Three Essays on Sourcing Decisions

Dissertation

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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The Ohio State University

2022

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2022

Abstract

This dissertation addresses the relative importance of price and non-price criteria in sourcing decisions from three distinct perspectives. Each essay is motivated by the same problem: that organizations tend to unintentionally overweight costminimization objectives in their sourcing decisions.

In the first of three essays, I show that excessively price-based decision-making is a widespread problem in sourcing. To do this, I combined two sources of data on contract awards by the US federal government. I applied coarsened exact matching to identify cases where contracts were awarded using different criteria in similar situations. I then used logistic regression to show that when non-price criteria are weighted more heavily, the same contractor is more likely to receive awards for similar work in the future. This relationship is absent when there is a requirement for the decision-maker to provide written justification for the use of the more price-based approach, allowing me to infer a solution to the problem identified.

In the second essay, I investigate whether the procurement profession's identity influences the relative importance of price in supplier selection decisions. I first conducted a series of semi-structured interviews with current practitioners, eliciting their comments on: their level of identification with the procurement profession; procurement's group image; others' perceptions of procurement's group image; and, procurement's status within their organization. Drawing from the observed variation in responses, I designed and conducted a scenario-based experiment. I find that strong identification with the procurement profession can contribute to more price-based sourcing decisions.

In the third essay, I expand my focus from procurement professionals to a broader set of professions that commonly contribute to sourcing decisions: supply management, engineering, and marketing. Seeking to understand how these different perspectives influence sourcing decisions, I gathered text corpora from each discipline (specifically, from practitioner-targeted magazines published by leading professional associations). I then used the word2vec algorithm to train independent semantic space models. I interpret differences between these models as differences in perspectives between these professions and I demonstrate an application of the technique by using it to identify points of similarity and divergence between the professions' competitive priorities.

I conclude by summarizing the implications of these three essays for theory and practice and highlighting opportunities for future related research. This is dedicated to my sister Heather, who has been endlessly supportive and understanding of this long journey.

Acknowledgments

I thank all the faculty in the (former) Management Sciences and (present) Operations & Business Analytics department at The Ohio State University who provided the rigorous training that prepared me to tackle these research questions. In particular, I thank my advisors, John Gray and James Hill, who were always generous with their time and helpful with their advice, as well as being excellent company. I hope that my future accomplishments will make you proud.

I also fondly acknowledge the three mallard ducks who lived at Mirror Lake during my dissertation work and the coronavirus pandemic. They were reliable and peaceful company whenever I needed to escape my apartment.

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Fields of Study

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Chapter 1: Introduction

This dissertation follows the three-essay format that has become popular in business schools. As such, each chapter contains its own introduction, review of related literature, analysis and discussion. This brief introduction to the overall document has a narrower focus: on the motivations that underlay my stream of research.

My research is problem-driven: each chapter in this dissertation tackles the problem of excessively price-based decision-making by firms from a different perspective and with a different methodology. I define excessively price-based decision-making as decision-making which weights price (or, easily-measurable costs) more heavily than what would be consistent with the decision-makers' own preferences and objectives. My research designs carefully accommodate the fact that the ideal relative importance of price to non-price factors varies greatly between contexts.

I first came to believe that organizations (including both for-profit businesses and organizations with other goals) tend to unintentionally overweight easily-measurable costs relative to other factors based on my work experience before I began my graduate studies. This belief was not contradicted by the academic literature. To the contrary, case studies (Platts and Song 2010, Gray et al. 2017) and laboratory experiments (Anderson et al. 2000, Dekel and Schurr 2014) had already shown that those responsible for making sourcing decisions overvalue cost-minimization objectives in at least some situations. Strong explanations for why purchasing managers might tend to overweight easily-measurable factors were already available in the literature on cognitive biases (Gray et al. 2020) and economic incentives (Holmstrom and Milgrom 1991). However, the economic importance and the scale of the problem had not yet been established. The first essay of my dissertation, i.e., Chapter 2: When Does Price-based Sourcing Hurt Performance?, tackles this issue. John Gray, one of my two advisors, generously contributed his expertise to the research project and is the second author on this chapter.

Having found evidence that excessively price-based decision-making in sourcing is indeed an important problem, my next task was to further explore factors that might exacerbate or alleviate the problem: I tackle this in the second essay of my dissertation, i.e., Chapter 3: When Does Professional Identity Affect Sourcing?. In this chapter, I draw from prior research showing that social identities affect information seeking and information processing (Tripsas 2009, Anand et al. 2013, Lifshitz-Assaf 2018) to hypothesize that the identity of the procurement profession might influence individuals' evaluation of the relative importance of price to non-price factors. My results suggest that it does. James Hill, also my advisor, generously contributed his own expertise to this research project and is the second author on this chapter.

Next, having established that the prevalence of excessively-price based sourcing can be affected by the group identity of relevant decision-makers, I became curious about how perspectives from a wider set of professions might affect my motivating problem, given that complex sourcing decisions in large firms are often made by crossfunctional teams. In the third essay of my dissertation, i.e., Chapter 4: What Can Function-Specific Semantic Models Tell Us About Sourcing?, I show that existing machine learning techniques (i.e., Mikolov et al. 2013) can be applied to text associated with a specific profession or functional group, and that the differences between the resulting models can shed light on groups' divergent priorities. I am the sole author of this chapter.

To summarize: while each essay of this dissertation tackles its own research question, they all share a common motivation. Many of the great problems that humanity is currently grappling with - problems such as climate change and human rights abuses - may have been exacerbated by excessively price-based decision-making in sourcing. This research attempts to tackle those great problems indirectly, by addressing the contributing factor that falls within my domain of expertise.

Chapter 2: When Does Price-based Sourcing Hurt Performance?

2.1 Introduction

Practitioners (Ericksen 2021) and academics (Ellram and Tate 2021) alike have long lamented the tendency of purchasing functions to overweight easily measurable costs in their decision-making at the expense of harder to quantify factors such as lead time (De Treville et al. 2014). Excessively cost-based decision-making has been blamed as a driver of important and varied problems including the offshoring of American manufacturing (Gray et al. 2017) and the loss of technological innovation (Fuchs and Kirchain 2010). In spite of this hand-wringing, there is a lack of empirical evidence on the extent of excessively cost-based decision-making in sourcing. Consequently, there is also a lack of work examining the effectiveness of potential solutions. These gaps in the literature have persisted, not due to a lack of interest, but rather due to empirical challenges including the need for a valid performance measure, the difficulty in locating a large quantity of contracts for similar work that were sourced differently, and the rarity of thoroughly and accurately documented decision-making processes. Our research design addresses each of these concerns. We employ novel data and methods to examine the effects of the criteria and weightings used in supplier selection decisions on contract performance. We ask: does price-based decision-making harm performance (whether employing price-based decision making is explicitly discouraged, or not)? Does more customized evaluation improve performance? Does consideration of social and/or environmental factors improve or harm performance? To answer these questions, we first apply a coarsened exact matching approach (Iacus et al. 2012) that considers both spend characteristics and stakeholders, then we estimate the average effect of treatment in our overlap region (i.e., the set of sourcing decisions in which either sourcing approach might be reasonably applied; Greifer and Stuart 2021b).

Each of our independent variables has practical and theoretical relevance. Regarding price-based decision making, we study decisions made under two incentive structures: 1) when focusing on price is not financially or bureaucratically incentivized for buyers, and 2) when it is explicitly discouraged. Note that both of these structures tilt towards making decisions less based on price than would be the case in many private-sector settings (Helper et al. 2021, LeRoux and Feeney 2013) where cost reductions are often purchasing's main priority (Murfield et al. 2021). Our findings here will hint at solutions to the problem of excessively price-based decision-making. We also examine the extent to which customized evaluation relates to performance, which could inform the extent to which context-specific factors should be included. And finally, we test for the effects of including social and/or environmental factors in the proposal evaluation, in order to contribute to the burgeoning literature on the performance outcomes of investments in these areas (e.g., Carter and Washispack 2018). Our performance metric is recontracting. We define recontracting as similar work being awarded to the same contractor the following year, conditioned on similar work being competitively bid out. Note that we do not consider cases where the same contract is extended, only new contracts involving similar work. This metric is broad enough to capture subjective, objective, and context-specific aspects of performance. This metric is also a relational measure of contract performance: cases of suppliers who stop bidding on contracts from a particular customer are correctly recognized as negative outcomes.

The context of our study is government contracting. Government contracting decisions are extensively documented, resulting in data that can be used to answer research questions of shared importance with the private sector. The lack of incentives and motivations for public sector buyers to focus on cost-cutting (Brewer and Kellough 2016, LeRoux and Feeney 2013, Bowman 2010) is another important advantage of this context; our findings here are likely to be conservative relative to most private sector settings. Government contracts are also a significant part of the world economy in their own right: public procurement spend is between 5 and 20% of GDP in every OECD country (OECD 2019).

We employ longitudinal data from the US government in this study, which has several advantages for our analysis. One is that it allows us to look at incentives for price-based decision-making in two ways. First, the Federal Acquisition Regulations (FAR) discourage price-based decision-making by requiring contracting officers to justify their use of the lowest price technically acceptable (LPTA) source selection process (General Services Administration 2021, FAR 15.101-2). This requirement counters the incentive to prefer LPTA for simplicity alone. Second, sourcing processes not using LPTA must specify whether non-price factors are given more, less, or approximately equal weighting with price, but this decision does not require written justification. This granularity enables analysis of the effects of more price-based decision-making both with and without the procedural requirement for justification. Aside from the above advantages, the US government has a regulatory requirement that past performance be considered in subsequent contract awards (which supports our choice of performance measure) and has awarded numerous contracts through negotiated procedures similar to those used in the private sector (which allows us to maximize the generalizability of our results by limiting our sample to these contracts).

Methodologically, we adopt a coarsened exact matching approach (Iacus et al. 2012). For our purposes, estimating the average treatment in an overlap (ATO) population and discarding unmatched observations is preferable to estimating the average treatment effect (ATE) or average treatment effect on the treated (ATT): it eliminates the extrapolation region and focuses on the area of equipoise (Greifer and Stuart 2021a). We do not find a significant effect of using LPTA, which requires explicit justification, on contract performance. When tradeoff procedures are used instead (i.e., procedures that do not require justification for decisions on the relative weighting of price and non-price factors), we find that when more weighting is placed on non-price factors subsequent contract performance is better. We do not detect significant effects of evaluation customization. We find a positive effect of social/environmental evaluation on contract performance, although the effect is not consistently significant across robustness tests.

Our results will interest both public sector policymakers and private sector decisionmakers. Many private sector businesses and public sector jurisdictions promote pricebased decision-making to a much greater extent than the federal US government. The State of Ohio is one example that encourages its agencies to "award to the lowest responsive and responsible bidder" while also permitting less price-based evaluation if lowest-bidder selection is not considered advantageous (Ohio Department of Administrative Services 2021, PM-01 2.6.2); this is an inverse of the federal tactics discouraging LPTA. Thus, one contribution of our study is to encourage other government entities to follow the U.S. federal government's approach by requiring justification for using LPTA. It is noteworthy that we find that with other approaches, where no written justification is required, more price-based decision-making relates to worse performance. This finding is in spite of the fact that federal contracting officers are not incentivized by bonuses or promotion opportunities to focus on short-term costcutting; they are paid according to the US government's General Schedule based on paygrade and experience (current pay tables are available from the U.S. Office of Personnel Management at www.opm.gov). Thus, a second contribution of our study is to encourage the federal government to discourage price-based decision-making in its non-LPTA procedures as well. In the private sector financial incentives tend to be stronger (LeRoux and Feeney 2013) and purchasing managers are commonly incentivized to seek the lowest price (Goebel et al. 2012). Accordingly, an implication is that the problem of excessively price-based decision-making that we identify in our research setting is likely more severe in many private-sector settings. Making pricebased decision making more difficult appears to be an effective solution, thus a third

contribution of this study is to encourage private-sector parties to consider modifying their own processes in similar ways.

The rest of this chapter is structured as follows: we briefly review the related literature in Section 2, then present our hypotheses in Section 3. We detail our data and identification strategy in Section 4 before presenting our analysis and results in Section 5. Finally, we discuss the theoretical, managerial and policy implications of our results in Section 6, and offer closing remarks in Section 7.

2.2 Dimensionality and Bias in Sourcing

The supplier selection process has long been recognized as an important and strategic area within operations management (Elmaghraby 2000). The multi-dimensional nature of supplier selection decisions in practice is also well-established (Dickson 1966), although these selection processes are often simplified into one or two dimensions for analysis (e.g., total cost, or cost and quality).

There is empirical evidence suggesting that firms tend to underweight non-price factors in sourcing decisions. Platts and Song combine multiple in-depth case studies with survey data to reach their finding that companies significantly underestimate the true costs of global sourcing (2010). Gray et al. (2017) explain the reshoring decisions they observed in case studies of four SMEs as corrections to offshoring decisions that undervalued difficult-to-quantify risks and performance challenges. In a series of scenario-based experiments with purchasing managers, Anderson et al. (2000) find that purchasing managers consistently prefer lower-value, lower-price products to higher-value, higher-price products. In experiments with government buyers, Dekel and Schurr find that technical evaluations are biased in favor of low-cost bidders when prices and technical bids are evaluated simultaneously (2014). Experiments motivated by the COVID-19 pandemic show that decision-makers facing potential supply disruptions under-diversify on average, and especially so when risks are severe (Goldschmidt et al. 2021). These studies are case studies and experiments. One of the contributions of our study is its assessment of the pervasiveness of this bias using a large and longitudinal sample of actual sourcing decisions in the field.

Procurement managers, together with their cross-functional colleagues, make decisions on what criteria to assess and their relative importance within each sourcing decision. Researchers have analyzed sourcing strategies in contexts with complications including heterogeneous supplier reliability (Wang et al. 2010), resource flexibility (Tomlin and Wang 2005), proprietary technologies (Chu and Wang 2015), non-verifiable quality (Tunca and Zenios 2006), options to increase scope (Huang et al. 2021) and coproduction of services (Akkermans et al. 2019). These complications are also present in many of the contracting decisions we observe in our study. If we assume that each sourcing decision is made by competent professionals aiming to maximize contract performance, we should expect those professionals to tend to select more complex evaluation approaches when such approaches are more valuable. Given that performance tends to improve when public sector buyers have greater discretion (Coviello et al. 2018) this assumption is a reasonable one. For example, a procurement manager may determine that a particular high-value contract involves a complex supply market and that the situation therefore calls for a particularly involved evaluation process (Kraljic 1983). With this in mind, we can interpret a statistical relationship between an evaluation approach and contract performance as a tendency to over- or under-utilize that evaluation approach. For example, a finding that more price-based evaluations are associated with worse performance implies that the observed decisions were, in the aggregate, biased to overweight prices at the expense of non-price factors.

Purchasing managers' over-prioritization of cost factors have been variously attributed to poor demonstration of value by suppliers, budgetary constraints, and reward systems that emphasize price (Anderson et al. 2000), mental accounting techniques and reinforcement learning that combine to encourage under-diversification in the face of severe disruption risk (Goldschmidt et al. 2021), and decision-making processes that emphasize costs (Gray et al. 2020). As important as understanding the source of the problem is, understanding the efficacy of potential solutions may be more impactful in practice. The research setting of our study is relatively free from the reward systems that promote price-based decision-making in the private sector (LeRoux and Feeney 2013), allowing cleaner attribution of the observed relationships to the process itself.

2.3 Hypotheses

When proposal evaluation is exclusively or primarily price-based, this favors the selection of low-cost bidders and discourages potential suppliers with other competitive strengths from participating in the bidding process. Goods and services being contracted are not perfectly specified, whether due to bounded rationality (Simon 1955) or because an exhaustively detailed specification would restrict the potential supply base. Furthermore, even for simple spend areas, execution of a contract involves some amount of interaction between buyers and sellers and these interactions can be time-consuming and difficult. For these reasons, almost every competitive bidding process involves variance in some non-price factors relevant to supplier performance, meaning that decision-makers should at least attempt to weigh the costs and benefits of these more ambiguous factors (Goebel et al. 2012, 2018) against price. And, if the supplier market is efficient, the supplier that offers the lowest price will likely be inferior in one or more non-price dimensions. While these non-price dimensions are difficult to assess ex-ante (i.e., adverse selection), they may become quite visible during the implementation of the work, in the form of missed deadlines, low-quality work, or poor communication. Awarding the contract with less regard for non-price differences is accordingly expected to result in worse performance in non-price dimensions.

When contract performance is defined broadly to include both price and nonprice dimensions of performance, more price-based decision-making could feasibly be consistent with an organization's objectives. However, prior case studies and experimental research (Platts and Song 2010, Gray et al. 2017, Anderson et al. 2000, Dekel and Schurr 2014, Goldschmidt et al. 2021) suggests that firms tend to underweight non-price factors. Accordingly, we hypothesize that price-based decision-making will be negatively related to contract performance. We test this hypothesis in two ways.

In one analysis, we consider decisions to award based on the lowest price from among qualified bidders. In our research setting, the use of this supplier selection process must be explicitly justified in writing, which discourages the practice. Support for H1a would suggest that this procedural requirement is insufficient to counter the bias towards making excessively price-based sourcing decisions. **Hypothesis 1a:** Contract performance is worse when evaluation is price-based, even when price-based decision-making is discouraged.

In our second analysis, we consider cases where trade-offs between price and nonprice factors are permitted. In our research setting, weighting non-price factors as more, less, or equally important as price is neither encouraged nor discouraged. Our setting also lacks the individual financial incentives that commonly promote a focus on short-term cost-cutting in the private sector. Thus, support for H1b would provide evidence that removing these incentives is insufficient to counter the bias towards making excessively price-based sourcing decisions.

Hypothesis 1b: Contract performance is worse when evaluation is price-based, when price-based decision-making is not encouraged or discouraged.

Next, we consider how certain context-specific details provided in a request for proposals relate to performance. The evaluation factors listed in a Request for Proposal (RFP) serve two purposes: 1) they determine what will be evaluated and thereby influence the supplier selection decision, and 2) they communicate this information to the supply base and therefore influence potential suppliers' proposal preparation and bidding behavior.

When evaluation factors are customized to a specific situation, they provide more information about the buyer's priorities to the supply base. Suppliers' technical capabilities affect performance (Hartley et al. 1997) and which capabilities are important depends on context (e.g., Humphreys et al. 2007) and should be aligned to strategy (Krause et al. 2001). Procedural rationality (measured with items for extensive information search and quantitative analysis) is beneficial for reducing uncertainty and improving decision performance in sourcing (Riedl et al. 2013, Kaufmann et al. 2012). This suggests that a more customized evaluation process should generally perform better in non-price aspects of performance.

Both bidding (Snir and Hitt 2003) and bid evaluation (Carr 2003) are costly, which could deter decision-makers from including many context-specific factors. We draw from this observation, as well as prior case studies showing that companies can fail to recognize all relevant factors in sourcing decisions (Platts and Song 2010, Gray et al. 2017), to hypothesize that decision-makers in our context will be biased towards the under-inclusion of unusual and difficult-to-measure criteria in their evaluations of bidders' proposals. This leads us to the following hypothesis:

Hypothesis 2: Contract performance is better when evaluation is customized.

Finally, we consider the effects of including social and/or environmental factors among the non-price factors evaluated. Many studies have argued that it pays to be green (Golicic and Smith 2013) and there is a positive relationship between CSR and performance (Awaysheh et al. 2020). Some environmentally-friendly practices provide operational benefits such as increased production quantities (Raz and Souza 2018). Game theoretical models have shown that ethically constrained firms can outperform unconstrained firms in settings with bounded rationality, incomplete contracts, moral hazard, and adverse selection (Anand and Goyal 2019).

Public sector organizations commonly have social and/or environmental objectives, and including factors that favor selection of suppliers with behavior congruent with these objectives may directly support a public sector organization's goals. Additionally, public sector personnel tend to have public service motivations (Crewson 1997), and including social or environmental factors in proposal evaluation may result in the selection of suppliers with behavior more congruent with their individual values. Congruence in CSR orientations has been shown to beneficially affect relationship performance between supply chain partners (Liu et al. 2021).

Despite these potential benefits, suppliers' performance in social and environmental dimensions is also notoriously difficult to accurately evaluate (Plambeck and Taylor 2016), which may lead decision-makers to include these factors in their evaluations of bidders' proposals less often than would be optimal. Accordingly, we hypothesize:

Hypothesis 3a: Contract performance is better when evaluation includes social or environmental factors.

We also offer a competing hypothesis, drawing from the idea that suppliers' investments in social objectives may hamper their performance in objectives more salient to the client organization. Studies showing that environmentally-friendly practices can also be profit-maximizing have been criticized for incompletely measuring impacts (Pagell and Shevchenko 2014), and companies sometimes face real trade-offs between economic and non-economic performance (e.g., Tura et al. 2019, Wu and Pagell 2011). The introduction of sustainability objectives by one member of a supply network can generate a variety of tensions for other parties (Tura et al. 2019), and investments in CSR can even increase rates of employee misbehavior (List and Momeni 2021).

In our study context, the visibility of public sector RFPs may motivate decisionmakers to include social and environmental factors that they do not genuinely consider important because of the human desire to present oneself in the best possible light (i.e., social desirability bias; Fisher 1993). This would reduce the quality and value of information being conveyed to the supply base through the RFP documents, potentially reducing the efficacy of the early planning work of the successful bidder. Furthermore, contract management capacity is lacking in some government entities (Brown and Potoski 2003), such that complex performance objectives may be inadequately managed even when they are appropriately selected for (Henderson and Bromberg 2015). This leads to the competing hypothesis:

Hypothesis 3b: Contract performance is worse when evaluation includes social or environmental factors.

2.4 Data

We collected data from two public sources of data on US government contracts: USAspending.gov and SAM.gov (formerly fbo.gov, which was beta.sam.gov during most of our data collection work).

First, we downloaded data from USAspending.gov for fiscal years 2012 to 2020 inclusive. USAspending data has been previously used for research on public-sector contracting for R&D services (with patent data for performance outcomes; Bruce et al. 2019). For this study, we extracted the subset of transactions meeting all of the following criteria: definitive contract award type (to simplify our analysis by excluding more complex contract forms such as multi-agency contracts and blanket purchase agreements), recipients and primary places of performance within the United States of America, action type null (to exclude a variety of non-award transactions), awarding agencies other than the Department of Defense (as those transactions can be subject to slightly different acquisition regulations), and awarded using negotiated procedures (to maximize generalizability to the private sector). As in the private sector, pre-qualification is common in our research setting; the supplier selection that is our focus is selection from among qualified bidders.

For each contract in this set, we checked to see if similar work was awarded in the following year, defining similar work as having the same: product or service code, state-level primary place of performance, 6-digit North American Industry Classification System (NAICS) code, and awarding sub-agency. Importantly, this check for similar work considers new contract awards (rather than contract extensions which tend to favor incumbents due to switching costs). If no similar work was awarded in the following year, the observation was dropped from the sample. We also dropped observations without a solicitation identifier. This resulted in a set of 3718 observations.

For each of those 3718 contract awards, we searched for the RFP documents corresponding to its solicitation identifier on beta.sam.gov and extracted data on the method of evaluation. Automating this task was considered, but rejected due to the non-standardized formatting and structures of these documents. Contracts with missing data (including due to restricted document access), awarded through Small Business Innovation Research (SBIR) or Small Business Technology Transfer (STTR) programs, and for individual contractors were excluded from further analysis at this stage. This resulted in a sample of 1237 observations. In order to focus only on commercial contracts awarded in non-monopoly situations, we further excluded RFPs for which only one offer was received, as well as awards valued at one dollar or one cent (including the base value of the contract as well as any options). This resulted in a final sample of 1088 observations.

2.4.1 Variables

Dependent Variable

Our dependent variable for performance, *Recontracted*, is a binary outcome for whether the similar work awarded the following year was awarded to the same company (matching on recipient DUNS number; the recipient DUNS number is a 9-digit unique identifier for businesses assigned by Dun & Bradstreet.). This approach to performance measurement depends on the assumption that additional work tends not to be awarded to suppliers who have recently provided unsatisfactory performance. In our context, this assumption is supported by a regulatory requirement that past performance be considered in the contract awards that we observe (FAR 15.305-2). We believe that this novel measure effectively provides an overall measure of performance. Since some aspects of performance are essentially impossible to measure, we believe this to be a superior metric to any attempt to quantify overall performance, especially in a large sample of non-identical contracts.

Independent Variables

Price-based evaluation: our data contains four levels of price-based evaluation, as shown in Figure 2.1. When the lowest price technically acceptable (LPTA) procedure is used, there is no advantage for a bidder who exceeds the minimum technical requirements. When the tradeoff procedure is used, the RFP documents further specify whether the combined non-price factors are less important than, approximately as important as, or more important than price. (In our data, non-price-only procedures were used only for recruitment of individual contractors and were excluded from our analysis accordingly). We test two measures of price-based evaluation: 1) *LPTA* (i.e., the procedure with maximally price-based evaluation, contrasted with all other levels of price-based evaluation): we again note that our specific study context discourages the use of LPTA procedures by requiring documented justification to use that evaluation method. 2) *MoreNonprice* (i.e., the procedure with minimally price-based evaluation, contrasted with the two other levels of price-based evaluation within the trade-offs group): the extent to which non-price factors are considered relative to price in tradeoff procedures does not require any explicit justification.



Figure 2.1: Factor levels of price-based evaluation

Customized evaluation: our data contains a count of the number of dimensions evaluated in each RFP. The mode is three factors; a typical observation considers technical capabilities, past performance and price. Evaluations that consider a larger number of factors break the broad concept of 'technical factors' into several dimensions. The distribution of the count of factors is skewed: the median is four factors and the mean is 4.589 factors. For our main analysis, we test the contrast at the breakpoint between three or fewer factors and four or more factors with the measure *Morethan3Factors*.

Social/environmental evaluation: our data also contains the specific factors evaluated in each RFP. We manually reviewed these factors and coded an indicator variable for the inclusion of a social or environmental criterion: *SocEnvFactors*. Examples include safety, preferences for veteran-owned businesses, preferences for bio-based products, and benefits for local communities. We coded social and environmental criteria as present if they were listed as a dimension to be evaluated (e.g., the factor evaluated is "contractor safety plan"), but excluded cases where a social or environmental criterion was only mentioned as a portion of a broader dimension that includes significant non-social/environmental elements (e.g., the factor evaluated is "quality, safety and infection control").

Controls and Matching Variables

We considered three general categories of factors likely to affect decisions about evaluation approaches: stakeholders participating in the planning process, characteristics of the product or service for which a contract is to be awarded, and characteristics of the market. To address the first category, we identify both the funding sub-agency and awarding sub-agency as potentially influential stakeholders to include in our matching approach. See Table A.1 in the appendix for a list of the awarding sub-agencies in our data set. To address the second category, we include the 6-digit NAICS code and the log of the contract value (specifically, the base value of the contract plus any options) in our matching models. The 6-digit NAICS is quite finegrained; see Table A.2 in the appendix for a listing of NAICS codes used in our data set. To address the third category, we use the log of the number of offers received as a proxy for market competition and include it as a control in our estimation model. Following the recommendations of Stuart (2010) we refrain from matching on this variable, as it may also be influenced by the treatment variables. Descriptive statistics for these continuous variables, as well as the number of factors evaluated in the RFPs, are shown in Table A.3 in the appendix.

2.5 Analysis and Results

We use coarsened exact matching (CEM) to construct pseudo-treatment and control groups, which we then use to assess the average treatment effect in our overlap population (Greifer and Stuart 2021a). CEM has recently been criticized for dropping large numbers of observations and misidentifying average treatment effects (ATE; Black et al. 2020). This is not a shortcoming in our case because our goal is not to estimate the effect of applying a particular evaluation approach to all supplier selection decisions. Instead, we aim to observe the effects of price-based evaluation, customized evaluation, and social/environmental evaluation on performance only in the overlap: the decisions that could have gone either way.

2.5.1 Matching Approach

For our main analysis we construct models with exact matching on 6-digit NAICS code, funding sub-agency, and awarding sub-agency. We coarsen our only continuous matching variable, the log of the contract value. We conduct our analysis using the MatchIt package in R (package version 4.3.4, updated March 2022, Ho et al. 2011,

R Core Team 2013). We perform separate matching, and therefore have different samples and sample sizes for each of our hypothesis tests. We conduct two analyses testing H1 (Models 1 and 2, for H1a and H1b respectively), and one analysis each testing H2 (Model 3) and H3 (Model 4). We use 40 cutpoints in log of contract value in all matching models. We arrived at this number by gradually increasing the number of cutpoints until the increase in balance (caused by the smaller strata) was not worth the decrease in sample size (due to fewer matches); this is consistent with recommendations to apply context-specific expertise and iterate matching to find the best combination of balance and sample size (Ho et al. 2007). This matching approach results in good balance (see Table 2.1): our balance measures post-matching fall well within recommendations for standardized mean difference to be below 0.05 and variance ratios to be between 0.5 and 2 (Ho et al. 2011); no specific recommendations on acceptable K-S values are known to the authors. We chose to use the same number of cutpoints for all four models because it intuitively makes sense that two contract values that are considered similar in one analysis should also be considered similar in the next. We also hope that this consistency will help to alleviate potential concerns about model sensitivity. Results for alternative matching approaches are included in our robustness section later in the article.

Model 1 matches lowest price technically acceptable (LPTA) procedures with similar tradeoff procedures. We use the same matching variables for all models: log of contract value, 6-digit NAICS code, funding sub-agency, and awarding sub-agency. See Table 2.1, Model 1 (LPTA) for a summary of balance measures for the log of contract value before and after matching. The distributional balance of contract value can be seen in more detail in the appendix (Figure A.1). This matching approach

	Unmatched			Matched		
	St. Diff.	Var. Ratio	K-S	St. Diff	Var. Ratio	K-S
Model 1	-0.3298	0.6501	0.125	0.0047	0.9771	0.041
(LPTA)						
Model 2	0.5005	0.9603	0.279	-0.0068	1.0120	0.071
(MoreNonprice)						
Model 3	0.4534	0.814	0.221	0.0132	0.9868	0.069
(Morethan3Factors)						
Model 4	0.2839	1.5365	0.241	0.0051	0.9839	0.048
(SocEnvFactors)						

Table 2.1: Balance Measures: Log of Contract Value

Note: St. Diff is the standardized difference between treatment and control means; values closer to 0 indicate more balance. Var. Ratio is the variance ratio between groups; values closer to 1 indicate more balance. K-S is the Kolmogorov-Smirnov statistic; values closer to 0 indicate more balance.

reduces our original sample of 724 control and 364 treated (LPTA) observations to a matched sample of 255 control and 219 treated observations.

Model 2 matches tradeoff procedures where non-price factors are more important than price with similar procedures that place a lower weighting on non-price factors. The alternatives to non-price factors that are more important than price are 1) tradeoff procedures with non-price factors that are approximately equally important as price, and 2) tradeoff procedures with non-price factors that are less important than price. The 364 observations using LPTA procedures are excluded from this analysis. Table 2.1, Model 2 (MoreNonprice) shows that matching improved covariate balance. The distributional balance of contract value can be see in more detail in the appendix (Figure A.2). This matching approach reduces our original sample of 355 control and 369 treated (*MoreNonprice*) observations to a matched sample of 148 control and 98 treated observations.

Model 3 matches contracts awarded after evaluation of three or fewer factors with those awarded after evaluation of four or more factors. Table 2.1, Model 3 (Morethan3Factors), again, shows that matching improved covariate balance. The distributional balance of contract value can be see in more detail in the appendix (Figure A.3). This matching approach reduces our original sample of 316 control and 772 treated (*Morethan3Factors*) observations to a matched sample of 152 control and 346 treated observations.

Model 4 matches contracts awarded through evaluation processes that included an evaluation of one or more social or environmental factors with similar contract awards that did not. Table 2.1, Model 4 (SocEnvFactors), again, shows that matching improved covariate balance. The distributional balance of contract value can be see in more detail in the appendix (Figure A.4). This matching approach reduces our original sample of 936 control and 152 treated (*SocEnvFactors*) observations to a matched sample of 261 control and 93 treated observations.

To allow our readers to assess the quality of our matching approach, we randomly selected five matched pairs from each matched model. Since CEM is not a one-to-one matching approach, we first randomly selected a stratum containing matches, then randomly selected one treatment and one control observation from that stratum for presentation to the reader. We repeated without replacement to arrive at a sample of 5 matched pairs for each of our 4 main models (i.e., a total random sample of 20). We report basic details including the award description, award value, and solicitation identifier on these observations in the appendix (Figures A.5 through A.8).
2.5.2 Effect Estimation

For our main analysis we fit logistic regression models, using CEM weights (Iacus et al. 2012) and cluster-robust standard errors (Liang and Zeger 1986), clustered on the strata from the matching stage, to estimate the average treatment effect on the treated in our overlap regions. For estimating conditional effects, covariate-adjusted logistic regression models are clearly defined (i.e., conditional on the specific covariates included) and are not overly sensitive to the targeted estimand (Forbes and Shortreed 2008). Following the recommendations of Stuart (2010) we include log of contract value in the estimation model to account for residual imbalance in continuous variables; our other matching variables are categorical and exact matched so no imbalance remains. Our results are presented in Table 2.2. We note that the coefficients of variables other than the treatment variables should not be interpreted (per the current documentation for the MatchIt package; Version 4.3.4; Ho et al. 2011).

Our estimate of the average effect of the treatment on the treated in the overlap region of Model 1 (i.e., *LPTA*) is not significant (p > 0.1). This means that H1a is not supported. Contracts awarded using tradeoff procedures are not recontracted at a higher rate than similar contracts awarded using LPTA procedures. This suggests that excessively price-based decision-making does not occur when it is explicitly discouraged by a requirement for documented justification.

Our estimate of the average effect of the treatment on the treated in the overlap region of Model 2 (i.e., *MoreNonprice*) is highly significant and positive (p < 0.01). This provides support for H1b. When contracts are awarded using tradeoff procedures, those that place more weight on non-price factors are recontracted at a higher rate. This suggests that excessively price-based decision-making does occur when neither financial incentives encouraging it, nor procedural requirements discouraging it, are present.

Our estimate of the average effect of the treatment on the treated in the overlap region of Model 3 (i.e., *Morethan3Factors*) is not significant (p > 0.1). This means that H2 is not supported. Contracts awarded after a customized evaluation process are not recontracted at a higher rate than others. The under-inclusion of relevant context-specific evaluation factors does not appear to be problem in our study context.

Finally, our estimate of the average effect of the treatment on the treated in the overlap region of Model 4 (i.e., *SocEnvFactors*) is significant and positive (p < 0.05). This provides support for H3a: contracts awarded after a process that considers social and/or environmental factors are recontracted at a higher rate than similar contracts not considering these factors. This suggests that social and/or environmental factors should be included more often in the future. That said, this result is less robust than our results regarding price-based evaluation, as we will show in the next section, and we recommend further investigation (rather than immediate changes to practice) in response to this finding.

2.6 Robustness

We test the robustness of our results by varying both our matching and our estimation approaches. We begin by using several alternative matching strategies. First, we use fewer cutpoints on log of contract value (i.e., 30 cutpoints instead of 40; Table A.4 in the appendix) to demonstrate that our results are not sensitive to the exact matching specification chosen for our main analysis. Second, we add two additional exact matching variables: 1) year of contract award, and 2) type of contract

	Dependent variable:								
		Recor	ntracted						
	(1)	(2)	(3)	(4)					
LPTA (H1a)	$0.051 \\ (0.341)$								
MoreNonprice (H1b)		1.339^{***} (0.447)							
Morethan3Factors (H2)			0.497 (0.326)						
SocEnvFactors (H3)				0.486^{**} (0.241)					
logoffers	$\begin{array}{c} 0.663^{***} \\ (0.230) \end{array}$	$0.168 \\ (0.442)$	$0.211 \\ (0.455)$	$0.098 \\ (0.239)$					
logcontractvalue	$0.045 \\ (0.088)$	$0.062 \\ (0.112)$	0.128^{*} (0.072)	$\begin{array}{c} 0.110 \\ (0.095) \end{array}$					
Constant	-2.722^{*} (1.461)	-3.382^{**} (1.528)	-3.327^{***} (1.008)	-2.975^{**} (1.454)					
Observations	474	246	498	354					
Treatment	219	98	346	93					
Control	255	148	152	261					

Table 2.2: Logistic Regression Results

*p<0.1; **p<0.05; ***p<0.01

Note: Cluster-robust standard errors, clustered on CEM strata.

pricing (i.e., firm fixed price, cost plus fixed fee, cost plus incentive fee, fixed price with economic price adjustment, time and materials, fixed price with incentive; Table A.5 in the appendix). Matching on year of contract award addresses the possibility that our observed effects might be driven by federal-level policy changes coinciding with changes in economic conditions during our study period. Matching on type of contract pricing addresses the possibility that our observed effects might be driven by different incentive structures (faced by the contractor) correlating with different proposal evaluation approaches. Third, we limit our analysis to contracts awarded in the fiscal year 2017-2020 (Table A.6 in the appendix), to address the potential effects of the 2017 change in administration.

We further check our robustness with alternative estimation approaches: We use robust standard errors (MacKinnon and White 1985) instead of cluster-robust standard errors (clustered on strata from the matching process) to address the possibility that the strata produced by our matching approaches are insufficiently meaningful for clustering to improve the estimate (Table A.7 in the appendix). We also use bias-corrected and accelerated bootstrapping (Austin and Small 2014) to estimate the marginal odds ratios for the effects of our treatment variables on the treated in our overlap regions. This addresses the potential concern that conditional effect estimates can generate positively biased estimates for non-null treatment effects due to the non-collapsibility of strata (Stampf et al. 2010, Forbes and Shortreed 2008, Ho et al. 2011). The reported bootstrapped 95% confidence intervals are estimated with 10,000 replications per model and the same covariates, weights and matching approach as our main analysis (Table A.8 in the appendix).

	Robustness Check: Direction and Significance						
	Table	LPTA	MoreNonprice	Morethan3 Factors	SocEnv Factors		
Main Analysis	2	n.s.	+ ***	n.s.	+ **		
Fewer Cutpoints	A4	+ *	+ ***	+ *	+ **		
More Matching Vars.	A5	n.s.	+ ***	n.s.	+ *		
Single Administration	A6	n.s.	+ **	+ *	+ ***		
Robust SEs	A7	n.s.	+ ***	n.s.	n.s.		
Bootstrapped SEs	A8	n.s.	+ **	n.s.	n.s.		

Table 2.3: Summary of Results of Robustness Checks

*p<0.1; **p<0.05; ***p<0.01

The results of all of these robustness checks for each of our four models are summarized in Table 2.3. Our main result (i.e., the positive relationship between *MoreNonprice* and *Recontracted*) remains significant at least at the p < 0.05 level in all tests. We also observe a pattern of a marginal and inconsistent positive association between *SocEnvFactors* and *Recontracted*, which we believe merits further investigation in future studies.

2.7 Discussion

In 2010, Breul noted that "In the federal procurement system today, there is a common recognition that a *cost-only* focus does not necessarily deliver the best quality or performance for the government or the taxpayers" (p. 198, emphasis added). Our results support this observation. Model 1 shows that there is no significant performance difference between similar contracts awarded through LPTA and tradeoff procedures, which suggests that LPTA procedures are not being overused in cases

where either procedure could be realistically selected. In other words, the US federal government's requirement for justification for use of the LPTA procedure appears to be effective. Other public sector jurisdictions may benefit from introducing a similar policy to combat cost-only decision-making.

At the same time, the problem of *cost-first* focus remains imperfectly addressed in the federal procurement system: We observe evidence of significant excessively price-based decision-making in Model 2, which compared the performance outcomes of tradeoffs placing more weight on non-price factors with those that weighted price relatively heavily. This suggests that the current recognition of the shortcomings of cost-only approaches is not sufficient: similar rejection of cost-first approaches is also warranted. One potential solution is to adopt the same technique that was shown to be effective in our analysis of Model 1: weighting non-price factors more heavily than price could be the default for trade-off procedures, and exceptions permitted with written justification.

Regarding the private sector implications of our study, we note that the academic literature has previously highlighted the financial incentives of decision-makers as a driver of excessively price-based decision-making (Ellram and Tate 2021). Our study offers evidence that excessively price-based sourcing decisions occur even when they are not incentivized, as is the case in the U.S. government (Model 2). Further, we show that when price-based decision making is explicitly disincentivized (in this case through bureaucratic requirements, Model 1), there is no evidence of excessive pricebased decision making. These results imply a need for a different (or additional) set of solutions: Even removing the career benefits of negotiating an impressive-sounding price cut will not fully resolve the problem of excessively price-based decision-making. More is needed (here, a burdensome procedure to choose based on price, but other process designs are possible).

The results of our analysis of Model 3 does not suggest a need for changes to policy or practice. Contract officers working on behalf of the U.S. federal government do not appear to be systematically under-customizing the evaluation criteria in their published RFPs.

Our finding of an inconsistently positive relationship between social/environmental evaluation and performance is entirely consistent with the mixed results of past sustainability research. Based on our main results (Model 4) we tentatively encourage decision-makers to consider these criteria in their sourcing decisions more often in the future.

2.8 Limitations and Future Research

There are many opportunities to further refine our findings with additional research examining specific factors and trade-offs. Prior research suggests that some social and environmental factors may be more valued by some decision-makers than others (Rogers et al. 2019), and that social factors may generally be valued more than environmental factors by purchasing managers (Goebel et al. 2018). Future research with more granular analysis of social and environmental factors could reveal differences in their performance effects as well.

Our study context was carefully selected based on our research questions and certain regulatory details, but similar data is available in other jurisdictions and cross-jurisdictional analysis may yield further insights. We hope that our finding that excessively price-based decision-making is a widespread problem will motivate researchers, policymakers and practitioners to develop and implement solutions in both the public and private sectors. We further hope that our finding that this problem can be eliminated with processes that make cost-based decision-making more cumbersome will motivate process improvements in the public and private sectors.

Chapter 3: When Does Professional Identity Affect Sourcing?

3.1 Introduction

"I'm a public health official, I'm a scientist, I'm a physician. That's my identity. The only thing I care about professionally is to put an end to this outbreak." Anthony Fauci, Director of the National Institute of Allergy and Infectious Diseases, interview with Amanpour & Company on Aug 5 2020.

Professional work requires individuals to define the scopes of their roles and to balance competing objectives in novel situations. At times, individuals draw from their own professional identities to guide these choices. In this study, we investigate procurement's professional identity, and the impact that identification with this profession can have on operational decisions.

Procurement professionals, like other professionals, have a shared group identity established through training, socialization, and membership-based professional associations, as well as workplace experiences. Procurement professionals are also boundary spanners (Zhang et al. 2011) who frequently interact with members of other groups both internally and externally. They are simultaneously responsible for coordinating cross-functional decision-making processes and for representing their own group's interests in these processes. The idea that social identities can affect information seeking and processing is well-established (Tripsas 2009, Anand et al. 2013, Lifshitz-Assaf 2018), but it has not previously been applied in a cross-functional setting quite like procurement.

Consider a cross-functional sourcing decision where one group advocates for the current supplier, and another advocates for change: Making a decision involves interpreting ambiguous information and making trade-offs between costs, benefits, and risks. In this context, any factor that causes a person to place greater (or lesser) weight on the input of another person can meaningfully influence the decision that results. In this chapter we will show that professional identity is one such factor. In so doing, we also establish that: 1) role-based image discrepancies (Vough et al. 2013) are relevant in inter-professional relationships as well as professional-client relationships, 2) that the costs associated with role-based image discrepancies partially differ between these settings, 3) that strong identification with the procurement profession has a dark side , and 4) that inter-group politics can emerge in sourcing contexts even in the absence of misaligned functional goals.

In-group favoritism may be the best-known effect of group identification. It appears even in newly formed groups with no commonalities beyond their shared group membership (Tajfel et al. 1971, Spears and Otten 2012). Considering this concept in the procurement context, we ask: Do procurement professionals who strongly identify with the procurement profession attribute less importance to the preferences of out-group members? Recognizing that the professional identity of procurement has

evolved from an ordering function into a much more strategic role (Ellram et al. 2020), we ask: Does this effect depend on procurement's group status and/or group image?

Our multi-method study both investigates the professional identity of procurement practitioners and tests its effects on decision-making. Through semi-structured interviews (Study 1), we collected information on how procurement professionals define their own professional identities, and their perceptions of others' views of the procurement profession. Our respondents perceived the public image of procurement as being cost-focused and transactional, while their private images of their profession's identity were more varied and positive. We combined our observations from these interviews with the predictions of social identity theories to conduct a scenario-based experiment (Study 2) testing whether realistic variation in levels of group identification, group status, and group image would cause respondents to make more (or less) cost-driven supplier selection decisions.

The dependent variable in our experiment, the perceived importance of costs in a multi-objective sourcing decision, has extremely broad societal importance. Excessively cost-based decision-making has contributed to major problems including the offshoring of American manufacturing (Gray et al. 2017) and the loss of technological innovation (Fuchs and Kirchain 2010). Many researchers have argued that excessively cost-based decision-making is common in procurement, and that an increased emphasis on non-cost factors (such as revenues, risks, and social and environmental impacts) can benefit both the focal firm and other stakeholders (Ellram and Feitzinger 1997, Hinterhuber and Snelgrove 2016, Vitasek et al. 2012, Wouters et al. 2005, Gray et al. 2020). Respondents in a treatment with strong group identification were less willing to pay for a higher-quality option favored by members of another group than respondents in a treatment with weak group identification. We also found a significant threeway interaction between group identification, group status, and group image and developed a post hoc interpretation: that status threat can be induced in a weakly identified group by either a negative group image or low group status, and that the former is more likely to lead to disconfirming behaviors while the latter is more likely to lead to retaliatory behaviors.

In the following sections, we review related literature (Section 2) and briefly describe our research context (Section 3). We then present the methods and results of our qualitative Study 1 (Section 4), followed by the hypotheses, methods and results of our experiment Study 2 (Section 5). We discuss the implications of this research for theory and practice (Section 6) before concluding the article.

3.2 Social Identity

Social identity theory (Tajfel and Turner 1979) and self-categorization theory (Turner et al. 1987) are sometimes discussed as separate theories and sometimes subsumed into a single social identity umbrella. The social identity approach, broadly defined, is "a social psychological analysis of the role of self-conception in group membership, group processes, and intergroup relations" (Hogg 2018, p. 112). Core tenets of social identity theory are the ideas that social identities are maintained through intergroup comparisons and that groups seek positive differences between themselves and reference groups to enhance self-esteem (Tajfel 1978, 1981).

Our research contributes to a influential stream of research that focuses on the behavioral outcomes of identification with groups in business contexts. A case study by Tripsas (2009) showed that organizational identity can serve as a filter for external stimuli, causing technological opportunities inconsistent with that identity to be missed. Anand et al. (2013) also studied the relationship between identification and information seeking behavior, but in the context of a firms' strategic groups of perceived competitors. The multiple identities of directors serving on corporate boards affects several elements of their behavior, including monitoring and resource provision (Golden-Biddle and Rao 1997, Hillman et al. 2008) and voluntary exit (Withers et al. 2012). Our study differs from these in several ways, including through its focus on identities likely to be be particularly salient in a cross-functional decision-making context.

Sourcing decisions are important decisions that are often made in cross-functional contexts. The identities of the professions involved overlap to varying extents with the firms' functional groups. These professional identities are group identities that are formed through interactions with professional associations, other employers, professional services companies, and individual thought leaders (Brouard et al. 2017) as well as the role that a function plays within a particular firm. For example, "there is general agreement that public accountants develop a shared understanding of what it means to be a professional, and that this professional identity directly influences their behaviors and self-concepts" (Empson 2004, p.759). Identification with a particular professional group has been shown to influence behavior in context-specific ways. One vivid example of this is provided in Lifshitz-Assaf (2018), which explains how decreased opposition to open innovation at NASA resulted from R&D professionals redefining their professional identities from problem-solver to solution-seeker.

Discrepancies between internal and perceived external images are a common feature of professional identities. Identity congruence is generally seen as preferable for organizations as well as individuals, e.g. Foreman and Whetten (2002) find that identity congruence significantly affects commitment and legitimacy in the context of rural cooperatives. Focusing on an individual level, Reid (2015) describes three behavioral responses that consultants adopt in response to an ideal worker image of total commitment and availability (i.e., they embrace the image, they pass as consistent with the image, or they reveal their discrepancies with the image). Focusing on a group level, Morales and Lambert (2013) ethnographically document the struggle of management accountants to distance themselves from a devalued "beancounter" group image. Using data from semi-structured interviews with professionals from four fields, Vough et al. (2013) argue that these role-based image discrepancies have both productivity costs and emotional costs in the context of a relationship between a client and a professional. Our study focuses on a different relationship context that of cross-functional interactions. We contribute by both establishing that rolebased image discrepancies affect procurement professionals and their cross-functional interactions, and testing whether group image in this context also affects operational decisions.

Status and professional group image are closely related concepts. The image discrepancies that professionals attempt to correct are images of reduced scope and complexity that lead to devaluation of the professional services in question (Vough et al. 2013). This clearly relates to the concept of market status, defined as "the perceived quality of a producer's products in relation to the perceived quality of that producer's competitors' products" (p. 830, Podolny 1993). Status is not merely a signal of quality, however, it is also an intangible asset that may be gained or lost (Piazza and Castellucci 2014). Status loss by a professional group is experienced as a negative event that can generate resentment and distrust towards those who experience status gain (Neeley 2013). Thus, the role-based image discrepancies that professionals have been shown to struggle with in practice are not only incongruences, but specifically incongruences that may threaten status loss. We contribute to this stream of research by disentangling the effects of status from those of group image and group identification in our experimental design.

3.3 Research Context

Procurement is a context in which cross-functional decision-making is frequent. Functional interdependency, strategy complications, and misaligned functional goals are known sources of problems in cross-functional sourcing decision processes (Moses and Åhlström 2008). Misaligned functional goals are sometimes seen as a prerequisite for the emergence of political behaviors in purchasing teams (Franke and Foerstl 2020a), but the vulnerability of decision-making in sourcing to political behaviors and power influences also relies on multidimensional performance outcomes and trade-offs between these dimensions (Stanczyk et al. 2015, Smart and Dudas 2007, Van Bavel and Pereira 2018). Social identity theories offer an explanation for intergroup conflict that does not rely on misaligned functional goals or misaligned functional performance incentives. Our application of social identity theories in the cross-functional sourcing decision process therefore broadens the set of contexts in which political behaviors should be expected to occur, and allows these behaviors to take more subtle forms such as modified information seeking behaviors (e.g., as in Tripsas 2009).

To our knowledge, intra-organizational inter-group behavior in cross-functional procurement decision-making has not previously been studied through a social identity lens. Identity has, however, been discussed in other procurement contexts. The identity of procurement as a field of research has been a recent subject of academic discourse (Ellram et al. 2020), and many researchers focused on inter-organizational interactions have adopted a social identity approach. Ireland and Webb (2007) suggest "generating a common supply chain identity" as one of several strategies for building cultural competitiveness; they focus on the benefits of shared identity among organizations. Corsten et al. (2011) find that supplier-to-buyer identification benefits operational performance. Stringfellow et al. (2008) study the effects of differences between national identities in the context of offshoring services, while Loch and Wu (2008) experimentally investigate how social preferences affect performance in a twoplayer sequential mover game. Our study differs from all of these in its focus on a cross-functional decision-making context within an organization.

Compared to other cross-functional decision-making contexts, procurement has the advantage of (often) yielding a very clear outcome. While the decision-making process involves ambiguity that makes it vulnerable to social influences and cognitive biases (Gray et al. 2020), the resulting supplier selection decision is not ambiguous: a contract is awarded to one party, or another, or both, or neither. This clarity makes this an ideal context for detecting the potentially subtle effects of identification, status and image in cross-functional teams, relative to alternatives such as cross-functional strategic planning and product development teams. Our multi-method approach to this topic is a sequential exploratory approach. In Study 1, we collected qualitative data through a series of semi-structured interviews with experienced procurement practitioners. This analysis offers insights into how these individuals characterize their own professional identities and the intergroup dynamics in their organizations. In Study 2, we collected quantitative data from a scenario-based experiment to provide evidence of causal relationships between those same variables and the decisions that result. While we developed the hypotheses tested in Study 2 prior to execution of Study 1, we present our hypotheses together with the methods and results of Study 2 for ease of exposition.

3.4 Study 1: Semi-structured Interviews

We describe the methods and results of the first study of this research project in this section.

3.4.1 Methods

Semi-structured interviews have often been used as a primary data source in business research, particularly within the context of case study research (e.g., Bingham and Eisenhardt 2011, Lashley and Pollock 2020). Semi-structured interviews are conducted conversationally with one respondent at a time, include both closed- and open-ended questions, and allow follow-up questions which can lead to new topics (Adams 2015). Although semi-structured interviews are a labor-intensive form of data collection, they are recommended when open-ended questions are needed and respondents may not speak candidly in front of their peers, or as a supplement which adds depth to quantitative analysis (Adams 2015). In this study, group identification, group image, and group status are all potentially sensitive topics that are well-suited for open-ended conversations.

Although semi-structured interviews are designed to be more free-ranging that questionnaires, this does not imply a lack of preparation. Six themes were identified for discussion: group identity, group image, the effect of identity and image on behavior, group status, the effect of group status on behavior, and financial incentives. Sample questions within each theme were prepared and included in an interview guide which was used by the researcher conducting the interview.

We contacted potential respondents through a university-affiliated business consortium which emailed its member companies an invitation to participate in the study. Each participating individual provided informed consent to participate in the study and to be recorded during the interview. Due to the coronavirus pandemic, all interviews were conducted virtually. One of the authors conducted all interviews and generated transcripts (with identifying information on individuals and companies removed) from the recordings. Each transcript was manually coded and the statement(s) that most directly related to the variables of interest were extracted.

3.4.2 Results

Nine interviews were conducted, each lasting approximately 45 minutes. All respondents were employed in procurement roles at the time of the interview. Respondents were employed in a variety of industries: consumer packaged goods, manufacturing of industrial products, professional services, and healthcare. Some respondents also drew from their previous experience in other industries, most notably automotive. Their job titles included commodity manager, supplier diversity officer, supply chain manager, procurement director, and VP global procurement. For transparency, each respondent has been arbitrarily labeled with a number from 1-9 and is consistently referred to by that number throughout the analysis. Multiple respondents from two companies participated in the interviews: R4, R5 and R7 were employed by the same company, and R3 and R6 were employed by the same company.

Group Identification

Every respondent confirmed that they identify as procurement professionals when asked. Several respondents, unprompted, qualified this response by mentioning education or work experience in another area (R4, R8, R9). Others, again unprompted, emphasized their professional affiliation with procurement by mentioning their years of experience (R2, R3, R4, R5, R6, R8). Although all respondents confirmed that they consider themselves procurement professionals, their responses provide evidence of substantial variation in the extent to which procurement personnel identify with the procurement profession. Table 3.1 presents the most relevant quotes related to group identification.

Group Image

Each respondent was asked about their own views of the procurement profession's identity, and then their perceptions of other people's views of the procurement profession's identity. Table 3.2 contains the codification and relevant quotes related to both group images. Far more variation is apparent in the former; procurement professionals see themselves as problem-solvers, consultants, educators, operators, connectors, strategists, and relationship managers. The private images of respondents at the same company are imperfectly overlapping (e.g., R4's private image of operator contrasts

	Group Ident.	Quote
R1	High	"I think, you know, a lot of the people that I've brought into my team share that outlook [on procurement's identity], right. They enjoy, you know, trying to help towards the greater good."
R2	High	"I have learned a lot in [number] years of sourcing about the profession, and I still to this day am continuing to learn. But when it comes to processes and improving sourcing organizations, obviously you acquire a lot of experience in [number] years of being in this profession in a number of different industries."
R3	High	"I've been working in procurement since [year]. So it's been a pretty long career in procurement. I've purchased everything from components to services, and now kind of shifting my focus to actually be able to help and educate suppliers."
R4	Low	"I do now that I've been doing it for [number] years." "I was an accounting major, worked in accounting and finance so first [number] years were kind of finance leadership roles, and then I got the opportunity to come over to procurement."
R5	Very High	"Yes. Yes. Love procurement. I've been doing this for around [number] years now. Yes, this is my way of life."
R6	Med	"My college degree is in business marketing. So I can't identify through that, but my identification to supply chain industry is through my actual working history half of those years went deep into supply chain and, you know, procurement, sourcing, purchasing all kinds of names that we used to describe that functionality."
R7	Med	"I don't have a pure procurement background, but I have a critical thinking and, you know, analytical background that also pertains to procurement. So, kind of the same deal. If you can solve problems you can function in procurement quite well."
R8	High	"In procurement [at my company], I'm the only one who has done other things. But I've been doing procurement now for over a decade."
R9	Low	"I'm a mechanical engineer by background, I started as an R&D engineer, and because of my passion and cost reductions and findings, that's what led me to the procurement role. So I believe any engineer can be a procurement professional, because you need- the current procurement world is you have to have understanding of the technical background, it's not just commercial understanding."

Table 3.1: Interview Responses on Group Identification

with their colleagues' responses of connector and problem-solver), which supports the interpretation that these are individuals' personal views of their profession's identity rather than management-issued definitions of roles and responsibilities.

The perceived external image of the procurement profession is less positive. While some respondents report that their colleagues in other functions sometimes view procurement as strategic and sometimes as transactional (R2, R4), most respondents describe an external image that is cost-focused or transactional (R1, R3, R5, R6, R7, R9). No respondent reported an exclusively positive external image.

Group Status

Respondents were asked to provide comments on their cross-functional interactions. Although no respondent directly stated that the procurement function at their organization has lower group status than another function, this condition was variously implied through the absence of decision rights, the need for formality and caution in inter-group interactions, and a fight to demonstrate value (R1, R3, R6). Other respondents indicated relatively high group status by highlighting their own decision rights, leadership and influence (R5, R7, R9). Respondents from the same companies provided similar remarks, supporting their interpretation as indicative of the procurement function's group status rather than the respondent's individual status. Representative quotes on group status are presented in Table 3.3.

Taken together, this analysis serves two purposes. First, it provides evidence of external validity for the independent variables we use in Study 2. Procurement professionals may strongly or weakly identify with procurement as a group, and the procurement function may hold high or low status relative to the other groups that it interacts with within an organization. Both problem-solver and cost-cutter group

	Internal	Quote	External	Quote
R1	Problem- solver	"When I think of procurement professionals, I think of people who are ethical, I think of people who are curious, and problem- solvers."	Cost- focused	"Procurement has a reputation historically, right, of someone who's only focused on cost."
R2	Consultant	"I see our role as a consultant to the business."	Trans- actional /Strategic	"It's gone from more of a trans- actional type of role in the past to more of a strategic type, right?"
R3	Educator	"Sometimes it means educating the customer on what the price and budget should be, occasionally, right? They're looking for bottom dollar, but they want the highest quality item and those two don't always match. So there's some education that happens both ways with your suppliers and with your customers or stakeholders that allows you to find a happy medium that has all those rights in the right slots."	Cost- focused	"In general, I think the thought process is all we're about is cutting costs."
R4	Operator	"I think of myself as an operator now. I'm not sure the rest of the organization always thinks of procurement as operators, but, you know, understanding how the operations work, how you bring the materials in, what's the best way, you know, so you can focus on what's the business objective."	Trans- actional /Strategic	"It's probably a mixed bag. I think some people think, hey, you're just writing POs and buying stuff And then I think some people truly appreciate and understand that, you know, you're really managing the supply chain before it gets to the company."
R5	Connector	"I'd say that we are the connector we connect the external suppliers with our internal business needs. We seek out, we connect, those who bring that best value to the organization."	Cost- focused	"Folks outside of procurement, you know, can't help but think that we're just focusing on cost which is not the case."
R6	Strategist/ Educator	"So that's sort of it in the end, right. Doing this strategy, the negotiations and contracting and then help managing that suppliers' performance, you know, moving forward." "So the sourcing person has to, you know, understand what they want and then teach and educate the surgeon with the whole market."	Trans- actional	"They think that the sourcing function is you're just receiving quotes and you're doing a comparison and making a decision." "They don't really understandwhat we do. They just think you spend money, right? No."
R7	Problem- solver/ Connector	"I described it before: solve problems. You know, whether it's cost on a material or a supply chain challenge or seeking new, we solve problems. We fill needs." "I take pride in being kind of a greater connection to the external world for our colleagues, our associates, like, we help bridge to our external vendor partners."	Trans- actional	"Like, oh, he buys the pens that kind of seems to be more theunderstanding, it's like a transactional kind of buy-sell nature, almost purely executional."
R8	Relationship manager	"Comprehensive, so, you know, every aspect of managing a third party relationship, or what we would call the supplier lifecycle."	Shopper	"I think other people think of us, as, you know, people who buy stuff. Right? It's kind of like shopping for a living is probably what they think."
R9	Strategic	"There's a strategic part in it, you need to have a clear strategy, not just for one year, you need to have a three to five year plan, how we are going to evolve, how we are going to ever optimize the supply chain."	Trans- actional	"That is what people think of, it's just plainly these guys are just purchase order management and stuff like that, but it's beyond that."

Table 3.2: Interview Responses on Group Image

	Status	Quote
R1	Lower	"like a lot of other functional overheads we're all in a similar position, right, where we're always trying to fight to prove our worth and show value."
R2	Similar	[in case of a disagreement] "The business partner gets their way however, there is a caveat to that, right. There are several groups in our company that can absolutely grind something to a halt and stop it. Sourcing is one, legal is another."
R3	Lower	"Because most of it involves patient care, they're the ones making decisions for sure." "You definitely have to make sure that you have your ducks in a row and your conversations aren't quite as candidly casual."
R4	Similar	"It depends. You know, R&D is going to be a pretty, very strong voice, maybe even a stronger voice because, you know, we'll come up with a couple different options, but you know, they're looking for your specific profile or specific action from the product." "In some of these instances, we're not the end decision maker."
R5	Higher	"So while procurement does have the ability to award a piece of business, we still look for alignment. Not, not approval, but alignment." "We have to own it and lead it, we're the experts, you know, that's again where, as the connector the company's counting on us to be providing that value."
R6	Lower	"You know, the surgeon, it's his or her reputation, right? And part of that formula is the product that the surgeon uses. So, he or she is, you know, more of a driver in that regard, right, more, you know, I gotta have this." "So if you're a sourcing person, you know, you have to understand and work with all of that."
R7	Similar/ Higher	"We take pride in the fact that we're the lifeblood of the company, but maybe not every group sees it that way. Right? Brand's going to tell you the same thing, that they're the ones driving the company, the vision, the projects, all that." "At least in our organization, you know, procurement may have more of a voice than in others."
R8	Similar	" sometimes there are fiscal approvals, there are also contract approvals, so we have our general counsel who approves contract language. The business also has to approve the final language before the contract is signed."
R9	Similar/ Higher	"In general supply chain is the lifeblood of the company so procurement is a very important, very, very important function within the company, very important status. But at the same time, procurement cannot do the job by itself." "So it is a joint effort, and all of us play an important part and especially with- we're all links in the chain, if one link is kind of broken it is a challenge."

Table 3.3: Interview Responses on Group Status

images are directly relevant to procurement professionals: the former is an example of a internal group image that some procurement professionals use to describe their group identity. The latter is a common external image, which may be perceived as a negative stereotype used by other groups to characterize procurement's group identity. Second, we have confirmed that procurement profession is affected by a prototypical role-based image discrepancy, i.e., the combination of an internal image of a profession that is complex and positive with an external image that is simple and less valuable (Vough et al. 2013). This finding confirms that role-based image discrepancies affect interactions between different professional groups as well interactions between professionals and clients, and encourages our application of these ideas to a cross-functional setting within a firm.

3.5 Study 2: Scenario-based Experiment

We begin this section by developing the hypotheses to be tested with this experiment, then we present the methods and results of Study 2.

3.5.1 Hypotheses

The critical factor that transforms three or more individuals into a group is group identification. Other factors can facilitate or strengthen group identification, but identification is the psychological process underlying group phenomena (Hogg 2018). Group identification and social identification have been used interchangeably and may be defined as "the perception of oneness with or belongingness to some human aggregate" (Ashforth and Mael 1989). The extent to which an individual identifies with a category is a matter of degree, with group identification tending to be stronger when groups are distinctive (Oakes and Turner 1986, Tolman 1943), have high prestige (Ashforth and Mael 1989), and when out-groups are salient (Turner et al. 1987).

In-group favoritism may be the best-known behavioral result of group identification; it has been called one of the universal features of the human mind (Brown 2004). In-group favoritism has been observed in minimal groups (Tajfel et al. 1971, Yamagishi and Mifune 2008, Spears and Otten 2012) and socially meaningful groupings such as political affiliation (Fowler and Kam 2007) and ethnicity (Whitt and Wilson 2007). When group identities are salient, the identical action of an in-group member can be perceived more favorably than that of an out-group member (Molenberghs et al. 2013). Group identification can alter memory, implicit evaluation, and perceptual judgments (Van Bavel and Pereira 2018). The disposition to engage in effortful information processing amplifies motivated reasoning when group identities are salient (Kahan 2012), suggesting that in-group favoritism is not easily countered by quantitative analysis.

In the context of a cross-functional procurement decision, this suggests that stronger group identification may cause individuals to pay less attention to the preferences of out-group members, i.e., members of other professions also participating in the crossfunctional decision-making process. In cross-functional sourcing decisions, business units that are also end-users of a product or service commonly advocate for a higherquality, higher-cost option. Accordingly, we hypothesize that when group identification is stronger, our respondents will be less willing to pay a premium for the higher-quality option preferred by the out-group members. If supported, this will offer an explanation for why participants in a cross-functional decision-making process might undervalue the preferences of their out-group counterparts, even in the absence of financial incentives to do so.

Hypothesis 1: Strong group identification increases the perceived importance of costs in cross-functional sourcing decisions.

Group identification tends to be stronger when groups have high prestige (Ashforth and Mael 1989). When group status is low, it may cause respondents to distance themselves from groups that they would otherwise strongly identity with. This suggests that low group status may attenuate the effects of group identification. Furthermore, although in-group favoritism is common, it is not an inevitable result of group identification: Members of low-status groups may instead pursue social mobility strategies, either collectively or individually (Ellemers et al. 1993). Which intergroup behaviors are generated depend on beliefs about status, the stability and legitimacy of status relationships, the permeability of the boundary between groups, and the conceivability and achievability of alternatives to the status quo (Hogg 2018, p.124). In our organizational context, efforts by low-status groups motivated to improve their standing (Cikara and Van Bavel 2014) could take the form of efforts to gain status through favorably treatment of the preferences of out-group members. Finally, highstatus groups are motivated to defend their high status (Cikara and Van Bavel 2014) which can result in stronger in-group favoritism. Jointly considering these effects, we hypothesize that when group status is low the effect of strong group identification will be weaker than when group status is high.

Hypothesis 2: High group status amplifies the effects of strong group identification.

Intergroup comparisons are made using prototypes – fuzzy cognitive representations that emphasize similarities within groups and differences between groups (Hogg 2018). These prototypes describe idealized, rather than typical, in-group members and their identity-defining behavior (Turner et al. 1987). An internal group image is the prototype held by group members for their own group, while the external group image is the prototype held by non-group members for that group. When the external image of a group that a person identifies with is perceived as positive, that person will tend to behave in ways consistent with the salient aspects of that group identity (Ashforth and Mael 1989). Stronger group identification then results in greater conformity with these in-group norms (Terry and Hogg 1996).

In Study 1, we identified a variety of internal and external group images of the procurement profession that exist in practice. For Study 2, we select two of these images: one that is directly related to our outcome of interest, i.e., *cost-cutter*, and one that is a more neutral control, i.e., *problem-solver*.

The logic of strengthened adherence to salient in-group norms leads us to the first of two competing hypotheses: that the positive effects of strong group identification on cost-focus increase in combination with a cost-cutter group image.

Hypothesis 3a: Strong group identification increases the perceived importance of costs in cross-functional sourcing decisions when combined with a cost-cutter group image.

In the context of organizational identification, Dutton et al. (1994) proposed that attractive group images cause stronger group identification. However, when the external image of a group is perceived as negative, individuals may experience stereotype threat and seek to either disconfirm the stereotype or distance themselves from the group (Spencer et al. 2016). Based on the results of Study 1, we anticipate that the cost-cutter group image may be perceived as a negative stereotype that reduces group identification and/or prompts disconfirming behaviors. This logic leads to our competing hypothesis: that the positive effects of strong group identification on cost-focus decrease in combination with a cost-cutter group image.

Hypothesis 3b: Strong group identification decreases the perceived importance of costs in cross-functional sourcing decisions when combined with a cost-cutter group image.

Group identification, group status, and group image are related concepts, as discussed here and in earlier sections of this article. Identity is complex and can affect behavior in ways that are difficult to predict. We do not hypothesize specific effects for each treatment group, but we do conduct a planned test for a three-way interaction between group identification, group status, and group image and discuss its results.

3.5.2 Methods

There are several views on the use of vignette studies to conduct research in operations management (Lonati et al. 2018, Eckerd et al. 2021). The approach is well-suited to this research topic because the external context of interest is one of decision-making under ambiguity: there is no "correct" response that a respondent can provide, which alleviates the potential for experimental demand effects. The richness of the scenario provides necessary opportunities for respondents to engage in biased information seeking, information attention, and information evaluation – these being 1) behaviors that tend to arise when group identity is involved (Minson et al. 2020) and 2) mechanisms through which the effect of interest may occur.

Following recommendations provided by Rungtusanatham et al. (2011) the vignette was designed with two separate but related modules of information: a common module and an experimental cues module. The common module, shown in Figure 3.1, is comprised of information that is identical across treatment groups; in our study it describes a sourcing decision, including information on two shortlisted potential suppliers and the preference of the other key group involved in making the decision. To ensure realism, the scenario is based on an anonymized decision from industry that one of the authors was already familiar with. Although the full complexity of that decision is not conveyed, the details included are those that were seen as important by the real-world decision-makers. The experimental cues module (see Table 3.4) consists of statements that vary the factors of interest: group identification (strong, weak), group image (cost-cutter, problem-solver), and group status (high, low). These statements were developed with reference to the literature and to the interviews, which were ongoing when the experimental design was finalized. The experiment is a full-factorial 2 x 2 x 2 between-subjects design.

Group identification. Although minimal groups research (Tajfel et al. 1971) shows that individuals can begin to identify with an arbitrary group with minimal prompting, our aim with this study is to observe the effects of realistic variation in

this dimension. We recognized that telling a respondent that they strongly identify with a particular group is unlikely to create a sense of group identification. Instead, we draw from research on antecedents of group identification and describe an organizational environment with those characteristics: we emphasize group homogeneity (Turner et al. 1987) and distinctiveness (Ashforth and Mael 1989) by providing group information and highlighting similarities among group members. We mention one of the factors traditionally associated with group formation, namely interpersonal interactions, which also imply proximity (Ashforth and Mael 1989). Contrasting to this, in the weak group identification condition we mention membership in other groups to reduce group distinctiveness, differences among group members, and the absence of social interaction. In both conditions we include mention of another sourcing professional, to increase the salience of the group and make convergence between relational and group levels of identification (Sluss and Ashforth 2008) possible.

Group status. Similar to our approach with group identification, we chose to convey group status indirectly. Community members tend to evaluate status using publicly available references that are relevant for the social situation (Stewart 2005). Accordingly, we mention prestigious backgrounds and high-profile successes (which would be public knowledge within the organization) in the high status condition. Acts of deference and disrespect are considered trademark status-driven behaviors (Piazza and Castellucci 2014), so we also mention respectful behavior by colleagues in the high status condition. Contrasting to this, in the low status condition we mention less-prestigious backgrounds, and disrespectful behavior by colleagues.

Group image. The form of group image presented here is the image of the group that in-group members perceive to be held by external groups. The perceived external

image is the group image that caused individuals to adopt various other problemfocused image management tactics in related work on role-based image discrepancies (Vough et al. 2013). External image is also easier to incorporate into a scenariobased experiment (since external image can vary without the individual's own beliefs about a group being manipulated), and more likely to result in realistically-actionable managerial implications.

Perceived importance of costs. The dependent variable is a measure of costbased decision-making: Respondents were asked to identify their indifference point (on a scale from 0 to 100) between two options, one of which is superior on non-cost criteria including safety, quality, and on-time completion. The relative importance of cost and non-cost criteria in sourcing decisions is an operationally meaningful variable with implications for overall performance as well as numerous social and environmental issues (Gray et al. 2020). The exact question wording used for this measure is provided in the common module presented in Figure 3.1.

We tested the internal validity of our experimental module (i.e., performed a manipulation check) outside of our main experiment to avoid creating demand effects. This pre-test was done using the MTurk platform. Respondents were asked to select the factor level associated with each paragraph. In all cases, respondents were more likely to select the correct factor level (n=33, p <0.01).

3.5.3 Results

We conducted our scenario-based experiment on the MTurk platform using only respondents with the premium qualification "Job Function – Management". The median response time was 9 minutes. We received 403 completed responses. Responses

Figure 3.1: Common Module

The Decision

You and Susan are preparing your recommendations on the selection of a contractor to construct a specialized, non-industrial, building on an empty lot. You and Susan started with a shortlist of six options. After reviewing the bids and meeting with each qualified contractor, you and Susan have narrowed the options down to two:

Option A: Falcon Construction

Falcon is an experienced, reputable company that your company has previously used for projects more complex than this one. It has a local, unionized workforce, and has previously performed well on all your company's major non-financial criteria (safety, quality, on-time completion).

Option B: Bruce Construction

Bruce is also an experienced, reputable company that your company has previously used, but only for projects simpler than this one. It has a non-unionized workforce, and sometimes recruits temporary workers at very low wages. Bruce's past performance meets your firm's requirements, but is weaker than Falcon's in all major non-financial criteria.

Your company has an internal construction management (CM) team, which you and Susan worked with to evaluate the bids. CM strongly prefers Falcon, saying that although Bruce has performed adequately in the past, their adequate performance was attributable to CM's constant monitoring and frequent interventions. Falcon, in contrast, has previously required minimal oversight. Unfortunately, Falcon is also more expensive.

What will you recommend?

I recommend using Falcon, as long as Falcon's bid is not more than X% more expensive than Bruce's.

orag to choose X. 0% means the costs are	e equ	al; 100	% mea	ans the	costs	are do	uble.)				
	Ó	10	20	30	40	50	60	70	80	90	100
	h.,										

Identification	Status	Image
You and Susan work in a team known as "ST", which stands for "Sourcing Team". All the sourcing professionals at your company have similar professional training and experience. Most are also members of a professional association called "Sourcing Professional Association". You and Susan know and meet regularly with sourcing professionals who work at other companies. [strong]	ST's team members all worked at very prestigious organizations before joining the company. The team won an award at the company's annual party a few years ago. ST's team members are confident that their colleagues respect their contributions to the company. [high]	Most sourcing professionals in your company have a talent for figuring out where an organization is spending too much, and know how to bring those costs down. Members of ST have a reputation for being cost-cutters. [cost-cutter]
You and Susan work in a team known as "ST", which stands for "Sourcing Team". Some sourcing professionals at your company work 50% of their time in sourcing and 50% in another department in the firm. All of you have different professional training and experience. You and Susan do not know many other sourcing professionals. [weak]	ST's team members all worked at little-known organizations before joining the company. People often arrive late to meetings with ST, or cancel meetings at the last minute. ST's team members feel like they have to fight to prove their worth to their colleagues. [low]	Most sourcing professionals in this company have a talent for finding the root cause of a problem, and know how to correct a bad situation before it gets worse. Members of ST have a reputation for being problem-solvers. [problem-solver]

Table 3.4: Experimental Cues Module

were dropped for bot-like or off-topic responses to questions requiring text responses (n=38), extreme DVs of 0 or 100 (n=8), contradictory responses (n=6), or unusually fast page submissions (n=3). This results in a final sample for analysis of 348 across the 8 scenarios.

The respondents currently work in a variety of industries and job functions, with Sales/Marketing being the most frequent category (n=80), followed by Operations (n=65) and Finance/Accounting (n=62). The remaining categories of Customer Service, Engineering/R&D, Procurement/Sourcing and Other all have fewer than 50 responses. Although these respondents are generally not procurement professionals themselves, 93% report having at least some procurement-related work experience, and 75% report having at least two years of procurement-related work experience.

		<u>1</u>				
Scenario	Group Identification	Group Image	Group Status	Sample Size	Mean	Standard Deviation
1	Weak	Problem-Solver	Low	47	44.02	23.77
2	Weak	Problem-Solver	High	45	59.62	27.23
3	Weak	Cost-Cutter	Low	47	54.78	24.48
4	Weak	Cost-Cutter	High	47	46.02	22.97
5	Strong	Problem-Solver	Low	39	45.56	26.37
6	Strong	Problem-Solver	High	44	41.23	26.35
7	Strong	Cost-Cutter	Low	40	43.8	27.35
8	Strong	Cost-Cutter	High	39	50.69	24.68

Table 3.5: Descriptive Statistics

Accordingly, we expect that most of these respondents do not identify with the procurement profession, but are broadly familiar with its responsibilities.

To test our hypotheses, we performed a $2 \ge 2 \ge 2 \ge 2$ between-subjects analysis of variance (ANOVA) using as a dependent variable the indifference point between a higher-quality higher-cost contractor and a lower-quality lower-cost contractor. Lower values indicate more cost-based decision-making, while higher values indicate that a respondent is placing a relatively higher importance on non-cost factors. Summary statistics are shown in Table 3.5.

The main effect for group identification is significant: F (1, 340) = 4.577, p <0.05, indicating that the strength of group identification affects decision-making behavior. The direction of the effect supports Hypothesis 1 (t = -2.11, df = 346, p <0.05). We hypothesized that strong group identification can cause in-group favoritism, in the form of lower importance being placed on the preferences of other functional groups participating in a cross-functional sourcing decision, lead to more cost-based sourcing decisions.

Neither of the hypothesized two-way interactions are significant. Hypothesis 2 is not supported: the evidence does not suggest that high group status amplifies the

Variable	Degrees of Freedom	Mean Squares	F Value	P Value
Group Identification	1	2949	4.577	0.033
Group Image	1	118	0.183	0.669
Group Status	1	432	0.67	0.414
Group Identification X Group Image	1	606	0.941	0.333
Group Identification X Group Status	1	99	0.153	0.696
Group Image X Group Status	1	1327	2.059	0.152
Group Identification X Group Status X Group Image	1	6847	10.626	0.001
Residuals	340	644		

Table 3.6: Analysis of Variance Table

effects of group identification. Hypothesis 3 is not supported: the evidence does not suggest that the effects of group identification are different when the group image is that of a cost-cutter relative to a problem-solver.

However, we do find a statistically significant three-way interaction F (1, 340) = 10.626, p <0.01, indicating that group status, group image, and group identification combine to affect decision-making. Our ANOVA results are shown in Table 3.6.

To aid in the post hoc interpretation of three-way interaction result, an interaction plot with 95% confidence bands is provided in Figure 3.2. The treatment groups with strong group identification are shown on the left; these groups display greater consistency in the level of cost-based decision-making than those with weak group identification. There are no significant differences between treatments within the strong group identification condition. There are differences between strong and weak group identification conditions, and within the weak group identification condition. Scenario 2 (weak identification, high status, problem-solver) is significantly different from Scenario 6 (strong identification, high status, problem-solver; Tukey's HSD, p <0.05). This indicates that stronger group identification most increases cost-based decision-making when the group image is problem-solver and group status is high. Scenario 2 (weak identification, high status, problem-solver) is also marginally different from Scenario 1 (weak identification, low status, problem-solver; Tukey's HSD, p <0.10). It may be the case that respondents facing Scenario 1 are experiencing status threat that they perceive as unjustified and retaliating accordingly, while those facing Scenario 3 (weak identification, low status, cost-cutter) perceive their low status as justified based on the cost-cutter image and instead seek to remedy this potential shortcoming with problem-focused image management tactics. Vough et al. (2013) showed that professionals sometimes manage role-based image discrepancies by informing (i.e., providing clients with information about the work and the process), demonstrating (i.e., using behaviors and cues to illustrate the true complexity and scope of the work), and relationship building (i.e., developing connections and garnering goodwill with clients), and this pattern of behavior may partially explain our results.

3.6 Discussion

In the following section, we discuss the theoretical and managerial implications of these findings.

3.6.1 Theoretical Implications

Our qualitative Study 1 demonstrates (to our knowledge, for the first time) that role-based image discrepancies (Vough et al. 2013) are relevant in inter-professional relationships as well as professional-client relationships. Through our experimental Study 2, we provide evidence that the costs associated with image discrepancies in inter-professional settings are likely to differ from those previously identified:




whereas Vough et al. (2013) identified productivity costs (i.e., impaired collaboration, fee contestation, bypassing the professional) and emotional costs (i.e., frustration and annoyance), we focused on the impacts to a specific operational decision instead. Our results suggest that group image can affect sourcing decisions, albeit only in combination with group status and group identification. While our research focused on a single profession and cross-functional decision-making context, it seems probable that similar role-based image discrepancies and behavioral responses occur in many other cross-functional organizational contexts.

Our finding that strong identification with the procurement profession can lead to more cost-based sourcing decisions also contributes to a (currently) small body of management literature on the 'dark sides' of identification (Caprar et al. 2022). To our knowledge, ours is the first study to show a dark side of strong identification with the procurement profession. This finding also contributes to emerging literature on politics in sourcing teams Franke and Foerstl (2020b), by providing support for the notion that harmful political behaviors can emerge in cross-functional environments without the need for misaligned functional goals.

3.6.2 Managerial Implications

In Study 1 we observed that many procurement professionals perceive their colleagues in other departments as misunderstanding the identity and roles of the procurement profession. This image discrepancy, like role-based image discrepancies in other professions, may negatively impact productivity, cause frustration and annoyance, and cause personnel to dedicate time and effort to image management tactics Vough et al. (2013). It may be more efficient to shift responsibility for image management to an authority figure who can create messaging targeted for the appropriate internal audiences and counter unjustified negative images of the group.

Businesses that are interested in short-term cost-cutting may find it useful to organize their purchasing departments in ways that increase identification with the procurement profession: potentially by increasing proximity between procurement staff (e.g., centralizing the function), encouraging membership in professional associations, and creating intra-departmental career paths rather than inter-departmental ones. In contrast, business that are more interested in maximizing non-cost performance may prefer to adopt the opposite tactics.

3.7 Conclusions

Various aspects of group identity have been recognized as relevant in management (e.g., Ashforth and Mael 1989, Albert et al. 2000), but a social identity lens has more rarely been applied to research questions in operations management. This study began as an investigation of whether and when the identity of the procurement profession contributes to excessively cost-based sourcing decisions. As we designed and conducted the study, we noted that our research setting and outcome of interest were novel for social identity work in the management literature. This has allowed us to also contribute new findings to established streams of literature on professional image, on inter-group relations in cross-functional teams, and on the dark sides of identification.

However, our study is not without limitations. Our experimental findings are based on a single scenario, and should be replicated with other groups and respondents to ensure the validity of our conclusions (Shrout and Rodgers 2018). Our interpretation of the observed three-way interaction is a post hoc interpretation, and, while it is grounded in prior theory, still requires further testing with an independent sample.

Based on the fruit of this study, we believe that there are many opportunities for further research on the operational impacts of professional identification in crossfunctional contexts.

Chapter 4: What Can Function-Specific Semantic Models Tell Us About Sourcing?

4.1 Introduction

Communication challenges are particularly persistent when individuals share a vocabulary but associate different meanings with their shared words (Koçak and Puranam 2022). A person can quickly recognize when an unfamiliar word is used, but when a familiar word is used with a different meaning the communication failure is more difficult to detect and correct. This situation - of shared vocabulary and divergent interpretations - is exceedingly common in cross-functional work environments. The situation where one colleague believes that 'urgent' means 'right now' and another believes it to mean 'this week' may be a familiar example for some readers.

Divergent meanings such as these can influence sourcing decisions: Consider the case where one functional group argues that greater emphasis should be placed on a particular competitive priority in future supplier selection decisions. Whether the recipient of that message should truly prioritize that objective *more* necessarily depends on both the current level of importance assigned to that priority, and the ideal level. Both the current and the ideal may be understood differently by each party

to the conversation, generating persistent miscommunication between the functional groups (Koçak and Puranam 2022).

Potentially making miscommunication caused by divergent understandings of the priorities of an organization even more difficult to detect and resolve, each functional group within a firm is also likely to perceive itself as imperfectly understood by its counterparts. The October 2019 issue of the American Marketing Association (AMA)'s *Marketing News Quarterly* includes details of an interview with an analyst who explained "Sometimes, analysts are stereotyped as number crunchers who find it really difficult to socialize with people. But I think the glue that defines 99% of analysts is we tend to be very literal and highly logical people, very logic-driven." The October 2020 issue of the American Society of Mechanical Engineers (ASME)'s *Mechanical Engineering Magazine* describes a presentation exploring engineering identity and encouraging introspection on how engineers are perceived by others. Other relevant identities may confuse the issue still further: the November 2020 issue of the Institute for Supply Management (ISM)'s *Supply Management Magazine* includes a discussion of how generational stereotypes might impair inter-generational communication.

The potential for these sources of miscommunication to persist and affect sourcing decisions is what motivates this study. I ask: Can I quantify the semantic differences between disciplines? Can I do so with readily available data sources? If so, can this work with sufficiently small amounts of data so as to make the methodological approach applicable in a wide range of cross-functional contexts?

In the remaining sections of this essay, I discuss related literature, explain my methodological approach, then demonstrate a simple application and interpret its results. I close by discussing the limitations of this work and how they can be addressed with future research.

4.2 Related Literature

Koçak and Puranam aimed to develop a theory to explain when communication breakdowns are more persistent across organizational boundaries (2022), but their ideas apply well to cross-functional interactions within an organization too. Many of their motivating examples involve communication between professions or functions, e.g., between pilots and air traffic controllers (Jones 2003), among healthcare professionals (Ganiyat et al. 2013), and among technical specialists working on a construction design (Luck 2013). Koçak and Puranam (2022) organize terms by similarity in label and stimulus to identify four types of code differences: 1) alien codes, in which a specialized term has no meaning for the other group; 2) label clashes, in which different terms are used for the same thing; 3) stimulus clashes, in which the same term has different associations for different groups; and 4) jumbled codes, where label and stimulus clashes co-occur. Using simulation, they show that jumbled codes are far more persistent than alien codes, which supports this study's focus on stimulus clashes and jumbled codes only.

Rather than attempting to analyze all the semantic differences between all disciplines, I chose a narrower scope for this initial analysis. The competitive priorities of cost, quality, delivery, flexibility and innovation (Hayes and Pisano 1996, Boyer and Lewis 2002, Rosenzweig and Roth 2004, Peng et al. 2011) are integral to operations strategy and familiar to most, if not all, scholars of operations management. These competitive priorities appear often in practitioners' decision-making as well; the RFP data analyzed in an earlier chapter of this dissertation contains many examples of explicit trade-offs being made between two or more of these competitive priorities. A varied stream of research has established that misalignment with respect to competitive priorities can negatively influence sourcing: whether in a principal-agent framework (Steven et al. 2014) or due to internal incentive structures that vary between disciplines (Oliva and Watson 2011). Accordingly, I tackle my methodological research questions with a simple and specific application to the question: do business functions differ in their perceptions of the importance of these priorities?

Machine learning techniques have previously been used to determine the meaning of words based on the contexts in which they appear. This essay does not attempt to improve upon these existing techniques, but rather to apply them within a sourcing context: the word2vec skip-gram algorithm (Mikolov et al. 2013) has been successfully used to account for association-based judgements in a variety of tasks (Bhatia 2017) and it performs well as a predictor of human ratings of word association (Hofmann et al. 2018). Word2Vec was also previously selected for use in comparing the semantic spaces of US political parties (Li et al. 2017). I adopt it here as the current methodological standard for measuring both 1) word associations, and 2) differences between word associations.

4.3 Data and Methods

In this section I explain my data selection and provide methodological details.

4.3.1 Data Sources

My training text comes from the practitioner-aimed publications of each of the three selected professional associations: 1) AMA's *Marketing News Quarterly*, 2) ASME's *Mechnical Engineering Magazine*, and 3) ISM's *Supply Management Magazine*. Since this essay is a methodological proof-of-concept rather than a case study of a particular decision-making scenario, I deemed three parties sufficient for assessing the feasibility of the approach. My use of news sources for training the model is consistent with the widely-used model (trained on approximately 100 billion words from the Google News feed) that Google made available for public use ¹ and which has been used in related prior research (e.g., Bhatia 2017).

To select three professional associations, I considered a prototypical widget-buying scenario and concluded that the three parties should include representation from sales or marketing, from purchasing or supply management, and from a technical discipline. I then searched online for large professional associations associated with each (broadly-defined) discipline and selected AMA, ISM and ASME due to their shared traits: Each of these professional associations has a primarily US-based current membership, a comparable membership size (in the tens of thousands), and regularly publishes a practitioner-targeted magazine.

4.3.2 Data Collection

Having selected these publications, I proceeded with data collection: I collected text from the most recent issue first, then added additional issues to each corpus until I reached approximately 300,000 words. For ASME, the text is from issues dated

 $^{^1 {\}rm See} \ {\rm https://code.google.com/archive/p/word2vec/}$ for details.

September 2020 to May 2022 inclusive. For ISM, I included text from issues dated from January 2020 to May 2022 inclusive. For AMA, I included text from issues dated from February 2019 to Spring 2022, and supplemented this with additional practitioner-targeted text (text introducing white papers and ebooks, and text from partially available earlier issues January 2019 and October 2018) in order to reach 300,000 words and ensure comparably sized corpora for training the models.

In summary, each text corpus consists of practitioner-targeted news and messaging from an American professional association. Each has a similar word count, and has a publication period coinciding with the same major social events (e.g., the coronavirus pandemic, the Black Lives Matter movement).

4.3.3 Model Training

I performed minimal data pre-processing: removing quotation marks and converting to lowercase and UTF-8 format. The paragraph structure of the original input text is retained so that words in neighboring sentences within a paragraph are interpreted as co-located while words in neighboring sentences across paragraphs are not.

I used the word2vec package in R to independently train each of my semantic space models. I used training parameters informed by Mikolov et al.'s recommendations for increasing accuracy for rare words: hierarchical softmax, window length of 10, 50 dimensions, and five iterations (2013).

4.3.4 Model Validation

My general approach in this study is to independently train these models and make comparisons between them based on differences in the semantic distance between words. However, it must be noted that independently trained semantic space models can have different dimensions of semantic space. Each model has the same number of dimensions, but which dimensions are the most discriminating for a given corpus varies. For example: one model could contain a dimension interpretable as color which another model lacks, while that other model instead contains a dimension interpretable as altitude which the first one lacks. For this reason, I refrain from interpretation of results along any particular dimension and instead focus on the comparing distances between words over the full 50-dimensional space of each model.

To evaluate the validity of this approach, I began with the set of words appearing in all three models (2948 words), and generated one alphabetically-sorted symmetric matrix of within-model semantic distances between words for each. I then subtracted these (i.e., AMA, ASME, ISM) matrices from one another, to yield three new matrices of the differences between models (i.e., AMA-ASME, AMA-ISM, ISM-ASME). I use the absolute value of each element in subsequent analysis because the direction of these differences is not meaningful. Each element in these new matrices is the difference between the semantic distance between a pair of words in one model and the semantic distance between the same pair of words in one another model. The words with the smallest average difference (averaged over all words) should be those that have the most similar semantic meanings, regardless of the comparability of dimensions.

In Table 4.1 below, we can see that the results are generally consistent with this interpretation: the words with the lowest average difference largely consist of common prepositions, pronouns and adverbs which have more grammatical than semantic purpose. The high between-model consistency of those nouns that do appear (i.e., chief, university, professor, corporation, senior) may be attributable to the bylines of

contributing authors, which tend to follow a standard format. Meanwhile, many of the words with the highest average difference have multiple meanings, inviting the possibility that one meaning may be more common in one discipline, while the other prevails in its counterpart.

	AMA-ASME		AMA-ISM	ISM-ASME		
Smallest	Average Difference	Smallest	Average Difference	Smallest	Average Difference	
these	0.12193	makes	0.12191	that	0.11047	
been	0.12524	which	0.12458	a	0.11154	
where	0.12562	́в	0.12532	on	0.11432	
with	0.12606	than	0.12601	are	0.11601	
there	0.12643	two	0.12611	at	0.11833	
chief	0.12664	serve	0.12618	which	0.11940	
does	0.12675	university	0.12627	those	0.12012	
two	0.12759	set	0.12645	chief	0.12142	
university	0.12796	big	0.12654	this	0.12319	
well	0.12805	this	0.12688	have	0.12321	
along	0.12824	no	0.12718	will	0.12330	
professor	0.12833	at	0.12728	corporation	0.12331	
than	0.12887	fact	0.12770	senior	0.12341	
now	0.12908	continue	0.12770	than	0.12361	
Largest	Average Difference	Largest	Average Difference	Largest	Average Difference	
land	0.20437	re	0.22424	scott	0.23412	
powers	0.20453	floor	0.22144	outlook	0.23182	
contributes	0.20480	sea	0.22075	contributions	0.22469	
lowest	0.20483	rethinking	0.21389	voice	0.22399	
transparent	0.20532	directions	0.21327	rest	0.22231	
grew	0.20687	ton	0.21001	contributes	0.22164	
relative	0.20751	attitude	0.20752	sponsor	0.21854	
fuel	0.20790	straight	0.20742	brown	0.21782	
ton	0.20919	fuel	0.20648	upper	0.21572	
amazing	0.21051	increment al	0.20549	z	0.21537	
operates	0.21160	identity	0.20522	lowest	0.21479	
outlook	0.21253	remarkable	0.20419	calling	0.21273	
recipient	0.22117	predictions	0.20350	andrew	0.21008	
expense	0.22944	operates	0.20315	collect ed	0.20816	

Table 4.1: Least and Most Different Words

A further potential concern is that these models' estimates of each word's location in the relevant semantic space may be unstable. The word2vec skip-gram algorithm begins by randomly initializing a vector for each word, and, particularly with low-frequency words, this initial randomization could be influential in the estimated semantic distance.

To alleviate this risk, I trained 10 additional models on each corpora (set seed = 1000 to 1010) and calculated the distance between the same five pairs of words in each (see tables 4.2 through 4.4 below). The average standard deviation is subjectively reasonable ($\sigma = 0.06$), but it does vary²: As expected, the standard deviation tends to be higher for low-frequency words (max $\sigma = 0.14$, for the importance-flexibility word-pair in the AMA corpora, in which 'flexibility' occurs only 16 times), suggesting that the estimation of several models, or the collection of further data, may be necessary for reliable estimates in these cases.

Further model validation is both possible and desirable: I offer recommendations for addressing the limitations of this preliminary analysis in a later section.

4.4 **Results and Interpretation**

For this preliminary proof-of-concept, I focus on the relative importance of the competitive priorities (i.e., cost, quality, delivery, innovation, flexibility); these priorities have been the subject of extensive prior research on trade-offs (Hayes and Pisano 1996, Boyer and Lewis 2002, Rosenzweig and Roth 2004, Peng et al. 2011) and the idea that functional groups can be misaligned with respect to these priorities has also been established in prior literature (e.g., Oliva and Watson 2011, Franke et al. 2021). This study offers a minor contribution to this stream of research by quantitatively assessing the extent to which misalignment may be promoted by the three selected

²The similarity measure used, dot product, has a range from 0 to 1. If $\sigma = 0.06$ seems high when compared with the averages displayed in Table 4.1, please note that those are average distances over thousands of words rather than pairwise distances between specific words.

	Cost	Quality	Delivery	Innovation	Flexibility
Model1	0.32013	0.42794	0.00000	0.59370	0.50898
Model2	0.35005	0.30069	0.00000	0.47473	0.42956
Model3	0.34155	0.42772	0.00000	0.54576	0.47201
Model4	0.29911	0.25867	0.00000	0.51955	0.44897
Model5	0.27916	0.40859	0.00000	0.49050	0.51084
Model6	0.28663	0.22222	0.00000	0.50060	0.42731
Model7	0.40049	0.37377	0.00000	0.52652	0.50293
Model8	0.12868	0.44480	0.00000	0.53282	0.37736
Model9	0.21207	0.45471	0.00000	0.55717	0.37370
Model10	0.33728	0.38980	0.00000	0.60925	0.52041
Average	0.30	0.37	0.00	0.54	0.46
St. Dev.	0.07	0.07	0.00	0.04	0.05
Occurrences in Corpora	364	91	28	176	32

Table 4.2: Semantic Similarity with the word 'Important': ASME

professional associations. I will discuss the results with respect to each professional association before discussing points of similarity and difference.

Table 4.2 presents ten estimates of the semantic distance between the word 'important' and each competitive priority. Each estimate was generated using the same word2vec algorithm and text (i.e., approximately 300,000 words from ASME's *Mechanical Engineering Magazine*). The results overall suggest that ASME's publication offers a perspective that emphasizes the importance of innovation and flexibility. Cost and quality are also associated with 'important', but, on average, to a slightly lesser extent, while 'delivery' has no association with 'important' at all.

Table 4.3 also presents ten estimates for each of the same five word-pairs, but this time the text, of similar volume, comes from AMA's *Marketing News Quarterly*. AMA's perspective seems to promote an emphasis on quality. 'Flexibility' has an unstable estimated relationship with 'important' (based on a small number of mentions). Both 'cost' and 'delivery' have little-to-no association with 'important' from this perspective, while 'innovation' has a moderate association.

				-	
	Cost	Quality	Delivery	Innovation	Flexibility
Model1	0.00000	0.48461	0.04394	0.20462	0.20567
Model2	0.00000	0.56150	0.06691	0.25336	0.46021
Model3	0.00000	0.51021	0.00000	0.13829	0.46929
Model4	0.00000	0.47362	0.08201	0.25297	0.17498
Model5	0.00000	0.42697	0.00000	0.32292	0.41961
Model6	0.00000	0.47157	0.00000	0.21739	0.00000
Model7	0.00000	0.46210	0.00000	0.17129	0.43204
Model8	0.00000	0.47105	0.00000	0.00000	0.45051
Model9	0.00000	0.42213	0.05851	0.13700	0.32114
Model10	0.00000	0.45022	0.00000	0.13984	0.40051
Average	0.00	0.47	0.03	0.18	0.33
St. Dev.	0.00	0.04	0.03	0.08	0.14
Occurrences in Corpora	130	146	45	117	16

Table 4.3: Semantic Similarity with the word 'Important': AMA ${\bf AMA}$

	Cost	Quality	Delivery	Innovation	Flexibility
Model1	0.22504	0.36824	0.20545	0.52993	0.04525
Model2	0.08507	0.42150	0.09823	0.39789	0.35517
Model3	0.06655	0.44771	0.00000	0.52476	0.37659
Model4	0.12306	0.40032	0.00000	0.48392	0.32740
Model5	0.00000	0.31389	0.00000	0.52291	0.46590
Model6	0.25393	0.35536	0.00000	0.41795	0.48060
Model7	0.31086	0.39703	0.00000	0.40832	0.52981
Model8	0.16747	0.37036	0.06679	0.51139	0.50396
Model9	0.25770	0.44229	0.00000	0.40783	0.44993
Model10	0.13860	0.28226	0.16594	0.47478	0.35168
Average	0.16	0.38	0.05	0.47	0.39
St. Dev.	0.09	0.05	0.07	0.05	0.13
Occurences in Corpora	516	149	113	162	47

Table 4.4: Semantic Similarity with the word 'Important': ISM ISM

Table 4.4 repeats the same analysis, this time using text from ISM's *Supply Management Magazine*. From ISM's perspective, 'innovation', 'flexibility' and 'quality' all have similarly strong associations with 'important', while 'cost' and 'delivery' have similarly weak associations with the 'important'.

Comparing these results across disciplines, I observe that ISM's average estimated association falls between those of AMA and ASME for all competitive priorities save delivery. Delivery has little-to-no association with 'important' in general, but it has its strongest results in models generated from ISM's publications. I further observe that ISM and ASME share the same ordinal ranking among these priorities (i.e., innovation, flexibility, quality, cost, delivery; from most to least associated with 'important'), while AMA's ordinal ranking is quite different (i.e., quality, flexibility, innovation, delivery, cost).

Based on these results, I tentatively offer the following recommendations: that each of these associations and their memberships consider whether the competitive priority of delivery merits more consideration than it currently receives; that AMA and its membership consider whether the competitive priority of cost merits more attention within the field of marketing than it currently receives; and that ISM and its membership should continue to offer a balanced perspective (i.e., both by seeking to balance competing perspectives, and by seeking balanced consideration of competitive priorities).

4.5 Limitations and Future Research

This methodological approach, as executed, has clear limitations. Although some potential validity concerns were addressed in a previous sections, others remain to be addressed in future research.

The sensitivity of these estimates to changes in the text corpora has not been addressed. Clearly, if the results were to differ substantially with the addition or subtraction of a single magazine issue, they could not be interpreted as reliable measures. Bootstrapping is one of several potential strategies for resolving this limitation.

The use of the word 'important' alone may not fully capture the association of interest; neither may the words selected for each competitive priority fully capture the relevant discussions of each discipline. Duplication of these results with related terms would increase the robustness of this analysis.

Duplication of these results with modified training parameters, or with an alternative algorithm (such as GloVe), would add to the robustness of the analysis, and computational experiments to determine the minimum required corpus size to generate reliable semantic comparisons would support the application of this approach in other contexts.

4.6 Conclusions

This essay aimed to answer three research questions: Can I quantify the semantic differences between disciplines? Can I do so with readily available data sources? If so, can this work with sufficiently small amounts of data so as to make the methodological approach applicable in a wide range of cross-functional contexts? The answer to each of these questions is yes.

Despite its acknowledged limitations, this essay has demonstrated the application of an extremely flexible tool to a broad family of problems: cross-functional miscommunication. Perhaps, once they have been identified and quantified, divergent word meanings will finally become a less persistent source of communication challenges.

Chapter 5: Contributions and Future Work

Each essay of this dissertation has summarized its own contributions. These brief closing remarks consolidate those paragraphs in one place, and offer a broader perspective on future work in this stream of research.

In Chapter 2: When Does Price-Based Sourcing Hurt Performance? I, with my coauthor and advisor John Gray, provide evidence that excessively price-based decisionmaking is a widespread problem: one that exists even in contexts where individual decision-makers are not directly incentivized to overweight cost-minimization objectives. This work has practical, as well as theoretical, implications: the results suggest that a change in policy in the organization studied would be beneficial. Further, since many other jurisdictions and organizations explicitly encourage their employees to prioritize cost-minimization objectives, changes in policy at those organizations can be expected to yield even greater benefits.

In Chapter 3: When Does Professional Identity Affect Sourcing?, I, with my co-author and advisor James Hill, provide evidence that procurement professionals who more strongly identify with the profession are less willing to pay for a higherquality option favored by members of another profession than their more weakly identifying counterparts. This finding is directly relevant to community-building and professionalization efforts within the discipline. This study also offers theoretical contributions: extending work on role-based image discrepancies (Vough et al. 2013) to inter-professional relationships, and adding our findings on the effects of identification with the procurement profession to general management literature on the 'dark sides' of identification (Caprar et al. 2022).

In Chapter 4: What Can Function-Specific Semantic Models Tell Us About Sourcing? I demonstrate how an existing machine learning tool can be applied to a new family of research questions on cross-functional decision-making. In doing so, I provide preliminary evidence that engineers and supply chain professionals have shared competitive priorities that diverge from those of marketing professionals.

There are many opportunities for further research that tackles the problem of excessively price-based decision-making in sourcing. While Chapter 2 has established that less price-based decisions leads to better overall performance outcomes in one (carefully selected) context, similar research in other organizational settings can add new insights. While Chapter 3 has identified one variable that causes more price-based decisions, other variables with similar effects are almost certain to exist. Chapter 4 of this dissertation is an exploratory study, and additional work is needed: both to validate the research design and to establish rigorous methodological standards. When that necessary work has been completed, there will be an opportunity to apply the same approach to an extraordinarily broad swathe of research questions. Appendix A: Supplement for When Does Price-based Sourcing Hurt Performance?

	n	%
AGENCY FOR INTERNATIONAL DEVELOPMENT	11	1.01
AGRICULTURAL MARKETING SERVICE	1	0.09
AGRICULTURAL RESEARCH SERVICE	1	0.09
BUREAU OF LAND MANAGEMENT	40	3.68
BUREAU OF RECLAMATION	4	0.37
BUREAU OF THE FISCAL SERVICE	1	0.09
CENTERS FOR DISEASE CONTROL AND PREVENTION	19	1.75
DEPARTMENTAL OFFICES	3	0.28
EDUCATION, DEPARTMENT OF	10	0.92
EMPLOYMENT AND TRAINING ADMINISTRATION	23	2.11
ENERGY, DEPARTMENT OF	17	1.56
ENVIRONMENTAL PROTECTION AGENCY	2	0.18
FEDERAL ACQUISITION SERVICE	1	0.09
FEDERAL AVIATION ADMINISTRATION	2	0.18
FEDERAL EMERGENCY MANAGEMENT AGENCY	6	0.55
FEDERAL HIGHWAY ADMINISTRATION	1	0.09
FEDERAL LAW ENFORCEMENT TRAINING CENTER	1	0.09
FEDERAL PRISON SYSTEM / BUREAU OF PRISONS	1	0.09
FOOD AND DRUG ADMINISTRATION	8	0.74
FOREST SERVICE	267	24.54
INTERNAL REVENUE SERVICE	1	0.09
MARITIME ADMINISTRATION	1	0.09
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	17	1.56
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	2	0.18
NATIONAL INSTITUTES OF HEALTH	49	4.50
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	13	1.19
NATIONAL PARK SERVICE	50	4.60
OFFICE OF ASST SECRETARY FOR PREPAREDNESS AND RESPONSE	1	0.09
OFFICE OF PERSONNEL MANAGEMENT	1	0.09
OFFICE OF PROCUREMENT OPERATIONS	11	1.01
OFFICE OF THE ASST SECRETARY FOR ADMINISTRATION (ASA)	1	0.09
OFFICE OF THE ASST SECRETARY FOR ADMINISTRATION AND MGMT	2	0.18
OFFICE OF THE SECRETARY	1	0.09
OFFICES, BOARDS AND DIVISIONS	3	0.28
PENSION BENEFIT GUARANTY CORPORATION	2	0.18
PRETRIAL SERVICES AGENCY	1	0.09
PUBLIC BUILDINGS SERVICE	106	9.74
SMITHSONIAN INSTITUTION	3	0.28
STATE, DEPARTMENT OF	6	0.55
TRANSPORTATION SECURITY ADMINISTRATION	4	0.37
U.S. CITIZENSHIP AND IMMIGRATION SERVICES	3	0.28
U.S. COAST GUARD	11	1.01
U.S. CUSTOMS AND BORDER PROTECTION	1	0.09
U.S. FISH AND WILDLIFE SERVICE	1	0.09
VETERANS AFFAIRS, DEPARTMENT OF	378	34.74

Table A.1: Awarding Sub-Agencies

Table A.2: NAICS Code Descriptions

·	n	0%
ADMINISTRATIVE MANACEMENT AND CENERAL MANACEMENT CONSILUTING SERVICES	11	1.01
ALL OTHER MICHAELE ANEOLIS (PARE AND GENERAL MARAGEMENT CONSULTING SERVICES	26	2.20
ALL OTHER MISCELLANEOUS CAOP FARMING	20	2.39
ALL OTHER MISCELLANEOUS FABRICATED METAL PRODUCT MANUFACTURING	1	0.09
ALL OTHER MISCELLANEOUS WASTE MANAGEMENT SERVICES	2	0.18
ALL OTHER PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES	8	0.74
ALL OTHER SPECIALTY TRADE CONTRACTORS	9	0.83
ANALYTICAL LABORATORY INSTRUMENT MANUFACTURING	1	0.09
ARCHITECTURAL SERVICES	9	0.83
BIOLOGICAL PRODUCT (EXCEPT DIAGNOSTIC) MANUFACTURING	3	0.28
CEMETERIES AND CREMATORIES	4	0.37
	- 4	0.01
COASTAL AND GREAT LAKES FASSENGER TRANSFORTATION	0	0.28
COMMERCIAL & INDUSTRIAL MACHINERY & EQUIPMENT (EXCEPT AUTOMOTIVE & ELECTRONIC) REPAIR & MAINTENANCE	- 3	0.28
COMMERCIAL AND INSTITUTIONAL BUILDING CONSTRUCTION	273	25.09
COMPUTER SYSTEMS DESIGN SERVICES	1	0.09
CONVEYOR AND CONVEYING EQUIPMENT MANUFACTURING	1	0.09
COURIERS AND EXPRESS DELIVERY SERVICES	5	0.46
CUT STONE AND STONE PRODUCT MANUFACTURING	4	0.37
ELECTRICAL CONTRACTORS AND OTHER WIRING INSTALLATION CONTRACTORS	â	0.83
	5	0.46
ENVIRONMENTAL CONSULTING SERVICES	1	0.40
ENVIRONMENTAL CONSULTING SERVICES	1	0.09
FACILITIES SUPPORT SERVICES	2	0.18
FOOD SERVICE CONTRACTORS	1	0.09
GENERAL MEDICAL AND SURGICAL HOSPITALS	1	0.09
GUIDED MISSILE & SPACE VEHICLE PROPULSION UNIT & PROPULSION UNIT PARTS MANUFACTURING	2	0.18
HIGHWAY, STREET, AND BRIDGE CONSTRUCTION	136	12.50
HOTELS (EXCEPT CASINO HOTELS) AND MOTELS	1	0.09
INDEPENDENT ARTISTS WRITERS AND PERFORMERS	2	0.18
INDUSTRIAL BUILDING CONSTRUCTION	1	0.00
	1	0.03
INDUSTRIAL GAS MANUFAUTURING	1	0.09
INTERNATIONAL AFFAIRS	2	0.18
JANITORIAL SERVICES	27	2.48
LANDSCAPING SERVICES	47	4.32
LOGGING	2	0.18
MARKETING RESEARCH AND PUBLIC OPINION POLLING	2	0.18
MEDICINAL AND BOTANICAL MANUFACTURING	6	0.55
MOTION PICTURE AND VIDEO PRODUCTION	1	0.09
	69	6.95
NONSCHEDULED CHARTERED FREIGHT AIR TRANSFORTATION	00	0.20
OFFICE ADMINISTRATIVE SERVICES	3	0.28
OFFICE FURNITURE (EXCEPT WOOD) MANUFACTURING	1	0.09
OFFICE SUPPLIES AND STATIONERY STORES	1	0.09
OFFICES OF DENTISTS	1	0.09
OFFICES OF LAWYERS	3	0.28
OFFICES OF PHYSICIANS (EXCEPT MENTAL HEALTH SPECIALISTS)	4	0.37
OTHER BUILDING EQUIPMENT CONTRACTORS	2	0.18
OTHER COMMERCIAL AND SERVICE INDUSTRY MACHINERY MANUFACTURING	10	1.75
	10	0.10
OTHER COMMUNIT ROUGING SERVICES	2	0.18
OTHER COMPUTER RELATED SERVICES	1	0.09
OTHER ELECTRONIC AND PRECISION EQUIPMENT REPAIR AND MAINTENANCE	22	2.02
OTHER FOUNDATION, STRUCTURE, AND BUILDING EXTERIOR CONTRACTORS	2	0.18
OTHER HEAVY AND CIVIL ENGINEERING CONSTRUCTION	21	1.93
OTHER RESIDENTIAL CARE FACILITIES	1	0.09
OTHER SPECIALIZED DESIGN SERVICES	1	0.09
OTHER SUPPORT ACTIVITIES FOR AIR TRANSPORTATION	1	0.09
OTHER TECHNICAL AND TRADE SCHOOLS	23	2.11
OTHER WAREHOUSING AND STOPAGE	20	0.19
OTHER WARFIOUSING AND STORAGE OUTDATENT MENTAL HEALTH AND SUBCTANCE ADJRE CENTERS	1	0.10
OUTFATIENT MENTAL HEALTH AND SUBSTAINCE ABUSE CENTERS	1	0.09
PAINTING AND WALL COVERING CONTRACTORS	1	0.09
PARKING LOTS AND GARAGES	3	0.28
PETROLEUM & PETROLEUM PRODUCTS MERCHANT WHOLESALERS (EXCEPT BULK STATIONS & TERMINALS)	1	0.09
PHARMACEUTICAL PREPARATION MANUFACTURING	7	0.64
PLUMBING, HEATING, AND AIR-CONDITIONING CONTRACTORS	44	4.04
PORTFOLIO MANAGEMENT	2	0.18
RADIO & TELEVISION BROADCASTING & WIRELESS COMMUNICATIONS EQUIPMENT MANUFACTURING	1	0.09
RELIGIOUS ORGANIZATIONS	1	0.09
RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY	17	1.56
DESEADOU AND DEVELOPMENT IN DIOTECHNOLOGY (EVCEPT NANODIOTECHNOLOGY)	0	0.74
RESEARCH AND DEVELOPMENT IN DIOTECTINOLOGY ENCODED IN ANODOTECTINOLOGY (DECEMPTION OF COMPACTINOLOGY)	0	0.74
RESEARCH AND DEVELOPMENT IN THE PHYSICAL, ENGINEERING, & LIFE SCIENCES (EXCEPT BIOTECHNOLOGY)	29	2.67
R&D IN THE PHYSICAL, ENGINEERING, AND LIFE SCIENCES (EXCEPT NANOTECHNOLOGY AND BIOTECHNOLOGY)	42	3.86
RESEARCH AND DEVELOPMENT IN THE SOCIAL SCIENCES AND HUMANITIES	10	0.92
RESIDENTIAL REMODELERS	1	0.09
ROOFING CONTRACTORS	14	1.29
SEARCH, DETECTION, NAVIGATION, GUIDANCE, AERONAUTICAL & NAUTICAL SYSTEM & INSTRUMENT MANUFACTURING	1	0.09
SECURITY SYSTEMS SERVICES (EXCEPT LOCKSMITHS)	3	0.28
SHIP BUILDING AND REPAIRING	21	1.93
SIGN MANUFACTURING	1	0.00
	1	0.09
SUL PREFAMILION OUNTRACIONS	2	0.18
SOIL PREPARATION, PLANTING, AND CULTIVATING	2	0.18
SOLID WASTE COLLECTION	3	0.28
SPECIAL NEEDS TRANSPORTATION	1	0.09
SUPPORT ACTIVITIES FOR FORESTRY	44	4.04
SURGICAL AND MEDICAL INSTRUMENT MANUFACTURING	3	0.28
SUBGICAL APPLIANCE AND SUPPLIES MANUFACTURING	4	0.37
TEMPORARY HELP SERVICES	8	0.74
This order the second	1	0.14
INITED FARLE FARMENTS I RATION OF INSURANCE AND FENSION FUNCTION	1	0.09
WATER AND SEWER LINE AND RELATED STRUCTURES CONSTRUCTION	19	1.75
WIRED TELECOMMUNICATIONS CARRIERS	2	0.18

Statistic	Mean	St. Dev.	Min	Max
Contract value	34,599,413	805,915,593	100	26,499,791,300
Number of offers received	6.906	15.348	2	420
Number of factors evaluated	4.589	2.300	0	16
Recontracted	0.2252	0.4177	0	1
LPTA	0.3346	0.4719	0	1
MoreNonprice*	0.5180	0.4997	0	1
Morethan3Factors	0.7096	0.4539	0	1
SocEnvFactors	0.1397	0.3467	0	1

Table A.3: Descriptive Statistics (n = 1088, unless noted)

Note: MoreNonprice has n = 724, due to excluding LPTA from analysis of weighting in tradeoff procedures. Contract value is the sum of the base contract value and all options.

		Dependent variable:						
		Recontracted						
	(1)	(2)	(3)	(4)				
LPTA	0.476^{*} (0.258)							
MoreNonprice	. ,	1.416^{***} (0.363)						
Morethan3Factors		()	0.497^{*} (0.299)					
SocEnvFactors			()	0.623^{**} (0.283)				
logoffers	0.729^{***} (0.227)	0.022 (0.483)	0.294 (0.413)	(0.200) -0.029 (0.344)				
logcontractvalue	(0.124) (0.094)	-0.006 (0.126)	(0.145^{**}) (0.069)	(0.011) 0.155^{*} (0.088)				
Constant	-4.298^{***} (1.440)	(0.120) -2.143 (1.646)	(3.000) -3.758^{***} (1.045)	-3.586^{**} (1.545)				
Observations	510	265	529	394				
Treatment	245	114	364	107				
Control	265	151	165	287				

Table A.4: Robustness Check: Fewer Cutpoints on Log of Contract Value

Note: 30 cutpoints on log of contract value instead of 40.

	_	Dependent variable:					
		Recont	racted				
	(1)	(2)	(3)	(4)			
LPTA	0.022 (0.292)						
MoreNonprice	· · ·	1.337^{***} (0.498)					
Morethan3Factors		()	0.356 (0.397)				
SocEnvFactors			(0.001)	0.527^{*} (0.298)			
logoffers	-0.238	-0.422	0.687^{*}	(0.200) 0.049 (0.372)			
logcontractvalue	(0.200) 0.045 (0.130)	(0.044) -0.176 (0.177)	(0.303) -0.035 (0.153)	(0.912) 0.067 (0.147)			
Constant	(0.130) -1.740 (1.871)	(0.177) 0.612 (2.161)	(0.133) -1.833 (2.321)	(0.147) -2.470 (2.206)			
Observations	295	116	339	292			
Treatment	146 140	50 66	227	82			
Control	149	00	112	210			

Table A.5: Robustness Check: Additional Matching Variables: Year and Pricing

Note: Additional exact matching on fiscal year of contract award and type of contract pricing. 30 cutpoints on log of contract value used instead of 40 to preserve sample size given the additional matching variables.

	Dependent variable:					
		Recor	ntracted			
	(1)	(2)	(3)	(4)		
LPTA	$0.069 \\ (0.391)$					
MoreNonprice		1.039^{**} (0.428)				
Morethan3Factors		· · · ·	0.950^{*} (0.511)			
SocEnvFactors				0.800^{***} (0.295)		
logoffers	0.838^{**} (0.330)	0.210 (0.469)	0.860^{*} (0.449)	-0.136 (0.591)		
logcontractvalue	0.182 (0.125)	-0.008 (0.191)	0.275^{*} (0.149)	0.260^{*} (0.143)		
Constant	-4.891^{**} (1.912)	-2.306 (2.373)	-6.170^{**} (2.629)	-4.732^{**} (2.390)		
Observations	257	141	260	196		
Treatment	130	49	183	52		
Control	127	92	77	144		

Table A.6: Robustness Check: Trump Administration

Note: Sample restricted to awards in fiscal years 2017 to 2020 inclusive.

	_	Dependent variable:					
		Recontracted					
	(1)	(2)	(3)	(4)			
LPTA	0.051 (0.282)						
MoreNonprice		1.339^{***} (0.471)					
Morethan3Factors		()	0.497 (0.314)				
SocEnvFactors			()	0.486 (0.308)			
logoffers	0.663^{***} (0.210)	0.168 (0.380)	0.211 (0.332)	(0.098) (0.300)			
logcontractvalue	0.045 (0.096)	0.062 (0.113)	0.128 (0.095)	0.110 (0.107)			
Constant	-2.722^{*} (1.408)	-3.382^{**} (1.619)	-3.327^{**} (1.304)	-2.975^{*} (1.659)			
Observations	474	246	498	354			
Treatment	219	98	346	91			
Control	255	148	152	263			

Table A.7: Robustness Check: Robust Standard Errors

Note: Robust rather than cluster-robust SEs.

	Dependent variable:					
	Recontracted					
	(1)	(2)	(3)	(4)		
LPTA	(0.571, 1.965)					
MoreNonprice		$(1.199, 11.229)^*$				
Morethan3Factors			(0.745, 2.985)			
SocEnvFactors			x · · x	(0.808, 3.080)		
Observations	474	246	498	354		
Treatment	219	98	346	91		
Control	255	148	152	263		

Table A.8: Robustness Check: Bootstrapped 95% Confidence Intervals for Marginal Odds Ratios

Note: Bias-corrected and accelerated (BCa) bootstrap intervals. Intervals containing 1 are not statistically significant at 95% level. Controls included for log of offers received and log of contract value.



Figure A.1: Distributional Balance for Log of Contract Value in Model 1 Distributional balance before and after matching on whether LPTA or tradeoff procedures are used.



Figure A.2: Distributional Balance for Log of Contract Value in Model 2 Distributional balance before and after matching on the weighting of non-price factors (tradeoffs only).



Figure A.3: Distributional Balance for Log of Contract Value in Model 3 Distributional balance before and after matching on number of factors evaluated.



Figure A.4: Distributional Balance for Log of Contract Value in Model 4 Distributional balance before and after matching on the inclusion of social/environmental factors.

	Random Sample	from Model 1 Matches				
Treatment	NAICS Description	Award Description	Solicitation Identifier	Awarding Subagency	Contract Value	Award Date
	HIGHWAY, STREET, AND BRIDGE	IGF::OT::IGF ROUGH FIRE ASPHALT REHABILITATION				
LPTA	CONSTRUCTION	PROJECT	AG-9A40-S-17-0004	FOREST SERVICE	\$ 330,000.00	6/22/2017
	HIGHWAY, STREET, AND BRIDGE					
Tradeoff	CONSTRUCTION	KNF / PIPE CREEK BRIDGE/ NFSR 471 MP 0.3	12034319R0003	FOREST SERVICE	\$ 247,755.00	4/25/2019
	COMMERCIAL AND					
	INSTITUTIONAL BUILDING			VETERANS AFFAIRS,		
LPTA	CONSTRUCTION	IGF::OT::IGF REPAIR SITE SANITARY SEWER PIPING	VA256-16-R-0353	DEPARTMENT OF	\$ 69,850.00	6/28/2016
	COMMERCIAL AND					
	INSTITUTIONAL BUILDING			VETERANS AFFAIRS,		
Tradeoff	CONSTRUCTION	REPLACE WATER VALVES IGF::OT::IGF	VA248-17-R-0909	DEPARTMENT OF	\$ 70,992.44	9/22/2017
				VETERANS AFFAIRS,		
LPTA	LANDSCAPING SERVICES	IGF::CL::IGF TREE PRUNE AND REMOVAL	VA786-15-R-0256	DEPARTMENT OF	\$ 85,500.00	8/25/2015
		IGF::OT::IGF REMOVE EXCESS FILL DIRT AT THE		VETERANS AFFAIRS,		
Tradeoff	LANDSCAPING SERVICES	HAMPTON NATIONAL CEMETERY, HAMPTON, VA	VA786-16-Q-0054	DEPARTMENT OF	\$ 80,000.00	2/29/2016
	OTHER ELECTRONIC AND					
	PRECISION EQUIPMENT REPAIR	IGF::OT::IGF SERVICES FOR LUMENIS EYE LASER		VETERANS AFFAIRS,		
LPTA	AND MAINTENANCE	EQUIPMENT	VA262-17-Q-0474	DEPARTMENT OF	\$ 97,617.98	4/7/2017
	OTHER ELECTRONIC AND					
	PRECISION EQUIPMENT REPAIR			VETERANS AFFAIRS,		
Tradeoff	AND MAINTENANCE	IGF::OT::IGF MAINTENANCE OF TWO STERILIZERS	VA257-17-Q-0393	DEPARTMENT OF	\$ 92,640.00	5/1/2017
	OTHER COMMERCIAL AND					
	SERVICE INDUSTRY MACHINERY	ITEM 4 - 300/400 LB WASHER EXTRACTOR ITEM 13 -		VETERANS AFFAIRS,		
LPTA	MANUFACTURING	FLAT IRONING SYSTEM	VA797H-17-R-0012	DEPARTMENT OF	\$ 736,343.50	10/25/2017
	OTHER COMMERCIAL AND					
	SERVICE INDUSTRY MACHINERY	SHEET SEPARATOR WITH CONVEYOR, THERMAL FLUID		VETERANS AFFAIRS,		
Tradeoff	MANUFACTURING	FLATWORK IRONING SYSTEM	VA797R-15-R-0006	DEPARTMENT OF	\$ 687,435.00	7/8/2015

Figure A.5: Random Matches: Model 1

Random Sample from Model 2 Matches						
Treatment	NAICS Description	Award Description	Solicitation Identifier	Awarding Subagency	Contract Value	Award Date
		CALVERTON NATION CEMETERY HEADSTONE RAISE				
		AND REALIGNMENT PROJECT AND TURF		VETERANS AFFAIRS,		
MoreNonprice	LANDSCAPING SERVICES	RENOVATION. IGF::OT::IGF	VA119A-16-Q-0015	DEPARTMENT OF	\$ 2,443,971.00	4/8/2015
				VETERANS AFFAIRS,		
EqualNonprice	LANDSCAPING SERVICES	IGF::CL::IGF MOW AND TRIM SERVICES	VA786-14-R-0354	DEPARTMENT OF	\$ 2,475,792.00	2/29/2016
	NONSCHEDULED CHARTERED	IGF::CT::IGF EXCLUSIVE USE TYPE-III HELICOPTER				
MoreNonprice	FREIGHT AIR TRANSPORTATION	SERVICES, USFS REGION 5	AG-024B-S-13-9503	FOREST SERVICE	\$ 3,954,029.00	2/27/2013
		IGF::CT::IGF CRITICAL FUNCTION REGION 1				
	NONSCHEDULED CHARTERED	EXCLUSIVE USE LIGHT FIXED WING SERVICES (ATGS)				
EqualNonprice	FREIGHT AIR TRANSPORTATION	FOR WILDLAND FIREFIGHTING	AG-024B-S-17-9114	FOREST SERVICE	\$ 4,000,000.00	5/30/2017
	NONSCHEDULED CHARTERED	IGF::CT::IGF CRITICAL FUNCTIONS - LARGE FIRE				
MoreNonprice	FREIGHT AIR TRANSPORTATION	SUPPORT EU HELICOPTERS SERVICES	AG-024B-S-15-9007	FOREST SERVICE	\$ 26,955,644.00	4/10/2016
	NONSCHEDULED CHARTERED	IGF::CT::IGF CRITICAL FUNCTION - EXCLUSIVE USE,				
EqualNonprice	FREIGHT AIR TRANSPORTATION	INITIAL ATTACK HELICOPTER SERVICES	12024B18Q9301	FOREST SERVICE	\$ 20,000,000.00	3/13/2018
				NATIONAL OCEANIC AND		
				ATMOSPHERIC		
MoreNonprice	SHIP BUILDING AND REPAIRING	FY2018 DOCKSIDE REPAIRS TO NOAA SHIP PISCES	EA-133M-16-RP-0137	ADMINISTRATION	\$ 751,670.00	12/23/2016
				NATIONAL OCEANIC AND		
				ATMOSPHERIC		
EqualNonprice	SHIP BUILDING AND REPAIRING	DOCKSIDE REPAIRS TO NOAA SHIP NANCY FOSTER	EA133M-17-RP-0181	ADMINISTRATION	\$ 890,700.00	11/29/2017
	COMMERCIAL AND					
	INSTITUTIONAL BUILDING			VETERANS AFFAIRS,		
MoreNonprice	CONSTRUCTION	REPLACE WATER VALVES IGF::OT::IGF	VA248-17-R-0909	DEPARTMENT OF	\$ 70,992.44	9/22/2017
	COMMERCIAL AND					
	INSTITUTIONAL BUILDING			VETERANS AFFAIRS,		
EqualNonprice	CONSTRUCTION	IGF::OT::IGF CANTEEN UPGRADES	36C25918R0585	DEPARTMENT OF	\$ 72,993.00	7/11/2018

Figure A.6: Random Matches: Model 2

	Random Samp	le from Model 3 Matches				
Treatment	NAICS Description	Award Description	Solicitation Identifier	Awarding Subagency	Contract Value	Award Date
		IGF::CT::IGF 2016 PLACERVILLE HERBS ELDORADO				
	SUPPORT ACTIVITIES FOR	NATIONAL FOREST PERIOD OF PERFORMANCE: 05/02/2016-				
Morethan3Factors	FORESTRY	06/02/2016	AG-9JGP-S-16-0061	FOREST SERVICE	\$ 123,464.00	4/27/2016
	SUPPORT ACTIVITIES FOR	IGF::OT::IGF CHIPITA CREEKS THINNING AND FUELS				
3orLessFactors	FORESTRY	REDUCTION SUMMITT	AG-82BH-S-16-0035	FOREST SERVICE	\$ 115,541.00	9/13/2016
				VETERANS AFFAIRS,		
Morethan3Factors	LANDSCAPING SERVICES	IGF::OT::IGF , JANITORIAL SERVICES	VA786-16-R-0059	DEPARTMENT OF	\$ 24,900.00	1/12/2016
				VETERANS AFFAIRS,		
3orLessFactors	LANDSCAPING SERVICES	"IGF::OT::IGF" LAWN CARE SERVICES "IGF::OT::IGF"	VA247-17-R-0670	DEPARTMENT OF	\$ 27,000.00	9/1/2017
		IGF::OT::IGF THE CONTRACTOR SHALL REPLACE 2				
		EXPANSION JOINTS ON THE CHILLED WATER AND				
	PLUMBING, HEATING, AND AIR	CONDENSER WATER SYSTEMS AS WELL AS REPLACE CHILLED				
	CONDITIONING	WATER PUMPS #1, #2 AND #3 AT THE LITTLE ROCK FEDERAL		PUBLIC BUILDINGS		
Morethan3Factors	CONTRACTORS	BUILDING IN LITTLE ROCK, AR.	GS-07-P-16-HT-C-7010	SERVICE	\$ 206,000.00	8/18/2016
		PROVIDE ALL MATERIALS, SUPPLIES, LABOR, EQUIPMENT				
		AND SUPERVISION, NECESSARY TO COMPLETE THE				
		DEMOLITION AND REPLACEMENT OF ONE (1) 127 HP HOT				
		WATER BOILER AND REPLACE FLUE GAS STACK CONNECTED				
		TO BOILERS 1 AND 2. UPON COMPLETION OF THE PROJECT,				
	PLUMBING, HEATING, AND AIR	THE NEW BOILER SHALL BE CONNECTED TO THE COMMON				
	CONDITIONING	BUILDING HOT WATER LOOP AND BUILDING AUTOMATION		PUBLIC BUILDINGS		
3orLessFactors	CONTRACTORS	SYSTEM (BAS).	47PH1118R0005	SERVICE	\$ 144,989.00	9/21/2018
	SUPPORT ACTIVITIES FOR					
Morethan3Factors	FORESTRY	LONG VALLEY SAGE GROUSE TREE REMOVAL IGF::CT::IGF	AG-9JGP-S-17-0100	FOREST SERVICE	\$ 34,590.00	6/27/2017
	SUPPORT ACTIVITIES FOR					
3orLessFactors	FORESTRY	IGF::OT::IGF 2016 ICARUS PLANTATION PCT/MASTICATION	AG-9AC7-S-16-0074	FOREST SERVICE	\$ 37,680.00	5/20/2016
		CONTRACTOR SHALL PROVIDE ALL LABOR, EQUIPMENT,				
		MATERIAL AND SUPERVISION TO SUPPORT SUBJECT		VETERANS AFFAIRS,		
Morethan3Factors	LANDSCAPING SERVICES	CONTRACT. IGF::CL::IGF	VA786-17-R-0212	DEPARTMENT OF	\$ 393,360.00	5/31/2017
		RAISE AND REALIGN HEADSTONES WITH TURF		VETERANS AFFAIRS,		
3orLessFactors	LANDSCAPING SERVICES	RENOVATION	36C78618R0182	DEPARTMENT OF	\$ 389,789.50	5/10/2018

Figure A.7: Random Matches: Model 3

	Random Sample fro	m Model 4 Matches				
Treatment	NAICS Description	Award Description	Solicitation Identifier	Awarding Subagency	Contract Value	Award Date
		FOREST SERVICE ROAD 29, M.P. 15.7, 15.9,				
		16.0, 16.1,&18.3 CULVERT REPLACEMENTS.				
	HIGHWAY, STREET, AND	REMOVE AND REPLACE EXISTING CULVERTS.				
SocEnvFactors	BRIDGE CONSTRUCTION	GOVERNMENT PROVIDED FINAL DESIGN.	1205G219R0001	FOREST SERVICE	\$ 79,977.00	5/23/2019
	HIGHWAY, STREET, AND					
NoSocEnvFactors	BRIDGE CONSTRUCTION	ROAD RECONSTRUCTION (FSR 550-A)	12467018R0106	FOREST SERVICE	\$ 85,595.25	9/26/2018
	NONSCHEDULED	IGF::CT::IGF CRITICAL FUNCTION - REGION 1				
	CHARTERED FREIGHT AIR	EXCLUSIVE USE LIGHT FIXED WING ATGS				
SocEnvFactors	TRANSPORTATION	SERVICES	AG-024B-S-13-9104	FOREST SERVICE	\$ 4,501,020.00	2/20/2013
	NONSCHEDULED	IGF::CT::IGF:: CRITICAL FUNCTION - REGION 3				
	CHARTERED FREIGHT AIR	EXCLUSIVE USE TYPE III HELICOPTER				
NoSocEnvFactors	TRANSPORTATION	SERVICES FOR WILDLAND FIREFIGHTING.	AG-024B-S-16-9305	FOREST SERVICE	\$ 5,000,000.00	3/18/2016
	COMMERCIAL AND					
	INSTITUTIONAL BUILDING	IGF::OT::IGF OTHER FUNCTION 589A5-15-		VETERANS AFFAIRS,		
SocEnvFactors	CONSTRUCTION	205, REMODEL CANTEEN	VA255-17-R-0721	DEPARTMENT OF	\$ 641,256.00	9/26/2017
	COMMERCIAL AND					
	INSTITUTIONAL BUILDING	IGF::OT::IGF - SITE PREPARATION FOR PET CT		VETERANS AFFAIRS,		
NoSocEnvFactors	CONSTRUCTION	INSTALLATION PROJECT 546-CSI-113	VA248-17-R-0174	DEPARTMENT OF	\$ 861,252.00	5/24/2017
		THIS CONTRACT IS BEING ISSUED FOR				
1		CONSTRUCTION SERVICES FOR THE 450GG				
		INFRASTRUCTURE PROJECT LOCATED AT THE				
	COMMERCIAL AND	PHILIP J. BURTON FEDERAL BUILDING AND				
	INSTITUTIONAL BUILDING	U.S. COURTHOUSE IN SAN FRANCISCO,		PUBLIC BUILDINGS		
SocEnvFactors	CONSTRUCTION	CALIFORNIA. IGF::OT::IGF	GS-09-P-16-KT-C-7006	SERVICE	\$ 14,555,297.00	9/9/2016
	COMMERCIAL AND					
	INSTITUTIONAL BUILDING	IGF::OT::IGF_DOC A TENANT FIT-OUT, ST		PUBLIC BUILDINGS		
NoSocEnvFactors	CONSTRUCTION	ELIZABETHS WEST CAMPUS, SE, WASH., DC	GS-11P-15-MM-C-7000	SERVICE	\$ 13,508,700.00	4/1/2016
	SUPPORT ACTIVITIES FOR					
SocEnvFactors	FORESTRY	IGF::OT::IGF FOR OTHER FUNCTIONS	AG-82X9-S-16-4005	FOREST SERVICE	\$ 726,495.00	9/16/2016
	SUPPORT ACTIVITIES FOR	IGF::OT::IGF THREE R'S THIN/HAND PILE ALL				
NoSocEnvFactors	FORESTRY	SLASH (839 ACRES)	AG-9AC7-S-16-0108	FOREST SERVICE	\$ 954,720.00	8/1/2016

Figure A.8: Random Matches: Model 4
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