

# **The Flattening Firm and Product Market Competition: The Effect of Trade Liberalization**

Maria Guadalupe  
*Columbia University,  
CEPR and NBER*

Julie Wulf  
*Graduate School of Business Administration  
Harvard University*

September 2008

## Abstract

It has been documented that firm hierarchies are flattening. CEO span of control has increased significantly, the number of levels in the hierarchy has declined, while performance-based pay for lower level managers has increased. In this paper, we establish a causal effect of competition from trade liberalization on various characteristics of organizational design. We exploit a unique panel dataset of large U.S. firms with detailed information on firm hierarchies, compensation and managerial positions over the period 1986-1999. We find that increasing foreign competition leads to flatter firms: (i) firms reduce the number of positions between the CEO and division managers, and (ii) increase the number of positions reporting directly to the CEO. We also find that competition increases performance-based pay for division managers and firms appear to adjust organizational elements in a coordinated manner. The results are generally consistent with the explanation that firms redesign their organizations through a set of potentially complementary choices in response to changes in their environment.

JEL No. L2, M2, M52

Keywords: organizational change, hierarchy, organizational structure, incentives, complementarities, decentralization, competition

We would like to thank Michael Raith, Luis Garicano, Tim Baldenius and Tano Santos, for very helpful comments and discussions, as well as audiences at Columbia, HBS, Rochester, Stanford SITE conference, UCLA, USC, LSE, UCL, NYU-Stern, Egon Sohmen Symposium. The usual disclaimer applies. Corresponding author: Maria Guadalupe, 3022 Broadway, Uris Hall 624, New York NY 10025; p: 212 854 6176; e: [mg2341@columbia.edu](mailto:mg2341@columbia.edu)

## 1. Introduction

Firm hierarchies are becoming flatter. Spans of control have broadened and the number of levels within firms has declined (Rajan and Wulf, 2006). These trends are consistent with conventional wisdom discussed in the business press and have been suggested and documented in select academic papers (e.g. Powell; 1990, Osterman, 1996; and Whittington, et al., 1999). While there are several possible explanations for the flattening of firms, one leading candidate is changes in the nature of product markets, in particular the increase in domestic and foreign competition from the dramatic reductions in trade, communication and transport costs. The purpose of this paper is to evaluate this hypothesis and explore the effect of changes in product market competition on the flattening of firms.

There is little research in economics that explores the link between competition in product markets and organizational design. Yet, management scholars have long argued that increased competition leads firms to search for new organizational practices in an attempt to replace traditional hierarchical structures. Since additional layers in the hierarchy impede information flows, firms eliminate layers (i.e. “delayer”) to improve response times to changes in competitive forces. Moreover, firms decentralize decision-making to respond more quickly to changes in the business environment and to exploit the knowledge of lower level managers.<sup>1</sup> Despite empirical evidence showing that the internal hierarchical organization of the firm (Liberti, 2006; Garicano and Hubbard, 2007) and organizational and workplace practices (Black and Lynch, 2001) have a significant impact on productivity, there is limited work on the role of internal hierarchies in the organization of labor. In this paper, we investigate whether product market competition resulting from the globalization of markets is an important driver of organizational change. In doing so, we are able to shed light on organizational choices and the implications for communication and decision-making processes inside firms.

Our findings indicate that greater international competition following a liberalization of trade leads to flatter firms. We find that U.S. firms in manufacturing industries more exposed to the trade liberalization, reduce the number of hierarchical levels, broaden the span of control for the CEO, and increase incentive-based pay for division managers. Furthermore, firms appear to

---

<sup>1</sup> Refer to Whittington, Pettigrew, Peck, Fenton and Conyon (1999) for a review of the relevant literature in management. For early works that discuss the link between organizational change and the environment, refer to Burns and Stalker (1961) and Lawrence and Lorsch (1967).

adjust organizational elements in a coordinated manner: certain changes appear to occur together.

While our results are novel, an equally important contribution is our empirical approach which allows us to establish a causal effect of foreign competition on organizational change.<sup>2</sup> First, we rely on panel-level data of the internal organization of large U.S. manufacturing firms in various industries. We exploit variation in organizational variables within firms (and within division manager positions) across a 14-year period thus addressing concerns about unobserved heterogeneity. Second, our primary identification comes from a quasi-natural experiment based on a bilateral trade liberalization between the U.S. and Canada in 1989 which led to differential changes in tariffs—and changes in the extent of competition—across industries. Finally, we show that our results are not driven by increases in expenditures on IT, nor exclusively by firms changing their business focus, location of activities, and a host of other potential confounding factors. Our paper contributes to our understanding of one of the most important drivers of organizational change and also sheds light on how firms adjust organizational elements in a coordinated manner in response to changes in their environment.

Standard measures of product market competition, such as, industry Herfindahl indices and average price cost margins, are subject to numerous concerns: they are endogenous to changes in the competitiveness of markets and non-monotonic in competition (Sutton, 1991; Schmalensee, 1989). We improve upon these measures by exploiting the Canada-United States Free Trade Agreement of 1989 (FTA) that eliminated tariffs between the U.S. and Canada. Canada is the biggest trading partner of the U.S. accounting for 20 percent of U.S. imports. Firms in industries with high U.S. tariffs on Canadian imports prior to 1989 experienced a greater reduction in entry barriers into the industry, than those in industries with negligible tariffs. This allows us to implement a difference-in-differences strategy to assess the causal effect of competition on a number of features of the organizational design of firms. Since the trade liberalization was bilateral, it also implied a reduction in Canadian tariffs on U.S. exports potentially leading to market expansion opportunities for our U.S. firms which we will take into account. Our findings suggest that increased competition causes firms to simultaneously reorganize on several dimensions: span of control, number of managerial levels, and compensation design for division managers. The reorganization is a result of falling U.S. tariffs rather than of falling Canadian

---

<sup>2</sup> Previous papers on hierarchies and organizations more generally have been unable to do this.

tariffs, suggesting that it is competitive pressure rather than market expansion opportunities that U.S. firms responded mostly to. These results are consistent with theories arguing that complementarities exist among a firm's organizational design elements (e.g. Milgrom and Roberts, 1990, 1995). As such, our paper is related to the limited empirical research on the existence of complementary human resource management (HRM) practices (e.g. Ichniowski, Shaw, and Prensushi, 1997; and Bresnahan, Brynjolfsson, and Hitt, 2002; Cockburn, Henderson and Stern, 2004). A unique contribution of our paper is that we exploit an exogenous shock to the firm's competitive environment and find evidence that is consistent with firms redesigning their organizations to "fit" the environment in which they operate.<sup>3</sup> To our knowledge, much of the research on adoption of complementary work practices does not capture responses to exogenous shocks.<sup>4</sup>

While we do not observe decision-making inside firms, we believe our findings are also consistent with greater decentralization and authority at the division manager level in response to more competition. In this sense, we complement Bloom, Sadun and Van Reenen (2007) who document a cross-sectional relationship between competition (measured by import penetration and survey responses) and greater decision-making authority of plant managers across countries.<sup>5</sup>

A number of papers have explored the relationship between information technology and organizational characteristics, including firm size (Brynjolfsson, Malone, Gurbaxani, Kambil, 1994), work practices (Bresnahan, Brynjolfsson and Hitt, 2002), skill-biased organizational change (Caroli and Van Reenen, 2001), adoption of new management practices (Bartel, Ichniowski, and Shaw, 2007), firm boundaries (Baker and Hubbard, 2004) and delegation of authority (Acemoglu, Aghion, Lelarge, Van Reenen and Zilibotti, 2007). However, there is little evidence on the role of competition on organizational change. While acknowledging the importance of information technology, our focus is on whether there is a causal effect of product market competition on the observed flattening of firms.

---

<sup>3</sup>This idea is captured in the following quote: "Achieving high performance in a business results from establishing and maintaining a fit among three elements: the strategy of the firm, its organizational design, and the environment in which it operates. (Roberts, 2004, pg. 12). For a discussion of empirical frameworks to identify structural parameters when multiple organizational design practices are jointly determined, see Athey and Stern (1998).

<sup>4</sup> One exception, and relatedly, Baker and Hubbard (2004) document how an exogenous change in technology affects the ownership structure of trucking firms.

<sup>5</sup> Relatedly, Bloom and Van Reenen (2007) also find that the level of import penetration is significant in explaining variation in management practices across industries and countries.

The remainder of the paper is organized as follows. Section 2 reviews the related theoretical literature on organizational design and discusses the potential links between the competitive environment, internal hierarchies, and managerial incentives. Section 3 describes the data and our empirical strategy. Section 4 outlines our results and discusses potential interpretations. Section 5 concludes.

## **2. Theoretical Considerations and Empirical Implications**

M-form organizations, as described and documented in the pioneering work of Alfred Chandler (1962), are comprised of a central administrative unit or “headquarters” and operating units or divisions. Simple economic models typically characterize headquarters (or the CEO) as the principal with the objective of maximizing firm profits and division managers as self-interested agents that are better informed about local markets. The optimal design of an organization depends on trade-offs associated with various characteristics such as information, incentives, and coordination which in turn are a function of the environment in which the firm operates (Roberts, 2004).

An external shock to the environment, such as an increase in the intensity of product market competition, can cause firms to reorganize along various dimensions. One traditional explanation is that firms are not optimizing and that competition forces firms to eliminate organizational slack or X-inefficiency (Liebenstein, 1966). However, explicit changes to organizational design need not be the result of earlier inefficient behavior, but could be an optimal response to the trade-offs inherent in distinct strategic and design choices.

For example, under certain theories of hierarchies, firms have to trade-off adaptation and coordination: decentralized decision-making may replace centralized structures as quick adaptation to local markets becomes paramount. Yet, local decisions by autonomous business unit managers may be more costly for corporate headquarters to coordinate (e.g., Alonso, Dessein, and Matouschek, 2008; Dessein and Santos, 2006). Firms may also trade-off loss of information and loss of control when making organizational decisions as the delegation of decision rights can encourage generation of higher quality information, but comes at a cost of lack of control (e.g., Aghion and Tirole, 1997). A further dimension that firms can optimize is the generation and processing of information. The elimination of management levels may facilitate faster and more accurate flow of information throughout the hierarchy, but broader

spans of control associated with fewer levels can lead to loss of control and the inability to process information by headquarters (e.g., Williamson, 1967). Firms also choose the appropriate level of incentive provision as the return to managerial effort increases: the optimal performance-pay sensitivity depends on the characteristics of the environment (Raith, 2003).

Finally, decentralization and incentive provision may also interact (e.g., Mookerjee, 2006) and decentralized decision-making can be coupled with higher performance pay to appropriately align incentives (e.g., Prendergast, 2002; Wulf, 2007). However, local incentives can be costly as they fail to realize synergies across business units (e.g. Athey and Roberts, 2001).<sup>6</sup>

But beyond making explicit the existence of a series of trade-offs facing firms, an important result of organizational theory highlights the interactions and potential complementarities among different subsets of organizational design choices. Milgrom and Roberts (1990, 1995) analyze complementarities among different features of modern production technologies, while Holmstrom and Milgrom (1991, 1994) examine levels of incentives to elicit effort for various tasks and the interactions among incentives, asset ownership and job restrictions. Other more recent papers include Friebel and Raith (2007), Dessein, Garicano and Gertner (2007) and Athey and Roberts (2001), each of which examines the determination of incentives and decision-making authority from various perspectives.

As a consequence of changes in the competitive environment, firms are likely to face different costs and benefits of various trade-offs. This will cause firms to adjust their set of complementary organizational practices including, but not limited to, the location of decision rights, the layers in a hierarchy, and the design of incentives. Rantakari (2008) models these choices and makes predictions about interactions among different organizational design parameters and the joint fit with the volatility of the firm's environment.

Other related work that explicitly links product market competition to the internal organization of firms is Marin and Verdier (2003). They develop a model of hierarchies based on Aghion and Tirole (1997) and show that greater international competition leads to a delegation of

---

<sup>6</sup>There is a growing theoretical literature in economics that relates to each of these features. Several models explore the role of a hierarchy in enabling a firm to process and communicate information among agents (e.g. Radner, 1993; Bolton and Dewatripont, 1994; Garicano, 2000). More recent research focuses on the trade-off between information and authority or control (e.g. Aghion and Tirole, 1997; Rajan and Zingales, 2001; Dessein, 2002; Hart and Moore, 2005; and Alonso, Dessein and Matouschek, 2008). The early theoretical work which is less central to this paper considers hierarchies as a means to create incentives (e.g. Lazear and Rosen, 1981), to supervise workers (e.g. Williamson, 1967; Calvo and Wellisz, 1978) or to assign talent (e.g. Rosen, 1982).

authority from the CEO to the managers.<sup>7</sup> In addition to altering the location of decision rights, increased competition is likely to change the importance of incentives provided through pay independently of the effect on hierarchies (e.g. Raith, 2003; Cuñat and Guadalupe, 2006).

In sum, the effect of competition on various organizational choices—hierarchy, location of decision rights, and performance pay—is ultimately an empirical issue. To explore some of the theoretical considerations and empirical implications discussed above, we examine the effect of increased competition arising from trade liberalization and reductions in trade costs on the changes in organizational design of U.S. manufacturing firms over the period from 1986 to 1999.

Of course there are other explanations besides intensified competition for the flattening of firms, the most obvious being the rise of information technology. Managers receive, process, and transmit information, and improvements in the technology of communication and computation may directly affect hierarchical structure and incentives and may have differential effects in more competitive environments. For example, improvements in communication technology may allow more efficient processing of information thereby increasing spans of control, and this effect may be more pronounced in competitive environments in which quick decision-making is essential. As discussed in the introduction, a number of empirical papers demonstrate that IT is an important determinant of organizational design. However, to our knowledge, there is little empirical evidence on the relationship between IT or competition and the structure of the internal hierarchy.

Finally, increased competition can affect organizational design through many channels, including, but not limited to: changes in business scope, the reduction of organizational slack (or X-inefficiency), and outsourcing or offshoring. While it is beyond the scope of the paper to consider each of these various channels, we will attempt to consider several of these mechanisms in our empirical specifications.

### **3. Data and Empirical Strategy**

#### **3.1 Organizational Data**

---

<sup>7</sup>Marin and Verdier (2008) also develop a model to show how the size of the market affects corporate hierarchies. Other related papers that consider the effect of competition, but do not deal explicitly with hierarchies include the following: Askenazy, Thesmar and Thoenig (2006) consider how new technologies increase the value of innovation which causes firms to design more “reactive” organizations. Thesmar and Thoenig (2000) show that an increase in the rate of creative destruction (the arrival of new products) has an impact on organizational choice. Harstad (2007) explores the effect of competition in the choice of U-form versus M-form by firms. Finally, Conconi, Legros and Newman (2008) develop a trade model to examine how liberalization affects the ownership structure of firms.

The primary dataset from which we draw our sample is an unbalanced cross-industry panel of more than 300 publicly traded U.S. firms over the years 1986-1999. This dataset includes detailed information on job descriptions, titles, reporting relationships, and reporting levels of senior and middle management positions that allow us to characterize organizational structures of firms in a potentially more accurate way than previous research. The dataset is rather unique because it allows us to identify changes in hierarchies within firms over a 14-year period that is characterized by significant organizational change.

The data are collected from a confidential compensation survey conducted by Hewitt Associates, a leading human resources consulting firm specializing in executive compensation and benefits. The survey is the largest private compensation survey (as measured by the number of participating firms). The survey participants are typically the leaders in their sectors and the survey sample is most representative of Fortune 500 firms. For a more detailed description of the data and their representativeness, see Rajan and Wulf (2006).

An observation in the dataset is a managerial position within a firm in a year. This includes both operational positions (e.g., Chief Operations Officer and Division Managers) and senior staff positions (e.g., Chief Financial Officer and General or Legal Counsel). The data for each position include all components of compensation including salary, actual bonus, and grants of restricted stock, stock options, and other forms of long-term incentives (e.g., performance units)<sup>8</sup>; as well as position-specific characteristics such as job title, the title of the position that the job reports to (i.e., the position's boss), number of positions between the position and the CEO in the organizational hierarchy, and both the incumbent's status as a corporate officer and tenure in position.

We analyze changes in organizational structure by focusing on two characteristics: breadth and depth of the hierarchy. These can be defined consistently across firms and over time and reflect important information about two important positions in the hierarchy, namely the division manager and the Chief Executive Officer (CEO). We also analyze changes in division manager pay—both levels and performance sensitivity.

Span is a firm-level measure that captures a horizontal dimension or breadth of the hierarchy. It measures CEO span of control and is defined as the number of positions reporting directly to

---

<sup>8</sup>The Hewitt database is thus far more comprehensive than the SEC filings which form the basis for the ExecuComp database. Because firms are required to only file information on the top five executive officers, information on division managers is rarely included in these sources.

the CEO. One obvious question when using this variable is: what information is reflected in a direct reporting relationship to the CEO? First, the CEO should have direct authority over the manager in the position (i.e. his subordinate). Second, presumably the exchange of information between the CEO and the manager is more direct than it would be if the “chain of command” included other intermediary positions. Since the CEO is at the top of the lines of authority and communication, his job involves decision-making at the highest level, but also includes a role as coordinator of information and decisions that are associated with a complex, multidivisional firm.

Our other measure, depth, is defined at the division level and represents a vertical dimension, or steepness, of the hierarchy. It is defined as the number of positions between the CEO and the division manager. Division managers (DM) are the highest authority in the division, where a division is defined as “the lowest level of profit center responsibility for a business unit that engineers, manufactures and sells its own products.” We focus on the division manager position for two reasons: (i) it is the position furthest down the hierarchy that is most consistently defined across firms; and (ii) it is informative about the extent to which responsibility is delegated in the firm.

Figure 1 displays an example of a hierarchy that demonstrates both measures of span and depth. In this example, the measure of span equals 4 -- there are four positions reporting directly to the CEO -- and the measure of depth equals 2 — there are two positions between the CEO and the division manager. Figure 2 shows the evolution of average depth and span in our sample over the period. Average span increased from 4.5 positions in 1986 to 7 positions in 1999 and average depth fell from around 1.5 to 1.

In this paper, we focus on the subset of firms that operate in the manufacturing sector -for which we have data on tariffs. This leads to a sample of approximately 1962 firm-years and 5702 division-years that includes 230 firms and 1524 divisions. We will report both firm-level regressions (span of control is a firm level variable) and division-level regressions (division depth and division manager pay will vary by division within the firm).

We also have information on division level sales and employment and the above data are supplemented with financial information from Compustat. Finally, we construct a number of variables that are used as controls and that we will describe in the results section (see the Data Appendix for details on how these are built).

### **3.2 Product Market Competition: The 1989 Canada U.S. Free Trade Agreement**

In January 1989, U.S. President Reagan and Canadian Prime Minister Mulroney signed the Canada U.S. Free Trade Agreement (FTA) to eliminate trade barriers, and in particular, all tariffs between Canada and the United States. Negotiations for the agreement had started earlier, partly because of the failure to reach an agreement in the Tokyo round of the General Agreement on Tariffs and Trade (GATT) and President Reagan's objective to explore regional and bilateral liberalization agreements. In October 1987, when the details of the agreement were first revealed, they encountered substantial opposition in Canada.<sup>9</sup> By early 1988, the Liberal Party announced that it would use its majority in the Senate to block passage of the free trade agreement until Canadian voters decided the agreement's fate in a general election. The Liberal party had an advantage of 20 points in the polls over the Conservative party. The highly contested election took place in October 1988 with a narrow Conservative victory. Three months later the agreement came into effect and the first round of tariff reductions took place.

The advantages of this turn of events for our empirical strategy are threefold (Trefler, 2004). Since the passage of the agreement was highly improbable and unexpected, it can be interpreted as an exogenous shock. Furthermore, it was not a response to a macroeconomic shock, but rather to the lack of progress in the Tokyo round, so that it was unaccompanied by other economic packages that could affect industries simultaneously. Finally, there were no other important trade agreements during that period so that the shock to trade with Canada is unlikely to be confounded with other factors.

This reduction of U.S. tariffs on imports from Canadian firms affected a substantial fraction of U.S. trade since the U.S.-Canada trade relationship is the world's largest in volume and Canadian imports represented an average of 20% of total U.S. imports at the time (in comparison to Mexico at around 5%). In addition, Canada is similar to the U.S. in terms of product specialization, so that Canadian products are likely to compete directly with U.S. products. In fact, Head and Ries (2001) estimate the elasticity of substitution between U.S. and Canadian goods at approximately 8, suggesting a potentially large response of Canadian imports from the

---

<sup>9</sup> "Canada was a sharply divided nation [...] as details of the free-trade agreement with the United States became known, with business generally supporting the pact and trade unions and nationalist groups adamantly against it." (6/10/87, *The New York Times*).

tariff reductions. They also document substantial trade-distorting non-tariff barriers suggesting a potentially even larger effect from the trade liberalization. We discuss below the effect the liberalization had on North-American trade.

In the empirical analysis, we are interested in the effect of the trade agreement on organizational change. We exploit the fact that U.S. firms in industries with high tariffs on Canadian imports prior to 1989 suffered a bigger ‘competitive shock’ following the liberalization than firms facing low tariffs. Our dependent variables will be a set of organizational variables  $ORG_{dst}$  by division  $d$  (or firm), industry  $s$  and year  $t$ , such as division-level depth, division manager pay, and CEO span of control (defined at the firm level).

In order to capture the level of exposure of the firm to the liberalization, we define the average tariff on Canadian imports by industry for the period between 1986 and 1988 (Feenstra et al., 1996).<sup>10</sup> Tariffs are defined as duty divided by customs value by 4 digit SIC (or 3 digit SIC) by year and we take the average of the three years before 1989.<sup>11</sup> We report the average tariff by industry (3 digit SIC) for firms in our sample in Table 1a. The simplest specification that exploits the trade liberalization is a standard difference-in-differences regression where the treatment is continuous ( $AvT89_s$  the level of tariffs on Canadian imports in the industry pre-89) and is as follows:

$$ORG_{dst} = \theta_1 AvT89_s + \theta_2 Post89_t + \theta_3 AvT89_s * Post89_t + d_s + \varepsilon_{dst} \quad (1)$$

where  $Post89_t$  is a dummy that equals one after 1989,  $d_s$  are industry dummies, and  $\varepsilon_{dst}$  is an error term.  $\theta_3$  captures the differential effect of the liberalization on firms according to their trade exposure prior to 1989, net of the general change post 1989 and net of possible permanent differences across industries.<sup>12</sup>

However, since we have access to individual firm and division data and to a long panel dataset, we are able to control further for firm or division-level characteristics that may vary over time (in particular firm and division size which are included in the vector  $X$  below), as well as

<sup>10</sup> The data are available from <http://www.internationaldata.org/> in the “1972-2001 U.S. import data”.

<sup>11</sup> We do not have non-tariff barriers, however to the extent that these are correlated with tariffs, we can interpret the tariff effect as the overall trade-liberalization effect (Trefler, 2004).

<sup>12</sup> Firms and divisions are assigned the industry reported as the firm’s primary four digit SIC in the first year they appear in the sample using historic SICs. This industry classification is not allowed to vary over time since these changes are endogenous and we use three digit SICs if four digit SICs are not reported. 70% of the firms in the sample appear before 1989, for those that appear after, we keep the first SIC reported. We conduct a series of robustness tests using a variety of methods in classifying the industry or industries in which a firm operates.

for firm or division permanent unobserved heterogeneity ( $\eta_d$ ), and division specific trends in the organizational variable,  $\eta_d * t$ . Incorporating these variables gives us the following specification:

$$ORG_{dst} = \theta_3 AvT89_s * Post89_t + X_{dst}' \beta + d_t + \eta_d + \eta_d * t + \varepsilon_{dst} \quad (2)$$

Notice that the effect of the post-89 dummy is absorbed by the year dummies ( $d_t$ ) and the pre-existing differences in  $AvT89_s$  and other permanent cross-sectional differences are absorbed in the division (or firm) fixed effects.

One concern in estimating equation (2) is that our organizational variables—both span and depth—exhibit a strong trend over time (as suggested in Figure 2) leading to autocorrelated errors. Not surprisingly, a test of autocorrelation strongly rejects the null of no autocorrelation, even when allowing for division-specific time trends (F statistic of 431.2). This implies that the fixed effects (within) estimation is inefficient. We estimate equation (2) in first-differences, since this removes the autocorrelation (F statistic of 2.6) and thus is the efficient estimator in this case (Wooldridge, 2002). Furthermore, since  $AvT89_s$  is defined at the industry level, we cluster standard errors by four digit SIC in all specifications to allow for correlation across observations within an industry.

#### A. *Validity of the trade liberalization as a “Quasi-natural experiment”*

We argued earlier that the agreement itself was largely unexpected and therefore one can consider it as an exogenous shock to the different industries. In order to make sure that there are no differential pre-existing trends in organizational variables that are correlated with tariff levels, we include division trends. We will also run a “placebo” test on the main specification, to assess potential anticipation effects of the liberalization. A potential source of endogeneity is the phase-out schedule of the tariffs. Some tariff reductions took effect immediately, while others were scheduled to be phased out over a period of five or ten years. Since that choice is endogenous and subject to lobbying, we treat all industries equally regardless of their phase-out schedule.<sup>13</sup>

But even if the implementation of the agreement was unexpected, and if we do not allow for endogenous phase-out of tariffs to identify our results, we still need to address the fact that the

---

<sup>13</sup> We will run a robustness check that shows that the effect of the liberalization on organizational change was larger in industries with faster reductions in tariffs.

pre-89 level of tariffs is not necessarily random. We do this in two different ways. Trefler (2004) argues that one source of tariff endogeneity is that declining industries may have high tariff levels. He addresses this concern by controlling for industry specific trends. We address this concern by controlling for division specific time trends ( $\eta_d * t$ ) that absorb the industry secular trends. We further control for other pre-existing industry characteristics that are typically related with tariff protection: skill intensity, capital intensity and TFP growth of U.S. industries. The vector  $Z_s$  includes the averages of each of these measures before FTA (between 1986 and 1988). Analogous to our tariff measure, we also allow organizational change to vary along these dimensions after 1989 through the interaction term ( $Z_s * Post89_t$ ).

Once we include these variables and take first differences, the regression we estimate is:

$$\Delta ORG_{dst} = \theta_3 \Delta AvT89_s * Post89_t + \Delta X_{dst}' \beta + \Delta d_t + \eta_d + \Delta(Z_s * Post89_t)' \varphi + \Delta \varepsilon_{dst} \quad (3)$$

### *B. Economic Significance of FTA for U.S. firms*

A final question before we proceed to the results is to what extent we could expect FTA to significantly affect U.S. firms. Clausing (2001), using disaggregated data at the commodity level (10 digit product categories), explicitly estimates the effect of the trade liberalization on U.S. imports from Canada as well as from the rest of the world. She finds that the increase in imports from Canada was larger the larger the tariff reduction (the higher the pre-1989 tariff). In fact, for imports that saw a tariff reduction in excess of 5%, trade doubled in size between 1989 and 1994, and over half of the \$42 billion increase in imports from Canada between 1989 and 1994 was the result of the trade agreement. Head and Ries (2001) find that a 1% reduction in tariffs is associated with a 9.6 % increase in imports from Canada, and Romalis (2007) also finds a sizable effect of the tariff reductions on trade volumes.

So overall the trade liberalization increased bilateral trade flows and import penetration,<sup>14</sup> which is consistent with an increase in competitive pressure for firms on both sides of the border. In fact, there is substantial micro-econometric work documenting the effect of FTA on Canadian firms. For example, Trefler (2004) finds a substantial increase in labor productivity of Canadian companies following the agreement. Further, the paper finds that the reduction in U.S. tariffs on exports from Canada led to a 6 % expansion of the most productive, export-oriented plants (and

---

<sup>14</sup> The evidence on whether the increase in trade was at the expense of trade with other countries is more mixed: Clausing (2001) and Head and Ries (2001) find no evidence of trade diversion, but Romalis (2007) does.

to a contraction of the most import-competing), suggesting that the liberalization allowed them to expand production, increase sales to the larger U.S. market, and move down their average cost curve. There is also evidence of plant rationalization for Canadian companies in this period (Head and Ries, 1999).

However, in contrast to the amount of evidence on the effect of the trade agreement on Canadian firms, there is much more limited evidence on the response of U.S. firms to the agreement. A few exceptions are Head and Ries (2001) and Feinberg and Keane (2001, 2006). Feinberg and Keane (2006) study the import/export behavior of U.S. multinationals and their Canadian subsidiaries and show that the reduction in tariffs led to a substantial increase in arms-length exports of U.S. multinationals to Canada (20% increase) and of their Canadian subsidiaries to the U.S. (29.8% increase). They also find increases in U.S. domestic sales and employment for these firms. Changes in tariffs explain most of the change in arms-length trade, but not changes in intra-firm trade (trade between affiliates their U.S. parents).

We assessed the effect of the trade liberalization on some basic economic outcomes for the firms in our sample (Table A1). Overall, we found that the trade liberalization significantly raised the stock market value of our firms, but there was a qualitatively different response to U.S. tariff reductions (that implied more import competition) and to Canadian tariff reductions (that presented more export opportunities). For the firms in our sample, Canadian tariff reductions raised firm employment which is consistent with the market expansion interpretation, while U.S. tariff reductions had a negligible effect on employment and a negative effect on average price cost margins. This decrease in margins is consistent with increased competitive pressure from foreign firms. Even though a thorough analysis of the effect of the liberalization on productivity and the profitability of U.S. firms is beyond the scope of this paper, the evidence indicates that it had a significant effect on the firms in our sample. In sum, the findings are generally consistent with increased opportunities for market expansion from the reduction in Canadian tariffs and higher competitive pressure from the reduction in US tariffs. Next, we will assess the organizational response to the liberalization.

## **4. Results**

### **4.1 Trade Liberalization and the Flattening Firm: Changes in Division Depth and CEO Span of Control**

In what follows we focus on the effect of the trade liberalization on changes in division depth and CEO span of control as the main organizational variables. In a subsequent section, we will explore how other aspects of organizations (in particular, levels of pay and incentive compensation for division managers) are also changing over time in order to provide a fuller picture of organizational change and to explore the possible mechanisms by which these changes occur.

Before turning to the regression results, let us begin by discussing Figures 3 and 4 that show the main variation that we exploit in our empirical analysis. We divide firms and divisions according to whether the firm is in an industry with a tariff above or below the median tariff pre-1989. We plot the average span (figure 3) and depth (figure 4) by year for the two subgroups. While we observe trending in organizational variables in both groups, there is a distinct difference in the change in trend after 1989 between the groups. Firms in high tariff industries increase their span by more and decrease depth by more after the trade liberalization in comparison to firms in low tariff industries. The patterns suggest that firms in industries facing increased competition alter the shape of their organizational hierarchy--greater span and decreased depth. These graphs restrict the sample to firms that are present in the data before 1989, and we observe even starker patterns in the whole sample. While the figures depict raw differences in organizational change of firms in industries facing different competitive shocks, they do not take into account firm or division characteristics, unobserved heterogeneity, or the overall time trend. For this, we turn to our regression analysis.

Clearly, changes in span and depth are correlated. As division managers get closer to the top of the hierarchy and are more likely to report directly to the CEO, span increases. Later we show that this relationship is not simply a mechanical one. In Tables 2 and 3, we report our results of the effect of FTA on division depth and CEO span of control respectively. The tables have a similar structure with specifications reported in roughly the same order. Since these organizational variables are related, we will describe and discuss our findings for both depth and span in parallel to provide a more coherent picture. In the depth regressions (Table 2) the unit of

observation is the division-year (there are 1524 divisions in the data); while in the span regressions (Table 3), it is the firm-year (230 firms).<sup>15</sup>

All regressions follow the structure of equation (3) and include year dummies and controls for firm size (as the natural logarithm of sales) and the endogeneity of tariffs through interactions of industry characteristics (skill intensity, capital intensity and TFP growth) with a post 89 dummy. Standard errors are clustered at the industry level. The regressions also account for permanent unobserved heterogeneity (firm or division) that might bias our estimates. This is a big advantage of this dataset, in that the estimates are exclusively identified from within firm variation in their exposure to FTA (and not from differences across firms).

The coefficient of interest (variable  $AvT89*Post89$ ) is the interaction of the average tariff in the industry before the 1989 FTA with a post 89 dummy. The agreement specified that all tariffs be eliminated (within a time frame) after 1989. As such, we expect the agreement to reflect a greater increase in competitive pressure (i.e., a larger fall in entry barriers) in industries with high tariffs relative to low tariff industries.

The main results are shown in Column 1 of Tables 2 and 3. In column 1 of Table 2 (depth) the coefficient on the interaction term is negative and statistically significant. This suggests that firms in industries with higher tariffs prior to the trade liberalization decreased division depth more over the period as their product markets faced greater competition due to a decline in tariffs. A firm in an industry with average U.S. tariffs on Canadian imports (4 %) decreased division depth by 0.146 positions following the trade liberalization ( $3.661*0.04$ ). This represents 11.2 % of average depth in the sample. Turning to span of control, in Table 3 column 2, we find a positive and statistically significant coefficient suggesting that firms increase span of control more in response to a greater fall in tariffs in their industries. A firm with average tariffs before 1989 increased span by 0.324 positions following the trade liberalization ( $8.106*0.04$ ), or 6 % of average span in the sample.

In Table 2 (depth) columns 2 through 11, we also control for division specific time trends and for division size (the log of division employment). We lose around 700 observations where

---

<sup>15</sup> It is important to run the depth regressions at the division level –instead of averaging by firm- in order to look at changes of the same division over time, and be able to control for division size. Given that the coverage of divisions within a firm can fluctuate (firms do not report all divisions in the data), changes in average depth within firms may be capturing compositional changes. We also checked whether the coverage of divisions (as the fraction of total sales represented by the divisions in the sample out of total firm sales as reported by Compustat) changed with the experiment, and found that it did not (column 1 Table A2 in the Appendix).

division employment is missing, but this does not substantially alter the results. Perhaps not surprisingly, larger firms have greater depth and larger divisions within firms are closer to the top. Controlling for division employment also allows us to indirectly control for the potential down-sizing of divisions due to outsourcing, or off-shoring of certain activities, since this would possibly lead to a reduction in employment. The stability of the main coefficient of interest suggests that outsourcing is unlikely to be driving our main findings. Even conditional on division size, we find that divisions in firms more affected by FTA repositioned their DMs closer to the top of the hierarchy.

Column 2 of Table 3 (span) controls for firm specific time trends, and we obtain a similar though slightly larger effect than in column 1 (coefficient of 9.9 instead of 8.1). This indicates that the result is not driven by pre-existing trends in span that may have pre-dated the liberalization agreement.<sup>16</sup>

Next, since the trade liberalization implied not only a fall in U.S. tariffs on Canadian imports, but also a reduction of Canadian tariffs on U.S. exports, we want to allow for an effect of this second aspect of the liberalization. Column 3 includes an interaction of the average Canadian tariff on U.S. exports with a post 1989 dummy (labeled as Export AvT89<sup>17</sup> and defined in an analogous way to U.S. AvT). The effect is positive for depth and negative for span, suggesting that on average the market expansion possibilities given by easier exporting to Canada by U.S. firms led to smaller decreases in depth and increases in span, relative to the trend. However, since this effect is never statistically significant, this suggests that it is the increase in competitive pressure that leads firms to flatten, rather than greater export opportunities. What might explain this? One explanation is that the Canadian market is small relative to the U.S. market, so that the market expansion opportunities are not substantial. Alternatively, to the extent that market

---

<sup>16</sup> Since the increase in the number of direct reports may come from senior officer positions as well as from lower level managers, and since the presence of the Chief Operating Officer (COO) has decreased substantially over the sample period, we also controlled for the presence of a COO and a Chief Administrative Officer (CAO) that may report directly to the CEO. We found that the effect of the liberalization is slightly reduced suggesting that the estimated increase in span also includes other senior officer positions as well as managers traditionally lower in the hierarchy (unreported).

<sup>17</sup> This is the average Canadian tariff by 4 digit SIC (3 where 4 is missing) on US exports, measured as the mean tariff between 1986 and 1989. This is fixed and interacted with a Post89 dummy to allow for a differential effect of export tariffs in addition to the main import tariff effect. The data on Canadian tariffs are from Trefler (2004), and we use a converter provided by the author to convert Canadian industry codes into US SIC codes.

expansion does not generate competitive pressure, it may lead to other types of organizational changes different from those that we can identify in our data.<sup>18</sup>

For the remaining columns in both Tables 2 and 3, we explore the robustness of the main results to the inclusion of a number of controls and to alternative explanations. Column 4 provides a test of the main specification and specifically the assumption that the shock was unanticipated. We replace the Post 89 dummy in  $AvT*Post89$  with a post 1988 dummy variable and keep the same set of controls. If the liberalization was anticipated, or if there was a pre-existing trend, then this new variable would pick up what we argue is a discrete “shock” before it occurred. But, the coefficient is statistically insignificant in both tables, lending credibility to the fact that the liberalization was truly unanticipated and that firms only started to respond after 1989.

In column 5 of both tables, we further analyze the timing of the effect by considering if there was a lag in the firm’s response or if some of the change occurred around the time of the North American Free Trade Agreement (NAFTA). Since NAFTA did not alter trade agreements between Canada and the US (it was only an extension to Mexico), we expect it to have a negligible effect. To test this, we include an interaction of the average tariff between 1990 and 1993 with a post-94 dummy variable ( $AvT94*Post94$ ). This captures the differential effect of NAFTA across firms operating in industries with different levels of protection after 1989, but before 1994. We find statistically insignificant coefficients on both the interaction term associated with the 1994 experiment and on the lagged term. These findings suggest that most of the effect came from the 1989 agreement. The absence of an effect for the 1994 experiment is also consistent with the fact that there were no radical changes in the tariff agreements of NAFTA with respect to Canada. Furthermore, it suggests that we are not just capturing a spurious time trend. If it was spurious, the 1994 experiment coefficient should be significant, particularly since substantial flattening occurred during the late 1990s.

All the results above are based on average U.S. tariffs on Canadian imports in the firm’s primary 4 digit SIC code (3 digit if reported at 3 digits) in which the firm operated before 1989.

---

<sup>18</sup> In fact, we also found evidence that division depth and CEO span significantly respond to other standard measures of competitive pressure (Appendix Table A4). We found that higher competition as reflected in lower trade costs (defined as tariffs plus transport costs, columns 1 and 4), a lower industry Lerner Index (columns 2 and 5) or higher import penetration (columns 3 and 6) significantly reduces depth and increases CEO span of control (although for the latter, only the trade costs variable is significant). While these measures can be subject to many criticisms and are by no means exogenous –that is why we use the FTA as our core specification- they provide evidence consistent with the main result in this paper: that flattening is a response to competitive pressure.

We use the industry classification that is reported prior to the trade liberalization to isolate the effect from endogenous changes in the main industry reported. Since our sample is comprised of multidivisional firms that typically operate in different industries and may change industry focus over time, we analyze the effect of the trade liberalization on a number of sub-samples to assess the validity of the main results.

For firms that operate in more than one industry, there may be considerable noise in the industry tariff measure as a proxy for the change in competition that a firm faces. To address this concern, instead of using industry tariffs of the firm's primary SIC code, we construct a firm-specific measure that recognizes the firm's business mix. We use the weighted average of US tariffs for the industries in which the firm operates before the liberalization, where the weights are the fraction of sales of each of the firm's segments (as reported in 1988 from Compustat segment data). The weights are kept constant over the sample period to avoid endogeneity in choice of industry (for the same reason we kept the primary SIC constant). This comes at a cost in that, if segment data are noisy, the weights will be as well and this could induce measurement error. We report the results based on this firm-specific tariff measure in column 6 of both tables. The estimated effect is approximately 14 to 20 % larger for depth and span respectively and still statistically significant (although the standard errors are larger, and there is no statistical difference from the main effect).

Relatedly, we might expect industry tariffs to be a more precise measure of competition for firms that report their industry at a lower level of aggregation (i.e., 4 digit SIC codes instead of 3 or 2). In column 7 in both tables, we restrict the sample to firms that report a 4 digit SIC and find a larger and more precisely estimated main effect. Finally, in column 8 in both tables, we restrict the sample to firms that report the same SIC throughout the sample period. In these regressions, since we exclude firms that may have endogenously changed their primary industry of operations, we would expect tariff reductions to more closely approximate actual changes in competition. This should lead to larger and more precisely estimated effects and this is exactly what we find in column 8 in both tables.<sup>19</sup>

---

<sup>19</sup> Further robustness checks of the main results are presented in the Appendix Table A3 (depth in Panel A and span in Panel B). The results are similar if we restrict the sample to firms that are present in the sample before 1989 (column 1), if we include all services firms in the estimation as a control group (with average tariff  $AvT89$  of zero, column 2) and when controlling for fluctuations in the exchange rate that may differentially affect industries with different levels of import penetration (column 3). The magnitude of the effect is larger when we restrict the sample

Overall, we find convincing evidence that the effect of the trade liberalization on the flattening of firms took place around the 1989 period, that the liberalization was unanticipated, and that the effect was larger in industries where we have better measures of changes in competition. To reiterate the main findings: we find systematic evidence that U.S. firms, in response to trade liberalization with Canada, flattened the structure of their organizations. They reduced division depth by moving division managers closer to the top of the hierarchy and they increased the CEO span of control. Next we consider a couple of alternative explanations that could affect our main results.

One frequent reason for why firms change their organizations is explained by changes in firm leadership. Very often reorganizations come about when the CEO is replaced. In column 9 in both tables, we address this question by including a dummy variable that controls for a change in CEO. We find that depth decreases by 0.182 positions (division managers move closer to the top) in the event of a change in the CEO, and that span increases by 0.446 positions. The effect is highly statistically significant for both depth and span and contributes substantially to the R-squared of both regressions. However, the point estimate of  $AvT89*Post89$  hardly changes (from 3.5 to 3.3 for depth and no change for span) and is estimated with similar precision, suggesting that the trade liberalization has an independent effect on organizational change that is distinct from CEO turnover. We also checked whether the probability of a CEO change increased with the liberalization, with positive but statistically insignificant results (column 2 Table A1 in the Appendix).

Finally, we try to consider the relevance of IT as a driver of organizational change. The mere availability of IT and falling IT prices should not be a problem for our identification since the availability of IT was similar across industries and our experiment exploits the differential effect across industries after 1989. However, to the extent that firms in different industries adopt IT in similar ways, we control for two types of IT investment at the industry level: total IT in column 10 (includes hardware, software and communications) and communication technology (CT) in column 11 of Table 2. These are defined as the investment in IT (CT) capital stock at the 2-digit SIC industry level based on data from the Bureau of Economic Analysis (BEA) (refer to the data appendix for specifics). The data are very aggregated relative to what one would require for a

---

to firms: (i) with no Canadian subsidiaries (column 4), and (ii) with a faster scheduled reduction in tariffs (column 5).

conclusive analysis, however, they allow us to evaluate the robustness of our main results to investments in information technology. We find that our coefficient of interest is unaffected.

Regarding the coefficient on overall IT in column 10 in both tables, we find it is positive for both depth and span suggesting that increases in IT are associated with deeper organizations and wider spans of control. However, both coefficients are statistically insignificant. When we exclusively focus on the communications component of IT (Table 2 column 11), we find a positive and statistically significant coefficient in the depth regression (but, insignificant for span, (unreported)). This suggests that firms in industries that are investing in IT and, in particular CT, are steeper (Garicano, 2000). Therefore the effect on delayering of more IT (CT) goes in the opposite direction to the competition effect that we have shown in this study. While these results are only suggestive, and while a more detailed analysis of IT and hierarchical change is needed, it is unlikely that the effect we are capturing is due to IT.

Overall, we find systematic evidence that firms experiencing a larger shock following the trade liberalization (those in more protected industries prior to 1989) reduced division depth and increased CEO span of control *more* relative to firms less affected by the liberalization. As for the robustness of the effect, once we control for industry trends, firm size, division employment, division fixed effects, and division specific time trends our estimates suggest that the trade liberalization led to a reduction in the levels of the managerial hierarchy and an increase in CEO span of control in U.S. manufacturing firms.

#### **4.2 Division Manager (DM) Compensation and Incentives**

The previous results show that the trade liberalization partially explains some of the flattening of US firms—both the increased span of control of the CEO and the decreased depth of division managers (or the delayering of levels in the hierarchy). Arguably, they represent causal estimates of an exogenous shock to the product market, that go beyond the simple correlations of prior research. However, even though they capture a significant causal effect, they are silent on the reasons for why firms alter their organizational structure and what the flattening actually means. While it is difficult to identify precise channels for the causal mechanism, in this section we attempt to shed some light on this issue by analyzing changes in DM pay and incentives. From this we try to infer the way in which the role of these managers changes with the flattening of the organization.

As shown earlier, following the trade liberalization, division managers are closer to the CEO in the organizational hierarchy. We argue that this may reflect the increased responsibility of division managers (DM) and potentially greater delegation of authority as an optimal response to competition (consistent with Marin and Verdier, 2003). Strictly speaking, our depth measure reflects “number of reporting levels” without any information on the actual role of the DM, or the decisions they make. However, by looking at DM compensation and the importance of performance pay in their contracts, we can potentially infer a difference in job scope.<sup>20</sup>

Table 4 shows the effect of the liberalization on the level of pay and on DM incentives based on division-level performance (as opposed to firm-level performance, reported in Table 5). The dependent variable is the logarithm of division manager total compensation. Total pay for DMs is the sum of salary, bonus, and long-term compensation. The value of the long-term compensation includes restricted stock, stock options and other components of long-term incentives and is determined by a modified version of Black-Scholes.<sup>21</sup> The regressions are again as in equation (3).

Column 1 shows that higher competitive pressure leads to higher total pay *within the division* (it includes division fixed effects). That is, the same DM position earns higher total pay after the competitive shock. Division managers in industries with average tariffs on Canada pre-1989 received a 7.0 % increase ( $1.751 \times 0.04$ ) in total compensation after the trade liberalization relative to managers in industries with no tariffs. But while interesting in itself, this could be driven by firms replacing managers with more skilled ones following FTA. If firms are hiring more talented managers that require higher pay, then our result is a mixture of more skilled hires combined with changes in job scope. To address this, columns 2 through 5 include manager times division fixed effects (so that the effect is identified out of changes in pay of an individual in a division). Even though we do not know the identity of the manager filling the position (the

---

<sup>20</sup> One concern is that the notion of a division varies across firms and what we are picking up in our pay regressions is either just differences in a firm’s definition of a division or differences in firm compensation policies. Since we have division fixed effects, permanent cross-sectional differences in how firms define a division will not affect our estimates. Moreover, the results are robust to controlling for division depth.

<sup>21</sup> The value of long-term compensation is computed by Hewitt Associates and therefore is consistent across firms and over time. Stock options are valued using a modified version of Black-Scholes that takes into account vesting and termination provisions in addition to the standard variables of interest rates, stock price volatility, and dividends. As is standard practice among compensation consulting firms, the other components of long-term incentives (i.e. restricted stock, performance units and performance shares) are valued using an economic valuation similar to Black-Scholes that takes into account vesting, termination provisions, and the probability of achieving performance goals.

unit of observation in the data is a position), for most divisions in our sample we can identify managerial turnover using changes in tenure for the position over time. Therefore these estimates are net of individual unobserved ability, and division (and firm) permanent unobserved characteristics. The results in column 2 for the level of pay are similar to those in column 1, suggesting that firms respond to increased competition, not by replacing existing managers with new, higher-skilled managers, but instead by paying existing managers more. This result is robust to controlling for manager specific linear trends in pay (column 3).<sup>22</sup>

One way to interpret this increase in pay along with the simultaneous reduction in depth and increase in span is that firms in more competitive environments are more likely to delegate authority from the senior most positions to division managers. The CEO may face greater time constraints as his span of control increases, thereby delegating more decision-making authority to division managers. The increase in division manager pay may be commensurate with the increase in responsibilities and job scope. However, in order to more convincingly make this argument, it is important to look at changes in performance-based pay and not just to changes to total pay.

In conjunction with greater delegation of decision-making, firms may increase performance-based pay to ensure that division managers make decisions that are optimal for the firm. It is often argued that delegation and incentive provision are complementary (Prendergast, 2002): in the absence of multi-tasking, delegating authority will be more productive for the firm the more incentives the division manager has to take initiative, collect information, and make the right decisions for the business unit.

Column 4 of Table 4 presents the basic sensitivity of DM pay to division performance as measured by the natural log of division sales. The estimated coefficient is the elasticity of pay to sales: we find that a 1 % increase in division sales (controlling for division employment and firm size) leads to a 0.085 % increase in pay.<sup>23</sup> Column 5 assesses how this elasticity changes with the trade liberalization. The coefficient of interest is on  $AvT*Post89*\ln Div\ Sales$  which reflects the effect of the trade liberalization on the performance pay sensitivity of division managers. The results indicate that the estimated performance pay sensitivity for DMs increased by more in

---

<sup>22</sup> These manager fixed effects also capture any other variables that determine wages and do not change over time such as gender differences and education. The individual trends also account for linear age and tenure effects.

<sup>23</sup> All these regressions include the logarithm of division employment as a control for division size. When we do not include it, the magnitude of the elasticity is 0.108 instead of 0.085.

industries with greater increases in competition. In particular, the sensitivity increases by 0.02 for the division in an industry with average tariffs ( $0.499*0.04$ ). So it raises the base elasticity by 23% (compare increase of 0.02 in sensitivity in column 5 to 0.085 in column 4), and it reduces the intercept of pay by  $-0.204$  ( $-5.015*0.04$ ). So overall, the average estimated incentive contract has a higher slope and a lower intercept, which reflects an increase in incentives. As mentioned above, we know from theoretical work that delegation and incentive provision are often complements. So, the fact that performance pay sensitivities are increasing as the DM moves closer to the CEO suggests that the estimated delayering is possibly accompanied by delegation.

However, an important cost of excessive reliance on division level incentives is that DMs as agents are motivated by the performance of their division and not of the firm as a whole (Athey and Roberts, 2001). While there are benefits of delegating decision-making, there are offsetting costs in the loss of coordination across divisions. Division manager decisions/actions may impact other divisions (through internal capital market allocations, information sharing, or lack thereof, etc). In order to reduce the cost of delegation, firms may tie a larger fraction of incentives to overall firm performance and not just division-level performance. Of course, the power of firm level incentives is relatively low (since the manager only gets a small fraction of his contribution to firm level performance), but firms can use firm level incentives to induce coordination across divisions.<sup>24</sup>

We evaluate further changes in incentive provision by firms in Table 5 where now the dependent variable is the fraction of long-term incentives out of total pay that division managers receive (columns 1 to 3). The results show that the trade liberalization led to a higher fraction of total pay in the form of long-term incentives for division managers. For the firm facing average tariffs, the increase in the share of long-term incentives is 3.5 % ( $0.882*0.04$ ) relative to the average share of 28% for all division managers. Stronger links between pay and firm performance should encourage DMs to consider the effect of their decisions on overall firm performance and to coordinate their actions with other division managers.

Finally, just as we can test for the sensitivity of DM pay to division performance, we can estimate its sensitivity to firm performance. We do this in columns 4 and 5 of Table 5 where we use the log of total stock market value of the firm as our performance measure (includes

---

<sup>24</sup> A puzzle when thinking about incentives is why do firms offer firm-based incentives to managers below the executive suite. One answer is coordination (Alonso et. al, 2008; Friebel and Raith, 2007), other reasons include employee retention and sorting (Oyer and Schaefer, 2005)

dividends).<sup>25</sup> Since the equation is in first differences, this estimates the change in log pay from increases in log stock returns (including dividends). The basic sensitivity in column 4 is 0.131, and the interaction with the liberalization (column 5) suggests that the sensitivity of DM pay to firm performance increased more in industries that faced greater competition after the liberalization.<sup>26</sup>

Tables 4 and 5 show that competition from FTA triggered changes in both the level and performance sensitivity of pay for division managers: increased overall pay, increased sensitivity to division performance, as well as an increased importance of firm level performance in total compensation. This set of facts is consistent with the explanation that increased competition leads to a greater need to quickly adapt to local conditions. Firms respond by delegating authority to division managers. However, since delegation is costly because it exacerbates agency and coordination problems, firms increase the performance sensitivity of division manager pay, especially pay that is linked to firm performance.

The results so far strongly suggest that our organizational variables are highly complementary within firms. We turn to an explicit evaluation of these complementarities in the next section.

### 4.3 Complementarities in Organizational Design

The results so far show that the trade liberalization had an effect on a number of different organizational practices and strongly suggest that our organizational variables are highly complementary within firms. While we do not observe returns to firm organizational choices, we can evaluate the extent to which changes in organizational design move together by the strength of the *correlation* within divisions among these variables.<sup>27</sup> In Table 6, we correlate the different practices in a regression framework, allowing for division fixed effects, division trends, and controls for division and firm size.

---

<sup>25</sup> We obtain similar results if we use log firm sales as the performance measure.

<sup>26</sup> Although it is not the focus of the paper, we also analyzed the evolution of CEO pay following liberalization. We found the changes in CEO pay to mirror those of division managers. Total CEO compensation (column 3 table A2) and the fraction of long-term incentives in total pay (column 4 table A2) increased more in highly affected industries after 1989.

<sup>27</sup> For example, changing one organizational design choice, such as moving the division manager closer to the top of the hierarchy may be more effective in improving firm performance when it occurs in conjunction with other design elements. Hence, when division managers are closer to the top of the hierarchy, firms may provide stronger firm-level incentives to encourage division managers to make decisions that enhance firm value.

We find strong correlations between these variables. For example, each additional layer between the CEO and the division manager is associated with a decrease in division manager pay: a 7.2% decline in the logarithm of total compensation (column 1) and a 1.2% decline in the share of long-term incentives to total compensation (column 2). Depth and span are also strongly negatively correlated (columns 3 and 4). As firms move division managers closer to the top, the span of the CEO increases. And, this is not a purely “mechanical” result. In column 4, we find that depth is related to the number of DM positions that report to the CEO excluding the own division (thereby removing the purely mechanical part of the correlation) as well as to the number of senior functional positions that report directly to the CEO (such as the CFO, General Counsel, Chief Information Officer, Head of Human Resources, etc.).

With regard to pay and span, the results are more subtle (columns 5 through 8). While division manager pay and incentives are positively related to the number of other division managers reporting directly to the CEO, they are negatively related to the number of functional managers reporting directly to the CEO. This suggests that division positioning in the hierarchy and managerial pay are complements, but interestingly, that senior staff positioning and division manager pay are substitutes. One plausible explanation for this finding is that when senior staff managers report directly to the CEO and certain functions are centralized, their increase in authority comes at the expense of division manager authority and job scope.

In sum, the strong correlations found between CEO span of control, division depth and the design of division manager compensation are consistent with the view that these organizational choices are indeed complements. Moreover, the trade liberalization, as an exogenous shock to the environment, triggered a series of organizational changes that illustrate the complementarities.

#### **4.4 Alternative explanations**

We argue that the observed organizational changes in response to the trade liberalization and the implied increase in competitive pressure are the result of firms altering a number of complementary organizational practices at their disposal to better respond to the changes in the product market. However, this is not the unique interpretation of the results, so we tested for a number of alternative explanations. We consider additional aspects of organizations (e.g., the number and pay of select intermediary positions and the degree of firm diversification) that may

change with the trade liberalization. Since these changes are endogenous, we cannot simply include them as controls in our previous specifications. In Table 7, we treat these as dependent variables and analyze their response to the trade liberalization.

The first alternative explanation that we explore is downsizing. A simple explanation often provided for why firms reorganize is to cut costs. Under this line of reasoning, firms delay and eliminate managerial positions (i.e., division managers move closer to the CEO) primarily to cut costs and the reorganization has little to do with changes in how decisions are made. To evaluate this, we consider our pay results in a different light. If the reorganizations were simply cost-cutting, we would expect the level of division manager pay to decline with the trade liberalization. We find the opposite. Of course, the pay increases might be specific to division managers and the firm may be eliminating other senior manager positions and reducing their pay. To evaluate this, we focus on an intermediary position between the CEO and the division manager: the group manager. These managers have multiple profit center responsibility and are typically positioned between the CEO and the division manager.<sup>28</sup>

In column 1 Table 7, we regress the number of group positions in the firm on our competition measure and include firm fixed effects and trends and control for firm size. We find that the trade liberalization has a negative effect (although not statistically significant). So, there is some (weak) evidence of downsizing: firms are reducing the number of group managers in the face of greater competition. But, to really shed light on the downsizing argument, we need to ask: what is happening to the pay of these group managers? If firms are cutting costs, we would expect pay to be declining. Again, we find the opposite. In column 2, the dependent variable is the total wage bill for the group positions (i.e., the number of group managers \* total compensation per group manager). We find a positive and statistically significant coefficient suggesting that, while firms may be reducing the number of group positions, they are increasing their average pay. Also, we find that firms are increasing CEO pay in response to the trade liberalization (reported in the appendix—Table A2). Since we do not observe labor costs for all senior management positions, it could be that firms eliminate and reduce pay of other positions. Never-the-less, the

---

<sup>28</sup> In the paper, we do not focus on the group manager position for several reasons. First, not all firms report them: they are more likely to appear in larger, more diversified firms. Second, since group managers are defined on the basis of their position in the hierarchy (proximity to CEO and COO), it is harder to infer facts about depth or responsibility from their position. By contrast, division managers are defined on the basis of their responsibility, and hence we can infer more about hierarchies from where they are placed.

documented increases in senior management pay in response to the trade liberalization are inconsistent with the simple explanation of cost-cutting.

An alternative explanation for the increase in span of control would be that firms diversify into more businesses as the result of the liberalization –maybe to diversify risk-, and as a result span of control increases as the additional business unit managers report directly into the CEO. We use the Herfindahl index of sales across different 2 digit segments, as an inverse measure of firm diversification, and find evidence against the diversification story: multidivisional firms tend to decrease scope and focus their business operations (become less diversified) in the presence of increased competition. Column 3 in Table 7 shows this result.

Since many of these firms have multinational operations, and some are likely to have Canadian subsidiaries before 1989, we tried to test whether their choice of being located in Canada changed with the liberalization. If U.S. firms created Canadian subsidiaries because of trade barriers, we might expect the benefits of local presence in Canada to disappear with freer trade. Column 4 presents the results where the dependent variable is the number of Canadian subsidiaries of the firm. We only have information for 1988 and 1993, and therefore rely on the change between the two years. Even though we find a negative sign (firms for whom the reduction in tariffs was greatest reduced the number of subsidiaries), it is not significant, so it is hard to ascribe the main effect we find on depth and span to this explanation.

These results are suggestive of firms responding in a variety of ways to the trade liberalization. These include focusing on their core businesses and rationalizing the location of their operations. The findings on flattening that we establish in this paper are possibly part of the implementation of this new corporate strategy.

## **5. Conclusion**

Conventional wisdom and recent empirical evidence suggest that firm hierarchies are flattening— hierarchies have fewer levels and broader spans of control. What are the possible explanations for the flattening of firms? Do hierarchies flatten because of the adoption of information technology, changes in work practices or managerial skill, or new plans for firm strategy and shifts in business mix? Many have argued that increased competition from globalization has driven firms to search for new organizational forms to replace traditional hierarchical structures. In this paper, we focus on this explanation.

The main contribution of the paper is to establish a causal effect between increased foreign competition measured by the trade liberalization between Canada and the U.S. and the flattening of firms. We use a unique panel-dataset of organizational practices that allows us to identify our results from variation within divisions and firms over time, and not from cross-sectional differences. Since the trade liberalization was bilateral, it also implied a reduction in Canadian tariffs on U.S. exports potentially leading to market expansion opportunities for our U.S. firms. But, our findings suggest that it is increased competition that causes firms to reorganize rather than greater market expansion opportunities.

We find that U.S. firms in manufacturing industries more exposed to the trade liberalization reduce the number of hierarchical levels, broaden the span of control for the CEO, and radically change the structure of compensation of division managers with more incentives based on division performance as well as on firm performance. Thus, the firms in our sample appear to change a number of practices simultaneously following a shock to their economic environment which is consistent with theories of complementarities in organizational practices. It is the simultaneous change of these complementary practices that allows us to provide an interpretation for the reasons behind firms' choices. .

Our evidence suggests that firms may be fundamentally altering how decisions are being made. While we do not directly observe changes in authority, the greater importance of performance-based pay for division managers in conjunction with closer proximity to the CEO is consistent with this interpretation. To the extent that competition increases the value of delegation and quick decision-making, firms can eliminate layers and increase the authority of division managers to become more adaptive to local information. Delegation is then accompanied by an increase in local (division-based) incentives since these tend to be complementary practices. However, since delegation and local incentives come at the cost of less coordination across divisions, firms also raise the power of global incentives (based on total firm performance). Furthermore, the broadening in the CEO's span of control possibly enabled more accurate transmission of information and a more important coordinating role for the CEO and his senior functional officers. Our findings are generally consistent with this account of the evolution of complementary choices as a response to an external shock.

We also discuss a number of alternative explanations for our results, the simplest one being cost-cutting by firms. However, we find that pay of division managers (and other senior

management positions) increases in more competitive environments which seems at odds with the simple cost-cutting explanation.

Finally, we only identify one channel for the flattening of firms, and there are possibly many others, such as the increased availability of IT. Moreover, firms may be responding to the new competitive environment along other dimensions with the changes in organization being complementary. We find some evidence that, in response to competition, firms “refocus” on core competencies and become less diversified. Further investigation of how organizational structure interacts with other corporate responses and the overall impact of these changes on firm performance is left for future research.

## References

- Acemoglu, Daron, Philippe Aghion, Claire Lelarge, John Van Reenen and Fabrizio Zilibotti (2007), "Technology, Information and the Decentralization of the Firm," *Quarterly Journal of Economics*, forthcoming.
- Aghion, Philippe, and Jean Tirole (1997), "Formal and Real Authority in Organizations," *Journal of Political Economy*, 105, pp. 1-27.
- Alonso, Ricardo, Wouter Dessein and Niko Matouschek (2008), "When Does Coordination Require Centralization?," *American Economic Review*, 98(1), 145-179.
- Askenazy, P., D. Thesmar, and M. Thoenig (2006), "On the Relation Between Organizational Practices and New Technologies: The Role of Time Based Competition," *The Economic Journal*, 116, pp.128-154.
- Athey, S. and J. Roberts (2001), "Organizational Design: Decision Rights and Incentive Contracts," *American Economic Review*, Papers and Proceedings, 1.91, pp. 200-205.
- Athey, S. and S. Stern, (1998), "An Empirical Framework for Testing Theories about Complementarity in Organizational Design," NBER Working Paper 6600.
- Baker, George P., and Thomas Hubbard (2004), "Contractibility and Asset Ownership: On-Board Computers and Governance in US Trucking," *Quarterly Journal of Economics* 119(4), pp. 1443-1479.
- Bartel, Ann, Casey Ichniowski and Kathryn Shaw (2007), "How Does Information Technology Affect Productivity? Plant-Level Comparisons of Product Innovation, Process Improvement and Worker Skills," *Quarterly Journal of Economics*, 122(4), pp. 1721-1758.
- Bartelsman, Eric J. and Wayne B. Gray (1996), "The NBER-CES Manufacturing Industry Database," (1958-1996), NBER Working Paper 205
- Black, Sandra and Lisa M. Lynch (2001), "How to Compete: The Impact of Workplace Practices and Information Technology on Productivity," *Review of Economics and Statistics*, 83(3), 434-445.
- Bernard, Andrew B., J. Bradford Jensen and Peter Schott (2006), "Survival of the Best Fit: Low Wage Competition and the (Uneven) Growth of US Manufacturing Plants," *Journal of International Economics*, 68 pp. 219-237.
- Bloom, Nicholas, and John Van Reenen (2007), "Measuring and Explaining Management Practices Across Firms and Countries," *Quarterly Journal of Economics*, 122(4), pp. 1351-1408.
- Bloom, Nicholas, Raffaella Sadun, and John Van Reenen (2007), "The Organization of Firms Across Countries," Stanford Working Paper.
- Bolton, Patrick and Mathias Dewatripont (1994), "The Firm as a Communication Network," *Quarterly Journal of Economics*, 109(4), pp.809-839.
- Bresnahan, Tim, Eric Brynjolfsson and Lorin Hitt (2002), "Information Technology, Workplace Organization, and the Demand for Skilled Labor: Firm-Level Evidence," *Quarterly Journal of Economics*, February 2002, 339-376.
- Brynjolfsson, Erik, Malone, Thomas W., Gurbaxani, Vijay, and Kambil, Ajit (1994), "Does Information Technology Lead to Smaller Firms?" *Management Science*, 40(12), pp. 1628-45.
- Burns, Tom and G.M. Stalker (1961), *The Management of Innovation*, Travistock, London, England.
- Calvo, Guillermo and Stanislaw Wellisz (1979), "Hierarchy, Ability, and Income Distribution," *Journal of Political Economy*, 87(5). p 991-1010. Part 1, Oct. 1979.
- Caroli, Eve, and Van Reenen, John (2001), "Skill Biased Organizational Change," *Quarterly Journal of Economics*, 116, pp.1448-1492.
- Chandler, Alfred D., Jr. (1962), *Strategy and Structure: Chapters in the History of Industrial Enterprise*, Cambridge, Mass. MIT Press.
- Clausing, Kimberly A. (2001), "Trade Creation and Trade Diversion in the Canada-United States Free Trade Agreement," *The Canadian Journal of Economics*, 34(3), pp. 677-96.

- Cockburn, Iain; Rebecca Henderson, and Scott Stern, (2004), "Balancing Incentives: The Tension Between Basic and Applied Research," Northwestern University (Kellogg), working paper.
- Conconi Paola, Patrick Legros, and Andrew F. Newman (2008), "Trade Liberalization and Organizational Choice," CEPR working paper.
- Cuñat, Vicent and Guadalupe, Maria (2006), "Globalization and the provision of incentives inside the firm: The effect of foreign competition", Columbia University working paper.
- Dessein, Wouter (2002), "Authority and Communication in Organizations," *Review of Economic Studies*, 69(4), pp.811-838.
- Dessein Wouter, Luis Garciano and R. Gertner (2007), "Organizing for Synergies," CEPR Discussion Paper No. 6019.
- Dessein, Wouter and Tano Santos (2006), "Adaptive Organizations," *The Journal of Political Economy*, 114(5), pp. 956.
- Feenstra, Robert C. (1996), "NBER Trade Database, Disk1: U.S. Imports, 1972-1994: Data and Concordances," NBER Working Paper no. 5515.
- Feinberg, Susan E. and Michael P. Keane (2006), "Accounting for the Growth of MNC-Based Trade Using a Structural Model of U.S. MNCs," *American Economic Review*, 96(5), pp. 1515-1558.
- \_\_\_\_\_ (2001), "US-Canada Trade Liberalization and MNC Production Location," *The Review of Economics and Statistics*, 83(1), pp. 118-132.
- Freibel, G. and M. Raith (2007), "Resource Allocation and Firm Scope," Mimeo, University of Toulouse and Simon School of Business, University of Rochester.
- Garciano, Luis (2000), "Hierarchies and the Organization of Knowledge in Production," *Journal of Political Economy*, 108(5), pp.874-904.
- Garciano, Luis and Tom Hubbard (2007), "The Return to Knowledge Hierarchies," Working Paper Chicago
- Hart, Oliver and John Moore (2005), "On the Design of Hierarchies: Coordination Versus Specialization," *Journal of Political Economy*, 113(4), pp.675-702.
- Head, C. Keith and John Ries (2001), "Increasing Returns versus National Product Differentiation as an Explanation for the Pattern of US-Canada Trade," *American Economic Review*, 91(4), pp. 858-876.
- \_\_\_\_\_ (1999), "Rationalization Effects of Tariff Reductions," *Journal of International Economics*, 47(2), pp. 295-320.
- Holmstrom, Bengt and Paul Milgrom (1991), "Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design," *Journal of Law, Economics and Organization*, 7. Pp. 24-51.
- Holmstrom, Bengt and Paul Milgrom (1994), "The firm as an Incentive System," *The American Economic Review*, 84(4), pp. 972-991.
- Ichniowski, Casey, Katherine Shaw and Jon Prennushi (1997), "The Effects of Human Resource Management Practices on Productivity," *American Economic Review*, 86, pp. 291-313.
- Lawrence, Paul R. and Jay W. Lorsch (1967, 1986), "Organization and the Environment," Harvard Business School Press, Boston, MA.
- Lazear, Edward and Rosen Sherwin (1981), "Rank Order Tournaments as Optimal Labor Contracts," *Journal of Political Economy*, 89, pp. 841-864.
- Leibenstein, Harvey (1966), "Allocative Efficiency vs. "X-Efficiency," *The American Economic Review*, 56(3), pp. 392-415.
- Liberti, Jose Maria (2006), "Initiative, Incentives, and Soft Information: How Does Delegation Impact the Role of Bank Relationship Managers?," Northwestern University, working paper.

- Marin, Dalia and Theirry Verdier (2008), "Corporate Hierarchies and the Size of Nations: Theory and Evidence," *Center for Economic Policy Research*, working paper DP6734.
- \_\_\_\_\_ (2003), "Globalization and the New Enterprise," *Journal of the European Economic Association*, MIT Press, 1(2-3), pp. 337-344.
- Milgrom, Paul and John Roberts (1995), Complementarities and fit: Strategy, structure and organizational change in manufacturing," *Journal of Accounting and Economics*, 19, pp. 179-208.
- \_\_\_\_\_ (1990), "The Economics of Modern Manufacturing: Technology, Strategy and Organization," *American Economic Review* 80(3), 511-28.
- Mookherjee, Dilip (2006), "Decentralization, Hierarchies, and Incentives: A Mechanism Design Perspective," *Journal of Economic Literature*, XLIV, pp. 367-390.
- Osterman, P. 1996. *Broken ladders: Managerial careers in the new economy*. New York: Oxford University Press.
- Oyer, Paul and Scott Schaefer (2005), "Why Do Some Firms Give Stock Options to All Employees? An Empirical Examination of Alternative Theories," *Journal of Financial Economics*, 76, 99-133.
- Powell, Walter (1990), "Neither Market Nor Hierarchy: Network Forms of Organization," In *Research in Organizational Behavior*, edited by Barry Straw and Lawrence Cummings, 295-336. JAI Press, Greenwich, CT.
- Prendergast, Candice (2002), "The Tenuous Trade-Off between Risk and Incentives," *Journal of Political Economy*, 2002, 110(5), pp. 1071-102.
- Radner, Roy (1993), "The Organization of Decentralized Information Processing," *Econometrica*, 61(5), pp.1109-1146.
- Raith, Michael (2003), "Competition, risk, and managerial incentives", *The American Economic Review*, 93(4), pp. 1425.
- Rantakari, Heikki (2008), "Organizational Design and Environmental Volatility," University of Southern California, Marshall School of Business, working paper.
- Rajan, Raghuram G. and Julie Wulf (2006), "The Flattening Firm: Evidence on the Changing Nature of Firm Hierarchies from Panel Data," *Review of Economics and Statistics*, 88(4), pp.759-773.
- Rajan, Raghuram G. and Luigi Zingales (2001), "The Firm as A Dedicated Hierarchy: A Theory Of The Origins And Growth Of Firms," *Quarterly Journal of Economics*, 116(3), pp. 805-851.
- Roberts, John (2004), "The Modern Firm: Organizational Design for Performance and Growth." Oxford University Press, New York, NY.
- Romalis, John (2007), "NAFTA's and CUSFTA's impact on international trade," *The Review of Economics and Statistics*, 2007, 89(3), pp. 416.
- Rosen, Sherwin (1982), "Authority, Control, and the Distribution of Earnings," *The Bell Journal of Economics*, 13, pp.311-323.
- Schmalensee, Richard (1989), "Inter-Industry Studies of Structure and Performance," *Handbook of Industrial Organization*, 2, edited by Richard L. Schmalensee and Robert D. Willig.
- Stiroh, Kevin J. (2002), "Information Technology and the U.S. Productivity Revival: What Do the Industry Data Say?" *The American Economic Review*, 92(5), p. 1559 (18 pages)
- Sutton, John (1991), *Sunk Costs and Market Structure*, MIT Press, Cambridge, MA.
- Thesmar, David and Mathias Thoenig (2000), "Creative Destruction and Firm Organizational Choice," *The Quarterly Journal of Economics*, 115(4), pp. 1201-37.
- Trefler, Daniel (2004), "The Long and Short of the Canada-U.S. Free Trade Agreement" *The American Economic Review*, 94(4), pp. 870-896.

Whittington, R., A. Pettigrew, S. Peck, E. Fenton, M. Conyon (1999), "Change and Complementarities in the New Competitive Landscape: A European Panel Study, 1992-1996," *Organization Science*, 10(5), pp. 583-600.

Williamson, Oliver E. (1967), "Hierarchical Control and Optimum Firm Size," *Journal of Political Economy*, 75(2), pp. 123-138.

Wooldridge, Jeffrey M. (2002), *Economic Analysis of Cross Section and Panel Data*, MIT Press, Cambridge, MA.

Wulf, Julie (2007), "Authority, Risk, and Performance Incentives: Evidence from Division Manager Positions Inside Firms," *Journal of Industrial Economics*, LV (3) pp. 169-196.

## DATA APPENDIX

### Additional Firm and Industry Data

#### From Compustat Database:

- In Firm Sales: Natural logarithm of firm sales (in million dollars)
- In Firm Performance: Natural log of total market value at the end of the year, calculated as number of shares outstanding times stock price at calendar year end and dividends per share. (in million dollars)
- In Firm Employ: Natural log of total firm employees (in thousands)
- Av.PCM is the average price cost margin for the firm, calculated as (firm sales-cost of sales)/firm sales
- HHI Segment: Using Compustat Business Segment data, we construct the Herfindhal index (HHI) of 2 digit segment sales as the sum of squared shares of each reported segment sales over total sales. Business Segments are declared by firms that report the industries they operate in.
- Lerner index is the industry average price cost margin, based on all Compustat firms.
- % Sales represented is the sum of division sales from Hewitt data divided by total firm sales from Compustat.

#### Other Sources:

- U.S. industry average skill intensity pre-89: ratio of non-production to production workers by industry, we take the average for 1986-1988. Source: The NBER-CES Manufacturing Industry Database (1958-1996).
- U.S. industry average capital intensity pre-89: ratio of Total capital expenditure to Total employment, we take the average for 1986-1988. Source: The NBER-CES Manufacturing Industry Database (1958-1996).
- TFP growth pre-89: 4-factor TFP annual growth rate, we take the average for 1986-1988. Source: The NBER-CES Manufacturing Industry Database (1958-1996).
- Trade Costs: Sum of tariff and transport costs by industry. Source: Bernard et al. (2006)
- Import Pen.: Import Penetration by industry. Source: Bernard et al. (2006).
- Exch.Rate\*OriginImp.Pen: is the bilateral Canada U.S. dollar exchange rate multiplied by the level of import penetration of the industry in 1988, Source: IMF-IFS and Bernard et al. (2006).

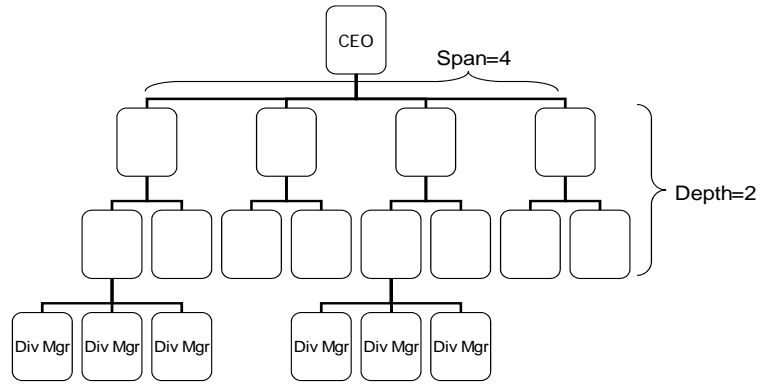
## **Information Technology data**

- IT growth is defined as the change in the logarithm of average real stock of the components of IT capital, per year and industry (at 2 digit SIC).

We obtain the average real stock of the components of capital at the industry level over the time period. The Bureau of Economic Analysis (BEA) industry data are based on data from the Census Bureau in the benchmark years (1982, 1987, and 1992) and interpolations in the intervening years are made based on data from the Survey of Manufactures and the Annual Capital Expenditures Survey. These data are used in Stiroh (2002). Using a similar approach, we determine the change in the importance of Information Technology in a 2-digit industry by calculating the growth in IT capital stock (normalized by total capital stock) between the current and prior year. Data are estimates of real non-residential fixed assets (all corporations and proprietorships) from Detailed Fixed Assets Tables available on the BEA website. Series are adjusted using the quality-adjusted PPI deflator. Information technology capital stock includes hardware, software, and communications with components in each category as follows: (i) Hardware includes mainframe computers, personal computers, direct access storage devices, printers, terminals, tape drives, storage devices, integrated systems, and office/ accounting equipment, (ii) software includes prepackaged, custom, and own-account software, and (iii) communications includes communication equipment.

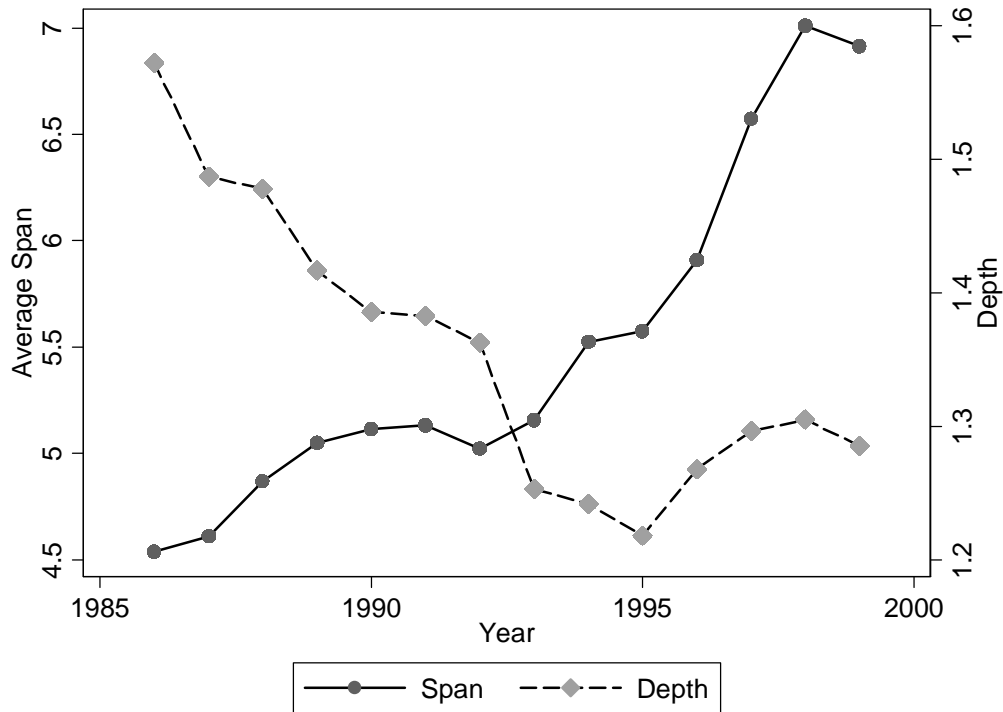
**Figures**

**Figure 1 An example of a hierarchy: Span and Depth**



**Span=number of positions reporting to CEO**  
**Depth=number of positions *between* the CEO and Division Manager**

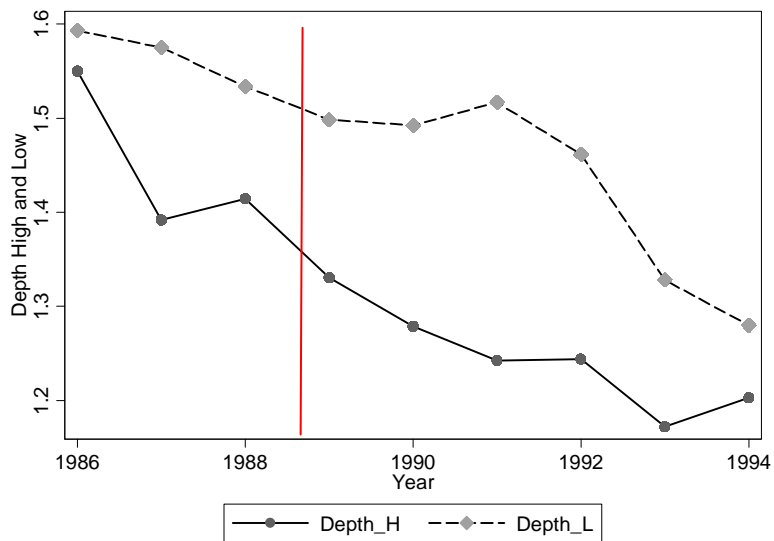
**Figure 2 The Evolution of CEO Span of Control and Division Depth**



**Figure 3 The Differential Effect of FTA on Span -high vs. low tariff industries**



**Figure 4 The Differential Effect of FTA on Depth -high vs. low tariff industries**



**Table 1: Descriptive Statistics**

	Mean	S.D.	# Observations
<i>Division level variables:</i>			
Div.Depth	1.432	0.791	6396
ln DM Tot.Comp.	12.729	0.66	6396
Share LT Incent.	0.29	0.157	6396
ln Div.Empl.	-0.033	1.42	5857
ln Division Sales	12.454	1.404	5869
IT invest (2digit)	0.054	0.041	6396
CT Invest.	0.021	0.016	6396
#DM dir. excl.own	0.422	1.129	6396
# FUNCT.Direct	3.673	2.245	6396
<i>Firm level variables:</i>			
CEO span	5.473	2.82	1962
lnCEO comp.	14.629	0.778	1962
CEO LT/Total	0.435	0.187	1962
ln Firm Sales	8.296	1.228	1962
lnFirm Performance	8.095	1.596	1902
# Group Mgrs.	2.7	1.596	1450
ln Wage Bill Group	14.91	0.846	1445
Segment HHI	0.761	0.243	1941
#Can. Subsid	2.413	3.046	1459
<i>Trade variables:</i>			
AvT89	0.039	0.041	1962
Export: AvT89	0.053	0.065	1962

Notes: Div. Depth is the number of managers between the DM and the CEO; ln DM Tot Comp. is the log of Div. Manager total pay; Share LT Incent. is the fraction of long term incentives over Div. Manager total pay; IT invest (CT invest) is the annual change in IT (Communication Technologies) capital stock at 2 digit SIC from BEA data; #DM dir.excl own is the number of DMs that report directly to the CEO excluding own division; #FUNCT direct is the number of senior staff operational positions that report directly to the CEO; CEO Span is the number of managers that report directly to the CEO; lnCEO comp. is the log to total CEO pay; CEO LT/Total is the fraction of long term incentives over total CEO pay; ln Firm Performance is log total market value for the year including stock returns and dividends; # Group Mgrs is the number of group managers between the DM and the CEO; ln Wage bill group is # Group managers multiplied by group manager's average pay (in logs); Segment HHI is the Herfindahl index of 2 digit segment sales (inverse measure of diversification); AvT89 is the average US tariff rate on Canadian imports in 86-88, by industry. Export: AvT89 is the Canadian Tariff on US exports (see data appendix for more details and sources).

**Table 1a: Average U.S. Tariff on Canadian Imports**

US SIC 87 (3-digit)	Industry Name	1986-1988 Average
302	Rubber & Plastics Footwear	36.06%
233	Women's, Misses, Juniors Outerwear	21.55%
211	Cigarettes	19.33%
225	Knitting Mills	16.81%
282	Plastics, Syn. Resins, Syn. Rubber, Cellulosic, Other Fibers, Ex. Glass	11.26%
202	Dairy Products	10.46%
314	Footwear, Except Rubber	10.01%
203	Canned, Frozen, Preserved Fruit & Vegetables	9.76%
287	Agricultural Chemicals	9.76%
221	Broadwoven Fabric Mills, Cotton	8.81%
364	Electric Lighting & Wiring Equipment	7.29%
201	Meat Products	7.16%
382	Lab. App., Analytical, Optical, Measuring & Controlling Instruments	6.94%
208	Beverages	6.77%
366	Telephone & Telegraph Apparatus	6.61%
375	Motorcycles, Bicycles & Parts	6.38%
284	Soap, Detergent, Cleaning Preparation, Perfumes, Cosmetics, & Other	6.13%
267	Converted Paper, Paperboard Products, Except Boxes	5.97%
329	Abrasive, Asbestos, Misc. Nonmetallic Mineral Products	5.83%
384	Surgical, Medical, & Dental Instruments & Supplies	5.72%
349	Misc. Fabricated Metal Products	5.51%
359	Misc. Industrial & Commercial Machinery & Equipment	5.35%
343	Heating Equipment (ex. Electric & warm air) Plumbing Fixture	5.28%
361	Electric Transmission & Distribution Equipment	5.13%
327	Concrete, Gypsum, & Plaster Products	5.04%
206	Sugar & Confectionery Products	5.00%
243	Millwork, Veneer, Plywood	5.00%
342	Cutlery, Handtools & General Hardware	4.95%
346	Metal Forgings & Stampings	4.95%
351	Engines & Turbines	4.83%
363	Household Appliances	4.81%
277	Greeting Cards	4.72%
204	Grain Mill Products	4.68%
365	Household Audio & Video Equipment, Audio Recording	4.38%
354	Metalworking Machinery & Equipment	4.22%
286	Industrial Organic Chemicals	4.12%
357	Computer & Office Equipment	3.84%
394	Dolls, Toys, Games, Sporting & Athletic Goods	3.84%
301	Tires & Inner Tubes	3.83%
331	Steel Works, Blast Furnaces, Rolling & Finishing Mills	3.75%
386	Photographic Equipment & Supply	3.72%
285	Paint, Varnish, Lacquer, Enamel & Allied Products	3.64%
308	Misc. Plastics Products	3.55%
322	Glass & Glassware, Pressed or Blown	3.53%
281	Industrial Inorganic Chemicals	3.25%
356	General Industrial Machinery & Equipment	3.24%
289	Misc. Chemical Products	3.20%
283	Drugs	3.13%
332	Iron & Steel Foundries	2.95%
362	Electrical Industrial Apparatus	2.79%
358	Refrigeration & Service Industry Machinery	2.61%
353	Construction, Mining, Materials Handling Machinery & Equipment	2.21%
259	Misc. Furniture & Fixtures	2.03%
275	Commercial Printing	1.99%
323	Glass Products, Made of Purchased Glass	1.62%
263	Paperboard Mills	1.57%
341	Metal Cans & Shipping Containers	1.24%
291	Petroleum Refining	0.92%
367	Electronic Components & Accessories	0.38%
371	Motor Vehicles & Motor Vehicle Equipment	0.17%
262	Paper Mills	0.12%
333	Primary Smelt & Refining Nonferrous Metals	0.12%
376	Guided Missiles & Space Vehicles & Parts	0.07%
372	Aircrafts & Parts	0.04%
352	Farm & Garden Machinery & Equipment	0.01%
242	Sawmills & Planing Mills	0.00%
271	Newspaper: Publishing, Publishing & Printing	0.00%

The third column shows the tariff faced by firms in the sample and used in the analysis, averaged by industry (3 digit SIC).

**Table 2: Division Depth and Trade Liberalization**

	Div.Depth	Div.Depth	Div.Depth	Div.Depth	Div.Depth	Div.Depth	Div.Depth	Div.Depth	Div.Depth	Div.Depth	Div.Depth
	1	2	3	Placebo	Timing	Weighted	4 digit	Same SIC	Change CEO	IT	CT
AvT89*Post89	-3.661	-3.501	-3.73		-3.501	-4.069	-5.541	-5.084	-3.279	-3.539	-3.739
	[1.191]***	[1.190]***	[1.147]***		[1.196]***	[2.079]*	[1.029]***	[1.322]***	[1.177]***	[1.177]***	[1.118]***
Export: AvT89*Post89			0.655								
			[0.894]								
AvT89*Post88(placebo)				1.5							
				[1.443]							
AvT94*Post94					2.622						
					[1.868]						
LAGAvT89*Post89					0.711						
					[1.323]						
Change of CEO									-0.182		
									[0.025]***		
IT invest (2 digit)										4.981	
										[3.693]	
CT Invest.											56.901
											[17.044]***
In Firm Sales	0.238	0.216	0.216	0.217	0.217	0.231	0.293	0.082	0.231	0.2	0.185
	[0.145]	[0.120]*	[0.121]*	[0.123]*	[0.126]*	[0.122]*	[0.174]*	[0.138]	[0.122]*	[0.113]*	[0.109]*
In Div.Empl.		-0.07	-0.07	-0.071	-0.068	-0.07	-0.079	-0.087	-0.068	-0.07	-0.07
		[0.019]***	[0.019]***	[0.019]***	[0.019]***	[0.019]***	[0.026]***	[0.024]***	[0.019]***	[0.019]***	[0.019]***
Division FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Division trends		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	6396	5702	5702	5702	5538	5687	3983	3818	5661	5702	5702
R-squared	0.016	0.031	0.03	0.026	0.033	0.029	0.041	0.039	0.062	0.033	0.043
Number of Divisions		1524	1524	1524	1480	1523	1043	1031	1517	1524	1524

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies and the interaction of Post89 with US industry skill intensity, capital intensity and TFP growth pre-89 to account for tariff endogeneity. Div Depth is the number of managers between the DM and the CEO. AvT89 (AvT94) is the average US tariff rate on Canadian imports in 86-88 (90-93), by industry. Column 3 also includes the Canadian tariff on US exports. Column 6 uses weighted averages of tariffs on Canadian imports by firm where the weights are the 1988 fractions of sales in the firm's different segments; Column 7 restricts the sample to firms that report a 4 digit SIC code as their primary industry; Column 8 restricts the sample to firms that do not change primary SIC; Change CEO is a dummy variable indicating a CEO change; See notes to Table 1 for definition of other variables

**Table 3: CEO Span of Control and Trade Liberalization**

	CEO Span	CEO Span	CEO Span	CEO Span	CEO Span	CEO Span	CEO Span	CEO Span	CEO Span	CEO Span
	1	2	3	Placebo	Timing	Weighted	4 digit	Same SIC	Change CEO	IT
	1	2	3	4	5	6	7	8	9	10
AvT89*Post89	8.106	9.908	11.386		11.314	12.814	10.089	11.961	9.89	9.777
	[3.613]**	[3.839]**	[3.590]***		[3.724]***	[5.038]**	[3.546]***	[5.858]**	[3.739]***	[3.883]**
Export: AvT89*Post89			-3.544							
			[3.529]							
AvT89*Post88(placebo)				-5.61						
				[4.601]						
AvT94*Post94					-0.507					
					[4.256]					
LAGAvT89*Post89					-5.556					
					[3.429]					
Change of CEO									0.446	
									[0.133]***	
IT invest (2 digit)										16.904
										[20.164]
In Firm Sales	0.461	0.947	0.961	0.959		0.933	0.605	0.586	0.918	0.951
	[0.262]*	[0.294]***	[0.294]***	[0.290]***		[0.292]***	[0.429]	[0.383]	[0.280]***	[0.292]***
Firm FE	yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm trends		Yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1962	1962	1962	1962	1929	1962	1341	1403	1957	1962
R-squared	0.015	0.021	0.021	0.02	0.022	0.02	0.016	0.027	0.031	0.021
Number of firms	230	230	230	230	227	230	155	173	229	230

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies and the interaction of Post89 with US industry skill intensity, capital intensity and TFP growth pre-89 to account for tariff endogeneity. Span is the number of managers that report directly to the CEO. AvT89 (AvT94) is the average US tariff rate on Canadian imports in 86-88 (90-93), by industry. Column 3 also includes the Canadian tariff on US exports. Column 6 uses weighted averages of tariffs on Canadian imports by firm where the weights are the 1988 fractions of sales in the firm's different segments; Column 7 restricts the sample to firms that report a 4 digit SIC code as their primary industry; Column 8 restricts the sample to firms that do not change primary SIC; Change CEO is a dummy variable indicating a CEO change; see notes to Table 1 for definition of other variables.

**Table 4: DM Total Compensation and Division Performance-Based Incentives**

	ln DM Tot.Comp. 1	ln DM Tot.Comp. 2	ln DM Tot.Comp. 3	ln DM Tot.Comp. 4	ln DM Tot.Comp. 5
AvT89*Post89	1.751 [0.629]***	1.829 [0.558]***	1.817 [0.564]***		-5.015 [3.378]
lnDivision Sales				0.085 [0.027]***	0.098 [0.032]***
(AvT89*Post89)*lnDiv Sales					0.499 [0.244]**
(AvT89)*lnDiv Sales					-0.829 [0.471]*
(Post89)*lnDiv Sales					0.006 [0.020]
ln Firm Sales	0.18 [0.034]***	0.195 [0.035]***	0.222 [0.046]***	0.196 [0.048]***	0.185 [0.047]***
ln Div.Empl.	0.109 [0.011]***	0.103 [0.012]***	0.089 [0.012]***	0.06 [0.014]***	0.058 [0.013]***
Division FE	yes				
Indiv*Div FE		yes	yes	yes	yes
Indiv*Div Trend			yes	yes	yes
Observations	5718	4737	4737	4560	4560
R-squared	0.165	0.183	0.148	0.158	0.164
Number of Divisions	1460	1460	1460	1405	1405

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies and the interaction of Post89 with US industry skill intensity, capital intensity and TFP growth pre-89 to account for tariff endogeneity. ln DM Tot Comp. is the log of Div. Manager total pay. AvT89 is the average US tariff rate on Canadian imports in 86-88, by industry. See notes to table 1 for definition of other variables.

**Table 5: DM Total Comp./ Long-Term Incentives and Firm Performance-Based Incentives**

	Share LT Incent.	Share LT Incent.	Share LT Incent.	Ln DM Tot.Comp.	Ln DM Tot.Comp.
	1	2	3	4	5
AvT89*Post89	0.882 [0.292]***	0.901 [0.308]***	0.988 [0.314]***		-3.107 [2.071]
InFirm Performance ( <i>stock returns</i> )				0.131 [0.037]***	0.112 [0.044]**
(AvT89*Post89)*InFirm Perf.					0.491 [0.244]**
(AvT89)*InFirm Perf.					0.007 [0.961]
(Post89)*InFirm Perf.					0.001 [0.013]
In Firm Sales	0.026 [0.016]	0.027 [0.017]	0.017 [0.023]	0.111 [0.057]*	0.105 [0.057]*
In Div. sales	0.014 [0.004]***	0.013 [0.005]**	0.012 [0.007]*	0.105 [0.026]***	0.105 [0.026]***
Division FE	yes				
Indiv*Div FE		yes	yes	yes	yes
Indiv*Div Trend			yes	yes	yes
Observations	5842	4836	4836	4739	4739
R-squared	0.05	0.054	0.051	0.157	0.161
Number of Divisions	1494	1494	1494	1462	1462

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies. Share LT Incent. is the fraction of long term incentives over Div. Manager total pay. AvT89 is the average tariff rate on Canadian imports in 86-88, by industry. In firm performance is log total stock market returns including dividends. See notes to table 1 for definition of other variables.

**Table 6: Panel Correlations between Organizational Practices**

	In DM Tot.Comp.	Share LT Incent.	Div.Depth	Div.Depth	In DM Tot.Comp.	In DM Tot.Comp.	Share LT Incent.	Share LT Incent.
	1	2	3	4	5	6	7	8
Div.Depth	-0.072 [0.014]***	-0.012 [0.006]*						
CEO Span			-0.063 [0.012]***		-0.006 [0.004]		0 [0.002]	
#DM dir. excl.own				-0.126 [0.020]***		0.014 [0.007]**		0.009 [0.004]**
# FUNCT.Direct				-0.015 [0.009]*		-0.011 [0.006]*		-0.004 [0.002]**
In Firm Sales	0.216 [0.051]***	0.022 [0.021]	0.237 [0.101]**	0.231 [0.103]**	0.199 [0.053]***	0.197 [0.054]***	0.023 [0.021]	0.018 [0.021]
In Div.Empl.	0.093 [0.011]***	0.02 [0.003]***	-0.067 [0.017]***	-0.069 [0.017]***	0.099 [0.011]***	0.099 [0.011]***	0.021 [0.003]***	0.021 [0.003]***
Division FE	yes	yes	yes	yes	yes	yes	yes	yes
Division trends	yes	yes	yes	yes	yes	yes	yes	yes
Observations	5702	5702	5702	5702	5718	5702	5718	5702
Number of Div.	1524	1524	1524	1524	1530	1524	1530	1524
R-squared	0.14	0.048	0.102	0.077	0.127	0.13	0.045	0.053

Notes: Std. Errors in brackets, clustered by firm. All regressions include year dummies. In DM Tot Comp. is the log of Div. Manager total pay. Div Depth is the number of managers between the DM and the CEO. Span is the number of managers that report directly to the CEO. #DM dir. excl.own is the number of DMs in the firm that report directly to the CEO excluding the own division. # FUNCT.Direct is the number of senior functional positions that report directly to the CEO. Share LT Incent. is the fraction of long term incentives over Div. Manager total pay. See notes to table 1 for definition of other variables.

**Table 7: Alternative Explanations for Flattening**

	# Group Mgrs.	ln Wage Bill Group	Segment HHI	#Can. Subsid
	1	2	3	4
AvT89*Post89	-1.195 [2.319]	1.762 [0.968]*	0.508 [0.213]**	-3.749 [7.719]
ln Firm Sales	0.527 [0.296]*	0.613 [0.125]***	-0.07 [0.030]**	-0.835 [0.578]
Firm FE	yes	yes	yes	yes
Firm trends	yes	yes	yes	
Observations	1351	1343	1944	1462
R-squared	0.023	0.027	0.04	0.004
Number of firms	192	192	232	

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies. AvT89 is the average US tariff rate on Canadian imports in 86-88, by industry. See notes to table 1 for definition of other variables.

## Appendix of Tables

**Table A1: Effect of the Trade Liberalization on Market Value, Employment and Average Price Cost Margins**

	In Firm Performance (market value)	In Firm Performance (market value)	In Firm Employ.	In Firm Employ.	Avg. PCM	Avg. PCM
	1	2	3	4	5	6
AvT89*Post89	0.962 [0.692]	1.917 [0.742]**	0.175 [0.279]	0.056 [0.384]	-0.089 [0.065]	-0.258 [0.083]***
Export: AvT89*Post89	1.492 [0.677]**	1.426 [0.771]*	0.483 [0.154]***	0.559 [0.178]***	0.023 [0.030]	0.059 [0.050]
Firm FE	yes	Yes	yes	yes	yes	yes
Firm trends	yes	Yes	yes	yes	yes	yes
Sample	all	main>50%	all	main>50%	all	main>50%
Observations	1891	1451	1954	1499	1962	1508
R-squared	0.1	0.1	0.02	0.02	0.02	0.04
Number of firms	222	178	230	184	230	184

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies. The dependent variables are the log of total stock market returns including dividends (col. 1 and 2), the log of total firm employment (col. 3 and 4), and average price cost margin (col. 5 and 6); AvT89 (Export: AvT89) is the average tariff rate on Canadian imports (U.S. exports) in 86-88, by industry. Columns 2, 4 and 6 restrict the sample to firms whose largest segment represented at least 50% of sales before the liberalization (in 1988).

**Table A2: Other results**

	%Sales represented	Change CEO	lnCEO Comp.	CEO LT/Total
	1	2	3	4
AvT89*Post89	0.597 [0.620]	0.474 [1.297]	2.544 [0.615]***	0.906 [0.257]***
ln Firm Sales		0.032 [0.106]	0.347 [0.079]***	0.002 [0.035]
Firm FE	yes	Yes	yes	yes
Firm trends	yes	Yes	yes	yes
Observations	1920	1960	1965	1965
R-squared	0.007	0.012	0.071	0.02
Number of firms	232	231	232	232

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies. The dependent variable in col.1 is the percentage of sales from divisions available in the data, out of total firm sales; in col.2 it is the dummy variable for whether the firm changed CEO in that year; in col.3 it is the log of total CEO Pay, and in col.4 the share of long-term incentives out of total pay. AvT89 is the average US tariff rate on Canadian imports in 86-88, by industry.

**Table A3: Robustness Checks**

<b>Panel A: Division Depth</b>					
	Div.Depth In 1988 1	Div.Depth Incl. Serv. 2	Div.Depth 3	Div.Depth No Subsid. 4	Div.Depth Fast 5
AvT89*Post89	-3.49 [1.199]***	-3.21 [1.248]**	-3.398 [1.259]***	-5.7 [4.017]	-5.491 [1.245]***
Exch.Rate*OriginImp.Pen.			0.806 [1.190]		
Division FE	yes	yes	yes	yes	Yes
Division trends	yes	yes	yes	yes	Yes
Observations	5631	6965	5702	1150	1697
Number divisions	1490	1895	1524	290	509
R-squared	0.032	0.023	0.032	0.118	0.084

<b>Panel B: CEO Span of Control</b>					
	CEO Span In 1988 1	CEO Span Incl. Serv. 2	CEO Span 3	CEO Span No Subsid. 4	CEO Span Fast 5
AvT89*Post89	8.874 [3.972]**	7.545 [4.025]*	10.453 [4.155]**	21.576 [10.532]**	5.648 [6.926]
Exch.Rate*OriginImp.Pen.			4.649 [7.736]		
Firm FE	yes	yes	yes	yes	Yes
Firm trends	yes	yes	yes	yes	Yes
Observations	1914	2711	1962	339	531
Number of firms	222	340	230	42	65
R-squared	0.021	0.019	0.021	0.114	0.059

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies. All regressions also include the interaction of Post89 with US industry skill intensity, capital intensity and TFP growth pre-89 to account for tariff endogeneity (except col. 2 because these are not available for services industries). Div Depth is the number of managers between the DM and the CEO. AvT89 is the average US tariff rate on Canadian imports in 86-88, by industry. Column 1 restricts the sample to firms present in the sample as of 1988; col. 2 also includes services firms in the estimation, with AvT89=0; col. 3 includes the interaction of the Canada-US exchange rate and the level of import penetration in the industry before 1989; col. 4 restricts the sample to firms that report zero Canadian subsidiaries in 1988; col. 5 restricts the sample to firms in industries that had experienced at least 60% tariff reductions from their original level by 1994.

**Table A4: Correlation between Organizational and Competition Variables**

	Div.Depth	Div.Depth	Div.Depth	CEO	CEO	CEO
	1	2	3	Span	Span	Span
	1	2	3	4	5	6
Trade Costs	2.822			-21.927		
	[1.304]**			[9.384]**		
Lerner Index		0.14			0.128	
		[0.067]**			[0.367]	
Import Penetration			-0.781			-0.01
			[0.362]**			[1.448]
Division FE& trends	yes	yes	yes			
Firm FE& trends				yes	yes	yes
Observations	4503	5600	4018	1378	2046	1196
Number of Div.	1161	1500	1100			
R-squared	0.021	0.014	0.02	0.025	0.009	0.011
Number of Firms				157	258	156

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies. Trade costs are the sum of tariff and transport costs by industry, Lerner index is the industry's average price cost margin (4 digit SIC), and import penetration is the percentage of imports out of total domestic consumption by 4 digit industry. Columns 2 and 5 include firms in services and manufacturing, while 1, 3, 4 and 6 are restricted to manufacturing industries. See data appendix for exact definitions and sources.