Review: Selected Research and Writings of Nathan Miller, Newly Appointed Chief Economist of the Antitrust Division, Department of Justice

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INTRODUCTION

The Department of Justice (DOJ) has appointed Professor Nathan Miller to serve as its new chief economist in the Antitrust Division. Professor Miller succeeds Professor Susan Athey, who has held the post since 2022.

Professor Miller will maintain his tenured position as professor in the McDonough School of Business and Department of Economics at Georgetown University. He previously served as staff economist for the DOJ's Antitrust Division, working on cases including *Bazaarvoice/PowerReviews*, *AT&T/T-Mobile*, and *Ticketmaster/Live Nation*.

Professor Miller has made important contributions to the economic literature on antitrust and merger review topics. His academic work focuses on tools that facilitate merger investigations for agencies and competition practitioners. This includes a routinely used merger simulation model in business-to-business (B2B) procurement settings, as well as state-of-the-art contributions to the empirical assessment of coordinated effects.

Outside of mergers, Professor Miller conducts research on innovation, cartels, pass-through, and markups, among other subjects.

This article presents an overview of his various contributions to antitrust and competition.

MERGERS: COORDINATED EFFECTS

Economic theory and practical antitrust enforcement have long recognized that, in addition to unilateral effects, mergers may increase the possibility of "coordinated effects." Historically, evaluating coordinated effects has relied on the "checklist" approach of industry characteristics. The checklist is by its nature more qualitative and less predictive than many of the tools available to evaluate unilateral effects.[1]

Professor Miller has offered novel work on coordinated effects in that it formally models the risk of certain types of coordination through merger simulation. Two papers by Professor Miller and coauthors analyze the US beer industry, which they argue is characterized by increasing concentration and pre-existing "price leadership" coordination mechanisms.[2] They model the industry as one firm announcing yearly price increases and competitor firms setting prices in response to these announcements. In this context, Professor Miller and coauthors have developed an empirical approach that incorporates consumer demand, oligopolistic price leadership, and supply-side parameters, such as firms' marginal costs and their incentives to participate in collusive pricing.

Professor Miller and coauthors then simulate pricing changes that arise from mergers in such price-leadership settings. In particular, they measure whether price increases can be attributed to coordinated effects. Such modeling can bring seemingly counterintuitive results to light. For example, the modeling suggests that merger-related efficiencies, which typically decrease the scale of unilateral effects, can in certain cases increase the magnitude of coordinated effects.

Professor Miller and coauthors adapt the above modeling approach in their 2023 paper to make it more forward-looking.[3] They simplify the framework to allow for the analysis of a single market and easier-to-estimate demand structures. They also show how to use the model with information available to antitrust authorities during merger review proceedings. While this method will only apply to some mergers, it provides a useful step forward in the explicit quantification of coordinated effects.

MERGERS: UNILATERAL EFFECTS

In addition to an article providing a useful overview of different methods used to evaluate unilateral effects in the era of the 2010 Horizontal Merger Guidelines,[4] Professor Miller has also contributed to this toolkit through original research. This research often focuses on practical ways to eliminate or reduce ambiguity in the relevant academic literature. By examining the theoretical economic foundations and the types of information typically available in merger cases, Professor Miller's work helps to identify

conditions under which easier-to-apply tools can reliably predict merger effects, facilitating time-constrained merger investigations and litigation.

Mergers in procurement settings. Many mergers involve B2B transactions in which buyers play suppliers against one another or make purchases through "requests for proposal." In a 2014 paper, Professor Miller lays out a merger simulation model that captures pricing decisions and unilateral effects in these settings and is simple to apply.[5] This approach has been successfully used by agencies' expert witnesses on several litigated mergers, including *Sysco/US Foods* (2015),[6] *Anthem/Cigna* (2016),[7] *Wilhelmsen/Drew Marine* (2018),[8] *Penguin Random House/Simon & Schuster* (2022),[9] and *IQVIA/Propel Media Inc* (2023).[10]

Professor Miller models the buyer's decision-making process as a "second score" auction. In this setting, sellers vary in how well-suited they are to each buyer or even each project. The first-best seller (due to high value, low costs, or a combination of both) wins the bid and earns a payment related to the second-best seller's net value. Modeled this way, any given buyer is affected by the merger if the merging parties were the buyer's first- and second-best options, and then only to the extent that the third-best option lagged behind. Beyond the model's intuitive appeal, it only requires data that are typically available in merger investigations—essentially market shares and a single margin.

Upward Pricing Pressure (UPP). UPP is a straightforward economic method used to quantify post-merger incentives to increase price. Its appeal, as explained in a series of articles by Carl Shapiro and in the 2010 Horizontal Merger Guidelines,[11] lies at least in part in its simplicity. UPP can be calculated using just data on diversion rates between merging parties and merging party margins, both of which are often available in merger proceedings. But economists have sometimes refrained from using UPP to predict actual price effects, noting that doing so involves estimates of pass-through, which are frequently not available.[12] UPP is therefore not always translated into price effects.

To test the extent to which these conceptual concerns make an empirical difference, Professor Miller and coauthors use numerical methods to simulate mergers under different assumptions and assess whether UPP captures the true price effect.[13] Their experimental results indicate that in many cases, the UPP by itself—with no adjustment for pass-through—reasonably predicts merger price effects. They conclude that UPP offers a useful merger screen that provides comparably accurate price predictions to merger simulation.[14]

Notably, the authors observe that UPP's accuracy is sensitive to the true underlying demand system, and that—under certain circumstances related to the demand curve's shape—UPP can understate a merger's predicted price effect.[15]

Herfindahl-Hirschman Index (HHI). In 2022, Professor Miller served as lead author of a paper coauthored with numerous former chief economists from the Federal Trade Commission (FTC) and DOJ Antitrust Division.[16] The paper explains that regressions of price on HHI are generally inappropriate in merger investigations. HHI is a measure of market concentration that antitrust practitioners frequently use to screen whether a merger might reduce competition and increase prices.

The authors explain that presumptions based on the levels of and changes in HHI remain a useful tool. They argue that changes in HHI due to proposed mergers provide "economically sensible information about likely merger effects that can be combined with other relevant information."[17] Such information includes structural econometric modeling results, merger retrospectives, and complementary evidence such as internal documents, all of which can provide a clearer picture of likely merger price effects.

Nonetheless, merging parties sometimes regress price on measures of concentration and point to a lack of a statistically significant relationship as evidence that the proposed merger is unlikely to have price effects.[18] The authors explain that price and HHI are both "equilibrium outcomes determined by demand, supply, and the factors that drive them," which means that "there is no causal relationship to be estimated."[19]

The authors walk through simple numerical examples demonstrating, for example, that prices and HHI could vary across regions because of differences in costs. They conclude that their examples show that the relationship between price and HHI can be ambiguous even in models that have unambiguous predictions about the competitive effects of a merger.

Innovation. The effect of mergers on innovation remains an open topic in antitrust and merger enforcement. In a 2021 paper, Professor Miller and coauthors conduct an empirical analysis of the US cement industry to examine the market conditions driving technological adoption.[20] They examine such factors as competitive dynamics, demand conditions, and factor prices within a "reduced form" empirical model. They find that higher input prices *increase* technological adoption: when alternatives are limited and inputs cannot be substituted, firms are incentivized to invest in cost-saving technologies. However, higher input costs also increase exits from the market. Further, the authors find that increased competition *decreases* technological adoption. With more competition, any one firm's share of output is lower, and therefore returns to investment (through, say, cost reduction) are lower too. These results indicate an important mechanism through which merger-induced concentration changes may affect innovation.

Pass-through. Professor Miller's work places significant emphasis on pass-through, which can inform both the competitive dynamics of markets and the structure of demand.

Two papers highlight the usefulness of pass-through in antitrust analysis. In the first, Professor Miller and coauthors demonstrate how cost pass-through can be used as a tool to calibrate demand in antitrust analysis, particularly when traditional data (e.g., margins and diversion ratios) are unavailable.[21] Notably, they argue that observed cost pass-through rates can offer insights into the appropriateness of different demand systems, and help enhance the robustness of merger analysis tools such as UPP or merger simulation.

In the second paper, Professor Miller and coauthors examine the application of pass-through rates to predict merger price effects.[22] Specifically, they find that precise measurement of pass-through increases the accuracy of post-merger price prediction in a specific variant of a UPP-style analysis.[23]

In addition to the use of pass-through for antitrust analysis, Professor Miller has conducted research on how to measure pass-through using practical "reduced form" regression analysis.[24]

Spatial analysis. Professor Miller and a coauthor analyze geographical competition and price discrimination in the cement industry in the southwestern United States.[25] They develop and estimate a novel structural model with several key features. These include allowing for the use of aggregated data of the type that may be available in antitrust investigations; capturing the features of competition with spatial differentiation; and incorporating the role of transportation costs.

They conduct two counterfactual experiments to demonstrate the usefulness of their model. First, they show how reducing spatial price discrimination could substantially increase consumer surplus within their model. Second, they evaluate a hypothetical merger between the two largest producers to demonstrate the model's utility in assessing the competitive effects of mergers in industries with high transportation costs.

Forward contracts. In a 2020 paper, Professor Miller and a coauthor analyze the effect of mergers in industries that sell in "forward markets"—markets where firms sell their output through contracts for sales in the future, alongside regular "spot market" sales, for example, wholesale electricity markets.[26] The authors develop a generalized model, building on an existing literature that had previously only considered duopoly. They argue that forward contracts can exacerbate a merger's welfare loss to consumers if markets are sufficiently concentrated, but can mitigate loss otherwise.

MERGERS: MITIGATING FACTORS

Entry. In a 2024 working paper, Professor Miller and coauthors analyze the role of entry and efficiencies in merger assessment.[27] Authorities and practitioners often consider whether entry or efficiency gained through marginal cost reductions may mitigate any merger-induced effects, such as loss of competition or price increases. This paper develops a formal framework to analyze these two sources of mitigation and argues that robust assessments may need to consider both together, stating that, for many mergers, "the current practice of analyzing each in isolation" can be inappropriate.[28] The authors identify instances where mergers that do not lead to merger-specific efficiencies induce entry, but that entry is insufficient to fully offset merger effects; or where mergers that do lead to merger-specific efficiencies would not in fact induce entry.

The intuition is not unlike that which led to a rethinking of the role of critical loss analysis a few decades ago.[29] If there are no barriers to entry but no pre-merger entry, there reveals something about the likely profitability of entry. Moreover, with certain assumptions about the merging firms' ability to predict the effects of the merger and their current or prospective competitors' capabilities, there is also information in the merging firms' decision to merge. Entry that fully offsets merger effects is possible but cannot merely be assumed.

The paper applies this approach to a past merger, arguing that entry can partly offset merger effects but may not be sufficient on its own, and that efficiencies must be analyzed carefully in conjunction with entry.

MERGERS: VERTICAL EFFECTS

Vertical mergers. In another coauthored paper, Professor Miller explores the competitive dynamics and antitrust implications when firms in a vertical upstream-downstream relationship have the option to enter each other's markets.[30] A potential procompetitive element of vertical mergers is that the elimination of double marginalization may reduce prices. This study, however, shows that certain vertical mergers can be anticompetitive, and that each firm's entry into another firm's markets can lead to an outcome with lower prices than under the vertical merger. The research further demonstrates that the unique position of firms within vertical relationships can allow them to compete effectively, even where a third party would not find entry profitable.

RESEARCH ON OTHER ANTITRUST TOPICS

Markups and market power. Recent studies have argued that, in the US and globally, markups and market power are increasing.[31] Several of Professor Miller's coauthored works investigate this relationship and apply the industrial organization toolkit to derive further insight. A 2023 paper examines the connection between firm-level markup changes and industry-level price changes.[32] The research finds no strong empirical support for a correlation between rising markups and rising prices, challenging the hypothesis that increased markups are driven by reduced competition. A forthcoming paper further considers this topic, applying a demand model to price and quantity data across

multiple product categories.[33] The paper finds that markups increased by about 30 percent from 2006 to 2019, and that the change is attributable to decreases in marginal cost that are not passed to consumers through lower prices.

A 2024 working paper by Professor Miller further addresses developments in this area, summarizing various research and industry studies.[34] He notes several important findings. With respect to competition enforcement, for example, he notes: "To the extent that market power has increased broadly, across the economy, the industry studies as a group point to technological change, rather than weak antitrust enforcement, as the more important catalyst."[35] Such a conclusion has implications for the role of competition economics research, providing insight into how competition affects innovation incentives, and the degree to which firms are likely to pass through innovation gains to consumers.

Cartels. Professor Miller has written on the impact of leniency programs, finding that they significantly enhance both the detection and deterrence of cartels.[36] He has also conducted empirical studies on price-fixing mechanisms and the impact of anticompetitive behavior on market structure, pricing, and non-price activity in the canned tuna industry.[37]

Merger retrospectives. Professor Miller and a coauthor apply a difference-in-differences approach to conduct a retrospective analysis of the *Delta/Northwest* merger.[38] Using this technique, they find that inaccurate choice of control groups can dramatically influence mergers' estimated impact. They also emphasize the importance of careful control group design in antitrust analysis, suggesting that more sophisticated matching methods (such as synthetic controls) may be appropriate in retrospective merger review.

Financial markets. Professor Miller has also written about issues related to financial markets, analyzing the decision-making of banks and the role of information asymmetry in their lending and borrowing decisions.[39]

CONCLUSION

Professor Miller has developed a large body of work on merger review and competition issues. His research on coordinated effects provides one of the first robust approaches to empirically predict coordinated effects for certain industries, paving the way for more sophisticated assessments of these issues.

Professor Miller's research on the unilateral effects of mergers demonstrates the utility of several simple-to-apply tools and methodologies. These approaches offer a valuable bridge between academic research and its practical application for antitrust practitioners and competition agencies.

ABOUT THE AUTHORS

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ENDNOTES

[1] In practice, as Professor Miller and coauthors note, "coordinated effects analyses often default to identifying characteristics of an industry that make it more or less susceptible to collusion." See Ryan Mansley et al., "A Price Leadership Model for Merger Analysis," *International Journal of Industrial Organization* 89 (2023), 102975, available at https://doi.org/10.1016/j.ijindorg.2023.102975. See also Janusz A. Ordover, "Coordinated Effects (2008)," in *Issues in Competition Law and Policy* 2 (ABA Section of Antitrust Law, 2008), pp. 1359–1383, available at https://ssrn.com/abstract=1527808. The discussion of coordinated effects in *T-Mobile/Sprint* provides an example of courts evaluating such evidence in practice. See *New York v. Deutsche Telekom AG*, 439 F. Supp. 3d 179, 234–237 (S.D.N.Y. 2020).

[2] Nathan H. Miller and Matthew C. Weinberg, "Understanding the Price Effects of the MillerCoors Joint Venture," *Econometrica* 85, no. 6 (2017): 1763–1791; Nathan H. Miller et al., "Oligopolistic Price Leadership and Mergers: The United States Beer Industry," *American Economic Review* 111, no. 10 (2021): 3123–3159.

[3] Ryan Mansley et al., "A Price Leadership Model for Merger Analysis," *International Journal of Industrial Organization* 89 (2023), 102975, available at https://doi.org/10.1016/j.ijindorg.2023.102975.

[4] Nathan H. Miller and Gloria Sheu, "Quantitative Methods for Evaluating the Unilateral Effects of Mergers," *Review of Industrial Organization* 58, no. 1 (2021): 143–177, Special Issue: The 2010 Horizontal Merger Guidelines after Ten Years.

[5] Nathan H. Miller, "Modeling the Effects of Mergers in Procurement," *International Journal of Industrial Organization* 37 (2014): 201–208, available at https://doi.org/10.1016/j.ijindorg.2014.10.001.

[6] *Sysco/US Foods* Memorandum Opinion, pp. 89–92, available at https://www.ftc.gov/legal-library/browse/cases-proceedings/sysco-usf-holding-corp-us-foods-inc.

[7] *Anthem/Cigna* district-level Memorandum Opinion, pp. 58–59, 66–67, available at https://www.justice.gov/atr/case/us-and-plaintiff-states-v-anthem-inc-and-cigna-corp.

[8] *Wilhelmsen/Drew Marine* Memorandum Opinion, pp. 44–45, available at https://www.ftc.gov/legal-library/browse/cases-proceedings/171-0161-wilhelm-wilhelmsen-et-al.

[9] *US v. Bertelsmann SE & Co. KGaA et al.* Memorandum Opinion, pp. 54–57, available at https://www.justice.gov/atr/case/us-v-bertelsmann-se-co-kgaa-et-al.

[10] Opinion and Order, *Federal Trade Commission v. IQVIA Holdings Inc.*, No. 23 Civ. 06188 (ER) (S.D.N.Y. Dec. 29, 2023), pp. 78–81.

[11] Joseph Farrell and Carl Shapiro, "Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition" (working paper, February 15, 2010), available at https://ssrn.com/abstract=1313782; US Department of Justice and Federal Trade Commission, "Horizontal Merger Guidelines," 2010, Section 6.1, available at https://www.justice.gov/atr/horizontal-merger-guidelines-08192010.

[12] For example, in Joseph Farrell and Carl Shapiro, "Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition," *The BE Journal of Theoretical Economics* 10, no. 1 (2010), the authors argue that "UPP does not predict post-merger prices, but only predicts the sign of changes in price." See also Sonia Jaffe and E. Glen Weyl, "The First-Order Approach to Merger Analysis," *American Economic Journal: Microeconomics* 5, no. 4 (2013): 188–218. Jaffe and Weyl show that UPP must be scaled by a measure of pass-through in order to provide an approximation of price effects.

[13] Nathan H. Miller et al., "Upward Pricing Pressure as a Predictor of Merger Price Effects," *International Journal of Industrial Organization* 52 (2017): 216–247, available at https://doi.org/10.1016/j.ijindorg.2017.01.010.

[14] *Ibid*., p. 217. The paper explains that "Prediction error does not systematically exceed that of misspecified simulation models, nor is it much greater than that of correctly-specified models simulated with imprecise demand elasticities."

[15] *Ibid*., p. 217. In economics terms, the situations are those where demand systems are highly convex: "UPP is quite accurate with standard log-concave demand systems but under-states price effects if demand exhibits greater convexity."

[16] Nathan H. Miller et al., "On the Misuse of Regressions of Price on the HHI in Merger Review," *Journal of Antitrust Enforcement* 10, no. 2 (2022): 248–259, available at https://doi.org/10.1093/jaenfo/jnac009.

[17] *Ibid*., p. 257.

[18] For example, the merging party expert in *Aetna/Humana* offered regressions that "found that there's no relationship between the market outcomes and level of competition." See *US v. Aetna Inc.*, 240 F. Supp. 3d 1 (D.C. 2017), Day 12 A.M. Transcript, December 20, 2016, p. 3189.

[19] Nathan H. Miller et al., "On the Misuse of Regressions of Price on the HHI in Merger Review," *Journal of Antitrust Enforcement* 10, no. 2 (2022): 248–259, at p. 255, available at https://doi.org/10.1093/jaenfo/jnac009.

[20] Jeffrey T. Macher, Nathan H. Miller, and Matthew Osborne, "Finding Mr. Schumpeter: Technology Adoption in the Cement Industry," *RAND Journal of Economics* 52, no. 1 (2021): 78–99, available at https://doi.org/10.1111/1756-2171.12362.

[21] Nathan H. Miller, Marc Remer, and Gloria Sheu, "Using Cost Pass-Through to Calibrate Demand," *Economics Letters* 118, no. 3 (2013): 451–454, available at https://doi.org/10.1016/j.econlet.2012.12.021.

[22] Nathan H. Miller et al., "Pass-Through and the Prediction of Merger Price Effects," *Journal of Industrial Economics* 64, no. 4 (2016): 683–709, available at https://doi.org/10.1111/joie.12131.

[23] Specifically, they test for the impact of pass-through accuracy in the "First Order Approximation" approach of Jaffe and Weyl (2013). See Alexander McKay et al., "Bias in Reduced-Form Estimates of Pass-Through," *Economics Letters* 123, no. 2 (2014): 200–202, available at https://doi.org/10.1016/j.econlet.2014.02.017.

[24] *Ibid*. See also Nathan H. Miller, Matthew Osborne, and Gloria Sheu, "Pass-Through in a Concentrated Industry: Empirical Evidence and Regulatory Implications," *RAND Journal of Economics* 48, no. 1 (2017): 69–93, available at https://doi.org/10.1111/1756-2171.12168.

[25] Nathan H. Miller and Matthew Osborne, "Spatial Differentiation and Price Discrimination in the Cement Industry: Evidence from a Structural Model," *RAND Journal of Economics* 45, no. 2 (2014): 221–247, available at https://doi.org/10.1111/1756-2171.12049.

[26] Nathan H. Miller and Joseph U. Podwol, "Forward Contracts, Market Structure and the Welfare Effects of Mergers," *Journal of Industrial Economics* 68, no. 2 (2020): 364–407, available at DOI:10.1111/joie.12222.

[27] Peter Caradonna, Nathan H. Miller, and Gloria Sheu, "Mergers, Entry, and Consumer Welfare" (working paper, June 27, 2024), available at http://dx.doi.org/10.2139/ssrn.3537135.

[28] *Ibid*., p. 1.

[29] Michael L. Katz and Carl Shapiro, "Critical Loss: Let's Tell the Whole Story," *Antitrust* 17 (2002): 49–56, available at https://www.law.berkeley.edu/wp-content/uploads/2015/04/Katz-Shapiro-Critical-Loss-Lets-Tell-the-Whole-Story-2003.pdf.

[30] Juan S. Lleras and Nathan H. Miller, "The Entry Incentives of Complementary Producers: A Simple Model with Implications for Antitrust Policy," *Economics Letters* 110, no. 2 (2011): 147–150, available at https://doi.org/10.1016/j.econlet.2010.11.013.

[31] Jan De Loecker, Jan Eeckhout, and Gabriel Unger, "The Rise of Market Power and the Macroeconomic Implications," *Quarterly Journal of Economics* 135, no. 2 (2020): 561–644; Sharat Ganapati, "Growing Oligopolies, Prices, Output, and Productivity," *American Economic Journal: Microeconomics* 13, no. 3 (2021): 309–327; Jan De Loecker, Jan Eeckhout, and Simon Mongey, "Quantifying Market Power and Business Dynamism in the Macroeconomy" (NBER Working Paper No. w28761, 2021).

[32] Christopher Conlon et al., "Rising Markups, Rising Prices?," *AEA Papers and Proceedings* 113 (2023): 279–283, available at https://www.aeaweb.org/articles?id=10.1257/pandp.20231098.

[33] Hendrik Döpper et al., "Rising Markups and the Role of Consumer Preferences," *Journal of Political Economy* (revise and resubmit, 2023).

[34] Nathan H. Miller, "Industrial Organization and The Rise of Market Power" (working paper, 2024), available at http://www.nathanhmiller.org/iomktpower.pdf.

[35] *Ibid*., p. 20.

[36] Nathan H. Miller, "Strategic Leniency and Cartel Enforcement," *American Economic Review* 99, no. 3 (2009): 750–768, available at https://www.aeaweb.org/articles?id=10.1257/aer.99.3.750.

[37] Minhae Kim et al., "Price-Fixing Allegations in the Canned Tuna Industry: A Look at the Data," *The Antitrust Bulletin* 68, no. 1 (2023): 154–163, available at https://doi.org/10.1177/0003603X221150372.

[38] Aditi Mehta and Nathan H. Miller, "Choosing the Appropriate Control Group in Merger Evaluation," in *More Pros and Cons of Merger Control* (2012), p. 189, available at https://www.konkurrensverket.se/en/knowledge-and-research/the-pros-and-cons/more-pros-and-cons-of-merger-control/.

[39] Allen N. Berger, W. Scott Frame, and Nathan H. Miller, "Credit Scoring and the Availability, Price, and Risk of Small Business Credit," *Journal of Money, Credit and Banking* 37, no. 2 (2005): 191–222, available at https://www.jstor.org/stable/3838924; Allen N. Berger et al., "Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks," *Journal of Financial Economics* 76, no. 2 (2005): 237–269, available at https://doi.org/10.1016/j.jfineco.2004.06.003; Allen N. Berger et al., "Debt Maturity, Risk, and Asymmetric Information," *The Journal of Finance* 60, no. 6 (2005): 2895–2923, available at https://doi.org/10.1111/j.1540-6261.2005.00820.x; Allen N. Berger et al., "Why Do Borrowers Pledge Collateral? New Empirical Evidence on the Role of Asymmetric Information," *Journal of Financial Intermediation* 20, no. 1 (2011): 55–70, available at https://doi.org/10.1016/j.jfi.2010.01.001.