Scientific Input Costs and Budgetary Constraints in University Life Sciences Research

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I. Motivation

Federal funding for university-based life sciences research in the United States exceeds $30 billion annually, with the National Institutes of Health and the National Science Foundation serving as primary sources. This substantial public investment supports research that generates the scientific innovations underlying new drugs and therapeutics. In recent decades, however, scientists have faced intensifying budgetary pressures from both the funding and cost sides. Grant competition has intensified and award amounts have failed to keep pace with inflation. At the same time, scientists face rising prices for essential laboratory inputs, driven largely by consolidation among scientific equipment suppliers. These dual pressures force scientists to make difficult resource allocation decisions that ultimately shape the rate and direction of biomedical discovery.

The scientific equipment market is highly concentrated, dominated by a handful of firms such as Thermo Fisher Scientific and Millipore Sigma. Several features of this market enable suppliers to raise prices with limited demand response. On the bargaining side, suppliers privately negotiate individual contracts with universities and institutions aren't able to benchmark prices against peer universities. At the researcher level, switching costs are high because time constraints limit the ability to price shop and because experimental protocols depend on consistent use of specific inputs, making it costly to switch to cheaper alternatives mid-experiment.

In this paper, we study how researchers adapt to input price increases in a budget-constrained setting. For university-based life sciences researchers, budgets are largely fixed within grant cycles, leaving little room to absorb price increases. The majority of grant dollars are committed to personnel salaries and benefits, with the remainder mainly going toward laboratory consumables such as reagents and antibodies. Unlike large instrumentation, which is typically funded through indirect costs, consumables represent a variable cost that researchers must manage within their grant allocations. Even modest price increases can meaningfully constrain research capacity. We examine whether rising costs lead researchers to reduce experimental scope, reallocate effort toward securing additional funding, or adjust labor investments. We explore the heterogeneity in these responses, asking whether researchers with access to private funding, positions at universities with better bargaining power, stronger grant-writing track records, or greater willingness to adapt their research direction are more resilient to cost shocks.

II. Institutional Setting

The procurement of life science equipment for university researchers involves a complex bargaining process among manufacturers, distributors, and universities. Manufacturers such as Integrated

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DNA Technologies and New England Biolabs produce specialized scientific consumables. To maximize market reach, these manufacturers sell their products to distributors such as Thomas Scientific and Quartzy. In recent decades, the supplier side has experienced significant consolidation, resulting in vertically integrated entities that control both manufacturing and distribution channels. For instance, the most dominant firm in this space, Thermo Fisher Scientific, encompasses both a manufacturing arm (Thermo Scientific) and a distribution arm (Fisher Scientific). Overall, the current distribution of scientific equipment is dominated by three main companies: Thermo Fisher Scientific, VWR, and MilliporeSigma. While universities do negotiate contracts with smaller non-integrated manufacturers, most researchers purchase inputs based on the negotiated contracts their university have with these large vertically integrated platforms for convenience.

We study the impact of this concentrated market structure in the first part of our project. Specifically, we estimate input price shocks generated by a large acquisition of Life Technologies Corporation by Thermo Fisher Scientific in 2014. This $13.6 billion merger combined the largest and third-largest life sciences suppliers of molecular biology, cell culture and genomics products, attracting significant antitrust scrutiny. Regulators ultimately required Thermo Fisher Scientific to divest manufacturing units related to cell culture supplies, gene modulation, and magnetic beads to GE Healthcare. We leverage the fact that the merger differentially impacted product markets based on the competitive overlap between the merging entities to estimate input price shocks.

III. Data and Sample

Our empirical analysis combines procurement records from public universities with publication metadata to observe the prices of scientific inputs and scientists' research activity.

The primary source for observing prices comes from GovSpend, a commercial data vendor that aggregates procurement records from public institutions. These transaction-level data contain item descriptions, prices, quantities, spending, purchase dates, supplier identifiers, and purchasing institutions. Our data extract consists of 4.8 million purchases from 165 public universities between 2010 and 2019. The breadth of coverage makes GovSpend well-suited for analyzing input prices across universities, but these data present two limitations. First, purchase records contain unstructured text descriptions (e.g., "200uL Tip Rack Reload 960/PK") rather than standardized product codes, making it difficult to systematically track the same product over time. Second, the data do not identify which scientist made each purchase.

To address the first limitation, we develop a hierarchical supervised machine learning model that maps functionally similar items into discrete product markets. For example, our model groups "Phusion HS DNA Polymerase" and "KOD Hot Start DNA Polymerase" into the same product market of *hot start DNA polymerase*. This classification model enables us to measure price variation across product markets. We train the model using procurement records from the UT Dallas Departments of Biological Sciences and Chemistry & Biochemistry. The advantage of the UT Dallas data is that they include supplier stock keeping units (SKUs), which allow us to precisely match items to supplier catalogs and classify each item into product markets. This process yields over 60,000 labeled item descriptions across 1,322 distinct product markets.

To address the second limitation, we filed Freedom of Information Act (FOIA) requests to life

sciences departments at public universities. We obtained data from five universities that identify both the scientist and spending associated with each purchase: University of Texas at Dallas, University of Texas at Austin, University of Kansas, Texas Tech University, and East Carolina University. These data allow us to observe how different types of researchers allocate their budget across input types and to measure their exposure to the merger price effects.

We link researcher merger exposure to changes in research activity using *OpenAlex*, a comprehensive open catalog of scholarly entities. *OpenAlex* allows us to track research output, grants cited on publications, and research direction through abstracts. We supplement *OpenAlex* with grant funding databases, patent records, and labor allocation measures from IRIS UMetrics to construct a scientist-year panel that allows us to analyze how researchers adapt to input price shocks.

IV. Empirical Strategy

Our empirical approach proceeds in two stages. We first estimate merger-induced price effects using a difference-in-differences design, then trace how these price shocks affect downstream research production.

To estimate price effects, we define treatment status based on the Federal Trade Commission's and European Commission's assessments of the merger. Treated product markets are those identified as having competitive overlap between the merging entities. For each treated product market, we use nearest neighbor matching on pre-merger price trends and spending levels to identify appropriate control product markets. Using a difference-in-differences specification at the product market level, we compare price changes in treated markets to matched controls before and after the merger. The coefficient of interest captures the merger-induced price shock, which we estimate separately for each product market to reflect heterogeneity in competitive conditions and demand elasticities.

To trace downstream effects on research, we construct a researcher-level exposure measure that captures each scientist's reliance on affected product markets. Using the FOIA data with researcher-linked purchases, we construct our exposure measure as the spending-weighted average of estimated price shocks across product markets. Scientists who devote larger budget shares to product markets experiencing larger price increases have higher exposure measures. While detailed purchase data are available only for scientists at five universities, we impute exposure for the broader population of life sciences researchers under the assumption that scientists within narrow research subfields employ similar input bundles. We classify scientists into narrow subfields using textual k-means clustering on titles, abstracts, and materials and methods sections.

Having constructed exposure measures, we estimate event study specifications that interact researcher exposure with relative year fixed effects, allowing us to trace the dynamic adjustment of research production to input cost changes. Our primary outcome is citation-weighted publication output, with additional specifications examining patent activity and labor allocation. This framework allows us to explore heterogeneity in responses across researcher and institution characteristics.

V. Preliminary Results

Our preliminary estimates indicate that the merger resulted in significant price increases for researchers. Pooled across treated product markets, we find that prices increased by an average of 20% following the merger relative to unaffected product markets. The magnitude of these price effects varies across product markets, with some markets experiencing substantially larger increases. For instance, fetal bovine serum faced a 60% price increase. Fetal bovine serum is a critical input for cell culture work and represents one of the more expensive consumables that many molecular biologists must purchase regularly. Scientists are typically unwilling to switch suppliers because experimental protocols tend to be very sensitive to serum characteristics. This preliminary finding is consistent with anecdotal evidence from scientists we've spoken to and with the hypothesis that consolidation enabled suppliers to exercise market power, particularly for specialized inputs where researchers are more price inelastic.

In the second stage of our analysis, we trace how these input price shocks influence downstream research production. We examine heterogeneity across university types, research areas, and scientist characteristics to identify which researchers are most vulnerable to budget shocks and how their adaptability relates to research output. Several forces may shape these responses. Early-career scientists with smaller labs and less funding may face tighter constraints than established investigators with larger grants, yet these early-career scientists may be more willing to price shop, find substitutes, or change research direction. Scientists at better-resourced universities may be able to avoid cost increases if their institution has stronger bargaining power against suppliers. Researchers in fields with more private funding options, such as oncology, may also find themselves insulated from these price shocks.

By illuminating inefficiencies in institutional procurement and the downstream effects of supplier pricing power, this paper provides new evidence on how binding budget constraints shape the rate and direction of scientific innovation. University life sciences research serves as a critical input to medical innovation, generating the scientific discoveries that inform drug development and therapeutic interventions. Our data allow us to examine not only how researchers respond to cost shocks, but also how these responses vary with researcher characteristics and productivity. These findings carry implications for antitrust policy in the scientific supplier market, the design of federal research funding mechanisms, and university procurement practices.