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Thorsten Martin

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Mr. Thorsten MARTIN

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M., Biais, Bruno, Professeur Toulouse School of Economics, Président et Rapporteur
M., Sautner, Zacharias, Professeur Frankfurt School of Finance and Management, Rapporteur
M., Spaenjers, Christophe, Associate Professeur, HEC Paris, Examinateur
M., Gromb, Denis, Professeur, HEC Paris, Directeur de thèse

Real Effects of Price Transparency: Evidence from Steel Futures*

Thorsten Martin‡

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Abstract

I study the real effects of product price transparency on producers and their customers. I use the introduction of steel futures at the London Metal Exchange and the New York Mercantile Exchange in 2008 as a quasi-natural experiment. I exploit the fact that the futures market did not become a new venue for buying physical steel and did not change firms' hedging behavior significantly. Instead, the creation of the futures market increased price transparency in the product market. I compare steel products with futures traded on the exchanges to other steel products in a difference-in-differences setting. I find that price transparency reduces prices, producer surplus and customer material costs. Price transparency further reduces input cost dispersion within narrowly defined customer industries and increases the market share of low-cost producers and aggregate producer productivity.

Keywords: Price Transparency, Real Effects of Financial Markets

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‡HEC Paris, *E-mail:* thorsten.martin@hec.edu

1 Introduction

Price information is central to the efficient functioning of markets. Accordingly, price transparency is an increasingly popular policy tool as evidenced by recent regulations in healthcare, finance and consumer goods industries.[1] But despite its prominent role in economic theory and its relevance for public policy, price transparency has received relatively little attention in the empirical literature, mainly due to the lack of suitable settings. In particular, how improved price transparency affects the good producing and buying firms, the allocation of ressources and productivity remain open questions.

In theory, increasing price transparency reduces prices, price dispersion, producer profits and customer costs (e.g. Janssen, Pichler, and Weidenholzer (2011)). Transparency also enables customers to identify low-cost producers, increasing matching efficiency and aggregate producer productivity (Duffie, Dworczak, and Zhu (2017)). The main empirical challenge is to isolate the effects of price transparency. In the ideal experiment, price transparency is introduced without affecting other dimensions of the market. For instance, the diffusion of the internet arguably reduced search costs and increased price transparency, but also drastically altered firms' distribution networks and product offerings.

To solve this identification problem, I use the introduction of steel futures as a quasi-natural experiment. Steel is sold from steel producers to their customers in an opaque forward market.[2] When steel futures were introduced, steel market participants were now able to observe the market price for futures of the affected products, discovered on a centralized exchange. Importantly, steel futures contracts are usually cash-settled with very little actual

[1]Christensen, Floyd and Maffett (2017) describe a number of price transparency regulations adopted in the U.S. healthcare sector in the past decade. The introduction of post-trade transparency in the U.S. corporate bond market by FINRA in 2003 is a widely studied case of price transparency regulation in financial markets. Chintagunta and Rossi (2016) study price transparency regulation in the retail gasoline market in 2007. Another example is the U.S. Department for education College Affordability and Transparency Center that compares tuition fees and net prices across universities and was launched in 2011.

[2]According to Steel Market Update, an information service provider for steel buyers, steel is sold with lead times of one to three months and predicting the future price of steel is key to succeeding in price negotiations with steel producers.

physical delivery taking place. Thus, the futures market did not simply offer a new venue to buy physical steel and did not alter firms' production and distribution networks. Further, the futures market did not change firms' hedging behavior significantly. This allows me to isolate the informational role of the newly created market. Moreover, the two steel futures contracts introduced in 2008 were for specific steel products: The London Metal Exchange (LME) introduced a contract for billets, while the New York Mercantile Exchange (NYMEX) introduced a contract for hot-rolled coils. Thus, I employ a difference-in-differences (DID) strategy to estimate the effect of the increase in price transparency brought about by the futures market on steel prices, steel producers and their customers. I compare steel products with futures traded on the exchange to other steel products and map these products to steel producing firms and their customers.

I start by examining the effect of price transparency on steel prices. Janssen, Pichler, and Weidenholzer (2011) and Duffie, Dworczak, and Zhu (2017) model price transparency as a reduction in customers' uncertainty about producers' cost in a sequential search framework. When customers learn about producers' cost they can use this information in their decision whether to buy from a given producer or to continue to search. Producers take this into account and charge lower expected prices in equilibrium. In my empirical setting, when steel futures are introduced steel customers can use the information contained in the futures prices in their decision whether to buy from a given steel producer or to search for a better offer.[3] In line with the theory, I find that prices for treated steel products drop by nine percent relative to control steel products right after the introduction of steel futures. Treated and control product prices follow similar prior trends, and the effect persists five years after the introduction.

I then turn to steel producing firms. In theory, as the increase in transparency brought about by the futures market reduces expected prices, producer profit margins decrease. In the baseline specification, I map the treated products to producers using the product descriptions of six-digit NAICS industries. I find that right after the introduction of steel futures treated producer profit margins drop by five percentage points relative to control steel

[3] In line with this intuition, Steel Market Update recommends to use the futures price of steel as the first reference point in negotiations with steel producers. Table A.1 shows the anecdotal evidence.

producers. The results are robust to refining the assignment into treatment using producers' sales covariation with the treated product price indices and information from 10-K filings.

Next, I ask how increased price transparency affects steel customers. The drop in expected prices for steel products reduces their material costs. Further, the theory predicts that price transparency reduces the equilibrium price dispersion of treated steel products, decreasing the dispersion of material costs among affected steel customers. I use the Bureau of Economic Analysis (BEA) input-output table to link steel producing industries to their customer industries. I find that an increase in treated steel materials out of total materials by one standard deviation (eight percentage points) decreases material costs by 0.8 percent. Moreover, the dispersion of customer material costs measured by the coefficient of varation[4] decreases by 1.5 percentage points when the fraction of treated inputs increases by one standard deviation (five percentage points).

I then examine if the improved price transparency increases matching efficiency and aggregate producer productivity. Duffie, Dworczak, and Zhu (2017) model the effects of price transparency when producer cost are heterogenous. Producers' total cost are composed of a common and an idiosyncratic cost component. They show that if search costs are sufficiently low, revealing the common cost component leads all customers to buy from low-cost producers. In my setting, when the futures market is introduced, customers are better able to assess whether a high price offer is due to a high common or idiosyncratic component of production cost. This improves matching efficiency and increases the market share of low-cost producers. To identify low-cost producers, I exploit the fact that steel is made either from iron ore using basic oxygen furnaces (BOF) or from steel scrap using electric arc furnaces (EAF). Due to the lower cost of steel scrap, producing steel with electric arc furnaces was cheaper during the sample period. I classify steel producers that report operating an electric arc furnace in their 2002 10-K filings as low-cost producers.[5] I find that the aggregate market share of low-cost producers increases by 20 percentage points. This

[4]The coefficient of variation is defined as the standard deviation scaled by the mean and is standard in the price dispersion literature.

[5]I measure firm and industry characterstics in 2002, before the LME as the first exchange announced in 2003 plans to launch steel futures.

aggregate increase translates into an average 1.4 percentage point increase in market-share for each low-cost producer in the treatment group relative to the control group. Further, I find that aggregate producer total factor productivity increases by eight percent. Assuming there are no within firm productivity gains, this suggests that the difference in productivity of low and high-cost producers is 50 percent. In comparison, Syverson (2004) finds that the productivity difference between the 90th and 10th percentile in the average four-digit SIC manufacturing industry is 90 percent.

One concern is that the drop in prices and producer profit margins is driven by a deterioration in demand conditions for treated steel products relative to control steel products. In particular, the Great Recession that started in 2007 and the housing bust might have affected treated and control steel products differently. However, customers of treated steel products do not experience a decrease in profit margins relative to other steel customers. Further, there is no evidence of a reversal of the drop in prices and producer profit margins when the economy and the steel industry recovers. Additionally, treated steel producers do not decrease their scale of operations as measured by assets, sales or quantities sold relative to control producers. I also verify that treated and control producers exhibit a similar sensitivity to overall GDP and to construction sector employment before the introduction of steel futures. The results are also robust to controlling for exposure to overall economic activity and the construction sector directly. I also run a plabeco test around the recession of 2001 and do not find a similar pattern. Finally, I examine the stock market reactions to the announcement of the LME and NYMEX to launch steel futures contracts. If the drop in prices and producer profit margins is related to the introduction of steel futures rather than driven by demand conditions, stock prices of treated producers should drop at the day of the announcement relative to control producers. If customers pass the cost savings due to lower material prices only partially on to their customers, stock prices of treated customers should increase relative to control customers. Reassuringly, I find that treated producer stock prices decrease, whereas treated customer stock prices increase relative to the respective control group on the announcement dates of the LME and NYMEX.

Another concern is that differences in import competition, especially from China, between treated and control industries are driving the results. I show that import competition did not intensify for treated industries relative to control industries. The results are also robust to controlling for import competition as well as import competition from China.

One further concern is that the results are driven by changes in the risk managment choice set rather than price transparency. Treated steel producers might hedge more of their output price risk after the introduction of steel futures. In the presence of financing frictions, this could increase investment in productive capacity and aggregate production volumes, and decrease equilibrium prices. However, trading volumes on the exchanges, while significant in absolute terms, are low relative to steel production. Further, treated steel producers do not increase their hedging activity. They are not more likely to report derivative income or losses after the introduction of the futures market. They also do not increase investment or their scale of operations. Another risk management related concern is that steel producers implicitly sell price insurance to their customers by offering fixed-price contracts. With the creation of the futures market, steel customers can obtain input price insurance through hedging on the exchange. This may reduce the profits made by steel producers on these implicit insurance contracts. However, I find that the reduction in profit margins is not concentrated among steel producers who in the data appear to offer more stable prices to their customers.

Another potential concern is that the introduction of the futures market increases standardization of products in the treated industry. Customers may adapt their production technologies to process the exact type of steel for which futures are traded on the exchange. Higher standardization might increase competition between producers and decrease prices, producer profit margins, and customer material costs. However, using Hoberg and Phillips' (2016) text-based measure of product similarity between firms, I do not find any evidence for increased standardization in the treated industry.

This paper contributes to the literature on price transparency. There is a significant body of evidence showing that the introduction of post-trade transparency in the U.S. corporate bond market reduces bid-ask spreads (Bessembinder, Maxwell, and Venkataraman (2006), Edwards, Harris, and Piwowar (2007), Goldstein, Hotchkiss, and Sirri (2007) and Asquith, Covert, and Pathak (2013)). There is also a literature on price transparency in non-financial markets. Devine and Marion (1979) find that mandatory disclosure of supermarket prices in a local newspaper in Canada reduces prices by seven percent relative to the control group. In contrast, Albæk, Møllgaard, and Overgaard (1997) find that following the publication of ready-mix concrete prices through the Danish antitrust authority prices increase by 15 to 20 percent. They argue that increased price transparency facilitates collusion and reduces price competition. More recently, Chintagunta and Rossi (2015) find that mandatory price signs on highways in Italy reduce gas stations' prices, but find no effect on price dispersion. Grennan and Swanson (2016) provide evidence that joining a benchmarking database leads to lower prices paid by hospitals. Christensen, Floyd, and Maffett (2017) find that regulation mandating hospitals to post their charges online, decreases charges by six percent but does not lower actual payments. This paper goes beyond prices and documents the real effects of price transparency for producers and customers in an important intermediate input market.

A related literature studies how the diffusion of the internet affects markets. There is a growing literature that studies how the internet affects prices and price dispersion (see Baye, Morgan, and Scholten (2006) for a survey). Goldmanis, Hortaçsu, Syverson, and Emre (2010) examine in an investigative study the effect of e-commerce on supply-side industry structure. They model the arrival of e-commerce as a leftward shift in the distribution of consumer search costs and, similar to Duffie, Dworczak, and Zhu (2017), predict a decline in equilibrium prices and price dispersion and an increase in low-cost producer market share. They test the model for travel agencies, bookstores, and new car dealerships. Using establishment size as a proxy for production cost, they show that an increase in the fraction of consumers buying online in an area is associated with a decrease in the number of small establishments. In contrast to their paper, I focus more narrowly on the effects of price transparency. When the fraction of consumers buying online increases, it affects the industry structure in a variety of ways other than through price transparency. Bar-Isaac, Caruana, and Cuñat (2012) argue that reductions in consumer search cost drastically change firms' product offerings and strategies. A good example of how reductions in search cost affect an industry is the case of Amazon.com which revolutionized first the book-selling industry and later retail industries for a variety of consumer goods. The internet allows consumers to learn about product offerings without visiting stores, which drastically changes optimal warehousing, distribution networks, and product offerings. One advantage of the steel industry is that the product mix is remarkably steady over time (Collard-Wexler and De Loecker (2015)). Further, I also directly document the effect of price transparency on affected firms.

This paper also contributes to the literature on the real effects of financial markets. The extant literature focuses on how financial markets improve individual firms' investment and production decisions (see Bond, Edmans, and Goldstein (2012) for a survey). Brogaard, Ringgenberg and Sovich (2017) are closest to this paper. They argue that the increase in index investing in existing commodity futures markets reduces the informational content of commodity future prices, which leads to worse production decisions and lower profits by firms mentioning the affected commodities in their 10-K filings. In contrast, in this paper, I show that by increasing price transparency the introduction of the futures market for steel reduces informational asymmetries between producers and customers.

In terms of methodology, two papers use the introduction of new derivatives markets as an experiment. Pérez-Gonzaléz and Yun (2013) argue that the introduction of weather derivatives improves weather-sensitive firms' ability to hedge, leading to increased valuation, investment, and leverage. Almeida, Hankins, and Williams (2017) also use the introduction of steel futures to show that firms use purchase obligations as a risk management tool. Both papers focus on the risk management implications of derivative markets, whereas this paper focuses on the informational implications.

This paper also relates to the literature on misallocation. Hsieh and Klenow (2009) estimate that reallocation of inputs across firms could increase total factor productivity by 30 to 60 percent. Onishi (2016) argues that quantity discounts in the aircraft industry lead to price dispersion and misallocation of aircrafts in the airline industry. This paper shows that a lack of price transparency can be one barrier to efficient ressource allocation across firms. First, opaqueness hinders high-productivity producers to capture more market share. Second, opaqueness increases the input cost dispersion of intermediate good buyers. Such firm-level distortions of factor prices may lead to inefficient allocation. In this paper, I show that price transparency increases low-cost producer market share and aggregate producer total factor productivity and reduces input cost dispersion in customer industries.

The paper proceeds as follows. Section 2 describes the institutional environment. Section 3 briefly presents the theoretical framework and derives the predictions tested in this paper.

Section 4 discusses the identification strategy. Section 5 describes the data. Section 6 presents the results. Section 7 discusses alternative explanations. Section 8 concludes.

2 Institutional Environment

2.1 Industry Background

According to the American Iron and Steel Institute (AISI), raw steel is produced in two principle ways. Basic oxygen furnaces (BOF) use pig iron, made from iron ore, coal and limestone in a blast furnace, and 25 to 35 percent steel scrap to produce new steel. Electric arc furnaces (EAF) use 100 percent steel scrap.[6] In 2001, about 53 percent of steel in the U.S. was produced in blast furnaces, and the remaining 47 percent in electric arc furnaces (Rogers (2002)).

Both processes produce molten steel which can be solidified into semi-finished steel products of different shapes and for different uses and further processed through casting, forging or rolling. Semi-finished products are categorized into slabs, blooms and billets based on their height and width. These semi-finished products can be reheated and further processed. Slabs are either processed into plates and pipe products or into hot-rolled sheets or coils. Hot-rolled coils may then further be processed into pickled and oiled coils, cold-rolled coils and sheets and coated coils. Blooms and billets are processed into seamless tubes, structural mill products or bars and rods. Table 1 shows U.S. steel production for the major product groups. The steel industry is a competitive industry. In 2002 there were 67 public firms operating in steel producing industries.

2.2 Introduction of Steel Futures

In April 2008 trading in steel billet futures started at the London Metal exchange (LME) and in October 2008 hot-rolled coil futures startet trading at the Ney York Mercantile Exchange (NYMEX). This raises the question of why steel futures were introduced in 2008 and why

[6] Direct reduced iron (DRI) can be used as a substitute for steel scrap in electric arc furnacess, but is typically more expensive than steel scrap.

these particular products were chosen by the exchanges.

Carlton (1984) argues that one necessary condition for the success of futures contracts is price volatility. As shown by Figure 1 steel price volatility increased largely before the LME as the first exchange announced to start working on launching steel futures contracts in 2003. Reassuringly, the rise in steel price volatility is observed for both eventually treated and control steel products. This increase in steel price volatility created the necessary demand for derivatives to manage steel price risk.

In the decision which steel products to use as an underlying in the futures contract, exchanges face a trade-off between minimizing basis risk and maximizing liquidity. Offering a futures contract for each steel product would mimimize the basis risk for each product but would lower liquidity in each contract as total trading volume is split across the products. The emergence of steel futures contracts for billets at the LME and hot-rolled coils at the NYMEX reflects this trade-off. Steel future contracts have been introduced for other products in other parts of the world.[7] This shows that the decision by the LME and NYMEX were not driven by unique product features of billets and hot-rolled coils. However, steel is sold in largely regionally segmented markets. The NYMEX contract is based on U.S. mid-west hot-rolled coils. The LME contract has multiple points of delivery in the U.S. As the focus of this paper are Northamerican firms I only consider the NYMEX and LME contracts following Almeida, Hankins, and Williams (2017).

Next, I turn to the question of how steel futures affected steel producers and their customers. First, to isolate the effect of price transparency it is important that the futures market did not simply become an alternative way to buy physical steel. The NYMEX contract is cash-settled without the possibility of physical delivery. The billet futures contract has the option of physical delivery. But according to the LME physcial delivery is very low as traders usually close their position before actual delivery. Second, as shown in Table A.2, although trading volume is significant in absolute terms, it is low relative to overall

[7] In the sample period futures traded for reinforcing bars in Dubai and Shanghai, for ingots and hot-rolled coils in India, and wire rod in Shanghai. Trading volumes in Dubai and India are small and trading in Shanghai is restricted to Chinese traders. Steel imports from China, India and the United Arab Emirates combined average 2.7 percent in the sample period.

steel production. This makes it unlikely that changes in the risk management practices of firms had a large effect on steel producing industries and their customers. Further, I do not find evidence that treated producers increased their hedging activity relative to control producers. I adress hedging related alternative explanations in section 6.

Instead I argue that steel futures increased price transparency for steel products traded on the exchange. Unlike other metal markets, prices for steel are not controlled by a public auction, which makes information about producers' production cost and overall market conditions crucial for customers. There are price indices published by the Bureau of Labor Statistics (BLS) and private data collectors. However, these indices are based on voluntary surveys and published with a delay, whereas according to Steel Market Update steel is usually sold forward with lead times of one to three months. Thus, steel futures provide valuable information to customers about the future price of steel. In line with this intuition, Steel Market Update recommends to use the futures price of steel as the first reference point in negotiations with steel producers. Further, steel producer executives strongly opposed the introduction of the futures market for steel, fearing to loose control over pricing. Table A.1 presents the anecdotal evidence.

3 Theoretical Framework

To derive the predictions tested in this paper I borrow from Janssen, Pichler, and Weidenholzer (2011) and Duffie, Dworczak, and Zhu (2017). The effect of price transparency is modeled by comparing the case where customers know producers' production cost to the case where customers do not know the production cost in a sequential search market.

In the setting of Janssen, Pichler, and Weidenholzer (2011), producers maximize profits taking prices charged by competitors and customer search behavior as given. Upon observing a price offer, customers can either buy or pay a search cost to obtain one additional offer. A fraction λ of customers, the *shoppers*, have zero seach cost, obtain price offers of all producers and buy at the lowest price. The remaining fraction of *nonshoppers* pays search cost greater than zero and trades off the search cost against the expected benefit from search. Customers buy if the observed price p is below their reservation price r, continue to search if $p > r$ and are indifferent if $p = r$. A standard result in the search literature is that for $\lambda \in (0, 1)$ producers follow a mixed-strategy and draw price offers from the cumulative price distribution F as they trade off setting low prices to attract shoppers with setting high prices to extract rents from selling to nonshoppers.[8] The upper bound of the price distribution F is given by the reservation price, as no producer sets a higher price than the reservation price in equilibrium.

In the transparent market, customers can condition on the production cost and their reservation price is then given by the production cost c plus a mark-up proportional to the search cost. In the opaque market, customers do not observe the production cost and shoppers can only condition on price offers they observe in their decision to buy or continue to search. The upper bound of the price distribution is then given by the first round reservation price. Janssen, Pichler, and Weidenholzer (2011) show that this first round reservation price is higher than the reservation price in the transparent equilibrium. Thus, expected prices, producer profits and the expected price spread between the highest and the lowest prices in the market are higher and customer surplus is lower compared to the case where production cost are known. Intuitively, in the opaque market producers strategically exploit that customers are uninformed about their production cost, and set on average higher prices compared to the transparent case.

In my empirical setting, the introduction of steel futures increased price transparency for the steel products with futures traded on the exchange, moving the market for these products from the opaque to the transparent equilibrium. This increase in transparency leads to the following predictions:

> ***Prediction 1:*** *Expected prices charged by producers decrease in response to increased price transparency.*

> ***Prediction 2:*** *Producer profit margins decrease in response to increased price transparency.*

[8]If $\lambda = 1$ the equilibrium in pure strategies is the Bertrand equilibrium where all producers charge prices equal to their marginal cost. If $\lambda = 0$ the equilibrium in pure strategies is the Diamond (1971) paradox, where all firms charge the monopoly price.

Prediction 3: *Customer material costs decrease in response to increased price transparency.*

Further, as the spread between the lowest and highest prices charged by producers is lower in the transparent compared to the opaque market, the increased price transparency brought about by the futures market decreases dispersion in customers' material cost.

Prediction 4: *Dispersion in customer material cost decreases in response to increased price transparency.*

Duffie, Dworczak, and Zhu (2017) extend the analysis to include heterogeneity in producer cost. Producers' total cost are composed of a common and an idiosyncratic cost component and price transparency reveals the common cost component c. They show that if search costs are sufficiently low, price transparency leads all customers to buy from low-cost producers. Knowing the common cost component c allows customers to distinguish between efficient and inefficient producers. In the opaque market, where customers do not know the common cost component, they can only rely on observed prices. However, when the realization of the common cost component c is low, high-cost producers can offer prices that low-cost producers would make under higher realizations of c. Nonshoppers then buy from high-cost producers. Revealing the common cost component allows customers to distinguish between high prices from low-cost producers under high cost realizations and low prices from high-cost producers under low cost realizations. In my empirical setting, the increased price transparency brought about by the introduction of the futures market increases customers ability to assess whether a high price offer is due to the common or the idiosyncratic component of production cost. This improves matching efficiency and increases the market share of low-cost producers.

Prediction 5: *Low-cost producer market share increases in response to increased price transparency.*

Finally, as low-cost producers increase their market share, aggregate total factor productivity increases in the producer industry.

Prediction 6: *Aggregate producer total factor productivty increases in response to increased price transparency.*

4 Identification Strategy

4.1 Difference-in-differences estimation

To assess the effect of price transparency, I use a difference-in-differences (DID) estimation and compare steel products with futures traded on the exchange to other steel products before and after the introduction of steel futures. This strategy allows to control for shocks that affect the steel industry as a whole. Futures were introduced for billets in April 2008 at the LME and for hot-rolled coils in October 2008 at the NYMEX. In this section I describe the specification to estimate the effect of price transparency on product prices. I present adapted specifications to test the predictions on producers and customers right before discussing the result.

To estimate the effect of price transparency on the level of prices, I estimate the following OLS regression at the product-month level in the sample of steel industries,

$$\textit{Log(Price-Index)}_{p,t} \quad = \quad \beta \times \textit{Post-Treated-Product}_{p,t} + \delta_p + \eta_t + \varepsilon_{p,t} \qquad (1)$$

where p indexes products and t indexes year-months. $\textit{Log(Price-Index)}_{p,t}$ is the log of the price index in year-month t for product p, δ_p are product fixed effects, η_t are year-month fixed effects, and $\varepsilon_{p,t}$ is the error term. The main variable of interest, $\textit{Post-Treated-Product}_{p,t}$, is a dummy variable equal to one for billets after April 2008 and for hot-rolled coils after October 2008. I cluster standard errors at the industry and year-month level. The coefficient of interest β measures the change in prices after the introduction of steel futures for treated relative to control steel products.

4.2 Internal Validity

The key identifying assumption in this setting is that, if the steel futures market had not been introduced, treated steel products would have moved in the same way as control steel products moved.

This identifying assumption cannot be tested directly, but I verify that treated and control steel products follow parallel trends in the period before the introduction. Figure 2 presents the evolution of steel prices from the beginning of the sample period in 2003 (five years before the introduction) until the end of the sample period in 2013 (five years after the introduction) for eventually treated and never treated steel products. The graph shows that eventually treated and never treated products follow similar trends prior to the introductions of steel futures in April and October 2008. Figure 3 presents the evolution of steel producer profit margins for eventually treated and never treated steel producers during the sample period. Again, the graph shows that eventually treated and never treated producers follow similar trends prior to the introduction of steel futures. In section 6, I also analyze the dynamics of the effect and show that the effect of steel futures only starts after the introduction.

5 Data

5.1 Prices

I use price indices from the Bureau for Labor Statistics (BLS) Producer Price Index (PPI) series. These indices are based on voluntary surveys of systematically selected samples of establishments that produce the product and published around two weeks after the reference month.[9] I restrict the sample to steel products with full price index information during the sample period.

5.2 Firm Characteristics

To measure firm characteristics I use accounting data from Compustat Northamerica. I use historical NAICS codes for the year 2002 to assign firms into treatment and control industries. I measure profit margins as operating income over sales and material costs as cost of goods sold over sales. I also compute the log of assets, leverage ratio and sales-to-assets ratio in 2002. To measure the stock market reaction to the exchanges' announcements, I use daily

[9] Once an establishment agrees to cooperate it reports prices for selected products until a new sample is selected for the industry after 7 to 8 years. Currently around 25,000 establishments report their monthly prices. In comparison, there were 7,663,938 establishments in the U.S. according to the latest Statistics on U.S. Businesses (SUSB) in 2015.

stock prices from CRSP. All variables are winsorized at the 1st and 99th percentile.[10]

5.3 Customers

To identify steel customer, I use the 2002 Bureau of Economic Analysis (BEA) input-output table. For each four-digit downstream industry j, I compute the fraction of inputs from steel producing industries,

$$\textit{Steel-Input}_j = \frac{\sum_k \textit{Steel-Producer}_k \times \textit{Gross-Flow}_{j,k}}{\sum_k \textit{Gross-Flow}_{j,k}},$$

where $\textit{Steel-Producer}_k$ is a dummy variable equal to one if upstream industry k produces steel, and $\textit{Gross-Flow}_{j,k}$ is the gross-flow from upstream industry k to downstream industry j. I then compute the fraction of inputs for which futures become available in 2008,

$$\textit{Future-Steel-Input}_j = \frac{\sum_k \textit{Future-Steel-Producer}_k \times \textit{Gross-Flow}_{j,k}}{\sum_k \textit{Gross-Flow}_{j,k}},$$

where $\textit{Future-Steel-Producer}_k$ is a dummy variable equal to one if upstream industry k produces steel traded on either the LME or NYMEX. I compute *Steel-Material* and *Future-Steel-Material* using analogous calculations, excluding upstream industries that do not produce physical goods.[11] Further, I compute *Future-Steel* as the fraction of inputs from treated producer industries over total steel inputs.

To measure customer input cost dispersion, I compute the coefficient of variation for $COGS/Sales$, defined as the standard deviation (SD) scaled by the mean, for each year-quarter within each four-digit industry,

$$CV(COGS/Sales)_{j,t} = \frac{SD(COGS/Sales)_{j,t}}{\overline{(COGS/Sales)}_{j,t}}.$$

5.4 Low-Cost Producer Market Share and Producer Productivity

To measure the market share of low-cost producers I first use steel producers' 10-K filings to identify low-cost producers. The dummy variable $\textit{Low-Cost Producer}_i$ equals one if a steel

[10] All results are robust to using non-winsorized variables.

[11] Materials are defined as inputs from physical goods producing industries, excluding NAICS codes 1150, 2130, 2211, 23, and 4 to 8.

producer's 2002 10-K filing mentions operating an electric arc furnace. I then compute for the treatment and control group the market share of low-cost producers for each year-quarter,

$$\textit{Low-Cost Producer Market Share}_{g,t} = \frac{\sum_i \textit{Low-Cost Producer}_i \times \textit{Sales}_{i,g,t}}{\sum_i \textit{Sales}_{i,g,t}}.$$

Finally, to measure aggregate producer productivity I use the NBER-CES manufacturing database. The NBER-CES data provides yearly total factor productivity measures at the six-digit NAICS code level and is available until 2011.

6 Results

6.1 Summary Statistics

Table 2 presents summary statistics. Panel A compares treated and control producers in 2002. Treated steel producers are larger and have sligthly lower leverage and sales-to-assets ratios than control producers. To ensure that the results are not driven by differences between firms, I include a vector of firm-level characteristics interacted with the *Post* dummy in the producer regressions. In Panel B I split the sample of steel customer industries in 2002 at the median of $\textit{Future-Steel}_j$, the fraction of treated steel inputs out of total steel inputs. Steel customers above the median use less capital and have higher sales-to-capital ratios. To ensure that the results are not driven by differences between customer industries, I include a vector of industry-level characteristics interacted with the *Post* dummy in the customer regressions.

6.2 Prices

I begin by testing whether increased price transparency leads to lower prices (Prediction 1). To estimate the effect of price transparency on the level of prices, I use the BLS Producer Price Indices for steel producing industries and I estimate equation 1 at the product-month level in the sample of steel industries.

Table 3 presents the DID estimate for the effect of the introduction of steel futures on the level of prices. Prices of treated products drop by seven to ten percent relative to control products. The effect is robust to controlling for product-specific time-trends in column (2), initial product characteristics in column (3), and business cycle and import competition controls in columns (4) and (5). Columns (1) and (2) restrict the sample to include only products within the same six-digit industry as the treated products. Columns (3) to (5) include all steel products presented in Table 1. Next, I estimate the dynamics of the effect. The results in Panel A of Figure 4 show that there is a sharp drop in prices right after the introductions of the steel futures contracts.

6.3 Producer Profit Margins

I then test whether price transparency reduces producers' profit margins (Prediction 2). To estimate the effect of price transparency on producer profit margins, I map the treated products to steel producers. I start with all Compustat firms operating in steel producing industries during the sample period. Industries are defined at the six-digit NAICS code level. In the baseline specification I use NAICS product descriptions to map the treated products to six-digit industries. As shown in Table 1, billets and hot-rolled coils are produced in NAICS 331111. I then assign firms into the treatment and control group based on their industry in 2002, before the LME first announced their plans to launch steel future contracts in 2003.[12] I estimate the following OLS regression at the firm-quarter level in the sample of steel producing industries,

$$\frac{Profit_{i,j,t}}{Sales_{i,j,t}} = \beta \times Post \times Treated_j + \delta_i + \eta_t + \varepsilon_{i,j,t} \quad (2)$$

where i indexes firms, j indexes industries at the six-digit NAICS level, and t indexes year-quarters. δ_i are firm fixed effects, η_t are year-quarter fixed effects, and $\varepsilon_{i,j,t}$ is the error term. The dummy variable $Treated_j$ is equal to one for treated producers. The dummy variable *Post* is equal to one after Q2 2008. To account for potential differences between treated and control firms, I introduce controls for initial firm characteristics. I interact the log of assets, leverage and sales-to-assets ratio measured in 2002 with the *Post* dummy. To account for different time trends for treated and control producers, I also introduce separate

[12] No treated firms change industries during the sample period.

time trends for each industry. I cluster standard errors at the industry and year level. The coefficient of interest β measures the change in profit margin after the introduction of steel futures for treated relative to control steel producers. Table 4 presents the DID estimates for the effect of the introduction of steel futures on producer profit margins. I find that treated producer profit margins drop by five to nine percentage points relative to control producers. The effect is robust to controlling for initial firm characteristics in column (2) and industry-specific time-trends in column (4). In columns (1) and (2) I use all firms in steel producing industries in Compustat. I restrict the sample to firms with headquarters in the North American Free Trade Agreement (NAFTA) region in columns (3) to (6). The results are robust to refining the assignment into treatment using the covariation of firm sales with the treated products and information from firms' 10-K filings, reported in Table A.10 and A.11 in the Appendix. The dynamics of the effect are shown in Panel B of Figure 4. Treated producer profit margins drop sharply after steel futures are first introduced.

One concern in this setting is that the drop in prices for treated steel products and producer profit margins is driven by other events in that time period which impacted treated and control steel products differentially. Steel futures might have been introduced at a time when demand conditions for treated steel products deteriorated relative to control products. In particular, the Great Recession might have had a stronger negative impact on treated steel products. A related concern is that treated and control products might differ in their exposure to the construction sector. The bust in the housing sector might have affected treated products more than control products.

I conduct several tests to adress these crisis-related concerns. First, as shown in Table A.3, customers of treated steel products do not experience a decrease in profit margins relative to other steel customers. The point estimates are not statistically significant at conventional levels and positive, showing no evidence for a stronger weakening in demand conditions for customers of treated steel products. Second, I find no evidence of a reversal in producer profit margins when the steel industry recovers in 2012, as shown in Table A.4. The point estimate on the interaction of the *Treated* dummy with a dummy variable equal to one after 2012 is not significant and negative. Third, as shown in Table A.5, treated steel producers do not decrease their scale of operations relative to control steel producers, measured by the log of assets, sales and quantities sold.[13] All three point estimates are not significant and positive. Fourth, as shown in Table A.6, treated and control producers exhibit a similar sensitivity to real GDP and to the construction sector before the introduction of steel futures. I regress a firm's beta with respect to real GDP and constuction sector employment, estimated during the ten years prior to the introduction (1998 to 2007), on the *Treated* dummy. The point estimates are not significant and negative. Next, I run a placebo test and re-run the producer profit margin regressions around the recession of 2001 to test if treated steel producers' profit margins drop in general more in recessions.[14] Table A.7 shows no differential development of profit margins for treated and control producers around the recession in 2001. The point estimates are not significant and positive.

Another concern is that differences in import competition, and in particular import competition from China, between treated and control firms are driving the results. Table A.8 shows that import competition did not intensify for treated relative to control industries after the introduction of steel futures. The point estimates are not significant and negative.

Next, I examine the stock market reactions to the announcement of the LME and NYMEX to launch steel futures contracts. If the drop in prices and producer profit margins is related to the introduction of steel futures rather than driven by demand conditions or import competition, I expect stock prices of treated producers to drop at the day of the announcement relative to control producers. If customers pass the cost savings due to lower material prices only partially on to their customers, stock prices of treated customers should increase relative to control customers. I construct portfolios for treated and control producers and customers for the announcements by the LME and NYMEX respectively. I then run the following OLS regression,

$$Return(Treated - Control)_t = \beta \times AnnouncementDay_t + \gamma' F_t + \varepsilon_t, \tag{3}$$

where t indexes day, $Return(Treated - Control)_t$ is the return on a portfolio that is long the treated firms and short the control firms for the respective announcement. $AnnouncementDay_t$

[13]Quantities sold are measured by deflating firms' sales with industry price-indices.

[14]The corresponding NBER recession dates are: March 2001 - November 2001 and December 2007 - June 2009. www.nber.org/cycles.

is a dummy equal to one on the day of the announcement and F_t is a vector of the three Fama-French factors size, book-to-market and the market risk premium.[15] Table A.9 confirms that treated producer stock prices decrease, whereas treated customer stock prices increase relative to the respective control group on the announcement dates of the LME and NYMEX.

Finally, I also include controls for exposure to overall economic activity and the construction sector as well as for import competition. I control for the sensitivity to real GDP and to employment in the construction sector of products, firms, and industries depending on the specification, interacted with the *Post* dummy. I also control for quarterly real GDP growth and employment growth in the construction sector, interacted with the respective treatment variable. I also control for import competition as well as import competition from China in the steel industry, interacted with the treatment variable. Columns (3) to (5) of Table 3 show that the price results, and columns (2) to (6) of Table 4 show that the profit margin results are robust to including these controls.

6.4 Customer Costs

Next, I test whether increased price transparency reduces customers' material costs (Prediction 3). To estimate the effect of price transparency on customer costs, I use the 2002 Bureau of Economic Analysis (BEA) input-output table to identify steel customer. I merge the information from the input-output table to the NBER-CES manufacturing database based on four-digit NAICS codes. I restrict the sample to industries with at least ten percent steel materials and exclude steel producing industries. I then estimate the following OLS regression at the industry-quarter level in the sample of steel buying industries,

$$\textit{Log(Material Prices)}_{j,t} = \beta \times \textit{Post} \times \textit{Future-Steel-Material}_j + \gamma' \textit{Post} \times X_j + \delta_j + \eta_t + \varepsilon_{j,t}, \quad (4)$$

where j indexes industries at the four-digit level, and t indexes years. δ_j are firm fixed effects, η_t are year fixed effects, and $\varepsilon_{j,t}$ is the error term. The outcome variable *Log(Material Prices)*$_{j,t}$ is the log of the material price deflator. *Future-Steel-Material*$_j$ is the fraction of

[15] The Fama-French factors were obtained from Kenneth French's website at `http://www.http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/`.

an industry's treated steel materials out of total materials used. The vector X_j includes the fraction of an industry's steel materials out of total materials, *Steel-Material*$_j$, in all regressions. I also include controls for initial industry log of capital and sales-to-capital ratio interacted with the *Post* dummy. I cluster standard errors at the industry and year level.

Table 5 shows that material costs decrease by 0.8 percent more after the introduction of steel futures when the fraction of treated steel materials, *Future-Steel-Material*$_j$, increases by one standard deviation or 8 percentage points. These magnitudes are consistent with the effects on producer prices reported in Table 3. The effect is robust to controlling for initial industry characteristics, crisis-related and import competition controls in columns (2) and (3). To assess the dynamics of the effect, I interact a dummy variable equal to one if the fraction of treated steel materials out of total steel materials, *Future-Steel*$_j$, is above the median with the full set of year fixed effects. Figure 5 shows that material cost start to decrease only after the introduction of steel futures.

6.5 Customer Cost Dispersion

I then test whether increased price transparency reduces customers' input cost dispersion (Prediction 4). I merge the information from the input-output table with Compustat based on 2002 four-digit NAICS codes. I restrict the sample to industries with at least ten percent steel inputs and exclude steel producing industries. I compute the coefficient of variation of *COGS/Sales* for each year-quarter within each four-digit customer industry. I then estimate the following OLS regression at the industry-quarter level in the sample of steel buying industries,

$$CV(COGS/Sales)_{j,t} = \beta \times \textit{Post} \times \textit{Future-Steel-Input}_j + \gamma' \textit{Post} \times X_j + \delta_j + \eta_t + \varepsilon_{j,t}, \quad (5)$$

where j indexes industries at the four-digit level, and t indexes year-quarters. δ_j are industry fixed effects, η_t are year-quarter fixed effects, and $\varepsilon_{j,t}$ is the error term. *Future-Steel-Input*$_j$ is the fraction of an industry's treated steel inputs out of total inputs used.[16] The vector

[16] I use all inputs in this regression to match the outcome variable. Cost of goods sold include all costs that are directly related to the goods sold, not only materials. The results are robust to only using materials instead.

X_j includes the fraction of an industry's steel inputs out of total inputs, *Steel-Input*$_j$, in all regressions. I also include controls for initial average industry log of assets, sales-to-asset ratio, leverage, real GDP beta and construction sector beta, interacted with the *Post* dummy. I cluster standard errors at the industry and year level.

Table 6 shows that the coefficient of variation of $COGS/Sales$ decreases by 1.5 percentage points more after the introduction of steel futures when *Future-Steel-Input*$_j$ increases by one standard deviation (five percentage points). The effects are robust to controlling for industry trends in column (2) and initial industry characteristics, crisis-related and import competition controls in column (3). Figure 5 shows that input cost dispersion starts to decrease only after the introduction of steel futures. Thus, transparency reduces price dispersion and decreaes prices paid by customers with high search cost relative to customers with low search cost. One implication of this result is that price transparency improves input allocation in the customer industry. Hsieh and Klenow (2009) argue that as firms equate marginal revenue to marginal cost, distortions which affect the relative prices firms' pay for their inputs lead to misallocation and lower aggregate output. In my setting, customers which pay higher prices have higher marginal revenue products and reducing price dispersion improves allocation.

6.6 Low-Cost Producer Market Share

Next, I test whether increased price transparency improves matching efficiency and increases the market share of low-cost producers (Prediction 5). I use information from steel producers' 10-K filings to identify low-cost producers. I classify steel producers as low-cost, if they mention operating electric arc furnaces in their 2002 10-K filing. Due to the lower cost of steel scrap, producing steel using electric arc furnaces was cheaper than using basic oxygen furnaces during the sample period. I then compute the market share of low-cost producers in each year-quarter for the treatment and the control group and estimate the following OLS regression at the group-quarter level in the sample of steel producing industries,

$$\textit{Low-Cost Producer Market Share}_{g,t} = \beta \times \textit{Post} \times \textit{Treated}_g + \delta_g + \eta_t + \varepsilon_{g,t}, \tag{6}$$

where g indexes the treatment and control group, and t indexes year-quarters. δ_g are group fixed effects, η_t are year-quarter fixed effects, and $\varepsilon_{g,t}$ is the error term. I also introduce separate time trends for the treatment and control group. I cluster standard errors at the year-quarter level.

Table 7 shows that low-cost producer market share increases by 20 to 26 percentage points for the treated group relative to the control group after the introduction of steel futures. The effects are robust to controlling for separate time-trends for the treated and control groups in column (2), and crisis-related and import competition controls in columns (3) and (4). Panel A of Figure 6 shows low-cost producer market share starts to increase right at the introduction of steel futures. In terms of magnitudes, the aggregate increase translates to an increase of 1.4 to 1.9 percentage points for each low-cost producer in the treatment group relative to low-cost producers in the control group.[17] In Table A.12 I further show that firms' market share in the steel industry become more sensitive to proxies for productivity.

6.7 Aggregate Producer Total Factor Productivity

I then study whether price transparency increases aggreagte producer total factor productivity (Prediction 6). Six-digit industry total factor productivity (TFP) data are obtained from the NBER-CES manufacturing database. I estimate the following OLS regression at the industry-year level in the sample of steel producing industries,

$$\mathit{Log(TFP)}_{j,t} = \beta \times \mathit{Post} \times \mathit{Treated}_j + \delta_j + \eta_t + \varepsilon_{j,t}, \tag{7}$$

where j indexes industries, and t indexes years. δ_j are industry fixed effects, η_t are year fixed effects, and $\varepsilon_{j,t}$ is the error term. I cluster standard errors at the industry and year level.

Table 8 shows aggregate TFP increases by 8 percent in the treated industry relative to the control industries after the introduction of steel futures. The effects are robust to controlling for crisis-related and import competition controls in column (2). Panel B of Figure 6 shows aggregate producer TFP increases right at the introduction of steel futures. Assuming there are no within firm productivity gains, this suggests that the difference in productivity of

[17] There are 14 low-cost producers in the treatment group.

low and high-cost producers is 50 percent.[18] In comparison, Syverson (2004) finds that the productivty difference between the 90th and 10th percentile in the average four-digit SIC manufacturing industry is 90 percent.

7 Alternative Explanations

7.1 Hedging Increases Investment and Production Volumes

One potential concern regarding the intepretation of the findings on prices, producer profit margins and the level of customer material costs is that steel futures might allow treated producers to hedge more of their output price risk. In the presence of financing frictions, this could increase investment in productive capacity, aggregate production volumes and reduce equilibrium prices, producer profit margins and customer material costs. However, as shown in Table A.2 hedging volumes are significant in absolute terms but are low relative to total steel production, never exceeding three percent of overall production. In addition, Table A.13 shows that treated producers do not increase their hedging activity, measured by a dummy variable equal to one if a producer reports income or losses from derivatives. Further, they do not increase investment or their scale of operations as measured by the log of assets, log of sales, or log of quantities sold as shown in Table A.5. Taken together, these findings are inconsistent with the view that increased hedging activity by producers is driving the results.

7.2 Hedging Reduces Producers' Implicit Insurance Profits

Another potential concern is that the existence of the futures market gives steel customers the option to obtain insurance against input price fluctuations through trading the futures contracts on the exchange. This outside option may reduce profits steel producers are generating by offering implicit price insurance to their customers through fixed-price contracts.

[18]In 2001, 47 percent of steel production in the U.S. used electric are furnaces. Increasing this fraction to 67 percent would lead to an increase in TFP of 8 percent if the productivity difference between low and high-cost producers was 50 percent.

However, according to industry participants the fraction of profits stemming from implicit price insurance to customers is negligible. Further, I do not find that steel producers who in the data appear to offer more implicit price insurance to their customers experience a larger decrease in profit margins. Producers who sell implicit price insurance offer fixed-price contracts and absorb variations in input cost without passing them on to their customers. These producers should exhibit a lower sales beta with respect to input cost. I measure producers' sales beta with respect to a cost-index of iron ore and steel scrap prices and interact this cost beta with the treatment variable. Table A.14 shows that steel producers with a lower cost beta experience a smaller decrease in profit margins, the opposite of what the insurance view predicts.

7.3 Standardization of Products Intensifies Competition

Another concern is that the introduction of the futures market increases standardization of products in the treated industry. Customers may adapt their production technologies to process the exact type of steel traded on the exchange. Higher standardization might increase competition between producers and decrease prices, producer profit margins and customer material costs. To test this view, I use Hoberg and Phillips' (2016) text-based measure of product similarity between firms.[19] Table A.15 shows that the average similarity score between a producer and its closest rival firms does not increase for treated producers relative to control producers, which is inconsistent with the view that an increase in standardization explains the results.[20]

8 Conclusion

This paper asks how price transparency affects producers, customers and aggregate productivity. To isolate the role of price transparency, I use the introduction of steel futures in 2008. The futures market increased price transparency for affected products and leads to a

[19] See Hoberg and Phillips (2010, 2016) for descriptions of the data.

[20] The table shows the result for the 10 and 20 closest firms. The results are robust to using the closest 5 or 15 firms instead.

drop in prices by nine percent. This causes steel producer profit margins to decrease by five to nine percentage points and customer material costs to decrease. Further, dispersion in customer material costs decreases. Finally, the market share of low-cost producers increases by 20 percentage points and aggregate steel producer productivity increases by eight percent. Taken togehter, the results show that price transparency has important real effects.

References

[1] Albæk, S., Møllgaard, P., Overgaard, P., 1997. Government-assisted oligopoly coordination? a concrete case. *Journal of Industrial Economics* 45, 429 – 443.

[2] Almeida, H., Hankins, K., Williams, R., 2017. Risk Management with Supply Contracts. *Review of Financial Studies* 30, 4179 – 4215.

[3] Asquith, P., Covert, T., Pathak P., 2013. The Effects of Mandatory Transparency in Financial Market Design: Evidence from the Corporate Bond Market. Working paper.

[4] Baker, M., Wurgler, J., 2002. Market Timing and Capital Structure. *Journal of Finance*, 57, 1 – 32.

[5] Bar-Isaac, H., Caruana, G., Cunãt, V., 2012. Search, Design, and Market Structure. *American Economic Review* 102, 1140 - 1160.

[6] Baye, M., Morgan, J., Scholten, P., 1996. Information, search, and price dispersion. *Handbook of Economics and Systems*, 619 – 729.

[7] Bertrand, M., Duflo, E., Mullainathan, S., 2004. How much should we trust differences-in-differences estimates? *Quarterly Journal of Economics* 119, 249 – 275.

[8] Bessembinder, H., Maxwell, W., Venkataraman, K., 2006. Market Transparency, Liquidity Externalities, and Institutional Trading Costs in Corporate Bonds. *Journal of Financial Economics* 82, 251 – 288.

[9] Bond, P., Edmans, A., Goldstein, I., 2012. The Real Effects of Financial Markets. *Annual Review of Financial Economics* 4, 339 – 360.

[10] Brogaard, J., Ringgenberg, M., Sovich, D., 2017. The Economic Impact of Index Investing. Working paper.

[11] Carlton, D., 1984. Futures markets: Their purpose, their history, their growth, their successes and failures, *Journal of Futures Markets* 4, 237 – 271.

[12] Chintagunta, P., Rossi F., 2016. Price Transparency and Retail Prices: Evidence from Fuel Price Signs in the Italian Motorway, *Journal of Marketing Research* 53, 407-423.

[13] Christensen, H., Floyd, E., Maffett, M., 2017. The Effects of Charge-Price Transparency Regulation on Prices in the Healthcare Industry. Working paper.

[14] Collard-Wexler, A., De Loecker, J., 2015. Reallocation and Technology: Evidence from the US Steel Industry. *American Economic Review*, 105, 131 – 171.

[15] Devine, G., Marion, B., 1979. The influence of consumer price information on retail pricing and consumer behavior. *American Journal of Agricultural Economics* 61, 228 – 237.

[16] Diamond, P., 1971. A Model of Price Adjustment, *Journal of Economic Theory* 3, 156 – 168.

[17] Duffie, D., Dworczak, P., Zhu, H., 2017. Benchmarks in Search Markets. *Journal of Finance* 72, 1983 – 2044.

[18] Edwards, A., Harris, L., Piwowar M., 2007. Corporate Bond Market Transaction Costs and Transparency. *Journal of Finance* 62, 1421 – 1451.

[19] Fruehan, R., 1998. Steel Making and Refining. *The Making, Shaping and Treating of Steel* 11th edition, 1 – 12.

[20] Goldmanis, M., Hortaçsu A., Syverson C., Emre Ö., 2010. E-Commerce and the Market Structure of Retail Industries. *The Economic Journal*, 120. 651 – 682.

[21] Goldstein, M., Hotchkiss, E., Sirri, E. 2007, Transparency and Liquidity: A Controlled Experiment on Corporate Bonds. *Review of Financial Studies* 20, 235 – 273.

[22] Grennan, M., Swanson, A., 2016. Transparency and Negotiated Prices: The Value of Information in Hospital-Supplier Bargaining. Working paper.

[23] Hoberg, G., Phillips G., 2010. Product Market Synergies and Competition in Mergers and Acquisitions: A Text-Based Analysis. *Review of Financial Studies* 23, 3773 – 3811.

[24] Hoberg, G., Phillips, G., 2016. Text-Based Network Industries and Endogenous Product Differentiation. *Journal of Political Economy* 124, 1423 – 1465.

[25] Janssen, M., Pichler, P., Weidenholzer, S., 2011. Oligopolistic Markets with Sequential Search and Production Cost Uncertainty, *RAND Journal of Economics* 42, 444 – 470.

[26] Larrain, M., Stumpner, S., 2017. Capital Account Liberalization and Aggregate Productivity: The Role of Firm Capital Allocation. *Journal of Finance* 72, 1825 – 1858.

[27] Onishi, K., 2016. Quantity Discounts and Capital Misallocation in Vertical Relationships: The Case of Aircraft and Airline Industries. Working paper.

[28] Pérez-Gonzaléz, F., Yun, H., 2013. Risk Management and Firm Value: Evidence from Weather Derivatives. *Journal of Finance* 68, 2143 – 2176.

[29] Rajan, R., Zingales, L., 1995. What do we know about capital structure? Some evidence from international data. *Journal of Finance* 50, 1421 - 1460.

[30] Rogers, P., 2009. An Economic History of the American Steel Industry. *Routledge explorations in economic history* 42.

[31] Stahl, D., 1989. Oligopolistic Pricing with Sequential Consumer Search. *American Economic Review* 79, 700 – 712.

[32] Syverson, C. 2004. Product Substitutability and Productivity Dispersion. *Review of Economics and Statistics* 86, 534 – 550.

[33] Titman, S., Wessels, R., 1988. The determinants of capital structure choice. *Journal of Finance* 43, 1 - 19.

[34] Xu, J., 2012. Profitability and capital structure: Evidence from import penetration. *Journal of Financial Economics* 106, 427 – 446.

Figure 1: Evolution of Price Volatility Over Time

Figure 1 plots the yearly average absolute change in the monthly price indices for eventually treated and never treated steel mill products over time. Price volatility increased for both eventually treated and control products before the LME as the first exchange announced to start working on launching steel futures contracts in 2003, creating the necessary demand for derivatives to manage steel price risk.

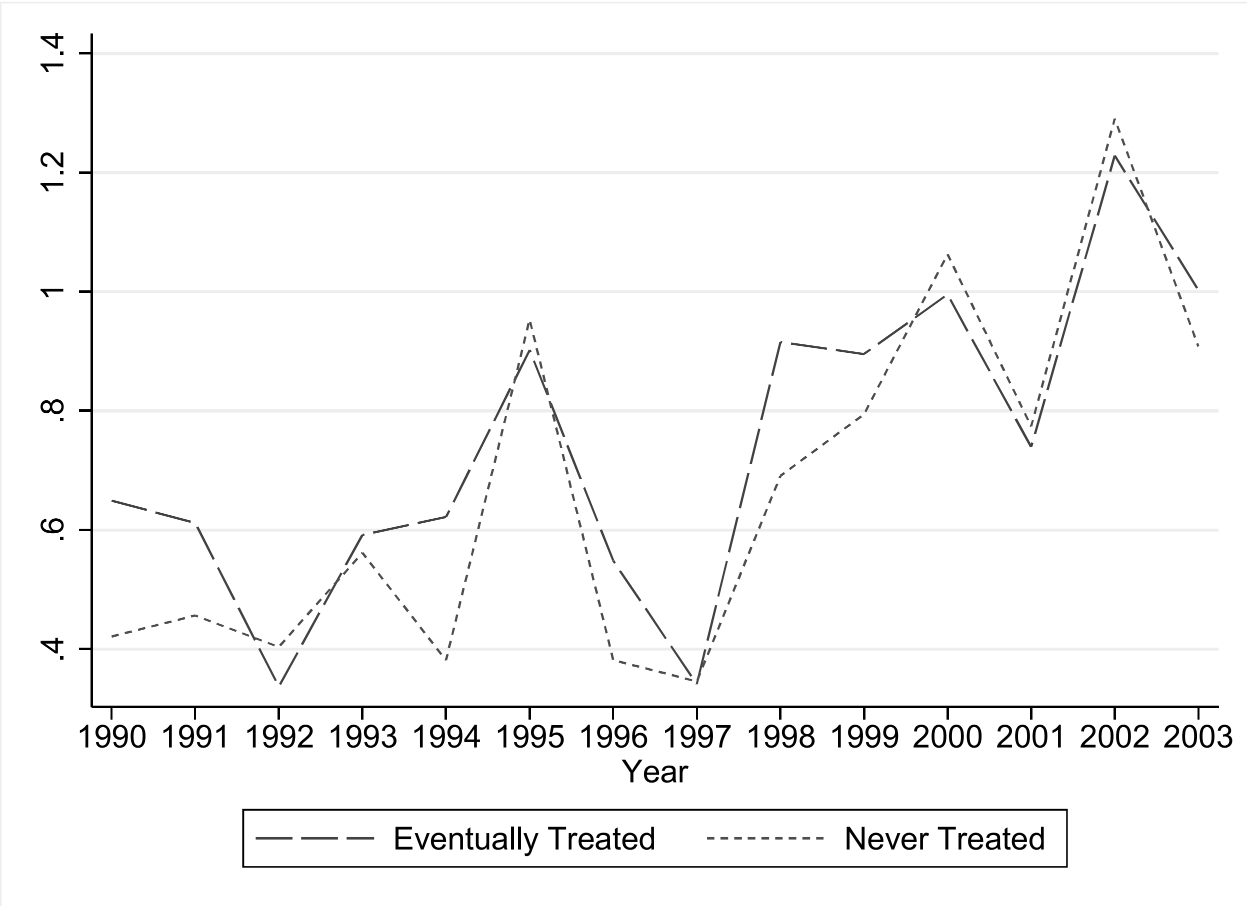


Figure 2: Evolution of Product Prices Over Time

Figure 2 plots the price indices of eventually treated and never treated steel mill products over time. The vertical grey bar indicates the introduction of the steel futures contracts. Price indices are expressed relative to their value in March 2008, before the first introduction of steel futures at the London Metal Exchange.

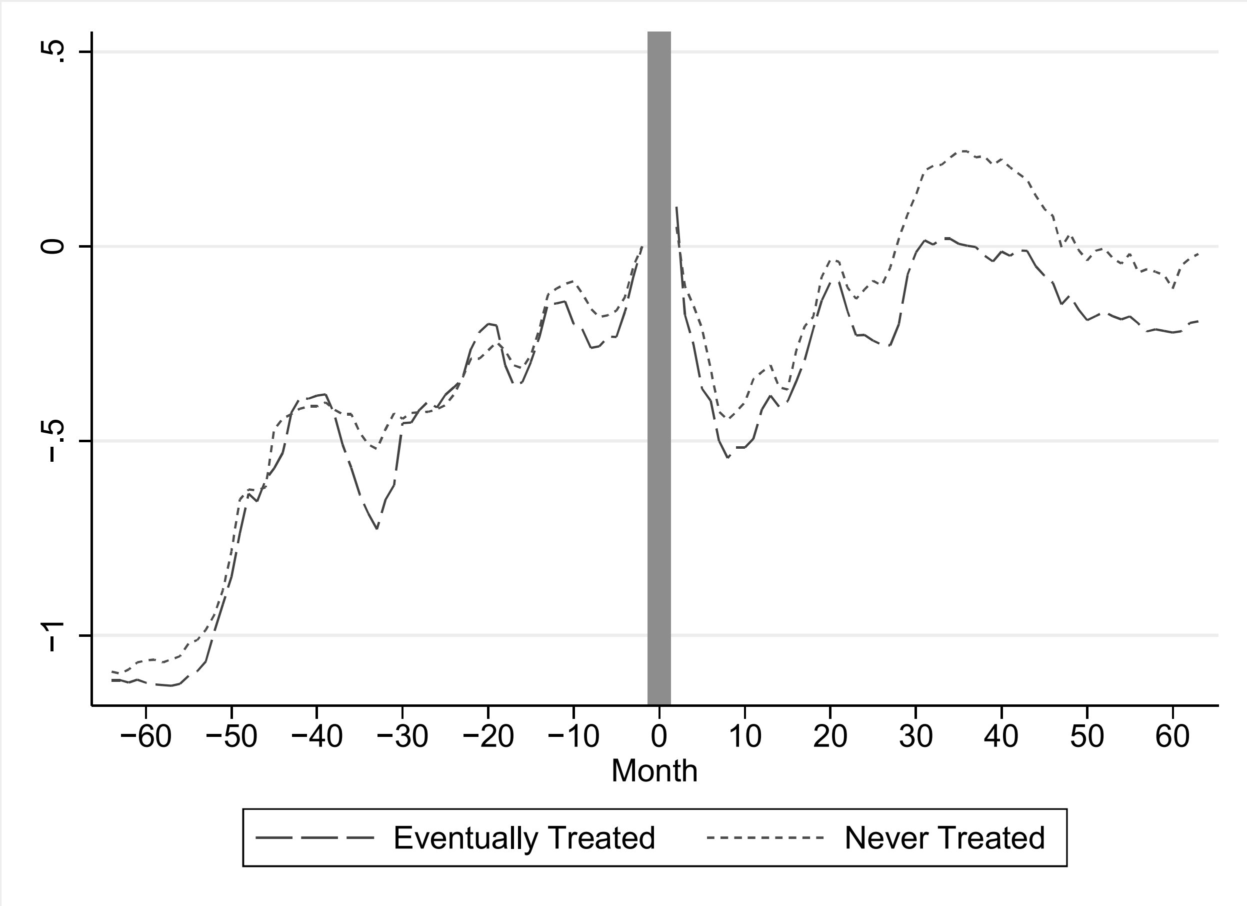


Figure 3: Evolution of Producer Profit Margins Over Time

Figure 3 plots the profit margin of eventually treated and never treated steel producers over time. The vertical grey bar indicates the introduction of the steel futures contracts.

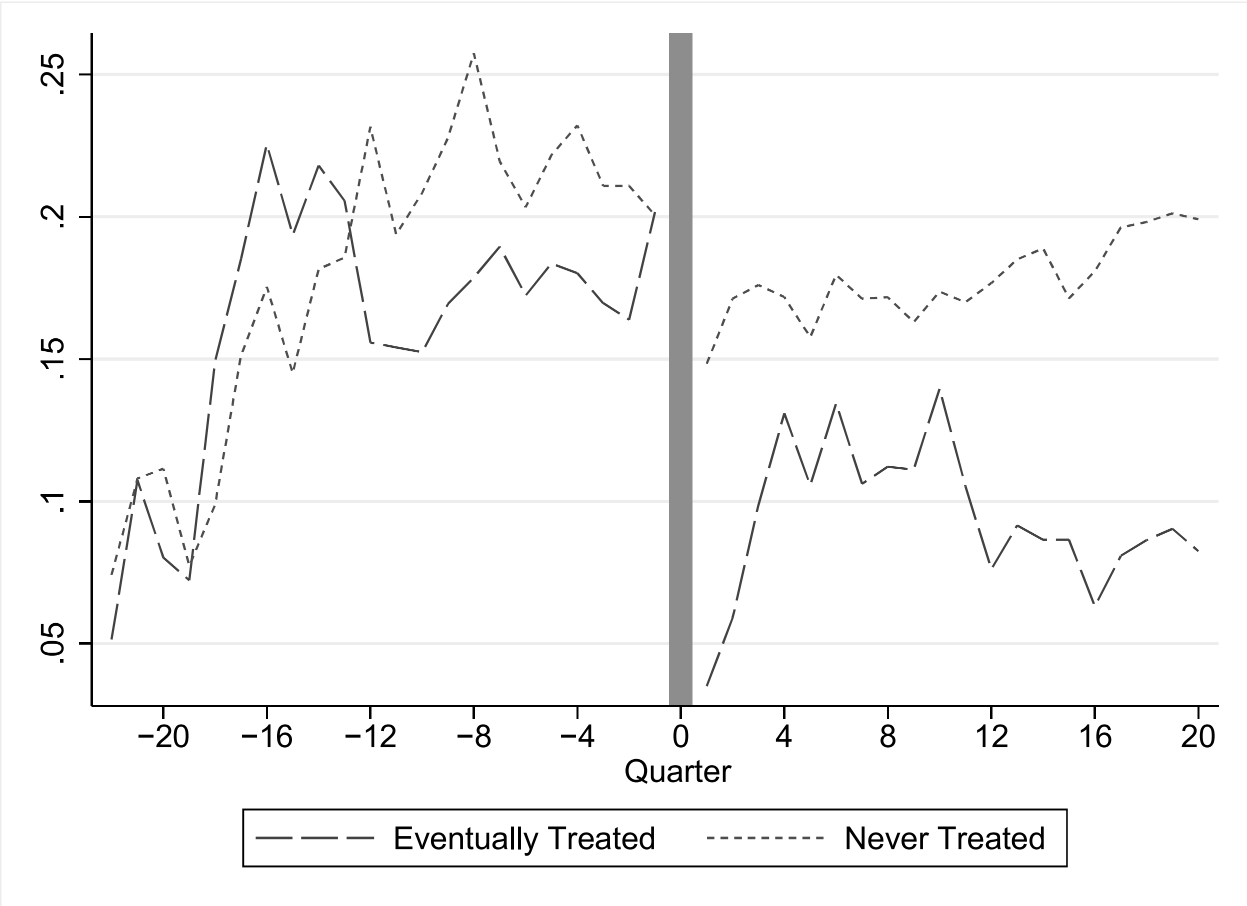
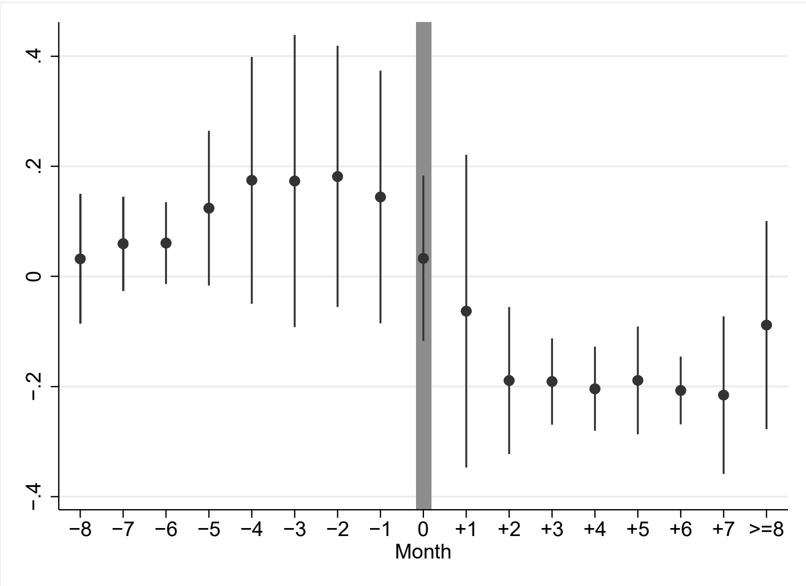


Figure 4: Prices and Profit Margins

Panel A plots the beta coefficients of the regression in equation 1 with the *Post-Treated-Product* dummy split into dummies equal to one for treated products eigth month before and after the event. Panel B plots the beta coefficients of the regression in equation 2 with the *Post* dummy replaced by eight year-quarter dummies before and after the event. The blue lines represent the 95% confidence intervals.

A. Log(Price-Index)



B. Profit Margin

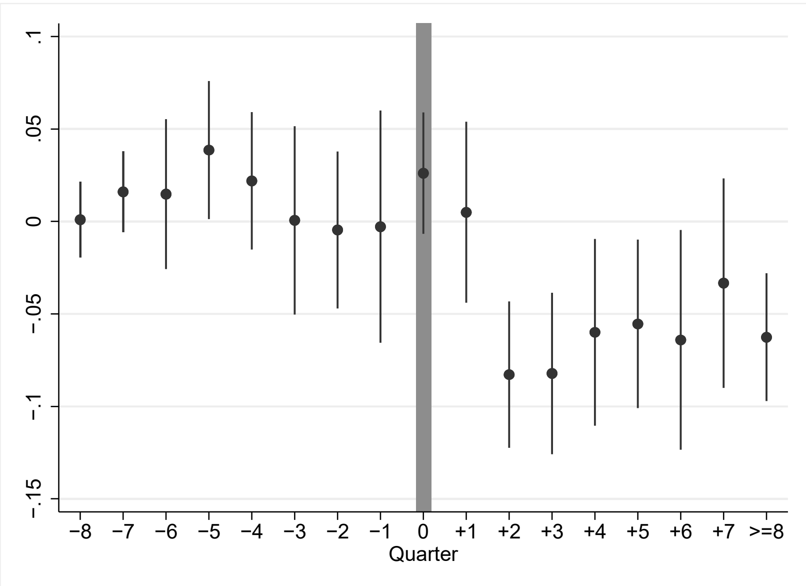
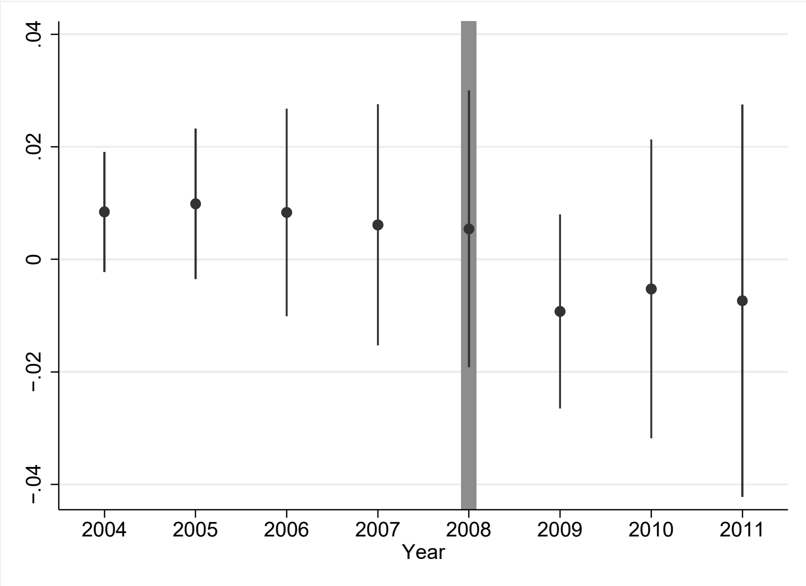


Figure 5: Customer Cost and Cost Dispersion

Panel A plots the difference in material costs between treated and control customers. Treated (control) customers are above (below) the median of the fraction of treated steel material out of total steel material. Panel B plots the difference in COGS/Sales dispersion between treated and control customers. Treated (control) customers are above (below) the median of the fraction of treated steel input out of total steel input. The blue lines represent the 95% confidence intervals.

A. Log(Material Prices)



B. CV(COGS/Sales)

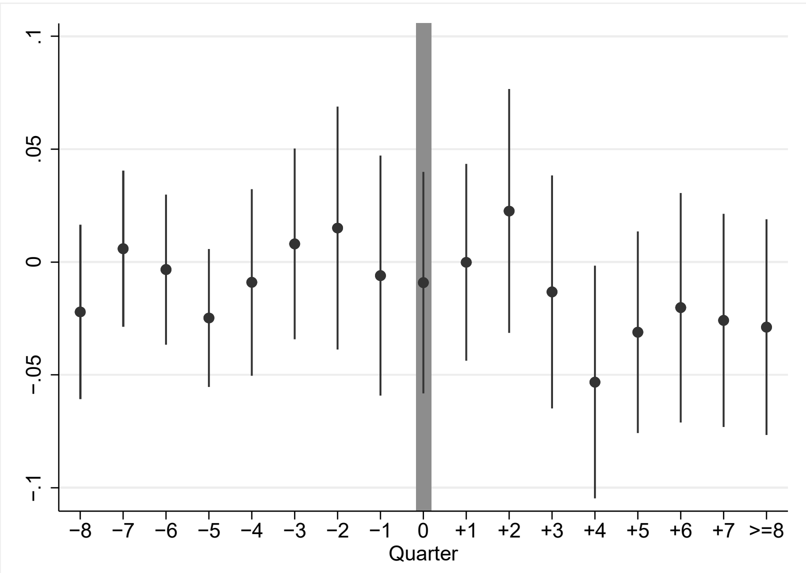
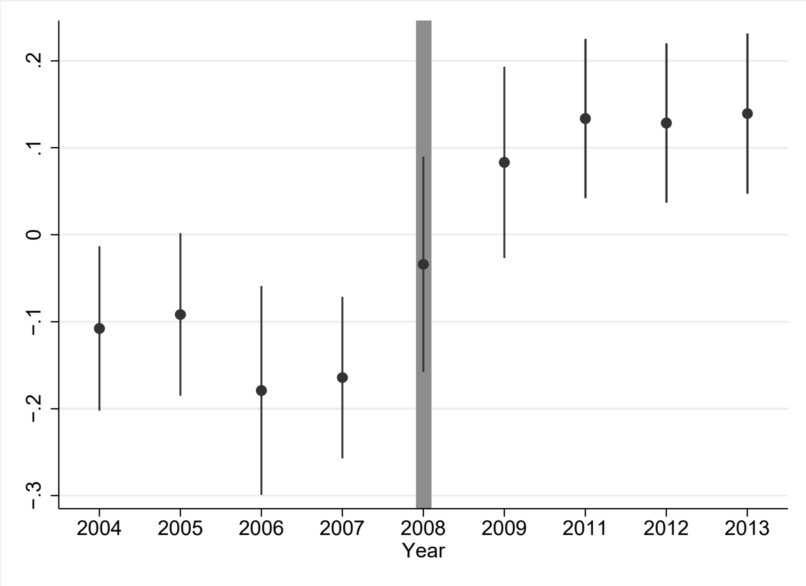


Figure 6: Low-Cost Producer Market Share and Aggregate Producer Productivity

Panel A plots the beta coefficients of the regression in equation 6 and Panel B of the regression in equation 7 with the *Post* dummy replaced by the full set of year dummies. The blue lines represent the 95% confidence intervals.

A. Low-Cost Producer Market Share



B. Log(TFP)

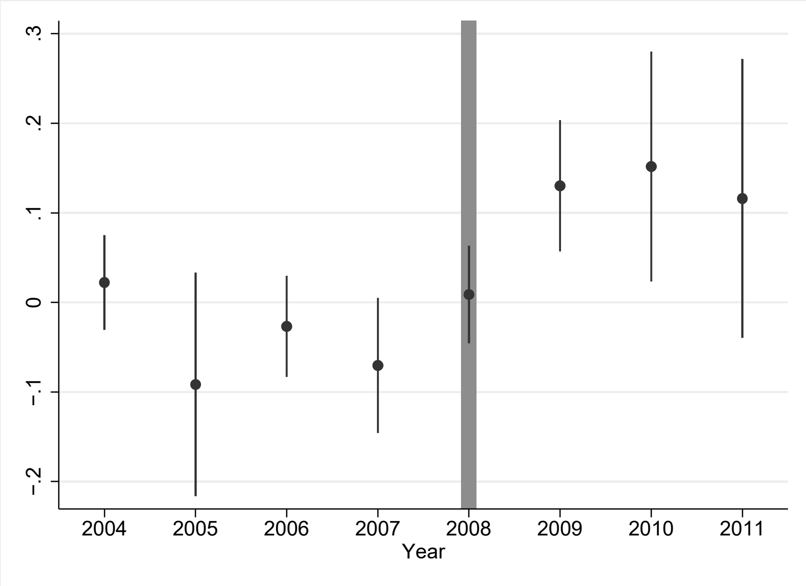


Table 1: U.S. Steel Production by Product

Product	NAICS Product Code	Treatment	% Production
Ingots and semi-finished products[1]	3311113	treated Q2 2008	7
Hot-rolled sheet	3311115	treated Q4 2008	31
Hot-rolled bars	3311117	control	22
Pipes and tubes	3312100	control	6
Cold-rolled sheet	3312211	control	23
Cold-finished bars	3312213	control	2
Wire	3312225	control	2
Other	3321111[2], 3321140[3]	control	6

Source: Adapted from Collard-Wexler and De Loecker (2015).
[1]Including billets. [2]Forgings. [3]Roll form products.

Table 2: Summary Statistics

This table presents summary statistics. Panel A compares firm-level statistics from Compustat for 41 steel producers in the eventually treated industry (NAICS 331111). and 29 steel producers in the never treated industries in 2002. Panel B compares industry-level statistics from the NBER-CES manufacturing database for 53 six-digit steel customer industries with the fraction of treated steel inputs over total steel inputs. Future-Steel. above the median to the remaining 55 steel customer industries. Panel C presents statistics for the main variables in the sample period. The sample period is 2003 to 2013 for all variables except aggregate TFP and Customer Log(Material Prices). which are only available until 2011.

Panel A: Pre-Period Statistics (2002): Producer

	Eventually Treated			Never Treated		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Profit Margin	140	0.07	0.11	96	0.05	0.10
Assets	140	2,375	2.671	96	635	1,155
Debt/Assets	140	0.29	0.16	96	0.31	0.22
Sales/Assets	140	0.27	0.12	96	0.30	0.11

Panel B: Pre-Period Statistics (2002): Customer

	Future-Steel > Median			Future-Steel $\leq$ Median		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Capital	53	2,247	1.798	55	4,064	4.875
Sales/Capital	53	2.66	1.27	55	2.22	0.91

Panel C: Sample Period Statistics:

Variable	Obs.	Mean	Std. Dev.	Min.	25%	Median	75%	Max.
Log(Price-Index)	1188	5.13	0.27	4.56	4.95	5.09	5.31	5.64
Producer Profit Margin	1761	0.11	0.10	-0.25	0.06	0.10	0.17	0.42
Low-Cost Producer Market Share	88	0.42	0.23	0.07	0.22	0.51	0.65	0.67
Aggregate Producer TFP	117	1.00	0.13	0.72	0.91	1.00	1.07	1.30
Steel-Material	972	0.26	0.10	0.14	0.19	0.22	0.28	0.68
Future-Steel-Material	972	0.16	0.08	0.04	0.10	0.12	0.19	0.37
Customer Log(Material Prices)	972	0.17	0.13	-0.21	0.07	0.17	0.26	0.62
Steel-Input	660	0.16	0.04	0.11	0.13	0.15	0.19	0.26
Future-Steel-Input	660	0.11	0.05	0.03	0.07	0.10	0.16	0.22
Customer CV(COGS/Sales)	660	0.15	0.05	0.05	0.11	0.14	0.18	0.44

Table 3: Effect of Steel Futures on Steel Product Prices

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on product-level prices. Product prices are obtained from the BLS Producer Price Index series. Post-Treated-Product is a dummy equal to 1 for treated products after the treatment date. The treatment date is April 2008 for billets and October 2008 for hot-rolled coils. Initial controls include a product's price beta with respect to real GDP and with respect to the construction sector. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. The sample period is 2003 to 2013. In columnns 1 and 2 the sample is restricted to steel mills. Standard errors are clustered by year-month in columns 1 and 2 and twoway clustered by industry and year-month in columns 3 to 5. *t*-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Log(Price-Index)				
Post-Treated-Product	-0.099***	-0.087***	-0.092***	-0.095***	-0.071**
	(-9.62)	(-2.81)	(-7.14)	(-6.73)	(-3.48)
Post×Initial Controls	No	No	Yes	Yes	Yes
Product×Trend	No	Yes	No	No	Yes
Crisis Controls	No	No	No	Yes	Yes
Import Controls	No	No	No	No	Yes
Product FE	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes
Steel Industries	Mills	Mills	All	All	All
R^2	0.915	0.950	0.923	0.923	0.953
Observations	396	396	1,188	1,188	1,188

Table 4: Effect of Steel Futures on Steel Producer Profit Margins

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on gross profit margins. Profit margin is defined as operating income over sales. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Post is a dummy equal to 1 after the first steel futures are introduced in Q2 2008. Initial controls include the log of assets, leverage and sales-to-assets measured in 2002, as well as a firm's beta with respect to real GDP and with respect to the construction sector. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2013. Standard errors are twoway clustered by industry and year-quarter. *t*-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Profit Margin					
Post×Treated	-0.047***	-0.051**	-0.067***	-0.094***	-0.066***	-0.077***
	(-4.00)	(-2.92)	(-3.41)	(-3.76)	(-3.28)	(-3.77)
Post×Initial Controls	No	Yes	Yes	Yes	Yes	Yes
Industry×Trend	No	No	No	Yes	No	No
Crisis Controls	No	No	No	No	Yes	Yes
Import Controls	No	No	No	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	All	NAFTA	NAFTA	NAFTA	NAFTA
R^2	0.560	0.587	0.531	0.545	0.531	0.544
Observations	1,761	1,761	1,474	1,474	1,474	1,474

Table 5: Effect of Steel Futures on Steel Customer Material Costs

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on steel customer material costs. Steel-Material is the fraction of steel materials out of total materials. Future-Steel-Material is the fraction of treated steel materials out of total materials. The sample is restricted to industries with at least ten percent steel materials and excludes steel producers. Post is a dummy equal to 1 after steel futures are introduced in 2008. Initial controls include the log of capital and sales-to-capital measured in 2002. Crisis controls include interactions of Future-Steel-Material with real GDP growth and with growth in construction sector employment. Import controls include interactions of Future-Steel-Material with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2011. Standard errors are clustered by industry. t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Log(Material Prices)		
Post×Future-Steel-Material	-0.101**	-0.101**	-0.100**
	(-2.55)	(-2.42)	(-2.54)
Post×Inital Controls	No	Yes	Yes
Crisis Controls	No	No	Yes
Import Controls	No	No	Yes
Post×Steel-Material	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R^2	0.959	0.959	0.964
Observations	972	972	972

Table 6: Effect of Steel Futures on Steel Customer Cost Dispersion

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on steel customer cost dispersion. Cost dispersion is measured as the coefficient of variation (standard deviation scaled by mean) of COGS/Sales within four-digit industries. Steel-Input is the fraction of steel inputs out of total inputs. Future-Steel-Input is the fraction of treated steel inputs out of total inputs. The sample is restricted to industries with at least ten percent steel inputs and excludes steel producers. Post is a dummy equal to 1 after the first steel futures are introduced in Q2 2008. Crisis controls include interactions of Future-Steel-Input with real GDP growth and with growth in construction sector employment. Import controls include interactions of Future-Steel-Input with the log of steel imports and the log of steel imports from China. Industries are defined at the four-digit NAICS code level. The sample period is 2003 to 2013. Standard errors are twoway clustered by industry and year-quarter. *t*-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	CV(COGS/Salses)		
Post×Future-Steel-Input	-0.330**	-0.526***	-0.588***
	(-2.30)	(-5.55)	(-3.82)
Post×Initial Controls	No	No	Yes
Industry×Trend	No	Yes	No
Crisis Controls	No	No	Yes
Import Controls	No	No	Yes
Post×Steel-Input	No	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	Yes	Yes
R^2	0.340	0.429	0.401
Observations	660	660	660

Table 7: Effect of Steel Futures on Low-Cost Producer Market Share

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on low-cost producer market share. Low-Cost Producer Market Share is the fraction of low-cost producer sales out of total sales in the treatment and control group respectively. Low-cost producer are firms that report operating electric arc furnaces in their 10-K filings in 2002. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Post is a dummy equal to 1 after the first steel futures are introduced in Q2 2008. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. The sample period is 2003 to 2013. Standard errors are clustered by year-quarter. t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Low-Cost Producer Market Share			
Post×Treated	0.238***	0.206***	0.259***	0.201***
	(15.04)	(4.67)	(14.66)	(3.51)
Treated×Trend	No	Yes	No	No
Crisis Controls	No	No	Yes	Yes
Import Controls	No	No	No	Yes
Treatment Group FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
R^2	0.988	0.988	0.990	0.990
Observations	88	88	88	88

Table 8: Effect of Steel Futures on Aggregate Producer Productivity

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on aggregate producer total factor productivity (TFP). Five-factor industry TFP data are obtained from the NBER-CES manufacturing database. Treated is a dummy equal to 1 for the treated steel producing industry. Post is a dummy equal to 1 after the first steel futures are introduced in Q2 2008. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2011. Standard errors are twoway clustered by industry and year. t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Log(TFP)		
Post-Treated	0.079**	0.081***	0.082***
	(2.70)	(4.02)	(9.11)
Crisis Controls	No	Yes	Yes
Import Controls	No	Yes	Yes
Treatment	6-digit	6-digit	4-digit
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
R^2	0.733	0.734	0.784
Observations	117	117	117

Appendix to

"Real Effects of Price Transparency: Evidence from Steel Futures"

Table A.1: Anecdotal evidence

A. Physical delivery

In reality, physical delivery occurs in a very small percentage of cases on the LME as most organizations use the exchange for hedging purposes.
Futures Industry, 2011.

B. Choice of products and regional segmentation

Establishing a global price for steel has been met with skepticism by some industry participants because of regional differences between products. [...] Establishing a global price would depend on the product. Maybe a global price for scrap might make sense. **But the price difference between Asia and the U.S. is pretty significant in hot rolled.**
American Metal Market, 2007.

One key characteristic about Shanghais steel futures market is that it is only open to Chinese investors, with all delivery points located in China. Until this market is open to foreign investors, there is little way global steel market participants can use this contract as a hedging tool.
Futures Industry, 2011.

C. Price transparency

Steel futures will allow the financial markets to set steel prices rather than steel mills.
Dan DiMicco, CEO Nucor Corp., the largest steel producer in the U.S.
American Metal Market, 2007.

Knowledge is power - knowing more than the other side of the table is a huge advantage in any negotiation, **particularly in the steel business where prices are not controlled by a public auction** (like most other metals are) [...] **So what factors do I suggest a buyer look at to assist in predicting the future price of steel? Item number one is the futures price of steel.**
Steel Market Update.

The major mills have a dominance in pricing in the current system, and they're happy not to introduce any new means of price discovery. But that's not specific to the steel industry. In almost every case in the last 30 to 40 years established players have generally resisted new contracts.
Paul Shellman, CME Group
American Metal Market, 2008.

Table A.2: Trading Volume

This table presents the combined trading volume at the LME and NYMEX along with average open interest and U.S. steel production volumes in million ton.

Year	Volume (contracts)	Volume (m. ton)	Production (m. ton)	Volume (% of Production)	Av. Open Interest (m. ton)
2008	3,364	0.22	92	0.24	0.01
2009	15,315	0.45	59	0.75	0.05
2010	37,357	1.54	81	1.90	0.11
2011	43,970	1.62	86	1.89	0.11
2012	60,103	2.14	89	2.40	0.15
2013	65,314	2.00	87	2.30	0.14
2014	45,657	0.93	88	1.05	0.17
2015	58,967	1.18	79	1.49	0.42

Source: Bloomberg and U.S. Geological Survey.

Table A.3: Customer Profit Margins

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on customer profit margins. Profit Margin is defined as sales less payroll, material and energy costs over sales. Steel-Material is the fraction of steel materials out of total materials. Future-Steel-Material is the fraction of treated steel materials out of total materials. The sample is restricted to industries with at least ten percent steel materials and excludes steel producers. Post is a dummy equal to 1 after steel futures are introduced in 2008. Initial controls include the log of capital and sales-to-capital measured in 2002. Crisis controls include interactions of Future-Steel-Material with real GDP growth and with growth in construction sector employment. Import controls include interactions of Future-Steel-Material with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2011. Standard errors are clustered by industry. *t*-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Profit Margin		
Post×Future-Steel-Material	0.052	0.062	0.066
	(0.61)	(0.70)	(0.85)
Post×Steel-Material	-0.021	-0.032	-0.032
	(-0.61)	(-0.79)	(-0.78)
Post×Inital Controls	No	Yes	Yes
Crisis Controls	No	No	Yes
Import Controls	No	No	Yes
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R^2	0.728	0.729	0.730
Observations	972	972	972

Table A.4: Persistence of the Effect after Recovery

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on gross profit margins. Profit margin is defined as operating income over sales. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Post is a dummy equal to 1 after the first steel futures are introduced in Q2 2008. Post-Recovery is a dummy equal to 1 after the steel industry recovered in 2012. Initial controls include the log of assets, leverage and sales-to-assets measured in 2002, as well as a firm's beta with respect to real GDP and with respect to the construction sector. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2013. Standard errors are twoway clustered by industry and year-quarter. t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Profit Margin				
Post×Treated	-0.031**	-0.065***	-0.061**	-0.077***	-0.055*
	(-2.58)	(-3.26)	(-2.96)	(-3.74)	(-1.97)
Post-Recovery× Treated	-0.018*	-0.013	-0.018	-0.000	0.020
	(-2.11)	(-1.56)	(-1.48)	(-0.02)	(1.07)
Post×Initial Controls	No	Yes	Yes	Yes	Yes
Industry×Trend	No	No	No	No	Yes
Crisis Controls	No	No	No	Yes	Yes
Import Controls	No	No	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
R^2	0.495	0.531	0.531	0.544	0.556
Observations	1,474	1,474	1,474	1,474	1,474

Table A.5: Effect of Steel Futures on Scale of Operations

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on the scale of operations. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Post is a dummy equal to 1 after the first steel futures are introduced in Q2 2008. Initial controls include the log of assets, leverage and sales-to-assets measured in 2002, as well as a firm's beta with respect to real GDP and with respect to the construction sector. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2013. Standard errors are twoway clustered by industry and year-quarter. *t*-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Log(Assets)	Log(Sales)	Log(Volumes)	Log(Capex)
Post×Treated	0.083	0.083	0.033	-0.002
	(0.45)	(0.39)	(0.18)	(-0.01)
Post×Initial Controls	Yes	Yes	Yes	Yes
Crisis Controls	Yes	Yes	Yes	Yes
Import Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	No
Year FE	No	No	No	Yes
R^2	0.977	0.970	0.977	0.940
Observations	1,463	1,474	1,267	354

Table A.6: Differences in Sensitivity to GDP and Construction Sector

This table presents estimates of steel producers' exposure to real GDP and the construction sector. The betas are obtained from quarterly regressions of a firm's profit margin on log of real GDP and log of construction sector employment respectively, in the period from 1998 to 2007. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Initial controls are measured in 2002 and include the log of assets, leverage and sales-to-assets. Industries are defined at the six-digit NAICS code level. *t*-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	β_{GDP}		$\beta_{Construction}$	
Treated	-0.186	-0.185	-0.066	0.067
	(-1.20)	(-1.02)	(-0.30)	(0.26)
Initial Controls	No	Yes	No	Yes
R^2	0.022	0.047	0.001	0.019
Observations	67	67	67	67

Table A.7: Placebo Test Around 2001 Recession

This table presents placebo tests around the recession in 2001. Profit margin is defined as operating income over sales. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Post is a dummy equal to 1 after Q3 2001. Initial controls include the log of assets, leverage and sales-to-assets measured in 1995, as well as a firm's beta with respect to real GDP and with respect to the construction sector. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 1996 to 2006. Standard errors are twoway clustered by industry and year-quarter. t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Profit Margin				
Post×Treated	0.006	0.009	0.008	0.026	0.022
	(0.58)	(0.99)	(0.87)	(1.04)	(1.00)
Post×Inital Controls	No	Yes	Yes	Yes	Yes
Industry×Trend	No	No	No	No	Yes
Crisis Controls	No	No	No	Yes	Yes
Import Controls	No	No	No	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Sample	All	All	NAFTA	NAFTA	NAFTA
R^2	0.588	0.616	0.602	0.619	0.626
Observations	1,816	1,816	1,764	1,764	1,764

Table A.8: Changes in Import Competition for Treated and Control Industries

This table presents estimates of changes in import competition around the introduction of steel futures for treated and control industries. % Imports are industry imports scaled by total steel output. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Post is a dummy equal to 1 after 2008. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2012, as import data not available after 2012 for three of the sample industries. Standard errors are twoway clustered by industry and year. *t*-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	log(Imports)		% Imports	
Post×Treated	-0.033	-0.441	-0.764	-0.780*
	(-0.40)	(-1.04)	(-0.82)	(-2.73)
Exporter Country	All	China	All	China
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2	0.989	0.920	0.976	0.786
Observations	50	50	50	50

Table A.9: Stock Market Reactions

This table presents OLS regressions of the difference in portfolio returns of treated and control firms on dummies for the announcement days for the introduction of steel futures by the LME and NYMEX. Treatment and control group are adapted to the respective announcement. In column (1) treated firms are all firms in steel producing industries as the LME did not specify the affected products initially. The control group are firms in other metal producing industries (NAICS 331 and 332). In column (2) treated firms are hot-rolled coil producers and the control group are all other steel producers. In column (3) treated firms are all firms in steel buying industries with steel inputs above the median. The control group are firms in the other steel buying industries with at least ten percent steel inputs. In column (4) treated firms are all firms in steel buying industries with the fraction of treated steel inputs out of total steel inputs above the median and the control firms are all firms in the other steel buying industries. Announcement LME is a dummy for April 2, 2003, the day the LME first announced their plans to launch steel futures. Announcement NYMEX is a dummy for September 24, 2008, the day the NYMEX announced their plans to launch hot-rolled coil futures. Industries are defined at the six-digit NAICS code level. The sample period is 2002 to 2009. Standard errors are robust to heteroskedasticity. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Return (Treated) – Return (Control)			
Announcement LME	-0.018***		0.004***	
	(-19.22)		(5.71)	
Announcement NYMEX		-0.038***		0.008***
		(-28.34)		(16.20)
Treated	Steel Prod.	Coil Prod.	Steel Cust.	Coil Cust.
Fama-French Factors	Yes	Yes	Yes	Yes
R^2	0.084	0.058	0.045	0.067
Observations	2,015	2,015	2,015	2,015

Table A.10: Treatment Refinement Prices

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on gross profit margins. Profit margin is defined as operating income over sales. The assignment into treatment is refined using a firm's quarterly sales beta with respect to billet and hot-rolled coil prices. Firms in the treated industry (NAICS 331111) with a sales beta with respect to billet (hot-rolled coil) prices above the median are defined as billet (hot-rolled coil) producers. Post-Treated is a dummy equal to 1 for treated firms after the treatment date. The treatment date is Q2 2008 for billet producers and Q4 2008 for hot-rolled coil producers. Initial controls include the log of assets, leverage and sales-to-assets measured in 2002, as well as a firm's beta with respect to GDP and with respect to the construction sector. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2013. Standard errors are twoway clustered by industry and year-quarter. t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Profit Margin					
Post-Treated	-0.071***	-0.063***	-0.068***	-0.073***	-0.066***	-0.061***
	(-6.75)	(-5.93)	(-4.71)	(-4.53)	(-4.93)	(-5.64)
Post×Inital Controls	No	Yes	Yes	Yes	Yes	Yes
Industry×Trend	No	No	No	Yes	No	No
Crisis Controls	No	No	No	No	Yes	Yes
Import Controls	No	No	No	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	All	NAFTA	NAFTA	NAFTA	NAFTA
R^2	0.573	0.595	0.537	0.549	0.537	0.550
Observations	1,761	1,761	1,474	1,474	1,474	1,474

Table A.11: Treatment Refinement 10-K filings

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on gross profit margins. Profit margin is defined as operating income over sales. The assignment into treatment is refined using firms' 10-K filings. Firms in the treated industry (NAICS 331111) which mention billets (hot-rolled coils) in their 2002 10-K are defined as billet (hot-rolled coil) producers. Post-Treated is a dummy equal to 1 for treated firms after the treatment date. The treatment date is Q2 2008 for billet producers and Q4 2008 for hot-rolled coil producers. Initial controls include the log of assets, leverage and sales-to-assets measured in 2002, as well as a firm's beta with respect to GDP and with respect to the construction sector. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2013. Standard errors are twoway clustered by industry and year-quarter. t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Profit Margin				
Post-Treated	-0.037***	-0.042***	-0.065***	-0.039***	-0.032***
	(-3.91)	(-3.23)	(-6.59)	(-3.62)	(-5.20)
Post×Inital Controls	No	Yes	Yes	Yes	Yes
Industry×Trend	No	No	Yes	No	No
Crisis Controls	No	No	No	Yes	Yes
Import Controls	No	No	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
R^2	0.589	0.609	0.641	0.611	0.632
Observations	1,064	1,064	1,064	1,064	1,064

Table A.12: Market Share Sensitivity to Productivity

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on the sensitivity of market share to productivity. The variable Market Share is defined as a firm's sales over steel industry sales in a given year-quarter. In column (1) Productivity is a dummy equal to one for firms reporting operating an electric arc furnace (EAF) in their 2002 10-K filing. In column (2) Productivity is a firm's profit margin in 2002. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Post is a dummy equal to 1 after the first steel futures are introduced in Q2 2008. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2013. Standard errors are twoway clustered by industry and year-quarter. *t*-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Market Share	
Post×Treated×Productivity	0.005**	0.088***
	(2.80)	(12.35)
Post×Treated	-0.004**	0.001
	(-2.51)	(0.41)
Post×Productivity	-0.002	0.000
	(-1.05)	(0.03)
Firm FE	Yes	Yes
Year-Quarter FE	Yes	Yes
Productivity Measure	EAF	Margin
R^2	0.956	0.824
Observations	1,064	1,696

Table A.13: Hedging Probability

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on the probability to hedge. The variable Hedging Dummy is equal to 1 if a firm reports derivative income or losses in a given year-quarter. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Post is a dummy equal to 1 after the first steel futures are introduced in Q2 2008. Initial controls include the log of assets, leverage and sales-to-assets measured in 2002, as well as a firm's beta with respect to real GDP and with respect to the construction sector. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2013. Standard errors are twoway clustered by industry and year-quarter. t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Hedging Dummy					
Post×Treated	0.058	-0.050	0.020	0.038	-0.000	0.011
	(0.79)	(-0.38)	(0.19)	(0.32)	(-0.00)	(0.11)
Post×Inital Controls	No	Yes	Yes	Yes	Yes	Yes
Industry×Trend	No	No	No	Yes	No	No
Crisis Controls	No	No	No	No	Yes	Yes
Import Controls	No	No	No	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	All	NAFTA	NAFTA	NAFTA	NAFTA
R^2	0.646	0.652	0.688	0.704	0.688	0.689
Observations	1,761	1,761	1,474	1,474	1,474	1,474

Table A.14: Insurance Provider

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on gross profit margins. The variable Cost-Beta is the beta of firms' sales with a cost index of iron ore and steel scrap prices. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Post is a dummy equal to 1 after the first steel futures are introduced in Q2 2008. Initial controls include the log of assets, leverage and sales-to-assets measured in 2002, as well as a firm's beta with respect to real GDP and with respect to the construction sector. Crisis controls include interactions of the treatment dummy with real GDP growth and with growth in construction sector employment. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2013. Standard errors are twoway clustered by industry and year-quarter. *t*-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Profit Margin				
Post×Treated×Cost-Beta	-0.042***	-0.040***	-0.046***	-0.040***	-0.046***
	(-5.19)	(-7.33)	(-6.56)	(-12.93)	(-6.47)
Post×Treated	-0.004	0.013	0.020	-0.016	0.010
	(-0.26)	(1.29)	(1.27)	(-0.93)	(0.62)
Post×Cost-Beta	0.010	0.009	0.010	0.002	0.010
	(1.13)	(1.43)	(1.26)	(0.46)	(1.20)
Post×Inital Controls	No	Yes	Yes	Yes	Yes
Industry×Trend	No	No	No	Yes	No
Crisis Controls	No	No	No	No	Yes
Import Controls	No	No	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Sample	All	All	NAFTA	NAFTA	NAFTA
R^2	0.579	0.588	0.532	0.546	0.545
Observations	1,761	1,761	1,474	1,474	1,474

Table A.15: Standardization

This table presents difference-in-differences estimates of the effect of the introduction of steel futures on product similarity. Product Similarity is the average similarity score of a given producer with its closest rivals using Hoberg and Phillips' (2016) text-based measure of product similarity between firms. Treated is a dummy equal to 1 for the treated steel producing industry (NAICS 331111). Post is a dummy equal to 1 after the first steel futures are introduced in 2008. Initial controls include the log of assets, leverage and sales-to-assets measured in 2002, as well as a firm's beta with respect to real GDP and with respect to the construction sector. Import controls include interactions of the treatment dummy with the log of steel imports and the log of steel imports from China. Industries are defined at the six-digit NAICS code level. The sample period is 2003 to 2013. Standard errors are twoway clustered by industry and year. t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Product Similarity					
Post×Treated	0.007	0.001	0.002	0.002	0.003	-0.002
	(1.10)	(0.25)	(0.20)	(0.73)	(0.58)	(-0.41)
Post×Initial Controls	No	No	Yes	No	No	Yes
Industry×Trend	No	Yes	No	No	Yes	No
Import Controls	No	No	Yes	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of Rivals	10	10	10	20	20	20
R^2	0.769	0.817	0.786	0.729	0.755	0.739
Observations	230	230	230	230	230	230

The Downstream Impact of Upstream Tariffs: Evidence from Investment Decisions in Supply Chains*

Thorsten Martin‡ and Clemens A. Otto§

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Abstract

Using data on import tariffs and investment in U.S. manufacturing industries between 1974 and 2012, we show that upstream tariff reductions are followed by increased downstream investment. We test different possible explanations. The results are most consistent with tariff reductions improving downstream customers' incentives to invest by mitigating the risk of ex post hold-up from upstream suppliers. In particular, we find that the investment response is stronger if the customers have little bargaining power and are not vertically integrated with their suppliers, if the suppliers produce specific inputs, and if high uncertainty inhibits the use of long-term contracts.

JEL classification: D23, F14, G31, L14

Keywords: Import Tariffs, Corporate Investment, Supply Chains, Hold-up Problems

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‡HEC Paris, *E-mail:* thorsten.martin@hec.edu

§Singapore Management University, *E-mail:* clemensotto@smu.edu.sg

1 Introduction

After several decades of trade liberalization, protectionist policies to shelter domestic industries from foreign competition experience a resurgence in popularity both in the U.S. and in Europe. The economic consequences of protectionism versus liberalization have been an important topic of political and academic debate for a long time, and the majority view for many years has been that trade liberalization is net beneficial. While this view is backed by abundant empirical evidence from developing countries, it is unclear which empirical patterns extend from developing to industrialized economies. More importantly, while there is a large literature studying the direct effects within a given industry, there is surprisingly little evidence on the indirect effects on other, related industries.

We aim to make a first step towards filling this gap by studying one important channel through which trade liberalizations – in particular, tariff reductions – in one industry impact economic activity in other industries: Using data on import tariffs and corporate investment in U.S. manufacturing industries between 1974 and 2012, we trace out the impact of tariff reductions in upstream industries on downstream firms' investment in productive capacity. We find that downstream firms significantly increase capital expenditures following tariff reductions in their suppliers' industries. Specifically, our estimates imply that downstream firms increase investment by 5% to 6% if the fraction of upstream suppliers that have experienced large tariff reductions increases by one standard deviation (7%). At the aggregate level, the estimates imply an increase of total investment in the U.S. manufacturing sector by USD 5 to 6 billion per year and an increase in output and employment by 5%. To the best of our knowledge, we are the first to document these results.

A concern is that tariff reductions may be due to industrial lobbying and that firms' lobbying efforts may depend on their growth opportunities. Krugman, Obstfeld, and Melitz (2015) argue that multilateral trade negotiations are less likely to be captured by lobbying groups than the decision making process behind unilateral policy changes. We thus confirm that our findings are robust to relying only on tariff cuts resulting from multilateral trade agreements.[1] Further, we show that the relation between upstream tariff cuts and downstream investment is weaker if shipping costs are high, consistent with shipping costs acting as a barrier to international trade. A mere correlation between tariff cuts and unobserved growth opportunities does not predict this result.

After documenting the empirical finding that downstream investment increases following upstream tariff reductions, we ask why this is the case. Arguably the most natural explanation is that import tariff reductions lead to lower input prices for downstream firms. Lower input prices, in turn, make it more profitable to invest in additional productive capacity. The data strongly support this view. In contrast, we do not find support for other possible explanations: There is no evidence that the increase in investment is driven by a reduction in uncertainty about input prices or a by relaxation of the downstream firms' financial constraints.

Next, we examine the mechanism through which tariff reductions impact prices and investment. One possibility is that lower tariffs simply imply lower import duties and thus lower costs when buying from foreign suppliers. Another possibility is that domestic suppliers reduce their prices in response to increased competition from foreign rivals (or the threat thereof): If prices are set through monopolistic competition, a larger number of competing suppliers goes hand in hand with lower prices (e.g., Melitz and Ottaviano (2008)). Alternatively, if prices are set through bilateral bargaining, tariff reductions can alleviate hold-up problems: When import tariffs in upstream industries are lowered, downstream customers' bargaining position vis-à-vis their domestic suppliers improves as the cost of procuring inputs from abroad decreases. This, in turn, reduces the suppliers' ability to hold-up their customers ex post, leads to lower prices, and increases the customers' incentives to invest in productive capacity ex ante (e.g., Hart (1995)).

The above channels are not mutually exclusive, and all are likely to play some role in the

[1]The GSP introduction in 1976, completion of GATT rounds in 1979 and 1994, and start of NAFTA in 1994.

increase in investment we observe. To gauge their relative importance, we exploit differences in the cross-sectional variation they imply. Specifically, we consider that tariff reductions may affect the marginal cost of supplying the input (e.g., because of lower import duties) or the markup that suppliers charge (e.g., because of increased competition). We further consider two different price-setting mechanisms: monopolistic competition among the suppliers and bilateral bargaining in the presence of hold-up problems. We then test the different cross-sectional implications in the data.

We begin by distinguishing between customers and suppliers with high and low bargaining power. In case of monopolistic competition, suppliers post prices at which they are willing to sell to any customer. As a consequence, an individual customer's bargaining power does not play a role. In case of bilateral bargaining, the direction in which differences in bargaining power influence the investment response depends on whether tariff reductions lower the supplier's marginal cost of production or improve the customer's outside option. If tariff reductions lower the cost at which upstream firms can supply their downstream customers, then customers with higher bargaining power should increase their investment more because they should be able to demand larger price reductions. If, instead, tariff reductions alleviate hold-up problems by improving the customers' outside option, then the investment response should be weaker for customers with high bargaining power. Using industry concentration and firm size as proxies, we find that this is indeed the case.

The finding that customers' investment response is negatively related to their bargaining power is a first piece of evidence pointing towards hold-up problems. Key ingredients to such problems are that suppliers and customers are not vertically integrated, that investments are relationship-specific, and that contracts are incomplete. Consistent with these premises, we find a significant relation between upstream tariff reductions and downstream investment only for non-integrated customers and suppliers producing specific rather than generic inputs (as proxied by high R&D expenditures). Further, the relation is stronger if a high level of uncertainty about future contingencies (as proxied by customers' sales volatility) makes the use of comprehensive, long-term contracts more difficult.

In contrast, a mere reduction in the cost of importing goods from abroad does not predict that the investment response varies with vertical integration, input specificity, or uncertainty about future contingencies. Similarly, this cross-sectional variation is difficult to reconcile with a pure competition effect to which domestic suppliers respond by lowering prices (i.e., the absence of hold-up problems). In that case, the relation between upstream tariff cuts and downstream investment should be weaker if the suppliers produce specific rather than generic inputs. The reason is that product specificity should shield domestic suppliers from foreign competition (Hombert and Matray (2017)). Further, a simple decrease in prices due to increased competition neither explains why we find an increase in investment only for customers that are not vertically integrated with their suppliers, nor why the increase is larger if uncertainty about future contingencies is high.

In summary, the notion that hold-up problems between upstream suppliers and downstream customers distort investment decisions can explain all our findings. In contrast, the alternative explanations that tariff reductions lower the marginal cost of supplying the input or induce monopolistically competing suppliers to lower their prices are difficult to reconcile with the evidence we document. In particular, these explanations do generally not predict the observed cross-sectional variation or even predict regression coefficients with the opposite sign. Hence, while we cannot *perfectly* distinguish between the different channels through which upstream tariff reductions can impact downstream investment, our findings are most consistent with the idea that prices are set through bilateral bargaining and that import tariff reductions alleviate hold-up problems between suppliers and customers by improving customers' outside option (i.e., buying from abroad).

Our paper makes two main contributions. First, we document a new empirical fact: Upstream tariff reductions are followed by increased downstream investment. Using data from the NBER-CES Manufacturing Industry Database, we confirm that this finding holds not only at the firm but also at the industry level. Moreover, we show that upstream tariff reductions are also associated with an increase in aggregate output and employment in the downstream industries. This is a first step towards a more holistic assessment of the consequences of tariff reductions, which are likely to impact not only the directly affected but also other, related industries.[2] Our analysis thus adds to our understanding of the intricate effects of trade liberalizations in industrialized countries with highly interconnected firms. This is all the more important as the majority of empirical evidence on the effects of trade liberalizations is based on data from emerging economies, and it is not clear ex ante which findings extend to developed economies (Trefler (2004)).

Second, our paper contributes to the literature on corporate investment by providing empirical evidence of the impact that hold-up problems have on investment decisions. Our results thus speak to a key building block of both transaction cost economics (Williamson (1975), Klein, Crawford, and Alchian (1978)) and the property rights theory of the firm (Grossman and Hart (1986), Hart and Moore (1990)). An implication is that firms' organization along the supply chain does not eliminate all hold-up problems. Hence, our results point towards significant barriers to firms' ability to overcome hold-up problems through, for example, contractual arrangements (e.g., Iyer and Sautner (2016)) or vertical integration (see Lafontaine and Slade (2007) for a review).

Most closely related to our paper is the study by Fresard and Valta (2016), who show that firms reduce investment when the threat of competition from foreign rivals intensifies. A key difference is that we study how firms adjust their investment after tariff reductions <u>in their suppliers' industries</u>, while Fresard and Valta (2016) investigate firms' investment decisions after tariff reductions <u>in their own industry</u>.[3] Our paper thus examines a different phenomenon, but to make sure that our results

[2]In that regard, our results also shed additional light on the propagation of economic shocks through production networks (e.g., Barrot and Sauvagnat (2015)).

[3]Other papers that examine the consequences of tariff reductions and import competition in firms' own industries on corporate actions and outcomes include Guadalupe (2007), Guadalupe and Cuñat (2009), Fresard (2010),

are not confounded by the effect documented in Fresard and Valta (2016), we show that our findings remain unchanged when controlling for tariff reductions in firms' own industries. More generally, our paper is related to the literature on the consequences of trade liberalizations.[4] Given that our findings highlight the importance of hold-up problems in supply chains, it is also related to the empirical literature on transaction cost and property rights based explanations for vertical integration.[5] Through this channel, our work is also related to a small number of empirical papers that examine how hold-up problems affect investment decisions.[6]

The rest of the paper proceeds as follows. In Section 2, we describe the data sources and variables. In Section 3, we document our main empirical finding: Downstream firms increase investment following upstream tariff reductions. In Section 4, we provide evidence on the mechanism through which import tariff reductions upstream translate into lower input prices and increased investment downstream. In Section 5, we explore the impact on aggregate investment, output, and employment at the industry level. We conclude in Section 6. The Appendix contains variable definitions, further analyses, and robustness tests.

2 Data

2.1 Import Tariffs

We obtain data on U.S. imports in manufacturing industries (SIC codes 2000 to 3999) between 1974 and 2012 from Peter Schott's website and the Center for International Data at UC Davis.[7]

Guadalupe and Wulf (2010), and Valta (2012).

[4]Tybout, de Melo, and Corbo (1991), Tybout and Westbrook (1995), Pavcnik (2002), Melitz (2003), Amiti and Konings (2007), Melitz and Ottaviano (2008), Topalova and Khandelwal (2011), Halpern, Koren, and Szeidl (2015).

[5]See Lafontaine and Slade (2007), Joskow (2008), and Klein (2008) for reviews.

[6]Ciliberto (2006), Vukina and Leegomonchai (2006), Geng, Hau, and Lai (2016), Cookson (2018).

[7]`http://faculty.som.yale.edu/peterschott/` and `http://cid.econ.ucdavis.edu/`, respectively.

Throughout the paper, we define industries at the four-digit SIC code level and compute the import tariff rate for each industry-year combination as the total value of duties collected divided by the total value of imports. Figure 1 shows the (equally weighted) average import tariff rate across all industries in our data for each year between 1974 and 2012. As is well known, the average import tariff has steadily declined over the past 40 years, from 8.23% in 1974 to 1.86% in 2012.

[Figure 1 around here.]

2.2 Large Tariff Reductions

We follow the literature and focus on "large" tariff reductions (e.g., Fresard (2010), Valta (2012), Fresard and Valta (2016)). Specifically, we classify a tariff reduction in year t as large if it is more than three times as large as the average absolute year-on-year tariff change in the industry.[8] Our findings, however, do not depend on this definition and are robust to using alternative measures of tariff reductions (see Table A.3 in the Appendix).

Focusing on large (rather than any) tariff reductions has two main benefits. First, it facilitates comparing our findings with the existing literature. Second, investments in productive capacity (e.g., building a factory) are likely to be discrete and to have a fixed cost component. Hence, firms are likely to react only to tariff reductions that are sufficiently large.

[Figure 2 around here.]

Figure 2 shows the number of large tariff reductions across industries from 1974 to 2012 and

[8] Because we are not interested in transitory changes we also require that the implied tariff reductions from years $t-1$ to $t+1$, $t-2$ to $t+2$, and $t-3$ to $t+3$ are larger than three times the average absolute tariff change. Further, because tariff reductions are unlikely to have an economically significant effect if the tariff rate is very small to begin with, we do not classify a tariff reduction as large if the tariff rate before the reduction is already smaller than 1%.

reveals two distinct features. First, large tariff reductions occur in almost all years.[9] Second, there are three noticeable spikes in the number of large tariff reductions, corresponding to major events in international trade policy: the implementation of the Generalized System of Preferences (GSP) in 1976, which eliminated import tariffs on several thousand types of products when imported from a number of designated beneficiary countries, the completion of the seventh and eighth General Agreement on Tariffs and Trade (GATT) rounds in 1979 and 1994 – the so called "Tokyo round" and the "Uruguay round," which led to the creation of the World Trade Organization (WTO) – and the start of the North American Free Trade Agreement (NAFTA) in 1994.[10]

[Figure 3 around here.]

Figure 3 shows how the average tariff rate evolves during the five years before and after large reductions. On average, such reductions imply a decrease in the tariff rate by 1.74 percentage points, corresponding to a 27% decrease relative to the average rate of 6.43% before the reduction. Tariff reductions of this magnitude are generally considered important events in the literature and have been shown to have significant economic effects (e.g., Trefler (2004); Fresard and Valta (2016)).

2.3 Customer-Supplier Relations

Following Acemoglu, Autor, Dorn, Hanson, and Price (2016), we identify customer-supplier relations at the industry level based on the gross flows of goods between industries reported in the 1992 U.S. Bureau of Economic Analysis (BEA) input-output table. An advantage of this approach

[9] Large tariff *increases*, instead, are much less frequent: In total, we observe 493 large tariff reductions but only 55 large increases. Including these increases in our analysis does not change our findings (see column (4) of Table 2).

[10] While the general pattern is the same, the precise number of large tariff reductions in each year does not exactly match that in Fresard and Valta (2016), primarily because we are using a longer sample period – 1974 to 2012 vs. 1974 to 2005 – so that the cutoff defining "large" tariff changes (three times the average tariff change in an industry during the sample period) is not exactly the same in the two samples.

– compared to identifying customer-supplier relations at the firm level – is that relations at the industry level are more likely to be determined by the industries' innate production technologies than an individual firm's choice to buy from a particular supplier. As a consequence, customer-supplier relations at the industry level are more likely to be exogenous to unobserved firm level characteristics than relations at the firm level.

2.4 Fraction of Supplier Industries that Experienced Large Tariff Reductions

Based on the customer-supplier relations derived from the 1992 BEA input-output table, we compute for each industry-year combination the (gross-flow-weighted) fraction of upstream industries that have experienced large tariff reductions in the past. The resulting variable, denoted *Supplier Tariff Reduction*, is the main regressor of interest in our analysis. *Supplier Tariff Reduction* ranges from zero to one. It is equal to zero if none of the upstream industries have experienced a large tariff reduction. It is equal to one if large tariff reductions have occurred in all upstream industries.

Formally, for customer industry j and year t, we have

$$\textit{Supplier Tariff Reduction}_{j,t} = \sum_{s \in S_{\text{-}j}} \omega_{s,j} \times \textit{Post Tariff Reduction}_{s,t}, \tag{1}$$

where

$$\omega_{s,j} = \frac{\textit{Gross flow of goods from industry s to industry j}}{\textit{Total gross flow of goods from all industries to industry j}}, \tag{2}$$

Post Tariff Reduction$_{s,t}$ is an indicator equal to one if industry s has experienced a large tariff reduction prior to year t, and $S_{\text{-}j}$ is the set of all industries other than j.[11]

To give an example, consider an industry j that obtains 50% of its inputs from industry $s = 1$ and 30% from industry $s = 2$. The remaining 20% of inputs are produced by j itself. Suppose

[11] If an industry experiences a large tariff increase after having previously experienced a large tariff reduction, for the years following the large tariff increase, we treat the industry as if it had not previously experienced a large tariff reduction. That is, we assume that large tariff increases "cancel out" large tariff reductions.

now that prior to year t there has been a large tariff reduction in industry $s = 1$ but not in $s = 2$. *Supplier Tariff Reduction*$_{j,t}$ would then be equal to 0.5 because industry j obtains 50% of its inputs from supplier industries that have experienced a large tariff reduction prior to year t.

2.5 Investment and Control Variables

We measure investment by capital expenditures in year t scaled by the book value of total assets at the end of year $t-1$ (e.g., Baker, Stein, and Wurgler (2003)).[12] We also compute *Ln(Assets)*, *Tobin's Q*, *Cash/Assets*, *Debt/Assets*, *EBITDA/Assets*, *Cash Flow/Assets*, *Sales Growth*, *Excess Return*, and *Excess Volatitlity* for each firm-year combination and *Industry Sales Growth* and *Industry Concentration* for each industry-year combination in our sample. All data are obtained from Compustat and CRSP, and all variables are winsorized at the 1st and 99th percentile as in Baker, Stein, and Wurgler (2003).[13] Detailed definitions are provided in the Appendix.

2.6 Summary Statistics

Table 1 shows summary statistics. Our sample comprises 44,590 firm-year observations from 1974 to 2012.[14] The mean value of *Supplier Tariff Reduction* indicates that, on average, firms obtain 11% of their inputs from upstream industries that have previously experienced large tariff reductions.

[Table 1 around here.]

The summary statistics for the different firm- and industry-level variables are similar to the corresponding statistics for all firms in Compustat during the sample period (unreported). The

[12]We show in the Appendix that our results are robust to using $Ln(Capex)$ as an alternative measure (Table A.1).

[13]We show in the Appendix that using non-winsorized variables leads to very similar results (Table A.2).

[14]The number of observations in some of our subsequent analyses can be smaller than 44,590 because the information required for some regression specifications is not always available for all observations in the sample.

average book value of assets is USD 1 billion. Our sample, however, spans firms with assets of USD 2 million to firms with assets of more than USD 25 billion. The average value of our measure of investment, *Capex/Assets*, is 0.06. As for the value of total assets, the variation across observations is large, and *Capex/Assets* ranges from a minimum value of 0.001 to a maximum of 0.347.

3 Supplier Tariff Reductions and Customer Investment

We now examine the relation between large import tariff reductions in upstream industries and the subsequent investment decisions of downstream firms. Specifically, we estimate by OLS:

$$\frac{Customer\ Capex_{i,j,t}}{Customer\ Assets_{i,j,t-1}} = \beta \times Supplier\ Tariff\ Reduction_{j,t} + \gamma' X_{i,j,t-1} + \delta_i + \eta_t + \varepsilon_{i,j,t} \qquad (3)$$

where i indexes firms, j industries (defined at the four-digit SIC code level), and t years.

For each firm i in industry j in year t, $Supplier\ Tariff\ Reduction_{j,t}$ is the (gross-flow-weighted) fraction of supplier industries that experienced large tariff reductions in the past. $X_{i,j,t-1}$ is a vector of lagged firm- and industry-level controls: *Ln(Assets)*, *Tobin's Q*, *Cash/Assets*, *Debt/Assets*, *EBITDA/Assets*, *Cash Flow/Assets*, *Sales Growth*, *Excess Return*, *Excess Volatility*, *Industry Sales Growth*, and *Industry Concentration*. We further control for firm fixed effects (δ_i) and year fixed effects (η_t). All standard errors are clustered in two ways, by industry×year and by firm.[15]

[Table 2 around here.]

Table 2 presents the results. In column (1), we only control for firm and year fixed effects (δ_i and η_t). In column (2), we add the different firm- and industry-level control variables ($X_{i,j,t-1}$). The coefficient estimate on *Supplier Tariff Reduction* is positive and statistically significant in both specifications (at the 1% level in column (1) and at the 5% level in column (2)). The point estimates

[15] We show in the Appendix that our results are robust to alternative clustering choices (Table A.4).

imply an increase in customer investment by 5% to 6% for a one-standard-deviation increase in *Supplier Tariff Reduction* (relative to the average level of *Capex/Assets* of 0.06).

A concern is that tariff changes are not randomly assigned and may coincide with unobserved changes in investment opportunities. In particular, tariff changes (or a lack thereof) may be the result of industrial lobbying. Firms in industries with lucrative growth opportunities may lobby for a reduction in import tariffs in their suppliers' industries. Similarly, suppliers to industries with declining growth opportunities may lobby for an increase in import tariffs to be protected from foreign competitors in times of declining demand.

Krugman, Obstfeld, and Melitz (2015) argue that multilateral trade negotiations are less likely to be captured by lobbying groups than the decision making process behind unilateral policy changes.[16] Tariff changes due to multilateral trade agreements are therefore more likely exogenous to changes in customers' investment opportunities. In column (3), we thus only rely on large tariff reductions occurring in 1976, 1980, and 1995, following the implementation of the Generalized System of Preferences (GSP), the completion of the seventh and eighth General Agreement on Tariffs and Trade (GATT) rounds, and the start of the North American Free Trade Agreement (NAFTA) (see also Fresard and Valta (2016)). As in columns (1) and (2), we find a positive coefficient estimate on *Supplier Tariff Reduction* that is statistically significant at the 5% level.

The magnitude of the coefficient estimate in column (3), 0.054, is very similar to the magnitude of the estimates in columns (1) and (2), 0.055 and 0.042, respectively. This finding suggests that a potential correlation between tariff cuts in upstream industries and unobserved growth opportu-

[16]The key argument is as follows: Unilateral trade liberalizations may face opposition from import-competing domestic producers, who stand to lose from a tariff reduction and are typically better informed and organized than the domestic consumers that stand to gain. In multilateral trade negotiations, domestic exporters provide a counterweight: They stand to gain from a liberalization of trade between the involved countries and are arguably as well informed and organized as the import-competing producers.

nities of downstream customers that may be due to industrial lobbying is unlikely to generate a quantitatively important bias. At the same time, relying only on large tariff reductions in 1976, 1980, and 1995 ignores variation stemming from tariff changes in other years. For this reason, throughout the paper, we exploit all large tariff reductions during the entire sample period.[17]

In column (4), we add *Supplier Tariff Increase* as an explanatory variable, the (gross-flow weighted) fraction of supplier industries that have experienced large tariff *increases* in the past.[18] The point estimate of the coefficient on *Supplier Tariff Increase* is negative but not statistically significant. The coefficient on *Supplier Tariff Reduction* remains positive and significant at the 5% level. In column (5), we include two additional control variables: an indicator for large tariff reductions in a firm's own industry (*Own Industry Tariff Reduction*) and the gross-flow weighted fraction of downstream industries that have experienced large tariff reductions (*Downstream Tariff Reduction*). The coefficient estimate on *Supplier Tariff Reduction* is not affected by these controls.

We now turn towards potential reasons for the increase in downstream investment. Arguably the most natural explanation is that tariff reductions in upstream industries lead to lower input prices for downstream firms, and that lower input prices make it profitable to add productive capacity. Another possibility is that import tariff reductions reduce the uncertainty surrounding future input prices, and a reduction in uncertainty may spur additional investment (Pindyck (1993)). Further, downstream firms may increase their investment if upstream tariff reductions alleviate the firms' financial constraints. For example, tariff reductions that lead to lower input prices may make downstream customers more profitable and through this channel improve the customers' ability to finance additional investment.

[17]Unreported analyses confirm that our findings are generally robust to using only large tariff reductions following multilateral trade agreements (as we do in column (3) of Table 2) in all our analyses.

[18]*Supplier Tariff Increase* is constructed analogously to *Supplier Tariff Reduction*.

We begin by examining the relation between import tariff reductions and prices. Using industry-specific price indices for U.S. manufacturing industries (SIC codes 2000-3999) from the NBER-CES Manufacturing Industry Database,[19] we estimate the following OLS regression:

$$Ln(Price\ Index)_{s,t} = \beta \times Post\ Tariff\ Reduction_{s,t} + \delta_s + \eta_t + \varepsilon_{s,t}. \tag{4}$$

$Ln(Price\ Index)_{s,t}$ is the natural logarithm of the price index for industry s in year t.[20] *Post Tariff* $Reduction_{s,t}$ is an indicator equal to one if industry s has experienced a large tariff reduction prior to year t. δ_s are industry and η_t year fixed effects. Standard errors are clustered by year.

[Table 3 around here.]

Table 3 presents the results. The sample period is 1974 to 2011 (the last year in the NBER-CES data). We find a negative and statistically significant coefficient estimate on *Post Tariff Reduction*, showing that import tariff reductions indeed lead to lower prices. This result is consistent with downstream firms facing lower input prices after tariff reductions in their suppliers' industries and increasing productive capacity in response. To further corroborate this interpretation, we examine how the relation between tariff reductions and prices and the relation between tariff reductions and investment vary with shipping costs. The idea is that these costs inhibit international trade (e.g., Krugman, Obstfeld, and Melitz (2015)), so that tariff cuts are likely to have a smaller impact on prices – and thus, on investment – if shipping costs are high.

[Table 4 around here.]

Table 4 presents the results. We classify an industry-year combination as having high shipping costs if the shipping costs are larger than the median and otherwise as having low shipping costs.

[19]The data are provided jointly by the National Bureau of Economic Research (NBER) and U.S. Census Bureau's Center for Economic Studies (CES) and available at `http://www.nber.org/nberces/`.

[20]Using *Price Index* as the dependent variable yields very similar results (untabulated).

Panel A shows that the relation between tariff reductions and prices is indeed weaker if shipping costs are high: The coefficient estimate on the interaction between *Post Tariff Reduction* and *Shipping Costs* is positive and statistically significant at the 5% level. In Panel B, we re-examine the relation between upstream tariff cuts and downstream investment while distinguishing between supplier industries with high versus low shipping costs. We find a significant relation between upstream tariff reductions and downstream investment only for supplier industries with low shipping costs. Taken together, Tables 3 and 4 are consistent with the interpretation that downstream investment increases after upstream tariff reductions because such tariff reductions entail lower input prices to which the downstream firms respond by investing in additional productive capacity.

An alternative channel through which upstream tariff reductions may impact downstream investment is a reduction in uncertainty about input prices. To examine this possibility, we explore the relation between import tariff reductions and the variability of prices. Relying on information from the NBER-CES Manufacturing Industry Database as before, we compute the standard deviation of the industry-specific price indices before and after large tariff reductions. We retain only two observations per industry and large tariff reduction – one before and one after – and estimate

$$\mathit{Std(Price\ Index)}_{s,t} = \beta \times \mathit{Post\ Tariff\ Reduction}_{s,t} + \delta_s + \varepsilon_{s,t}. \tag{5}$$

$\mathit{Std(Price\ Index)}_{s,t}$ is the standard deviation of the price index in industry s before $(t = 0)$ or after $(t = 1)$, and $\mathit{Post\ Tariff\ Reduction}_{s,t}$ is an indicator equal to one after the tariff reduction $(t = 1)$. δ_s are industry fixed effects.

[Table 5 around here.]

Table 5 presents the results. We do not find any evidence of a significant relation between import tariff reductions and the variability of prices. This result suggests that a reduction of uncertainty about future input prices is unlikely to be the main driver for the increase in downstream investment.

To check whether upstream tariff reductions lead to increased downstream investment through a relaxation of financial constraints, we examine sub-samples of customers that are unlikely to be financially constrained to begin with. Specifically, we restrict attention to (1) firms that pay dividends, (2) firms with a KZ-index (Kaplan and Zingales (1997)) that is smaller than the sample median, and (3) firms with a WW-index (Whited and Wu (2006)) that is smaller than the sample median. If large tariff reductions in their suppliers' industries impact customers' investment decisions because they alleviate the customers' financial constraints, then we should not find any investment response when focusing on sub-samples of presumably unconstrained firms.

[Table 6 around here.]

Table 6 shows that we find positive coefficient estimates on *Supplier Tariff Reduction* in all three sub-samples of financially unconstrained customers (statistically significant at the 1% level in column (1) and at the 5% level in columns (2) and (3)). The magnitude of the coefficients is similar to the magnitude of the coefficients reported in Table 2. This result suggests that a reduction of financial constraints is unlikely to be the main reason for the increase in investment.[21]

4 Evidence on the Mechanism

In this section, we examine the mechanism through which upstream tariff reductions translate into lower input prices and increased downstream investment. To structure our analysis, we rely on the following framework. Consider a firm that chooses investment $i \in \mathbb{R}_+$ to maximize net profits

$$\Pi = f(i, p) - c(i), \tag{6}$$

[21] Further, in unreported analyses, we find no evidence of a relation between upstream tariff reductions and the three measures of downstream firms' financial constraints.

where $f(i, p)$ is the firm's profit gross of the cost $c(i)$ of investing in productive capacity (e.g., building a factory). p denotes the price of the input to the firm's production function. We assume $f_i(i, p) > 0$, $f_p(i, p) < 0$, $f_{ii}(i, p) < 0$, $f_{ip}(i, p) < 0$, $c_i(i) > 0$, and $c_{ii}(i) > 0$, where the subscripts indicate partial derivatives. Taking the input price p as given, the optimal investment i^* is given by the first order condition

$$f_i(i^*, p) - c_i(i^*) = 0. \tag{7}$$

It follows that the optimal amount of investment is decreasing in the input price:

$$\frac{di^*}{dp} = -\frac{f_{ip}(i^*, p)}{f_{ii}(i^*, p) - c_{ii}(i^*)} < 0. \tag{8}$$

We now ask how the input price depends on the import tariff. Without loss of generality, we can write the price p as the sum of the marginal cost k of supplying the input and a markup m:

$$p = k + m. \tag{9}$$

Doing so highlights two channels through which the import tariff rate can affect the input price. First, the marginal cost of supplying the input may depend on the tariff τ, i.e., $k = k(\tau)$. This would be the case, for example, if the input is bought from abroad. In that case, the tariff has a direct effect on the cost at which a foreign firm can supply a domestic customer. Another possibility is that trade liberalizations lead to an increase in supplier productivity and thus a decrease in the marginal costs of producing the input.

Second, the markup may depend on the import tariff, i.e., $m = m(\tau)$. We consider two price-setting mechanisms for which this is the case: monopolistic competition and bilateral bargaining. In case of monopolistic competition, suppliers post prices at which they are willing to sell to any customer, and the equilibrium markup is a decreasing function of the number of competing suppliers. Krugman, Obstfeld, and Melitz (2015), for example, present a simple version of this case in which

$$m = \frac{a}{n}, \tag{10}$$

where n is the number of suppliers, and a is a positive constant that represents the responsiveness of a supplier's sales to the price. If tariff reductions increase the number of competing suppliers – i.e., $n = n(\tau)$ with $n_\tau(\tau) < 0$ – then we obtain $m = m(\tau)$ with $m_\tau(\tau) > 0$.

In case of bilateral bargaining, the markup is determined by the customer's outside option and relative bargaining power vis-à-vis the supplier. Specifically, assuming Nash bargaining, we have

$$m = (1 - \beta)(\omega - k), \tag{11}$$

where β and $\omega > k$ denote the customer's bargaining power and outside option, respectively. Hence, if tariff reductions improve the customer's outside option (e.g., the price at which the input can be bought from a foreign supplier) – i.e., $\omega = \omega(\tau)$ with $\omega_\tau(\tau) > 0$ – then we obtain $m_\tau(\tau) > 0$.

Note, however, that in the case of bilateral bargaining, additional assumptions are needed to make the customer's investment dependent on the input price (i.e., $di^*/dp < 0$). The reason is that under frictionless, bilateral bargaining, a customer and supplier maximize the joint surplus by choosing the first-best investment, which depends only on the marginal cost of supplying the input but not on the markup (which is only used to redistribute this surplus). We thus consider the well-known case that bilateral bargaining does not lead to the first-best investment if bargaining must occur after investing and contracts are incomplete (e.g., Hart (1995)). In that case, a hold-up problem between the supplier and customer drives a wedge between the first-best and the equilibrium investment, which then depends on the input price.[22]

To summarize, we consider that upstream tariff reductions may affect input prices and downstream investment through the following channels: First, tariff reductions may reduce the marginal

[22]Note that $\omega > k$ implies that the marginal return from investing is larger if trade with the supplier occurs than if it does not. This condition is what makes the investment "relationship-specific" in the sense of Hart (1995).

cost of supplying the input: $k = k(\tau)$ with $k_\tau(\tau) > 0$. Second, tariff reductions may reduce the markup charged by suppliers: $m = m(\tau)$ with $m_\tau(\tau) > 0$. This markup may be determined either through monopolistic competition or bilateral bargaining. In the latter case, we assume that contracts are incomplete and investment occurs before bargaining over input prices, thus creating a hold-up problem. Note that these channels are not mutually exclusive and may all play a role in the observed increase in downstream investment. However, the different channels yield different cross-sectional implications that can be used to gauge the channels' relative importance.

4.1 Variation in Bargaining Power

We begin by examining variation in customers' relative bargaining power vis-à-vis their suppliers. First, note that an individual customer's bargaining power does not play a role if the price of the input is determined by monopolistic competition among the suppliers. The reason is that there is no bilateral bargaining, and suppliers simply post prices at which they are willing to sell to any customer. As a consequence, differences in individual customers' bargaining power do not matter.

If, instead, the input price is determined through bilateral Nash bargaining, we have

$$p = k + m = \beta k + (1 - \beta)\omega. \tag{12}$$

Hence, in case import tariff reductions translate into a lower marginal cost of supplying the input, i.e., $k = k(\tau)$ with $k_\tau(\tau) > 0$, we have $p_\tau(\beta, k, \omega) = \beta k_\tau(\tau) > 0$. This, in turn, implies

$$\frac{\partial \frac{di^*}{d\tau}}{\partial \beta} = -\frac{f_{ip}(i^*, p) k_\tau(\tau)}{f_{ii}(i^*, p) - c_{ii}(i^*)} < 0. \tag{13}$$

That is, all else equal, a tariff reduction that decreases the marginal cost of supplying the input has a *stronger* effect on the customer's investment if the customer's bargaining power is high.

In case import tariff reductions translate into a better outside option for the customer, i.e.,

$\omega = \omega(\tau)$ with $\omega_\tau(\tau) > 0$, we have $p_\tau(\beta, k, \omega) = (1-\beta)\omega_\tau(\tau) > 0$. This, in turn, implies

$$\frac{\partial \frac{di^*}{d\tau}}{\partial \beta} = \frac{f_{ip}(i^*, p)\omega_\tau(\tau)}{f_{ii}(i^*, p) - c_{ii}(i^*)} > 0. \tag{14}$$

That is, all else equal, a tariff reduction that improves the customer's outside option has a *weaker* effect on the customer's investment if the customer's bargaining power is high.

Empirically, we distinguish between customers with high and low bargaining power by measuring the concentration in the customers' industries (using the HHI of sales) as well as the size of each customer (using the natural logarithm of total assets). The idea is that both industry concentration and size increase a customer's bargaining power. We then add interaction terms between *Supplier Tariff Reduction* and *Customer Industry Concentration* and *Customer Size* to the regressions.

As an alternative approach, we distinguish between tariff reductions in supplier industries that are concentrated and in supplier industries that are dispersed. The idea is that suppliers in more concentrated industries have more bargaining power (and customers thus less). At one end of the spectrum would be maximum concentration: an industry with a single, monopolistic supplier that has all the bargaining power vis-à-vis its customers. The polar opposite would be maximum dispersion: an industry with atomistic suppliers in perfect competition and with zero bargaining power. Based on this intuition, we assess the suppliers' bargaining power by computing the Herfindahl-Hirschman Index (HHI) of sales for each industry-year combination in the Compustat database between 1974 and 2012. We then classify an industry-year combination as "concentrated" if its HHI is larger than the median HHI. Otherwise, the industry is classified as "dispersed."

[Table 7 around here.]

Table 7 presents the results. All regressions include the full set of firm and industry level controls ($X_{i,j,t-1}$) specified in Equation (3).[23] To conserve space, we do not report the associated

[23]Note that $X_{i,j,t-1}$ includes both proxies of customers' bargaining power, *Industry Concentration* and *Ln(Assets)*.

coefficient estimates and t-statistics. In columns (1) and (2), we interact *Supplier Tariff Reduction* with *Customer Industry Concentration* and *Customer Size*. In line with our earlier results (Table 2), we find positive coefficient estimates on *Supplier Tariff Reduction* that are statistically significant at the 1% level in both columns. Further, we find negative coefficients on the interactions with *Customer Industry Concentration* and *Customer Size* (both statistically significant at the 5% level).

Column (3) shows the estimation results obtained from the regression in which we distinguish between large tariff reductions in concentrated and in dispersed supplier industries. In this specification, we also control for the average level of concentration across all of a customer's supplier industries (*Supplier Industry Concentration*). The regression reveals a positive relation between customers' capital expenditures and large tariff reductions in concentrated supplier industries (statistically significant at the 1% level). In contrast, the coefficient estimate for large tariff reductions in dispersed supplier industries is close to zero and not statistically significant. The null-hypothesis that the coefficient on large tariff reductions in dispersed supplier industries is the same as for concentrated supplier industries is rejected at the 1% level by a Wald test (unreported). This result is consistent with columns (1) and (2): The investment response is stronger if *suppliers* have more bargaining power and thus weaker if *customers* have more bargaining power.

Overall, we find that customers with higher bargaining power vis-à-vis their suppliers increase their investments less in response to large tariff reductions in upstream industries than customers with lower bargaining power. This result is consistent with input prices being determined through bilateral bargaining between suppliers and customers and tariff reductions improving the customers' outside option (e.g., lowering the price at which the input can be bought from abroad). In contrast, this evidence is at odds with tariff reductions lowering the marginal cost at which the input can be supplied and with prices being determined through monopolistic competition among the suppliers.

4.2 Variation in Vertical Integration, Input Specificity, and Uncertainty

The finding that upstream tariff reductions entail lower input prices and increased investment downstream and that the investment response is weaker for customers with more bargaining power is consistent with the presence of hold-up problems between suppliers and customers: When import tariffs in upstream industries are lowered, downstream customers' bargaining position vis-à-vis their domestic suppliers improves as the cost of procuring inputs from foreign sources decreases. This, in turn, reduces the suppliers' ability to hold-up their customers ex post, leads to lower prices, and increases the customers' incentives to invest in productive capacity ex ante.

To provide further evidence in support of this interpretation, we now consider cross-sectional variation in vertical integration, input specificity, and uncertainty about future contingencies. The idea is that hold-up problems do *not* arise if customers and suppliers are vertically integrated, if the input is generic and can be supplied at the same marginal cost by many alternative domestic suppliers, and if customers and suppliers can write comprehensive, long-term contracts.

We thus distinguish between customers that are vertically integrated into their suppliers' industries and those that are not. We also distinguish between suppliers that produce specific inputs and those that produce generic inputs. Further, we examine whether customers' response to tariff reductions in their suppliers' industries is stronger if a higher level of uncertainty about future contingencies makes the use of comprehensive, long-term contracts more difficult.

[Table 8 around here.]

Table 8 presents the results. In panel A, for each customer, we distinguish between large tariff reductions in supplier industries into which the customer is vertically integrated and large tariff reductions in supplier industries into which the customer is not vertically integrated. We expect that customers increase their investments in response to tariff reductions if they are *not* vertically integrated with their suppliers. In contrast, we expect no reaction to tariff reductions if suppliers and customers *are* vertically integrated because, in that case, there is no hold-up problem to begin with. In line with this argument, we find a significant relation between upstream tariff reductions and downstream investment only for customers that are *not* vertically integrated into their suppliers' industries. The difference between the coefficient estimates for customers that are not integrated and customers that are integrated is statistically significant at the 5% level (unreported).

In panel B, we distinguish between supplier industries that produce specific inputs and those that produce generic inputs. We expect an increase in customers' investment in response to tariff reductions if the suppliers produce specific inputs – but not if the inputs are generic. The intuition is as follows: Ex post bargaining about the price of specific inputs creates a hold-up problem that can be mitigated by import tariff reductions. If, instead, the inputs are perfectly generic and can be bought from a large number of suppliers at the same (quality adjusted) price, then there is no hold-up problem in the first place.

In the spirit of Barrot and Sauvagnat (2015), in each year, we thus classify an industry as producing specific goods if the ratio of aggregate R&D expenditures to aggregate sales in the industry is higher than the median R&D-to-sales ratio in Compustat from 1974 to 2012. Otherwise, the industry is classified as producing generic goods. Using this classification, we find a significant relation between upstream tariff cuts and downstream investment only if the suppliers produce specific inputs. In contrast, we find no relation for suppliers producing generic inputs.[24]

In panel C, we examine how the investment response varies with the volatility of the customers' sales. The idea is as follows. There is no hold-up problem if a customer and supplier can write a

[24]The regression coefficient for suppliers producing generic inputs is estimated with low precision. As a consequence, despite a point estimate close to zero, the hypothesis that the coefficient for suppliers producing generic inputs does not differ from that for suppliers producing specific inputs cannot be rejected at conventional levels (unreported).

complete, long-term contract. Such a contract is arguably more difficult to write if there is more uncertainty about the relevant future contingencies. Hence, a high level of uncertainty is likely to inhibit the use of comprehensive, long-term contracts as a means to overcome hold-up problems.

We thus expect the relation between tariff reductions in upstream industries and downstream customers' investment to be stronger if the level of uncertainty about future contingencies is high. Using *Customer Sales Volatility* as a proxy for such uncertainty, we find strong support for this prediction. The coefficient estimate on the interaction term between *Supplier Tariff Reduction* and *Customer Sales Volatility* is positive and statistically significant at the 1% level.[25]

All of the cross-sectional findings presented in Table 8 are predicted by the presence of hold-up problems between suppliers and customers. In contrast, a simple reduction in the cost of importing goods from abroad does not predict that the investment response should vary with vertical integration (i.e., the legal relation between the supplier and customer), input specificity, or uncertainty about future contingencies. Similarly, in the absence of hold-up problems, a mere increase in competition from foreign rivals to which domestic suppliers respond by lowering prices would predict that the relation between tariff cuts and investment is weaker if the suppliers produce specific rather than generic inputs. The reason is that product specificity should shield domestic suppliers from foreign competition (Hombert and Matray (2017)). Further, a simple decrease in prices due to increased competition neither explains why we find an increase in investment only for customers that are not vertically integrated with their suppliers, nor why the increase is larger if uncertainty about future contingencies is high. The presence of hold-up problems between suppliers and customers, however, predicts both findings.

[25] Note that *Customer Sales Volatility* is estimated using the time-series of a customer's annual sales during the sample period. Hence, it is a constant for a given customer, and its main effect is absorbed by the firm fixed effects.

5 Outcomes at the Aggregate Level

We now explore the relation between upstream tariff reductions and downstream outcomes at the aggregate level. Specifically, we obtain information on the total amount of investment, output, and employment of all private and public U.S. manufacturing firms (SIC codes 2000 to 3999) in the NBER-CES Manufacturing Industry Database between 1974 and 2011 (the last year in the database). We then estimate industry-level regressions that relate the aggregate amount of investment, output, and employment to the fraction of upstream suppliers that have experienced large import tariff reductions in the past.

[Table 9 around here.]

Table 9 displays the results. Column (1) presents the findings regarding the aggregate amount of investment in the downstream industries.[26] The coefficient estimate on *Supplier Tariff Reduction* is positive and statistically significant at the 5% level, showing that the increase in downstream investment that we document at the firm-level extends also to the aggregate, industry level. In terms of economic magnitude, the point estimate implies an increase of total investment in the U.S. manufacturing sector by USD 5 to 6 billion per year for a one-standard-deviation (7%) increase in the fraction of upstream industries that have experienced large tariff reductions.[27] Columns (2) and (3) show that this increase in investment is accompanied by an increase in aggregate output and employment. Specifically, our estimates imply that an increase in the fraction of upstream suppliers that have experienced large tariff reductions by one standard deviation translates into an

[26] *Capex/Capital Stock* is the total amount of capital expenditures in year t scaled by the total amount of capital stock at the end of year $t-1$. The book value of assets is not available in the NBER-CES Manufacturing Industry Database, so we cannot compute the ratio of capital expenditures to book assets as in the firm-level analysis.

[27] During our sample period, the average aggregate investment per year of all public and private firms in the NBER-CES Manufacturing Industry Database is about USD 100 billion.

increase in total output and employment by about 5%.

6 Conclusion

We document that upstream tariff reductions are followed by increased downstream investment, output, and employment. Specifically, our estimates imply an increase of total investment in the U.S. manufacturing sector by USD 5 to 6 billion per year and an increase in aggregate output and employment by about 5% for a one-standard-deviation increase in the fraction of upstream industries that have experienced large import tariff reductions. In light of the ongoing debate about protectionist trade policies around the world, these findings contribute towards a more comprehensive understanding of the intricate effects that import tariffs can have on industrialized economies, in which highly interconnected firms operate in complex supply chains.

The cross-sectional variation of the investment-response that we find is most consistent with the idea that upstream tariff reductions impact downstream investment by alleviating hold-up problems between suppliers and customers. Our results thus highlight the empirical importance of hold-up problems for firms' investment decisions and speak to a key building block of both transaction cost economics and the property rights theory of the firm. An implication is that firms' organization along the supply chain does not eliminate all hold-up problems. As such, our findings point towards significant barriers to firms' ability to overcome hold-up problems through contractual arrangements or vertical integration.

References

Acemoglu, D., Autor, D., Dorn, D., Hanson, G., Price, B., 2016. Import competition and the great US employment sag of the 2000s. Journal of Labor Economics 34, 141–198.

Amiti, M., Konings, J., 2007. Trade liberalization, intermediate inputs, and productiviy: Evidence from Indonesia. American Economic Review 97, 1611–1638.

Baker, M., Stein, J., Wurgler, J., 2003. When does the market matter? Stock prices and the investment of equity-dependent firms. Quaterly Journal of Economics 118, 969–1005.

Barrot, J., Sauvagnat, J., 2015. Input specificity and the propagation of idiosyncratic shocks in production networks. Quarterly Journal of Economics, forthcoming.

Ciliberto, F., 2006. Does organizational form affect investment decisions? Journal of Industrial Economics 54, 63–93.

Cookson, J., 2018. Does contract enforcement mitigate hold up? Review of Corporate Finance Studies, forthcoming.

Fresard, L., 2010. Financial strength and product market behavior: The real effects of corporate cash holdings. Journal of Finance 65, 1097–1122.

Fresard, L., Valta, P., 2016. How does corporate investment respond to increased entry threat? Review of Corporate Finance Studies 5, 1–35.

Geng, H., Hau, H., Lai, S., 2016. Technological progress and ownership structure. Unpublised Working Paper. University of Hong Kong, University of Geneva, and Swiss Finance Institute.

Grossman, S., Hart, O., 1986. The costs and benefits of ownership: A theory of vertical and lateral integration. Journal of Political Economy 94, 691–719.

Guadalupe, M., 2007. Product market competition, returns to skill, and wage inequality. Journal of Labor Economics 25, 439–474.

Guadalupe, M., Cuñat, V., 2009. Globalization and the provision of incentives inside the firm. Journal of Labor Economics 27, 179–212.

Guadalupe, M., Wulf, J., 2010. The flattening firm and product market competition: The effect of trade liberalization on corporate hierarchies. American Economic Journal - Applied Economics 4, 105–127.

Halpern, L., Koren, M., Szeidl, A., 2015. Imported inputs and productivity. American Economic Review 105, 3660–3703.

Hart, O., 1995. Firms, contracts, and financial structure. Oxford University Press. New York, NY.

Hart, O., Moore, J., 1990. Property rights and the nature of the firm. Journal of Political Economy 98, 1119–1158.

Hombert, J., Matray, A., 2017. Can innovation help U.S. manufacturing firms escape import competition from China? Journal of Finance, forthcoming.

Iyer, R., Sautner, Z., 2016. Contracting between firms: Empirical evidence. Review of Economics and Statistics, forthcoming.

Joskow, P., 2008. Vertical integration. Handbook of New Institutional Economics. Springer. Berlin.

Kaplan, S., Zingales, L., 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? Quarterly Journal of Economics 112, 169–215.

Klein, P., 2008. The make-or-buy decision: Lessons from empirical studies. Handbook of New Institutional Economics. Springer. Berlin.

Klein, B., Crawford, R., Alchian, A., 1978. Vertical integration, appropriable rents, and the competitive contracting process. Journal of Law and Economics 21, 297–326.

Krugman, P., Obstfeld, M., Melitz, M., 2015. International economics: Theory and policy, 10th (Global) Edition. Pearson Press. Essex, England.

Lafontaine, F., Slade, M., 2007. Vertical integration and firm boundaries: The evidence. Journal of Economic Literature 45, 629–685.

Lamont, O., Polk, C., Saá-Requejo, J., 2001. Financial constraints and stock returns. Review of Financial Studies 14, 529–554.

Melitz, M., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71, 1695–1725.

Melitz, M., Ottaviano, G., 2008. Market size, trade, and productivity. Review of Economic Studies 75, 295–316.

Pavcnik, N., 2002. Trade liberalization, exit, and productivity improvements: Evidence from Chilean plants. Review of Economic Studies 69, 245–276.

Pindyck, R., 1993. Investments of uncertain costs. Journal of Financial Economics 34, 53–76.

Topalova, P., Khandelal, A., 2011. Trade liberalization and firm productivity: The case of India. Review of Economics and Statistics 93, 995–1009.

Trefler, D., 2004. The long and the short of the Canada-U.S. free trade agreement. American Economic Review 94, 870–895.

Tybout, J., de Melo, J., Corbo, V., 1991. The effects of trade reforms on scale and technical efficiency. New evidence from Chile. Journal of International Economics 31, 231–250.

Tybout, J., Westbrook, M., 1995. Trade liberalization and the dimensions of efficiency change in Mexican manufacturing industries. Journal of International Economics 39, 53–78.

Valta, P., 2012. Competition and the cost of debt. Journal of Financial Economics 105, 661–682.

Vukina, T., Leegomonchai, P., 2006. Oligopsony power, asset specificity, and hold-up: Evidence from the broiler industry. American Journal of Agricultural Economics 88, 589–605.

Whited, T., Wu, G., 2006. Financial Constraints Risk. Review of Financial Studies 19, 531–559.

Williamson, O., 1975. Markets and hierachies: Analysis and antitrust implications. Free Press. New York, NY.

Figure 1: Average Import Tariff Rate in U.S. Manufacturing Industries from 1974 to 2012

This figure shows the (equally weighted) average import tariff rate (in percent) across all U.S. manufacturing industries in our data (SIC codes 2000 to 3999) in each year from 1974 to 2012. Import tariff rates for each industry-year combination are computed as the total value of duties collected divided by the total value of imports. Data on the value of imports and duties are from Peter Schott's website (`http://faculty.som.yale.edu/peterschott/`) and the Center for International Data at UC Davis (`http://cid.econ.ucdavis.edu/`).

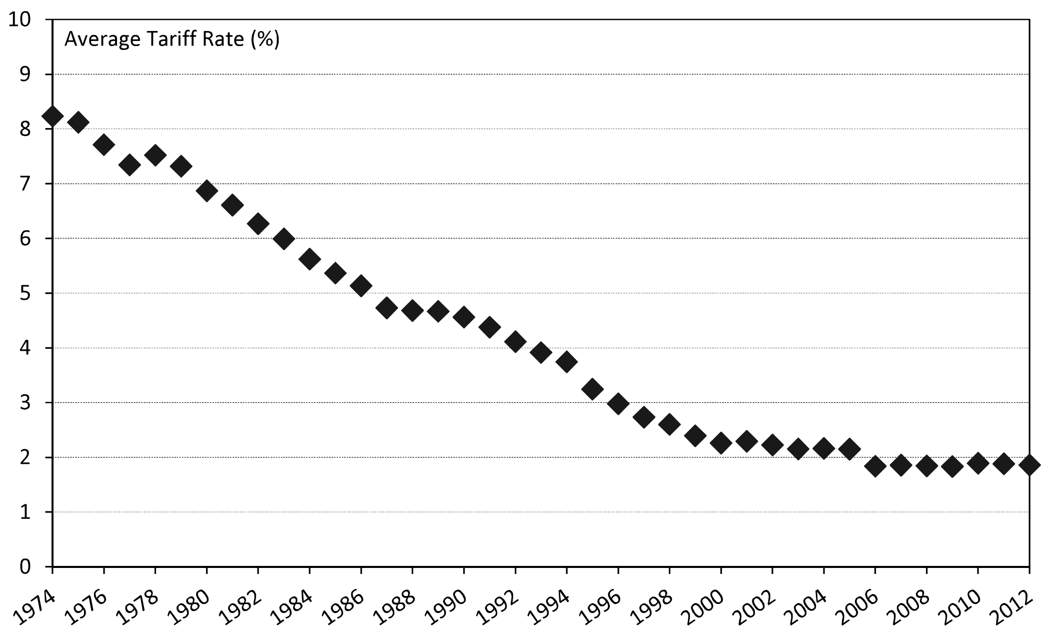

Figure 2: Number of Large Tariff Reductions in U.S. Manufacturing Industries from 1974 to 2012

This figure shows the number of large import tariff reductions in manufacturing industries in the U.S. (SIC codes 2000 to 3999) for each year during the sample period from 1974 to 2012. Tariff rates for each industry-year combination are computed as the total value of duties collected divided by the total value of imports. Year-on-year tariff reductions are classified as "large" if they are more than three times as large as the average absolute year-on-year tariff change in the industry. Data on the value of imports and duties are from Peter Schott's website (`http://faculty.som.yale.edu/peterschott/`) and the Center for International Data at UC Davis (`http://cid.econ.ucdavis.edu/`).

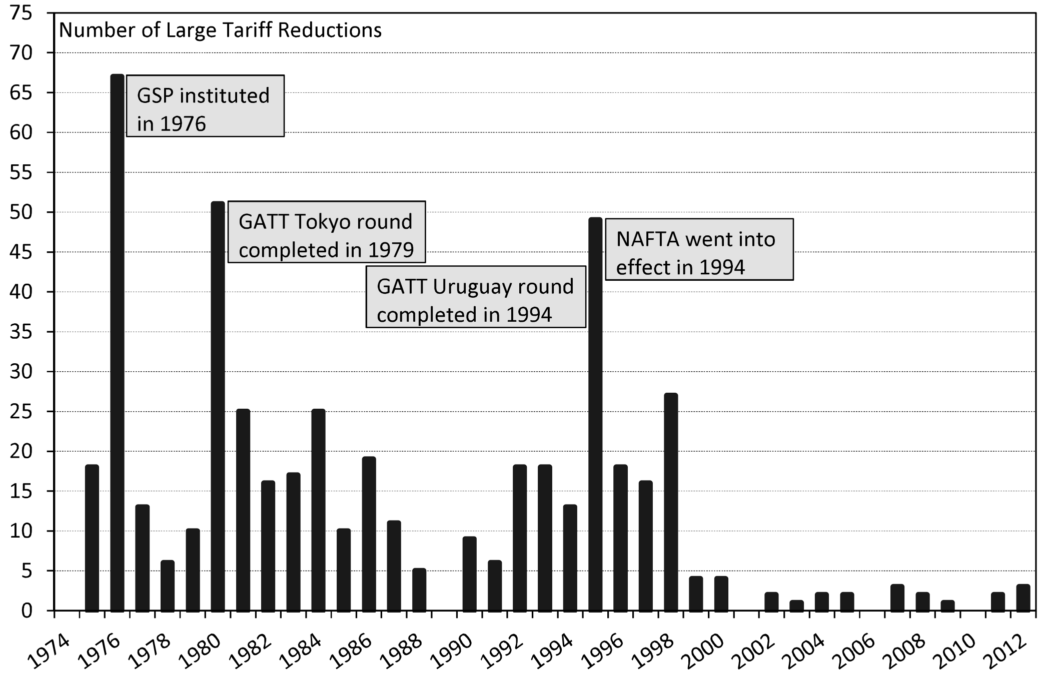

Figure 3: Average Tariff around Large Tariff Reductions in U.S. Manufacturing Industries from 1974 to 2012

This figure shows the (equally weighted) average import tariff rate (in percent) around large tariff reductions in U.S. manufacturing industries (SIC codes 2000 to 3999) during the sample period from 1974 to 2012. Tariff rates for each industry-year combination are computed as the total value of duties collected divided by the total value of imports. Year-on-year tariff reductions are classified as "large" if they are more than three times as large as the average absolute year-on-year tariff change in the industry. Data on the value of imports and duties are from Peter Schott's website (`http://faculty.som.yale.edu/peterschott/`) and the Center for International Data at UC Davis (`http://cid.econ.ucdavis.edu/`).

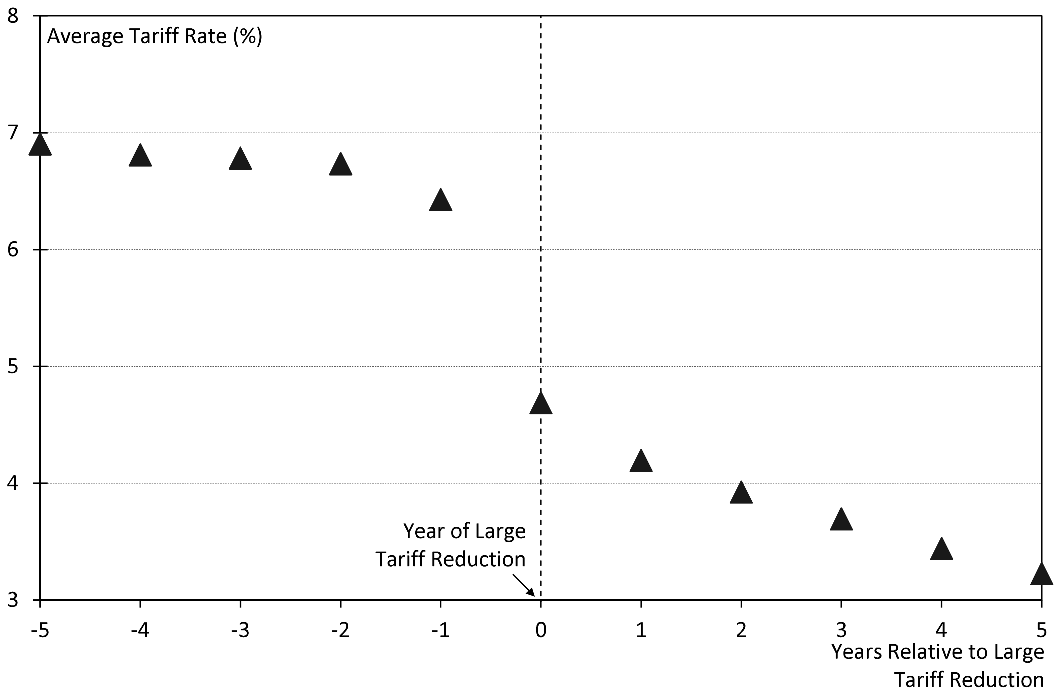

Table 1: Summary Statistics

This table presents summary statistics for our sample of 44,590 firm-year observations over the period from 1974 to 2012. For a given firm-year combination, *Supplier Tariff Reduction* is the fraction of supplier industries that have experienced large tariff reductions in the past. Detailed definitions of all variables are provided in the Appendix.

Variable	Observations	Mean	Std. Dev.	Min.	25%	Median	75%	Max.
Supplier Tariff Reduction	44,590	0.113	0.072	0.000	0.056	0.109	0.153	0.503
Capex/Assets	44,590	0.061	0.061	0.001	0.022	0.043	0.079	0.347
Assets (in USD million)	44,590	1,031	3,445	2	24	87	397	25,636
Ln(Assets)	44,590	4.676	2.061	0.688	3.179	4.466	5.984	10.152
Tobin's Q	44,590	1.985	1.732	0.560	1.015	1.391	2.191	11.010
Cash/Assets	44,590	0.190	0.221	0.001	0.030	0.097	0.270	0.911
Debt/Assets	44,590	0.201	0.180	0.000	0.039	0.172	0.312	0.783
EBITDA/Assets	44,590	0.060	0.226	-1.022	0.031	0.117	0.180	0.380
Cash Flow/Assets	44,590	-0.030	0.234	-1.226	-0.034	0.040	0.082	0.235
Sales Growth	44,590	0.195	0.564	-0.731	-0.023	0.101	0.254	3.939
Excess Return	44,590	0.037	0.713	-0.939	-0.376	-0.101	0.224	3.782
Excess Volatility	44,590	0.028	0.020	0.001	0.013	0.023	0.037	0.103
Industry Sales Growth	44,590	0.095	0.174	-0.399	0.012	0.090	0.164	0.815
Industry Concentration	44,590	0.274	0.193	0.055	0.135	0.217	0.362	0.922

Table 2: Large Import Tariff Reductions in Supplier Industries and Customers' Investment

This table presents coefficient estimates for the relation between large import tariff reductions in supplier industries and customers' capital expenditures. The sample period is 1974 to 2012. *Supplier Tariff Reduction (Increase)* is the fraction of supplier industries that have experienced large tariff reductions (increases) in the past. *Own Industry Tariff Reduction* is an indicator equal to one if there has been a large tariff reduction in a customer's own industry. *Downstream Tariff Reduction* is the fraction of downstream industries that have experienced large tariff reductions. *Capex/At* is a customer's capital expenditures in year t scaled by the book value of total assets at the end of year t-1. Detailed variable definitions are provided in the Appendix. Column (3) uses only large tariff reductions in 1976, 1980, and 1995, following the GSP implementation, completion of the seventh and eighth GATT rounds, and start of NAFTA. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	Capex/At	Capex/At	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.055***	0.042**	0.054**	0.040**	0.041**
	(2.87)	(2.27)	(2.34)	(2.14)	(2.19)
Supplier Tariff Increase				-0.115	
				(-1.45)	
Own Industry Tariff Reduction					0.002
					(1.01)
Downstream Tariff Reduction					0.014
					(1.27)
Ln(Assets)		-0.011***	-0.011***	-0.011***	-0.011***
		(-13.02)	(-13.13)	(-13.07)	(-13.02)
Tobin's Q		0.007***	0.007***	0.007***	0.007***
		(15.33)	(15.36)	(15.32)	(15.34)
Cash/Assets		-0.006*	-0.006*	-0.006*	-0.006*
		(-1.86)	(-1.82)	(-1.85)	(-1.87)
Debt/Assets		-0.038***	-0.038***	-0.038***	-0.038***
		(-11.57)	(-11.59)	(-11.56)	(-11.58)
EBITDA/Assets		0.044***	0.044***	0.044***	0.044***
		(9.64)	(9.60)	(9.64)	(9.64)
Cash Flow/Assets		-0.004	-0.004	-0.004	-0.004
		(-1.34)	(-1.29)	(-1.34)	(-1.33)
Sales Growth		0.004***	0.004***	0.004***	0.004***
		(5.53)	(5.54)	(5.53)	(5.51)
Excess Return		0.004***	0.004***	0.004***	0.004***
		(8.91)	(8.90)	(8.92)	(8.91)
Excess Volatility		-0.258***	-0.256***	-0.258***	-0.259***
		(-10.32)	(-10.26)	(-10.34)	(-10.37)
Industry Sales Growth		0.010***	0.010***	0.010***	0.010***
		(5.16)	(5.21)	(5.12)	(5.14)
Industry Concentration		0.002	0.004	0.003	0.003
		(0.55)	(0.96)	(0.59)	(0.58)
Firm & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.417	0.475	0.475	0.475	0.475
Observations	44,590	44,590	44,590	44,590	44,590

Table 3: Large Import Tariff Reductions and Prices

This table presents coefficient estimates for the relation between large import tariff reductions and prices at the industry level. The data are obtained from the NBER-CES Manufacturing Industry Database (`http://www.nber.org/nberces/`) and cover U.S. manufacturing industries (SIC codes 2000-3999). The sample period is 1974 to 2011 (the last year in the NBER-CES data). Individual industries are identified by their four-digit SIC codes. *Post Tariff Reduction* is an indicator equal to one if the industry has experienced a large tariff reduction in the past. *Ln(Price Index)* is the natural logarithm of the price index for each industry. Standard errors are clustered by year, and t-statistics are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)
Dependent Variable:	Ln(Price Index)
Post Tariff Reduction	-0.040**
	(-2.60)
Industry & Year Fixed Effects	Yes
R^2	0.482
Observations	4,706

Table 4: Cross-Sectional Variation Depending on Shipping Costs

This table presents coefficient estimates for the relation between large import tariff reductions, prices, and downstream investment. Panel A shows coefficient estimates for the relation between large import tariff reductions and prices at the industry level. The data are obtained from the NBER-CES Manufacturing Industry Database (`http://www.nber.org/nberces/`) and cover U.S. manufacturing industries (SIC codes 2000-3999). The sample period is 1974 to 2011 (the last year in the NBER-CES data). Individual industries are identified by their four-digit SIC codes. *Ln(Price Index)* is the natural logarithm of the price index for each industry. *Post Tariff Reduction* is an indicator equal to one if the industry has experienced a large tariff reduction in the past. *Shipping Costs* is the value of shipping costs in the industry (as a percentage of the customs value). Standard errors are clustered by year, and t-statistics are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively. Panel B shows coefficient estimates for the relation between large import tariff reductions in supplier industries and customers' capital expenditures. We distinguish between tariff reductions in supplier industries with high shipping costs and in supplier industries with low shipping costs. The sample period is 1974 to 2012. In each year, a supplier industry is classified as having high shipping costs if its shipping costs (as a percentage of the customs value of the imports) are larger than the median and as having low shipping costs otherwise. *Shipping Costs* is the average value of the shipping costs (as a percentage of the customs value of the imports) across the customer's different supplier industries. *Control Variables* is a vector of all firm- and industry-level control variables as specified in Equation (3). All other variables are defined as in Table 2. Detailed variable definitions are provided in the Appendix. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Panel A: Prices		Panel B: Downstream Investment	
Dependent Variable:	Ln(Price Index)	Dependent Variable:	Capex/At
Post Tariff Reduction	-0.064***	Supplier Tariff Reduction	0.043**
	(-3.99)	(Low Shipping Costs)	(2.00)
Post Tariff Reduction	0.005**	Supplier Tariff Reduction	0.034
× Shipping Costs	(2.20)	(High Shipping Costs)	(1.57)
Shipping Costs	-0.008***	Shipping Costs	-0.001
	(-3.16)		(-1.22)
		Control Variables	Yes
Industry & Year Fixed Effects	Yes	Firm & Year Fixed Effects	Yes
R^2	0.763	R^2	0.476
Observations	4,034	Observations	43,779

Table 5: Large Import Tariff Reductions and Price Uncertainty

This table presents coefficient estimates for the relation between large import tariff reductions and price uncertainty at the industry level. The data are obtained from the NBER-CES Manufacturing Industry Database (`http://www.nber.org/nberces/`) and cover U.S. manufacturing industries (SIC codes 2000-3999). The sample period is 1974 to 2011 (the last year in the NBER-CES data). Individual industries are identified by their four-digit SIC codes. *Post Tariff Reduction* is an indicator equal to one if the industry has experienced a large tariff reduction in the past. *Std(Price Index)* is the standard deviation of the price index in a given industry. We retain only two observations per industry and large tariff reduction – one before and one after. t-statistics are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)
Dependent Variable:	Std(Price Index)
Post Tariff Reduction	0.034
	(0.97)
Industry Fixed Effects	Yes
R^2	0.414
Observations	148

Table 6: Large Import Tariff Reductions and Investment of Financially Unconstrained Customers

This table presents coefficient estimates for the relation between large import tariff reductions in supplier industries and customers' capital expenditures for three samples of customers that are unlikely to be financially constrained. In column (1), we focus on customers that pay out dividends. In column (2), we focus on customers whose Kaplan and Zingales (1997) index is smaller than the sample median. In column (3), we focus on customers whose Whited and Wu (2006) index is smaller than the sample median. The sample period is 1974 to 2012. *Control Variables* is a vector of all firm- and industry-level control variables as specified in Equation (3). All other variables are defined as in Table 2. Detailed variable definitions are provided in the Appendix. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)
Sample:	Dividend Payers	KZ-Index < Median	WW-Index < Median
Dependent Variable:	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.056***	0.049**	0.046**
	(2.58)	(2.18)	(2.12)
Control Variables	Yes	Yes	Yes
Firm & Year Fixed Effects	Yes	Yes	Yes
R^2	0.511	0.532	0.560
Observations	17,904	21,067	21,837

Table 7: Cross-Sectional Variation Depending on Customers' and Suppliers' Bargaining Power

This table presents coefficient estimates for the relation between large import tariff reductions in supplier industries and customers' capital expenditures. The sample period is 1974 to 2012. *Customer Size* is the natural logarithm of the book value of the customer's total assets. *Customer Industry Concentration* is the Herfindahl-Hirschman Index (HHI) of sales in the customer's industry. In column (3), we distinguish between tariff reductions in concentrated and in dispersed supplier industries. In each year, a supplier industry is classified as concentrated if the Herfindahl-Hirschman Index (HHI) of sales in the industry is larger than the median and as dispersed otherwise. *Supplier Industry Concentration* is the weighted average industry concentration across a customer's supplier industries. *Control Variables* is a vector of all firm- and industry-level control variables as specified in Equation (3) and includes *Customer Industry Concentration* and *Customer Size*. All other variables are defined as in Table 2. Detailed variable definitions are provided in the Appendix. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)
Dependent Variable:	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.082***	0.113***	
	(3.24)	(3.23)	
Supplier Tariff Reduction	-0.119**		
× Customer Industry Concentration (HHI)	(-2.53)		
Supplier Tariff Reduction		-0.011**	
× Customer Size (Ln(Assets))		(-2.11)	
Supplier Tariff Reduction			0.073***
(Concentrated Supplier Industry)			(3.41)
Supplier Tariff Reduction			-0.003
(Dispersed Supplier Industry)			(-0.13)
Supplier Industry Concentration			0.077
			(1.03)
Control Variables	Yes	Yes	Yes
Firm & Year Fixed Effects	Yes	Yes	Yes
R^2	0.475	0.475	0.476
Observations	44,590	44,590	43,779

Table 8: Cross-Sectional Variation Depending on Vertical Integration, Input Specificity, and Contingency Uncertainty

This table presents coefficient estimates for the relation between large import tariff reductions in supplier industries and customers' capital expenditures. The sample period is 1974 to 2012. In panel A, we distinguish between tariff reductions in supplier industries into which the customer is vertically integrated and in supplier industries into which the customer is not vertically integrated. *Customer Integration* is the fraction of supplier industries into which the customer is vertically integrated. In panel B, we distinguish between tariff reductions in supplier industries producing specific inputs and in supplier industries producing generic inputs. In each year, a supplier industry is classified as producing specific inputs if the ratio of aggregate R&D expenditures divided by aggregate sales in the industry is larger than the median and as producing generic inputs otherwise. *Supplier Specificity* is the fraction of a customer's supplier industries that are classified as producing specific inputs. In panel C, we interact *Supplier Tariff Reduction* with *Customer Sales Volatility*, the demeaned standard deviation of the customer's annual sales over the sample period scaled by the customer's average sales. *Control Variables* is a vector of all firm- and industry-level control variables as specified in Equation (3). All other variables are defined as in Table 2. Detailed variable definitions are provided in the Appendix. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Panel A: Vertical Integration		Panel B: Input Specificity		Panel C: Contingency Uncertainty	
Dependent Variable:	Capex/At	Dependent Variable:	Capex/At	Dependent Variable:	Capex/At
Supplier Tariff Reduction	0.052**	Supplier Tariff Reduction	0.043**	Supplier Tariff Reduction	0.048**
(Customer Not Integrated)	(2.44)	(Specific Input)	(2.22)		(2.49)
Supplier Tariff Reduction	-0.070	Supplier Tariff Reduction	-0.009	Supplier Tariff Reduction	0.186***
(Customer Integrated)	(-1.20)	(Generic Input)	(-0.16)	× Customer Sales Volatility	(4.39)
Customer Integration	0.164***	Supplier Specificity	-0.065		
	(3.22)		(-1.50)		
Control Variables	Yes	Control Variables	Yes	Control Variables	Yes
Firm & Year Fixed Effects	Yes	Firm & Year Fixed Effects	Yes	Firm & Year Fixed Effects	Yes
R^2	0.479	R^2	0.476	R^2	0.476
Observations	41,145	Observations	43,779	Observations	44,590

Table 9: Aggregate Outcomes at the Industry Level

This table presents coefficient estimates for the relation between large import tariff reductions in upstream industries and aggregate outcomes in downstream industries. The data are obtained from the NBER-CES Manufacturing Industry Database and cover U.S. manufacturing industries (SIC codes 2000-3999) from 1974 to 2011 (the last year in the NBER-CES data). Individual industries are identified by their four-digit SIC codes. *Capex/Capital Stock* is the aggregate amount of capital expenditures in year t scaled by the aggregate amount of capital stock at the end of year t-1. *Ln(Total Output)* is the natural logarithm of the total value of shipments (deflated by the price index). *Ln(Employment)* is the natural logarithm of the total number of employees . *Supplier Tariff Reduction* is the fraction of supplier industries that have experienced large tariff reductions in the past. All control variables are equally weighted averages across all firms in a given year and industry in the CRSP/Compustat merged database. Detailed variable definitions are provided in the Appendix. Standard errors are clustered by year, and t-statistics are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)
Dependent Variable:	Capex/Capital Stock	Ln(Total Output)	Ln(Employment)
Supplier Tariff Reduction	0.044**	0.676***	0.651***
	(2.49)	(3.65)	(6.96)
Own Industry Tariff Reduction	-0.006**	0.091***	0.053***
	(-2.24)	(3.43)	(3.24)
Ln(Assets)	-0.000	0.118***	0.035***
	(-0.25)	(9.85)	(3.28)
Tobin's Q	0.010***	-0.008	0.019**
	(6.80)	(-0.45)	(2.26)
Cash/Assets	-0.055***	1.620***	0.103
	(-4.72)	(8.85)	(0.99)
Debt/Assets	-0.009	-0.899***	-0.358***
	(-1.61)	(-5.75)	(-5.88)
EBITDA/Assets	-0.021	0.085	-0.200
	(-1.48)	(0.28)	(-0.72)
Cash Flow/Assets	0.050***	-0.744***	-0.250
	(3.46)	(-3.02)	(-0.88)
Sales Growth	0.004***	0.043***	0.042***
	(2.97)	(3.90)	(3.84)
Excess Return	-0.000	0.022	-0.009
	(-0.11)	(0.82)	(-0.49)
Excess Volatility	-0.028	1.631	-0.002
	(-0.22)	(1.48)	(-0.00)
Industry Concentration	-0.015***	-0.537***	-0.395***
	(-4.75)	(-9.11)	(-9.12)
Industry & Year Fixed Effects	Yes	Yes	Yes
R^2	0.471	0.891	0.904
Observations	4,296	4,296	4,296

Appendix to "The Downstream Impact of Upstream Tariffs: Evidence from Investment Decisions in Supply Chains"

Variable Definitions

Variable	Definition
Assets	Total assets (at). Source: Compustat.
Average Supplier Tariff Rate	(Gross-flow weighted) average import tariff rate in all supplier industries. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Capex/Assets	Capital expenditures (capx) in year t / total assets (at) at the end of year $t-1$. Source: Compustat.
Capex/Capital Stock	Aggregate capital expenditures in year t / aggregate capital stock at the end of year $t-1$. Source: NBER-CES database.
Cash/Assets	Total cash holdings (che) / total assets (at). Source: Compustat.
Cash Flow/Assets	Income before extraordinary items (ibc) / total assets (at). Source: Compustat.
Customer Integration	(Gross-flow weighted) fraction of supplier industries into which a customer is vertically integrated. Source: Compustat, 1992 BEA input-output table.
Customer Sales Volatility	Standard deviation of a customer's annual sales scaled by the customer's average sales. Demeaned. Source: Compustat.
Debt/Assets	Total long-term and short-term debt (dllt + dlc) / total assets (at). Source: Compustat.
Dividend Payer	Indicator equal to one if a firm pays dividends. Source: Compustat.
Downstream Tariff Reduction	(Gross-flow weighted) fraction of downstream industries that have experienced large tariff reductions in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
EBITDA/Assets	EBITDA (ebitda) / total assets (at). Source: Compustat.
Excess Return	Stock Return ([prcc_f / prcc_f$_{t\text{-}1}$] - 1) - Market Return ([usdval / usdval$_{t\text{-}1}$] - 1). Source: Compustat, CRSP.
Excess Volatility	Yearly standard deviation of daily returns - yearly standard deviation of daily market returns. Source: CRSP.
Growth of Capital Stock	(Aggregate capital stock at the end of year t / aggregate capital stock at the end of year $t-1$) - 1. Source: NBER-CES database.
Industry Concentration	Herfindahl-Hirschman Index (HHI) of sales in a given industry and year. Source: Compustat.
Industry Sales Growth	Growth rate of aggregate sales in a given industry and year. Source: Compustat.
Kaplan-Zingales (KZ) Index	$-1.001909\cdot[(ib+dp)/ppent_{t\text{-}1}]+0.2826389\cdot[(at+csho\cdot prcc\_f-ceq-txdb)/at]+3.139193\cdot[(dltt+dlc)/(dltt+dlc+seq)]-39.3678\cdot[(dvc+dvp/ppent_{t\text{-}1})]-1.314759\cdot[che/ppent_{t\text{-}1}]$. (Formula based on Lamont, Polk, and Saá-Requejo (2001)). Source: Compustat.
Ln(Assets)	Natural logarithm of total assets (at). Source: Compustat.

Variable	Definition
Own Industry Tariff Reduction	Indicator equal to one if the industry has experienced a large tariff reduction in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Post Tariff Reduction	Indicator equal to one if the industry has experienced a large tariff reduction in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Sales Growth	[Sales (sale) in year t / Sales in year t-1] - 1. Source: Compustat.
Shipping Costs	Shipping costs in percent of customs value. Source: Peter Schott's website, Center for International Data at UC Davis,1992 BEA input-output table.
Supplier Specificity	(Gross-flow weighted) fraction of supplier industries whose R&D expenditures scaled by sales are larger than the Compustat median. Source: 1992 BEA input-output table, Compustat.
Supplier Industry Concentration	(Gross-flow weighted) average of the Herfindahl-Hirschman Index (HHI) of sales in upstream industries. Source: Compustat, 1992 BEA input-output table.
Supplier Tariff Increase	(Gross-flow weighted) fraction of supplier industries that have experienced large tariff increases in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Supplier Tariff Reduction	(Gross-flow weighted) fraction of supplier industries that have experienced large tariff reductions in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Supplier Tariff Reduction ($3 \times$ Median Tariff Change)	"Supplier Tariff Reduction" using three times the median (instead of the mean) avg. tariff change as the cutoff defining "large" reductions. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
$\mathbb{1}${Supplier Tariff Reduction} (Important Suppliers Only)	Indicator equal to one if at least one upstream industry supplying at least 10% of the customer industry's inputs has experienced a large tariff reduction in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Supplier Tariff Reduction (Concentrated Supplier Industry)	"Supplier Tariff Reduction" based only on supplier industries whose Herfindahl-Hirschman index of sales is larger than the Compustat median. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.
Supplier Tariff Reduction (Customer Integrated)	"Supplier Tariff Reduction" based only on supplier industries into which a customer is integrated. We consider a customer integrated into a given supplier industry if the customer reports activities in that industry in the Compustat Segments data. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.
Supplier Tariff Reduction (Customer Not Integrated)	"Supplier Tariff Reduction" based only on supplier industries into which a customer is not integrated. We consider a customer not integrated into a given supplier industry if the customer does not report any activity in that industry in the Compustat Segments data.Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.

Variable	Definition
Supplier Tariff Reduction (Specific Input)	"Supplier Tariff Reduction" based only on supplier industries whose R&D expenditures scaled by sales are larger than the Compustat median. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.
Supplier Tariff Reduction (Dispersed Supplier Industry)	"Supplier Tariff Reduction" based only supplier industries whose Herfindahl-Hirschman index of sales is smaller than or equal to the Compustat median. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.
Supplier Tariff Reduction (Generic Input)	"Supplier Tariff Reduction" based only on supplier industries whose R&D expenditures scaled by sales are smaller than or equal to the Compustat median. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.
Tobin's Q	[Total assets (at) - book value of equity (ceq) + market value of equity (chso*prcc_f)] / total assets (at). Source: Compustat.
Whited-Wu (WW) Index	$-0.091 \cdot$ [ibc/at] $- 0.044 \cdot \ln(\text{at}) + 0.102 \cdot$ industry sales growth $- 0.035 \cdot$ sales growth $- 0.062 \cdot$ dividendpayer $+ 0.021 \cdot$ [dltt/at]. (Formula based on Whited and Wu (2006)) Source: Compustat.

Table A.1: Regression Results Using *Ln(Capex)* as the Dependent Variable

This table presents the results for the regressions reported in Table 2 when using *Ln(Capex)* instead of *Capex/At* as the dependent variable. All regressions (variables) are otherwise specified (defined) as in Table 2. *t*-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	Ln(Capex)	Ln(Capex)	Ln(Capex)	Ln(Capex)	Ln(Capex)
Supplier Tariff Reduction	0.223	0.884***	0.760**	0.823***	0.852***
	(0.46)	(3.25)	(2.34)	(3.01)	(3.17)
Supplier Tariff Increase				-3.463**	
				(-2.26)	
Own Industry Tariff Reduction					0.020
					(0.76)
Downstream Tariff Reduction					0.296*
					(1.79)
Ln(Assets)		0.890***	0.889***	0.889***	0.890***
		(64.86)	(64.86)	(64.92)	(64.78)
Tobin's Q		0.128***	0.128***	0.128***	0.128***
		(19.75)	(19.80)	(19.71)	(19.74)
Cash/Assets		-0.280***	-0.278***	-0.279***	-0.281***
		(-4.32)	(-4.27)	(-4.30)	(-4.33)
Debt/Assets		-0.721***	-0.719***	-0.720***	-0.721***
		(-11.95)	(-11.90)	(-11.94)	(-11.95)
EBITDA/Assets		0.805***	0.802***	0.804***	0.805***
		(9.04)	(9.01)	(9.04)	(9.05)
Cash Flow/Assets		0.040	0.043	0.040	0.040
		(0.63)	(0.67)	(0.64)	(0.64)
Sales Growth		0.079***	0.080***	0.079***	0.079***
		(6.60)	(6.61)	(6.60)	(6.59)
Excess Return		0.076***	0.076***	0.076***	0.076***
		(10.11)	(10.09)	(10.12)	(10.10)
Excess Volatility		-5.519***	-5.489***	-5.533***	-5.540***
		(-11.23)	(-11.16)	(-11.28)	(-11.29)
Industry Sales Growth		0.141***	0.143***	0.139***	0.140***
		(4.73)	(4.80)	(4.66)	(4.69)
Industry Concentration		0.063	0.093	0.069	0.064
		(0.85)	(1.25)	(0.93)	(0.86)
Firm & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.869	0.919	0.919	0.919	0.919
Observations	44,590	44590	44,590	44,590	44,590

Table A.2: Regression Results Using Non-Winsorized Variables

This table presents the results for the regressions reported in Table 2 when using non-winsorized variables. *t*-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	Capex/At	Capex/At	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.053***	0.042**	0.065**	0.039*	0.040**
	(2.62)	(2.07)	(2.51)	(1.90)	(1.97)
Supplier Tariff Increase				-0.174*	
				(-1.93)	
Own Industry Tariff Reduction					0.002
					(1.07)
Downstream Tariff Reduction					0.017
					(1.41)
Ln(Assets)		-0.013***	-0.013***	-0.013***	-0.013***
		(-11.58)	(-11.65)	(-11.61)	(-11.58)
Tobin's Q		0.006***	0.006***	0.006***	0.006***
		(10.73)	(10.75)	(10.72)	(10.73)
Cash/Assets		-0.004	-0.003	-0.004	-0.004
		(-0.81)	(-0.78)	(-0.80)	(-0.83)
Debt/Assets		-0.040***	-0.040***	-0.039***	-0.040***
		(-8.10)	(-8.10)	(-8.09)	(-8.10)
EBITDA/Assets		0.026***	0.026***	0.026***	0.026***
		(3.43)	(3.42)	(3.43)	(3.43)
Cash Flow/Assets		-0.001	-0.001	-0.001	-0.001
		(-0.31)	(-0.28)	(-0.30)	(-0.30)
Sales Growth		-0.000**	-0.000**	-0.000**	-0.000**
		(-2.36)	(-2.39)	(-2.37)	(-2.34)
Excess Return		0.001	0.001	0.001	0.001
		(1.56)	(1.56)	(1.56)	(1.56)
Excess Volatility		-0.204***	-0.203***	-0.205***	-0.205***
		(-5.33)	(-5.31)	(-5.34)	(-5.35)
Industry Sales Growth		0.001	0.001	0.001	0.001
		(1.57)	(1.56)	(1.56)	(1.58)
Industry Concentration		0.001	0.003	0.001	0.001
		(0.13)	(0.50)	(0.18)	(0.16)
Firm & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.349	0.388	0.388	0.388	0.388
Observations	44,590	44,590	44,590	44,590	44,590

Table A.3: Regression Results Using Alternative Measures of Tariff Reductions

This table presents coefficient estimates using alternative tariff reduction measures. The sample period is 1974 to 2012. *Supplier Tariff Reduction (3 × Median Tariff Change)* is based on the median (instead of the mean) year-on-year tariff change in an industry. $\mathbb{1}$ *{Supplier Tariff Reduction}(Important Suppliers Only)* is an indicator equal to one if at least one upstream industry supplying at least 10% of a customer industry's total inputs has experienced a large tariff reduction in the past. *Average Supplier Tariff Rate* is the weighted average import tariff rate across supplier industries. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)
Dependent Variable:	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.047***		
(3 × Median Tariff Change)	(2.75)		
$\mathbb{1}$ {Supplier Tariff Reduction}		0.011**	
(Important Suppliers Only)		(2.24)	
Average Supplier Tariff Rate			-0.006*
			(-1.92)
Ln(Assets)	-0.011***	-0.012***	-0.011***
	(-13.01)	(-4.48)	(-13.04)
Tobin's Q	0.007***	0.007***	0.007***
	(15.37)	(2.85)	(15.38)
Cash/Assets	-0.006*	-0.005	-0.006*
	(-1.88)	(-0.39)	(-1.83)
Debt/Assets	-0.038***	-0.029***	-0.038***
	(-11.52)	(-2.70)	(-11.54)
EBITDA/Assets	0.044***	0.103***	0.044***
	(9.62)	(4.98)	(9.63)
Cash Flow/Assets	-0.004	-0.017	-0.004
	(-1.30)	(-1.36)	(-1.31)
Sales Growth	0.004***	0.006***	0.004***
	(5.52)	(2.80)	(5.54)
Excess Return	0.004***	0.007***	0.004***
	(8.90)	(4.44)	(8.90)
Excess Volatility	-0.260***	-0.390***	-0.258***
	(-10.39)	(-4.47)	(-10.33)
Industry Sales Growth	0.010***	0.006	0.010***
	(5.17)	(1.30)	(5.20)
Industry Concentration	0.002	-0.024**	0.002
	(0.57)	(-2.46)	(0.54)
Firm & Year Fixed Effects	Yes	Yes	Yes
R^2	0.475	0.464	0.475
Observations	44,590	5,661	44,590

Table A.4: Regression Results Using Alternative Clustering Levels

This table presents the key coefficient estimates reported in Table 2 and the associated t-statistics for alternative clustering levels (in parentheses). The first t-statistic reported under each coefficient estimate is based on standard errors that are clustered by (SIC4-)industry×year. The second t-statistic is based on standard errors that are clustered by firm. The third is based on standard errors that are clustered in two ways, by firm and by year. The fourth is based on standard errors that are clustered by (SIC4-)industry. The fifth is based on standard errors that are clustered in two ways, by (SIC4-)industry and by year. All regressions are specified as in Table 2. We only report the key coefficients and the associated t-statistics to conserve space. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	Capex/At	Capex/At	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.055	0.042	0.054	0.04	0.041
(Cluster: Industry×Year)	(4.31)***	(3.64)***	(3.71)***	(3.43)***	(3.52)***
(Cluster: Firm)	(3.12)***	(2.42)**	(2.42)**	(2.28)**	(2.32)**
(Cluster: Firm & Year)	(2.97)***	(2.41)**	(2.43)**	(2.29)**	(2.30)**
(Cluster: Industry)	(2.42)**	(1.90)*	(2.47)**	(1.79)*	(1.78)*
(Cluster: Industry & Year)	(2.47)**	(1.99)*	(2.59)**	(1.87)*	(1.84)*
Supplier Tariff Increase				-0.115	
(Cluster: Industry×Year)				(-2.35)**	
(Cluster: Firm)				(-1.50)	
(Cluster: Firm & Year)				(-1.39)	
(Cluster: Industry)				(-1.44)	
(Cluster: Industry & Year)				(-1.39)	
Own Industry Tariff Reduction					0.002
(Cluster: Industry×Year)					(1.36)
(Cluster: Firm)					(1.08)
(Cluster: Firm & Year)					(0.96)
(Cluster: Industry)					(0.99)
(Cluster: Industry & Year)					(0.94)
Downstream Tariff Reduction					0.014
(Cluster: Industry×Year)					(2.02)**
(Cluster: Firm)					(1.35)
(Cluster: Firm & Year)					(1.15)
(Cluster: Industry)					(0.77)
(Cluster: Industry & Year)					(0.74)
Control Variables	No	Yes	Yes	Yes	Yes
Firm & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.417	0.475	0.475	0.475	0.475
Observations	44,590	44,590	44,590	44,590	44,590

Managerial Ownership Changes and Mutual Fund Performance✧

Thorsten Martin, and Florian Sonnenburg*

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ABSTRACT

We study the dynamics of fund manager ownership for a sample of U.S. equity mutual funds from 2005 to 2011. We find that ownership changes positively predict changes in future risk-adjusted fund performance. A one-standard-deviation increase in ownership predicts a 1.6 percent increase in alpha in the following year. Fund managers who are required to increase their ownership by fund family policy show the strongest increase in alpha. They do so by increasing their trading activity in line with the view that higher ownership aligns interests of managers with those of shareholders and induces higher effort.

JEL classification: G11, G14, G20, G23

Keywords: Mutual Funds, Fund Manager Ownership Changes, Fund Performance Predictability, Incentive Alignment, Superior Information

*Thorsten Martin is from the Department of Finance, HEC Paris, France. Email: thorsten.martin@hec.edu. Florian Sonnenburg is from the Department of Finance and Centre for Financial Research (CFR), University of Cologne, Germany. Email: sonnenburg@wiso.uni-koeln.de.
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1 Introduction

Since March 2005, mutual funds have to report fund managers' ownership within the Statement of Additional Information (SAI) using broad ownership ranges. By using one year of ownership data, Khorana, Servaes, and Wedge (2007) and Evans (2008) show that the *level* of ownership predicts future risk-adjusted performance. Since then, more and more fund investors are paying attention to manager ownership (see, e.g., Ma and Tang (2014)) and some mutual fund families adopted policies which require their managers to hold ownership in the funds they manage.[1] This raises the question if the increased attention to managerial ownership and the implementation of ownership requirements by fund families is warranted. Does managerial ownership provide valuable information about future fund performance or is the observed cross-sectional correlation driven by unobserved fund characteristics? Does ownership align incentives and can ownership requirements therefore be used to increase performance? Or do managers have superior information about future fund performance and choose to invest in funds which they know will perform better in the future? Given the nature of their cross-sectional data, these early studies are unable to answer these questions.

We fill this gap in the literature by examining the relationship between ownership *changes* and *changes* in future risk-adjusted fund performance using a hand-collected panel data set on mutual fund manager ownership. Examining ownership changes has two advantages in our setting. First, we are able to eliminate any heterogeneity bias stemming from time-invariant unobserved fund characteristics. For instance, funds differ in the degree of managerial discretion in making investment decisions. This managerial discretion may lead to higher fund returns on average, but exposes the fund investor to greater risk of moral

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[1] See "Another Way to Assess a Mutual Fund" in *The Wall Street Journal MarketWatch* (26/07/2006) and "Fund Managers: Betting their own money" in the *Bloomberg BusinessWeek* (14/01/2010). Both articles report that some mutual fund companies have started requiring their managers to invest in the funds they manage including Franklin Templeton Investments, Janus Capital Group, and T. Rowe Price.

hazard (see, e.g., Chen, Goldstein, and Jiang (2008)) and thus increases the optimal level of ownership.[2] Therefore, unobservable differences in managerial discretion may bias the ownership coefficient upwards. If managerial discretion is relatively stable within funds over time, we are able to eliminate this bias by using a first-difference approach. Moreover, we control for changes in a host of fund, board and family characteristics as well as predictors of fund performance which have been recently proposed by the literature.

Second, the cross-sectional studies are unable to examine whether the positive relationship between ownership levels and performance reflects fund managers' superior information about future fund performance or better alignment of fund managers' and shareholders' interests. We use changes in ownership mandated by family policy to disentangle the superior information and the incentive alignment hypotheses. The idea is that family mandated changes unlikely reflect a fund manager's information about future fund performance. If the positive relationship between manager ownership and fund performance reflects fund manager's superior information about future fund performance, we do not expect that ownership changes which are mandated by the fund family increase fund performance. If on the other hand manager ownership aligns the fund manager's interests with those of shareholders, we expect ownership changes to have a causal effect on performance even if the change is required by the fund family.

Using a hand-collected dataset on managerial ownership for a sample of single managed U.S. domestic equity mutual funds over the period from 2005 to 2011, we find that ownership changes are positively related to changes in future risk-adjusted fund performance no matter whether we measure performance as Fama and French (1993) three-factor alpha,

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[2] For example, Chen, Desai, and Krishnamurthy (2013) show that short-selling mutual funds outperform benchmarks by 1.5% per year. Consider a fund manager running two identical funds, but one is short-selling restricted and the other is not. From an optimal contracting perspective the manager should own more in the unrestricted fund as his ability to take actions against the interests of shareholders is greater. If this is the case, this creates a positive correlation between ownership and performance in the cross-section if short-selling restrictions are not controlled for.

Carhart (1997) four-factor alpha, or Pástor and Stambaugh (2003) five-factor alpha. The relation between increases in ownership and increases in future risk-adjusted fund performance is also economically significant: a one-standard-deviation increase in ownership leads to an increase in alpha between 1.1 percentage points for the Carhart (1997) four-factor alpha and 1.6 percentage points for the Pástor and Stambaugh (2003) five-factor alpha. This result stands several robustness tests regarding the construction of our ownership measure.

Next, we control for other predictors of fund performance. Recent studies show that the level of ownership (Khorana, Servaes, and Wedge (2007) and Evans (2008)), the industry concentration (Kacperczyk, Sialm, and Zheng (2005)), return gap (Kacperczyk, Sialm, and Zheng (2008)), active share (Cremers and Petajisto (2009), and Petajisto (2013)) and a fund's R^2 with respect to its benchmark (Amihud and Goyenko (2013)) predict future fund performance. We find that ownership changes are highly significant predictors of changes in future risk-adjusted fund performance even after controlling for the lagged level of ownership as well as changes in industry concentration, active share, return gap and R^2. A one-standard-deviation increase in ownership predicts an increase in risk-adjusted performance of up to 1.6 percentage points.

We then analyze whether the documented positive relation between ownership changes and changes in risk-adjusted performance is due to *incentive alignment* or due to *superior information*. To disentangle these two hypotheses, we use the adoption of fund family policies requiring managers to hold some ownership in all funds they manage. We proxy for such a policy by using the ownership information we observe. If in a given year and fund family at least one fund has zero ownership, we define that the fund family has no strict ownership requirement in place. Contrary, if all funds within a given fund family have ownership greater than zero in a given year, we define that the family has a strict ownership requirement in place.

We find that future risk-adjusted performance increases even stronger with ownership when managers increase their ownership simultaneously to the adoption of a new family policy which requires managers to hold some ownership in their funds. A one-standard-deviation ownership increase simultaneous to the adoption of an ownership requirement by the family increases alpha between 0.4 and 0.5 percentage points more than other ownership increases. As these changes are most likely not driven by fund managers' superior information about future fund performance, these results support the view that ownership aligns interests of fund manager's and shareholders and causally affects fund performance. One possibility is that mandatory ownership increases induce the manager to exert more effort to seek out profitable investment opportunities. In line with this view, we find that mandatory ownership changes strongly predict future changes in trading activity. Managers who increase ownership simultaneously to the adoption of a family wide ownership requirement increase their active share, turnover, unobserved actions and their equity holdings and decrease their cash holdings.

The paper contributes to three main strands of the literature. First, our paper relates to the growing literature on mutual fund governance. Several studies suggest that a fund's governance is significantly improved if more independent directors are on the board or if independent directors have a higher ownership in the fund and thus a higher motivation to effectively monitor the fund (see, e.g., Tufano and Sevick (1997), Ferris and Yan (2007), Khorana, Tufano, and Wedge (2007), Cremers, et al. (2009), and Ding and Wermers (2012). More related to our study, Khorana, Servaes, and Wedge (2007) and Evans (2008) show in their cross-sectional analysis that managers with higher levels of ownership have better future fund performance. Our study contributes to this literature in two ways. To begin with, we are the first who use panel data on managerial ownership. Therefore we are able to rule out that any unobservable fund, manager or family fixed effects lead to a spurious correlation between ownership and performance. Our second contribution to this literature is that we are able to disentangle the *superior information* and *incentive alignment hypotheses* and we find support for the latter.

Second, our paper is related to a growing body of literature that analyzes managerial incentives in the mutual fund industry. Several studies look at the relationship between fund managers' incentives and their risk-taking behavior arising from the convex flow-performance relation (e.g., Brown, Harlow, and Starks (1996), Chevalier and Ellison (1997), Koski and Pontiff (1999), Kempf and Ruenzi (2008) , Kempf, Ruenzi, and Thiele (2009), and Schwarz (2011)). Another strand of this literature analyzes the link between advisory fee contracts and performance (e.g., Elton, Gruber, and Blake (2003), Dass, Massa, and Patgiri (2008), and Massa and Patgiri (2009)). In a recent paper, Ma, Tang, and Gómez (2015) show that fund managers with explicit performance-based incentives perform better. We complement this literature by showing that fund manager ownership can act as an explicit incentive tool to align managers' and shareholders' interests.

Third, our paper relates to the vast literature of managerial ownership in corporations. We find that ownership changes which are mandated by the fund family increase fund performance and therefore contribute to the controversy if manager ownership can be used to change firm value (see, e.g. Himmelberg, Hubbard, and Palia (1999), Zhou (2001) , and Fahlenbrach and Stulz (2009)).

The rest of the paper proceeds as follows. Section 2 describes the data and compares our sample to the CRSP universe of mutual funds. In Section 3, we analyze the relation between ownership changes and changes in future risk-adjusted performance. In section 4, we examine if the results are robust to controlling for changes in other predictors of fund performance. In section 5 we explore how ownership changes due to fund family policy rather than personal portfolio decisions affect performance and Section 6 concludes.

2 Data and summary statistics

For our empirical analysis, we use data from three sources: (1) the Center for Research in Security Prices (CSRP) Survivor-Bias Free US Mutual Fund Database[3], (2) Thomson Financial Mutual Fund Holdings Database and (3) mutual funds' Statement of Additional Information (SAI) filed with the SEC.

From the CRSP Survivor-Bias Free Mutual Fund Database we gather information on mutual funds' monthly returns, total net assets, and other fund characteristics. We focus on single actively managed, domestic equity funds with no manager replacements during our sample period and exclude bond funds and international funds as well as index funds. We use the Lipper objective code to define a fund's investment objective. We aggregate the Lipper segments into seven broad categories: Aggressive Growth, Growth and Income, Income, Growth, Sector Funds, Utility Funds, and Mid-Cap Funds. Many funds offer multiple share classes which are listed as separate entries in the CRSP database. As these share classes are backed up by the same portfolio, we aggregate all share classes at the fund level to avoid multiple counting.

We match the CRSP funds to the Thomson Financial Mutual Fund Holdings Database using MFLINKS tables. Our last data source is the mutual funds' SAI (in SEC filings 485APOS and 485BPOS), which are Part B of the mutual fund's prospectus. The data from the SEC filings 485APOS and 485BPOS can be downloaded in text files from SEC EDGAR. We match these files with the CRSP data using the fund's name, also accounting for the fact that the fund name often differs from the filer name under which a mutual fund discloses its filings with the SEC or that the filings 485APOS and 485BPOS may contain SAI from multiple funds. The SAI reports detailed information on each portfolio manager's ownership in the fund. The ownership is reported in seven ranges: None; \$1–\$10,000; \$10,001–\$50,000;

[3] Source: CRSP, Center for Research in Security Prices. Graduate School of Business, The University of Chicago. Used with permission.

$50,001–$100,000, $100,001–$500,000, $500,001–$1,000,000, or over $1,000,000. We convert these ownership ranges into dollar amounts using the bottom of each range.

We build two ownership measures: (1) We construct a yearly percentage ownership measure by dividing the converted dollar amount by a fund's year–end total net assets (TNA) as suggested by the existing literature studying the impact of ownership on firm value going back to Jensen and Meckling (1976). (2) We define ownership changes as the difference between fund managers' current and lagged percentage ownership. To control for commonly used board characteristics, we further collect the following board information from the SEC files: Name of director, and whether the director is interested or independent as defined in the Investment Company Act (ICA). Our data cover 2,196 fund-year observations over the period 2005-2011.

Table 1 compares the summary statistics of our sample to the CRSP mutual fund universe with respect to the funds' total net assets (TNA), fund families' total net assets (Family TNA), funds' flows, the turnover ratio of the fund, and the Pástor and Stambaugh (2003) five-factor alpha. Table 1 also provides summary statistics on the board and ownership measures for our sample of funds, namely the funds' board size, the fraction of independent directors on the board, the level of ownership and the change in ownership.

– Please insert TABLE 1 approximately here –

The sample comparison shows that our sample funds are larger and belong to larger families. They also have slightly higher turnover and attract more flows. These differences are likely due to our sample selection criteria as we exclude team-managed funds as well as funds with manager changes to prevent that group dynamics or manager replacements drive the results. Further, as we are interested in manager ownership changes, we exclude funds without at least two consecutive years in the sample. The average fund in our sample has managerial ownership of 0.52 percent of the fund's TNA and changes it on average by 0.05 percent per year.

3 Ownership changes and changes in future fund performance

In this section we analyze the relation between ownership changes and changes in future risk-adjusted performance (Section 3.1). We check the robustness of our results in Section 3.2.

3.1 Main results

To examine the relation between ownership changes and changes in future risk-adjusted performance, we use three different performance measures: (1) Fama and French (1993) three-factor alpha, (2) Carhart (1997) four-factor alpha, and (3) Pástor and Stambaugh (2003) five-factor alpha. The alpha measures are determined based on a yearly estimation of the respective factor models. We calculate the performance measures based on gross returns as gross returns better reflect the quality of the investment decisions of the fund manager. To calculate a fund's gross return, we divide a fund's yearly expense ratio by twelve and add it to the fund's monthly net return observations.

We conduct first-difference regressions and use the change in the annualized performance measures from *t-1* to *t* as dependent variable $(\Delta Performance)$ in these regressions:

$$\begin{aligned}\Delta \text{Performance}_{i,t} = {} & \alpha + \beta \Delta \text{Ownership}_{i,t-1} \\ & + \gamma_1 \Delta \ln(\text{FundSize}_{i,t-1}) + \gamma_2 \Delta \text{Turnover}_{i,t-1} + \gamma_3 \Delta \ln(\text{FamilySize}_{i,t-1}) \\ & + \Phi_1 \Delta \text{BoardSize}_{i,t-1} + \Phi_2 \Delta \text{IndepDirectors}_{i,t-1} + \varepsilon_{i,t}\end{aligned} \quad (1)$$

Our main independent variable is the change in managerial ownership form year *t-2* to *t-1* $(\Delta Ownership)$. We add further variables to control for changes in fund, fund family, and governance characteristics. All of these changes are also measured from *t-2* to *t-1*. At the fund level, we add changes in the logarithm of the fund's size $(\Delta FundSize)$, and the fund's yearly turnover ratio $(\Delta Turnover)$ as control variables to the regressions. At the fund family level, we control for changes in the logarithm of the fund family's size $(\Delta FamilySize)$. The governance controls include changes in the fund's board size $(\Delta BoardSize)$ as well as changes in the fraction of independent directors on the board $(\Delta IndepDirectors)$. To control for any unobservable time or segment effects that could equally affect all funds in a given year or a particular market segment, respectively, we also include time and segment fixed effects in all regressions. We cluster the standard errors at the fund level. Table 2 presents the results.

– Please insert TABLE 2 approximately here –

The results clearly show that ownership changes are positively related to changes in future risk-adjusted performance. The coefficient of ownership changes is positive and significant at the 1%-level in all specifications. The effect is not only statistically but also economically significant: For example, when Pástor and Stambaugh (2003) five-factor alpha is used as performance measure, an increase in ownership by one-standard-deviation (0.02935) predicts a 1.6 percent higher alpha (= 0.02935 × 0.5311), after taking all control variables into account .The other control variables have no notable consistent impact on future risk-adjusted performance.

Overall, the results from this section provide evidence that the observed cross-sectional correlation between ownership and future fund performance is not stemming from a heterogeneity bias due to unobserved time-invariant fund characteristics.

3.2 Robustness

In this section we conduct additional tests to check that the positive effect of ownership changes on changes in future risk-adjusted performance is robust. The results from these tests are reported in Table 3.

– Please insert TABLE 3 approximately here –

Thus far, we have converted the bottom of each reported dollar range into dollar amounts. We now convert the reported dollar ranges into dollar amounts by assuming that the midpoint of the reported interval is always invested, except for ownership levels above $1 million, where we employ the bottom of the range. The results shown in Panel A remain similar: Ownership changes are positively associated with changes in future risk-adjusted performance.

In Panel B, we conduct a test to see whether our documented effect is driven by changes in the denominator of our ownership change measure. We replace our ownership change measure by a placebo ownership change measure. The nominator of this placebo ownership change measure takes on the mean dollar ownership in the sample for all funds and years whereas the denominator remains the fund size. Thus, all variation in this ownership change measure stems from variation in the denominator. We employ this measure in our first-difference regressions and do not find a significant effect on changes in future risk-adjusted performance. This implies that the positive relation between ownership changes and changes in future risk-adjusted performance is not simply driven by changes in the denominator of the ownership change measure.

In Panel C, we additionally control for changes in fund flows. Although we control for changes in fund size, one might argue that the denominator of our ownership change measure is driven by changes in fund flows. Panel C shows that our main results do not change when controlling for changes in fund flows: Ownership changes are positively related to changes in risk-adjusted performance even after controlling for fund flows.

Finally, we split our sample into small and large funds using the median fund size in the sample as cut-off. As we are using changes in percentage ownership as our main independent variable, the results could be driven by small funds as a given dollar ownership change leads to a larger percentage ownership change for small funds. The results from Panel D show that the observed effect of ownership on performance is not driven by small funds. Ownership changes predict future changes in performance for both small and large funds. The economic magnitude of the effect is even bigger for large funds. Given that the standard deviation of ownership changes for large funds (small funds) is 0.00053 (0.03913), a one-standard-deviation increase in percentage ownership of a large fund leads to an increase in risk-adjusted performance up to 2.0 percentage points (= 0.00053 × 37.156), compared to an increase in risk-adjusted performance up to 1.5 percentage points (= 0.03913 × 0.3867) for small funds.

Taken together, the findings in this section show that the baseline result of a positive impact of ownership changes on changes in risk-adjusted performance is robust to (1) using the midrange of the reported ownership range, (2) is not driven by changes in the denominator of the ownership measure, (3) is not driven by changes in fund flows, and (4) is not solely driven by small funds.

4 Ownership changes and other predictors of future fund performance

Having identified a robust measure to predict changes in future risk-adjusted performance, we now examine whether our measure survives after controlling for other existing measures to predict future performance.

In this context, Khorana, Servaes, and Wedge (2007) and Evans (2008), both provide evidence that the level of ownership is positively associated with superior future performance. Besides that, a growing body of literature uses holdings data of mutual funds to create performance predictability measures. Kacperczyk, Sialm, and Zheng (2005) develop the industry concentration index (ICI) and show that a high industry concentration is positively associated with future fund performance. Kacperczyk, Sialm, and Zheng (2008) use the return gap (RG) defined as the difference between the reported fund return and the return predicted from the previously disclosed fund holdings to measure unobserved actions by mutual fund managers. They find a positive correlation between the return gap (RG) and future fund performance. Cremers and Petajisto (2009) and Petajisto (2013) measure a fund's active share (AS) as the extent to which a manager deviates from her benchmark and find that active share positively predicts future fund performance. Finally, without using holdings data, Amihud and Goyenko (2013) show that a fund's R^2 with respect to its benchmark positively predicts performance.

To test if changes in ownership survive as performance predictability measure, we now additionally control for the lagged level of ownership and changes in industry concentration (ICI), return gap (RG), active share (AS) and R^2 in our regressions.

To compute the industry concentration index (ICI), we first sort all stocks into ten industries following Kacperczyk, Sialm, and Zheng (2005) and then calculate the weight for a specific industry in a portfolio by summing up the portfolio weights of all stocks belonging to that industry. The sum of the squared industry weights (averaged across the quarters of a year) is then used as a measure of industry concentration.

To calculate the return gap, we follow Kacperczyk, Sialm, and Zheng (2008) by comparing the realized fund returns with holding-based fund returns. The latter is a hypothetical portfolio that invests in the previously disclosed fund holdings. We then compound the monthly return gap observations to come up with a yearly measure.

We use the active share database of Cremers and Petajisto (2009) and Petajisto (2013).[4] The active share is calculated as the absolute difference between the portfolio weight of a stock and the stock's weight in the respective benchmark, summed over all positions of the stock universe and divided by two.

To compute the R^2 measure of Amihud and Goyenko (2013), we first run yearly regressions of fund's monthly excess returns on the Carhart (1997) four factors. We then obtain the fund's R^2 from these regressions.

We add these other performance predictors to our baseline regressions from Section 3.1. The control variables are the same as in (1). We again control for time and segment fixed effects in the regressions. Standard errors are clustered at the fund level. For the sake of brevity we report only the results for the changes in ownership as well as for the lagged level of ownership and the changes in the other performance predictors. Results are provided in Table 4.

– Please insert TABLE 4 approximately here –

The ownership change measure is positive and significant at the 1% level for the three-factor and five-factor alpha (and at the 5%-level for the four-factor alpha). The effect is also economically significant: After controlling for the alternative predictors of fund performance, we still find an economically meaningful effect of ownership changes on changes in future risk-adjusted performance. A one-standard-deviation increase in ownership leads to an increase in four-factor alpha of 0.9 percentage points (= 0.02935 × 0.3055) and an increase in five-factor alpha of 1.6 percentage points (= 0.02935 × 0.5323). Of the alternative predictors

4 We downloaded the active share data from Antti Petajisto's website at http://www.petajisto.net/data.html.

only changes in return gap are significantly negatively related to changes in future fund performance. The standard deviation of return gap is 0.03906. Thus, the estimated slope of -0.5725 based on five-factor alpha implies that a one-standard-deviation increase in return gap translates to a decrease of 2.2 percentage points (= 0.03906 × -0.5725) in five-factor alpha.

Overall, the results from this section clearly show that ownership changes predict future risk-adjusted performance even after controlling for existing predictors of fund performance.

5 Changes in ownership induced by family policies

The results so far indicate that the cross-sectional correlation between managerial ownership and fund performance is not merely driven by unobserved time-invariant fund, manager or family characteristics. We now turn to the question whether the positive correlation is driven by incentive alignment or superior information. Under the *superior information hypothesis* managers increase their ownership in funds because they know these funds will perform better in the future. Under the *incentive alignment hypothesis*, managerial ownership aligns the manager's interests with those of fund shareholders leading to better investment decisions resulting in better performance.

We use the adoption of fund family policies requiring managers to hold some ownership in all funds they manage to disentangle the *superior information hypothesis* from the *incentive alignment hypothesis*. The idea is to capture ownership changes which are mandated by the fund family and thus do not reflect the manager's information. Under the *superior information hypothesis*, we expect that these mandatory ownership changes are not related to future changes in fund performance. Under the *incentive alignment hypothesis* however, ownership leads to aligned incentives regardless if the change in ownership is mandatory or voluntary. Therefore we expect mandatory and voluntary ownership changes to be positively related to future changes in fund performance under the incentive alignment hypothesis.

We construct a dummy variable for fund family policy changes which takes on the value one if the fund family did not have an ownership requirement in place in the past year and has such a requirement in place this year, and zero otherwise. As we cannot directly observe if such a family policy is in place, we proxy for it by using the ownership information we observe. If in a given year and fund family at least one fund has zero ownership, we define that in this fund family and year no strict ownership requirement is in place. If on the other hand, in a given year and fund family all funds in the family have ownership greater than zero, we define that in this fund family and year a strict ownership requirement is in place. We then interact the fund family policy change dummy with the ownership change measure and run first-difference regressions using the change in the respective performance measure as dependent variable. Other control variables are the same as in (1). We again control for time and segment fixed effects in the regressions and cluster standard errors at the fund level. For the sake of brevity we report only the results for the ownership change measure, the family policy change dummy and the interaction between both. The results are shown in Table 5.

– Please insert TABLE 5 approximately here –

We find that both the change in the ownership measure as well as the interaction of this change with the fund family policy change dummy strongly predict future changes in risk-adjusted performance. Given that the standard deviation of ownership changes within the family policy change group is 0.00054 , a one-standard-deviation increase of funds where the family adopted an ownership requirement increases future alpha by 0.4 percentage points (= 0.00054 × 7.2716 (estimated slope for the five-factor alpha)) to 0.6 percentage points ((= 0.00054 × 11.8349 (estimated slope for the three-factor alpha)) more than for all other funds.

This leads to an overall effect of up to 1.6 percentage points based on five-factor alpha (= 0.02935 × 0.4269 + 0.00054 × 7.2716). These results support the *incentive alignment hypothesis*: Ownership has an even stronger effect on performance if the changes are mandated by the fund family.

Next we examine where this performance effect stems from. One possible explanation is that fund managers who are required by their fund family to start holding some ownership in the funds they manage subsequently exert more effort in seeking out profitable investment opportunities. If this is the case, we expect to observe increased activity by these fund managers. In Table 6 we employ the same setup as in Table 5, using changes in the fund's active share, turnover, return gap, as well as cash and equity holdings as dependent variables.[5]

– Please insert TABLE 6 approximately here –

Table 6 shows that the interaction terms have the expected sign: A one standard deviation increase in percentage ownership concurrent to the adoption of an ownership requirement by the fund family increases active share by 0.09 percentage points (= 0.00054 × 1.6869), a fund's turnover by 1.23 percentage points (= 0.00054 × 22.8426), return gap by 0.45 percentage points (= 0.00054 × 8.3254) and equity holdings by 0.48 percentage points (= 0.00054 × 8.8644), whereas cash holdings decrease by 0.63 percentage points (= 0.00054 × -11.3762). The results reinforce the *incentive alignment hypothesis*: Ownership increases by funds when their families adopt ownership requirements significantly predict higher trading activity.

Taking all results of Section 5 together, we interpret them as supporting the view that managerial ownership aligns interests of managers with those of shareholders and induces managers to exert more effort.

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[5] We measure cash (equity) holdings as reported cash (equity) from CRSP.

6 Conclusion

In response to a number of scandals in the mutual fund industry, the Securities and Exchange Commission (SEC) adopted new disclosure requirements for mutual funds in 2004. Since March 2005, mutual fund managers are required to report their ownership in the funds they manage.

In contrast to earlier studies, we investigate the relationship between managerial ownership and fund performance dynamically. We find that managerial ownership changes are positively related to future changes in risk-adjusted fund performance. We show that this effect is robust to using the mid range instead of the minimum range of the reported dollar range and the results are not driven by changes in the denominator of our ownership measure or by small funds. We further show that our results hold even after controlling for the lagged level of ownership and changes in holdings-based predictors of future fund performance and a fund's R^2. Thus, the relationship between ownership changes and future risk-adjusted performance is robust to controlling for existing predictability measures.

Using family ownership requirements, we disentangle the *superior information* and *incentive alignment hypotheses*: Contrary to the superior information hypothesis and in line with incentive alignment we find that ownership changes which are induced by family policies predict changes in future fund performance even better. Funds that are required to increase their ownership are associated with an increase in alpha by up to 1.6 percent per standard deviation of ownership increase. They do so by increasing their active share, turnover, unobserved actions, equity holdings and by decreasing their cash holdings.

Altogether, this study provides evidence that managerial ownership is an important tool to align manager interests with those of shareholders.

REFERENCES

Amihud, Yakov, and Ruslan Goyenko, 2013, Mutual Fund's R2 as Predictor of Performance, *Review of Financial Studies* 26, 667-694.

Bloomberg, BusinessWeek, 2010, Fund Managers: Betting Their Own Money.

Brown, Keith C., W. V. Harlow, and Laura T. Starks, 1996, Of Tournaments and Temptations: An Analysis of Managerial Incentives in the Mutual Fund Industry, *Journal of Finance* 51, 85 - 110.

Carhart, Mark M., 1997, On Persistence in Mutual Fund Performance, *Journal of Finance* 52, 57-82.

Chen, Honghui, Hemang Desai, and Srinivasan Krishnamurthy, 2013, A First Look at Mutual Funds That Use Short Sales, *Journal of Financial And Quantitative Analysis* 48, 761-787.

Chen, Qi, Itay Goldstein, and Wei Jiang, 2008, Directors' Ownership in the U.S. Mutual Fund Industry, *Journal of Finance* 63, 2629-2677.

Chevalier, Judith, and Glenn Ellison, 1997, Risk Taking by Mutual Funds as a Response to Incentives, *Journal of Political Economy* 105, 1167-1200.

Cremers, K. J. Martijn, and Antti Petajisto, 2009, How Active Is Your Fund Manager? A New Measure That Predicts Performance, *Review of Financial Studies* 22, 3329-3365.

Cremers, Martijn, Joost Driessen, Pascal Maenhout, and David Weinbaum, 2009, Does Skin in the Game Matter? Director Incentives and Governance in the Mutual Fund Industry, *Journal of Financial And Quantitative Analysis* 44, 1345-1373.

Dass, Nishant, Massimo Massa, and Rajdeep Patgiri, 2008, Mutual Funds and Bubbles: The Surprising Role of Contractual Incentives, *Review of Financial Studies* 21, 51-99.

Ding, Bill, and Russ Wermers, 2012, Mutual Fund Performance and Governance Structure: The Role of Portfolio Managers and Boards of Directors, Working Paper.

Elton, Edwin J., Martin J. Gruber, and Christopher R. Blake, 2003, Incentive Fees and Mutual Funds, *Journal of Finance* 58, 779-804.

Evans, Allison L., 2008, Portfolio Manager Ownership and Mutual Fund Performance, *Financial Management* 37, 513-534.

Fahlenbrach, Rüdiger, and René M. Stulz, 2009, Managerial Ownership Dynamics and Firm Value, *Journal of Financial Economics* 92, 342-361.

Fama, Eugene F., and Kenneth R. French, 1993, Common Risk Factors in the Returns on Stocks and Bonds, *Journal of Financial Economics* 33, 3-56.

Ferris, Stephen P., and Xuemin Yan, 2007, Do Independent Directors and Chairmen Really Matter? The Role of Boards of Directors in Mutual Fund Governance, *Journal of Corporate Finance* 13, 392-420.

Himmelberg, Charles P., Glenn R. Hubbard, and Darius Palia, 1999, Understanding the Determinants of Managerial Ownership and the Link Between Ownership and Performance, *Journal of Financial Economics* 53, 353-384.

Jensen, Michael C., and William H. Meckling, 1976, Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure, *Journal of Financial Economics* 3, 305-360.

Kacperczyk, Marcin, Clemens Sialm, and Lu Zheng, 2005, On the Industry Concentration of Actively Managed Equity Mutual Funds, *Journal of Finance* 60, 1983-2011.

Kacperczyk, Marcin T., Clemens Sialm, and Lu Zheng, 2008, Unobserved Actions of Mutual Funds, *Review of Financial Studies* 21, 2379-2416.

Kempf, Alexander, and Stefan Ruenzi, 2008, Tournaments in Mutual-Fund Families, *Review of Financial Studies* 21, 1013-1036.

Kempf, Alexander, Stefan Ruenzi, and Tanja Thiele, 2009, Employment Risk, Compensation Incentives, and Managerial Risk Taking: Evidence from the Mutual Fund Industry, *Journal of Financial Economics* 92, 92-108.
Khorana, Ajay, Henri Servaes, and Lei Wedge, 2007, Portfolio Manager Ownership and Fund Performance, *Journal of Financial Economics* 85, 179-204.
Khorana, Ajay, Peter Tufano, and Lei Wedge, 2007, Board Structure, Mergers and Shareholder Wealth: A Study of the Mutual Fund Industry, *Journal of Financial Economics* 85, 571-598.
Koski, Jennifer, and Jeffrey Pontiff, 1999, How Are Derivatives Used? Evidence from the Mutual Fund Industry, *Journal of Finance Research Letters* 54, 791-816.
Laise, Eleanor, 2006, Another Way to Assess a Mutual Fund: Evidence Mounts That Performance Improves When Managers Invest in Their Own Portfolios, The Wall Street Journal.
Ma, Linlin, and Yuehua Tang, 2014, Portfolio Manager Ownership and Mutual Fund Risk Taking, Working Paper.
Ma, Linlin, Yuehua Tang, and Juan-Pedro Gómez, 2015, Portfolio Manager Compensation in the U.S. Mutual Fund Industry, Working Paper.
Massa, Massimo, and Rajdeep Patgiri, 2009, Incentives and Mutual Fund Performance: Higher Performance or Just Higher Risk Taking?, *Review of Financial Studies* 22, 1777-1815.
Pástor, Luboš, and Robert F. Stambaugh, 2003, Liquidity Risk and Expected Stock Returns, *Journal of Political Economy* 111, 642 - 685.
Petajisto, Antti, 2013, Active Share and Mutual Fund Performance, *Financial Analysts Journal* 69, 73-93.
Schwarz, Christopher G., 2011, Mutual Fund Tournaments: The Sorting Bias and New Evidence, *Review of Financial Studies*.
Tufano, Peter, and Matthew Sevick, 1997, Board Structure and Fee-Setting in the U.S. Mutual Fund Industry, *Journal of Financial Economics* 46, 321-355.
Zhou, Xianming, 2001, Understanding the Determinants of Managerial Ownership and the Link between Ownership and Performance: Comment, *Journal of Financial Economics* 62, 559-571.

Table 1 – Descriptive statistics

This table reports summary statistics for our sample of single-managed US equity mutual funds between 2005 and 2011 compared to the CRSP universe. We report mean and median differences for both samples for the following variables: fund size as measured by the total net assets in million USD, the fund turnover (in %), the fund flows (in %), the fund family size calculated as the total net assets of all team- and single-managed mutual funds in the family, and the Pástor and Stambaugh (2003) five-factor alpha. As the board characteristics and ownership measures are not available for the CRSP universe (denoted as n/a), we only report means and medians for the following variables for our sample: the fund board size, the fraction of independent directors on the board, the fund manager ownership level (in % of TNA), and the fund manager ownership change (in %) defined as the difference between the current percentage ownership and the lagged percentage ownership. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively, for the difference in means and medians between both samples (based on t-tests and Mann-Whitney-Wilcoxon rank-sum tests).

	Mean			Median		
	Sample	CRSP Universe	Difference	Sample	CRSP Universe	Difference
Fund and family characteristics:						
Fund size	1,758.04	1,005.42	752.62***	299.05	205.15	93.90***
Turnover (%)	92.97	90.30	2.67	64.00	64.00	0.00
Fund flows (%)	9.62	7.08	2.53*	-5.24	-6.89	1.64***
Family size	88,199.48	32,076.07	56,123.41***	7,070.10	5,280.60	1,789.50***
5 factor alpha (%)	0.64	0.95	-0.31	0.87	1.02	-0.16
Board characteristics:						
Board size	8.00	n/a	n/a	8.00	n/a	n/a
Indep. directors (%)	78.92	n/a	n/a	80.00	n/a	n/a
Ownership measures:						
Ownership level (%)	0.52	n/a	n/a	0.01	n/a	n/a
Ownership change (%)	0.05	n/a	n/a	0.00	n/a	n/a

Table 2 – Ownership changes and changes in fund performance

This table reports results from first-difference regressions of performance on lagged percentage ownership using three different performance measures: (1) Fama and French (1993) three-factor alpha, (2) Carhart (1997) four-factor alpha, and (3) Pástor and Stambaugh (2003) five-factor alpha. The dependent variable is the change from year *t-1* to year *t* of the respective performance measure. As fund control variables we use the logarithm of the fund's lagged size (measured in million USD), the fund's yearly turnover ratio, and the logarithm of fund's lagged family size (calculated as the total net assets of all team- and single-managed mutual funds in the family). As board control variables we use fund's lagged board size as well as the lagged fraction of independent directors on the board. All independent variables are calculated as changes from year *t-2* to year *t-1*. The regression specifications include time fixed effects and segment fixed effects. Robust t-statistics of the regression coefficients in parentheses are based on standard errors clustered by fund. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

Dependent variable:	Change in Alpha $_{t-1 \text{ to } t}$					
	3F		4F		5F	
	(1)	(2)	(3)	(4)	(5)	(6)
Ownership change $_{t-2 \text{ to } t-1}$	**0.4372*** **	**0.4022*** **	**0.4340*** **	**0.3785*** **	**0.5409*** **	**0.5311*** **
	(3.880)	**(3.101)**	**(2.927)**	**(2.954)**	**(3.546)**	**(3.726)**
Fund and family characteristics:						
Change in fund size $_{t-2 \text{ to } t-1}$		0.0055		0.0002		-0.0023
		(0.516)		(0.020)		(-0.175)
Change in turnover $_{t-2 \text{ to } t-1}$		0.0176		0.0284*		0.0288*
		(1.514)		(1.843)		(1.852)
Change in family size $_{t-2 \text{ to } t-1}$		0.0104		0.0156		0.0153
		(0.545)		(0.819)		(0.765)
Board characteristics:						
Change in boards size $_{t-2 \text{ to } t-1}$		-0.0009		-0.0020		-0.0055
		(-0.205)		(-0.465)		(-1.255)
Change in indep. directors $_{t-2 \text{ to } t-1}$		0.0372		0.0205		0.0569
		(0.388)		(0.246)		(0.586)
Segment fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	864	606	864	606	864	606
Adjusted R-squared	0.112	0.111	0.071	0.093	0.063	0.091

Table 3 – Robustness

This table reports results from first-difference regressions of performance on lagged percentage ownership using three different performance measures: (1) Fama and French (1993) three-factor alpha, (2) Carhart (1997) four-factor alpha, and (3) Pástor and Stambaugh (2003) five-factor alpha. The dependent variable is the change from year *t-1* to year *t* of the respective performance measure. In Panel A, the percentage ownership measure is calculated using the midpoint of the reported ownership range instead of the bottom of each range. In Panel B, we replace our percentage ownership measure by a placebo percentage ownership measure. The nominator of this placebo ownership measure takes on the mean dollar ownership in the sample for all funds and years whereas the denominator remains the fund size. In Panel C, we additionally control for the change in fund flows. Panel D shows results for the subsamples of small and large funds using the sample median of fund size as cutoff. For sake of brevity, we only report the coefficients for the change in ownership. Other independent variables are defined as in Table 2. All independent variables are calculated as changes from year *t-2* to year *t-1*. The regression specifications include time fixed effects and segment fixed effects. Robust t-statistics of the regression coefficients in parentheses are based on standard errors clustered by fund. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

Panel A: Mid range

Dependent variable:	Change in Alpha $_{t-1\ to\ t}$		
	3F	4F	5F
	(1)	(2)	(3)
Ownership change $_{t-2\ to\ t-1}$	**0.4262****	**0.4359***	**0.5780****
	(2.088)	**(1.862)**	**(2.439)**
Change in fund and family characteristics	Yes	Yes	Yes
Change in board characteristics	Yes	Yes	Yes
Segment fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	606	606	606
Adjusted R-squared	0.112	0.095	0.093

Panel B: Placebo ownership change

Dependent variable:	Change in Alpha $_{t-1\ to\ t}$		
	3F	4F	5F
	(1)	(2)	(3)
Ownership change $_{t-2\ to\ t-1}$	**0.9719**	**1.1012**	**1.2241**
	(1.147)	**(1.133)**	**(1.257)**
Change in fund and family characteristics	Yes	Yes	Yes
Change in board characteristics	Yes	Yes	Yes
Segment fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	606	606	606
Adjusted R-squared	0.112	0.097	0.093

Table 3 – Continued

Panel C: Impact of fund flows

Dependent variable:	Change in Alpha $_{t-1\ to\ t}$		
	3F	4F	5F
	(1)	(2)	(3)
Ownership change $_{t-2\ to\ t-1}$	**0.2974****	**0.2939****	**0.4338*****
	(2.523)	**(2.354)**	**(3.443)**
Change in fund flows $_{t-2\ to\ t-1}$	-0.0408***	-0.0345**	-0.0387***
	(-3.178)	(-2.520)	(-2.682)
Change in fund and family characteristics	Yes	Yes	Yes
Change in board characteristics	Yes	Yes	Yes
Segment fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	569	569	569
Adjusted R-squared	0.121	0.098	0.100

Panel D: Small versus large funds

Dependent variable:	Change in Alpha $_{t-1\ to\ t}$					
	Small funds			Large funds		
	3F	4F	5F	3F	4F	5F
	(1)	(2)	(3)	(4)	(5)	(6)
Ownership change $_{t-2\ to\ t-1}$	**0.2810****	**0.2727****	**0.3867*****	**37.1560*****	**19.9214***	**21.9912****
	(2.211)	**(2.048)**	**(2.896)**	**(3.370)**	**(1.746)**	**(2.297)**
Change in fund and family characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Change in board characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Segment fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	253	253	253	316	316	316
Adjusted R-squared	0.097	0.078	0.094	0.162	0.114	0.111

Table 4 – Ownership changes and alternative predictors of future fund performance

This table reports results from first-difference regressions of performance on lagged percentage ownership using three different performance measures: (1) Fama and French (1993) three-factor alpha, (2) Carhart (1997) four-factor alpha, and (3) Pástor and Stambaugh (2003) five-factor alpha. The dependent variable is the change from year *t-1* to year *t* of the respective performance measure. The *ownership level* is calculated as percentage ownership measure by dividing the converted dollar amount by a fund's year–end total net assets (TNA) and lagged by one year. We use the *active share* measure of Cremers and Petajisto (2009) and Petajisto (2013). To measure the *industry concentration*, we follow Kacperczyk, Sialm, and Zheng (2005) and sort all stocks into ten industries and calculate the weight for a specific industry in a portfolio by summing up the portfolio weights of all stocks belonging to that industry. The sum of the squared industry weights (averaged across the quarters of a year) is then used as a measure of industry concentration. To calculate the *return gap*, we follow Kacperczyk, Sialm, and Zheng (2008) by comparing the realized fund returns with holding-based fund returns. The latter is a hypothetical portfolio that invests in the previously disclosed fund holdings. We then compound the monthly return gap observations to come up with a yearly measure. To compute the R^2 measure of Amihud and Goyenko (2013), we first run yearly regressions of fund´s monthly excess returns on the Carhart (1997) four factors. We then obtain the fund´s R^2 from these regressions. For sake of brevity, we only report the coefficients for the change in ownership and the additional control variables. Other independent variables include those defined in Table 2 and fund flows. All independent variables are calculated as changes from year *t-2* to year *t-1* (except for the ownership level in *t-1*). The regression specifications include time fixed effects and segment fixed effects. Robust t-statistics of the regression coefficients in parentheses are based on standard errors clustered by fund. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

Dependent variable:	Change in Alpha $_{t-1\ to\ t}$		
	3F	4F	5F
	(1)	(2)	(3)
Ownership change $_{t-2\ to\ t-1}$	**0.4362*** **	**0.3055** **	**0.5323*** **
	(2.895)	**(2.311)**	**(4.183)**
Additional controls			
Ownership level $_{t-1}$	0.0038	0.1581	0.0278
	(0.024)	(1.098)	(0.200)
Change in active share $_{t-2\ to\ t-1}$	0.3378**	0.2198	0.2080
	(2.277)	(1.444)	(1.320)
Change in industry concentration $_{t-2\ to\ t-1}$	-0.3426	-0.3353	-0.3768*
	(-1.592)	(-1.567)	(-1.708)
Change in return gap $_{t-2\ to\ t-1}$	-0.4957***	-0.4674***	-0.5725***
	(-2.868)	(-3.042)	(-3.258)
Change in R^2 $_{t-2\ to\ t-1}$	0.1344	0.1097	0.1719
	(0.890)	(0.725)	(1.080)
Change in fund and family characteristics	Yes	Yes	Yes
Change in board characteristics	Yes	Yes	Yes
Segment fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	321	321	321
Adjusted R-squared	0.211	0.164	0.204

Table 5 – Family policy change: fund performance

This table reports results from first-difference regressions of performance on lagged percentage ownership and the interaction between the ownership change measure and a family policy change dummy using three different performance measures: (1) Fama and French (1993) three-factor alpha, (2) Carhart (1997) four-factor alpha, and (3) Pástor and Stambaugh (2003) five-factor alpha. The dependent variable is the change from year *t-1* to year *t* of the respective performance measure. The family policy changes dummy takes on the value one if the fund family did not have an ownership requirement in place in the past year and has such a requirement in place this year, and zero otherwise. For sake of brevity, we only report the coefficients for the change in ownership, the family policy dummy and the interaction between ownership changes and family policy changes. Other independent variables include those defined in Table 2 and fund flows. All independent variables are calculated as changes from year *t-2* to year *t-1*. The regression specifications include time fixed effects and segment fixed effects. Robust t-statistics of the regression coefficients in parentheses are based on standard errors clustered by fund. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

Dependent variable:	Change in Alpha $_{t-1\ to\ t}$		
	3F	4F	5F
	(1)	(2)	(3)
Ownership change $_{t-2\ to\ t-1}$	0.2869**	0.2856**	0.4269***
	(2.460)	(2.304)	(3.442)
Ownership change $_{t-2\ to\ t-1}$ * Family policy change $_{t-2\ to\ t-1}$	**11.8349*** **	**9.4690*** **	**7.2716*** **
	(4.654)	**(3.680)**	**(2.680)**
Family policy change $_{t-2\ to\ t-1}$	-0.0261	-0.0231	-0.0106
	(-1.460)	(-1.285)	(-0.581)
Change in fund and family characteristics	Yes	Yes	Yes
Change in board characteristics	Yes	Yes	Yes
Segment fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	569	569	569
Adjusted R-squared	0.123	0.099	0.098

Table 6 – Family policy change: channels

This table reports results from first-difference regressions of various trading activity measures as dependent variables on lagged percentage ownership and the interaction between the ownership change measure and a family policy change dummy. Active share and return gap are defined as in Table 4. To examine changes in cash and equity holdings and, we measure cash (equity) holdings as reported cash (equity) from CRSP. The family policy changes dummy takes on the value one if the fund family did not have an ownership requirement in place in the past year and has such a requirement in place this year, and zero otherwise. For sake of brevity, we only report the coefficients for the change in ownership, the family policy dummy and the interaction between ownership changes and family policy changes. Other independent variables include those defined in Table 2 and fund flows. All independent variables are calculated as changes from year *t-2* to year *t-1*. The regression specifications include time fixed effects and segment fixed effects. Robust t-statistics of the regression coefficients in parentheses are based on standard errors clustered by fund. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

Dependent variable:	Change $_{t-1\ to\ t}$ in				
	Active share	Turnover	Return gap	Cash holdings	Equity holdings
	(1)	(2)	(3)	(4)	(5)
Ownership change $_{t-2\ to\ t-1}$	-0.0214	-0.2467	0.0164	0.1439	-0.1572
	(-1.006)	(-0.215)	(0.313)	(0.788)	(-1.033)
Ownership change $_{t-2\ to\ t-1}$ * Family policy change $_{t-2\ to\ t-1}$	**1.6869***	**22.8426*****	**8.3254*****	**-11.3762*****	**8.8644*****
	(1.879)	**(3.655)**	**(7.298)**	**(-7.141)**	**(5.937)**
Family policy change $_{t-2\ to\ t-1}$	0.0026	-0.0440	-0.0050	0.0048	-0.0023
	(0.248)	(-0.857)	(-0.486)	(0.522)	(-0.269)
Change in fund and family characteristics	Yes	Yes	Yes	Yes	Yes
Change in board characteristics	Yes	Yes	Yes	Yes	Yes
Segment fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	243	567	485	570	570
Adjusted R-squared	0.038	0.028	0.075	0.033	0.045

Long résumé

Ce long résumé contient un aperu de la thèse. Le premier chapitre étudie l'effet de la transparence des prix sur l'équilibre de l'industrie dans le secteur de l'acier. Le deuxième chapitre demande comment les tarifs d'importation sur les intrants affectent l'investissement des entreprises en aval. Le troisième chapitre étudie comment la propriété managériale affecte la performance dans le secteur des fonds communs de placement.

L'effet réel de la transparence des prix

L'information sur les prix est essentielle au bon fonctionnement des marchés. Par conséquent, la transparence des prix est un outil politique de plus en plus populaire, comme en témoignent les réglementations récentes dans les secteurs de la santé, des finances et des biens de consommation. Mais malgré son rôle prédominant dans la théorie économique et sa pertinence pour les politiques publiques, la transparence des prix a reu relativement peu d'attention dans la littérature empirique, principalement en raison du manque de cadres appropriés. En particulier, comment l'amélioration de la transparence des prix affecte des enterprises, l'allocation des ressources et la productivité restent des questions ouvertes.

En théorie, l'augmentation de la transparence des prix réduit les prix, la dispersion des prix, les bénéfices des producteurs et les coûts des clients (par exemple, Janssen, Pichler et Weidenholzer (2011)). La transparence permet également aux clients d'identifier les producteurs à faible coût, d'accroître l'efficacit de l'appariement et la productivité globale des producteurs (Duffie, Dworczak et Zhu (2017)). Le principal défi empirique consiste à isoler les effets de la transparence des prix. Dans l'expérience idéale, la transparence des prix est introduite sans affecter d'autres dimensions du marché. Par exemple, la diffusion d'Internet a sans doute réduit les coûts de recherche et augmenté la transparence des prix, mais aussi considérablement modifié les réseaux de distribution des entreprises et les offres de produits.

Pour résoudre ce problème d'identification, j'utilise l'introduction des contrats futurs sur l'acier comme une expérience quasi-naturelle. L'acier est vendu par les producteurs d'acier à leurs clients dans un marché à terme opaque. Lorsque les contrats futurs sur l'acier ont été introduits, les participants au marché de l'acier étaient maintenant en mesure d'observer le prix du marché pour les contrats futurs des produits concernés, découvert sur un marché centralisé. Fait important, les contrats futurs sur l'acier sont habituellement réglés en espèces, avec très peu de livraison physique effective. Ainsi, les contrats futurs n'ont pas simplement offert un nouveau lieu d'achat d'acier physique et n'ont pas modifié les réseaux de production et de distribution des entreprises. En outre, les contrats futurs n'ont pas modifié de manière significative le comportement de couverture des entreprises. Cela me permet d'isoler le rôle informationnel du marché nouvellement créé. De plus, les deux contrats futurs sur acier introduits en 2008 concernaient des produits sidérurgiques spécifiques: le London Metal Exchange (LME) a introduit un contrat pour les billets, tandis que le New York Mercantile Exchange (NYMEX) a introduit un contrat pour les bobines laminées à chaud. Ainsi, j'utilise une stratégie de différence des différences (DID) pour estimer l'effet de l'augmentation de la transparence des prix induite par les contrat futurs sur les prix de l'acier, les producteurs d'acier et leurs clients. Je compare des produits d'acier avec des contrats futurs à d'autres produits d'acier et mappe ces produits à les entreprises productrices d'acier et leurs clients.

Je commence par examiner l'effet de la transparence des prix sur les prix de l'acier. Janssen, Pichler et Weidenholzer (2011) et Duffie, Dworczak et Zhu (2017) modélisent la transparence des prix comme une réduction de l'incertitude des clients concernant le coût des producteurs dans un cadre de recherche séquentielle. Lorsque les clients apprennent le coûts des producteurs, ils peuvent utiliser cette information dans leur décision d'acheter auprès d'un producteur donné ou de continuer à chercher. Les producteurs en tiennent compte et facturent des prix plus bas en équilibre. Dans mon contexte empirique, lorsque des contrats futurs sur acier sont introduits, les clients sidérurgiques peuvent utiliser l'information contenue dans les prix futurs dans leur décision d'acheter auprès d'un producteur d'acier donné ou de chercher une meilleure offre. Conformément à la théorie, je conclus que les prix des produits en acier traité diminuent de neuf pour cent par rapport aux produits en acier de contrôle juste après l'introduction des contrats futurs sur l'acier. Les prix des produits traités et contrôlés suivent des tendances antérieures similaires et l'effet persiste cinq ans après l'introduction.

Je me tourne ensuite vers les entreprises sidérurgiques. En théorie, à mesure que l'augmentation de la transparence induite par le marché futurs réduisant les prix attendus, les marges bénéficiaires des producteurs diminuent. Dans la spécification de base, je mappe les produits traités aux producteurs en utilisant les descriptions de produits des industries à six chiffres du SCIAN. Je trouve que, juste après l'introduction des contrats futurs sur l'acier, les marges bénéficiaires des producteurs chutent de cinq points de pourcentage par rapport aux producteurs d'acier contrôlés. Les résultats sont solides pour affiner l'affectation en traitement en utilisant la covariation des ventes des producteurs avec les indices de prix des produits traités et les informations provenant des dépôts de 10K.

Ensuite, je demande comment la transparence accrue des prix affecte les clients de l'acier. La baisse des prix attendus pour les produits sidérurgiques réduit leurs coûts matériels. En outre, la théorie prédit que la transparence des prix réduit la dispersion des prix à léquilibre des produits en acier traité, réduisant ainsi la dispersion des coûts des matériaux parmi les clients concernés. J'utilise le tableau d'entrées-sorties du Bureau of Economic Analysis (BEA) pour relier les industries productrices d'acier à leurs industries clientes. Je trouve qu'une augmentation d'un écart-type (huit points de pourcentage) des matériaux en acier traité par rapport au total des matières diminue les coûts des matériaux de 0,8 pourcent. De plus, la dispersion des coûts de matériel client mesurée par le coefficient de varatio diminue de 1,5 point de pourcentage lorsque la fraction des intrants traités augmente d'un écart-type (cinq points de pourcentage).

J'examine ensuite si l'amélioration de la transparence des prix augmente l'efficacité de l'appariement et la productivité globale des producteurs. Duffie, Dworczak et Zhu (2017) modélisent les effets de la transparence des prix lorsque les coûts de production sont hétérogènes. Le coût total des producteurs est composé d'un élément de coût commun et d'un composant idiosyncratique. Ils montrent que si les coûts de recherche sont suffisamment bas, révéler la composante coût commune conduit tous les clients à acheter auprès de producteurs à faible coût. Dans mon contexte, lorsque les contrats futurs sont introduit, les clients sont mieux à même dévaluer si une offre de prix élevée est due à une composante commune ou idiosyncratique du coût de production. Cela améliore l'efficacité de la mise en correspondance et augmente la part de marché des producteurs à faible coût. Pour identifier les producteurs à faible coût, j'exploite le fait que l'acier est fabriqué à partir de minerai de fer en utilisant des fours à oxygène de base (BOF) ou à partir de ferraille utilisant des fours à arc électrique (EAF). En raison du coût moindre des déchets dacier, la production dacier avec des fours électriques à arc était moins coûteuse au cours de la période déchantillonnage. Je classe les producteurs d'acier qui déclarent exploiter un four à arc électrique dans leurs dépôts de 10 K en 2002 en tant que producteurs à faible coût. Je trouve que la part de marché globale des producteurs à faible coût augmente de 20 points de pourcentage. Cette augmentation globale se traduit par une augmentation moyenne de 1,4 point de pourcentage de la part de marché de chaque producteur à faible coût dans le groupe de traitement par rapport au groupe témoin. De plus, je trouve que la productivité totale des facteurs totaux pour les producteurs augmente de huit pour cent. En supposant qu'il n'y ait pas de gains de productivité au sein des entreprises, cela suggère que la différence de productivit des producteurs à coûts faibles et élevés est de 50 pourcent. En comparaison, Syverson (2004) constate que la différence de productivité entre le 90e et le 10e centile dans lindustrie de fabrication à quatre chiffres SIC moyenne est de 90 pourcent.

Une préoccupation est que la baisse des prix et des marges bénéficiaires des producteurs est due à une détérioration des conditions de la demande pour les produits en acier traité par rapport aux produits en acier de contrôle. En particulier, la grande récession qui a débuté en 2007 et l'effondrement du marché de l'habitation auraient pu avoir une incidence différente sur les produits d'acier traités et de contrôle. Cependant, les clients des produits en acier traité ne connaissent pas de diminution des marges bénéficiaires par rapport aux autres clients de l'acier. En outre, il n'y a pas de preuve d'une inversion de la baisse des prix et des marges bénéficiaires des producteurs lorsque l'économie et la sidérurgie se redressent. De plus, les producteurs d'acier traité ne réduisent pas leur échelle d'exploitation telle que mesurée par les actifs, les ventes ou les quantités vendues par rapport aux producteurs témoins. Je vérifie également que les producteurs traités et les producteurs témoins présentent une sensibilité similaire au PIB global et à l'emploi dans le secteur de la construction avant l'introduction des contrats futurs sur l'acier. Les résultats sont également robustes pour contrôler l'exposition à l'activité économique globale et au secteur de la construction directement. Je cours aussi un test de placebo autour de la récession de 2001 et je ne trouve pas de modèle similaire. Enfin, j'examine les réactions boursières l'annonce des LME et NYMEX de lancer des contrats futurs sur l'acier. Si la baisse des prix et des marges bénéficiaires des producteurs est liée à l'introduction des contrats futurs sur l'acier plutét qu'aux conditions de la demande, les cours des producteurs traités devraient baisser au jour de l'annonce par rapport aux producteurs témoins. Si les clients répercutent les économies de coûts dues à la baisse des prix des matériaux sur leurs clients, les prix des actions des clients traités devraient augmenter par rapport aux clients contrôlés. Fait rassurant, je trouve que les prix des actions des producteurs traités diminuent, alors que les cours des actions des clients traités augmentent par rapport au groupe témoin respectif aux dates d'annonce de la LME et de la NYMEX.

Une autre préoccupation est que les différences de concurrence des importations, en particulier en provenance de la Chine, entre les industries traitées et les industries de contrôle sont les moteurs des résultats. Je montre que la concurrence des importations n'a pas augmenté pour les industries traitées par rapport aux industries de contrôle. Les résultats sont également robustes pour contrôler la concurrence des importations ainsi que la concurrence des importations en provenance de Chine.

Une autre préoccupation est que les résultats sont motivés par des changements dans l'ensemble des choix de gestion des risques plutôt que par la transparence des prix. Les producteurs d'acier traité pourraient couvrir une plus grande part de leur risque lié au prix de la production après l'introduction des contrats futurs sur l'acier. En présence de frictions de financement, cela pourrait augmenter l'investissement dans la capacité de production et les volumes de production globaux, et diminuer les prix d'équilibre. Cependant, les volumes de négociation sur les marchés boursiers, bien qu'importants en termes absolus, sont faibles par rapport à la production d'acier. De plus, les producteurs d'acier traité n'augmentent pas leur activité de couverture. Ils ne sont pas plus susceptibles de déclarer des produits dérivés ou des pertes après l'introduction des contrats futurs. Ils n'augmentent pas non plus l'investissement ou leur échelle d'opération. Une autre préoccupation liée à la gestion des risques est que les producteurs d'acier vendent implicitement une assurance-prix leurs clients en offrant des contrats à prix fixe. Avec la création des contrats futurs, les clients sidérurgiques peuvent obtenir une assurance des prix des intrants en faisant la couverture de la bourse. Cela pourrait réduire les bénéfices réalisés par les producteurs d'acier sur ces contrats d'assurance implicites. Cependant, je trouve que la réduction des marges bénéficiaires n'est pas concentrée chez les producteurs d'acier qui, dans les données, semblent offrir des prix plus stables à leurs clients.

Une autre préoccupation potentielle est que l'introduction des contrats futurs augmente la normalisation des produits dans l'industrie traitée. Les clients peuvent adapter leurs technologies de production pour traiter le type exact d'acier pour lequel les contrats futurs sont négociés en bourse. Une standardisation accrue pourrait accroître la concurrence entre les producteurs et faire baisser les prix, les marges bénéficiaires des producteurs et les coûts des matériaux clients. Cependant, en utilisant la mesure basée sur le texte de Hoberg et Phillips (2016) de la similarité des produits entre les entreprises, je ne trouve aucune preuve d'une standardisation accrue dans l'industrie traitée.

Cet article contribue à la littérature sur la transparence des prix. De nombreux éléments de preuve montrent que l'introduction de la transparence post-négociation sur le marché des obligations de sociétés américaines réduit les écarts entre cours acheteur et vendeur (Bessembinder, Maxwell et Venkataraman (2006), Edwards, Harris et Piwowar (2007), Goldstein, Hotchkiss et Sirri (2007) et Asquith, Covert et Pathak (2013)). Il existe également une littérature sur la transparence des prix sur les marchés non financiers. Devine et Marion (1979) constatent que la divulgation obligatoire des prix des supermarchés dans un journal local au Canada réduit les prix de sept pour cent par rapport au groupe témoin. En revanche, Alb æ k, M ø llgaard et Overgaard (1997) constatent qu'après la publication des prix du béton prêt à l'emploi par l'autorité antitrust danoise, les prix augmentent de 15 à 20 pour cent. Ils soutiennent qu'une transparence accrue des prix facilite la collusion et réduit la concurrence par les prix. Plus récemment, Chintagunta et Rossi (2015) ont constaté que les panneaux de prix obligatoires sur les autoroutes en Italie réduisaient les prix des stations-service, mais ne trouvaient aucun effet sur la dispersion des prix. Grennan et Swanson (2016) démontrent que l'adhésion à une base de données d'analyse comparative entraîne une baisse des prix payés par les hôpitaux. Christensen, Floyd et Maffett (2017) constatent que la réglementation obligeant les hôpitaux à afficher leurs frais en ligne, réduit les frais de six pour cent, mais n'abaisse pas les paiements réels. Cet article va au-delà des prix et documente les effets réels de la transparence des prix pour les producteurs et les clients sur un important marché d'intrants intermédiaires.

Une littérature connexe étudie comment la diffusion d'Internet affecte les prix et la dispersion des prix (voir Baye, Morgan et Scholten (2006) pour une enqute). Goldmanis, Horta şu, Syverson et Emre (2010) examinent dans une étude d'enquête l'effet du commerce électronique sur la structure de l'industrie de l'offre. Ils modélisent l'arrivée du commerce électronique comme un déplacement vers la gauche de la distribution des coûts de recherche des consommateurs et, comme Duffie, Dworczak et Zhu (2017), prédisent une baisse des prix d'équilibre et de la dispersion des prix et une augmentation des producteurs à bas coûts. part de marché. Ils testent le modèle pour les agences de voyages, les librairies et les concessionnaires de voitures neuves. En utilisant la taille de l'établissement comme indicateur du coût de production, ils montrent qu'une augmentation de la fraction des consommateurs qui achètent en ligne dans une région est associée à une diminution du nombre de petits établissements. Contrairement à leur article, je me concentre plus étroitement sur les effets de la transparence des prix. Lorsque la fraction des consommateurs achetant en ligne augmente, cela affecte la structure de l'industrie de diverses façons, autrement que par la transparence des prix. Bar-Isaac, Caruana et Cun ãt (2012) soutiennent que les réductions des coûts de recherche pour les consommateurs modifient radicalement l'offre de produits et les stratégies des entreprises. Amazon.com est un bon exemple de la façon dont les réductions des coûts de recherche affectent une industrie, ce qui a d'abord révolutionné l'industrie de la vente de livres et, plus tard, les industries de vente au dtail de divers biens de consommation. L'Internet permet aux consommateurs de se renseigner sur les offres de produits sans visiter les magasins, ce qui modifie radicalement l'entreposage optimal, les réseaux de distribution et les offres de produits. L'un des avantages de l'industrie sidérurgique est que la gamme de produits est remarquablement stable au fil du temps (Collard-Wexler et De Loecker (2015)). En outre, je documente également directement l'effet de la transparence des prix sur les entreprises touchées.

Cet article contribue également à la littérature sur les effets réels des marchés financiers. La littérature existante se concentre sur la façon dont les marchés financiers améliorent les décisions d'investissement et de production des entreprises individuelles (voir Bond, Edmans et Goldstein (2012) pour un sondage). Brogaard, Ringgenberg et Sovich (2017) sont les plus proches de cet article. Ils soutiennent que l'augmentation de l'investissement indiciel sur des contrats futurs existants réduit le contenu informatif des prix futurs des matières premières, ce qui conduit à des décisions de production plus mauvaises et à des bénéfices plus faibles des entreprises mentionnant les produits concernés dans leurs dépôts de 10K. En revanche, dans cet article, je montre qu'en augmentant la transparence des prix, l'introduction des contrats futurs de l'acier réduit les asymétries d'information entre producteurs et clients.

En termes de méthodologie, deux articles utilisent l'introduction de nouveaux marchés dérivés comme expérience. Perez-Gonzaléz et Yun (2013) soutiennent que l'introduction de dérivés météorologiques améliore la capacité de couverture des entreprises sensibles aux intempéries, ce qui entraîne une augmentation de la valorisation, des investissements et de l'effet de levier. Almeida, Hankins et Williams (2017) utilisent également l'introduction des contrats futurs sur acier pour montrer que les entreprises utilisent les obligations d'achat comme un outil de gestion des risques. Les deux documents se concentrent sur les implications de la gestion des risques des marchés dérivés, alors que ce document se concentre sur les implications informationnelles.

Cet article se rapporte également à la littérature sur la mauvaise allocation. Hsieh et Klenow (2009) estiment que la réaffectation des intrants entre les entreprises pourrait augmenter la productivité totale des facteurs de 30 à 60 pour cent. Onishi (2016) soutient que les remises quantitatives dans l'industrie aéronautique entraînent une dispersion des prix et une mauvaise allocation des avions dans l'industrie du transport aérien. Cet article montre qu'un manque de transparence des prix peut constituer un obstacle à une allocation efficace des ressources entre les entreprises. Premièrement, l'opacité empêche les producteurs à haute productivité d'obtenir plus de parts de marché. Deuxièmement, l'opacité augmente la dispersion des coûts d'entrée des bons acheteurs intermédiaires. De telles distorsions des prix des facteurs au niveau des entreprises peuvent conduire à une allocation inefficace. Dans cet article, je montre que la transparence des prix augmente la part de marché des producteurs à faible coût et la productivité totale des facteurs des producteurs et réduit la dispersion des coûts des intrants dans les industries clientes.

L'impact en aval des tarifs en amont

Après plusieurs décennies de libéralisation des échanges, les politiques protectionnistes visant à protéger les industries nationales contre la concurrence étrangère connaissent un regain de popularité tant aux États-Unis qu'en Europe. Les conséquences économiques du protectionnisme par rapport à la libéralisation ont longtemps été un sujet important de débats politiques et académiques, et la majorité de la population est d'avis depuis de nombreuses années que la libéralisation du commerce est un avantage net. Bien que ce point de vue soit étayé par de nombreuses données empiriques provenant des pays en développement, on ne sait pas très bien quels schémas empiriques vont des économies en développement aux économies industrialisées. Plus important encore, alors qu'il existe une grande littérature étudiant les effets directs dans un compte tenu de l'industrie, il y a étonnamment peu de preuves sur les effets indirects sur d'autres industries connexes. Nous visons à faire un premier pas en vue de combler cette lacune en étudiant un canal important par lequel les libéralisations commerciales, en particulier les réductions tarifaires, dans un secteur ont un impact sur l'activité conomique dans d'autres industries.

Utilisation de données sur les tarifs d'importation et les investissements dans les industries manufacturires des États-Unis entre 1974 et 2012, nous montrons que les réductions tarifaires en amont sont suivies d'une augmentation en aval investissement. Nous testons différentes explications possibles. Les résultats concordent le mieux avec les réductions tarifaires améliorant les incitatifs pour les clients en aval à investir en atténuant le risque de hold-up. En particulier, nous trouvons que la réponse de l'investissement est plus forte si les clients ont peu de pouvoir de négociation et ne sont pas verticalement intégrés avec leurs fournisseurs, si les fournisseurs produisent intrants specifiques, et si une incertitude élevée empêche l'utilisation de contrats à long terme.

La dynamique de propriété des gestionnaires de fonds

Depuis mars 2005, les fonds communs de placement doivent déclarer la propriété des gestionnaires de fonds dans l'énoncé d'information supplémentaire en utilisant de larges gammes de propriété. Khorana, Servaes et Wedge (2007) et Evans (2008), en utilisant une année de données sur la propriété, montrent qu'un niveau de propriété plus élevé prédit des performances plus élevées. Depuis lors, de plus en plus d'investisseurs s'intéressent à la propriété des gestionnaires (voir par exemple Ma et Tang (2014)) et certaines familles de fonds communs de placement ont adopté des politiques exigeant de leurs gestionnaires qu'ils détiennent des fonds. Cela soulève la question si l'attention accrue portée à la propriété managériale et à la mise en œuvre des exigences de propriété par les familles de fonds est justifiée. La propriété managériale fournit-elle des informations précieuses sur les performances futures des fonds ou est-ce la corrélation transversale observée qui est déterminée par les caractéristiques non observées des fonds? La propriété harmonise-t-elle les incitations et les exigences de propriété peuvent-elles être utilisées pour augmenter la performance? Ou les gestionnaires ont-ils des informations supérieures sur la performance future des fonds et choisissent-ils d'investir dans des fonds dont ils savent qu'ils seront plus performants l'avenir? Étant donné la nature de leurs données transversales, ces premières études sont incapables de répondre à ces questions.

Nous étudions la dynamique de propriété des gestionnaires de fonds pour un échantillon de fonds communs de placement américains de 2005 à 2011. Nous constatons que les changements de propriété prédisent positivement des changements dans la performance des fonds. Une augmentation de la propriété d'un écart type prédit une augmentation de 1,6 pour cent en alpha l'année suivante. Les gestionnaires de fonds qui sont tenus d'augmenter leur participation grâce à la politique de fonds de la famille montrent la plus forte augmentation en alpha. Ils le font en augmentant leur activité de trading, en ligne avec l'idée qu'une plus grande propriété aligne les intérêts des gestionnaires avec ceux des actionnaires et induit des efforts plus importants.

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Titre : Essais en finance d'entreprise empirique

Mots clés : Corporate Finance, Empirique, Organisation Industrielle

Résumé : Le premier chapitre étudie comment l'introduction d'un marché à terme de l'acier affecte les producteurs d'acier et leurs clients. Le deuxième chapitre demande comment les tarifs d'importation dans les industries en amont affectent les incitations à investir des entreprises en aval

Le troisième chapitre étudie comment la propriété managériale affecte la performance dans le secteur des fonds communs de placement.

Title : Essays in Empirical Corporate Finance

Keywords : Corporate Finance, Empirical, Industrial Organization

Abstract : The first chapter studies how the introduction of a futures market for steel affects steel producers and their customers. The second chapter asks how import tariffs in upstream industries affect downstream firms' incentives to invest.

The third chapter studies how managerial ownership affects performance in the mutual fund industry.