Outsourcing through Purchase Contracts and Firm Capital Structure

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ABSTRACT

We examine firm and industry characteristics associated with outsourcing and the relation between outsourcing and capital structure using a unique database of purchase contracts for a measure of firm outsourcing. We document firm, industry, and supplier characteristics that are significantly associated with outside purchase contracting. We find that supplier competition and distance impact the use of purchase contracts, along with firm growth options and value-added per worker. Examining the outside purchase contract and leverage decisions using simultaneous equations, we find that firms in competitive industries, with more growth options, that have suppliers farther away with higher competition are more likely to use purchase contracts but have less leverage. Our results are consistent with firms that choose to use purchase contracts using less leverage to mitigate the potential loss of relationship-specific investments of contacting parties that can occur with financial distress or bankruptcy.

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1 Introduction

How do firms that significantly rely on other companies for production differ from those that do business solely within their own operational infrastructure? Evidence from the electronics, pharmaceuticals, and automotive industries shows that the use of contract manufacturing has been growing significantly. For example, the electronics industry outsourced $75 billion to contract manufacturers in 2000, representing 10 percent of total production (Plambeck and Taylor (2005)). Firms also have been signing extensive contracts with outside firms to run their communications and information technology operations. Purchasing and outsourcing from unaffiliated companies have been growing extensively in the recent past, yet we know little about how such contracting decisions are associated with firms' real and financial outcomes.

Using a unique database of outsourcing through purchase contracts collected from firm 10-K filings for a measure of external contracting intensity, we document a number of important characteristics of firms that use outside purchase contracts and empirically link the use of those contracts to financial decisions. We first examine a broad set of firm and industry characteristics related to the decision to use outside contracts. We next analyze the potential effects of outside contracts on firms that use such contracts, specifically, on firm cash flows on the real side and capital structure on the financial side.

We collect the data on outside purchase contracts using web crawling and text parsing of firm 10-Ks following the Securities and Exchange Commission (SEC) rule that requires firms to report material purchase contracts to investors in their financial statements. These contracts include both traditional supply contracts and production and service contracts that outsource tasks like managing customer call centers, handling communications and information technology, and producing of products. A prominent example of the latter type of contracting is Apple Inc. contracting for the production of its iPhones.

The contracts we examine in this paper are any material long-term external contracts for production or inputs including both domestic and international contracts. Although US firms rely on increasingly more on contractors to produce, it is not necessarily international outsourcing.[1] Our evidence shows that 47.5 percent of suppliers are in the US, 25.5 percent in Asia, and the remainder in Europe and other regions.[2]

We find that firms that significantly rely on external contracting are larger in size with higher market to book ratios, consistent with such firms having more growth options. These firms have lower fixed asset ratios and spend more on R&D than on capital investment with higher value-added per worker. They are also geographically close to ports of entry including seaports, hub airports with cargo services, and border crossings. On the industry side, these firms are more likely to be in high-technology industries and industries with higher competition. We also find that the use of outside purchase contracts is not simply industry-specific as there is extensive within-industry variation in the use of purchase contracts. This fact enables us to examine effectively within-industry characteristics between firms that use material long-term purchase contracts and those that rely on their own operations. We illustrate this point in Section 4, in which we provide detailed examples of three firms in the semiconductor industry that employ considerably different external contracting strategies.

We show that the benefits of using outside purchase contracts include operational flexibility. We find that firms that use outside purchase contracts are better able to match input costs

[1] Grossman and Helpman (2005), who distinguish between domestic and foreign outsourcing, develop a theoretical model of firms' decisions about where to outsource. See Nunn and Trefler (2012) and Antràs (2014) for recent contributions to the international trade literature based on incomplete contracting and the property-rights theory of firm boundaries. Spencer (2005) and Helpman (2006) provide surveys of earlier studies on outsourcing and international trade. Also, see Handfield (1994), Levy (1995), and Monczka and Trent (2003) for the management literature on international outsourcing.

[2] Research from the Hackett Group, Inc. finds that domestic outsourcing has recently increased and many US cities now make attractive alternatives to offshoring for corporate finance, IT, and other business service operations. See Reuters (2015), "The Hackett Group Research Alert: Many US Cities Now Make Attractive Alternatives to Offshoring for Corporate Finance, IT, Other Business Service Operations," available at http://www.reuters.com/article/fl-hackett-group-idUSnBw196151a+100+BSW20150519.

that incorporate payments to counter-parties of contracts with output and also the economic state of the world. Firms that produce solely within their own operational infrastructure are more likely to be subject to inflexibility in input costs due to fixed assets and labor rigidity, for example. As a result of flexibility of purchase costs and also selling and general administrative costs, outsourcing firms have significantly less volatile cash flows.

Despite the reduction in cash flow volatility, we find strong evidence that firms with external purchase contracts use less financial leverage. We show that characteristics of suppliers, including supplier competition and distance, along with own labor force characteristics of the firms that use purchase contracts, can help explain the negative relation between outsourcing and leverage. Examining purchase contracting and leverage decisions using simultaneous equations, we find that firms in competitive and high-technology industries, with more growth options, with higher value-added workers, and close to a port of entry to the US are more likely to use outside purchase contracts, but have less leverage. This is consistent with the same underlying fundamental factors accounting for firms' tendency to use less leverage and simultaneously more outside purchase contracts.

In a complete contracting world, using outside purchase contracts would not affect firm capital structure. However, with incomplete contracts between the firm and its real side claimants, using outside contracts may affect financial structure. We consider suppliers' investment in relationship-specific assets as a possible channel to explain our finding of the strong negative relation between outside contracts and leverage. For example, Apple Inc. explicitly writes regarding its procurement strategies that they look for suppliers who take the time to learn about and understand their business and who look for ways to add value, which is consistent with the notion of relationship-specific investment on the supplier side.[3] Grossman and Hart (1986)

[3]The entire post of Apple Inc.'s procurement strategies on their website is available at https://www.apple.com/procurement/. Figure 1 shows an excerpt from the post related to their requirements and expectations for suppliers. Also, the intuition regarding suppliers' risk in making customer-specific invest-

model how the decision to be vertically integrated versus maintain separate ownership can affect incentives to invest ex ante in relationship-specific assets. In their model, if both parties' investments are important to the final outcome, the firms will be less likely to vertically integrate and more likely to sign implicit or explicit contracts with suppliers. In addition to the costs arising from incomplete contracts, related costs of financial distress on the contracting parties can include costs of searching for new business partners and costs arising from asymmetric information about new business partners' quality. In all of these cases, increased leverage can increase the costs that occur in the event of financial distress or bankruptcy and thus can affect the investment incentives of suppliers.

[Insert Figure 1 Here]

Our purchase contracts data are likely to capture such contract-based relationships that are long-term and thus involve relationship-specific investments on the supplier side. This type of contract-based relationship is distinct from spot market purchases of inputs or vertical integration, which our purchase contracts do not capture. Spot market purchases are less likely to require relationship-specific investments because they typically involve purchases of standardized products. Previous empirical studies (e.g., Kale and Shahrur (2007) and Banerjee, Dasgupta, and Kim (2008)) mainly use a database of supplier firms' principal customers—those that account for at least 10% of sales—from the business information file of Compustat, and thus are likely to pick up such spot market purchases as well. Vertical integration can involve relationship-specific investments as upstream divisions may tailor their investments to downstream divisions. However, it entails less contracting problems as the vertically-integrated firm can dictate decisions and also less uncertainty about the length of the relationship. Thus, capital structure of the firm is likely to be more important to suppliers than to integrated

ments is exemplified by Apple Inc.'s suppliers in a recent article, *Financial Times* (April 7, 2017), "The blessing and curse of being an Apple supplier" by Tim Bradshaw.

divisions.

In particular, material long-term contracts in manufacturing industries (i.e., contract manufacturing) can be directly affected by the financial stability of contracting parties due to higher levels of asset specificity. Given that contracts can be broken in bankruptcy, the expected duration of a contract, and thus the business relationship, will be shorter when firms have a higher probability of bankruptcy. If contracting parties especially invest in relationship-specific assets, they are more likely to be concerned about financial distress in counter-party firms that would result in failure to use those assets.[4] Therefore, lower leverage decreases the chances of financial distress and helps maintain the value of contracts and obtain better contractual terms. Our results are thus consistent with firms with more purchase contracts using less leverage to decrease the expected costs of financial distress on contracting parties and increase the incentives of contracting parties to invest in relationship-specific assets. These results enable us to conceptually show that the effects of incomplete contracting go beyond ownership, as in Grossman and Hart (1986), extending to how firms with outside contracts finance operations.

We recognize that firms that use purchase contracts may choose less leverage for other reasons. For example, managerial risk aversion may lead to low leverage and the extensive use of purchase contracts as well. We employ several methodologies that address this simultaneity to examine the association between the use of purchase contracts and financial leverage including (1) propensity-score matched regressions and (2) simultaneous regressions.[5] However, we acknowledge that our study does not make causal statements about the use of purchase contracts

[4]As a notable anecdotal evidence of the costs incurred by suppliers during the 2008 financial crisis period, Smart Union Group Ltd, a Hong Kong-listed leading toymaker and supplier to the US toy company, Mattel, went into distress and bankruptcy as Mattel was experiencing distress. Smart Union Group started closing their two factories in Guangdong province in China with an approximately 20 percent lower growth rate relative to the prior year and finally went bankrupt in October 2008 (from *China Daily*, October 16, 2008, "Sub-contract factories fall victim to US crisis" By Tu Lei).

[5]In additional analysis, we instrument for a firm's contracting decision using distance to the nearest port of entry including seaports, hub airports with cargo services, and border crossings. This location-based instrument captures the feasibility of purchasing products or services from suppliers in other states or countries far from a firm's main business location. The results are available in the online appendix, Table OA.1.

and leverage, as propensity-score matching is based on observable characteristics and simultaneous regressions do not aim at identifying causality. Instead, the simultaneous regressions have the advantage of showing the common factors that affect both outsourcing and leverage.

Our paper adds to several literatures. We first add to the outsourcing literature (see Antràs (2014) for recent contributions and Spencer (2005) and Helpman (2006) for extensive surveys) by showing that there is a financial dimension to using outside purchase contracts that has not previously been studied. Eun and Wang (2016) also explore the financial dimension of international outsourcing. Focusing on industry-level international outsourcing, they find that industries that have more intense foreign outsourcing have less leverage, but this negative link is mitigated by foreign national characteristics like better developed legal environments and trade openness. Second, we conceptually add to the incomplete contracting literature by showing that incomplete contracting and relationship-specific assets affect firm financing decisions. The previous literature on incomplete contracting, both the theoretical literature beginning with Grossman and Hart (1986) and empirical literature including Baker and Hubbard (2004), shows that residual rights of control affect firm ex ante incentives to invest in relationship-specific assets and who should own the assets. However, this literature does not deal with how the assets should be financed and whether capital structure is influenced when firms choose not to integrate. Our paper shows that the same factors that impact the use of outside purchase contracts also impact, but with the opposite signs, firm cash flows and capital structure.

We also add to the literature on customer and supplier relations by focusing on explicit contract-based relationships. Allen and Phillips (2000) show that firms with product market relationships in which one party owns equity in another experience better operating performance and more investment. Fee, Hadlock, and Thomas (2006) show that firms are more likely to invest in ownership positions in firms with which they have business relations. Kale and

Shahrur (2007) show that competition and the characteristics of customers and suppliers affect financial structure. Our study uniquely differentiates customer and supplier relations based on long-term purchase contracts from relations based on open market purchases, such as raw material acquisitions. We also add to the literature by Titman (1984), Titman and Wessels (1988), Maksimovic and Titman (1991), Opler and Titman (1994), and Banerjee, Dasgupta, and Kim (2008), which shows that the low leverage encourages relationship-specific investment by stakeholders to the firm. Our contribution relative to this literature is that we focus on explicit contract-based relationships and show in simultaneous regressions how the use of outside purchase contracts and leverage are both impacted simultaneously by firm and industry determinants.

2 Purchase contracts data and sample

We examine outside purchase contracts in public firms' 10-K filings that we download from the SEC's EDGAR website and process electronically. Our data begin in 2004, since the SEC issued a final rule on disclosure about off-balance sheet arrangements and aggregate contractual obligations in January 2003.[6] This rule requires public companies other than small business issuers to provide an explanation of contractual obligations in a separately captioned subsection of the Management's Discussion and Analysis (MD&A) section. The SEC's final rule on disclosure about contractual obligations particularly includes the "purchase obligations" category.

Importantly, and related to the context of our paper, purchase obligations should not be regarded as liabilities (in other words, as another form of debt or financing) because counter-parties will deliver goods or services at specific dates in the future.[7] Purchase obligations are

[6]This rule is to implement Section 401(a) of the Sarbanes-Oxley Act of 2002. See Final Rule: Disclosure in Management's Discussion and Analysis about Off-Balance Sheet Arrangements and Aggregate Contractual Obligations, Securities Act Rel. No. 33-8182, Exchange Act Rel. 34-47264, Financial Reporting Rel. No. FR-67, International Series Rel. No. 1266, http://www.sec.gov/rules/final/33-8182.htm (Jan. 27, 2003).

[7]These contracts are best viewed as forward contracts, and also not as leases. In a lease, firms receive products in advance and payments are a form of financing with counter-parties. Damodaran (2009) explicitly

firms' *promises* to purchase from their counter-parties and, thus, estimated amounts of cash outflows to the counter-parties within the pre-specified period. Supply contracts are tailored such that most payments occur in the future, on delivery of product, and some limited payments from purchaser to supplier are made at time of signing. Therefore, purchase obligations represent the inputs to production that a firm will purchase in the future (Lee (2010)). At the time of delivery of the product, the firm chooses how to arrange payment, either financing through equity or debt at that point or paying via cash.

Purchase contracts are also considered executory contracts under American bankruptcy law. An executory contract is one in which continuing obligations exist on both sides of the contract at the time of the bankruptcy petition, that is, one which commits both debtors and counter-parties to further performance. A trustee or debtor in possession may either assume any pre-petition executory contracts, preserving both debtor and counter-party obligations through the bankruptcy process, or reject it, thereby breaching it as of the petition date. Therefore, suppliers would have concerns about the chances of financial distress and bankruptcy of purchasing firms, and purchasing firms reserve the incentives to not have too much leverage.

For fiscal years ending on or after December 15, 2003, public firms (other than small business issuers) disclosed purchase obligations in their financial statements. Therefore, our primary sample includes all 10-K filers in the manufacturing sector associated with fiscal years ending in 2004 and up to 2010. Firms generally do not sub-categorize purchase obligations in their tabular disclosures, and sometimes provide limited information on the types of purchase obligations in the footnotes that follow. For manufacturing firms, the most common types of purchase obligations are inventory purchase commitments and service agreements related to advertising,

excludes purchase obligations in calculations of firm leases because leases are contracts whereby firms take delivery of a product or an asset up front. Even though purchase obligations are not regarded as liabilities, as we discuss later, to mitigate concerns related to these contracts being supplier financing, we additionally test the link between this measure and leverage by including accounts payable as part of total debt.

marketing, and IT.[8] Payment due is classified by specified periods in tabular disclosure format. Firms commonly disclose total amounts of purchase obligations broken down by specified periods (e.g., within one year, between one and three years, between three and five years, and beyond five years). Estimated payments due within one year must exist in the disclosure; firms can arbitrarily choose to report other future periods.

We use for our measure of purchase contract intensity a firm's estimated payment amount within the closest fiscal year under all of purchase contracts, normalized by cost of goods sold. The definition of purchase obligations from Financial Accounting Standards explicitly excludes any contracts that have a remaining term of one year or less.[9] Hence, a firm's estimated payment amount within one year under all of purchase contracts is not a measure of contracts with maturity of one year or less, but rather the aggregate amount of fund transfers to other parties in the given fiscal year as part of the overall payment schedule under all of long-term contracts.

Figure 2 shows an example of Apple Inc.'s purchase obligations disclosure reported in its 10-Ks. We present purchase obligations data for Apple Inc. for 2005 and 2008. From the data presented, we can see that purchase obligations have increased almost three-fold for Apple Inc.

[Insert Figure 2 Here]

We download firm 10-Ks via web crawling of the SEC EDGAR website and parse the documents to extract the purchase contracts data using PERL scripts. We provide the detailed collection procedure in Appendix A.[10] We extract these data from tables or text for which search keywords indicate the presence of purchase contracts data. The search keywords used

[8] See Lee (2010) for a discussion of cross-industry variation in types of purchase obligations.

[9] See Statement of Financial Accounting Standards No. 47: Disclosure of Long-Term Obligations for the definition of an unconditional purchase obligation.

[10] Lee (2010) first collects and studies purchase obligations data. The description of his data can be found at http://faculty.haas.berkeley.edu/klee/Kwang Lee Purchase Obligations Data.htm. Williams (2012) uses similar data to explore supplier-customer relationships.

are combinations of *"purchase"* and one of the following terms: *"obligation"*, *"commitment"*, *"agreement"*, *"order"*, and *"contract"*. From tables or text that include the search terms, we extract complete rows or sentences that contain amounts of purchase obligations.

We study public manufacturing firms because of the frequency with which they use outside purchase contracts for production, whereas purchase contracts in the service sector may exist just to supply finished goods that are then resold. We create the primary sample by merging all public manufacturing firms in the 10-K filings database with the CRSP/Compustat database using the central index keys (CIK). We exclude firms with revenues of less than $50 million because these are regarded as small business issuers not required to disclose contractual obligations. This sample construction procedure yields 1,727 firms operating in 20 two-digit SIC code industries and about 9,000 firm-years for the sample period from 2004 to 2010. We supplement this database with a supplier database created by obtaining supplier information from the Capital IQ database.

3 Descriptive statistics of purchase contracting

In this section, we present descriptive statistics in depth and breadth of outside contracting decisions. These analyses are particularly informative with respect to characteristics of firms that outsource through purchase contracts, and also suggest potential economic links between contracting decisions and various financial variables. Our analyses include industry, firm, and counter-parties.

3.1 Industry statistics

Table 1 displays industry descriptive statistics for outside purchase contracts in the manufacturing sector by two-digit SIC code.

[Insert Table 1 Here]

We assume that a firm that does not disclose an amount of purchase obligations in its 10-K has no contractual purchase obligations.[11] The table shows that across all industries more than 65 percent of manufacturing firms use outside purchase contracts, and the mean value of such contracting amounts is approximately 10 percent of the total cost of goods sold. The last column shows that outside purchase contracts account for nearly 15 percent of the total cost of goods sold within firms that have existing purchase contracts.

The table also shows that the use of outside purchase contracts is not restricted to high-technology industries. Purchase contract intensity is also high in food and kindred products, paper products, petroleum and coal products, and leather products. Importantly, there are in general 30-50% of manufacturing firms in each industry sector do not have any material purchase contracts. These might be vertically integrated or have suppliers in spot markets, but either case is less likely to involve relationship-specific investment. This important difference between firms with and without contracting-based suppliers enables us to effectively examine the characteristics of firms that rely on contractual relationships with other firms and the possible economic link between the intensity of such relationships and financial variables.

3.2 Summary statistics

Table 2 presents summary statistics for our key variables including firm size as captured by the market value of assets, firm age, market to book, profitability, sales growth, cash flow and stock return volatilities, percentage foreign tax, location feasibility of purchasing inputs, value-added per worker, competition, and industry indicators for high-technology and extensive purchase contracting.

[11]The SEC's final rule adopted the "reasonably likely" disclosure threshold that currently applies to other portions of MD&A disclosure. As stated in the SEC's 1989 MD&A Release, a company has an obligation to disclose prospective information in its MD&A "where a trend, demand, commitment, event or uncertainty is both presently known to management and reasonably likely to have material effects on the company's financial condition or results of operations".

[Insert Table 2 Here]

The table compares key characteristics between firms with and without outside purchase contracts and tests for significant differences between these groups. Overall, we find that nearly all variables are significantly different across firms with and without external purchase contracts. We further note that firms with purchase contracts have significantly lower leverage, and this is more pronounced when we use a strict measure of leverage that includes accounts payable as part of debt.

The table reveals that firms with purchase contracts are larger, older, and have higher market to book than firms without such contracts. Firms with purchase contracts also have a significantly higher fraction of foreign to total taxes paid than firms without contracts. This shows that outsourcing firms are likely to engage in offshore activities that generate foreign revenue. Further, firms with purchase contracts are less risky than firms that do not have purchase contracts, as cash flow volatility, default probability, and stock return volatility are significantly lower for firms with purchase contracts. Firms with external purchase contracts are more likely to be located close to a port of entry indicating location feasibility and potentially lower cost of receiving products or services from counter-parties. The distance to a port of entry is likely to affect a large number of US manufacturing firms that engage foreign suppliers, and thus is an important factor in decisions to increase or decrease the level of procurement through purchase contracts. Firms with purchase contracts have higher value-added workers than firms without contracts, indicating that high value-added employees represent the major part of the labor force in outsourcing firms after tasks that require low skills or standard technologies are likely outsourced. Lastly, firms with purchase contracts are in more competitive high-technology industries. Overall, the picture that emerges from these results is that firms with long-term purchase contracts are larger, less risky, and have more high value-added workers and lower

market leverage than firms that don't have such contracts.[12]

3.3 Counter-party statistics

We next examine purchase contracting strategies in depth by exploring customer and supplier relationships identified in the Capital IQ business relationship database. Previous studies use the input-output benchmark table from the Bureau of Economic Analysis (BEA) or customer data from the Compustat segment file to identify customer and supplier relationships. However, the input-output benchmark table represents interdependencies between industries, not between firms, and the Compustat customer data do not include business relationships with foreign or private domestic supply firms, as the database only compiles information on major customers of public domestic supply firms. The Capital IQ database collects data on foreign and private suppliers as well, for which it provides information on revenue, assets, total number of employees, SIC code, and headquarters location from more than 20,000 news sources. We note that we cannot identify the extent to which each supplier supplies a given firm as suppliers are listed only by name and not by amount of goods or services supplied.

We identify approximately 7,000 suppliers (3,715 unique suppliers, as some supply more than one firm) for 884 customer firms by merging our sample and the Capital IQ database with customer firms' CIK, ticker, or name. On average, customer firms in our sample have 7.82 suppliers. Table 3 presents informative statistics for these suppliers including geographic region, industry sector, revenue, assets, capital and labor intensity, and product market competition.

[Insert Table 3 Here]

Our focus is on both domestic and international purchase contracts as we find that 47.5 percent of suppliers are from the US, 25.5 percent from Asia, 17.2 percent from Europe, 0.3

[12]In an unreported analysis, we compare variances of market leverage and book leverage across highest, medium, and lowest terciles of the variance in purchase contract intensity. We find that firm-level variation in purchase contract intensity during our sample period is associated with firm-level variation in leverage.

percent from Africa, 1.9 percent from Oceania, and 1.6 percent from countries the Capital IQ is unable to identify. Most are in the manufacturing sector (47.5%); other suppliers are in the following industry sectors: services (17.2%), retail and wholesale trade (2.5%), transportation and utilities (3.2%), mining (2.0%), others (2.4%), and unknown (25.2%).

4 Semiconductor industry case study

Table 4 illustrates with detailed examples of three firms in the semiconductor industry the relation between purchase contracts and leverage, which we explore both cross-sectionally and in time series. These three companies' purchase contracts reflect significantly different external contracting strategies.

[Insert Table 4 Here]

Marvell Technology is known as a leading fabless semiconductor company, Fairchild as a firm that almost exclusively manufactures its own semiconductors. Xilinx, having substantially changed its volume of purchase contracts over time, provides greater time-series variation in external contracting intensity. All three firms have comparable revenues and thus are similar in size. The table shows large cross-sectional differences between Fairchild, which owns and operates semiconductor facilities, and Marvell Technology, which does not own its own facilities and outsources production of its semiconductors. Consequently, as shown in the columns for PPE/assets and CAPX/sales, Fairchild has higher asset tangibility and capital expenditure ratios than Marvell Technology. It is worth noting that Marvell Technology conducts more R&D, and has higher market to book ratios but almost no financial leverage. The last firm in the table, Xilinx, has experienced variation in external production as well as in leverage over time. This case thus illustrates the within-firm time-series relation between amount of purchase contracts and financial leverage.

It is also interesting to point out that a sharp decrease in external purchase contracts occurs

for all three firms during 2008, the year after the financial crisis began. This indicates that firms are able to reduce the amount of goods and services they obtain from external sources in subsequent years as demand conditions deteriorate. Thus, these outsourcing firms appear to be able to adjust the costs of their inputs as demand conditions fluctuate as well as revise their leverage decisions. We now analyze how this flexibility may result in differences in cross-sectional and time-series patterns of input costs and cash flows.

5 Outside purchase contracts and cash flows

In this section, we examine potential economic links between outside purchase contracts and real side variables, focusing on cost management and cash flows. Specifically, we address two questions in this section. First, do firms for which purchase contracts are more extensively used manage their costs more flexibly? Second, is the use of outside purchase contracts associated with a decline in cash flow volatility due to the increased flexibility in the cost management?

We first examine how firms with material external purchase contracts adjust input costs following demand fluctuations. To do this, we regress firm cost of goods sold (COGS) and/or SG&A on an indicator variable that equals one when the firm experiences a negative demand shock. The idea is to investigate whether firms with outside purchase contracts can scale costs down when faced with a negative demand shock. Our indication of a negative demand shock is when the downstream industry experiences a decline in sales. We scale COGS and SG&A by average firm sales to avoid an effect from changes in sales over the period. We include firm fixed effects to focus on the firm-specific difference relative to the time series average in COGS and SG&A. Results are presented in Table 5.

[Insert Table 5 Here]

We compare firms with and without outside purchase contracts in Panels A and B, respectively. The estimated coefficients of Negative demand shock in the table show that the purchase

contracting firms' COGS, combined with their SG&A, drops more than two times the amount for firms with no outside contract, when there is a negative demand shock. This effect is more pronounced when we analyze COGS and SG&A separately. The effects are significantly negative at the 1% level for both COGS and SG&A for firms with outside purchase contracts (Panel A), and insignificant for firms without outside purchase contracts (Panel B). These results show that firms with outside purchase contracts are able to reduce COGS and SG&A expenses significantly when faced with negative demand shocks.

We predict that the ability of purchase contracting firms to better match input costs to demand conditions will lead to less volatile cash flows and, thus, less business risk. We examine this prediction in Table 6.

[Insert Table 6 Here]

In this table, we consider the standard deviation of the 12 previous quarters' earnings after interest, taxes, depreciation, and amortization, scaled by sales (return of sales) instead of return on assets so that it does not include the potential effect of fewer fixed assets in outside contracting firms.[13] Using a matching estimator, we compare firms with outside purchase contracts to firms that have not used these contracts in a nonparametric way within the same quarter. Our matching is based on multiple variables including firm size, age, market to book, mean quarterly sales, asset tangibility, and competition.[14] Similar to how we split our sample in Table 5, the purchase contract variable considered in Table 6 is an indicator for whether a firm has purchase contracts (PC exists). PC exists equals one if the firm has disclosed a non-zero amount of purchase contracts for the given fiscal year. The control observations are the four nearest neighbors across the matching variables within the same FIC-25 code that have

[13]Our results are robust to using return on assets.

[14]We consider variables used in the leverage analysis later for the matching procedure. Some of the variables that are limited to explaining leverage such as Foreign tax %, that are highly correlated with cash flows themselves, or that are subsumed by exact-industry matching such as High-tech industry, are dropped. To normalize the firm-specific magnitudes of quarterly cash flows, we additionally consider quarterly sales as a matching variable. Our results are robust to using different matching variables.

no outside purchase contract.[15]

Results in Table 6 show that cash flow volatility for firms with outside purchase contracts is lower in many quarters than for firms without such contracts. If we collapse over all quarters, the standard deviation of cash flow is lower for firms with outside contracts by 0.031, and the difference is significant at the 10% level. In particular, the reduction in cash flow volatility is much stronger in both magnitude and significance from 2009 to 2010, indicating that firms with outside purchase contracts were able to reduce their cash flow volatility when faced with the financial crisis.

6 Outside purchase contracts and leverage

We next examine the relation between use of outside purchase contracts and firm capital structure on the financial side. One might expect that, given increased flexibility in managing costs and less volatile cash flows, firms with outside purchase contracts would use more debt and have higher leverage.

We begin by examining the relation between purchase contract intensity and leverage in a simple OLS framework. We recognize that these decisions are set jointly, and thus account for this simultaneity in later tables. Table 7 presents the OLS regression results for the association between purchase contract intensity and both Market leverage and Book leverage. Market (book) leverage is the ratio of total debt to market (book) value of assets. Market value of assets is market value of common equity plus book value of preferred stock plus debt (long-term debt + debt in current liabilities) plus book value of minority interest. The purchase contract intensity in the regressions is the dollar amount of the purchase contracts divided by cost of goods sold (PC/COGS). Control variables include measures of the extent of the firm's collateralizable

[15] We choose four matches following Abadie and Imbens (2006) and also as used in Agrawal and Tambe (2016). Results are robust to using different numbers of nearest neighbors and different industry classifications including three-digit SIC and four-digit NAICS code industry classifications.

assets measured by a firm's property, plant and equipment (PPE/assets), and other factors found to be important in examining leverage decisions in prior studies such as the percentage foreign tax paid by firms, firm size, age, profitability, measures of firm growth (market to book and sales growth), industry competition, and a high-technology industry indicator variable. Detailed variable definitions are available in Appendix B. All control variables are lagged one year. Depending on the column, we also include year and industry fixed effects.

[Insert Table 7 Here]

Results in Table 7 show that leverage decreases with purchase contract intensity in all specifications except book leverage without any control variables in column 4. These results show that there is a strong negative association between purchase contracts and leverage, which is opposite to the above view that less volatile cash flows of firms with purchase contracts may result in greater use of leverage. We find that a one standard deviation increase in outside purchase contract intensity is related to a 0.055 standard deviation decrease in market leverage in column 2. This economic magnitude is comparable to the effect of profitability (0.059). Importantly, given we control for fixed asset ratios, our results are not just picking up a reduced collateral effect from the fact that firms with outside purchase contracts use less fixed assets.[16]

6.1 Related-party incentives

We now explore the potential reasons for the negative association between leverage and the use of outside purchase contracts. Specifically, we examine whether suppliers' investment in relationship-specific assets with incomplete contracts is a possible channel that can explain our finding. The relationships that our purchase contracts data capture are more likely to be based on the relationship-specific investment on the supplier side. We test this by considering measures of the extent to which suppliers are concerned that their customer firms will switch

[16]Consistently, we also find that firms with no debt (20.17% of observations in our sample) on average have significantly higher purchase contract intensity than firms with debt.

to other suppliers or fail to buy from them after they have made investments to serve the firms. These measures include the competition in the suppliers' industry and the difficulty of ensuring trust of suppliers over longer geographic distance.

To investigate how outside purchase contracting is possibly related to the incentives of contracting parties to invest in relationship-specific assets, we split our sample between firms with and without purchase contracts. We compare the effects of variables that capture suppliers' concerns for contract instability on leverage between the two groups. For those variables, we specifically consider supplier competition and supplier distance. Supplier competition is the industry median of firm-specific supplier competition. Supplier distance is the industry median of firm-specific distances to domestic or foreign suppliers based on the latitude and longitude information of suppliers' headquarters location. Table 8 presents the results.

[Insert Table 8 Here]

Columns 1 and 2 compare the effects of supplier competition and geographic distance from the firm on market leverage. Columns 1 and 2 examine such effects for firms that have used outside purchase contracts and firms without these contracts, respectively. Columns 3 and 4 present the analogous test for book leverage. We find both in column 1 for market leverage and column 3 for book leverage that the effects of supplier competition and distance on leverage are significantly negative at the 1 % level for firms with outside purchase contracts. By contrast, the effects of supplier competition and distance are insignificant for firms that have not used outside purchase contracts in both columns 2 and 4. These firms without purchase contracts have suppliers that are likely to be from spot markets, and thus the relationship is less likely to involve relationship-specific investment. These results are consistent with the negative relation between outside purchase contracts and leverage being related to avoiding the potential impact of financial distress and bankruptcy on the contracting relation and thus increasing the

incentives of suppliers to invest in relationship-specific assets.

We also find that firm value-added per employee is negatively related to leverage for the set of firms that have purchase contracts (columns 1 and 3) but not for those that do not use purchase contracts (columns 2 and 4). This result is consistent with incentives of high value-added employees to invest in relationship-specific assets also being important to preserve for firms with purchase contracts. This suggests that purchase contracting firms take into consideration high value-added workers when making capital structure decisions, as they are implicit contracting parties (vs. explicit contracting parties, suppliers) whose value of relationship-specific investment may be reduced in the event of bankruptcy or financial distress as well.

7 Propensity-score matched and simultaneous equation regressions

Because firms using external purchase contracts are not randomly selected, we face the problem that both external purchase contracts and financing decisions may result from common factors like demand conditions or cost shocks. Empirical evidence from the data suggests that using outside purchase contracts is relatively more invariant than other corporate decisions. However, purchase contract intensity (how much to purchase from outside the firm) is associated with cash flow stability, as previously shown, which, in turn, is likely to be related to financing decisions. Although we acknowledge that we cannot eliminate this endogeneity problem without using a natural experiment, that we do not observe during our sample period, we address this issue by employing several methodologies including propensity-score matched regressions and simultaneous regressions.[17]

[17]In the online appendix, Table OA.1, we consider an OLS regression framework using multiple measures of leverage. We also instrument for a firm's contracting decision using distance to a port of entry including seaports, hub airports with cargo services, and border crossings. This location-based instrument captures the feasibility of purchasing products or services from suppliers in other states or countries far from the focal firm's main business location, and is less likely to have the first order effect in leverage decisions. We report the IV regression results in the online appendix, Table OA.1.

7.1 Purchase contract propensity

We first examine the propensity to use purchase contracts, and use the estimated propensities to further examine whether our results hold in the more refined propensity-matched subsample.

[Insert Table 9 Here]

Table 9 examines propensities to use purchase contracts extensively. Column 1 of the table shows results from a between-firm model in which the regression is at the firm level and each variable is collapsed into its time-series average. This specification is to examine the cross-sectional heterogeneity in purchase contracting decisions. In columns 2 to 4, we estimate panel regressions at the firm-year level for purchase contracting propensities using several different model specifications. In the first two specifications (columns 1 and 2), we estimate a logit model with the dependent variable High PC/COGS, which equals one if a given firm is in the highest tercile of PC/COGS and zero otherwise. Purchase contract intensity (PC/COGS) is the dollar amount of purchase contracts divided by cost of goods sold. In the last two specifications (columns 3 and 4), we estimate a linear probability model. We estimate standard errors that allow for heteroskedasticity and industry clustering for the firm-level regressions and industry-year clustering for the firm-year panel regressions. Depending on the column, we include year and industry fixed effects. Our matching variables are the same set of variables used in Table 8 as control variables except asset tangibility.[18]

The propensity estimation regressions are to generate propensity scores for all firms in our sample to be used for the propensity-score matching analysis in the next table, but it is also informative on its own with respect to characteristics of high purchase-contracting firms. We present and discuss the results in Table 9. Because the results in all specifications of the table are qualitatively similar, the following discussion applies to all specifications.

[18]We do not include asset tangibility (PPE/assets) in matching variables, as it is likely to have a mechanical relation with purchase contract intensity. Results are similar with and without the variable in the analysis.

We find that high purchase-contracting firms are larger and located close to major ports of entry, have higher market-to-book ratios and value-added per worker. Industry factors are also important in explaining a firm's use of purchase contracts. A firm is more likely to be high purchase-contracting firm when it operates in a more competitive or high-technology industry and when the industry overall competition of suppliers and distance to suppliers are greater. Overall, the results in Table 9 confirm the previous results in our descriptive analyses of the use of purchase contracts.

We next present our propensity-score matching analysis in Table 10. To ensure that we compare groups of firms with similar observable characteristics, except whether or not they are high purchase-contracting firms, we restrict our sample to the firms in the highest tercile of PC/COGS and their nearest neighbors selected among firms that are not in the highest tercile of PC/COGS. For matching, we use propensity scores estimated in column 2 of Table 9 without replacement.

[Insert Table 10 Here]

Panel A of Table 10 shows the difference in means of the matching variables between the two groups of firms that have high PC/COGS and their nearest neighbors with no or low PC/COGS. Matching variables are the same set of control variables used in the previous propensity estimation regressions. 2,061 firm years with high PC/COGS are matched to 2,061 control firm years. As we do not observe significant differences in the matching variables between the two groups after the matching procedure, propensity-score matching alleviates a concern that firms with high PC/COGS are likely different in those observable characteristics from firms with no or low PC/COGS.

In Panel B of Table 10, we examine whether leverage differs between the two groups after controlling for observable characteristics in Panel A. We begin with Market leverage and Book

leverage. We find in rows 1 and 2 that for either market or book leverage, firms with high PC/COGS have approximately 2% less leverage than firms with no or low PC/COGS, but otherwise similar.

A potential concern with examining market or book leverage is that our results may reflect outsourcing firms' substituting away from using short-term leverage toward the increased use of supplier financing as captured by the amount of purchase contracts. We address this concern by examining in rows 3 and 4 whether the results are present only for short-term leverage. We find that firms with high PC/COGS have less short-term leverage, as predicted above, although the magnitude and the significance of the effect weaken to 0.7% when only short-term leverage is considered. Furthermore, we find in a subsequent test that leverage reduction is more pronounced for long-term leverage. The negative link between outside purchase contracts and leverage thus takes the form of a decrease in both short-term and long-term leverage, the effect on long-term leverage being greater. This implies that firms that materially use purchase contracts choose particularly lower long-term leverage to decrease the chances of financial distress and bankruptcy.

We confirm this finding and the robustness of our results by considering two other measures of leverage, net leverage, and an alternative measure of leverage that accounts for potential supplier financing. Net leverage is the market leverage net of cash. For Leverage with AP, we additionally include accounts payable as part of total debt. Including accounts payable mitigates the concern that purchase contracting firms are likely to have greater accounts payable, which can be viewed as a substitute for debt.[19] We find in rows 5 and 6 that leverage is significantly lower for firms with high PC/COGS than for firms with no or low PC/COGS, and that the effect is much stronger with these alternative measures.

[19]We also note that lease obligations can be associated with purchase contract intensity. Our debt measure includes long-term (capitalized) lease obligations as part of long-term debt.

We consider six different measures of leverage including market leverage, book leverage, short-term and long-term market leverage, net leverage, and leverage with accounts payable. We find that leverage for high purchase-contracting firms is significantly lower than that for control firms with similar characteristics. For all these six leverage measures, the difference is significant at the 1% level. In addition to these difference tests, in an unreported analysis we run regressions with each leverage measure as a dependent variable on High PC/COGS and all matching variables. The regression results are consistent with the results of the difference tests reported in Panel B.

7.2 Simultaneous regressions

Our results for the propensity-score matching are based on controlling for observable characteristics. In this section, we consider simultaneous regressions in which we jointly predict purchase contracting and leverage. This simultaneous equation estimation has the advantage of showing the common factors that impact both outsourcing and leverage decisions. Specifically, we examine the simultaneous relation between PC/COGS and market or book leverage using seemingly unrelated regressions (SUR) with the identical right-hand side regressors. We thus focus on analyzing similar or differential effects of significant factors on the two decisions. The SUR estimation allows the residuals or omitted variables across the two decisions to be correlated. Table 11 reports estimates of two sets of systems of specifications for PC/COGS and market or book leverage.

[Insert Table 11 Here]

Columns 1 and 2 (3 and 4) estimate the system of panel regressions for PC/COGS and market (book) leverage, respectively, with year fixed effects. We report the correlation of residuals, *Rho*, of the two regressions for each system at the bottom of the table. Results for the two sets of equations being qualitatively similar, the following discussion applies to both

sets of results.

We find that only firm size has significant positive effects on both purchase contracts and leverage, and asset tangibility, market to book ratio, distance to a port of entry, value-added per employee, competition, and supplier competition and distance have significantly opposite effects. In particular, firms with more growth options have higher purchase contract intensity, but less leverage. Firms nearer to a port of entry have higher purchase contract intensity, consistent with having lower costs of outsourcing, but less leverage. Industry competition also shows significantly opposite effects on purchase contracts and leverage. Importantly, firms with higher value-added per worker and greater supplier competition and distance use more purchase contracts, but less leverage, consistent with the suggested channel of relationship-specific investment. Some variables, such as firm age, profitability, sales growth, and the high-technology industry indicator variable have effects on leverage, but not on purchase contracts.

We run analogous tests of simultaneous relations between purchase contracts and other measures of leverage including short-term vs. long-term, net leverage, and leverage with accounts payable. Table 12 reports estimates for four sets of systems of specifications for PC/COGS and each leverage measure.

[Insert Table 12 Here]

The results with alternative measures of leverage are similar to the results with market or book leverage. Firm size has significantly positive effects for both purchase contacts and long-term leverage, net leverage, or leverage with accounts payable. For short-term leverage, however, firm size shows the opposite effects. As previously shown, asset tangibility, market to book ratio, distance to a port of entry, value-added per employee, competition, and supplier competition and distance overall have significantly opposite effects for the two dependent variables.

In summary, we observe that the signs of the variables that affect purchase contracts in the simultaneous systems are similar to those reported in Table 9. Larger firms with higher market to book ratios and value-added per employee, close to a port of entry, that have suppliers farther away with higher competition, in more competitive and high-technology industries, are more likely to use outside purchase contracts. For leverage, firms with higher market to book ratios, asset tangibility, and value-added per employee, close to a port of entry, that have suppliers farther away with higher competition, in more competitive and high-technology industries, are more likely to use less leverage. We thus see opposite signs on these common key variables for the outsourcing and leverage decisions, confirming the negative relation between these two variables shown in earlier analyses. It is worth noting as well that for five of the six systems of simultaneous regressions that we consider, the correlation coefficients of the residuals (*Rho*) are significantly negative. This means that any omitted variables in our regression models overall have significant opposite effects as well for the two dependent variables. This result further supports our conclusion that underlying fundamental factors account for firms' tendency to use less leverage when they rely on more material outside purchase contracts.

8 Conclusions

We examine firm and industry characteristics associated with firm outsourcing using a unique database of purchase contracts as a measure of outsourcing. We first document informative stylized facts that outside purchase contracting is significantly associated with firm growth, firm value-added per worker, and the location feasibility of receiving products or services from counter-parties at the firm level, and higher competition and high technology at the industry level.

We find that firms' use of outside purchase contracts is related to a reduction in cash flow volatility relative to matched firms that do not use purchase contracts. In particular, during

the recent financial crisis, firms with purchase contracts were able to better match costs with sales fluctuations, as such firms incurred fewer fixed costs, thereby reducing their operating leverage.

Despite the reduction in cash flow volatility, we find strong evidence that firms with external purchase contracts use less financial leverage. We show that characteristics of suppliers, including supplier competition and distance, along with own labor force characteristics of the firms that use purchase contracts, can help explain the negative relation between the use of purchase contracts and leverage. Examining the outside purchase contract and leverage decisions simultaneously, we find that firms in competitive and high-technology industries, with more growth options, higher value-added workers, and suppliers farther away with higher competition, close to a port of entry to the US are more likely to use outside purchase contracts, but have less leverage. This is consistent with the same underlying fundamental factors accounting for firms' tendency to simultaneously use less leverage and more outside purchase contracts.

Overall, our results are consistent with firms that choose to use purchase contracts using less leverage to mitigate the potential loss of the relationship-specific investments that might occur when firms experience financial distress or bankruptcy. Our results are consistent with the hypothesis that the costs arising from incomplete contracts between firms and their contracting parties and related financial distress costs affects how firms that use outside purchase contracts finance their operations. We thus extend the extensive incomplete contracting literature that begins with Grossman and Hart (1986) and Hart and Moore (1990) by showing that incomplete contracting and the potential loss of value through financial distress affect not only who should own assets, but also how firms should sign contracts with external parties and finance operations.

Appendix A Collection of purchase contracts data

This appendix describes how we collect the outside purchase contracts data. We first electronically gather all "10-K"s and "10-K405"s by PERL web crawling[20] of the SEC EDGAR database, searching for the filings from 2004 to 2010. We do not include "10KSB"s and "10KSB40"s, because small business issuers (or smaller reporting companies) are not required to disclose purchase obligations by the SEC's final rules. Then, using PERL programming we specifically extract purchase obligations data in the MD&A section and other identifying information including the CIK number in each 10-K.

There are two types of reporting practices. First, firms use HTML documents. In this case, purchase obligations are disclosed in tabular formats. Second, firms use TEXT documents. In this case, it is highly likely that the firms disclose purchase obligations also in textual formats. For the HTML groups, we extract all tables first and then sort out the certain tables including search keywords. The search keywords are the combinations of *"purchase"* and one of the following terms: *"obligation" "commitment"*, *"agreement"*, *"order"* or *"contract"*. From the tables including the search terms, we extract the proper rows that contain the amount of purchase obligations. For the TEXT document group, we use page breaks instead of tables. From the pages including the above search terms, we extract the proper sentences that contain information on the amount of purchase obligations.

In the event that the extraction process cannot sort out a table or a page containing search terms, we reexamine the whole document and search for another terms including either *"contract obligation"* or *"contract commitment"*. When the extracted information does not contain *"purchase"* or there still exists no match for the search terms, we conclude that the firm has no purchase obligations. The reporting units vary with reporting firms. Therefore, we normalize the units of disclosed purchase obligations in million dollars, by matching other information in the extracted tables or pages with the corresponding Compustat data item.

[20]We acknowledge that Andy Leone's Perl resource page at http://sbaleone.bus.miami.edu/PERLCOURSE/Perl_Resources.html provides a useful help to get started EDGAR web crawling algorithms using PERL.

Appendix B Variable definitions

- *PC exists* is the firm-level variable that equals one, if a given firm has disclosed a non-zero amount of purchase obligations in the given year.
- *PC/COGS* is a firm's estimated payment amount within the closest fiscal year under all of purchase contracts, normalized by cost of goods sold.
- *Market leverage* is the ratio of total debt to market value of assets.
- *Book leverage* is the ratio of total debt to book value of assets.
- *Short-term leverage* is the ratio of debt in current liabilities to the market value of total assets.
- *Long-term leverage* is the ratio of long-term debt to the market value of total assets.
- *Net leverage* is the market leverage net of cash.
- *Leverage with AP* is market leverage that additionally includes accounts payable as part of total debt.
- *Log(mv assets)* is the log of market value of the firm's assets. Market value of assets is market value of common equity plus book value of preferred stock plus debt (long-term debt + debt in current liabilities) plus book value of minority interest.
- *Log(1+age)* is the log of one plus firm age, defined as a given year minus the year when the firm first appeared in Compustat.
- *PPE/assets* is gross property, plant and equipment divided by total assets in the prior year. *Profit margin* is earnings after interest, taxes, depreciation, and amortization scaled, scaled by sales.
- *Cash flow volatility* is the standard deviation of *profit margin* during the fiscal year 2004-2010 for a given firm or the previous 12 quarters for a given firm quarter.
- *M/B* is market value of assets divided by book value of assets.
- *Sales growth* is the percentage growth in sales in a given year.
- *Foreign tax %* is the percentage foreign income tax paid out of total income tax paid in each fiscal year.
- *Default probability* is Merton's naive default probability (distant to default) based on the approach in Bharath and Shumway (2008). Refer to our Empirical Strategy and Variables of Interest section and Bharath and Shumway (2008) for the detailed explanation on how to construct this measure.
- *Stock return volatility* is the log of standard deviation of the firm's daily logarithmic returns over the 252 trading days starting from June to May in the next year, multiplied by the square root of the time period, 252.
- *CAPX/sales* is capital expenditures divided by sales in the prior year.
- *R&D/sales* is R&D expenditures divided by sales in the prior year.
- *Close to port of entry* is one if the minimum distance from the firm's main business location to any port of entry including seaports, hub airports with cargo services, and border crossings is in the lowest tercile of the sample. The information on the U.S. seaports is provided by the Port Import Export Reporting Service from the Maritime Administration's

website at http://www.marad.dot.gov/. We identify 40 seaports within the U.S. 50 states that carry imports with a value of 500 TEUs or greater. The information of the U.S. airports is available on the Passenger Boarding and All-Cargo Data for U.S. Airports from the Federal Aviation Administration website at https://www.faa.gov/airports/. We identify 105 hub airports with cargo services using the information. In addition, we identify 21 Mexican border crossings and 79 Canadian border crossings with truck traffic. The border crossing data are available at http://transborder.bts.gov/.

- *Value-added per employee* is operating income before depreciation divided by the number of employees in the prior year. Negative values are set to zero.
- *Competition* is one minus the TNIC Herfindahl index. The TNIC Herfindahl index is a measure of product market competitiveness based on the Text-Based Network Industries by Hoberg and Phillips (2015).
- *High-tech industry* is a dummy variable indicating the 31 four-digit SIC code industries defined as high technology manufacturing industries by TechAmerica organization. By high-technology, we refer to micro-electronics rather than other technologies. We do not include bio-technology firms in the high-technology industries, as biotechnology is not established yet with its own set of SIC codes and rather widely spreads over the drug sectors. Our high-technology industry classification is compatible with Loughran and Ritter (2004) classification.
- *High PC/COGS industry* is an industry-year level dummy variable that equals one if a given industry's mean PC/COGS level is greater than the median of all industries in the sample at the given year.
- *Supplier distance* is the industry median of firm-specific distances to suppliers. The firm-specific distance to suppliers is the log of one plus the average distance from a given customer firm in US to each domestic or foreign supplier, computed using the latitude and longitude information of each supplier country or state's capital city.
- *Supplier competition* is the industry median of firm-specific supplier competitions based on the TNIC Herfindahl index by Hoberg and Phillips (2015). The CapitalIQ database identifies the SIC code of a supplier. We link the TNIC competition index to each SIC code and take the average of the TNIC supplier competitions for a measure of firm-specific supplier competitions.
- *Demand shock* is the detrended annual percentage change in the downstream industry demands, following Maksimovic and Phillips (2001). We obtain each industry's demand condition using the chain-type quantity indexes for gross output by industry from the BEA at http://www.bea.gov/ industry/xls/GDPbyInd_GO_NAICS_1998-2011.xls. For the consumer and government demands, we use personal consumption indexes and government spending and investment indexes. We then link these data to each supplier industry by a downstream matrix using the input-output benchmark table from the BEA at http://www.bea.gov/industry/io_benchmark.htm. We use the 2002 standard use tables at the detailed IO-code level, and match this data into NAICS codes by correspondence tables between IO and NAICS codes. To detrend, we regress the raw downstream industry demand on industry and year fixed effects indicator variables and then take the residuals from the regression. *Negative demand shock* is a discretized version of *demand shock*, which equals one when *demand shock* is negative and zero otherwise.

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Welcome to the Apple procurement website. Over the years, Apple has developed an entire ecosystem of suppliers who support our business operations. Our goal, in a nutshell, is to obtain stellar products and services within tight timeframes, at a cost that represents the best possible value to our customers and shareholders. If that sounds like a daunting task, it's the same one we assign ourselves.

We are proud of the strong relationships we have built with our suppliers, many of whom have been working with us for years. And we are always looking to expand our supplier base to accommodate our rapidly growing customer base. To that end, we periodically review our relationships and add new suppliers as needed.

Suppliers at Apple

Apple requires each of its suppliers to meet the highest standards for all goods and services. Our requirements include a commitment to rigorous quality assurance. In addition, suppliers must be committed, as we are, to ensuring the highest standards of social responsibility.

The ideal suppliers are those who understand our culture and expectations. We value suppliers who take the time to learn about and understand our business and who look for ways to add value. These suppliers know the importance of making and meeting commitments and delivering the highest quality goods and services.

Our business environment is competitive and fast-paced. Our suppliers must understand this dynamic and be agile and flexible in responding to changing business conditions. Above all, Apple values innovation. We appreciate suppliers who truly understand and share in our challenges, and who help us find the best possible solutions.

Supplier Diversity Program

We take our social and environmental responsibilities seriously. A good example is our strong and longstanding commitment to a diverse supplier base.

Apple's Supplier Diversity Program was formally established in 1993; since that time the company has

Figure 1: Example of customer-supplier relationship

Apple Inc.'s procurement strategies posted on their website at https://www.apple.com/procurement/.

	Total	Payments Due in Less Than 1 year	Payments Due in 1-3 years	Payments Due in 4-5 years	Payments Due in More Than 5 years
Operating Leases	$ 865	$ 108	$ 211	$ 192	$ 354
Purchase Obligations	1,994	1,994	—	—	—
Asset Retirement Obligations	14	—	2	2	10
Other Obligations	4	4	—	—	—
Total	$ 2,877	$ 2,106	$ 213	$ 194	$ 364

(a) Source: Apple Inc.'s 10-K for the fiscal year 2005

	Total	Payments Due in Less Than 1 Year	Payments Due in 1-3 Years	Payments Due in 4-5 Years	Payments Due in More Than 5 Years
Operating leases	$ 1,760	$ 195	$ 409	$ 368	$ 788
Purchase obligations	5,378	5,378	—	—	—
Asset retirement obligations	28	—	8	7	13
Other obligations	471	242	124	105	—
Total	$ 7,637	$ 5,815	$ 541	$ 480	$ 801

(b) Source: Apple Inc.'s 10-K for the fiscal year 2008

Figure 2: Examples of purchase obligations disclosures

Description of purchase obligations excerpted from the footnotes of Apple Inc.'s 2008 10-K: "The Company utilizes several contract manufacturers to manufacture sub-assemblies for the Company's products and to perform final assembly and test of finished products. These contract manufacturers acquire components and build product based on demand information supplied by the Company, which typically covers periods ranging from 30 to 150 days. The Company also obtains individual components for its products from a wide variety of individual suppliers. Consistent with industry practice, the Company acquires components through a combination of purchase orders, supplier contracts, and open orders based on projected demand information. Such purchase commitments typically cover the Company's forecasted component and manufacturing requirements for periods ranging from 30 to 150 days. In addition, the Company has an off-balance sheet warranty obligation for products accounted for under subscription accounting pursuant to SOP No. 97-2 whereby the Company recognizes warranty expense as incurred. As of September 27, 2008, the Company had outstanding off-balance sheet third-party manufacturing commitments, component purchase commitments, and estimated warranty commitments of $5.4 billion. During 2006, the Company entered into long-term supply agreements with Hynix Semiconductor, Inc., Intel Corporation, Micron Technology, Inc., Samsung Electronics Co., Ltd., and Toshiba Corporation to secure supply of NAND flash memory through calendar year 2010. As part of these agreements, the Company prepaid $1.25 billion for flash memory components during 2006, which will be applied to certain inventory purchases made over the life of each respective agreement. The Company utilized $567 million of the prepayment as of September 27, 2008."

Table 1: Industry statistics of purchase contracting activities

The table shows outside purchase contracting activities by two-digit SIC code in the manufacturing sector for the sample period from 2004 to 2010. The firm-level purchase contracts data are from purchase obligations information in 10-K filings. Purchase contract intensity is PC/COGS, which is a firm's estimated payment amount within the closest fiscal year under all of purchase contracts, normalized by cost of goods sold. PC/COGS is winsorized at the top and bottom 1% of the distribution.

Industry description	SIC code	Total firms(#)	Firms with purchase contracts(#)	Firms with purchase contracts(%)	Purchase contract intensity	Purchase contract intensity (within firms with purchase contracts)
Food and kindred products	20	80	58	0.725	0.095	0.131
Tobacco manufactures	21	6	6	1	0.167	0.167
Textile mill products	22	11	8	0.727	0.019	0.027
Apparel and other textile products	23	35	21	0.6	0.117	0.189
Lumber and wood products	24	16	6	0.375	0.008	0.021
Furniture and fixtures	25	24	13	0.542	0.035	0.065
Paper and allied products	26	37	29	0.784	0.053	0.067
Printing and publishing	27	44	25	0.568	0.022	0.037
Chemicals and allied products	28	332	232	0.699	0.124	0.177
Petroleum and coal products	29	21	18	0.857	0.11	0.128
Rubber and miscellaneous plastics products	30	33	17	0.515	0.036	0.067
Leather and leather products	31	16	13	0.812	0.142	0.174
Stone, clay, glass, and concrete products	32	14	12	0.857	0.081	0.095
Primary metal industries	33	57	39	0.684	0.088	0.13
Fabricated metal products	34	49	31	0.633	0.08	0.126
Industrial machinery and equipment	35	223	158	0.709	0.09	0.126
Electrical and electronic equipment	36	346	244	0.705	0.111	0.155
Transportation equipment	37	86	47	0.547	0.074	0.13
Instruments and related products	38	267	174	0.652	0.101	0.154
Miscellaneous manufacturing industries	39	30	17	0.567	0.054	0.096
Total		1727	1168	0.676	0.097	0.142

Table 2: Summary statistics

The table presents summary statistics for firms with and without outside purchase contracts. All variable definitions are available in Appendix B. The sample consists of 1,727 manufacturing firms during the fiscal years from 2004 to 2010. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Firms with purchase contracts		Firms without purchase contracts		
	Mean	Median	Mean	Median	Mean difference
		Firm characteristics			
PO/COGS	0.144	0.098	0.000	0.000	0.144***
Market leverage	0.123	0.087	0.140	0.096	-0.016**
Book leverage	0.187	0.151	0.194	0.141	-0.007
Net leverage	-0.055	-0.013	-0.035	0.014	-0.020
Leverage with AP	0.175	0.141	0.204	0.155	-0.029***
Log(mv assets)	6.864	6.690	5.579	5.420	1.285***
Log(1+age)	2.540	2.629	2.445	2.629	0.095**
PPE/assets	0.434	0.356	0.436	0.360	-0.002
Profit margin	-0.332	0.025	-0.350	0.012	0.018
M/B	2.190	1.798	2.023	1.558	0.167***
Sales growth	0.149	0.089	0.135	0.080	0.013
Foreign tax %	0.303	0.135	0.214	0.007	0.089***
Cash flow volatility	0.361	0.060	0.517	0.058	-0.156*
Default probability	0.015	0.000	0.030	0.000	-0.015***
Stock return volatility	0.422	0.422	0.466	0.466	-0.044***
Close to port of entry	0.347	0.000	0.253	0.000	0.094***
Value-added per employee	0.052	0.029	0.029	0.018	0.023***
R&D/sales	0.308	0.043	0.271	0.020	0.037
		Industry characteristics			
Competition	0.766	0.849	0.692	0.769	0.073***
High-tech industry	0.302	0.000	0.261	0.000	0.041*
High PC/COGS industry	0.312	0.143	0.261	0.000	0.050***
Supplier competition	0.821	0.832	0.813	0.808	0.008***
Supplier distance	7.448	7.776	7.300	7.691	0.148**
Observations		1210		597	

Table 3: Supplier statistics of purchase contracting activities

The table presents summary statistics of suppliers identified in the Capital IQ's business relationship database. The sample consists of 6,917 suppliers for 884 customer firms in our primary sample. The information on suppliers' revenue, assets, total number of employees, SIC code, and headquarters location from is available from the Capital IQ database. Each variable is collapsed into its time-series average. We use US public firms' industry median R&D intensity within the same four-digit SIC code to proxy foreign or US private suppliers' R&D intensity.

Supplier Characteristics	Mean	Min	P25	P50	P75	Max	Obs.
Domestic supplier	0.481	0	0	0	1	1	6917
Domestic public supplier	0.321	0	0	0	1	1	6917
Region: America	0.536	0	0	1	1	1	6917
Region: Asia	0.255	0	0	0	1	1	6917
Region: Europe	0.172	0	0	0	0	1	6917
Region: Africa	0.003	0	0	0	0	1	6917
Region: Oceania	0.019	0	0	0	0	1	6917
Region: Unknown	0.016	0	0	0	0	1	6917
Supplier Revenue ($million)	4595.580	0	50.386	244.643	1730.357	2384814.250	5281
Supplier assets ($million)	7794.225	0	63.025	305.264	2344.114	2421008.500	5282
Supplier capital intensity (sales/assets)	0.944	0.061	0.577	0.845	1.189	3.008	5277
Supplier labor intensity (employees/revenue)	8.059	0.094	2.992	4.972	8.754	58.148	4903
Supplier R&D intensity (R&D/sales)	0.102	0	0.004	0.087	0.125	0.763	5107
Supplier competition	0.812	0.038	0.739	0.845	0.924	0.978	5107
Supplier in manufacturing	0.475	0	0	0	1	1	6917

Table 4: Semiconductor firms and purchase contracting strategies

The table presents examples of three firms operating in the semiconductor industry that employ considerably different external contracting strategies. Marvell Technology is known as a leading fabless semiconductor company, Fairchild as a firm that almost exclusively manufactures its own semiconductors. Xilinx, having substantially changed its volume of purchase contracts over time, provides greater time-series variation in external contracting intensity. The table shows the three firms' purchase contracts intensity, financial leverage, and other firm characteristics over the sample period from 2004 to 2010. Purchase contract intensity is PC/COGS, which is a firm's estimated payment amount within the closest fiscal year under all of purchase contracts, normalized by cost of goods sold.

Year	Revenues ($MM)	PC ($MM)	PC/COGS	PPE/assets	CAPX/sales	R&D/sales	M/B	Market leverage
				Fairchild Semiconductor International Inc.				
2004-2010	1529.8	84.2	0.087	0.970	0.092	0.069	1.265	0.236
2004	1601.0	77.9	0.077	0.722	0.138	0.059	1.301	0.274
2005	1425.1	125.9	0.128	0.911	0.062	0.048	1.534	0.219
2006	1651.1	123.8	0.117	0.878	0.080	0.075	1.456	0.199
2007	1670.2	79.9	0.074	0.881	0.086	0.069	1.270	0.218
2008	1574.2	28.5	0.028	1.086	0.104	0.068	0.756	0.383
2009	1187.5	52.2	0.070	1.145	0.039	0.063	1.122	0.239
2010	1599.7	100.9	0.112	1.166	0.133	0.101	1.416	0.122
				Marvell Technology Group Ltd.				
2004-2010	2485.3	230.3	0.217	0.138	0.052	0.333	2.753	0.013
2004	1224.6	104.0	0.193	0.100	0.056	0.324	3.434	0.003
2005	1670.3	224.5	0.312	0.117	0.080	0.259	5.808	0.002
2006	2237.6	457.0	0.403	0.151	0.108	0.392	2.660	0.036
2007	2894.7	279.0	0.180	0.151	0.051	0.434	1.815	0.049
2008	2950.6	62.6	0.046	0.169	0.025	0.321	1.151	0.001
2009	2807.7	213.3	0.187	0.148	0.013	0.281	2.297	0.000
2010	3611.9	271.5	0.198	0.131	0.032	0.320	2.106	0.000
				Xilinx Inc.				
2004-2010	1858.8	89.2	0.141	0.227	0.035	0.209	2.728	0.067
2004	1573.2	97.2	0.185	0.207	0.044	0.225	3.488	0.000
2005	1726.3	76.8	0.127	0.210	0.043	0.210	2.889	0.000
2006	1842.7	59.1	0.089	0.239	0.064	0.225	2.837	0.111
2007	1841.4	74.3	0.117	0.252	0.025	0.194	2.591	0.123
2008	1825.2	46.5	0.076	0.275	0.021	0.193	2.253	0.108
2009	1833.6	129.5	0.208	0.225	0.015	0.202	2.524	0.044
2010	2369.4	141.3	0.184	0.181	0.035	0.214	2.513	0.086

Table 5: Cost adjustment in firms with and without outside purchase contracts

The table compares changes in input costs following demand fluctuations between firms with and without outside purchase contracts. We include a firm in Panel A if the firm discloses a non-zero amount of purchase contracts at least once during the sample period from 2004 to 2010, and in Panel B, otherwise. Each column shows the estimated coefficient of Negative demand shock from an OLS regression with firm-fixed effects. The dependent variables are COGS (cost of goods sold) combined with SG&A (selling, general & administrative expenses), COGS, and SG&A, scaled by average firm sales during the sample period. A demand shock is the detrended annual percentage change in downstream industry demands using the chain-type quantity indexes for gross output by industry and the 2002 input-output benchmark table from the Bureau of Economic Analysis. Negative demand shock is a discretized version of the demand shock, which equals one when the demand shock is negative and zero, otherwise. All specifications have firm fixed effects. *t-statistics* (in parenthesis) are robust and adjusted for firm clustering. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

PANEL A: Firms with outside purchase contracts	(COGS+SG&A)/avrg sales	COGS/avrg sales	SG&A/avrg sales
Negative demand shock	-0.0447***	-0.0268***	-0.0161***
	(-6.00)	(-4.18)	(-4.00)
Observations	6826	6826	6826
Adjusted R^2	0.598	0.671	0.739

PANEL B: Firms without outside purchase contracts	(COGS+SG&A)/avrg sales	COGS/avrg sales	SG&A/avrg sales
Negative demand shock	-0.0224*	-0.0152	-0.00410
	(-1.82)	(-1.57)	(-0.65)
Observations	2998	2998	2998
Adjusted R^2	0.574	0.676	0.764

Table 6: Purchase contracts and cash flow volatility

The table compares cash flow volatilities between firms with outside purchase contracts and matched firms without outside purchase contracts. We estimate a matching model using Log(mv assets), Log(1+age), M/B, Mean quarterly sales, PPE/assets, and Competition as matching variables. For each quarter, a firm with outside purchase contracts is one that disclosed a non-zero amount of purchase contracts for a given fiscal year. The control observations for a firm with outside purchase contracts are the four nearest neighbors across the matching variables within the same FIC-25 code that have no outside purchase contract. The variable of interest is the standard deviation of the 12 previous quarters' earnings after interest, taxes, depreciation, and amortization scaled by sales. Other variable definitions are available in the Appendix B. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

Quarter	[Purchase contracting firms – Matched firms]	Std. err.	z	P>z	N
	Standard deviation of cash flows				
All quarters	−0.031*	0.018	-1.72	0.085	1695
2004q1	−0.009	0.024	-0.367	0.714	1279
2004q2	−0.010	0.024	-0.401	0.688	1282
2004q3	−0.016	0.024	-0.657	0.511	1282
2004q4	−0.027	0.022	-1.198	0.231	1281
2005q1	−0.003	0.022	-0.161	0.872	1448
2005q2	−0.006	0.021	-0.268	0.789	1450
2005q3	−0.005	0.02	-0.265	0.791	1450
2005q4	−0.015	0.02	-0.773	0.439	1447
2006q1	−0.039**	0.02	-1.985	0.047	1401
2006q2	−0.039**	0.02	-1.995	0.046	1409
2006q3	−0.042**	0.02	-2.145	0.032	1410
2006q4	−0.039**	0.02	-1.988	0.047	1411
2007q1	−0.021	0.021	-0.98	0.327	1358
2007q2	−0.020	0.021	-0.951	0.342	1363
2007q3	−0.014	0.021	-0.688	0.491	1364
2007q4	−0.016	0.021	-0.779	0.436	1366
2008q1	0.003	0.022	0.156	0.876	1302
2008q2	0.011	0.022	0.477	0.633	1307
2008q3	0.003	0.023	0.13	0.897	1308
2008q4	0.002	0.024	0.086	0.931	1306
2009q1	−0.045*	0.027	-1.686	0.092	1077
2009q2	−0.049*	0.026	-1.865	0.062	1078
2009q3	−0.047*	0.025	-1.853	0.064	1078
2009q4	−0.046*	0.025	-1.837	0.066	1078
2010q1	−0.040	0.025	-1.589	0.112	1016
2010q2	−0.044*	0.025	-1.783	0.075	1016
2010q3	−0.047*	0.025	-1.926	0.054	1016
2010q4	−0.055**	0.025	-2.206	0.027	1016

Table 7: Purchase contracts and leverage - OLS regressions

The table examines the effect of outside purchase contracts on leverage. The dependent variable is market or book leverage. Market (book) leverage is the ratio of total debt to market (book) value of assets. Market value of assets is market value of common equity plus book value of preferred stock plus debt (long-term debt + debt in current liabilities) plus book value of minority interest. Other variable definitions are available in Appendix B. PC/COGS and all control variables are lagged one year. Industry fixed effects are at the FIC-25 code groups by Hoberg and Phillips (2015). *t-statistics* (in parenthesis) are robust and adjusted for industry-year clustering. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

	Market Leverage			Book Leverage		
	(1)	(2)	(3)	(4)	(5)	(6)
PC/COGS	-0.0763***	-0.0430***	-0.0360***	-0.0228	-0.0314*	-0.0259*
	(-6.40)	(-4.51)	(-4.30)	(-1.11)	(-1.75)	(-1.65)
Log(mv assets)		0.0168***	0.0137***		0.0296***	0.0258***
		(16.48)	(14.89)		(19.50)	(19.47)
Log(1+age)		-0.0200***	-0.0170***		-0.0230***	-0.0184***
		(-4.29)	(-6.56)		(-4.30)	(-5.29)
PPE/assets		0.0510***	0.0240***		0.0560***	0.0297***
		(6.90)	(3.69)		(5.41)	(3.50)
Profit margin		-0.00397***	-0.00343***		-0.00926***	-0.00774***
		(-7.10)	(-3.50)		(-7.26)	(-4.13)
M/B		-0.0306***	-0.0280***		-0.0143***	-0.0144***
		(-11.35)	(-20.87)		(-5.35)	(-5.22)
Sales growth		0.0129***	0.0106**		0.00701	0.00640
		(2.93)	(2.42)		(0.97)	(0.84)
Foreign tax %		-0.00186	0.00270		-0.00211	0.00395
		(-0.67)	(0.92)		(-0.58)	(1.02)
Close to port of entry		-0.0163***	-0.0186***		-0.0236***	-0.0265***
		(-5.57)	(-6.22)		(-4.82)	(-6.08)
Value-added per employee		-0.0633	-0.0562*		-0.0775	-0.0888
		(-1.59)	(-1.95)		(-1.27)	(-1.63)
Competition		-0.0540***	-0.0384***		-0.0631***	-0.0394***
		(-7.36)	(-5.24)		(-6.36)	(-4.24)
High-tech industry		-0.0406***			-0.0597***	
		(-13.26)			(-16.57)	
High ind PC/COGS		-0.00607			0.00213	
		(-1.45)			(0.34)	
Observations	8819	7950	7950	8819	7950	7950
Adjusted R^2	0.024	0.189	0.276	0.002	0.130	0.212
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	No	Yes	No	No	Yes

Table 8: Purchase contracts and counter-party incentives

The table presents the results of leverage regressions for firms with and without outside purchase contracts. We include a firm in the group of firms with purchase contracts if the firm discloses a non-zero amount of purchase contracts at least once during the sample period from 2004 to 2010, and in the group of firms without purchase contracts, otherwise. The dependent variable is market or book leverage. Market (book) leverage is the ratio of total debt to market (book) value of assets. Market value of assets is market value of common equity plus book value of preferred stock plus debt (long-term debt + debt in current liabilities) plus book value of minority interest. Other variable definitions are available in Appendix B. All control variables are lagged one year. *t-statistics* (in parenthesis) are robust and adjusted for industry-year clustering. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

	Market leverage		Book leverage	
	PC exists	PC doesn't exist	PC exists	PC doesn't exist
	(1)	(2)	(3)	(4)
Log(mv assets)	0.0168***	0.0136***	0.0296***	0.0249***
	(15.59)	(8.05)	(18.07)	(11.31)
Log(1+age)	-0.0251***	-0.0134**	-0.0264***	-0.0161**
	(-4.83)	(-2.30)	(-4.38)	(-2.05)
PPE/assets	0.0538***	0.0684***	0.0690***	0.0760***
	(7.20)	(5.90)	(6.71)	(5.16)
Profit margin	-0.00649***	-0.00259***	-0.0161***	-0.00759**
	(-6.17)	(-3.45)	(-7.23)	(-2.35)
M/B	-0.0301***	-0.0306***	-0.0177***	-0.0106**
	(-12.65)	(-8.73)	(-7.46)	(-2.42)
Sales growth	0.0186***	0.00784	0.0322***	-0.0131
	(4.03)	(0.91)	(4.01)	(-0.91)
Foreign tax %	0.00351	0.00416	0.00578	0.00218
	(1.24)	(0.61)	(1.50)	(0.29)
Close to port of entry	-0.0190***	-0.000978	-0.0209***	-0.0130
	(-7.02)	(-0.18)	(-4.74)	(-1.61)
Value-added per employee	-0.105***	0.0337	-0.185***	0.123
	(-3.24)	(0.55)	(-4.22)	(1.50)
Competition	-0.0390***	-0.0426***	-0.0485***	-0.0510***
	(-4.63)	(-3.26)	(-4.15)	(-3.33)
High-tech industry	-0.0304***	-0.0418***	-0.0515***	-0.0505***
	(-7.08)	(-6.09)	(-9.83)	(-5.57)
High PC/COGS industry	-0.00338	-0.00268	0.0114	0.00881
	(-0.78)	(-0.34)	(1.65)	(0.82)
Supplier competition	-0.225***	0.0277	-0.271***	0.0204
	(-3.43)	(0.33)	(-3.18)	(0.19)
Supplier distance	-0.00553***	-0.000205	-0.00513***	-0.000995
	(-3.29)	(-0.16)	(-3.11)	(-0.63)
Observations	6229	2695	6229	2695
Adjusted R^2	0.223	0.160	0.161	0.088
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	No	No	No

Table 9: Purchase contracting propensity

The table presents the results of the propensity estimation regressions. The dependent variable, High PC/COGS is one if a given firm is in the highest tercile of PC/COGS and zero, otherwise. The first column is from a firm-level between regression, and others are from firm-year level panel regressions. For panel regressions, we estimate both logit (column 2) and linear probability models (columns 3 and 4). Variable definitions are available in Appendix B. Industry fixed effects are at the FIC-25 code groups by Hoberg and Phillips (2015). *t-statistics* (in parenthesis) are robust, and adjusted for industry clustering for the firm-level regression and industry-year clustering for the firm-year panel regressions. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

	High PC/COGS			
	(1)	(2)	(3)	(4)
Log(mv assets)	0.140***	0.170***	0.0284***	0.0288***
	(3.35)	(10.16)	(8.63)	(8.80)
Log(1+age)	-0.0798	-0.0641	-0.00985	-0.00797
	(-1.06)	(-1.62)	(-1.46)	(-1.21)
Profit margin	-0.00224	0.00485	0.00112	-0.000850
	(-0.13)	(0.40)	(0.51)	(-0.37)
M/B	0.0331	0.0373**	0.00661*	0.0106***
	(0.65)	(1.98)	(1.83)	(3.05)
Sales growth	0.261	-0.000579	-0.00149	0.00509
	(1.55)	(-0.01)	(-0.10)	(0.36)
Foreign tax %	-0.0953	-0.187***	-0.0299***	-0.0250***
	(-0.69)	(-3.37)	(-3.72)	(-3.54)
Close to port of entry	0.240***	0.145***	0.0262***	0.0171**
	(2.77)	(3.17)	(3.25)	(2.15)
Value-added per employee	3.336***	0.953***	0.239***	0.235***
	(3.30)	(3.07)	(3.46)	(3.31)
Competition	0.795**	0.679***	0.0888***	0.0887***
	(2.24)	(3.96)	(4.04)	(4.19)
High-tech industry	0.532***	0.311***	0.0579***	
	(3.31)	(3.58)	(4.03)	
High PC/COGS industry	0.275	0.330***	0.0618***	
	(1.31)	(3.57)	(3.57)	
Supplier competition	4.489***	4.017***	0.674***	
	(2.73)	(4.23)	(4.53)	
Supplier distance	0.108**	0.0881***	0.0104***	
	(2.36)	(4.38)	(5.23)	
Observations	1658	8963	8963	8963
Pseudo or Adjusted R^2	0.082	0.059	0.061	0.078
Year Fixed Effects	No	Yes	Yes	Yes
Industry Fixed Effects	No	No	No	Yes
Estimation Method	Firm Between logit	Panel logit	Panel OLS	Panel OLS

Table 10: Differences in leverage with propensity-score based matching

The table examines the relation between purchase contracting and leverage with a propensity-score matched sample. The variable of interest is one of the following leverage measure: Market leverage, Book Leverage, Short-term leverage, Long-term leverage, Net leverage, and Leverage with AP. Market (book) leverage is the ratio of total debt to market (book) value of assets. Short-term leverage (long-term leverage) is the ratio of debt in current liabilities (long-term debt) to market value of total assets. Net leverage is the market leverage net of cash. Leverage with AP, which is computed by additionally including accounts payable as part of total debt. Market value of assets is market value of common equity plus book value of preferred stock plus debt (long-term debt + debt in current liabilities) plus book value of minority interest. High PC/COGS is one if a given firm is in the highest tercile of PC/COGS and zero, otherwise. The sample consists of all firm-years for firms with high PC/COGS and their matched observations with no or low PC/COGS. Other variable definitions are available in Appendix B. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

Panel A: Summary statistics for matching variables

	High PC/COGS	No or low PC/COGS		
Matching variables	Mean	Mean	Mean difference	t-statistics
Log(mv assets)	7.099	7.079	0.020	0.32
Log(1+age)	2.790	2.782	0.008	0.33
Profit margin	-0.301	-0.320	0.019	0.28
M/B	2.294	2.299	-0.005	-0.10
Sales growth	0.155	0.165	-0.010	-0.75
Foreign tax %	0.274	0.280	-0.006	-0.40
Close to port of entry	0.365	0.360	0.005	0.32
Value-added per employee	0.061	0.059	0.002	0.50
Competition	0.803	0.808	-0.006	-0.94
High-tech industry	0.366	0.370	-0.004	-0.26
High PC/COGS industry	0.373	0.374	-0.001	-0.06
Supplier competition	0.829	0.829	0.000	0.20
Supplier distance	7.546	7.556	-0.010	-0.33
Observations	2061	2061		

Panel B: Differences in leverage

High PC/COGS firms – Matched no or low PC/COGS firms				
Variable	Mean difference	Std. err.	z	P>z
(1) Market leverage	-0.022***	0.004	-5.522	0.000
(2) Book leverage	-0.023***	0.006	-3.733	0.000
(3) Short-term leverage	-0.007***	0.002	-3.148	0.002
(4) Long-term leverage	-0.019***	0.004	-5.237	0.000
(5) Net leverage	-0.050***	0.01	-4.81	0.000
(6) Leverage with AP	-0.026***	0.005	-5.696	0.000

Table 11: Simultaneous estimation of purchase contracts and leverage

The table examines the simultaneous relation between purchase contracts and leverage using seemingly unrelated regressions with the identical right-hand side regressors. The two dependent variables are PC/COGS and market or book leverage. PC/COGS is a firm's estimated payment amount within the closest fiscal year under all of purchase contracts, normalized by cost of goods sold. Market (book) leverage is the ratio of total debt to market (book) value of assets. Market value of assets is market value of common equity plus book value of preferred stock plus debt (long-term debt + debt in current liabilities) plus book value of minority interest. Other variable definitions are available in Appendix B. *Rho* is the correlation of the residuals of the two regressions for each system. All control variables are lagged one year. *t-statistics* (in parenthesis) are robust and adjusted for industry-year clustering. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

	PC/COGS	Market	PC/COGS	Book
	(1)	(2)	(3)	(4)
Log(mv assets)	0.0107***	0.0147***	0.0107***	0.0268***
	(9.66)	(14.72)	(9.68)	(17.99)
Log(1+age)	0.00129	-0.0200***	0.00128	-0.0215***
	(0.48)	(-4.32)	(0.47)	(-3.94)
PPE/assets	-0.0334***	0.0576***	-0.0334***	0.0703***
	(-4.85)	(7.83)	(-4.84)	(7.22)
Profit margin	-0.00140	-0.00513***	-0.00139	-0.0131***
	(-1.00)	(-7.77)	(-0.99)	(-9.58)
M/B	0.00736***	-0.0301***	0.00738***	-0.0152***
	(3.92)	(-11.88)	(3.92)	(-6.50)
Sales growth	-0.000243	0.0161***	-0.000225	0.0189***
	(-0.03)	(3.75)	(-0.03)	(2.79)
Foreign tax %	-0.00799***	0.00293	-0.00797***	0.00412
	(-3.18)	(0.98)	(-3.17)	(1.13)
Close to port of entry	0.00870***	-0.0146***	0.00867***	-0.0198***
	(2.81)	(-5.73)	(2.80)	(-4.65)
Value-added per employee	0.117***	-0.0800*	0.117***	-0.124*
	(3.41)	(-1.78)	(3.40)	(-1.84)
Competition	0.0285***	-0.0429***	0.0284***	-0.0530***
	(3.54)	(-6.06)	(3.54)	(-5.58)
High-tech industry	0.00526	-0.0344***	0.00525	-0.0514***
	(1.42)	(-8.09)	(1.42)	(-10.30)
High PC/COGS industry	0.0259***	-0.00321	0.0259***	0.0107
	(5.20)	(-0.72)	(5.19)	(1.53)
Supplier competition	0.252***	-0.152***	0.251***	-0.192**
	(5.23)	(-2.78)	(5.22)	(-2.55)
Supplier distance	0.00392***	-0.00369***	0.00392***	-0.00382***
	(6.90)	(-3.43)	(6.92)	(-3.54)
Rho	-0.0495***		-0.0132	
	(-4.79)		(-1.02)	
Observations	8949		8949	
Year Fixed Effects	Yes		Yes	

Table 12: Simultaneous estimation of purchase contracts and alternative leverage

The table examines the simultaneous relation between purchase contracts and leverage using seemingly unrelated regressions with the identical right-hand side regressors. The two dependent variables are PC/COGS and one of the alternative leverage measures. PC/COGS is a firm's estimated payment amount within the closest fiscal year under all of purchase contracts, normalized by cost of goods sold. Short-term leverage (long-term leverage) is the ratio of debt in current liabilities (long-term debt) to the market value of assets. Net leverage is the market leverage net of cash. Leverage with AP, which is computed by additionally including accounts payable as part of total debt. Market value of assets is market value of common equity plus book value of preferred stock plus debt (long-term debt + debt in current liabilities) plus book value of minority interest. Other variable definitions are available in Appendix B. *Rho* is the correlation of the residuals of the two regressions for each system. All control variables are lagged one year. *t-statistics* (in parenthesis) are robust and adjusted for industry-year clustering. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

	PC/COGS	Short-term	PC/COGS	Long-term	PC/COGS	Net	PC/COGS	With AP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(mv assets)	0.0107***	-0.00779***	0.0107***	0.0177***	0.0107***	0.0406***	0.0107***	0.00988***
	(9.65)	(-9.99)	(9.66)	(19.99)	(9.69)	(14.55)	(9.64)	(8.68)
Log(1+age)	0.00130	-0.00111	0.00129	-0.0193***	0.00127	-0.00370	0.00131	-0.0207***
	(0.48)	(-0.58)	(0.48)	(-5.43)	(0.47)	(-0.48)	(0.49)	(-4.20)
PPE/assets	-0.0334***	0.0195***	-0.0335***	0.0529***	-0.0334***	0.202***	-0.0334***	0.0725***
	(-4.83)	(4.78)	(-4.85)	(8.90)	(-4.85)	(12.31)	(-4.84)	(8.65)
Profit margin	-0.00139	0.000436	-0.00141	-0.00513***	-0.00139	-0.000413	-0.00140	-0.00472***
	(-0.99)	(1.50)	(-1.00)	(-7.27)	(-0.99)	(-0.28)	(-1.00)	(-7.14)
M/B	0.00737***	-0.0156***	0.00737***	-0.0253***	0.00737***	-0.00715*	0.00736***	-0.0409***
	(3.92)	(-8.94)	(3.92)	(-12.37)	(3.93)	(-1.73)	(3.92)	(-11.25)
Sales growth	-0.000222	0.000789	-0.000268	0.0155***	-0.000241	0.0296*	-0.000246	0.0165***
	(-0.03)	(0.34)	(-0.04)	(4.25)	(-0.03)	(1.92)	(-0.03)	(3.46)
Foreign tax %	-0.00797***	0.00859***	-0.00798***	-0.000288	-0.00798***	0.00711	-0.00799***	0.00814**
	(-3.17)	(4.01)	(-3.17)	(-0.10)	(-3.18)	(1.08)	(-3.18)	(2.40)
Close to port of entry	0.00868***	-0.00236	0.00869***	-0.0119***	0.00867***	-0.0405***	0.00870***	-0.0143***
	(2.81)	(-1.61)	(2.81)	(-5.47)	(2.81)	(-5.63)	(2.81)	(-5.11)
Value-added per employee	0.117***	-0.0148	0.117***	-0.0745**	0.117***	-0.177**	0.117***	-0.0892*
	(3.40)	(-0.93)	(3.41)	(-2.03)	(3.40)	(-2.43)	(3.41)	(-1.87)
Competition	0.0285***	-0.00552	0.0284***	-0.0334***	0.0284***	-0.141***	0.0286***	-0.0390***
	(3.54)	(-0.87)	(3.53)	(-5.03)	(3.53)	(-6.44)	(3.55)	(-4.37)
High-tech industry	0.00526	0.00358	0.00527	-0.0291***	0.00523	-0.0813***	0.00528	-0.0257***
	(1.42)	(1.41)	(1.42)	(-8.04)	(1.41)	(-6.42)	(1.42)	(-5.70)
High PC/COGS industry	0.0258***	-0.00924***	0.0259***	-0.00137	0.0258***	-0.00261	0.0259***	-0.0108*
	(5.19)	(-2.76)	(5.20)	(-0.34)	(5.19)	(-0.19)	(5.21)	(-1.91)
Supplier competition	0.251***	-0.258***	0.251***	-0.0917*	0.252***	-1.118***	0.252***	-0.349***
	(5.22)	(-7.68)	(5.22)	(-1.67)	(5.23)	(-8.03)	(5.22)	(-5.87)
Supplier distance	0.00393***	0.0000284	0.00392***	-0.00255**	0.00393***	-0.00574***	0.00392***	-0.00256***
	(6.92)	(0.03)	(6.91)	(-2.52)	(6.92)	(-2.66)	(6.91)	(-2.88)
Rho	-0.0219**		-0.0484***		-0.0325***		-0.0506***	
	(-2.55)		(-4.31)		(-3.70)		(-5.20)	
Observations	8949		8949		8949		8949	
Year Fixed Effects	Yes		Yes		Yes		Yes	

Online Appendix for "Outsourcing through Purchase Contracts and Firm Capital Structure"

This appendix contains an additional table that is mentioned in the paper but was not reported there to preserve space. Specifically, this appendix includes:

- Table OA.1: Purchase contracts and leverage - IV regressions

1 Purchase contracts and leverage - IV regressions

We consider an instrumental variable regression framework to examine the effect of purchase contract intensity on leverage, as the actual intensity of the firm's outside purchase contracting is likely endogenous. We thus instrument the actual value of PC/COGS with a location-based instrument in the first-stage regression and then use the predicted firm-year level purchase contract intensity to examine its impact on financial leverage in the second-stage regression.

A valid instrument for our analysis is a variable that affects the amount of outside purchase contracts, but whose effect on the firm's leverage decisions comes only through the purchase contracting channel. It has to thus be relevant and also satisfy the exclusion restriction. The instrument we use is a location-based variable that captures a firm's feasibility and related cost of receiving products or services from suppliers in other states or countries, based on the firm's distance to a port of entry that can be a sea port, a hub airport with cargo services, or a border crossing. The distance to a port of entry is likely to affect a large number of US manufacturing firms that hire foreign suppliers, and thus is an important factor in the firm's decision to increase or decrease its level of the procurement through purchase contracts. We

also note during the time period of our data that firms do not change their main business locations, while firm financing decisions frequently change.

Specifically, we use the variable, close to port of entry, that is one if the minimum distance from the firm's main business location to a port of entry including seaports, hub airports with cargo services, and border crossings is in the lowest tercile of the sample. This discretization allows for a likely nonlinear relation. The distance to the closest port, especially using water transportation, has been used as an exogenous instrument in Fort (2011) and Moon (2012). Fort (2011) shows that plants over 200 miles away from a deep water port are 2.4 percentage points less likely to fragment (outsource) relative to plants within 50 miles of the closest port. Moon (2012) also shows that whether the firm is close to the seaport is associated with a 1.2 percentage point increase in a firm's purchase contract intensity.

[Insert Figure OA.1 Here]

Figure OA.1 shows firm main business locations and also the locations of the seaports, border crossings and hub airports. From these maps we can see that many firms are some distance from external sourcing locations and especially so in the Midwest regions.

[Insert Table OA.1 Here]

Table OA.1 reports our results of the instrumental variable regression analysis. In column 1, we first estimate the first-stage regressions using close to port of entry as our instrument. The result in column 1 confirms our finding in the paper that firms with external purchase contracts are more likely to be located closely to a port of entry indicating location feasibility of receiving products or services from counter-parties. We report in columns 2 through 7 the second-stage regression results using the instrumented PC/COGS from column 1. For the dependent variables in the second stage, we begin with market leverage and book leverage, and move to more conservative measures including net leverage and leverage with AP.

Columns 2 to 7 show that firms with outside purchase contracts have significantly lower leverage in all specifications. Leverage decreases with the predicted outside purchase contract intensity. This result holds for both short-term and long-term leverage, and strongly so for leverage net of cash and leverage when we include accounts payable as part of debt in more stringent tests. These results confirm our conclusion in the paper that there is a strong negative effect of the purchase contracts on leverage.

Overall, results in Table OA.1 confirm the main findings of the paper and also complement the empirical methodologies of the paper based on propensity-score matched regressions and simultaneous regressions to further address endogeneity concerns.

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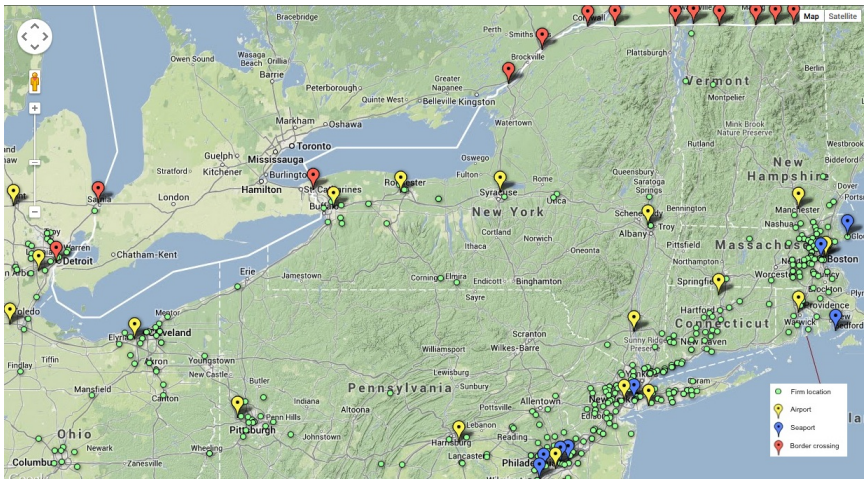
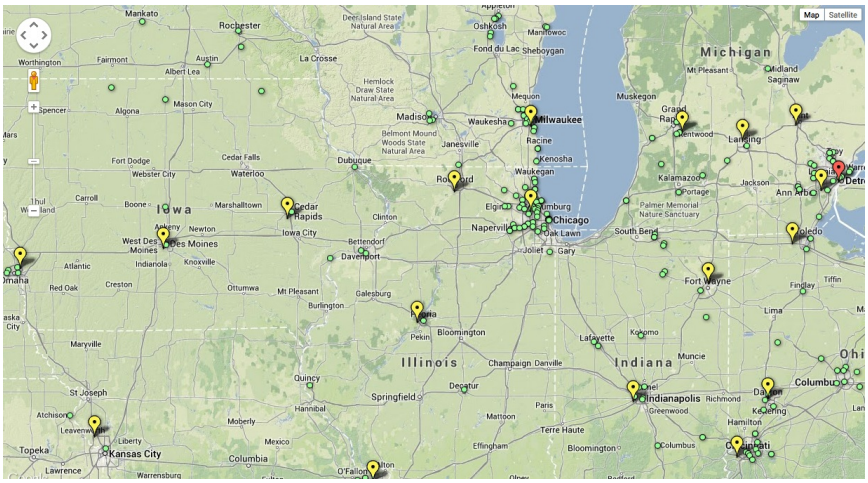
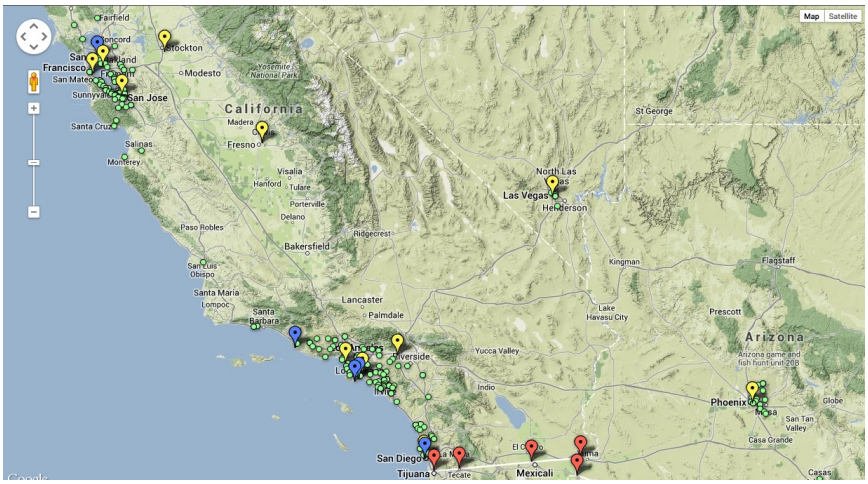


(a) East Coast Region



(b) Midwest Region



(c) West Coast Region

Figure OA.1: Firm Main Business Locations and U.S. Major Ports of Entry

Table OA.1: Purchase contracts and leverage - IV regressions

The table examines the effect of outside purchase contracts on leverage. The dependent variable is one of the following leverage measure: Market leverage, Book Leverage, Short-term market leverage, Long-term market leverage, Net leverage, and Leverage with AP. Market (book) leverage is the ratio of total debt to the market (book) value of total assets. Short-term leverage (long-term leverage) is the ratio of debt in current liabilities (long-term debt) to the market value of total assets. Net leverage is the market leverage net of cash. Leverage with AP, which is computed by additionally including accounts payable as part of total debt. Market value of total assets is market value of common equity plus book value of preferred stock plus debt (long-term debt + debt in current liabilities) plus book value of minority interest. Other variable definitions are available in Appendix B of the paper. PC/COGS and all control variables are lagged one year. *t-statistics* (in parenthesis) are robust and adjusted for industry-year clustering. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

	(1) PC/COGS	(2) Market	(3) Book	(4) Short-term	(5) Long-term	(6) Net	(7) With AP
Close to port of entry	0.0108**						
	(2.48)						
PC/COGS (instrumented)		-1.056***	-0.874*	-0.645***	-0.827***	-3.214***	-1.482***
		(-3.55)	(-1.83)	(-4.09)	(-3.27)	(-3.77)	(-4.78)
Log(mv assets)	0.00918***	0.0247***	0.0336***	0.00143	0.0237***	0.0775***	0.0252***
	(6.20)	(8.54)	(7.19)	(0.88)	(9.61)	(8.45)	(7.98)
Log(1+age)	0.00247	-0.0187***	-0.0213***	0.000519	-0.0200***	-0.00536	-0.0198***
	(0.83)	(-3.97)	(-3.85)	(0.25)	(-4.81)	(-0.64)	(-3.89)
PPE/assets	-0.0419***	0.0196	0.0466*	0.00161	0.0226	0.0687*	0.0239
	(-4.81)	(1.17)	(1.90)	(0.18)	(1.62)	(1.80)	(1.33)
Profit margin	-0.00104	-0.00497***	-0.0114***	-0.000502*	-0.00455***	-0.00547**	-0.00507***
	(-0.78)	(-5.29)	(-5.58)	(-1.73)	(-4.87)	(-2.13)	(-5.40)
M/B	0.00845***	-0.0201***	-0.00588	-0.00953***	-0.0180***	0.0194**	-0.0276***
	(3.09)	(-5.88)	(-1.52)	(-4.86)	(-6.34)	(1.98)	(-6.72)
Sales growth	0.0105	0.0219***	0.0169*	0.00660**	0.0195***	0.0429***	0.0264***
	(0.68)	(3.94)	(1.85)	(1.99)	(3.90)	(3.16)	(4.17)
Foreign tax %	-0.00963***	-0.00959**	-0.00424	-0.00156	-0.00986**	-0.0222**	-0.0116**
	(-2.68)	(-2.01)	(-0.60)	(-0.52)	(-2.23)	(-2.27)	(-2.34)
Value-added per employee	0.105***	0.00180	-0.0814	0.0438*	-0.0106	0.0883	0.0341
	(3.33)	(0.03)	(-0.91)	(1.96)	(-0.20)	(0.67)	(0.56)
Competition	0.0441***	0.00234	-0.0141	0.0151	0.00268	-0.0354	0.0175
	(4.62)	(0.14)	(-0.55)	(1.43)	(0.18)	(-0.77)	(0.86)
High-tech industry	0.00861*	-0.0279***	-0.0471***	0.00336	-0.0247***	-0.0871***	-0.0214***
	(1.78)	(-7.05)	(-7.14)	(1.17)	(-7.42)	(-4.98)	(-4.60)
High PC/COGS industry	0.0325***	0.0293***	0.0365**	0.00666	0.0248***	0.0762**	0.0317***
	(5.40)	(3.09)	(2.18)	(1.13)	(3.00)	(2.49)	(3.18)
Supplier competition	0.0433**	-0.00248	-0.0558*	-0.00777	-0.00203	-0.0355	-0.00867
	(2.44)	(-0.12)	(-1.72)	(-0.56)	(-0.10)	(-0.79)	(-0.38)
Supplier distance	0.00511***	0.00601***	0.00438	0.00627***	0.00466**	0.0200***	0.0110***
	(5.52)	(2.64)	(1.51)	(6.67)	(2.33)	(3.85)	(4.97)
Observations	4311	5100	5100	5105	5100	5098	5100
Adjusted R^2	0.078	0.223	0.135	0.193	0.203	0.207	0.276
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes