* | 0.87* | 0.20* | 0.02 | 0.03 | 1 | | | | | |
| 7 Foreign_Buyer | -0.02 | -0.03 | 0.09* | -0.07* | 0.09* | -0.04* | 1 | | | | |
| 8 Disclosure_Canada | 0.61* | 0.45* | -0.02 | 0.19* | 0.55* | 0.54* | -0.05* | 1 | | | |
| 9 Canada_Foreign | -0.07* | -0.07* | -0.03 | -0.04* | 0.28* | -0.09* | 0.70* | 0.01 | 1 | | |
| 10 Regulatory_Foreign | 0.16* | 0.19* | 0.19* | -0.03 | -0.03 | 0.21* | 0.55* | 0.06* | 0.20* | 1 | |
| 11 DDD_H2 | 0.09* | 0.11* | 0.07* | -0.00 | 0.11* | 0.11* | 0.29* | 0.21* | 0.41* | 0.53* | 1 |

*p< .05

TABLE 3A
Transaction counts by buyer country

| | Before law change (1990-2003) | | After law change (2004-2009) | | Total |
|-----------------|----------------------------------|-----|---------------------------------|-----|--------------|
| | Canada | USA | Canada | USA | |
| Foreign Buyers | 83 | 51 | 18 | 46 | 198 |
| Domestic Buyers | 426 | 846 | 336 | 493 | 2,101 |
| Total | 509 | 897 | 354 | 539 | 2,299 |
| | 1,406 | | 893 | | |

TABLE 3B
Transaction counts by seller size

| Deal Location | Before Canada law change (NI51-101) (1990-2003) | | After Canada law change (NI51-101) (2004-2009) | | Total (1990-2009) |
|---------------|---|-----|--|-----|----------------------|
| | Canada | USA | Canada | USA | |
| Large | 26 | 108 | 43 | 113 | 290 |
| Medium | 72 | 205 | 22 | 100 | 399 |
| Small | 62 | 91 | 36 | 89 | 278 |
| Smallest | 64 | 118 | 153 | 98 | 433 |
| Unspecified | 285 | 375 | 100 | 139 | 899 |
| Total | 509 | 897 | 354 | 539 | 2,299 |
| | 1,406 | | 893 | | |

TABLE 4
Bivariate DiD estimates (reserve value in USD per barrel)

| | Before law change | After law change | Before-After Difference |
|-----------------------|-------------------|------------------|------------------------------------|
| Canada | 5.65 (0.12) | 25.85 (0.67) | 20.19 (0.44) |
| USA | 5.46 (0.09) | 13.60 (0.35) | 8.13 (0.18) |
| Canada-USA difference | 0.19 (0.07) | 12.25 (0.39) | DiD: 12.06 (0.21) |

Notes: Numbers in parenthesis are standard errors for the transactions in each cell. Standard error for the entire sample is reported in the bracket under the DiD estimate.

TABLE 4A
Bivariate DiD estimates by size (reserve value in USD per barrel)

| | Before Canada law change (NI51-101) (1990-2003) | | After Canada law change (NI51-101) (2004-2009) | | Before-After Difference | |
|----------|---|----------------|--|-----------------|-------------------------|----------------|
| | Canada | USA | Canada | USA | Canada | USA |
| Large | 5.16 (0.63) | 5.54 (0.23) | 18.33 (1.32) | 15.36 (0.83) | 13.17 (1.66) | 9.81 (0.90) |
| Medium | 5.09 (0.35) | 5.54 (0.20) | 23.94 (2.34) | 13.67 (0.66) | 18.84 (1.18) | 8.12 (0.59) |
| Small | 5.87 (0.39) | 6.01 (0.29) | 24.96 (3.28) | 14.02 (0.94) | 19.09 (1.87) | 8.01 (1.33) |
| Smallest | 7.31 (0.44) | 6.48 (0.26) | 29.18 (0.96) | 13.22 (0.92) | 21.87 (1.27) | 6.75 (1.17) |

Notes: Numbers in parenthesis are standard errors for the transactions in each cell. Standard error for the entire sample is reported in the bracket under the DiD estimate.

TABLE 5**Effects of Disclosure Law on Acquisition Values**

| Dep. Variable: ln_deal | (1) Control only | (2) No controls | (3) All variables |
|------------------------|---------------------|--------------------|----------------------|
| ln_Price | 0.874** (0.020) | | 0.512** (0.035) |
| Technology | -0.0392 (0.033) | | 0.0115 (0.031) |
| Trust | 0.210** (0.042) | | 0.0624 (0.040) |
| Canada | | 0.0218 (0.026) | -0.0329 (0.025) |
| Regulatory_Change | | 0.859** (0.029) | 0.253** (0.051) |
| Disclosure_Canada | | 0.657** (0.045) | 0.724** (0.042) |
| Constant | -0.864** (0.063) | 1.597** (0.015) | 0.137 (0.099) |
| Adj. R ² | 0.515 | 0.577 | 0.618 |
| Observations | 2299 | 2299 | 2299 |

Notes: Standard errors robust to heteroskedasticity are reported in parentheses.

**, *, and + implies significance at the 99% level, 95% level, and 90% level, respectively.

TABLE 5A**Effects of Disclosure Law on Acquisition Values by Seller Size****(1990-2009) [N=2,299]**

| Dep. Var. ln_deal | (1a) Large | (2a) Medium | (3a) Small | (4a) Smallest |
|---------------------|---------------------|----------------------|----------------------|----------------------|
| ln_Price | 0.342*** (0.103) | 0.375*** (0.0896) | 0.609*** (0.101) | 0.517*** (0.0858) |
| Technology | 0.0700 (0.0676) | -0.0904 (0.0652) | 0.115 (0.0903) | 0.0419 (0.0663) |
| Trust | 0.326** (0.145) | 0.397* (0.204) | 0.201 (0.133) | -0.0617 (0.0690) |
| Canada | -0.241** (0.106) | -0.123* (0.0628) | -0.168** (0.0778) | 0.0384 (0.0701) |
| Regulatory_Change | 0.542*** (0.136) | 0.509*** (0.113) | 0.0357 (0.150) | 0.0149 (0.119) |
| Disclosure_Canada | 0.379** (0.157) | 0.654*** (0.123) | 0.729*** (0.139) | 0.871*** (0.0965) |
| Constant | 0.637** (0.289) | 0.531** (0.260) | -0.0505 (0.283) | 0.257 (0.259) |
| Adj. R ² | 0.533 | 0.524 | 0.528 | 0.670 |
| Observations | 290 | 399 | 278 | 433 |

Notes: Standard errors robust to heteroskedasticity are reported in parentheses.

**, *, and + implies significance at the 99% level, 95% level, and 90% level, respectively.

TABLE 6**Trivariate DDD estimates (reserve value in USD per barrel)**

| | Before law change | After law change | Before-After Difference |
|--|----------------------|---------------------|----------------------------|
| <i>Panel A: Deals in Canada [N=863]</i> | | | |
| Foreign Buyers | 5.34 (0.27) | 20.31 (2.87) | 14.98 (0.48) |
| Domestic Buyers | 5.71 (0.14) | 26.14 (0.69) | 20.43 (0.79) |
| Foreign-Domestic Buyer difference | -0.38 (0.12) | -5.83 (0.67) | -5.45 (0.44) |
| <i>Panel B: Deals in the USA [N=1,436]</i> | | | |
| Foreign Buyers | 5.87 (0.35) | 18.76 (1.61) | 12.90 (1.02) |
| Domestic Buyers | 5.44 (0.09) | 13.11 (0.34) | 7.68 (0.17) |
| Foreign-Domestic Buyer difference | 0.43 (0.09) | 5.65 (0.35) | 5.22 (0.18) |
| DDD: | | | -10.67 (0.21) |

Notes: Numbers in parenthesis are standard errors for the transactions in each cell. Standard error for the entire sample is reported in the bracket under the DDD estimate.

TABLE 7**Differential effects between foreign and domestic acquirer firms**

| Dep. Variable: ln_deal | (4) No controls | (5) All variables |
|------------------------|--------------------------------|----------------------|
| ln_Price | | 0.517** (0.034) |
| Technology | | 0.00307 (0.032) |
| Trust | | 0.0516 (0.040) |
| Canada | 0.0367 (0.028) | -0.0225 (0.026) |
| Regulatory_Change | 0.837** (0.030) | 0.227** (0.051) |
| Foreign_Buyer | 0.0956 (0.059) | 0.0913 (0.066) |
| Disclosure_Canada | 0.687** (0.046) | 0.762** (0.043) |
| Canada_Foreign | -0.153 ⁺ (0.082) | -0.123 (0.084) |
| Regulatory_Foreign | 0.231* (0.113) | 0.237* (0.114) |
| DDD_H2 | -0.523* (0.223) | -0.604** (0.216) |
| Constant | 1.591** (0.016) | 0.120 (0.098) |
| Adj. R ² | 0.581 | 0.623 |
| Observations | 2299 | 2299 |

Notes: Standard errors robust to heteroskedasticity are reported in parentheses.

**, *, and ⁺ implies significance at the 99% level, 95% level, and 90% level, respectively.

FIGURE 3. Yearly average value of petroleum reserves by country

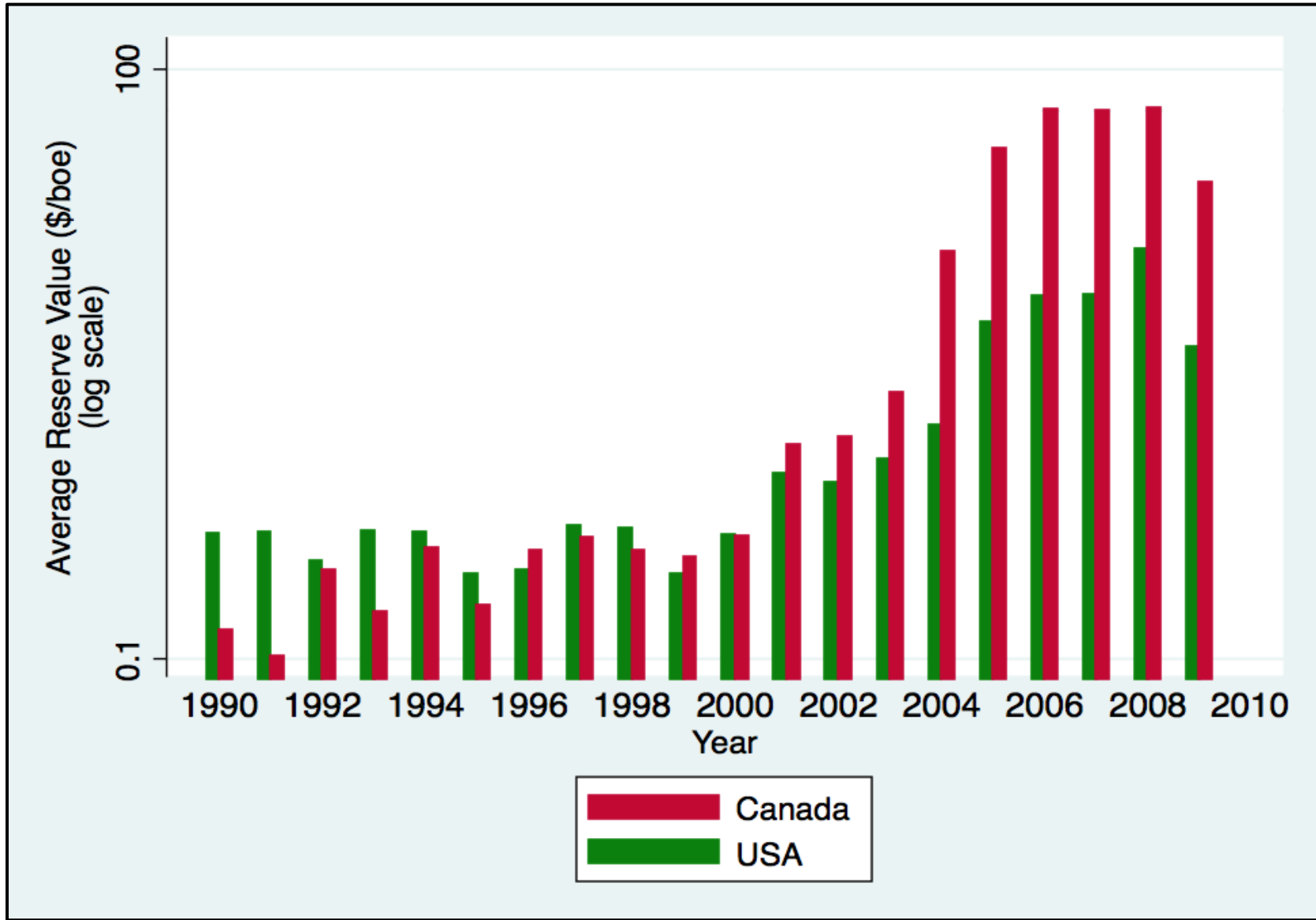


FIGURE 4A. Reserve values for the pre-treatment period (1990-2003)

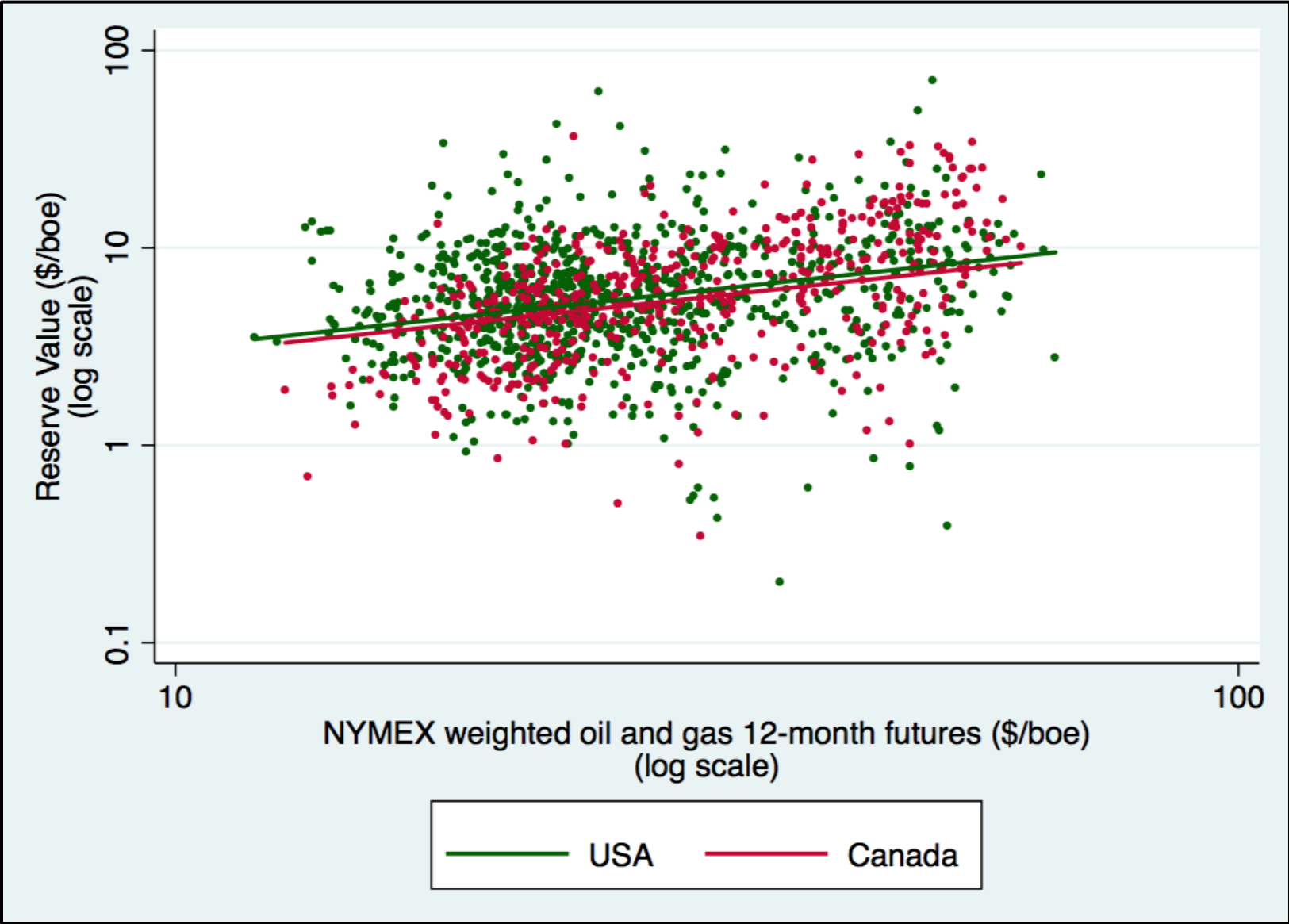


FIGURE 4B. Reserve values in post-treatment period (2004-2009)

