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THE FLATTENING FIRM AND PRODUCT MARKET COMPETITION: THE EFFECT OF TRADE LIBERALIZATION

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ABSTRACT

This paper establishes a causal effect of competition from trade liberalization on various characteristics of organizational design. We exploit a unique panel dataset on firm hierarchies (1986-1999) of large U.S. firms and find that increasing competition leads firms to become flatter, i.e., (i) reduce the number of positions between the CEO and division managers (DM), (ii) increase the number of positions reporting directly to the CEO (span of control), (iii) increase DM total and performance-based pay. The results are generally consistent with the explanation that firms redesign their organizations through a set of complementary choices in response to changes in their environment.

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1. Introduction

Firm hierarchies are becoming flatter. Spans of control have broadened and the number of levels within firms has declined. These trends are suggested and documented in a number of academic papers (e.g., Osterman, 1996; and Whittington, et al., 1999; Rajan and Wulf, 2006) and are often discussed in the business press. However, much less is known about the causes behind these trends. In this paper, we investigate the role of changes in the firms' product markets and, in particular, product market competition resulting from trade liberalization as a potential driver of organizational change.[1] In doing so, we shed some light on the possible reasons behind certain organizational choices and on the importance of communication and decision-making processes inside firms.

Our main finding is that greater international competition following trade liberalization leads to flatter firms. 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 total pay and incentive-based pay for division managers. Furthermore, firms appear to adjust organizational elements in a coordinated manner: certain changes appear to occur together.

We use a unique panel dataset of the internal organization of large U.S. manufacturing firms in various industries. We exploit variation within firms (and within division manager positions) in an array of organizational variables -such as hierarchical depth, CEO span of control, pay and incentives- over a 14-year period. This allows us to address concerns about unobserved heterogeneity.

1The economic importance of organizational change is non-negligible since the internal hierarchy of the firm (Liberti, 2006; Garicano and Hubbard, 2007) and organizational and workplace practices (Black and Lynch, 2001) have a significant impact on productivity.

In order to identify a potential causal effect of foreign competition on organizational change, our primary identification strategy exploits the Canada-United States Free Trade Agreement of 1989 (FTA) that eliminated tariffs and trade barriers between the two countries (Trefler, 2004). This can be thought of as a quasi-natural experiment that implied a greater reduction in entry barriers (a larger increase in competition) for firms in industries with high U.S. tariffs on Canadian imports prior to 1989 allowing us to implement a difference-in-differences strategy. [2] 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. However, while we find significant effects of these market expansion opportunities on other outcomes (such as firm size and market value), they had no significant impact on the firm's hierarchy: all the effect is driven by the fall in import tariffs. Finally, we show that our results are not driven by alternative factors that could also lead to flattening, such as increases in expenditures on IT, changes in business scope, location of activities, and a host of other potential factors.

Our findings suggest that it is the increased competition from falling U.S. tariffs that causes firms to simultaneously reorganize along several dimensions.. These results are consistent with theories arguing that complementarities exist among a firm's organizational design elements (e.g. Milgrom and Roberts, 1995). As such, our paper is related to the limited empirical research on the existence of complementary human resource management practices (e.g. Ichniowski, Shaw, and Prennushi, 1997; and Bresnahan, Brynjolfson, and Hitt, 2002; Cockburn, Henderson and Stern, 2004). Within this literature, an important contribution of our paper is that we show

2 When studying competition, it is important to exploit exogenous changes to entry barriers, instead of standard measures of product market competition, such as, industry Herfindahl indices and average price cost margins. These, as is well known, are subject to numerous concerns: they do not measure the underlying competition parameter (the entry barrier), they are endogenous to changes in the competitiveness of markets, and they are non-monotonic in competition (Sutton, 1991; Schmalensee, 1989).

that following an *exogenous* shock to the firm's competitive environment firms redesign their organizations arguably to "fit" the environment in which they operate.[3] To our knowledge, much of the research on adoption of complementary work practices does not capture responses to exogenous shocks.[4]

While we establish a robust causal relationship between the trade liberalization and the flattening of firms, an important question remains: what is the economic mechanism driving this change? 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.[5] Alternatively, in a world with X-inefficiency, firms may eliminate layers in an attempt to cut costs when faced with more competition. We provide a set of additional results that explore the different potential mechanisms. Our findings show little support for the cost-cutting story and are more consistent with flattening as reflecting changes in decision-making 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.

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[3]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).
[4]One exception, and relatedly, Baker and Hubbard (2004) document how an exogenous change in technology affects the ownership structure of trucking firms.
[5]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 Lawrence and Lorsch (1967).

There are certainly other reasons why firms may change their organizational structures. Information technology is a prominent candidate and a number of papers have explored the relationship between IT and organizational characteristics including 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). Even though our main focus is whether there is a causal effect of changes in product markets on the observed flattening of firms, we acknowledge and address the importance of information technology in our analysis.

Given that we find a significant effect from a specific trade liberalization, it is likely that increasing domestic and foreign competition from other sources (such as deregulation and reductions in trade, communication and transport costs) is also an important contributor to the flattening of firms. Analyzing these other drivers of increasing competition is beyond the scope of this paper. However, to the extent that one thinks that these are major forces, this paper is an important step in the understanding of the role of product markets in explaining organizational change.

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 Background

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. 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). 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). [6]

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 (1995) analyze complementarities among different features of modern production technologies, while Holmstrom and Milgrom (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

[6]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 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).

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 authority from the CEO to the managers.[7] 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.

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 organizational design 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

[7]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. Finally, Conconi, Legros and Newman (2008) develop a trade model to examine how liberalization affects the ownership structure of firms.

important determinant of organizational design and we will address its role in our empirical analysis.

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

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. 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)[8]; 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.

Our first measure, 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 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.

[8]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.

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. 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 Table A3 on how these are built).

3.2 Product Market Changes: 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. In October 1987, when the details of the agreement were first revealed, they encountered substantial opposition in Canada. 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 (see discussion in 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 tariff reductions. They also document substantial trade-distorting non-tariff barriers suggesting a potentially even larger effect from the trade liberalization. Below we discuss the effect the liberalization had on North-American trade.

In order to evaluate 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. We define $AvT89_s$ to measure the level of exposure of the firm to the liberalization. This is the average tariff on Canadian imports by industry *s* for the period between 1986 and 1988 (Feenstra et al., 1996),[9] where 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.[10] Our dependent variables are a set of organizational variables ORG_{dst} by division *d* (or firm), industry *s* and year *t*. For example, division-level depth, division manager pay, and CEO span of control (defined at the firm level), such that our basic empirical specification is as follows:

$$ORG_{dst} = \theta_3 AvT89_s * Post89_t + X_{dst}'\beta + d_t + \eta_d + \eta_d * t + \varepsilon_{dst} \quad (1)$$

Where $AvT89_s$ is the level of tariffs on Canadian imports in the industry pre-89, $Post89_t$ is a dummy that equals one after 1989, X_{dst} are division (or firms) characteristics such as size, d_t are year dummies, η_d are division fixed effects that absorb any permanent cross-sectional division/firm/industry differences and ε_{dst} is an error term. This is a standard quasi-difference in differences specification that exploits the trade liberalization, where $AvT89_s$ (the "treatment") is continuous. The coefficient of interest, θ_3, captures the differential effect of the liberalization on

[9] The data are available from http://www.internationaldata.org/ in the "1972-2001 U.S. import data".
[10] We report the average tariff by industry (3 digit SIC) for firms in our sample and list examples of Canadian firms operating in these industries (see Tables S1 and S2 in the Supplemental Appendix). Unfortunately, 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).

firms according to their trade exposure prior to 1989, net of the general change post 1989 and net of possible permanent differences across industries.[11] Finally, we also include division specific trends in the organizational variable, $\eta_d *t$.

One concern in estimating equation (1) is that our organizational variables—both span and depth--exhibit a strong trend over time (as suggested in Figures 2 & 3) 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 (1) in first-differences, since this removes the autocorrelation (F statistic of 2.6), and thus is the efficient estimator in this case. 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

[11] 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.

endogenous and subject to lobbying, we treat all industries equally regardless of their phase-out schedule.[12]

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 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 to 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 by industry before the 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:

$$\Delta ORG_{dst} = \theta_3 \Delta AvT89_s * Post89_t + \Delta X_{dst}'\beta + \Delta d_t + \eta_d + \Delta(Z_s * Post89_t)'\varphi + \Delta\varepsilon_{dst} \quad (2)$$

B. Economic Significance of the FTA for U.S. firms

A final question before we proceed to the results is to what extent we could expect the FTA to significantly affect U.S. firms. Clausing (2001) studies the FTA using disaggregated data at the commodity level (10 digit product categories) and finds that the increase in U.S. imports from Canada was larger the larger the tariff reduction (the higher the pre-1989 tariff). 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

[12] We also run a robustness check that shows that the effect of the liberalization on organizational change was larger in industries with faster reductions in tariffs.

result of the trade agreement. Head and Ries (2001) and Romalis (2007) also find a sizable effect of the tariff reductions on trade volumes.

So, overall the trade liberalization increased bilateral trade flows and import penetration, [13] 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 the 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 to a contraction of the most import-competing). This suggests that the liberalization allowed them to expand production, increase sales to the larger U.S. market, and move down their average cost curve.

Regarding the effect of the FTA on U.S. firms, 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 and their U.S. parents).

In this study, we also found a significant effect of the FTA on firms in our sample (Table A1). In fact, we found a qualitatively different response to U.S. tariff reductions (that implied more import competition) than to Canadian tariff reductions (that presented more export opportunities). Using the same specification as in equation (2), we found that reductions in U.S.

[13] 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.

tariffs on Canadian imports led to reductions in average price-cost margin for our firms suggesting a significant negative effect of competition on accounting measures. However, we found no significant changes on market value (excess returns) or employment. On the other hand, Canadian tariff reductions[14] did raise firm employment and excess market returns (and had no effect on price-cost margins), which is consistent with the market expansion interpretation and with earlier results by Feinberg and Keane (2001, 2006). 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 overall evidence suggests that the FTA led to greater competitive pressure from the reduction in U.S. tariffs, but also increased opportunities for market expansion from Canadian tariff reduction. Next, we 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 this section, 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 2 and 3 that show the main variation that we exploit in our empirical analysis. We divide firms and divisions

[14] 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 (computed in an analogous way to U.S. AvT89). 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.

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 2) and depth (Figure 3) 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. [15] These graphs restrict the sample to firms that are present in the data before 1989 to avoid compositional changes driving these patterns (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.[16] In Tables 2 and 3, we report our results of the effect of the 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

[15] In the Figure S1 in the Supplemental Appendix, we illustrate an example of the changes in a firm's hierarchy pre- and post-FTA. This firm operated in the textile manufacturing industry which faced average Canadian tariffs on US imports of 8.8%. The firm flattened through the elimination of an intermediary position (Chief Operating Officer) and in the process moved the division manager positions one level closer to the CEO. As a result, span increased from 5 to 7 and average depth decreased from 2 to 1.

[16] In Section 3 and Table S5 of the Supplemental Appendix, we show that this relationship is not simply a mechanical one.

(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).[17]

All regressions follow the structure of equation (2) 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 the FTA (and not from differences across firms).

The coefficient of interest is the interaction of the average tariff in the industry before the 1989 FTA with a post 89 dummy (variable AvT89*Post89). 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

[17] 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 to 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 S3 in the Supplemental Appendix).

11.2 % of average depth in the sample. One way to interpret the magnitude of this effect is to imagine a firm with six division managers each with one position between them and the CEO (i.e., depth of 1). Following the trade liberalization, a firm with average tariffs would move one of the six division managers to report directly to the CEO. Since this only requires a change in the level of reporting for a subset of the divisions, it is relatively easy to implement and, as we will show, most of the change occurs within the first year.

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. This implies that one of every three firms in our sample increased the CEO's span of control by one position.

In Table 2 (depth) columns 2 through 10, we also control for division specific time trends and for division size (the log of division employment). We lose around 700 observations where 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 the 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.[18]

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 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 and defined in an analogous way to U.S. AvT89). 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 increases in depth and decreases in span, relative to the trend. This is the opposite effect of what we find for import tariffs, and since this effect is never statistically significant, it seems that increasing competitive pressure 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. But this is unlikely since we do find that employment and market value increased significantly for these firms (Table A1). Alternatively, to the extent that market 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.

[18] 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).

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, 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 (this is a standard placebo test for differences in differences). 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 U.S. (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. We also allow for a lagged effect of the 1989 experiment and find that it is not significant suggesting that most of the organizational change occurs within the first year. This is not particularly surprising given that changes in the level of reporting don't have large implementation costs.

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. 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 U.S. 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). When we restrict the sample to firms that report a 4 digit SIC, we find a larger and more precisely estimated main effect (unreported). Finally, in column 7 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 7 in both tables.[19]

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. [20] Next we consider two important alternative explanations that could affect our main results.

[19] Further robustness checks of the main results are presented in Table S4 in the Supplemental Appendix (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 to firms: (i) with no Canadian subsidiaries (column 4), and (ii) with a faster scheduled reduction in tariffs (column 5).

[20] One could also wonder to what extent these effects are restricted to the FTA, or if they generalize to other measures of competition. In fact, we also found evidence that division depth and CEO span significantly respond to other standard measures of competitive pressure (Table A2). 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

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 8 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 the coefficient on 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 S3 in the Supplemental 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 9 (includes hardware, software and communications) and communication technology (CT) in column 10 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 Table A3 for specifics). The data are very aggregated relative to what one would require for a

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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.

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 9 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 10), 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 with the FTA 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. This effect is robust to a number of specifications and implies that, on average, the trade liberalization led U.S. manufacturing firms to flatten.

4.2 Why Are Firms Flattening?

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 the next three sub-sections we attempt to shed some light on this issue. We explore several possible explanations including simple cost-cutting, changes in decision-making, and changes in firm scope.

4.2.1 Division Manager (DM) Compensation and Incentives

As shown earlier, following the trade liberalization, division managers are closer to the CEO in the organizational hierarchy. One possible explanation is 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. [21]

The first four columns in Table 4 show the effect of the liberalization on the level of pay and on DM incentives based on division-level performance. 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.[22] The regressions are again as in equation (2). Column 1 shows that

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[21] 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.

[22] 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 that 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

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 pre-1989 received a 7.0% increase (1.751*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 the 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 4 include manager times division fixed effects (so that the effect is identified out of changes in pay of an individual in a division).[23] 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).[24]

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

using an economic valuation similar to Black-Scholes that takes into account vesting, termination provisions, and the probability of achieving performance goals.

[23] Even though we do not know the identity of the manager filling the position (the 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.

[24] 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.

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 assesses how the basic sensitivity of DM pay to division performance (as measured by the natural log of division sales) changes with trade liberalization. The estimated coefficient on division sales 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 0.098 % increase in pay. The coefficient of interest is on AvT*Post89*lnDiv 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 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) 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 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. 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.

In columns 5 through 7 of Table 4, we further evaluate changes in incentive provision by firms where now the dependent variable is the fraction of long-term incentives out of total pay that division managers receive. 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 column 8 of Table 4 where we use the log of total stock market value of the firm as our performance measure (includes dividends).[25] Since the equation is in first differences, this estimates the change in log pay from increases in log stock returns (including dividends). The positive coefficient on the interaction term

[25] We obtain similar results if we use log firm sales as the performance measure.

(AvT89*Post89*lnFirm Perf.) suggests that the sensitivity of DM pay to firm performance increased more in industries that faced greater competition after the liberalization.[26]

Table 4 shows that competition from the 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 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. In fact, we found a strong correlation between the different practices in a regression framework, allowing for division fixed effects, division trends, and controls for division and firm size (see discussion in Section 3 and Table S5 in the Supplemental Appendix). Even though we do not observe returns to firm organizational choices, it seems that firms adjust organizational elements in a coordinated manner and redesign their organizations through a set of potentially complementary choices in response to changes in their environment.[27]

4.2.2 Heterogeneous Effects in R&D and Advertising-Intensive Industries

[26] 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 and the fraction of long-term incentives in total pay (columns 3 and 4 in Table S3 in the Supplemental Appendix) increased more in highly affected industries after 1989.

[27] 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.

If the mechanism through which firms flatten their organizations is related to how decisions are made—either through improved flow of information or delegated decision-making—we might expect different responses to competition from firms operating in different industries. In particular, if firms delegate authority to more effectively exploit the informational advantage of the division manager relative to the CEO, we would expect more delegation to occur in industries where information about local markets is harder to communicate, such as industries characterized by high R&D and advertising intensity. In these industries, products are more likely to be differentiated with firms competing along the quality dimension. In contrast, firms offering homogeneous products generally compete on price where a low-cost position generates a competitive advantage. To capture the importance of product or quality differentiation, we characterize industries by the degree of spending on research and development (R&D) and advertising. In these industries, we might expect the value of quick decisions or adaptations to local markets to be greater relative to industries with homogeneous products. If so, then we should see stronger organizational responses to trade liberalization in firms operating in R&D and advertising-intensive industries.

To evaluate this, we classify firms as having a high R&D and advertising to sales ratio (where high refers to above median) using two different sources. From Compustat, we measure the average R&D plus advertising expenses over sales of the 4 digit SIC industry between 1986 and 1988. We also used an alternative measure based on the U.S. Federal Trade Commission (FTC) 1975 Line of Business Survey (Kugler and Verhoogen, 2008). We report the results in the first 4 columns of Table 5. In columns 1 and 3 with depth as the dependent variable, we find a negative and significant coefficient on the three-way interaction term (AvT89*Post89*High R&D+ADV). This implies that *for a given* tariff reduction, firms in a high R&D and advertising industry will reduce depth by more. Turning to division manager pay (columns 2 and 4), we find a positive coefficient on the interaction term, although the coefficient is statistically significant only when using the Compustat measure. These results suggest that firms in response to trade liberalization delayer their hierarchies by moving DMs closer to the CEO and increase their pay, particularly if they operate in R&D and advertising-intensive industries. They also highlight the fact that firms change different organizational practices together, in a coordinated way. We interpret this finding to be consistent with firms changing the way in which they make decisions either through improved transmission of information or delegation of authority.

4.2.3 Changes in Costs and Firm Scope

In the two sub-sections above, we present evidence that is generally consistent with firms restructuring their organizations to alter the way in which decisions are made—either through increased delegation or improved transmission of information. Let us now explore other potential mechanisms. A simple explanation often provided for why firms reorganize is to downsize or cut costs. Under this line of reasoning, firms delayer and eliminate managerial positions (i.e., division managers move closer to the CEO) primarily to cut costs -- 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 about cost-cutting, we would expect the level of division manager pay to decline with the trade liberalization. We find the opposite. However, these pay increases might be specific to division manager positions, and the firm may be eliminating other senior manager positions and/or reducing their pay. To evaluate this, we focus on the intermediary position between the CEO and the division manager for which we have some information: the group manager. These managers have multiple profit center responsibility and are typically positioned between the CEO and the division manager.[28]

In column 5 of Table 5, 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 reduces the number of group managers (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 explanation, 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 6, the dependent variable is the logarithm of 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 faster in industries facing more competition. This is also at odds with cost-cutting. But, firms may also be cutting pay of other senior executive positions. To address this, in column 7 we define the dependent variable as the logarithm of total pay for a group of senior executive positions (CEO, group managers, division managers, CFO, General Counsel, Head of Human Resources, and Head of Strategic Planning). We find that trade liberalization has a positive and significant effect on the pay of this larger group of executives. Since we do not observe labor costs for all senior management positions, it still could be that firms eliminate and reduce pay of other positions. Never-the-less, the documented

[28] 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.

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

Another explanation for some of the changes that we observe is that firms broaden their scope. For example, firms may 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 to 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 8 in Table 5 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 9 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,[29] 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.

[29] This is consistent with the results in Feinberg and Keane (2001).

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 decision-making, the greater importance of performance-based pay for division managers in conjunction with closer proximity to the CEO is consistent with this interpretation. Moreover, stronger organizational responses by firms in R&D and advertising-intensive industries—where firms compete through product differentiation--is also consistent with changes in decision-making. To the extent that competition increases the value of quick and responsive decision-making, firms can eliminate layers to improve the quality and speed of the transmission of information or 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. Our findings are generally consistent with this account of the evolution of complementary choices as a response to an external shock.

We also explore a number of other 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.

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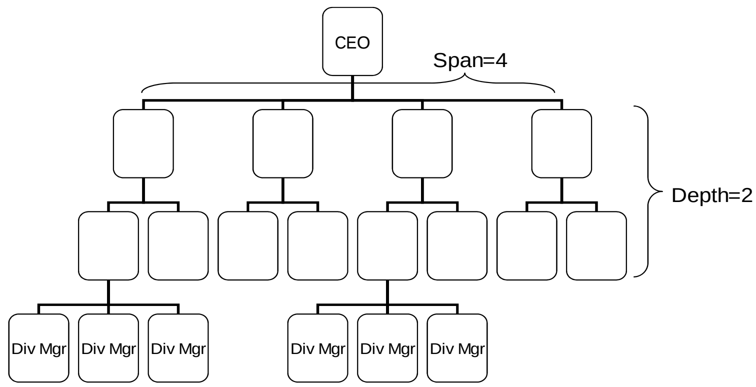
Figure 1 An Example of a Hierarchy: Span and Depth



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

Figure 2 The Differential Effect of the FTA on Span -High vs. Low Tariff Industries

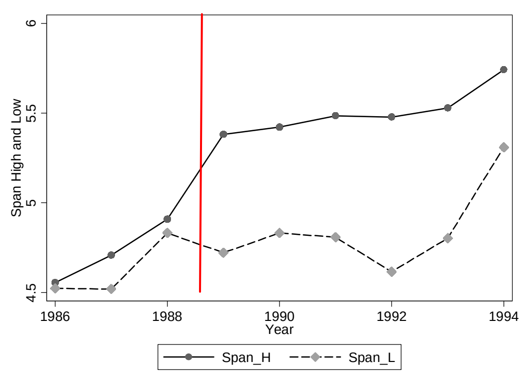


Figure 3 The Differential Effect of the FTA on Depth -High vs. Low Tariff Industries

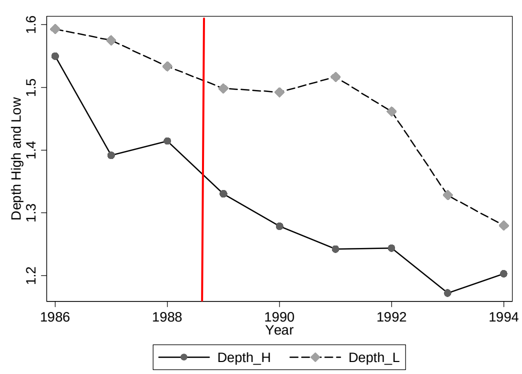


Table 1: Descriptive Statistics

	Mean	S.D.	# Observations
Division level variables:			
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
Firm level variables:			
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 Pay Group Mgrs.	14.91	0.846	1445
ln Pay Senior Exec.	16.03	0.692	1445
Segment HHI	0.761	0.243	1941
#Can. Subsid	2.413	3.046	1459
Trade variables:			
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; 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 Pay Group Managers is # Group managers multiplied by group manager's average pay (in logs); ln Pay Senior Exec. is the log of pay for CEO, group managers, division managers, CFO, General Counsel, Head of Human Resources, and Head of Strategic Planning; 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 Table A3 for more details and sources).

Table 2: Division Depth and Trade Liberalization

	Div.Depth	Div.Depth	Div.Depth	Div.Depth Placebo	Div.Depth Timing	Div.Depth Weighted	Div.Depth Same SIC	Div.Depth Change CEO	Div.Depth IT	Div.Depth CT
	1	2	3	4	5	6	7	8	9	10
AvT89*Post89	-3.661	-3.501	-3.73		-3.501	-4.069	-5.084	-3.279	-3.539	-3.739
	[1.191]***	[1.190]***	[1.147]***		[1.196]***	[2.079]*	[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 (2digit)									4.981	
									[3.693]	
CT Invest.										56.901
										[17.044]***
ln Firm Sales	0.238	0.216	0.216	0.217	0.217	0.231	0.082	0.231	0.2	0.185
	[0.145]	[0.120]*	[0.121]*	[0.123]*	[0.126]*	[0.122]*	[0.138]	[0.122]*	[0.113]*	[0.109]*
ln Div.Empl.		-0.07	-0.07	-0.071	-0.068	-0.07	-0.087	-0.068	-0.07	-0.07
		[0.019]***	[0.019]***	[0.019]***	[0.019]***	[0.019]***	[0.024]***	[0.019]***	[0.019]***	[0.019]***
Division FE	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Division trends		yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	6396	5702	5702	5702	5538	5687	3818	5661	5702	5702
R-squared	0.016	0.031	0.03	0.026	0.033	0.029	0.039	0.062	0.033	0.043
Number of Divisions		1524	1524	1524	1480	1523	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 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 Placebo	CEO Span Timing	CEO Span Weighted	CEO Span Same SIC	CEO Span Change CEO	CEO Span IT
	1	2	3	4	5	6	7	8	9
AvT89*Post89	8.106	9.908	11.386		11.314	12.814	11.961	9.89	9.777
	[3.613]**	[3.839]**	[3.590]***		[3.724]***	[5.038]**	[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]
ln Firm Sales	0.461	0.947	0.961	0.959		0.933	0.586	0.918	0.951
	[0.262]*	[0.294]***	[0.294]***	[0.290]***		[0.292]***	[0.383]	[0.280]***	[0.292]***
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes	Yes
Firm trends		yes	yes	yes	yes	yes	yes	yes	Yes
Observations	1962	1962	1962	1962	1929	1962	1403	1957	1962
R-squared	0.015	0.021	0.021	0.02	0.022	0.02	0.027	0.031	0.021
Number of firms	230	230	230	230	227	230	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 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: Division Manager (DM) Compensation

	Division-Performance Based Incentives				Firm-Performance Based Incentives			
	ln DM Tot.Comp.	ln DM Tot.Comp.	ln DM Tot.Comp.	ln DM Tot.Comp.	Share LT Incent.	Share LT Incent.	Share LT Incent.	ln DM Tot.Comp.
	1	2	3	4	5	6	7	8
AvT89*Post89	1.751	1.829	1.817	-5.015	0.882	0.901	0.988	-3.107
	[0.629]***	[0.558]***	[0.564]***	[3.378]	[0.292]***	[0.308]***	[0.314]***	[2.071]
lnDivision Sales				0.098				
				[0.032]***				
(AvT89*Post89)*lnDiv Sales				0.499				
				[0.244]**				
lnFirm Performance								0.112
(stock returns)								[0.044]**
(AvT89*Post89)*1nFirm Perf.								0.491
								[0.244]**
ln Firm Sales	0.18	0.195	0.222	0.185	0.026	0.027	0.017	0.105
	[0.034]***	[0.035]***	[0.046]***	[0.047]***	[0.016]	[0.017]	[0.023]	[0.057]*
ln Div.Empl.	0.109	0.103	0.089	0.058				
	[0.011]***	[0.012]***	[0.012]***	[0.013]***				
1n Div. Sales					0.014	0.013	0.012	0.105
					[0.004]***	[0.005]**	[0.007]*	[0.026]***
Division FE	yes				yes			
Indiv*Div FE		yes	Yes	yes		yes	yes	yes
Indiv*Div Trend			Yes	yes			yes	yes
Observations	5718	4737	4737	4560	5842	4836	4836	4739
R-squared	0.165	0.183	0.148	0.164	0.05	0.054	0.051	0.161
Number of Divisions	1460	1460	1460	1405	1494	1494	1494	1462

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies, interactions between AvT89 and each performance measure and interactions between Post89 and each performance measure, and the interaction of Post89 with US industry skill intensity, capital intensity and TFP growth pre-89 to account for tariff endogeneity. 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. 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. 1nFirm performance is log total stock market returns including dividends. See notes to table 1 for definition of other variables.

Table 5: Possible Explanations for Flattening

	Div.Depth	DM Pay	Div.Depth	DM Pay	# Group Mgrs.	ln Pay Gr. Mgrs.	ln Pay Sr. Exec.	Segment HHI	#Can. Subsid
	1	2	3	4	5	6	7	8	9
AvT89*Post89	-0.17	0.121	2.755	1.573	-1.07	2.35	1.31	0.57	-10.34
	[2.150]	[1.036]	[1.700]	[1.039]	[2.28]	[0.79]***	[0.51]**	[0.22]***	[7.05]
AvT89*Post89* High R&D+ADV	-5.41	3.254	-7.989	0.845					
	[2.393]**	[1.123]***	[2.028]***	[1.351]					
Post89*High R&D+ADV	0.303	-0.166	0.235	-0.06					
	[0.125]**	[0.050]***	[0.124]*	[0.057]					
Source for R&D+ADV Intensity	*Compustat 86-88*		*FTC Report 1975*						
Division FE & Trends	yes	yes	yes	yes					
Firm FE					yes	yes	yes	yes	yes
Firm trends					yes	yes	yes	yes	
Observations	5349	5365	5074	5090	1349	1341	1341	1941	1459
R-squared	0.035	0.135	0.045	0.128	0.02	0.03	0.13	0.04	0.01
Number of Firms					191	191	191	230	158
Number of Divisions	1434	1440	1364	1370					

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies, ln firm sales and the interaction of Post89 with US industry skill intensity, capital intensity and TFP growth pre-89 to account for tariff endogeneity. AvT89 is the average US tariff rate on Canadian imports in 86-88, by industry. High R&D+ADV is a dummy variable equal to 1 if the firm operates in a 4 digit sic industry with an above median ratio of R&D plus advertising expenses to sales (1986-1988). Columns 1 to 4 control for ln division employment. See notes to table 1 for definition of other variables.

Table A1: Effect of the Trade Liberalization on Stock Returns, Employment and Average Price Cost Margins

	Excess Returns	Excess Returns	1n Firm Employ	1n Firm Employ	Avg. PCM	Average PCM
	1	2	3	4	5	6
AvT89*Post89	0.441	1.244	0.175	0.056	-0.089	-0.258
	[1.015]	[1.310]	[0.279]	[0.384]	[0.065]	[0.083]***
Export: AvT89*Post89	1.612	1.451	0.483	0.559	0.023	0.059
	[0.611]***	[0.656]**	[0.154]***	[0.178]***	[0.030]	[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	1838	1411	1954	1499	1962	1508
R-squared	0	0	0.02	0.02	0.02	0.04
Number of firms	217	173	230	184	230	184

Notes: Std. Errors in brackets, clustered by industry (SIC4). All regressions include year dummies. The dependent variables are the excess stock market returns (col. 1 and 2), the log of total firm employment (col. 3 and 4), and average price cost margin (col. 5 and 6); AvT89 is the average tariff rate on Canadian imports in 86-88 by industry (Export: AvT89 for U.S. exports respectively). 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: Correlation between Organizational and Competition Variables

	Division Depth			CEO Span		
	Trade Costs	Lerner Index	Import Penetration	Trade Costs	Lerner Index	Import Penetration
	1	2	3	4	5	6
Competition Variable	2.822	0.14	-0.781	-21.927	0.128	-0.01
	[1.304]**	[0.067]**	[0.362]**	[9.384]**	[0.367]	[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 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 Table A3 for exact definitions and sources.

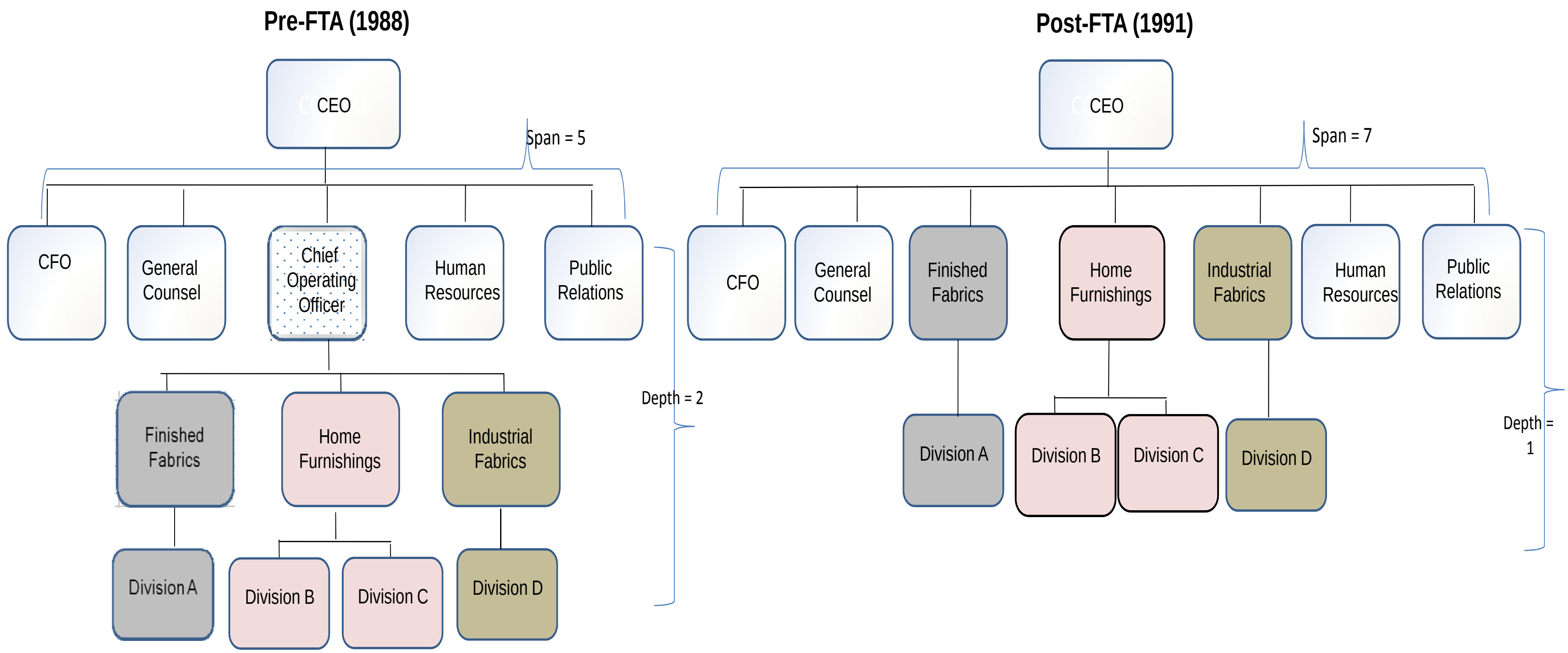
Table A3: Additional Firm and Industry Data

ln Firm Performance/ ln Firm Sales/ ln Firm Employment	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)/ Natural logarithm of firm sales (in million dollars)/ Natural log of total firm employees (in thousands). *Source: Compustat*.
U.S. industry average skill intensity/ U.S. industry average capital intensity/ TFP growth	Ratio of non-production to production workers by industry/ ratio of Total capital expenditure to Total employment/4-factor TFP annual growth rate; for all 3 measures, we take the average for 1986-1988 *Bartelsman, et al (1996). The NBER-CES Manufacturing Industry Database (1958-1996)*
IT (CT) Investment	Change in the logarithm of average real stock of the components of Information Technology (Communication Technology) capital, per year and industry (at 2 digit SIC). IT includes hardware, software and communication equipment. 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. *Source: Bureau of Economic Analysis (BEA)*
R&D and Advertising intensity	Average R&D plus advertising expenses over sales (1) of the 4 digit SIC industry between 1986 and 1988 from Compustat. (2) based on the U.S. Federal Trade Commission (FTC) 1975 Line of Business Survey *Source: Compustat and U.S. FTC 1975 Line of Business Survey*
HHI Segment	Herfindhal index (HHI) of 2 digit segment sales is 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. *Source: Compustat Business Segment data.*
Excess stock returns	Computed as the difference between calendar year company and market returns. Company returns are compounded daily and include all dividends. Total market returns are CRSP's NYSE/AMEX/NASDAQ market weighted returns. *Source: CRSP*
Avg.PCM	Average price cost margin [=(firm sales-cost of sales)/firm sales]. *Source: Compustat.*
Trade Costs	Sum of import tariff and transport costs by industry. *Source: Bernard et al. (2006)*
Import Penetration	Import Penetration by industry. *Source: Bernard et al. (2006).*
Lerner index	Approximated as the industry average price cost margin based on all Compustat firms. *Source: Compustat.*
Number of Canadian Subsidiaries by Firm	Source: *Directory of Corporate Affiliations*

Supplemental Appendix

1. Supplemental Figure

Figure S1: Textile Manufacturer: Changes in Hierarchy pre-FTA versus post-FTA
(Industry SIC 221: Broadwoven Fabric Mills, Cotton--U.S. Tariffs on Canadian Imports: 8.8%)



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

2. Supplemental Tables

Table S1: Top 20 Industries with High U.S. Tariffs on Canadian Imports

US SIC 87 (3-digit)	Industry Name	U.S. Tariffs on Canadian Imports 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%

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

Table S2: Examples of Canadian Companies in High Tariff Industries

US SIC 87 (3-digit)	Industry Name	U.S. Tariffs on Canadian Imports 1986-1988 Average	Examples of Canadian Companies (Sales in U.S. $)
211	Cigarettes	19.33%	Imperial Tobacco ($4.2 b) Rothman's ($400 m)
225	Knitting Mills	16.81%	Dominion Textiles ($1.4 b)
282	Plastics, Syn. Resins, Syn. Rubber, Cellulosic, Other Fibers, Ex. Glass	11.26%	Nova Chemicals ($4.8 b)
208	Beverages	6.77%	Seagram ($4.5 b) Molson ($2.1 b)
366	Telephone & Telegraph Apparatus	6.61%	Nortel Networks ($6.1 b)

Table S3: Other results

	%Sales represented	Change CEO	Ln CEO Comp.	CEO LT/Total
	1	2	3	4
AvT89*Post89	0.597	0.474	2.544	0.906
	[0.620]	[1.297]	[0.615]***	[0.257]***
ln Firm Sales		0.032	0.347	0.002
		[0.106]	[0.079]***	[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 Hewitt 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 S4: Robustness Checks

Panel A: Division Depth

	Div.Depth In 1988	Div.Depth Incl. Serv.	Div.Depth	Div.Depth No Subsid.	Div.Depth Fast
	1	2	3	4	5
AvT89*Post89	-3.49	-3.21	-3.398	-5.7	-5.491
	[1.199]***	[1.248]**	[1.259]***	[4.017]	[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

Panel B: CEO Span of Control

	CEO Span In 1988	CEO Span Incl. Serv.	CEO Span	CEO Span No Subsid.	CEO Span Fast
	1	2	3	4	5
AvT89*Post89	8.874	7.545	10.453	21.576	5.648
	[3.972]**	[4.025]*	[4.155]**	[10.532]**	[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. 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) .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.

3. Complementarities in Organizational Design

In Table S5 (below), we correlate the different practices in a regression framework, allowing for division fixed effects, division trends, and controls for division and firm size.

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.

Table S5: Panel Correlations between Organizational Practices

	ln DM Tot.Comp.	Share LT Incent.	Div.Depth	Div.Depth	ln DM Tot.Comp.	ln DM Tot.Comp.	Share LT Incent.	Share LT Incent.
	1	2	3	4	5	6	7	8
Div.Depth	-0.072	-0.012						
	[0.014]***	[0.006]*						
CEO Span			-0.063		-0.006		0	
			[0.012]***		[0.004]		[0.002]	
#DM dir. excl.own				-0.126		0.014		0.009
				[0.020]***		[0.007]**		[0.004]**
# FUNCT.Direct				-0.015		-0.011		-0.004
				[0.009]*		[0.006]*		[0.002]**
ln Firm Sales	0.216	0.022	0.237	0.231	0.199	0.197	0.023	0.018
	[0.051]***	[0.021]	[0.101]**	[0.103]**	[0.053]***	[0.054]***	[0.021]	[0.021]
ln Div.Empl.	0.093	0.02	-0.067	-0.069	0.099	0.099	0.021	0.021
	[0.011]***	[0.003]***	[0.017]***	[0.017]***	[0.011]***	[0.011]***	[0.003]***	[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. ln 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 in the paper for definition of other variables.