The Flattening Firm and Product Market Competition

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Abstract

This paper establishes a causal effect of product market competition on various characteristics of organizational design. Using a unique panel dataset on firm hierarchies of large U.S. firms (1986-1999) and a quasi-natural experiment (trade liberalization), we find that increasing competition leads firms to flatten their hierarchies, i.e., (i) firms reduce the number of positions between the CEO and division managers and (ii) increase the number of positions reporting directly to the CEO (span of control). Firms also alter the structure and level of division manager compensation, increasing total pay as well as local (division-level) and global (firm-level) incentives. Taken together, the results illustrate how firms redesign their organizational structure through a set of complementary choices in response to changes in their environment.

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1. Introduction

Firms are flattening their hierarchies. 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; Whittington, et al., 1999; and Rajan and Wulf, 2006) and are often discussed in the business press. However, much less is known about what causes flattening and organizational change more broadly. This is surprising given the role found, not only for hierarchies (Liberti, 2006; Garicano and Hubbard, 2007), but also for organizational (Bresnahan, Brynjolfsson and Hitt, 2002) and human resource practices in explaining firm productivity (Ichniowski, Shaw, and Prennushi, 1997; Black and Lynch, 2001; Bloom and Van Reenen, 2007). At the same time, a number of economic forces have strengthened competition in product markets: international competition has intensified from falling tariffs and transport costs, and several waves of trade liberalization (Tybout, 2003); domestic competition has increased from deregulations as well as reductions in information and transport costs. A number of authors have suggested that the trends in organizational change and competition are related (Roberts, 2004; Marin and Verdier, 2003 and 2008; Alonso, Dessein and Matouschek, 2008b; Conconi, Legros and Newman, 2009), but there is little convincing empirical evidence to support this claim.

In this paper, we investigate whether and how changes in product markets lead firms to restructure their organizations. In particular, we focus on how hierarchical structures (measured by the number of management levels (depth) and CEO span of control) and the structure of compensation of division managers (pay and incentives) respond to competition. One important contribution of the paper is to go beyond correlations between measures of product market competition and organizational change to establish causal identification. Our main finding is that greater competition causes firms to 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. Another contribution is that our data measure hierarchical change along with pay, incentives and other firm choices. This allows us to provide an interpretation of the mechanisms that lead firms to flatten. To the best of our knowledge, this is the first paper to establish a clear causal mechanism driving changes in firm hierarchies.

The richness of our data lead to a significant advantage over most of the existing empirical research on organizations, that has traditionally been limited to cross-sectional analysis or a

study restricted to a specific industry. We use a unique panel dataset of the internal organization of large U.S. firms in a broad set of manufacturing industries over 14 years (1986-1999). The data include detailed information on characteristics of firm hierarchies -CEO span of control, and hierarchical depth (or number of management levels) - as well as detailed information on pay and incentives. To ensure that our results are not driven by unobserved attributes of firms or divisions that may be correlated with organizational decisions, we fully exploit the panel dimension of the data (i.e. variation within firms and within division manager positions).

Using this panel dataset we show that flattening is indeed associated with a variety of proxies for product market competition, such as import penetration, industry price-cost margins, and trade costs (sum of transport costs and tariffs). But, while this evidence is suggestive of a link between competition and hierarchical structure, it is not conclusive evidence of a causal effect.[1] We go beyond existing research and exploit exogenous changes to entry barriers into an industry in order to identify a causal effect of foreign competition on organizational change. Our identification strategy exploits a quasi-natural experiment based on a trade shock. This is similar to the identification in Abowd and Lemieux (1993), Bertrand (2004), and Guadalupe (2007). Our experiment is the Canada-United States Free Trade Agreement of 1989 (FTA) that eliminated tariffs and other trade barriers between the two countries (Trefler, 2004). The U.S. firms most affected by the liberalization were those with the largest tariff reductions –i.e., firms in industries with high U.S. tariffs on Canadian imports prior to 1989. These firms experienced a larger decline in entry barriers and thus were arguably exposed to a greater increase in competition.

An important question is: how large could the effect of this liberalization be on U.S. firms? While the average tariff reduction was around 4%, this hides wide heterogeneity in tariffs across disaggregated industries and, in fact, there is substantial evidence showing that the liberalization increased competitive pressure on U.S. firms and increased imports from Canada (Clausing, 2001; Head and Ries, 2001; Romalis, 2007). This is hardly surprising given an estimated elasticity of substitution between Canadian and U.S. goods of 8 (Head and Ries, 2001). Furthermore, Feinberg and Keane (2001, 2006) show that the tariff reductions led to the reorganization of production of U.S multinationals and, consistent with intensified competition, our data also show that the trade liberalization reduced price-cost margins for our firms. We use

1 The standard measures, 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).

this quasi-natural experiment which led to a differential increase in competitive pressure across industries in order to implement a difference-in-differences strategy. We find that for a firm with average tariffs before the liberalization, span of control increased by 6% and depth decreased by 11% after 1989. Overall, our results show a number of precisely estimated effects of competition on hierarchies, and account for a moderate, but arguably causal, share of the secular change in firm hierarchies.

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 effects of these market expansion opportunities on other outcomes (such as firm size and market value), if anything they had a dampening effect on firm flattening (although not statistically significant). So, all the 'flattening' is driven by intensifying competition from the fall in import tariffs (and not market expansion from the fall in export tariffs).

We also evaluate a number of alternative explanations for the observed flattening and assess the robustness of the main results to additional specifications. In particular we evaluate the role of the rise of information technology,[2] CEO turnover, and a host of other potential factors. Overall, we find that the results are very robust and that these are not mediating mechanisms for the main result of the paper: increasing competition leads firms to adopt flatter structures, reducing depth and increasing span.

While the main result in this paper is to establish a robust causal relationship between the trade liberalization and the flattening of firms, we also address the following question: 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.[3] In economics, few theoretical papers directly link competition and hierarchical structure, and to our knowledge, there is no paper with theoretical constructs that map to our observables -depth and span. As such, this paper cannot definitively discriminate between different theories. However, the richness of our data allows us to look at

[2] 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), ownership structure (Baker and Hubbard, 2004) and delegation of authority (Acemoglu, Aghion, Lelarge, Van Reenen and Zilibotti, 2007).

[3] 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).

how other variables -for which we have theoretical predictions-, are changing, and thus shed light on the potential economic mechanisms driving the flattening of firms.

One possible explanation for flattening is due to increased returns to decentralization in more competitive environments (Marin et al, 2003 and 2008; Alonso, et al, 2008b). Models of decentralization have strong predictions on the complementarity between delegation and incentives (Holmstrom and Milgrom, 1994; Prendergast, 2002), and there is empirical evidence for the correlation between these organizational choices (Abernethy et al., 2004; Bouwens et al., 2007; Bushman, Indjejikian and Smith, 1995; Wulf, 2002 and 2007). We find that the trade liberalization, in addition to causing firms to flatten, also leads them to change the structure of division manager compensation. Total pay increases by 7% with competition, and so does the sensitivity of pay to both division-level and firm-level performance. We also find that the link between flattening and competition is more pronounced in firms with high R&D and advertising expenditures. While we do not observe decision-making directly, the combination of several of our findings is consistent with greater delegation of authority to division managers.[4]

Firms could also flatten in response to competition simply to eliminate slack and cut costs (Liebenstein, 1966). Or firms may alter scope by changing the number of products (Bernard, Redding and Schott, 2006), the location of production (Keane and Feinberg, 2001), or their outsourcing decisions. We explore these different mechanisms in the data and overall, our findings show little support for flattening as a way to simply cut costs. However, we do find some evidence of changes in firm scope since the liberalization led firms to become less diversified.

In reality, there is not necessarily a unique way in which firms respond to increasing competition, since they are likely to adjust along different margins at the same time. Our results seem to reflect two different mechanisms. First, our evidence on pay and incentives is consistent with flattening as a reflection of changes in decision-making in response to more competition. Second, we also find support for firms flattening as they reduce the number of products they produce or the lines of business in which they operate. With fewer product lines or businesses, firms eliminate intermediate positions between the division manager and the CEO that serve to coordinate activities between divisions.

[4] This is consistent with the results in 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.

Given the simultaneity of the organizational changes in response to an exogenous shock, our results are a good illustration of the theory of complementarities among a firm's organizational design elements (e.g. Milgrom and Roberts, 1995) and are related to the limited empirical research on the existence of complementary human resource management practices.[5] Within this literature, an important contribution of our paper is that we show that following an *exogenous* shock to their competitive environment, firms redesign their organizations to "fit" the environment in which they operate, and simultaneously reorganize along several dimensions: flattening the hierarchy and increasing pay levels and performance-based pay.

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 and discusses our results of changes in the hierarchy, division manager pay and other firm outcomes. Section 5 concludes.

2. Theoretical Background

It is generally thought and management scholars have long argued that 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. However, to date, there is limited theoretical work in the organizational economics literature that explicitly links product market competition to the internal organization of firms. A common argument is that firms in a non-competitive setting do not fully minimize costs (managers live "the quiet life" of a monopoly) and that an increase in competition forces them to eliminate organizational slack or X-inefficiency (Liebenstein, 1966).

However, changes to organizational design in response to competition need not be the result of earlier inefficient behavior, but instead could be an optimal response to the trade-offs inherent in distinct strategic and design choices. 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, speed, and coordination which in turn are a function of the environment in which the

[5] E.g. Ichniowski, Shaw, and Prennushi, 1997; Bresnahan, Brynjolfson, and Hitt, 2002; Cockburn, Henderson and Stern, 2004.

firm operates (Roberts, 2004). To the extent that competition changes the profit distribution among firms and the level and elasticity of demand facing the firm, the costs and benefits associated with the relevant organizational trade-offs will change, and so will the optimal form of organization. In sum, while there is an underlying theme in much of the theoretical literature that suggests that competition affects the firm's internal structure, the ex-ante predictions are ambiguous.[6]

To date, only a few theory papers discuss explicitly the effect of competition on organizational structure, and focus on the choice to delegate authority.[7] Marin and Verdier (2003, 2008) develop a model of delegation of decision-making inside a monopolistically competitive firm where the principal decides whether to delegate (formal) authority to an agent. They find that as competition increases due to trade from developing (Marin and Verdier, 2003) or developed (Marin and Verdier, 2008) countries, firms are more likely to decentralize decision-making in order to maximize initiative in acquiring and sharing information. In turn, Conconi, et al (2009) examine how trade liberalization affects across firm restructuring (ownership and firm boundary changes) and within firm restructuring (changes in compensation schemes).[8]

Two important aspects of organizational design that we are able to analyze with our data are hierarchical structure (e.g., the number of management levels determined from reporting relationships inside the firm) and compensation design (pay levels and incentives). While we cannot analyze delegation decisions directly, recent theories (e.g., Alonso, et al, 2008a; Rantakari, 2008) that consider the delegation choice as a tradeoff between coordination and adaptation, have implications for the number of management levels. One way to coordinate

[6]For example, faced with the tradeoff between loss of information and loss of control, firms will delegate authority when competition affects their relative importance. The loss of information can be due to loss of initiative by a manager (Aghion and Tirole, 1997) or loss of responsiveness to local information (Dessein, 2002; Alonso et al, 2008a; Rantakari, 2008). The loss of control may arise from an agency problem (Aghion and Tirole, 1997) or from a loss of coordination between units in a multi-divisional firm (e.g., Rantakari, 2008; Alonso et al. 2008a). Alternatively, in theories that optimize over the generation and processing of information, firms may reduce hierarchical levels when competition makes speed of response more important (e.g., Williamson, 1967). Rantakari (2008a) makes predictions about interactions among different organizational design parameters and the joint fit with the volatility of the firm's environment.

[7] In contrast with the limited work on competition and organizational structure, there is a more extensive theoretical literature on the effect of competition on the importance of incentives. While ex-ante the effect of competition on the return to effort is ambiguous (e.g. Schmidt, 1997), Raith (2003) shows that when there is free entry into an industry, competition leads to an increase in the power of incentives (Cuñat and Guadalupe, 2009).

[8] Other less closely related papers are Thesmar and Thoenig (2000) who show that an increase in the rate of creative destruction (the arrival of new products) has an impact on organizational choice. Alonso, Dessein and Matouschek (2008b) show the conditions under which decentralization is optimal when a multidivisional organization operates in several markets but can only set one price.

activities between divisions is to introduce another management level between division managers and the CEO (e.g., group manager) and give decision rights or P&L responsibility to the manager in that intermediary position. While this may limit the authority of the division manager to adapt to local markets, it facilitates coordination across divisions. Therefore, in hierarchies with intermediary positions between the CEO and division managers (i.e., more management levels), division managers should have less authority.

An important feature of the literature in organizational economics is that it underscores the interactions and potential complementarities among different subsets of organizational design choices (Milgrom and Roberts, 1995; Holmstrom and Milgrom, 1994, Mookerjee, 2006). In addition to a relationship between authority and position in the hierarchy, it has been found that decentralized decision-making should be coupled with higher performance-based pay to appropriately align incentives (e.g., Prendergast, 2002; Wulf, 2007). However, if decisions by one business unit have externalities on other units, local incentives (based on the unit's performance) can be costly as they fail to realize synergies across units or impose direct costs (e.g., Athey and Roberts, 2001; Friebel and Raith, 2007; Dessein, Garicano and Gertner, 2007). To improve coordination among divisions, firms may increase incentives based on overall firm performance. These predictions are confirmed in the data.[9]

Increased competition can also affect organizational design through other channels, such as changes in business scope, the reduction of organizational slack (or X-inefficiency), and outsourcing or off shoring. For instance Bernard, Redding and Schott (2006) show how trade liberalization could lead firms to focus on their core competencies, and Baldwin and Gu (2009) show that the FTA led to less diversification for Canadian firms. We also test for several of these alternative channels in our empirical specifications to try and shed light on the mechanisms behind our main result.

There are other explanations besides intensified competition for the flattening of firms, the most obvious being the rise of information technology since a primary role for managers is to receive, process, and transmit information (e.g. Radner, 1993; Bolton and Dewatripont, 1994; Garicano, 2000). As discussed in the introduction, a number of empirical papers demonstrate that

[9]The delegation of authority to division managers is correlated with an increased use of division level measures of performance (Abernethy et al., 2004; Bouwens et al., 2007), and that the use of global (firm performance-based) incentives is more prevalent in firms where coordination is more important (Bushman, Indjejikian and Smith, 1995; Wulf, 2002 and 2007.

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

In sum, competition is likely to alter multiple trade-offs, and lead to changes inside firms along more than one margin. As such, its effect on various organizational choices—hierarchy, location of decision rights, performance pay, firm scope or diversification, etc.--is ultimately an empirical issue. The purpose in this paper is not so much to discriminate between theories, but rather to exploit the unique richness of the data to document causal changes in a rich array of organizational variables in response to an exogenous shock.

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).[10]

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

[10] This description of the data takes into consideration sample representativeness relative to Compustat firms, concerns about selection, and potential misreporting in the survey (and several other issues).

units)[11]; 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.

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

[11]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.

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 A Quasi-Natural Experiment for 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 also 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 increased imports from Canada substantially (Clausing, 2001). The FTA actually affected a significant 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%). Tariff reductions for industries defined at 4 digit SIC ranged from 0% to as high as 36% (with more variation at higher levels of aggregation).[12] 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 to be very high, at approximately 8 (this is an eightfold increase in imports for each 1 percent reduction in tariffs). Below we discuss more extensively the effect that the liberalization had on U.S. firms.

In order to evaluate the effect on organizational change of the trade agreement as a quasi-natural experiment, 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. The reductions in U.S. tariffs on imports from Canada after 1989 were dramatic. Figure 2 reflects this faster reduction relative to the tariffs on imports from the rest of the world.

All tariffs were scheduled to go to zero after 1989, but while some tariff reductions took effect immediately, others were scheduled to be phased out over a period of five or ten years. This phase-out schedule is a potential source of endogeneity: the phase-out times are endogenous choices, likely to be correlated with industries that seek protection from the government through lobbying. To avoid the endogeneity of the schedule, we treat all industries equally regardless of their phase-out schedule, and only exploit the level of tariffs before the agreement.[13] Therefore, we define $AvT89_s$ to measure the level of exposure of the firm to the liberalization. This is the 3-year average tariff on Canadian imports by industry *s* for the period between 1986 and 1988

[12] Table S1in the supplemental appendix lists the twenty industries with the highest tariff reductions, and Table S2 shows some large Canadian firms that operate in those industries.

[13] This is the correct specification if one is concerned about endogeneity, and also given that all information on future tariff reductions was known in 1989. As we discuss later, if we ignore this source of endogeneity, we find –in a robustness check-- that the effect of the liberalization on organizational change was larger in industries with faster reductions in tariffs. We also find that our main result holds if we use the actual Canadian tariff changes year by year –instead of the tariff reduction based on AvT89s- as a regressor (Table A2). But since this is endogenous for the reasons discussed earlier, we focus on the specification of equation (2) in the paper.

(Feenstra, 1996),[14] where tariffs are defined as duty divided by customs value by 4 digit SIC (or 3 digit SIC) by year.[15] Our dependent variables are a set of organizational variables ORG_{dst} (e.g. division-level depth, division manager pay, and firm-level CEO span of control) by division *d* (or firm), industry *s* and year *t*, such that our basic empirical specification is the following reduced form:

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

Where $AvT89_s$ is the average level of tariffs on Canadian imports in the industry pre-89, $Post89_t$ is a dummy that equals one from 1989 onwards, X_{dst} are division (or firm) 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 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 firms according to their trade exposure prior to 1989. Or, in other words, since all tariffs were scheduled to go to zero, it is the effect of the change in tariffs due to the FTA, net of the general change post 1989 and net of possible permanent differences across industries.[16]

We argued earlier that the agreement itself was largely unexpected and therefore one can consider it as an exogenous shock to the different industries. However, in order to make sure that there are no differential pre-existing trends in organizational variables that may be correlated with the initial tariff level, we saturate the model even further and include division (firm)-specific linear trends, η_d *t. We will also run a "placebo" test on the main specification, to assess potential anticipation effects of the liberalization, and show that all the effect appears after the agreement was signed.

[14] The data are available from http://www.internationaldata.org/ in the "1972-2001 U.S. import data".

[15] 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).

[16] 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.

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. As mentioned, 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 $(Z_s * Post89_t)$.

Finally, 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.

Once we include all the relevant variables and take first-differences, the regression we estimate is:

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

3.2.1 Economic Impact of the FTA on U.S. Firms

An important final question before we proceed to the results is what evidence do we have on the impact of the FTA on 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 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,[17] which is consistent with an increase in competitive pressure for firms on both sides of the border. Using our data, 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. 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[18] 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 evidence suggests that the FTA led to greater competitive pressure for our firms from the reduction in U.S. tariffs, but also increased opportunities for market expansion from Canadian tariff reduction.

Other researchers have also found a significant 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).

[17] 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.

[18] 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.

Finally, on the Canadian side, there is substantial micro-econometric work documenting the effect of the FTA on Canadian firms. In particular, there is evidence that the FTA increased the productivity of Canadian firms and their exports to the U.S. consistent with the increased competitive pressure for U.S. firms from the FTA.[19]

Next, we assess the organizational response to this quasi-natural experiment.

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.[20] In a subsequent section, we will explore how other aspects of organizations (in particular, levels of pay and incentive compensation for division managers) are also changing over time in order to provide a fuller picture of organizational change and to explore the possible mechanisms by which these changes occur.

Before turning to the regression results, let us begin by discussing Figures 3 and 4 that show the main variation that we exploit in our empirical analysis. We divide firms and divisions according to whether the firm is in an industry with an above or below the median tariff reduction following the FTA (i.e., with a tariff above or below the median tariff pre-1989). We plot the average span (Figure 3) and depth (Figure 4) by year for the two subgroups. While we observe trending in organizational variables in both groups, there is a distinct difference in the change in trend after 1989 between the groups. Firms in industries with large tariff changes increase their span by more and decrease depth by more after the trade liberalization in

[19] Trefler (2004) finds a substantial increase in labor productivity of Canadian companies following the FTA. The paper also 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.

[20] Before turning to the main specification of the paper that exploits a quasi-natural experiment, we studied the correlation between some standard measures of product market competition, depth and span. We found that division depth and CEO span significantly respond to other standard measures of competitive pressure (Table A2). Higher competition as reflected in lower trade costs (defined as tariffs plus transport costs, columns 1 and 4), a lower industry Lerner Index (columns 2 and 5) or higher import penetration (columns 3 and 6) significantly reduces depth and increases CEO span of control (although for the latter, only the trade costs variable is significant). While these measures can be subject to many criticisms and are by no means exogenous –that is why we use the FTA as our core specification- they provide evidence consistent with the main result in this paper: flattening is a response to increased competitive pressure.

comparison to firms in low-tariff reduction industries. The patterns suggest that firms in industries facing increased competition alter the shape of their organizational hierarchy--greater span and decreased depth.[21] 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.

4.1.1. Estimates of the Effect of the FTA on Division Depth and CEO Span

In Tables 2 and 3, we report the 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.[22] In the depth regressions (Table 2), the unit of observation is the division-year (there are 1524 divisions in the data); while in the span regressions (Table 3), it is the firm-year (230 firms).[23]

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).

[21] Figure S1 in the Supplemental Appendix, illustrates 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.

[22] Table S4 of the Supplemental Appendix shows the relationship between span, depth and other organizational variables.

[23] 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).

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 11.2 % of average depth in the sample. But, how can we interpret the magnitude of the effect? One way to interpret it 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. This only requires a change in the level of reporting for one of the divisions in this example, so it is relatively easy to implement and does not involve significant reorganization costs (it simply requires that the CEO decides that one of the six division managers now reports directly to him). Overall, the effect that we capture is a relatively small proportion of the change in depth over the period.

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 (i.e., that either one more division manager or functional staff reports directly to the CEO). Again, this could simply require the CEO to change the reporting structure of one position.

The 11.2% decrease in depth and the 6% increase in span are the average response to the quasi-natural experiment. The fact that the effects are relatively small is consistent with the trade liberalization having only a moderate impact on U.S. firms. However, given that there is no

earlier work establishing a causal effect on changes in firm hierarchies, it is hard to benchmark our results against others. While there is still substantial variation in hierarchies that remains unexplained, our estimates capture a precisely estimated causal effect based on the trade liberalization.

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) and still find that firms more affected by the FTA repositioned their division managers closer to the top of the hierarchy.[24] 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. 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.

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, that we know affected employment and market value significantly for these firms (Table A1). 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 led U.S. firms to steepen their hierarchies relative to the trend. However, since this is the opposite effect of that for import tariffs and the effect is never statistically significant, we conclude that firms flatten in response to increasing competition from imports and not from greater export opportunities. For the remaining columns in both Tables 2 and 3, and in Table 4, we explore the robustness of the main results to the inclusion of a number of controls and to alternative explanations.

4.1.2 Robustness Checks and Alternative Explanations for the Effect of the FTA on Hierarchies

[24] This suggests that our main result is unlikely to be driven by downsizing of divisions due to outsourcing, or offshoring of certain activities, since this would possibly lead to a reduction in employment. (We found no relationship between log division employment and the experiment and hence we can include it as a control.)

Column 4 in both Tables 2 and 3 provides a test of the assumption that the shock was unanticipated. We replace the Post 89 dummy in AvT*Post89 with a Post88 dummy variable (equals one from 1988 onwards) 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. If it is zero, it provides support to the maintained hypothesis that the shock was unanticipated. 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, suggesting that most of the effect came from the 1989 agreement.[25] We also allow for a lagged effect of the 1989 experiment and find that it is not significant suggesting that for most firms, the organizational change occurs within the first year. We think that this is not particularly surprising given that all the information about the tariff reductions is available in 1989, and that firms can only make discrete choices in the number of levels (depth is 1.4 on average, so for a division that has a depth of 2 it can only go to 1 or 0).

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

[25] It also 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.

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 highly diversified firms that operate in more than one (3 or 4 digit SIC) industry, our industry tariff measure is a less accurate indicator 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).[26] 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). 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 while still statistically significant, the standard errors are much larger (there is no statistical difference from the main effect). Overall the industry-level measure is a much better and more precise predictor of changes in the organization, which is why we use it for our main specification.

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). 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.

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. Next, we consider two important alternative explanations that could affect our main results.

[26] The problem with this measure is that the weights we use are known to be noisy (Villalonga, 2004), and can introduce substantial measurement error in our data (exacerbated by the first-differencing), thus biasing our results.

One frequent reason for why firms change their organizations is because there is a change 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.[27] 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.

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, if the FTA causes firms to adopt IT, the effect we are estimating would not be the direct effect of competition on hierarchies, but the indirect effect of competition through higher IT adoption. Since both effects are interesting in themselves, we would like to assess their relative importance to the extent that the data allow. While we cannot tell the two stories completely apart because we only have one instrument, we tested whether IT adoption is related to our quasi-natural experiment with insignificant results.[28] Therefore, we introduce IT investment as a control in our main specification. 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.[29]

First, we find that our coefficient of interest is unaffected. But, more importantly for the interpretation of our results, the coefficient on overall IT (column 9 in both tables) is positive for both depth and span suggesting that increases in IT are associated with *steeper* organizations (more levels) and wider spans of control. However, both coefficients are statistically

[27] 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), so that we are comfortable using it as a control in our main specification.
[28] The results are in column 3 of Table S3 in the Supplemental Appendix.
[29] 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 conclusive analysis, however, they allow us to shed light on the importance of investments in information technology in explaining our results.

insignificant. Interestingly though, when we 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 is consistent with theories of IT and hierarchies that say that improvements in communication technologies (costs of acquiring/communicating information) can increase depth and span (Garicano, 2000). Therefore, if anything, 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 systematic analysis of IT and hierarchical change is needed, it seems unlikely that the effect we are capturing with the FTA is exclusively the indirect effect through 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. While this effect is robust to a number of specifications, one might still question whether the liberalization with Canada was important to U.S. firms. In Table 4, we provide additional evidence that further supports our claim that the trade liberalization led U.S. manufacturing firms to flatten.[30] The table shows that the effect of the FTA is larger in industries in which the cost of importing Canadian goods into the U.S. is higher relative to that for the rest of the world (columns 1 and 2).[31] It is also larger in industries in which the scheduled tariff reduction is faster (column 3).[32] Our results are robust when we include service industry firms as the main control group, with an assigned tariff (AvT) of zero (column 4). This mitigates concerns that all we are capturing is a spurious trend. Finally, the results are also unchanged when we control for exchange rate fluctuations that may differentially affect industries with different levels of import penetration (column 5)

[30] All regressions in Table 4 replicate the specification of column 2 onwards in Tables 2 (division depth, panel A of Table 4) and 3 (CEO span, panel B of Table 4) and include firm/ division fixed effects and trends.

[31] One should expect that tariff reductions will lead to greater competition and a bigger effect on flattening in industries where the US tariff on Canadian imports is higher than the rest of the world (ROW) tariff. Why? If the US tariff in an industry is above the ROW tariff, the cost of imports from Canada would decline by more relative to the cost in an industry with tariffs below the ROW tariff. We find the sub-sample of firms in industries that facea larger US tariff in comparison to the ROW tariff do flatten more.

[32] In our main specifications, we do not account for the phasing-in of tariff reductions because of concerns about endogeneity. However, in column 3, we relax this concern and find that the reduction in the number of levels is larger in firms that face faster scheduled tariff reductions (where by 1994 tariffs had fallen by at least 60% from their base year).

4.2 Why Are Firms Flattening?

The previous results show that the quasi-natural experiment based on the FTA explains flattening —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. Possible explanations include, but are not limited to, changes in the way decisions are made (delegation of authority), cost-cutting to improve efficiency, and changes in business scope. While it is difficult to identify precise channels for the causal mechanism (and it is not our objective), in this section we attempt to shed some light on this issue.

4.2.1 Changes in Decision-Making: 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, 2008). Strictly speaking, our depth measure reflects "number of reporting levels" without any information on the actual role/authority of the DM or the decisions they make. However, given the theoretical predictions on the complementarity between decentralization and incentive provision, by looking at DM compensation and the importance of performance pay in their contracts, we can potentially infer to what extent changes in depth may reflect delegation and differences in job authority and scope (e.g., Athey and Roberts, 2001; Prendergast, 2002). Moreover, as discussed earlier, recent theory predicts that division managers closer to the top of the hierarchy have greater authority due to the absence of intermediary positions that coordinate decisions between divisions (Alonso, et al, 2008a; and Rantakari, 2008).

The first four columns in Table 5 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.[33] The regressions are again as in equation (2). Column 1 shows that higher competitive pressure leads to higher total pay *within the division* (it includes division fixed effects). That is, the same DM position earns higher total pay after the competitive shock. Division managers in industries with average tariff changes (average pre-1989 tariffs) received a 7.0% increase (1.751*0.04) in total compensation after the trade liberalization relative to managers in industries with no tariffs throughout. But, while interesting in itself, this could be driven by firms replacing managers within a division with a more skilled manager following the FTA. To address this, columns 2 through 4 include manager times division fixed effects. [34] 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 ones, but instead by paying existing managers more. This result is robust to controlling for manager-specific linear trends in pay (column 3).[35] We also obtain similar results when we restrict the analysis to salary, instead of total pay (unreported).

One possible 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 increase in division manager pay may be commensurate with the increase in responsibilities and job scope. Furthermore, the CEO may face greater time constraints as his span of control increases, thereby delegating more decision-making authority to division managers. However, while this suggests that reductions in depth may be reflecting more delegation, in order to explore this argument further, we look at changes in performance-based pay.

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

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

[34] 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.

[35] 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.

the stronger the incentives for the division managers to take initiative, collect information, and make decisions for the business unit. And, there is some empirical evidence that delegation and incentives move together (Abernethy et al. 2004; Wulf, 2007, Bouwens et al., 2007).

We begin by analyzing "local" incentives -incentives based on the DM's division-level performance. Column 4 of Table 5 assesses how the sensitivity of DM pay to division-level 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 the DM's 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 (2 percentage points) for a division in an industry with an average tariff reduction (0.499*0.04), which reflects an increase in "local" incentives. As mentioned above, we know from theoretical work that delegation and (local) incentive provision are often complements. So, the fact that performance-pay sensitivities are increasing and the DM moves closer to the CEO as competition intensifies 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. So, while there are benefits of delegating decision-making, there are offsetting costs as well, for example, in the loss of coordination across divisions (e.g., Athey and Roberts, 2001; Alonso et al., 2008a). Division manager decisions/actions may impact other divisions (through internal capital market allocations, information sharing, or lack thereof, etc). In order to induce coordination across divisions, firms tie a larger fraction of incentives to overall firm performance (e.g., Bushman et al., 1995, Wulf, 2002). Of course, the power of firm-level ("global") incentives is limited since the manager only gets a small fraction of his contribution to firm-level performance.

In columns 5 through 8 of Table 5, we further evaluate changes in "global" incentive provision by firms. In columns 5 through 7 the dependent variable is the fraction of long-term incentives (defined as above) 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 a firm facing average tariffs, the increase in the share of long-term incentives is 0.035 (0.882*0.04 or 3.5 percentage points) relative to the average share of 0.28 (28 percent) for all 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.[36] We do this in column 8 of Table 5 where we use the log of total stock market value (plus dividend distributions) of the firm as our performance measure.[37] 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 (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.[38]

Table 5 shows that competition from the FTA triggered changes in both the level and performance sensitivity of pay for division managers: it increased total pay, as well as "local" and "global" incentives. This set of facts is consistent with flattening (resulting from higher competition) being a reflection of greater delegation of authority to division managers and more decentralized decision making inside the firm. In light of theoretical predictions, one could interpret these results in the following manner. Competition increases the need to quickly adapt to local conditions (and division managers have an informational advantage about local product markets with respect to the CEO). Firms respond by delegating authority to division managers and increase their pay. However, since delegation is costly because it exacerbates agency and coordination problems, firms increase the sensitivity of pay to both division-level (local) as well as firm-level (global) performance.

Finally, if the mechanism is related to how decisions are made, we might expect different responses to competition from firms that operate 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. For example, it is easier for a division manager to communicate a lower price of a competitor's product if it is identical (e.g., paper

[36] Stronger links between pay and firm performance encourage DMs to consider the effect of their decisions on overall firm performance and to coordinate their actions with other division managers.
[37] We obtain similar results if we use log firm sales as the performance measure.
[38] 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 4 and 5 in Table S3 in the Supplemental Appendix) increased more in highly affected industries after 1989.

clips as a homogenous good), but harder to communicate differences in quality (e.g., designer clothes). 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.[39]

We classify firms as having a high R&D and advertising to sales ratio (where high refers to above median) using two different sources.[40] We report the results in the first 4 columns of Table 6. 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. These results suggest that in response to the FTA, and for a *given* tariff reduction, delayering and pay increases are particularly pronounced in R&D and advertising-intensive industries.

Ultimately, our results show a causal response of a number of organizational practices (depth, span, pay and incentives) to the competitive shock. While there could be other explanations for this set of facts, the simultaneous change in local incentives, global incentives, pay and depth, and that the effects are larger in R&D and advertising-intensive industries suggest that change in decision-making is one of the mechanisms through which firms flatten their organizations.

4.2.2 Cost-Cutting

Another 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) in response to increased competition primarily to cut costs (the reorganization has little to do with changes in how decisions are made). That is, competition causes firms to reduce organizational slack and increase efficiency. 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

[39] 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.

40 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).

liberalization. We find the opposite. Of course, it is possible that the firm is raising DM pay while 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.[41]

In column 5 of Table 6, we regress the number of group positions in the firm on our competition measure and include firm fixed effects, firm-specific linear trends and a 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 in response to competition, but, to really shed light on this explanation, we need to ask: what is happening to the pay of the remaining 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 more in industries facing greater competition. However, it is certainly possible that firms are 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 a different set of positions. Nevertheless, the documented increases in senior management pay in response to the trade liberalization are inconsistent with the simple explanation of cost-cutting.[42]

4.2.3 Changes in Firm Scope

[41] 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.

[42] We also looked at the effect of the trade liberalization on Selling, General and Administrative expenses (SG&A), as a measure of overhead costs. We found the effect to be, if anything, positive (although not significant) indicating higher overhead costs in response to greater competition which is at odds with the simple cost-cutting explanation.

Another equally plausible explanation for some of the changes that we observe is that firms change the scope of their operations. For example, firms may diversify into more businesses as the result of the liberalization –maybe to diversify risk- and as a result change their organizational structure. Alternatively, as suggested in Bernard, Redding and Schott (2006), firms may find it optimal to reduce the number of products they produce in response to trade liberalization. Either way, the change in the number of products and the businesses the firm is engaged in may impact the organizational structure.

We use the Herfindahl index of sales across different 2 digit segments, as an inverse measure of firm diversification. Column 8 of Table 6 shows that firms decrease scope and focus their business operations (become less diversified), the larger the tariff reduction from Canada. As firms focus, they may eliminate intermediary positions that serve to coordinate division managers of diverse business operations. In turn, this may lead to decreases in depth and increases in span. We find some weak evidence (column 5) that the number of intermediate group positions falls, suggesting that one of the mechanisms for increased flattening may be through reductions in firm scope.

In addition to changing business scope, firms may change geographic scope. 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, so it is hard to ascribe the main effect we find on depth and span solely to this explanation.

Lastly, firms may respond to increased competition by downsizing divisions through outsourcing or off-shoring activities. While this is clearly possible, as mentioned earlier, we find no effect of changes in employment as a result of the FTA, suggesting this is not the primary driver.

5. Conclusion

Empirical evidence suggests that firm hierarchies have been flattening— hierarchies have fewer levels and broader spans of control. However there is little systematic evidence explaining these changes. The main contribution of this paper is to establish a causal effect between increased foreign competition from a quasi-natural experiment (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 stronger 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 evaluate possible explanations behind firms' choices.

Our evidence is consistent with firms altering how decisions are made in response to greater competition, either directly or as a by-product of changes in scope. To the extent that competition increases the value of quick and responsive decision-making, firms eliminate layers to improve the quality and speed of information transmission and/or increase the authority of division managers to become more adaptive to local information. Delegation of decision-making to division managers is then accompanied by an increase in local (division-level) 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 strengthen global incentives for division managers (pay linked to firm performance).

We also find some evidence that, in response to competition, firms "refocus" on core businesses and become less diversified. This could be a further mechanism, along with changes in delegation, through which competition has an effect on hierarchical structures. Focused firms

with narrower scope require fewer intermediate positions to coordinate activities across businesses.

We found no evidence that these changes resulted from pure cost-cutting efforts by firms. In fact, 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 or X-inefficiency explanation. We also find that the effect of competition on flattening is not driven by changes in outsourcing, changes in IT or CEO turnover.

This paper is an important step in the understanding of the role of product markets in explaining organizational change. While we establish a causal effect, our results account for a moderate fraction of overall changes in flattening. We would expect that other sources of increasing domestic and foreign competition (besides the FTA) are important contributors to the secular flattening of firms. Analyzing other drivers of competition, as well as 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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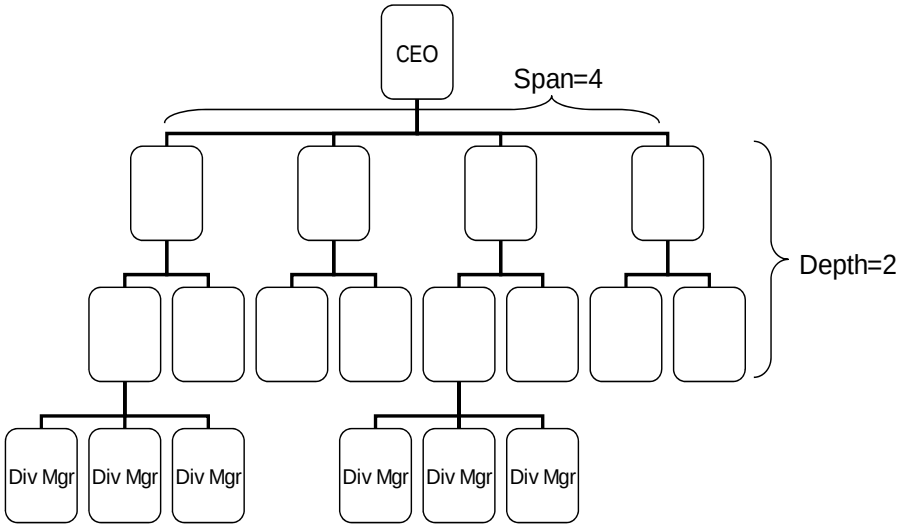
Figure 1 An Example of a Hierarchy: Span and Depth



Span=number of positions reporting to CEO

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

Figure 2: Average U.S. Tariffs on Imports from Canada and the Rest of World (ROW)

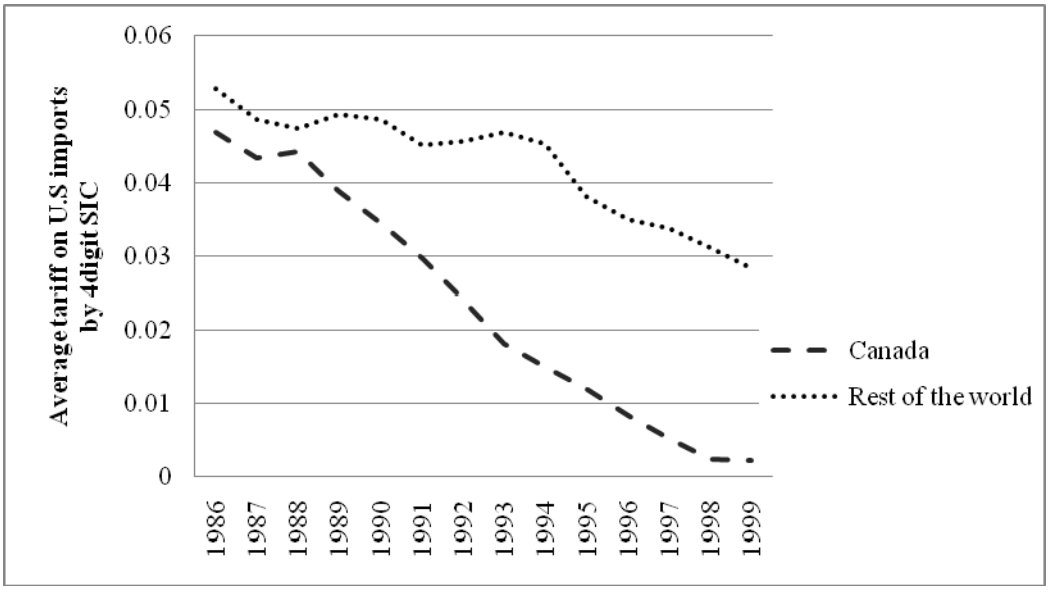


Figure 3 The Differential Effect of the FTA on Span -High vs. Low Tariff Industries

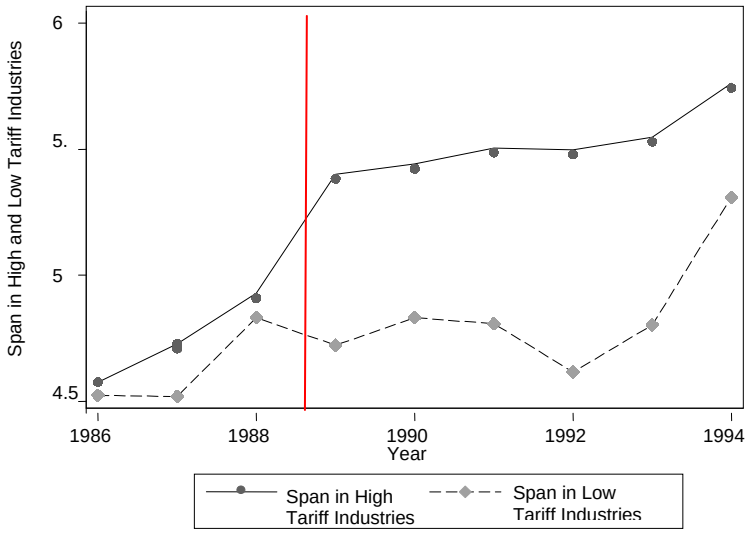


Figure 4 The Differential Effect of the FTA on Depth -High vs. Low Tariff Industries

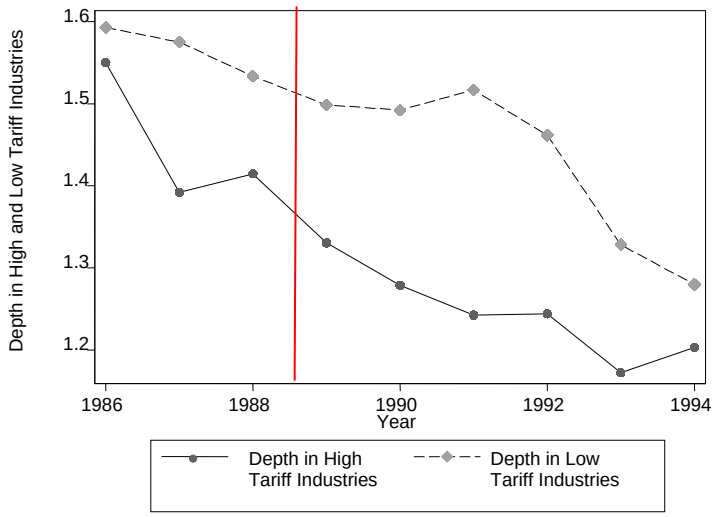


Table 1: Descriptive Statistics

	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 are estimated in first differences and 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 are estimated in first differences and 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 : Evidence for Effect of FTA

	Panel A: Division Depth				
	Div.Depth Canada> ROW Tariff	Div.Depth Canada> ROW Tariff 4 digit	Div.Depth Fast tariff reduction	Div.Depth Incl. Serv.	Div.Depth
	1a	2a	3a	4a	5a
AvT89*Post89	-5.523	-12.019	-5.491	-3.21	-3.398
	[2.504]**	[3.565]***	[1.245]***	[1.248]**	[1.259]***
Exch.Rate*OriginImp.Pen.					0.806
					[1.190]
Division FE	yes	yes	yes	Yes	yes
Division trends	yes	yes	yes	Yes	yes
Observations	2962	1545	1697	6965	5702
R-squared	0.04	0.08	0.084	0.023	0.032
	Panel B: CEO Span of control				
	CEO Span Canada> ROW tariff	CEO Span Canada> ROW tariff 4 digit	CEO Span Fast tariff Reduction	CEO Span Incl. Serv.	CEO Span
	1b	2b	3b	4b	5b
AvT89*Post89	18.137	23.466	5.648	7.545	10.453
	[10.504]*	[6.351]***	[6.926]	[4.025]*	[4.155]**
Exch.Rate*OriginImp.Pen.					4.649
					[7.736]
Firm FE	Yes	yes	yes	Yes	yes
Firm trends	Yes	yes	yes	Yes	yes
Observations	1073	512	531	2711	1962
R-squared	0.03	0.07	0.059	0.019	0.021

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. 4 because these are not available for services industries), as well as ln firm sales and ln division employment. 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). Columns 1 and 2 restrict the sample to firms in industries with US tariffs on Canadian imports above the average tariff on imports from the rest of the world; col. 3 restricts the sample to firms in industries with the fastest scheduled tariff reductions (that had experienced at least 60% tariff reductions from their original level by 1994); col. 4 also includes services firms in the estimation, with AvT89=0; col. 5 includes the interaction of the Canada-US exchange rate and the level of import penetration in the industry before 1989.

Table 5: 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 6: 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			
	Total Trade Costs	Canadian Tariff	Lerner Index	Import Penetration	Total Trade Costs	Canadian Tariff	Lerner Index	Import Penetration
	1	2	3	4	5	6	7	8
Competition Variable	2.822	7.681	0.14	-0.781	-21.927	-16.396	0.128	-0.01
	[1.304]**	[2.478]***	[0.067]**	[0.362]**	[9.384]**	[5.036]***	[0.367]	[1.448]
Division FE& trends	yes	yes	yes	yes				
Firm FE& trends					yes	Yes	yes	Yes
Observations	4503	4462	5600	4018	1378	1365	2046	1196
Number of Div.	1161	1146	1500	1100				
R-squared	0.021	0.02	0.014	0.02	0.025	0.01	0.009	0.011
Number of Firms					157	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 3 and 7 include firms in services and manufacturing, while the others are restricted to manufacturing industries. See Table A3 for exact definitions and sources.

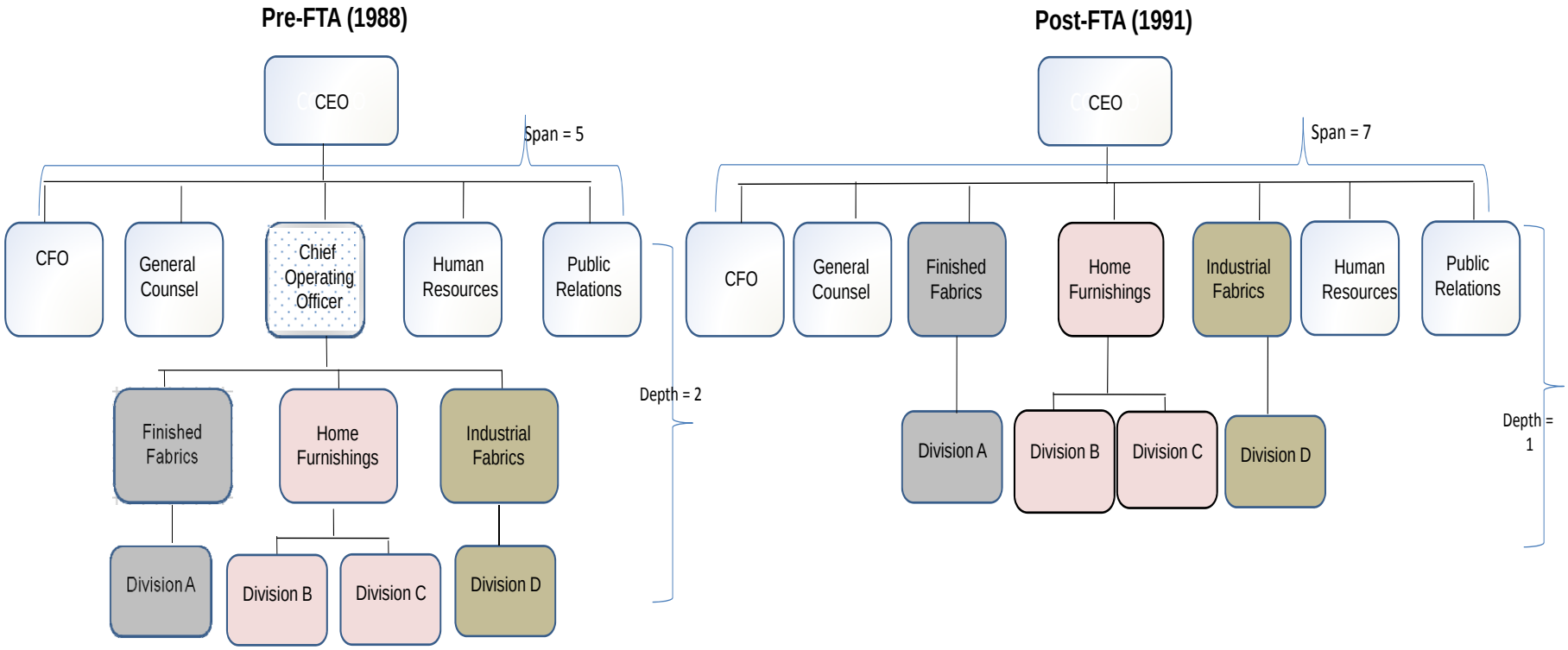
Table A3: Additional Firm and Industry Data

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: Not for Publication

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	IT Investment	Ln CEO Comp.	CEO LT/Total
	1	2	3	4	54
AvT89*Post89	0.597	0.474	0.007	2.544	0.906
	[0.620]	[1.297]	[0.005]	[0.615]***	[0.257]***
ln Firm Sales		0.032	-0.0002	0.347	0.002
		[0.106]	[0.0008]	[0.079]***	[0.035]
Firm FE	yes	yes	yes	yes	yes
Firm trends	yes	yes	yes	yes	yes
Observations	1920	1960	1962	1965	1965
R-squared	0.007	0.012	0.021	0.071	0.02
Number of firms	232	231	230	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.4 it is the log of total CEO Pay, and in col.5 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.

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 S4: 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.