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CONFLICTING INTERESTS AND THE EFFECT OF FIDUCIARY DUTY — EVIDENCE FROM VARIABLE ANNUITIES

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Conflicting Interests and the Effect of Fiduciary Duty — Evidence from Variable Annuities
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ABSTRACT

We examine the drivers of variable annuity sales and the impact of a proposed regulatory change. Variable annuities are popular retirement products with over $2 trillion in assets in the United States. Insurers typically pay brokers a commission for selling variable annuities that ranges from 0% to over 10% of investors' premium payments. Brokers earn higher commissions for selling inferior annuities, in terms of higher expenses and more ex-post complaints. Our results indicate that variable annuity sales are roughly four times as sensitive to brokers' financial interests as to investors'. To help limit conflicts of interest, the Department of Labor proposed a rule in 2016 that would hold brokers to a fiduciary standard when dealing with retirement accounts. We find that after the proposed fiduciary rule, sales of high-expense variable annuities fell by 52% as sales became more sensitive to expenses and insurers increased the relative availability of low-expense products. Based on our structural model estimates, investor welfare improved as a result of the fiduciary rule under conservative assumptions.

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1 Introduction

Variable annuities are one of the most popular retirement products in the United States. As of 2018, American households held over $2.2 trillion of assets in variable annuity accounts. However, despite their popularity, variable annuities have been criticized for having high expenses and are the most commonly cited financial products in brokerage customer complaints (Egan et al. (2019)).[1] Part of the criticism pertains to the distribution of variable annuities.[2] Variable annuities are sold through brokers who are typically paid a commission by the insurance company for selling its products. There is substantial heterogeneity in commissions, ranging from 0 to over 10% of the investment, which provides strong incentives for brokers to sell certain variable annuities over others and potentially creates conflicts of interest between brokers and their clients.

Concerns over conflicts of interest in these types of retirement products prompted the United States Department of Labor (DOL) to propose a rule imposing fiduciary duty on brokers, which was announced in 2015 and issued in 2016. The rule would obligate brokers to act in their clients' best interests when selling retirement products such as variable annuities. Although the rule was ultimately vacated in 2018, the annuity industry underwent many changes to comply with the rule starting around 2016.

This paper has two goals. First, we study the drivers of variable annuity sales and examine how sales respond to broker and investor incentives. While investor incentives matter, we find that broker incentives play a more important role in determining sales. Moreover, brokers' incentives conflict with those of their clients: brokers earn higher commissions for selling inferior annuities that have higher expenses, as well as fewer and worse-performing investment options. Second, we examine how the proposed fiduciary rule, which was intended to limit conflicts of interest, impacted the variable annuity market in the United States. We examine how the composition of variable annuities both offered by insurers and sold by brokers changed in response to the DOL rule. We find that the rule helped reduce conflicts of interest. In response to the rule, brokers stopped selling high-expense annuities (i.e. annuities ranked in the top quartile of expenses) as sales of such annuities fell by 52%. Similarly, insurers responded by updating their product suite

[1] Examples: https://www.wsj.com/articles/how-to-avoid-paying-high-fees-for-variable-annuities-1457001002[accessed 7/30/2020]

[2] See e.g. FINRA (https://www.finra.org/sites/default/files/InvestorDocument/p125846.pdf [accessed 7/30/2020])

and by increasing the availability of low-expense annuities to comply with the rule.

We study the variable annuity market using a panel data set that we construct from Morningstar and regulatory filings. A key novel feature of our data set is that we observe data on the commission rates that insurers pay to brokers for selling variable annuities. This variable allows us to separate the effect of brokers' preferences from those of investors. Conditional on the risks and return characteristics of a variable annuity, investors should be indifferent towards the associated brokerage commissions. In addition to commissions, we also observe detailed characteristics of the variable annuity products(e.g. expense ratios, investment options, and benefits/riders). We match commission rates and product characteristics with quarterly product sales data.

Our analysis consists of four parts. First, we study what factors drive the sales of variable annuities by analyzing how sales are related to product expense ratios, brokerage commissions, and other product characteristics. We find a strong negative relationship between expense ratios and sales, consistent with the notion that investors dislike high-expense products. We also find that brokerage commissions play a critical role in driving investment flows. Our estimates suggest that a one standard deviation increase in brokerage commissions is associated with a 38% increase in variable annuity sales. Our baseline estimates suggest that variable annuity sales are roughly four times as sensitive to broker incentives as to investor incentives. These results remain robust after accounting for a wide range of product characteristics including investment options and returns, the availability of benefits and riders, and the insurance companies underwriting the products. We also exploit variation within the same product across share classes, where an insurer offers the same variable annuity with different expense ratios and commission rates, which helps mitigate concerns about omitted variables. We find similar patterns across share classes of the same variable annuity. These patterns also hold when using instrumental variables to address the potential endogeneity of commissions and expenses.

Second, we present evidence of conflicts of interest in the variable annuity market. We start by examining the types of variable annuities that brokers are incentivized to sell. We document that there is substantial heterogeneity in brokerage commissions. The average commission rate is 6% of the principal invested and the standard deviation is 2.4%. The level and heterogeneity in commissions could create conflicts of interest if they incentivize brokers to sell products that are not desirable for investors. Indeed, consistent with commissions creating conflicts of interest, we find that, on average, brokers are incentivized to sell higher-expense products and products with worse investment options, as measured by the variety and performance of the investment options. A one percentage point increase in expense ratios is associated with a 1.9 percentage point increase in brokerage commissions. Collectively, our results suggest that these high-powered broker incentives distort investment decisions for investors.

Furthermore, consistent with the idea that brokers are incentivized to sell inferior products, we find that products with high expenses—which tend to have high commissions—are associated with a greater number of investor complaints and higher rates of broker misconduct. To measure investor complaints, we utilize data from the Financial Industry Authority's (FINRA) BrokerCheck website (see Egan et al. (2019) for a further description of the data). We observe the universe of investor complaints, including those pertaining to variable annuities. Our findings suggest that ex-post, higher-expense variable annuities are worse for investors as indicated by more frequent investor complaints against brokerage firms that sell these products. This finding also helps rule out alternative explanations that higher-expense variable annuities have unobservable (to the econometrician) characteristics that make them more desirable for investors, which would potentially explain why insurers pay higher commission rates on these products. These results on complaints, together with the positive relationship between broker commissions and expense ratios, suggest that brokers are incentivized to sell products that are less desirable for investors, consistent with conflicts of interest in the market.

In the third part of our analysis, we study the effect of the DOL fiduciary rule. The fiduciary rule was intended to reduce conflicts of interest in retirement-related investment products such as variable annuities. In 2015, then-President Obama announced the fiduciary rule, which was issued by the DOL in 2016 and set to be enforced starting in early 2017. While enforcement of the rule was delayed in 2017 and the rule was ultimately vacated in 2018, survey evidence indicates that brokers and insurers started complying with the fiduciary rule during this proposal and implementation period.

We find that in response to the rule annuity sales flows became twice as sensitive to expenses and sales of annuities with expenses in the top quartile fell by 52%. The results suggest that in response to the proposal of the rule brokers began complying with the rule by placing greater weight on investor interests. We also find that insurers responded to the rule by increasing the relative availability of low-expense products available for sale. Our findings are consistent with anecdotal evidence from annual reports of brokerage firms and insurers, where they reported changing their business practices in anticipation of the rule. These results imply that the regulatory change improved the distribution of products available to investors along the extensive margin, in terms of the annuities available for sale, as well as the intensive margin, in terms of the actual annuities sold by brokers. Furthermore, we do not find any evidence that investors with less wealth were disproportionately served less by brokers following the DOL rule, as argued by the brokerage industry against the fiduciary rule.[3]

Lastly, we develop and estimate a structural model of variable annuity distribution to evaluate the normative implications of the proposed DOL fiduciary rule. An advantage in our setting is that we directly observe the alternative equilibrium we are interested in from the data. Thus, the objective of the model is to help quantify the observed effects of the rule change rather than to solve for a new equilibrium. In the model, investors access the annuity market through brokers such that demand for variable annuities is jointly determined by the preferences of investors and brokers similar to the framework in Robles-Garcia (2019). We use the model to recover the preferences of investors and evaluate how the proposed rule impacted investor returns. While some investors could benefit from the fiduciary rule because it reduces conflicts of interest, other investors may be hurt by the rule if it raises the cost of providing financial advice, such that these other investors are no longer serviced by brokers. We find that the proposed rule change increased the risk-adjusted returns of investors by up to around 0.3 percentage points (pp) per annum. Even after accounting for the fact that some investors may have been forced to leave the annuity market as a result of the rule, under conservative assumptions investor welfare still improved on net. While some investors were forced out of the market as a result of the proposed rule, our estimates suggest that the DOL rule increased investor surplus, on average, as long as the risk-adjusted returns of those investors who were forced out of the market did not fall by more than 5.7 percentage points per annum.

Our paper contributes to the literature on the role of brokers and intermediaries in household investment decisions. Consistent with this prior literature (e.g. Bergstresser et al. (2008); Chalmers and Reuter (2012); Christoffersen et al. (2013); Anagol et al. (2017); Guiso et al. (2018); Egan

[3] https://www.sifma.org/resources/news/state-fiduciary-rules-will-raise-costs-limit-access/; https://www.sifma.org/wp-content/uploads/2017/08/Deloitte-White-Paper-on-the-DOL-Fiduciary-Rule-August-2017.pdf[accessed 7/30/2020]

(2019); Robles-Garcia (2019)), we find evidence suggesting that brokers are incentivized to sell high-expense products as high-expense products carry higher commissions on average. We contribute to this literature by providing new evidence of similar conflicts of interest in a large ($2.2 trillion) and important market, where information asymmetries between market participants, brokers and investors, loom large. The conflicts of interest in terms of the magnitudes of brokerage commissions in the variable annuity market are substantially larger than those that have been studied in other settings. For example, whereas the median brokerage commission associated with mutual funds and retail bonds is roughly 2% (Christoffersen et al. (2013); Egan (2019)), the median commission in the variable annuities market is almost 7%. One concern is that these conflicts of interest not only decrease investor returns but that, perhaps more importantly, they also undermine trust in financial markets, which is critical to a well-functioning financial system (Guiso et al. (2008); Gennaioli et al. (2015); Gurun et al. (2018)).[4]

Our paper also contributes more generally to the literature on household investments. We find that there is substantial heterogeneity in annuity expenses, ranging from 0.25% to 4.20% per annum. Such price dispersion has been documented in other financial products, such as mutual funds (Christoffersen and Musto (2002); Hortaçsu and Syverson (2004); Choi et al. (2010)), mortgages (Woodward and Hall (2012); Agarwal et al. (2017); Bhutta et al. (2020)), life insurance (Brown and Goolsbee (2002); Ge (2021)), and other retirement savings products (Duarte and Hastings (2012)). Price dispersion highlights the role of household sophistication in financial markets which provides insight into why brokers play a critical role in household investment decisions (Gennaioli et al. (2015); Foerster et al. (2017)) and why financial service providers often compete on dimensions other than price such as advertising and brokerage commissions (Gurun et al. (2016); Hastings et al. (2017); Roussanov et al. (2018)).[5]

Our paper also contributes to the ongoing policy debate and the literature on regulating consumer financial products (Campbell (2006); Agarwal et al. (2009); Campbell et al. (2010, 2011); Inderst and Ottaviani (2012a,b)). Specifically, we contribute new insight to this literature by evaluating the effects of an important regulatory tool, i.e. imposing a fiduciary duty on brokers. These

[4]Our work also relates to the growing literature on financial misconduct in the financial advice industry including: Qureshi and Sokobin (2015); Egan et al. (2017); Dimmock et al. (2018); Charoenwong et al. (2019); Egan et al. (2019); Gurun et al. (2019); Chang et al. (2015)

[5]A growing literature documents that financial services providers use strategic obfuscation, which may contribute to household's lack of financial sophistication (Carlin (2009); Carlin and Manso (2011); Célérier and Vallée (2017)).

findings relate to other work on fiduciary duty. Egan (2019) develops a broker-intermediated search model and finds that holding brokers to a fiduciary standard could increase investor risk-adjusted returns by up to 95-120 bps. Our paper also builds on the work by Bhattacharya et al. (2020) which studies how cross-state variation in common law fiduciary duty impacts sales of variable and indexed annuities. The authors find that fiduciary duty increases risk-adjusted returns of annuity investors without decreasing sales. In contrast to Bhattacharya et al. (2020), we find that following the DOL's highly publicized fiduciary rule that applied to all states, sales of variable annuity products declined sharply, with the decline concentrated in products with high expense ratios. Bhattacharya et al. (2020) highlight how holding a broker to a fiduciary standard could increase the fixed costs of providing advice, which will reduce the supply of financial advice; however, they do not find strong evidence of the fixed cost channel in their state difference-in-differences setting. Also distinct from Bhattacharya et al. (2020), we document how brokerage commissions drive annuity sales and distort the investment decisions of households due to conflicts of interest.

Our paper also contributes to the literature on annuities. One strand of the literature tries to understand forces that affect annuity demand. For example, Finkelstein and Poterba (2004) find evidence of adverse selection in the UK market. Brown and Poterba (2006) find that high-income and high-net-worth households are more likely to own variable annuities using survey data. Koijen and Yogo (2021) develop and estimate an equilibrium model of the variable annuity market to quantify the underlying frictions in the market. The authors estimate a Berry et al. (1995)-type model to estimate investor demand for variable annuities and find that sales are sensitive to products' minimum return guarantee options and associated fees. Building on their framework, we provide new insights by highlighting that broker commission rates are a first-order factor in determining variable annuity sales. Our paper also relates to the growing literature on the regulatory implications surrounding insurers and their liabilities in the US (Koijen and Yogo (2016); Drexler et al. (2017); Foley-Fisher et al. (2018); Sen (2019); Ellul et al. (2020)).

The paper proceeds as follows. Section 2 describes the institutional background of variable annuity products and the marketplace, as well as the DOL fiduciary rule. Section 3 describes the data. Section 4 analyzes what factors drive variable annuity sales and documents evidence of conflicts of interest in the variable annuity market. Section 5 studies the effects of the DOL fiduciary rule in a difference-in-differences setting. Section 6 develops and estimates a structural model of variable annuity distribution to quantify the effects of the DOL fiduciary rule. Section 7 concludes.

2 Institutional Details: Variable Annuities

In this section, we describe the institutional setting of the variable annuity market in the US. Section 2.1 provides an overview of what a variable annuity is, as well as the marketplace and distribution channels of variable annuity products in the US. Section 2.2 describes the context and details surrounding the proposal of the DOL fiduciary rule.

2.1 What are Variable Annuities?

Variable annuities are a common type of retirement savings product offered by life insurance companies and purchased by individual retail investors. Variable annuity products, like other types of annuities, consist of two phases. First, in the accumulation phase, the investor makes premium payments to the insurance company into her variable annuity account after expenses are deducted. Later, in the distribution phase, the investor receives payments from the insurance company at fixed intervals until her death or for a specified period, or as a lump-sum payout.[6]

Product Structure Variable annuities offer features similar to mutual funds and traditional fixed annuities. In the accumulation phase, variable annuity investors allocate the assets in their accounts among a set of investment options known as subaccounts. Each subaccount usually holds shares in a mutual fund or a fund of funds. Variable annuity products often offer multiple subaccounts for the investor to choose from, including a combination of government/corporate bond and equity funds spanning different industries with different investment objectives. Income and capital gains from investments within the annuity account are tax-deferred.

In the distribution phase, variable annuities provide investors with menus of different payout plans. These options include life annuities with or without a refund at the annuitant's death, and with or without a guaranteed payout period. Instead of life annuities, the investor can also choose

[6]There are primarily two other types of annuity products: fixed annuities and fixed indexed annuities. Fixed annuities grow at a predetermined fixed rate in the accumulation period and pay a pre-determined fixed rate in the distribution phase. Fixed index annuities grow based on the performance of one or more benchmark indices, such as the S&P 500 and some pre-determined minimum rate. The payout in the distribution phase is determined by a combination of the performance of the index and the minimum rate.

payouts for a specified period or a lump-sum payout. The payout can be a fixed periodic amount or a varying amount based on the performance of the subaccounts the investor selects.

Variable annuities can also offer different benefit options or riders for additional fees. These options include those that guarantee a minimum return on the assets (often referred to as a roll-up or step-up rate) while preserving the upside of the returns generated by the subaccounts selected by the investor.[7] These options all offer minimum returns on the assets but differ in their structures during the distribution period.

Expenses Variable annuity investors pay certain product- and subaccount-level expenses, which are assessed as percentages of the investors' account value. For brevity, we often refer to these expense ratios as expenses. There are several different types of product-level expenses. First, there is the mortality expense (M&E), associated with the death benefits in variable annuities, as well as various administrative and distribution charges. M&E and administrative fees are assessed annually, as are distribution charges. Another type of product-level expense is a surrender charge, which is assessed in the event of an early withdrawal of account assets during a pre-specified "lock-up" period. Investors also pay additional fees for the additional riders/benefit options mentioned above (e.g., GLWB). Subaccount-level charges are expenses assessed by mutual funds (i.e. subaccounts). In our analysis, the expense ratio we use is the sum of the product-level expenses (M&E, administrative, and distribution charges) and the average subaccount expenses for each variable annuity product. We do this because all investors incur these expenses (unlike optional charges/fees, such as surrender charges and benefit/rider fees).

Variable Annuity Investors and Market Size Annuities are common retirement products held by households in the US, accounting for roughly 10% ($3.1 trillion) of retirement assets and 18% of mutual fund assets as of 2018 (Investment Company Institute (2019)). According to Brown and Poterba (2006), variable annuity investors tend to be wealthy, older, and more educated. Variable annuities make up the bulk of annuity assets, with roughly $2.2 trillion held in variable annuities

[7]Such options include Guaranteed Lifetime Withdrawal Benefits (GLWB), Guaranteed Minimum Income Benefits (GMIB), Guaranteed Minimum Accumulation Benefits (GMAB), and Guaranteed Minimum Withdrawal Benefits (GMWB). Among these benefit options, GLWBs are the most commonly offered. According to computations by Sen (2019), these guarantees have similar sensitivities to interest rate and equity risk exposure. For more detailed information on these guarantees, see Koijen and Yogo (2021) and Sen (2019).

as of 2018, and the market has grown steadily over the past fifteen years. Figures 1b and 1c display the variable annuity market growth in terms of both assets and sales over the period 2005-2020. Over the past fifteen years, variable annuity sales averaged over $138 billion per year. The sheer size of the variable annuities market makes it of first-order importance for both household finances and the financial health of large insurance companies and other financial institutions in the US.

Distribution Variable annuities are Securities and Exchange Commission (SEC) registered securities and, consequently, can only be sold by brokers who are registered as such with the Financial Industry Regulatory Authority (FINRA). Brokers, who often call themselves "financial advisers," are registered with FINRA and the SEC, and are defined in the Securities and Exchange Act 1934 as "any person engaged in the business of effecting transactions in securities on the account of another." Brokers in the U.S. are not held to a fiduciary standard and are instead held to a suitability standard as per FINRA rule 2111. The broker may be a direct employee of the insurer issuing the variable annuity (or its affiliates), or work for an unaffiliated broker-dealer.[8]

Insurance companies typically compensate brokers for selling variable annuities with commissions. These commissions are paid directly by the variable annuity issuer (insurance company) to the broker, rather than being paid by the end investor to the brokerage company. This key feature of the market aids in identifying the effect of brokers' incentives on sales because conditional on the characteristics of the variable annuities, investors are indifferent towards the commission the insurance company pays to the broker. The commission represents the profit split between the broker and the insurer.

The commissions insurers pay to brokers consist of two parts. The first part is a one-time commission, often referred to as an "upfront," that is usually a percentage of the initial premium payments paid in by the investor. The second part is a recurring commission paid quarterly or

[8]In addition to brokers, there is another class of financial professionals called Investment Adviser Representatives who often also call themselves "financial advisors." Investment Advisor Representatives are registered with the SEC and provide financial advice rather than transaction services. Investment Adviser Representatives are held to a fiduciary standard; however, Investment Adviser Representatives are not allowed to sell variable annuities unless they are also registered as a broker. About half of the registered brokers in the US are also registered as investment advisers (Egan et al. (2019)). Individuals registered both as brokers and investment advisers are often referred to being as being "dual registered." Dual registered individuals are held to a suitability standard when acting as a broker (e.g., selling variable annuities) and to a fiduciary standard when acting as an investment adviser. This is often referred to in the industry as "wearing two hats." For example, seehttps://www.wsj.com/articles/dually-registered-investment-advisers-blur-the-broker-fiduciary-line-1427384699 [accessed 7/30/2020]

annually, which is referred to as a "trail." The trail is usually paid as a percentage of the total asset values, beginning in the second year of the contract. The upfront commission paid on any given product can range up to 10% or more of the premium payments. In many cases, selling agents and selling firms may also have the option to receive lower upfront commissions in exchange for higher trail commissions, usually up to 1.25% annually.

2.2 DOL Fiduciary Rule

Conflicts of interest may arise as brokers receive commissions from insurers for selling annuities. As discussed above, brokers are generally not required to act as fiduciaries when selling variable annuities and can influence investors' decisions to increase their commission earnings.

In February 2015, then-President Obama announced a proposal to mitigate conflict of interests for brokers, insurance agents, and other advisers of retirement investors (we refer to them all as brokers hereafter). In essence, all brokers who deal with retirement investors would need to comply with the fiduciary standard and put the clients' financial interests before their own. Under this rule, brokers and insurers would be at greater risk of class-action lawsuits, liabilities, and civil penalties.[9] The regulation was formally issued by the US Department of Labor in April 2016 and required initial compliance by April 10, 2017. The proposed rule faced significant opposition, both in Congress and by industry parties, which delayed enforcement of the rule. After several rounds of amendments, public solicitations of opinions, and legal challenges, the rule took partial effect in June 2017.[10] However, after further delays, the DOL indicated there would be minimal enforcement until July 2019. In March 2018, the rule was vacated by the US Fifth Circuit Court of Appeals.[11] Although the rule was vacated by the Fifth Circuit Court ruling, the legal status of fiduciary standards remained in limbo, as other regulators including the SEC and state governments sought to implement their own versions of the fiduciary rule and, in some cases, brought legal action against firms in their

[9] See e.g. https://www.morningstar.com/articles/793268/article; https://www.brokerdealerlawblog.com/2017/dols-best-interest-contract-requirement-effect-litigation-broker-dealers/; https://www.govinfo.gov/content/pkg/FR-2016-07-11/pdf/2016-16355.pdf; https://www.harp.org/erisa502.htm [accessed 2/3/2021]

[10] See e.g. https://www.dol.gov/agencies/ebsa/employers-and-advisers/guidance/field-assistance-bulletins/2018-02; https://www.nytimes.com/2017/06/08/your-money/now-your-financial-advisers-will-have-to-put-you-first-sometimes.html; https://www.wsj.com/articles/deregulators-must-follow-the-law-so-regulators-will-too-1495494029 [accessed 7/30/2020]

[11] Online Appendix D lists the timing of the main events surrounding the DOL fiduciary rule.

own jurisdictions on supposed fiduciary rule infractions.[12]

Fiduciary duty in the proposed rule requires brokers to "give prudent advice that is in the customer's best interest, avoid misleading statements, and receive no more than reasonable compensation" (DOL 2016). Receiving commission payments for products sold is usually incompatible with fiduciary responsibility. However, the proposed rule allowed brokers to receive commissions if the brokers and a financial institution (either the firms that employ/retain them or the insurance company) satisfied a list of conditions described in the Best Interest Contract Exemption rule. These conditions included acknowledging fiduciary duty to the investor, adhering to standards of impartial conduct, disclosing information about conflicts of interest, as well as adopting and publicly disclosing policies and procedures that mitigate conflicts of interest.

While the brokerage and financial advisory industry was lobbying aggressively against DOL's fiduciary rule, it was also preparing to comply with the rule. In a survey by Deloitte published in March 2016, 78% of the surveyed brokerage and other intermediary firms had by then started planning or implementing changes to adhere to the new rule.[13]

In addition to these survey responses, insurers and brokerage firms also reported updating their business practices in response to the DOL fiduciary rule starting in 2016. For example, in response to the DOL fiduciary rule, Voya stated that it "modified our sales and compensation practice." A number of insurers, such as AXA Group, AIG, and Ageon, also reported that changes in sales practices due to the rule contributed to a decline in variable annuity sales. In its 2017 annual report, Ageon explicitly stated that their decline in annuity sales was caused by "lower market demand following the implementation of the Department of Labor Fiduciary Rule, in addition to not following competitors' pricing changes for some products." However, not all insurers reported decreased sales from the DOL rule. In response to the Department of Labor Rule, Lincoln Financial Group reported that it had "refreshed its core products and introduced new annuities.... As a result of these actions, [total (variable and other types of annuities)] annuity sales increased 6% in 2017, compared to an 8% decrease for the industry." Figure 2 plots the total number of mentions of the

[12]For example, in 2018 the Commonwealth of Massachusetts pursued enforcement action against a firm for allegedly "[violating] its fiduciary duty by ignoring the policies it had put in place to meet the DOL regulation's standards for impartial conduct," see: `https://www.theregreview.org/2019/04/10/jacob-is-fiduciary-rule-dead/`; `https://www.investmentnews.com/dol-fiduciary-rule-might-be-dead-but-its-ghost-hovers-over-the-financial-advice-industry-75637` [accessed 7/31/2020].

[13]`https://www2.deloitte.com/content/dam/Deloitte/us/Documents/regulatory/us-reg-dol-fiduciary-rule-industry-preparedness.pdf` [accessed 1/27/2020]

word "DOL" or "Department of Labor" in insurers' and brokers' 10-K filings by year and documents a similarly sharp increase in mentions around 2016.

The data suggests that investors also responded to the rule proposal. We parse through the universe of investor complaints from FINRA's BrokerCheck website to identify fiduciary-duty-related complaints. Figure 3 displays the share of investor complaints where the broker allegedly violated his/her fiduciary duty to the investor. The figure illustrates that the share of fiduciary-duty-related complaints effectively doubled in the years following the DOL proposal in 2015 and issuance in 2016. These results are consistent with the notion that the DOL's fiduciary rule increased investors' awareness of brokers' potential conflicts of interest.

3 Data

3.1 Data Sources

Variable Annuity Characteristics and Sales We obtain quarterly sales data of variable annuities from Morningstar Annuity Intelligence from 2005Q1 to 2020Q2. The total variable annuity sales reported in our data for 2018 is $92.9 billion, which represents 93% of the total $100.2 billion of sales in the universe of variable annuity products in the US in 2018. Morningstar Annuity Intelligence also reports the quarter-end assets of each product. The total assets held in variable annuity contracts covered by Morningstar at the end of 2018 is $1.79 trillion, which represents 83% of the total $2.16 trillion in assets in the universe of variable annuity products in the US.

We determine the characteristics of each variable annuity using data from Morningstar Annuity Intelligence and Morningstar Principia. Morningstar Principia data is available as a quarterly CD-ROM series from 2005 to 2012. Morningstar Annuity Intelligence is a separate data set that provides information on variable annuity characteristics through mid-2020 (when we accessed the data). Both data sets contain information including the insurance company underwriting the product, expenses, sales, and asset size, as well as benefit options available (e.g. GLWB). For each policy, the data sets also provide characteristics of the subaccounts towards which the variable annuities policyholders can allocate their investments. Data on the subaccounts include names of the funds, their investment objectives, expense ratios, and historical returns. We describe how we use the two data sets to construct a time series of product characteristics in Online Appendix C.

We match the data sets on variable annuity characteristics and sales to construct a quarterly annuity level panel data set from 2005Q1-2020Q2. We use the full sample to document several empirical facts regarding the distribution of variable annuities in Section 4, and focus on the period 2013Q1-2020Q2 when studying the fiduciary rule in Sections 5 and 6.

Variable Annuity Sales Commissions We obtain information on sales commission rates for variable annuity products from the prospectuses and corresponding amendments filed with the SEC. Under the Securities Act of 1933 and the Investment Company Act of 1940, all insurance companies offering variable annuities must register the variable annuity products and file the prospectus of the products with the SEC. The prospectus contains basic descriptive information of the insurer underwriting the product, the investment options available to policyholders, expenses, restrictions, and information on the subaccounts' returns. Prospectuses are filed with the SEC initially in Form N-4 and updated through post-effective amendment Form 485BPOS filings, commonly at annual intervals. We access these filings through the SEC's EDGAR database. We match the filings by the product name and insurance company to the products in the Morningstar variable annuity data set.

Insurance companies are required to disclose in the prospectuses and applicable amendment filings the commission rates paid to the selling agents and firms for each variable annuity product. In these filings, insurance companies disclose the maximum upfront commissions, as a percentage of premium payments, along with trail commissions, as a percentage of the annuity value, if applicable. We then extract by hand the commission data disclosed for each matched product each year. This gives us a panel data set of commissions at the annuity product by quarter level. To standardize across the different commission schedules, in our empirical analyses, we use the maximum upfront commission, which is almost always associated with zero trail commissions in compensation schedules.[14]

One caveat is that insurers are required to disclose the maximum upfront commission rate, and the variation in the maximum upfront commission rates disclosed by insurers could, theoretically, not reflect the variation in the average commission rate that insurers pay. There are several reasons

[14]For example, one insurance company offered three main commission options for the selling agents and firms for one of its variable annuity products: first, an upfront commission of 6.5% of the premium payments plus no trail commissions; second, an upfront commission of 5% of the premium payments plus trail commissions of 0.25% on an annual basis, which increases to 0.40% after surrender charges are no longer applicable to the premium; and third, an upfront commission of 2% of the premium payments plus trail commissions of 0.75% on an annual basis.

why we believe that these limitations do not significantly hinder interpretations of our findings. First, the commission rates we find are consistent with industry knowledge of the levels of both upfront and trail commissions that selling agents and firms receive. Second, there is substantial heterogeneity in the disclosed maximum upfront commission rates. Insurers offer different commission schedules across variable annuity products at the same time. There is also variation in the reported commission rate within a variable annuity over time. The heterogeneity across products of the same insurance company and within products over time suggests that the disclosed commission rates reflect meaningful variation in the compensations paid to brokers for different products. Third, for some annuities, we observe the actual selling agreements, as reported in their SEC filings, between insurance companies and brokers and can confirm that the disclosed maximum upfront commission rate matches the contractual commission rate reported in the selling agreement. Finally, to the extent that the maximum rate contains measurement error in our explanatory variable, it would bias our results towards zero such that our results represent a conservative estimate of the impact brokerage commissions have in distorting investments.

3.2 Summary Statistics

Our data set contains 2,199 different variable annuity products offered by 98 insurance companies from 2005Q1 to 2020Q2. Table 1 presents summary statistics of the product characteristics. The total assets held in each product averages $3.0 billion. Quarterly sales average $95 million.

Expense ratios, including both product-level expenses (M&E, administrative, and distribution charges) and average subaccount expenses, have a mean of 2.23% of assets annually and range from 0.25% to 4.20% in the sample (Figure 4a displays the distribution). The substantial dispersion in expense ratios provides prima facie evidence of potential distortions and frictions in this market. An investor would lower her annual expenses by roughly 50% (1pp) by moving from the 90th percentile to the 10th percentile in terms of expenses. This amounts to an 8.56 percentage point increase in net present value (NPV) relative to the principal invested, assuming an 8% discount rate and that the annuity is outstanding for 15 years. Given the size of the annuity market ($2.2 trillion), the dispersion in annual fees is economically meaningful.

Table 1 and Figure 5a display the distribution of variable annuity commissions. The average upfront commission is 6.06% of premium payments across all products. A key feature of the commission rates is that there is substantial heterogeneity: the maximum disclosed upfront commissions range from 0% (no commissions paid) to 16% of premium payments. As such, brokers have strong monetary incentives to sell high-commission variable annuities over others. By moving from the 10th to the 90th percentile, a broker would almost triple the commission earned on making a sale (3% vs 8%).

4 Conflicts of Interest in the Variable Annuity Market

The motivation for the DOL rule was to limit conflicts of interest in retirement markets, such as the variable annuity market. In this section, we document evidence of conflicts of interest in the annuity market. First, we show how broker incentives play a key role in the distribution of variable annuities. Second, we show that brokers are incentivized to sell expensive products with worse observable characteristics for consumers. We also show that these more expensive products receive more consumer complaints, which suggests that they are both ex-ante and ex-post worse for consumers.

4.1 Annuity Sales

We begin by empirically documenting the drivers of variable annuity sales. We are particularly interested in how investors and brokers trade off variable annuity expenses versus brokerage commissions. We systematically examine drivers of variable annuity sales in the following regression specification:

$$\ln(Sales_{jkt}) = \alpha f_{jkt} + \gamma c_{jkt} + \beta X_{jkt} + \mu_{kt} + \epsilon_{jkt}. \tag{1}$$

Observations are at the variable annuity product-by-quarter level.[15] The dependent variable $ln(Sales_{jkt})$ is the log total sales of variable annuity j offered by insurance company k in quarter t. The independent variable f_{jkt} is the average total expense ratio in percentage points corresponding to variable annuity j in quarter t. The term c_{jkt} is the maximum upfront commission rate paid to selling agents and is a percentage of premiums paid. We control for an extensive set of other variable

[15]As discussed in Section 4.1.1 some variable annuities offer different share classes. We define a variable annuity product (j) at the share-class level.

annuity characteristics in the vector X_{jkt}, which includes the availability of GLWB, GMWB, GMAB, and GMIB riders, an indicator for a long (above median) lock-up period; the number of different subaccounts that are open for investment in quarter t; the number of distinct investment objectives offered by the subaccounts, such as large-cap growth stocks and high-yield debt; and the risk-adjusted historical performance on the investment options available, measured as the average net-of-expense CAPM alpha across subaccounts in the previous five years (minimum six months for new subaccounts). Previous research from Koijen and Yogo (2021) highlights the importance of minimum guarantees/roll-up rates in driving annuity sales. We calculate the roll-up rate following Koijen and Yogo (2021) and include an indicator for whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e. a fixed effect for each roll-up rate), and the associated annual fee as control variables.[16] Including roll-up rate fixed effects allows us to flexibly and non-parametrically account for the value associated with these minimum guarantees. In our most stringent specification, we also include insurer-by-quarter fixed effects (μ_{kt}) to control for time-varying insurer brand effects and insurer supply conditions.

Table 2 presents the results of the regression estimates corresponding to equation (1). We find evidence suggesting that investors are relatively price sensitive. In each specification, we estimate a negative and statistically significant relationship between annuity expenses and sales, α. The results in column (5) indicate that a one percentage point decrease in expense ratios is associated with a 42% increase in sales (for reference, the unconditional mean and standard deviation of expenses across all variable annuities are 2.2% and 0.4% respectively).

In all specifications, the coefficient on commissions, γ, is positive and statistically and economically significant, suggesting that investors are more likely to purchase products for which the broker earns a high commission from the insurance company. The results in column (5) indicate that a one percentage point increase in brokerage commissions is associated with an 18% increase in variable annuity sales. The positive relationship between commission rates and sales is robust to controlling for variable annuity product characteristics and is positive both cross-sectionally as well as within time periods and within insurance companies. These results suggest that broker incentives play a

[16]Specifically, for each product, we take the average roll-up rate and annual fee across all guarantees of each type that is offered each quarter. We then assign the roll-up rate and annual fee for each product each quarter in the following order: GLWB, GMWB, GMIB, GMAB, and other. For example, if the product had no GLWB riders and two GMWB riders available, we take the average of the roll-up rates and annual fees of the two GMWB riders as the roll-up rate and annual fee for the product. If a product does not offer a rider option with a roll-up rate, we set the roll-up rate to zero.

critical role in driving the sale of variable annuities.

We use the estimates from Table 2 to construct a back of the envelope estimate of how investors and brokers trade off their financial interests in terms of expenses and commissions. One distinction between commissions and expenses is that commissions are a one-time upfront payment while expenses are charged annually. Thus, to make an apples-to-apples comparison, we need to calculate the NPV of a one percentage point increase in annual expenses. Assuming that a variable annuity is outstanding for 15 years and an 8% discount rate, the NPV of a one percentage point decrease in expenses is 8.56%, relative to the amount invested. The results in column (5) indicate that a one percentage point decrease in the NPV of future expenses is associated with a 4.9% ($= 0.42/8.56$) increase in sales. Conversely, a one percentage point increase in broker commissions is associated with an 18% increase in variable annuity sales. The results suggest that variable annuity sales are almost four times as sensitive to the financial interests of brokers as those of investors.

Turning to other product characteristics, the results suggest that investors purchase more variable annuities that have more subaccounts to invest in and higher net-of-expense alphas on the subaccounts. These results are intuitive. The results in column (5) indicate that adding a new investment option/subaccount is associated with a 0.98% increase in variable annuity sales. A one standard deviation increase in average subaccount alpha (0.20%) is associated with a 51.2% ($= 0.2 \times 2.56$) increase in variable annuity sales. We also find some evidence that the sales of variable annuities with longer lock-up periods (longer than the median) tend to be higher. This may partially reflect the preferences of brokers who, as discussed in Section 2.1, often earn a trail commission for each year the annuity is outstanding. In columns (3)-(5) we include roll-up rate fixed effects to flexibly account for minimum guarantees. The estimated relationship between the roll-up rate and the associated fixed effect is positive and significant (corr=0.38), consistent with the idea that these roll rates are an important component of demand (Figure A1). As a robustness check, in Table A4 we also control for the minimum purchase thresholds and, to account for age restrictions, include fixed effects for minimum and maximum age requirements, as well as all reported benefits and riders. We find similar results with these alternative sets of controls.

One potential concern in our analysis is that annuity expenses/prices are potentially endogenous in eq. (1) and correlated with unobserved product characteristics. If an insurance company partially observes demand shocks for its annuities before setting product expenses, then expenses will be endogenous. For example, if an insurer experiences a positive demand shock, it may find it optimal to charge higher expenses on its annuities. Consequently, one might expect that the endogeneity bias would cause our OLS estimate of α to be biased upwards, such that our OLS estimates would suggest that investors are less sensitive to expenses than they actually are. For the same reason, one might also expect commissions to be endogenous. If an insurer experiences a positive demand shock, it may find it optimal to offer a lower commission. This would cause our OLS estimate of γ to be biased downwards, such that our OLS estimates would suggest that brokers are less sensitive to commissions than they actually are.[17] In general, the expenses and commissions associated with variable annuities appear relatively sticky in the data and are infrequently updated, which helps mitigate the endogeneity concerns. In the following subsections, we perform several robustness checks to address these potential endogeneity issues. First, we exploit variation across share classes of the same variable annuity product which allows us to effectively control for all variable annuity characteristics. Second, we use instrumental variables and control function approaches to address the endogeneity of commissions and expenses.

4.1.1 Share Class Analysis

To help address the potential concern with our analysis that our measures of expenses and commissions are correlated with some unobserved product characteristics, we exploit an institutional feature where an insurer sells otherwise almost identical variable annuities with different expenses, commissions, and lock-up periods. In general, different share classes of the same variable annuity have the same underlying investment options, product features, benefits, and other characteristics.[18] This helps mitigate concerns that some unobserved product characteristics are driving our

[17]One also might be worried about measurement error in commissions as discussed in Section 3. Such measurement error may be non-classical and consequently could bias γ in either direction. For example, one might be worried that such measurement error is correlated with demand shocks. As described in Section 4.1.2, we instrument for commissions to address these endogeneity and measurement error concerns. Provided our cost-shifter instruments are orthogonal to the measurement error, two-stage least squares will produce consistent estimates.

[18]As an example, consider the Premier Retirement variable annuity offered for sale by Prudential. In 2012, the Premier Retirement variable annuity was offered in L- and C-share classes. Both share classes of the Premier Retirement product had investment options in the same 59 subaccounts, ranging from large-cap growth funds to emerging markets' sovereign debt funds. Both share classes had the same death benefit and living benefit options and other identical contract features. The difference between the two shares lies in the expense and lock-up period: L-shares charged an annual M&E risk charge of 1.55% and had a 4-year lock-up period, whereas the C-shares charged an annual M&E risk charge of 1.60% and did not have any lock-up period. The two share classes also have different commission rates: the L-share had an upfront commission rate of 5.5%, whereas the C-share had an upfront commission rate of 2%. The L-share of the product had sales of $3.18 billion in the fourth quarter of 2012, whereas the C-share of the product had

results.

We compare different share classes of the same product or similar products offered by the same insurer to study the role expenses and commissions may have on variable annuity sales. In the empirical analysis, we identify by name all the share classes of the same product set offered by the same insurer in the same year and quarter. The share classes within a product set differ in expense structures and commissions. In total, we identify 261 product set-quarter groups where each product set has at least two share classes both offered for sale in the same quarter. These 261 product set-quarter groups include 681 unique share class-quarter observations. We report the summary statistics corresponding to this sample in Table A5 in Online Appendix A.

To analyze what drives sales across share classes, we estimate an equation similar to our main analysis (eq. 1) on the subset of share class-quarter sets for which there are multiple share classes with different commission rates and expenses:

$$ln(Sales_{jpt}) = \alpha f_{jpt} + \gamma c_{jpt} + \beta LongLockUp_{jpt} + \mu_{pt} + \epsilon_{jkt}, \tag{2}$$

where j denotes the share class, p denotes the product set for which there are multiple share classes, and t denotes the year and quarter of the observation. Here, we include product set-quarter fixed effects μ_{pt} which control for all variable annuity characteristics other than the share-class-specific characteristics: expense (f_{jpt}), commission (c_{jpt}), and whether the lockup is longer than the median $(LongLockUp_{jpt})$.

Table 3 reports the coefficient estimates. Across share classes of the same products, we find that the effect of commissions and expenses still persists in driving sales. Notably, $\gamma = 0.14$, which corresponds to a 30% increase in quarterly sales for a one standard deviation (2.13% in this subsample) increase in commissions across share classes (column 2). Similarly, we find that expenses are negatively correlated with sales. Overall, these results suggest that our earlier inference that annuity sales depend on both the broker's and client's interests are unlikely driven by omitted characteristics of the variable annuities.

sales of $240 million in that same time period.

4.1.2 Instrumental Variables

To further address the potential endogeneity concerns, we instrument for expenses and commissions using two different sets of instruments. In addition to using two-stage least squares, we also address the endogeneity concerns by using our instruments to form a control function (Petrin and Train (2010)) as described in the Online Appendix. We summarize the approaches here and describe the details of how the instruments and control function are constructed and implemented in Online Appendix B.

Instrument Set 1 (IV-1): We construct our first set of instruments following Koijen and Yogo (2021). We instrument for expenses using an insurer's reinsurance share of variable annuities, the log of the gross amount of variable annuity reserves scaled by the account value, and their squares. The rationale behind the instruments is that they are relevant because they impact an insurer's cost of issuing variable annuities. They are also plausibly exogenous because, conditional on the insurer's rating which we control for, variable annuity investors should be indifferent over the reinsurance share of variable annuities and the amount of variable annuity reserves.

We instrument for a variable annuity product's commissions using the average commissions that the insurer pays on ordinary life insurance policies the year before the inception of the variable annuity. This data is obtained from insurers' regulatory filings (downloaded from S&P Market Intelligence) and the squares of these commissions. These instruments are in the spirit of Hausman et al. (1994). The rationale behind the instrument is that it is relevant because an insurer's cost of selling ordinary life insurance policies is correlated with its cost of selling variable annuities. The exclusion restriction requires that conditional on variable annuities' characteristics and insurers' ratings, demand for variable annuities is otherwise uncorrelated with the commissions that insurance agents receive for selling ordinary life insurance policies. As with all Hausman et al. (1994) instruments, the potential endogeneity concern is that demand shocks are correlated across markets. Because we construct our instrument using the commissions the insurer paid on ordinary life insurance policies the year before the variable annuity's inception, the specific concern would be that past demand shocks for ordinary life insurance policies (the year before inception) are correlated with contemporaneous demand shocks for variable annuities. The facts that many of the variable annuities were created years prior and that the commission rates set on these products are persistent over time potentially alleviate this endogeneity concern.

Instrument Set 2 (IV-2): One limitation of our first set of instruments is that the instruments for expenses vary at the insurer-by-quarter level. To address this limitation, we also construct a second set of instruments that vary at the variable annuity-by-quarter level based on the cost of constructing the subaccounts of each variable annuity. Specifically, for each subaccount of each variable annuity in each quarter, we calculate the average expense ratio of all other mutual funds in the same Morningstar market category (e.g., Small Value Equity or Global Real Estate) that are offered by the same mutual fund provider that created the subaccount in that quarter. This "other-funds" average expense ratio is a proxy for the unobserved expense that the insurer pays to the mutual fund provider, which is a natural cost shifter for the cost of constructing a variable annuity. We then take the average of the other-funds average expense ratio across all subaccounts of a variable annuity to construct the annuity-by-quarter level instrument, Z_{jt}^{Exp}. We find that the instrument is highly relevant. The threat to exogeneity would be that the expenses of other mutual funds created by the mutual fund provider that created subaccounts for a given variable annuity are correlated with demand shocks for the same variable annuity.

Building on the instruments for expenses, we then instrument for commissions using the expected net present value of revenue generated by the variable annuity. The underlying assumption is that upfront commissions paid to the broker will be a function of the expected revenue generated by the annuity, which depends on variable expenses and the expected duration of the variable annuity, and brokers and insurers bargain over the surplus. For each variable annuity j, the net present value of revenue is given by $f_j E_j \left[\sum_{\tau=1}^{T} \frac{1}{(1+r)^\tau}\right]$, where $f_{j,}$ is its expense ratio, T is its maturity, which is stochastic, and r is the discount rate. For each annuity, we calculate the duration $D_{jt} = E_j \left[\sum_{\tau=1}^{T} \frac{1}{(1+r_t)^\tau}\right]$ using the 10 year Treasury rate as the discount rate and under the assumption that T is uniformly distributed over the period $[T_j^{min}, 20]$ where T_j^{min} is the earliest variable annuity j can be withdrawn without penalty and we assume annuities automatically mature after 20 years. Because f_j is endogenous, we then construct our instrument as $Z_{jt}^{Comm} = Z_{jt}^{Exp} \times D_{jt}$. While our assumptions about the maturity of an annuity are slightly ad-hoc, which produces potential measurement error, we find that our instrument is highly relevant. The exclusion restriction requires that the interaction of the expected duration of the variable annuity with our cost shifters Z_{jt}^{Exp} are orthogonal to demand shocks. We describe the details of the instruments in full in Online Appendix B and report the first-stage results in Table A6.

Results: We report the corresponding instrumental variable estimates in Table 4. Column (2) corresponds to our first set of instruments (IV-1) that are based on those used by Koijen and Yogo (2021). Column (4) corresponds to our second set of instruments (IV-2) which are constructed based on the cost of creating a variable annuity.[19] . For comparison, we also report the corresponding OLS estimates in columns (1) and (3) in Table 4. In each specification, we estimate a negative and significant relationship between expenses and annuity sales and the estimates are more negative in our IV specifications, which is consistent with the idea that the OLS-estimated coefficient corresponding to expenses is biased upwards. Similarly, we find a positive relationship between variable annuity sales and commissions in each specification, and the magnitudes are larger once we account for endogeneity. We also find quantitatively similar results when we use a control function approach to address the potential endogeneity problem as described in Online Appendix B and reported in Table A3.

4.2 Heterogeneity Across Distribution Channels

We also examine how the relationship between selling agents' incentives and annuity sales varies across distribution channels. While variable annuities must be sold by a registered securities broker, some of the brokers who sell annuities are direct employees of the insurer (captive brokers) while many others work independently from the insurer (non-captive).[20] These non-captive brokers can generally contract with any insurance company and can sell variable annuities issued by multiple insurance companies.

There are two main reasons why commissions and expenses may affect sales differently for captive brokers relative to non-captive brokers. First, insurance companies distributing variable

[19]We omit insurer-quarter fixed effects for our first set of instruments because some of the instruments vary at the insurer-quarter level.

[20]Non-captive brokers include (1) independent financial planners such as LPL Financial, M Financial Group, and Princor Financial Services; (2) regional broker-dealers such as Edward Jones, Oppenheimer, and Raymond James, which are large broker-dealer organizations that service many areas in the US, and (3) wire-houses such as Morgan Stanley, UBS, and Wells Fargo Advisors, which are the largest national financial services firms.

annuities through non-captive brokerage firms leads to double marginalization: insurance companies and brokerage firms that have market power in their respective markets will each apply their own markup to the variable annuity products sold. The optimal price in the vertically integrated market is lower than the optimal price in the unintegrated market. As such, one might expect products with higher expenses to be sold more across non-captive brokers than across captive brokers. Second, to the extent that selling a higher-expense product could create a reputational concern and threat of complaints or lawsuits against both the selling agent and the insurance company, the captive agent working exclusively for the insurance company may be more inclined to take the reputational concern of the insurance company into consideration, and thus is less likely to sell high-expense products.

To test this hypothesis, we repeat our analysis of equation (1), but decompose the independent variable, sales flow, into sales by non-captive brokers and sales by captive brokers separately. Table 5a reports the coefficient estimates for sales by captive brokers, and Table 5b reports those for sales by non-captive brokers. The results suggest that captive and non-captive brokers respond differently to commissions and expenses. In general, captive brokers appear to be substantially more sensitive to expenses and less sensitive to commissions. The estimated sales sensitivities to expenses for captive brokers ($\alpha = -0.63$) (panel b column 4) is 1.5 times as large as for non-captive brokers ($\alpha = -0.43$) (panel a column 4). Similarly, the results generally suggest that non-captive brokers are more sensitive to commissions than captive agents, although the differences are not statistically significant. Taken together, the analysis suggests that captive brokers place a higher weight on their clients' incentives relative to non-captive brokers.

4.3 What Types of Annuities are Brokers Incentivized to Sell?

Our results from Section 4.1 suggest that broker incentives play a critical role in determining which variable annuities investors purchase. In this section, we explore the types of variable annuities brokers are incentivized to sell, and the extent to which brokers' financial interests conflict with those of their clients. We first examine how annuity commissions vary with expenses and other product characteristics. We find that brokers are incentivized to sell high-expense products, as well as products with fewer and worse-performing investment options. We then examine how high-expense products, which offer higher commission incentives for brokers, relate to customer satisfaction, which is measured using variable annuity investor complaint data from FINRA.

4.3.1 Broker Commissions and Variable Annuity Characteristics

In Section 4.1, we find that brokers have strong incentives to sell certain variable annuities over others and that brokers appear to respond to these incentives. In principle, these incentives do not directly harm investors. However, broker commissions may impact the types of variable annuities that a broker chooses to market to investors. One concern, which prompted the DOL fiduciary rule, is that brokers may be incentivized to market inferior and expensive products to investors. This creates conflicts of interest as the broker's interest in higher commissions is in direct conflict with the investor's desire for higher quality products.

We identify the types of variable annuities that brokers are incentivized to sell by examining how broker commissions vary with product characteristics in the following linear regression:

$$c_{jkt} = \theta f_{jkt} + \phi X_{jkt} + \lambda_t + \lambda_k + \epsilon_{jkt}. \tag{3}$$

Observations are at the variable annuity product-by-quarter level, where we restrict the sample to those variable annuities that are available for sale in a given quarter. The dependent variable c_{jkt} is the maximum upfront broker commission corresponding to annuity j offered by insurer k at time t. We examine how commissions vary with variable annuity expenses f_{jkt} and other variable annuity characteristics in the vector X_{jkt}. We include the same set of annuity control variables corresponding to our earlier analysis (eq. 1), which includes the availability of different benefits/riders and subaccount characteristics. The corresponding coefficients provide insight into which types of variable annuities have high commissions, or in other words, which types of annuities brokers are incentivized to sell. We also include year-quarter fixed effects (λ_t) and insurance company fixed effects (λ_k).

Table 6 displays the estimates. In each column, we find a positive and significant relationship between commissions and expenses, suggesting that brokers are incentivized to sell high-expense products. The results in column (4) indicate that a one percentage point increase in expenses is associated with a 0.70 percentage point increase in commission rates. We also find some evidence suggesting that commissions are negatively correlated with the availability and performance of investment subaccounts. A one standard deviation decrease in the number of available subaccounts (56) is associated with a 0.73pp ($= 56 \times 0.013$) increase in commissions. Similarly, a one percentage point decrease in average net-of-expense subaccount alpha is associated with a 0.64pp increase in commissions (column 4). Overall, the results suggest that brokers are incentivized to sell products with higher expenses and worse investment options.[21]

4.3.2 Broker Misconduct and Product Expenses

In Section 4.3.1, we find evidence suggesting that brokers are incentivized to sell annuities with higher expenses, as well as fewer and worse-performing investment options. While this evidence suggests that brokers are incentivized to sell products that are worse for investors, high product expenses may still be positively correlated with some other unobserved variable annuity characteristic that is desirable for investors. To help address this alternative explanation, we further examine the relationship between variable annuity expenses and product quality by studying the relationship between expenses and variable annuity-related investor complaints. If products with high expenses are worse for investors, we would expect investors who end up buying high-expense products to complain about them more often.

We match our variable annuity sales data with complaints and broker misconduct records from FINRA and test whether brokers who are more likely to sell high-expense products receive more complaints and have higher rates of misconduct records. Because we do not have data on the specific products that each broker sells and an independent broker may simultaneously work with multiple insurers, we focus on captive brokerage firms that are affiliated with specific insurers, as they will primarily sell products offered by the affiliated insurers. For each insurance company that sells variable annuities in the Morningstar variable annuities data set, we identify all affiliated brokerage firms registered with FINRA. For each brokerage firm, we compute the sales-weighted average expense ratios on all variable annuities created by the brokerage firm's insurance arm.

Using the FINRA data, we identify complaints associated with variable annuity sales as well as

[21] In Figures A10a and A10b, we also explore the relationship between minimum purchase amounts and commissions and expense ratios, which could reflect commissions and expenses being higher for smaller accounts due to fixed costs. We find a slight negative relationship between minimum purchase amounts and commissions and a slight positive relationship between minimum purchase amounts and expenses.

records of misconduct at each brokerage firm. We compute the following measures of complaints and misconduct for each brokerage firm that is affiliated with an insurance company: (1) the number of variable annuity-related complaints filed against the brokerage firm each year, (2) the total dollar amount of pecuniary damages/settlements paid to claimants against the brokerage firm corresponding to variable annuity-related complaints each year, (3) among brokers affiliated with the brokerage firm each year, the percentage of brokers with any prior misconduct-related disclosures, and (4) the percentage who had any misconduct-related disclosure that given year. The measures of (1) and (2) are specific to broker conduct arising from variable annuity sales. With (3) and (4), we identify misconduct related to all possible products and services, not just variable annuities, assuming that brokers' overall conduct is correlated with their conduct in selling variable annuities. All misconduct variables are rates scaled by the number of broker agents employed by the brokerage firm in each year, per 100 brokers. As reported in the last row of Table 7, the average brokerage firm in our sample, per 100 brokers employed each year, receives 0.19 complaints, pays out $3,696 in pecuniary damages/settlements, has 5.35 brokers with misconduct records, and has 0.38 brokers who have a misconduct disclosure that year.

To estimate the relationship between product expenses and complaints or misconduct, we estimate the following equation:

$$Misconduct_{it} = \delta + \beta Expenses_{it} + \Gamma X_{it} + \epsilon_{it}. \tag{4}$$

Observations are at the brokerage firm-by-year level. $Misconduct_{it}$ is the complaint or misconduct variable of interest for brokerage firm i in year t. The independent variable of interest is $Expenses_{it}$ which measures the sales-weighted average expense ratio of variable annuities sold by brokerage firm i's affiliated insurer in year t. X_{it} is a set of brokerage-level covariates for brokerage firm i in year t including the size of the brokerage firm, measured by the number of broker agents employed by the brokerage in a given year and the total amount of variable annuity assets under management by the insurance company for whom the brokerage firm sells variable annuity products.

Table 7 presents the results. The coefficient estimates on $Expenses$ are all positive and statistically significant, indicating that brokers affiliated with insurers selling high-expense variable annuity products also have higher levels of complaints and misconduct. A one-standard-deviation increase in the sales-weighted average expenses is associated with 0.10 ($= 0.23 \times 0.43$, 53% relative to the mean) more complaints, $2,532 (69%) more in pecuniary damages awarded to complainants per 100 brokers per year, 0.71pp (13%) greater share of brokers with records of misconduct, and 0.10pp (26%) higher rate of misconduct incidents per year.

The results in these two subsections are consistent with the interpretation that brokers are incentivized to sell inferior products. We find that products with high expenses—which tend to have high commissions—are associated with a greater number of investor complaints and higher rates of broker misconduct. The positive relationship between variable annuity product expenses and broker misconduct could be driven by two explanations. First, brokers that are more likely to engage in misconduct may select themselves into selling high-expense products. Second, investors holding high-expense variable annuity products may be more likely to realize that these products are not desirable and thus file complaints against brokers. Both of these explanations are consistent with the notion that high-expense products are likely to be less desirable for investors. Since, as documented in the previous sub-section, brokers on average have higher commission incentives to sell these products, the results here support our argument that brokers face significant conflicts of interest.

5 Effects of the Department of Labor Fiduciary Rule

In this section, we analyze the impact of the proposal and partial implementation of the Department of Labor (DOL) fiduciary rule on the variable annuities market. As described in Section 2.2, the DOL fiduciary rule was proposed by then-President Obama in 2015, issued by the DOL in 2016, and with enforcement originally planned to start in 2017. The proposed rule would hold all brokers to a fiduciary standard when dealing with retirement investments. We employ a difference-in-differences identification strategy where we examine how the sales of high-expense variable annuities changed relative to the sales of low-expense annuities surrounding the DOL fiduciary rule. We then assess the implications of the proposed rule on investor surplus in Section 6.

We find that the DOL fiduciary rule coincided with a meaningful (19%) decrease in total variable annuity sales. The decline in sales was primarily driven by a decline in the sales of high-expense variable annuities while low-expense annuity sales remained relatively constant. In addition, we find that insurers decreased the total number of variable annuity products open for sale, especially those with high expenses. Consistent with the anecdotal evidence from insurer annual reports (Section 2.2), the empirical evidence suggests that the proposal of the DOL fiduciary rule led to a decline in the sales and availability of high-expense variable annuities. While we find that the fiduciary rule led to a decline in annuity sales, we do not find any evidence that less wealthy households were disproportionately served less by brokers following the DOL rule, as argued by the brokerage industry against the fiduciary rule.

5.1 Variable Annuity Sales and Expenses

We first document how the proposal of the DOL fiduciary rule impacted the sales of variable annuities. Figure 6a displays total variable annuity sales in the US over the period 2013-2020Q2. We find that there was a significant decrease in total sales of variable annuities around the proposal of the fiduciary rule. Quarterly sales of all variable annuity products declined by 19% from $32 billion in 2015Q1 to $26 billion in 2016Q1, consistent with the hypothesis that the DOL fiduciary rule significantly affected brokers' decisions to sell variable annuities. The decline in variable annuity sales was partially offset by an increase in fixed indexed annuity sales, which are typically considered less risky investments than variable annuities and, on average, have lower commissions and higher risk-adjusted returns (Bhattacharya et al. (2020));[22] together, fixed index and variable annuity quarterly sales fell by 5% YoY in 2016Q1 (Figure 6b).

We find that the decline in variable annuity sales is almost exclusively driven by those more expensive annuities. Figure 7 separately plots the total sales of high- and low-expense variable annuities (top/bottom quartile) over the period 2013-2020. The plot shows that sales for high-expense products decreased drastically around the proposal of the DOL rule by 52% from 2015Q1 to 2016Q1. By contrast, sales for low-expense products fell by only 9% over the same period. The difference in differences suggests that in response to the DOL rule, brokers curbed their sales of high-expense variable annuities.

We analyze how the relationship between variable annuity sales and expenses changed sur-

[22]For example, FINRA, the regulator, describes equity indexed annuities as having less risk than a variable annuity. See `https://www.finra.org/investors/alerts/equity-indexed-annuities-complex-choice` [accessed on 07/09/2020]. As of 2016, the average commission paid on variable annuities was 6.36% vs. 5.50% for fixed indexed annuities.

rounding the DOL rule in the following difference-in-differences regression specification:

$$ln(Sales_{jkt}) = \alpha f_{jkt} + \alpha^{DOL} f_{jkt} \times DOL_t + \gamma c_{jkt} + \beta X_{jkt} + \mu_t + \mu_k + \epsilon_{jkt}. \quad (5)$$

Observations are at the variable annuity product by quarter level over the period 2013-2020Q2. We restrict the sample period to this window to measure the impact of the DOL rule. The variable DOL_t is a dummy variable indicating whether the year is after 2015. Thus, the coefficient on the interaction term $f_{jkt} \times DOL_t$ measures how the expense sensitivity of variable annuity sales changed surrounding the proposal of the DOL rule.

We present the estimates in columns (1)-(3) in Table 8. In each specification we estimate a negative coefficient on the term f_{jkt}, suggesting sales are negatively correlated with expenses prior to the DOL rule. The coefficient on the interaction term $f_{jkt} \times DOL_t$ is negative and statistically significant, indicating that sales became more sensitive to expenses after the DOL rule. The results in column (2) indicate, that prior to the DOL proposal, a ten bps increase in expenses is associated with a 5.8% decrease in sales. After the rule proposal, a ten bps increase in expenses is associated with a 11.2% (=5.8%+5.4%) decrease in sales. This finding echoes the results displayed in Figure 7: the sales of high-expense variable annuities fell more relative to low-expense variable annuities after the proposal of the DOL rule.[23]

In columns (3)-(6) of Table 8 we also include the interaction term between commission rates and the dummy DOL to measure how the sensitivity of sales with respect to commissions changed surrounding the proposed rule. The results confirm our earlier finding that sales are positively associated with commissions prior to the DOL rule. We do not find that the commission sensitivity changed after the proposed rule. This is intuitive as the proposed DOL rule would penalize brokers for selling high-expense inferior investments, but not necessarily for selling high-commission products conditional on product expenses and other characteristics. Since we control for the expenses and quality of the variable annuities, we would not expect the sensitivity of sales with respect to commissions to change surrounding the proposal.

In Figure 8 we explore the persistence of the DOL rule where we allow the expense coefficient

[23]In Table A7 in the Online Appendix, we report results of our baseline analyses where we use subaccount-AUM-weighted expenses and CAPM alphas versus our baseline results with equal-weighted expenses and CAPM alphas. In Table A8 in the Online Appendix, we repeat the analyses excluding the period between the announcement and issuance of the rule, 2015Q1-2016Q1. In both sets of analyses, the results remain qualitatively similar to our baseline estimates.

(α) to vary at the yearly level relative to 2013. The estimates show that while variable annuity sales sensitivity to expense ratios in 2014 and 2015 were similar to 2013, sales became significantly more sensitive to expenses starting in 2016, consistent with our previous findings that insurers and brokers responded to the changes imposed by the DOL fiduciary rule. On the other hand, there does not appear to be a change in sensitivity after the rule was vacated in 2019 and 2020. This persistent impact of the fiduciary rule suggests that many insurers kept the changes to their business operations that they initially implemented to comply with the DOL rule.[24] As discussed in Section 2, there are two potential explanations for the lack of a reversal: first, while the DOL fiduciary rule was vacated, many state regulators proposed their own versions of the fiduciary rule around this time, and so insurers and brokers could be anticipating similar regulation in the near future. In fact, the DOL announced plans to revisit the rule in 2021 as part of their regulatory agenda. Second, although the rule was vacated, there remained some legal ambiguity as to whether the rule was still enforceable in jurisdictions outside of that of the Fifth Circuit, and the threat of legal actions from state regulators for supposed fiduciary violations remained.[25]

While we find that the announcement and issuance of the DOL rule had an impact on the variable annuity market, there are several important caveats for interpreting the results. First, the DOL rule was never fully enacted. To the extent that some market participants anticipated that the DOL rule would be delayed (in part due to a change in the political climate), our results may understate the effects of the fiduciary rule. Second, there may have been pre-existing policy ambiguity regarding the sales of variable annuities, and the DOL rule may have clarified some of that uncertainty. To the extent that the rule change was anticipated, our results might understate the effects of the fiduciary rule because firms anticipated the rule prior to 2015 and 2016; however, even if the rule was anticipated, our results suggest that participants did not react to it until 2016 (Figure 8). Third, we do not observe the counterfactual market outcomes if the DOL fiduciary rule

[24]Todd Giesing, director of annuity research at the LIMRA SRI, notes that many of the changes insurers had to make to accommodate the DOL rule have remained in place. "Even with the vacated rule, we've heard from many annuity providers that they made changes that remain in place today due to the rule." Those changes include changes to business processes and practices, and disclosure policies, he says. See `https://www.morningstar.com/articles/930554/the-uptick-in-annuities` [accessed 01/23/2020]

[25]For example, industry discussions suggest that even though the DOL fiduciary rule was vacated, brokers' "best strategy is to always act in the best interests of [their] clients" and that firms who adopted policies to comply with the DOL fiduciary rule must be careful not to violate their own policies: see `https://www.investmentnews.com/dol-fiduciary-rule-might-be-dead-but-its-ghost-hovers-over-the-financial-advice-industry-75637` [accessed 7/31/2020].

were not proposed, so some of the changes we document may have occurred even in the absence of the DOL fiduciary rule.[26] Lastly, the DOL rule helped mitigate conflicts of interest through several potential channels including increased disclosure, punishment, and consumer awareness. Because the rule simultaneously impacted disclosure, punishment, and awareness, we cannot separately attribute the effects of the DOL rule to each channel.

5.2 Insurers' Product Offerings: Expenses and Commissions

Insurers, in addition to brokers, also faced significant legal risks under the DOL fiduciary rule. The Department of Labor states that to keep the commission-based compensation structure, insurance companies must acknowledge fiduciary status and insulate brokers from incentives that violate the Best Interest standard when no other financial institution (such as a brokerage firm) acknowledges fiduciary status.[27] Consequently, to limit their legal risks, insurers could respond to the rule by removing high-expense annuities whose sales may violate the standard and by introducing new low-expense annuities. Insurers may also decrease the availability of high-expense products because brokers are less inclined to sell them following the DOL proposal as suggested by the evidence in Section 5.1.

Figure 9a tests this hypothesis by plotting the time-series equal-weighted average expenses of products open for sale. The average expenses declined sharply from 2015Q1 to 2017Q1, consistent with the idea that insurers are reducing the relative availability of high-expense products. Furthermore, the decline in average expenses is driven by both the opening of new low-expense products and the closure of old high-expense annuities (e.g. Figure A2).

Figure 9b plots the sales-weighted average expenses which also shows a sharp decline in expenses around 2016. The equal-weighted figure (Figure 9a) reflects the behavior of insurers as they changed the suite of available products, while the sales-weighted figure (Figure 9b) reflects the behavior of both insurers and brokers. Consequently, the sales-weighted decline in average expenses is larger than the equal-weighted decline in average expenses because it also reflects the

[26]In Figure A3, we calculate the sales-weighted average expenses after subtracting out a linear pre-trend estimated based on the pre-period for each quarter. We document a large and immediate drop in sales-weighted average expenses post-DOL in 2016 and 2017, which gradually converges to the linear pre-trend 2020Q1, which suggests that it is possible that the DOL fiduciary rule accelerated changes in the market.

[27]See `https://s3.amazonaws.com/public-inspection.federalregister.gov/2016-07925.pdf?1459955724`, page 243-244. [Accessed 3/29/2020]

change in broker behavior. As illustrated in Section 5.1, annuity sales became more sensitive to expenses following the DOL rule. Figure 9b also indicates that the response of brokers to the DOL rule was immediate and sharp. In contrast, Figure 9a indicates that the response of insurers was immediate but more gradual as it potentially took longer for insurers to update their product set. Since brokers face conflicting interests because they earn higher commissions by selling higher-expense products, and that higher-expense products are likely worse for investors, the DOL rule led insurers to alleviate the conflicts of interest faced by brokers by reducing the relative availability of high-expense products.

We can also visualize the change in the product space around the DOL fiduciary rule in a heatmap by expenses and commissions. For each region in the product space along these two dimensions, we compute the change in the average number of variable annuity products available for sale and average total sales in each quarter for the time period before (2013-2015) and the time period after (2016-2020Q2) the issuance of the DOL fiduciary rule. We measure both sales volume and the number of products available for sale as shares of the entire variable annuities market, such that the changes in sales and product offerings reflect changes in the composition of the marketplace.

Figures 10a and 10b plot the changes in product offerings and sales, respectively. An increase (decrease) in the number or sales of products in each region is denoted in red (blue). Figure 10a shows that in terms of the number of products as a fraction of all products available, low-expense products experienced an increase. Figure 10b shows a similar pattern in sales: low-expense products gained, while high-expense products lost market share. In particular, low-expense-low-commission products experienced the largest increase, and high-expense-high-commission products experienced the largest decrease. In the Online Appendix (Table A9) we formally examine the change in the product space around the DOL rule and confirm that insurers lowered expenses by roughly 8bps after the rule change. Overall, the results suggest that following the DOL fiduciary rule, the variable annuity market shifted away from higher-expense inferior products and towards lower-expense products, in terms of both product offerings and sales.[28]

[28]In the Online Appendix (Figures A2-A9) we report the time series of annuity market characteristics, such as the number of insurers, number of brokers, and product characteristics in the period surrounding the DOL rule.

5.3 Composition of Variable Annuity Investors

One primary concern associated with the fiduciary rule is that holding brokers to a fiduciary standard would raise the fixed cost of providing financial advice which would reduce the amount of financial advice. In particular, it may no longer be profitable for brokers to sell variable annuities to investors with smaller accounts. Bhattacharya et al. (2020) develop a general theoretical model illustrating how this fixed cost channel impacts the market for financial advice. While we do not directly observe the wealth of individual variable annuity investors, we exploit variation in minimum purchase thresholds across variable annuities to examine whether smaller investor accounts were differentially impacted by the fiduciary rule.

Variable annuities have different minimum purchase thresholds that specify the minimum amount of premium payments that an investor must invest in the product. As such, the thresholds are a way to differentiate investors by the amount of funds to invest, as investors with lower funds to invest may not be able to purchase variable annuities with higher minimum purchase thresholds. Variable annuities differ widely in their minimum purchase thresholds. The median minimum threshold on purchases across all products is $10,000 and ranges from $0 (no minimum purchase) to $1 million. Minimum purchase thresholds also differ significantly both across insurers and across products offered by the same insurer: the identity of the insurance company explains only 23% of the variation in minimum purchase thresholds.

We extend our baseline sales regressions (eq. 1) to examine how the sales of variable annuities changed surrounding the proposed rule change:

$$\ln(Sales_{jkt}) = \alpha f_{jkt} + \gamma c_{jkt} + \lambda MinAmt_{jkt} + \psi MinAmt_{jkt} \times DOL_t + \beta X_{jkt} + \mu_t + \mu_k + \epsilon_{jkt}. \quad (6)$$

Observations are at the product-by-quarter level over the period 2013-2020Q2. The variable $MinAmt_{jkt}$ measures the minimum purchase threshold for product j issued by insurer k at time t. The coefficient of interest is ψ which measures how the relationship between sales and minimum account sizes changed surrounding the DOL rule proposal.

Table 9 displays the corresponding estimates. We find some evidence that annuities with larger minimum purchase thresholds have lower sales. The results in column (2) indicate that a 1% increase in the minimum purchase threshold is associated with a 14% decrease in annuity sales.

Importantly, we do not find any evidence suggesting that the relationship between annuity sales and minimum purchase thresholds changed surrounding the DOL rule proposal. However, one limitation to this analysis is that we do not observe the quantity purchased at the transaction level, so the quantity purchased by each individual investor could still be affected by the DOL rule differentially across minimum purchase thresholds.[29] Overall, the results suggest that the DOL rule proposal did not disproportionately hurt smaller investors and force them out of the market.

6 Model of Variable Annuity Distribution and Estimates of the Change in Investor Surplus around the DOL Rule

In Section 5 we document the positive implications of the DOL proposal: the proposal was associated with a decrease in high-expense variable annuity sales and a decrease in the availability of high-expense variable annuities. In this section, we develop and estimate a model of variable annuity distribution that allows us to assess the normative implications for investors. An advantage in our setting is that we directly observe the alternative equilibrium we are interested in from the data. The objective of the model is to develop a simple demand framework that allows us to quantify the observed effects rather than to solve for a new equilibrium.[30]

6.1 Demand Framework

We model an investor's annuity investment decision as a discrete choice problem. Each investor wishes to invest a fixed amount of money in an annuity, and, with the aid of a broker, purchases one of the available annuities. Our framework is similar to the demand model used in Koijen and Yogo (2021). The key feature of our demand framework is that investors access the annuity market through brokers such that the total demand for variable annuities is jointly determined by the preferences of brokers and investors.

[29] Additionally, while we do not find evidence that the relationship between annuity sales and minimum purchase thresholds changed, one might expect that to the extent that the DOL rule raised the fixed cost of selling variable annuities, firms would raise their minimum purchase quantity amounts in response to the DOL rule. To examine this, we plot how the average minimum purchase thresholds changed around the issuance of the DOL rule in Figure A8. The results indicate that minimum purchase thresholds increased slightly in 2018-2020, however the increase is not statistically significant.

[30] In Online Appendix E we explicitly model the supply-side of the variable annuity market and use our demand estimates to infer insurer's marginal costs of creating variable annuities. Our estimates imply that the average markup insurers earn on a variable annuity is 0.80% of AUM per annum.

Investors: Investors value variable annuities based on their expenses and characteristics. The indirect utility of investor i purchasing product j is given by

$$u_{ij} = -f_j + X_j'\beta + \xi_j + \varepsilon_{ij}. \tag{7}$$

Without any loss in generality, we normalize investors' preferences with respect to expenses f_j to -1 such that the other preference parameters are in terms of annual return. The term X_j is a vector of variable annuity characteristics, such as the subaccount options and available riders, as accounted for in our baseline empirical analysis in Section 4.1, and β reflects how investors value these characteristics. The term ξ_j captures unobserved product characteristics/demand shocks associated with product j. Lastly, the term ε_{ij} is an investor-specific demand shock for product j, which introduces investor-specific heterogeneity in the model such that variable annuities are horizontally differentiated.[31]

Brokers: Each investor i accesses the market for variable annuities through a broker b. Brokers earn commissions c_j for selling annuity j and incur a broker-investor-annuity-specific cost η_{bj} for selling the variable annuity such that the profit associated with selling variable annuity j is:

$$\pi_{bij} = c_j - \eta_{bij}.$$

Following Robles-Garcia (2019), we assume that brokers maximize the joint surplus of investors and brokers. The broker's indirect utility ν_{bij} of selling annuity j to investor i is then a weighted function of the investor's utility and brokerage commissions:

$$\nu_{bij} = \omega(\pi_{bij}) + (1-\omega)(u_{ij}).$$

The term ω captures the weighting brokers place on their own financial incentives (commissions) versus the financial incentives/preferences of investors.

Each broker selects annuity j from the set of available annuities $\mathcal{J}$ that maximizes the broker's

[31] While we model investor utility quasi-linearly, a richer non-linear utility specification would be able to more fully account for investor beliefs and preferences and would be an interesting path for future research. In our estimations, we non-parametrically account for roll-up rates and other riders in the vector of annuity characteristics.

indirect utility:

$$\max_{j \in \mathcal{J}} \nu_{bij}.$$

As is standard in the demand estimation literature, we assume that the broker- and investor-specific unobserved component of the utility function $\zeta_{bij} = -\omega\eta_{bij} + (1-\omega)\varepsilon_{ij}$ scaled by σ is distributed Type-1 Extreme Value (i.e. $\frac{1}{\sigma}\zeta_{bij} \sim T1EV$). Under this assumption, the market share of annuity j has the standard multinomial logit form:

$$s_j = \frac{\exp\left(\frac{\omega}{\sigma}(c_j) + \frac{(1-\omega)}{\sigma}(-f_j + X_j'\beta + \xi_j)\right)}{\sum_{l \in \mathcal{J}} \exp\left(\frac{\omega}{\sigma}(c_l) + \frac{(1-\omega)}{\sigma}(-f_l + X_l'\beta + \xi_l)\right)}. \tag{8}$$

The above share equation is the heart of our estimation strategy as described below.

6.2 Estimation and Results

Our estimation strategy follows closely that of Berry (1994). Following eq. (8), we can write the log market share of product j at time t as:

$$\ln(s_{jt}) = \frac{\omega}{\sigma}(c_{jt}) + \frac{(1-\omega)}{\sigma}(-f_{jt} + X_{jt}'\beta + \xi_{jt}) - \ln\left(\sum_{l \in \mathcal{J}} \exp\left(\frac{\omega}{\sigma}(c_{lt}) + \frac{(1-\omega)}{\sigma}(-f_{lt} + X_{lt}'\beta + \xi_{lt})\right)\right),$$

which we can estimate in a regression framework as:

$$\ln(s_{jt}) = \underbrace{\gamma_1}_{\frac{\omega}{\sigma}} c_{jt} + \underbrace{\gamma_2}_{-\frac{(1-\omega)}{\sigma}} f_{jt} + X_{jt}' \underbrace{\Gamma}_{\frac{(1-\omega)}{\sigma}\beta} + \underbrace{\mu_t}_{\ln\left(\sum_{l \in \mathcal{J}} \exp\left(\frac{\omega}{\sigma}(c_{lt}) + \frac{(1-\omega)}{\sigma}(-f_{lt} + X_{lt}'\beta + \xi_{lt})\right)\right)} + \underbrace{\upsilon_{jt}}_{\frac{(1-\omega)}{\sigma}\xi_{jt}}, \tag{9}$$

where we define market shares at the year-quarter level. Using the estimated linear parameters γ_1, γ_2, and Γ, we can solve for the structural parameters of interest ω, σ, and β. We include time fixed effects μ_t to absorb the nonlinear term $\ln\left(\sum_{l \in \mathcal{J}} \exp\left(\frac{\omega}{\sigma}(c_{lt}) + \frac{(1-\omega)}{\sigma}(-f_{lt} + X_{lt}'\beta + \xi_{lt})\right)\right)$, which allows us to estimate the model with a simple linear regression. It is also worth noting that, because we include time fixed effects, we do not need to specify the outside good or need to observe an investors' full consideration set $\mathcal{J}$.[32]

As described in Section 4.1, a common challenge in the demand estimation literature is that

[32] While the outside option does not matter for estimating the main model parameters, it does matter for the welfare estimation. We discuss our choice of the outside good in Section 6.3.

expenses/prices are endogenous in eq. (9). If an insurance company observes its demand shock ξ_{jt} prior to setting product expense ratios (commissions), then expenses (commissions) will be endogenous. In general, the expenses and commissions associated with variable annuities appear relatively sticky in the data and are infrequently updated, which helps mitigate the endogeneity concerns. Nonetheless, we address the endogeneity of expenses and commissions using our instruments as described previously.

We estimate our simple demand framework using our variable annuity data set as described in Section 3. For estimation purposes, we define the market for annuities as total variable and fixed indexed annuity sales at the year-quarter level. We supplement our variable annuities data set with data on aggregate fixed indexed annuity sales from the Insurance Information Institute. To avoid conflating issues with the DOL rule issuance and because our primary objective is to estimate the utility parameters of the investor, we estimate the model over three periods: the full sample, prior to 2016, and post 2016 (inclusive of 2016).

We parameterize the investor's utility function corresponding to eq. (7). We control for the same set of variable annuity characteristics X_{jt} as in our main analysis in Section 4.1 which includes the types of benefits offered, subaccount characteristics, etc. We also include insurer-by-year fixed effects to capture investor preferences for different insurers. As of 2016, there were 317 different fixed index annuities open for sale.[33] We treat these fixed index annuities as a homogeneous product and normalize their utility equal to zero.

We present our estimates in Table 10. The columns correspond to different samples and estimation procedures. Columns (1)-(3) correspond to the full sample, columns (4)-(6) correspond to the pre-2016 sample, and columns (7)-(8) correspond to the post-2016 sample. We estimate the model using OLS in columns (1), (4), and (7) and estimate the model using our two sets of instrumental variables in the other columns. We report the estimates corresponding to the reduced-form parameters (γ_1, γ_2) in the top half of Table 10 and report the corresponding structural parameters (ω, σ) below. Consistent with our prior estimates, we find that demand for variable annuities is increasing in brokerage commissions $(\gamma_1 > 0)$ and is decreasing in expenses $(\gamma_2 < 0)$. As expected, we find that our OLS estimates of γ_1 and γ_2 understate how responsive sales are to expenses and

[33] See: `https://www.dolfiduciaryrule.com/portalresource/NAFAvDOL2016-08-10ECF33JtAppendix-Pt3B.PDF` [accessed 7/30/2020]

commissions. Using the instrumental variables, the estimate of γ_1 becomes more positive and that of γ_2 becomes more negative. Also consistent with our previous results, we find that demand became more sensitive to expenses after the DOL rule proposal such that the expense-sensitivity of investors effectively quadrupled after the proposal (column 4 vs. column 7).

In the bottom half of Table 10 we report the corresponding structural parameters. We estimate that prior to 2016, $\omega = 0.34$ (column 4), which implies that brokers behave as if they are willing to trade-off a one percentage point increase in commissions relative to the amount invested, with a 4.4 percentage point decrease in the NPV of the variable annuity.[34] These results suggest that sales are more than four times as sensitive to brokers' own incentives as to those of investors. Our estimates in columns (7) and (9) suggest that after 2016, brokers increased the weight they put on investor incentives. The results indicate that after 2016, brokers behaved as if they were willing to trade-off a one percentage point increase in commissions with a 1.9 percentage point decrease in investor NPV (column 7). Interestingly, the variance of the error term (σ) fell following the DOL rule across all specifications, which suggests that brokers became more careful in selecting the products they sold to consumers and placed greater weight on observable product characteristics. One interpretation of the DOL rule is that it was more about making brokers more conscientious, which increased the weight they put on investor incentives.

These estimates reinforce our earlier findings that (i) variable annuity sales respond to both brokers' and investors' incentives, (ii) sales are more sensitive to brokers' financial incentives than those of their clients, and (iii) following the 2016 DOL rule brokers increased the weight they put on investor incentives. The structural estimates also allow us to quantify how investor surplus changed as a result of the DOL proposal, which we explore in the next section.

[34] In the context of our framework, brokers are willing to trade off a one percentage point increase in commissions with a $\frac{\omega}{1-\omega}$ percentage point increase in annual expenses. Assuming that a variable annuity is outstanding for 15 years and an 8% discount rate, the NPV of a one percentage decrease in expenses in rates is 8.56. Consequently, our estimates suggest that brokers are willing to trade off a one percentage point increase in commissions with a $\frac{\omega}{(1-\omega)} \times 8.56$ percentage point decrease in investor NPV.

6.3 Changes in Investor Surplus around the Proposed DOL Rule Change

We use our parameter estimates to calculate how investor surplus changed surrounding the proposed DOL rule change. We calculate utility as

$$\hat{u}_{jt} = -f_{jt} + X'_{jt}\hat{\beta} + \hat{\xi}_{j,2016Q1}. \quad (10)$$

Because the coefficient with respect to annual expenses is normalized to -1, we can interpret estimated utility in terms of risk-adjusted annual returns. A couple of features of our estimated utility merit further discussion. First, we use the utility parameter estimates $\hat{\beta}$ in the pre-2016 period.[35] Second, we do not include the investor-specific demand shock, ε_{ijt} , in our utility formulation. Instead, we treat the investor-specific demand shock as an error term rather than utility as is often commonly done in the literature.[36] Lastly, we need to calculate the unobserved component of utility, $\xi_{jt} = \frac{\sigma}{1-\omega}\left(\ln(s_{jt}) - \ln s_{0t} - (c_{jt} - c_{0t})\frac{\omega}{\sigma}\right) - (-f_{jt} + X'_{jt}\hat{\beta})$. The term ξ_{jt} measures the unobservable component of the utility of product j relative to the utility of the outside good (fixed indexed annuities). Using data on fixed indexed annuity sales, we observe that, at around the time the DOL rule was issued (2016Q1), there were 317 fixed indexed annuities outstanding that paid an average commission of 5.5% and had average quarterly sales of $50m. We use this average sales and commissions data to calculate the unobserved component of utility as of 2016, and assume that the average unobserved component of utility remains constant over time. By keeping the unobserved product quality constant over time, our welfare analysis focuses on how the observable characteristics change in response to the DOL rule and how these changes impact investor surplus.

Figure 11 displays how the average annuity investor's risk-adjusted return has changed over time. Because of its arbitrary level, we normalize the risk-adjusted return in 2013 to 1.00% in the figure. The figure shows that after the regulation was announced in early 2015, there was a sharp increase in risk-adjusted returns which continued to increase through 2018. The results indicate that investor risk-adjusted returns were roughly 0.3pp higher in 2018 relative to the pre-DOL period. Investors moving towards lower-expense products accounted for roughly two-thirds of the

[35]We compute utility using average sub-account alphas within a variable annuity across the whole period to avoid conflating the effects of the DOL rule with the performance of variable annuity subaccounts.

[36]This is because (a) presumably investors make some idiosyncratic mistakes when choosing annuities and (b) the variance of the investor-specific error term is not separately identified from the investor-broker-specific error term η_{ij}.

increase in risk-adjusted returns. As referenced previously, Figure 9b shows how the average expense paid by variable annuity investors fell by roughly 20bps following the DOL rule change. The remainder of the change in risk-adjusted returns comes from investors purchasing annuities with more desirable investment options and observable characteristics from the investor's perspective. Our estimates suggest that a large portion of the welfare gain also comes from investors switching from variable annuities to fixed indexed annuities, which we find that consumers prefer relative to the average variable annuity. Over the period 2015Q1 through 2019Q1, the market share of fixed indexed annuities almost doubled from 27% to 47%.

One thing omitted from our analysis is the fact that total annuity sales (fixed indexed and variable) declined by 5% in the years following the DOL rule. Without taking a strong stance on where these 5% of annuity funds flow to, it is difficult to calculate the overall change in investor surplus. To address this issue, we calculate the lower bound $\Delta \underline{r}$, which indicates how much lower the risk-adjusted returns of those 5% of investors who no longer purchase annuities would need to be such that investors are, on average, equally well off after the rule change. Given that the risk-adjusted return of those 95% of investors who purchased annuities after the DOL rule increased by around 0.3pp, this implies that $\Delta \underline{r} = \frac{95\% \times 0.3pp}{5\%} \approx 5.7pp$. These results suggest that the DOL rule change increased investor surplus, as long as the risk-adjusted returns of those 5% of investors who did not purchase annuities after the rule change did not fall by more than 5.7pp. Even just focusing on the changes in expenses alone, our results suggest that the DOL rule change increased investor surplus as long as the risk-adjusted returns of those 5% of investors who did not purchase annuities after the rule change did not fall by more than 3.8pp ($\approx \frac{95\% \times 0.20pp}{5\%}$).

One caveat in this analysis is that our welfare estimates are based on changes observed only in the annuities market. As such, there could have been changes that occurred in other markets as a result of the DOL rule that decreased overall investor welfare. For example, brokers could have increased prices for other products. While we do not observe data that can rule out this story directly, there are some practical and legal reasons why it is unlikely. First, if brokers were able to increase the price of other products in the post-DOL period, it is not obvious why they would not have done so in the pre-period. Second, while the general rationale for such behavior would be due to bundling across different types of products, it is illegal in this setting for brokers to bundle the sales of variable annuities with other investment advice as per the Investment Advisers Act of

1940.

In summary, we find that the DOL rule had relatively large effects in terms of the composition and total amount of annuity sales. Given that enforcement of the DOL rule was delayed and the rule was never fully implemented, our results may reflect a lower bound on how the market would respond to a fiduciary standard. Regardless, consistent with anecdotal evidence from insurers' and brokers' annual reports, our results indicate that the DOL rule had a substantial and persistent impact on the behavior of brokers and insurers in annuity markets.

7 Conclusion

We examine how household investments in variable annuities are driven by both household and broker incentives, and how the DOL fiduciary rule proposal changed these dynamics. Our paper has two main sets of results. First, we find that sales are higher for variable annuities with high broker commission rates and lower for products with high expenses, after controlling for a wide range of variable annuity product characteristics. Moreover, we find evidence of conflicts of interest where brokers are incentivized to sell higher-expense products that are plausibly worse for investors. We also find that high expenses are positively correlated with more complaints against associated brokers and more frequent broker misconduct, suggesting that high-expense products are indeed ex post less desirable to investors.

Second, we find that the DOL fiduciary rule had a large impact on broker and insurer behavior. Following the proposal, variable annuity sales declined by 19%. The decline in annuity sales was primarily driven by a decline in high-expense variable annuity sales. Sales of high-expense annuities fell by 43% more than low-expense annuities. Insurers also decreased the relative availability of high-expense products. The DOL fiduciary rule was effective in shifting the incentives of brokers and insurers and resulted in a 10% decline in average expenses paid by investors.

In addition to documenting how the market for variable annuities changed following the proposed fiduciary rule, we develop and estimate a structural model of variable annuity demand that allows us to quantify how the rule change impacted investor surplus. In response to the rule, we find that brokers more than doubled the weight they put on maximizing investor returns when selling annuities. We find that the rule change increased investors' risk-adjusted returns by up to around 0.3pp. Even after accounting for the decline in annuity sales and under conservative assumptions, our results suggest that investors, on average, benefited from the fiduciary rule. These results suggest that the proposed rule change helped mitigate conflicts of interest between brokers and investors. Given that enforcement of the rule was limited and that the rule was ultimately vacated, our estimates may understate the impacts of fiduciary duty, and the long-term effects of the fiduciary policy remains a topic for future research. However, the DOL proposal provides a unique opportunity to study the effect of such a policy attempt, which can shed light on the effectiveness of related policies proposed since 2018 by various states and in 2019 by the Securities and Exchange Commission, as well as future policy efforts.

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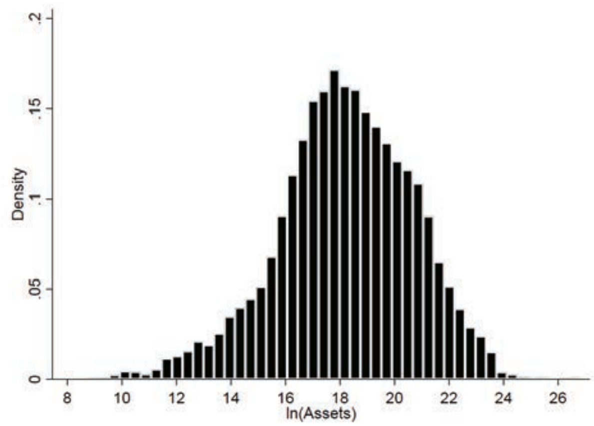
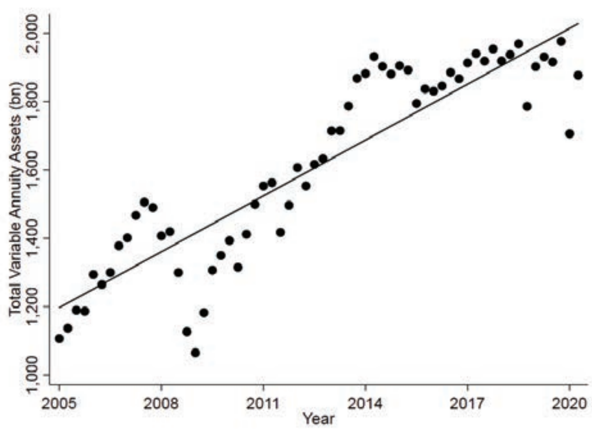
Figures and Tables

Figure 1: Variable Annuity Assets

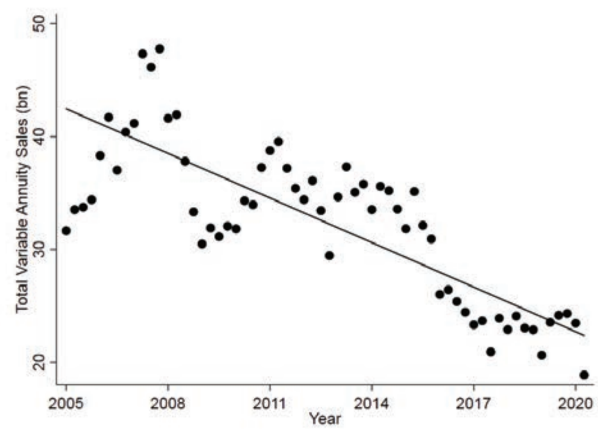
(a) Distribution of Variable Annuity Assets



(b) Total Variable Annuity Assets

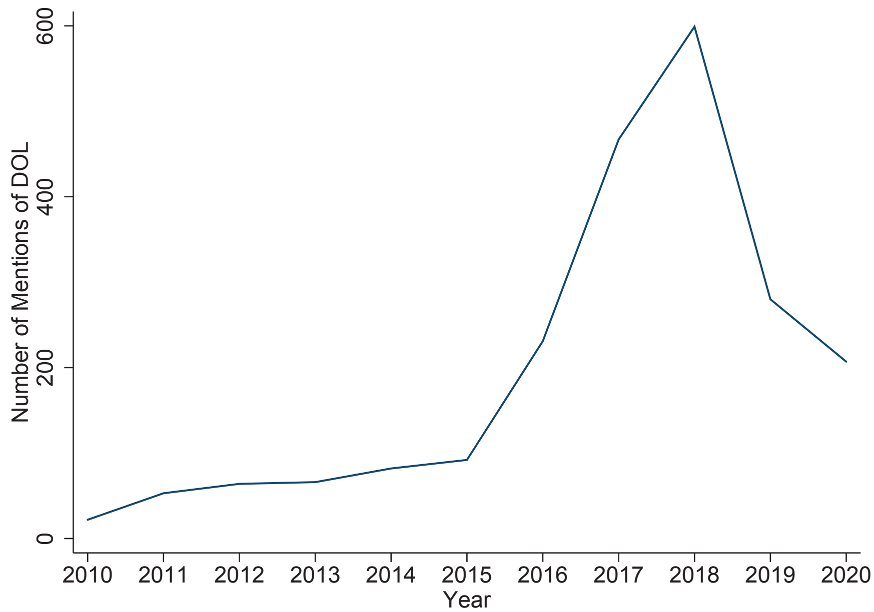


(c) Variable Annuity Sales



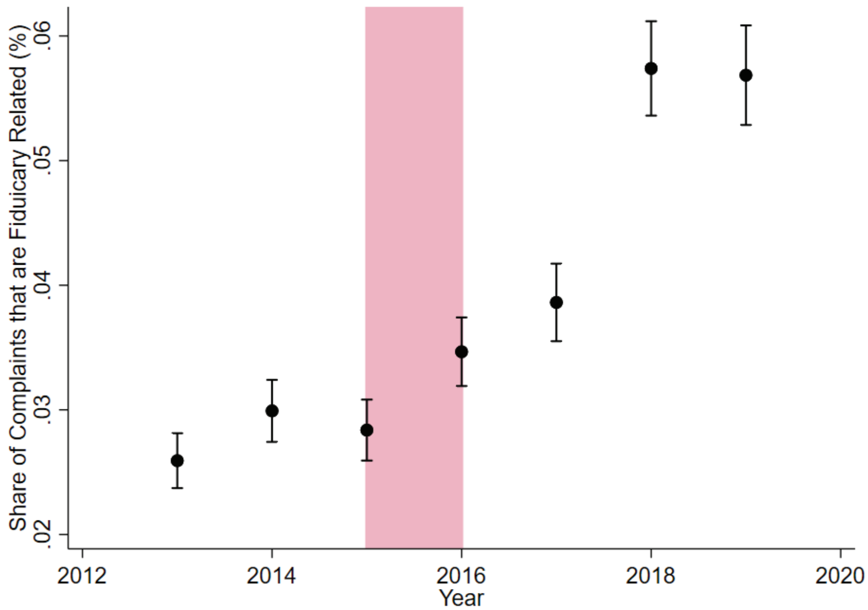
Note: Figure 1a displays the distribution of variable annuity assets. Observations are at the variable annuity by quarter level over the period 2005-2020Q2.
Figure 1b displays a scatter plot of total variable annuity assets over the period 2005-2020Q2.
Figure 1c displays a scatter plot of quarterly variable annuity sales over the period 2005-2020Q2.

Figure 2: Number of Mentions of “Department of Labor” in Insurers’ and Brokers’ 10ks



Note: Figure 2 displays the number of mentions of the words “DOL” and “Department of Labor” in insurers’ and brokers’ 10k filings since 2010. The horizontal axis represents the year of the 10k filings. We restrict 10k filings to those that mention either "annuity" or "annuities".

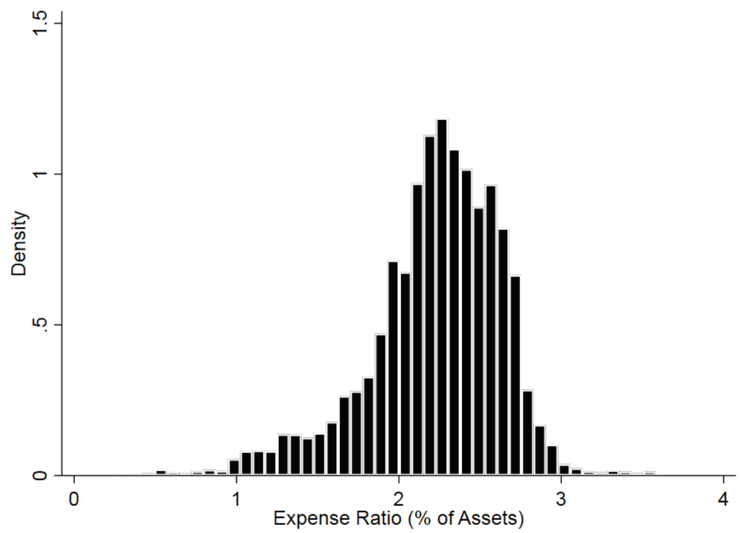
Figure 3: Fiduciary-Duty-Related Complaints



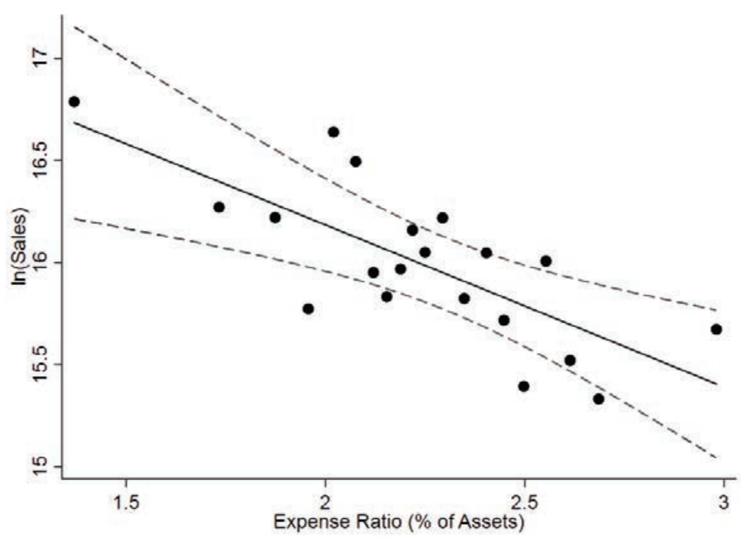
Note: Figure 3 displays the share of all broker customer complaints that are related to the broker allegedly violating his/her fiduciary duty, expressed as percentage points. The figure is constructed using data on the universe of investor complaints in the United States from FINRA's BrokerCheck website. Error bars correspond to the 95% confidence intervals.

Figure 4: Variable Annuity Expense Ratios

(a) Distribution of Variable Annuity Expense Ratios



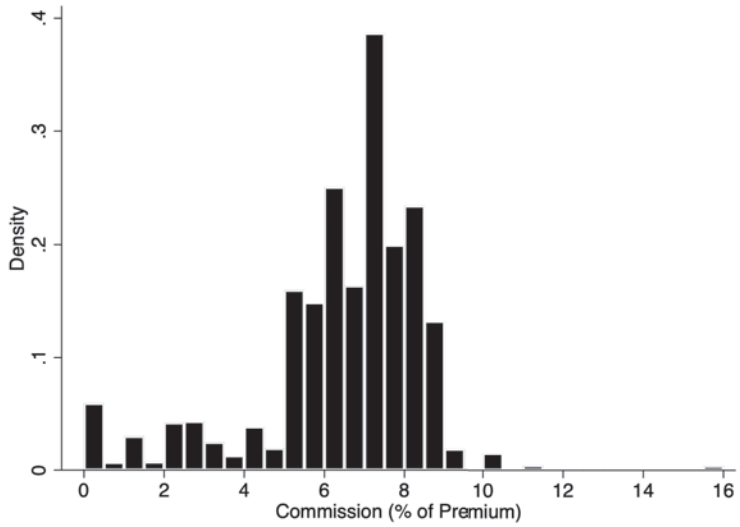
(b) Sales vs. Expense Ratios



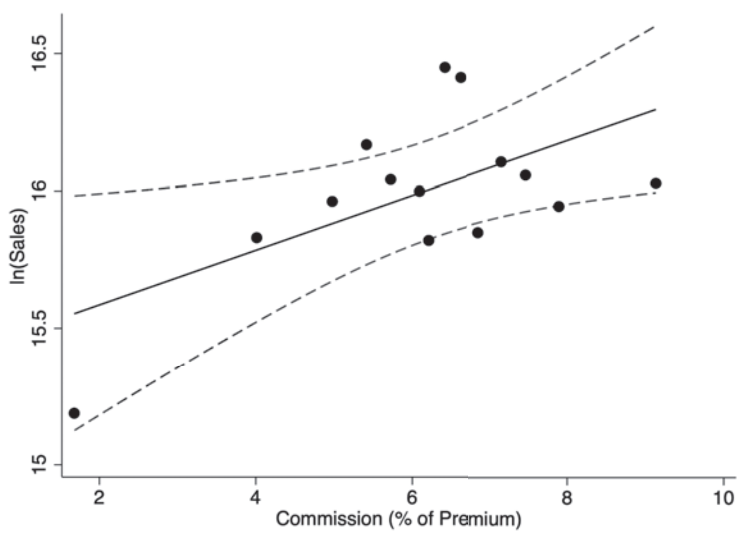
Note: Figure 4a displays the distribution of variable annuity expense ratios. Observations are at the variable annuity by quarter level over the period 2005-2020Q2. Figure 4b displays a binned scatter plot of quarterly variable annuity sales versus the average variable annuity expense ratios, controlling for commission rates. Observations are at the variable annuity by quarter level over the period 2005-2020Q2. The solid line plots the estimated linear relationship and the dashed lines correspond the 95% confidence interval with standard errors clustered at the variable annuity level.

Figure 5: Variable Annuity Commissions

(a) Distribution of Variable Annuity Commissions



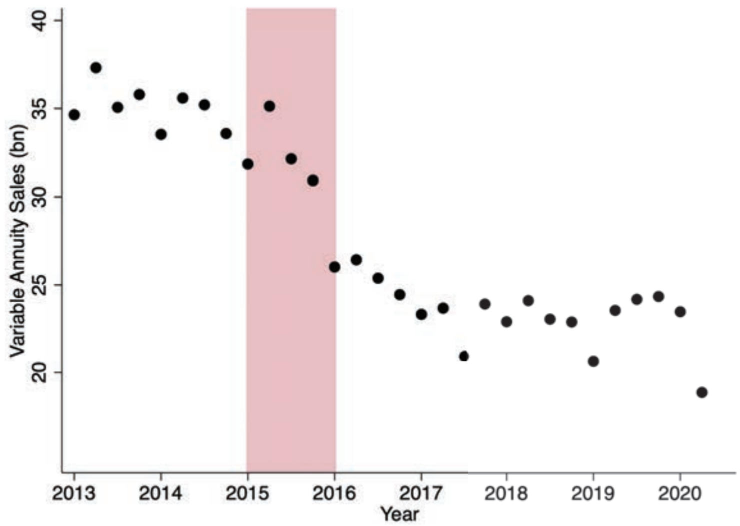
(b) Sales vs. Commissions



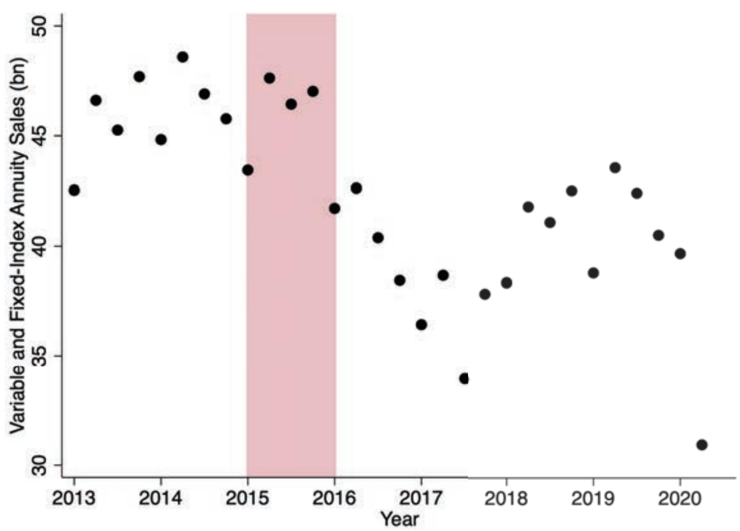
Note: Figure 5a displays the distribution of variable annuity commissions. Observations are at the variable annuity by quarter level over the period 2005-2020Q2. Figure 5b displays a binned scatter plot of quarterly variable annuity sales versus the associated variable annuity commission, controlling for product expense ratios. Observations are at the variable annuity by quarter level over the period 2005-2020Q2. The solid line plots the estimated linear relationship and the dashed lines correspond the 95% confidence interval with standard errors clustered at the variable annuity level.

Figure 6: Annuity Sales Around the DOL Fiduciary Rule

(a) Variable Annuity Sales

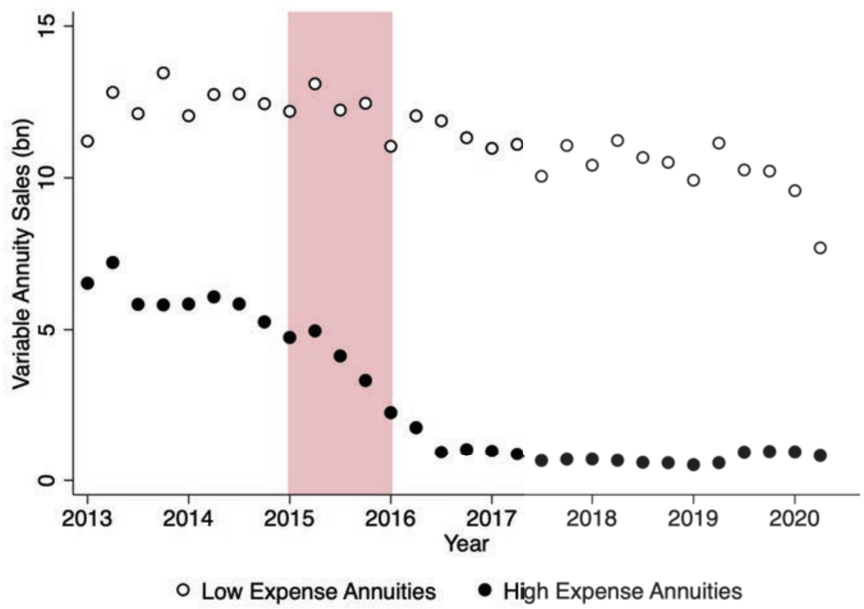


(b) Variable Annuity and Fixed Indexed Annuity Sales



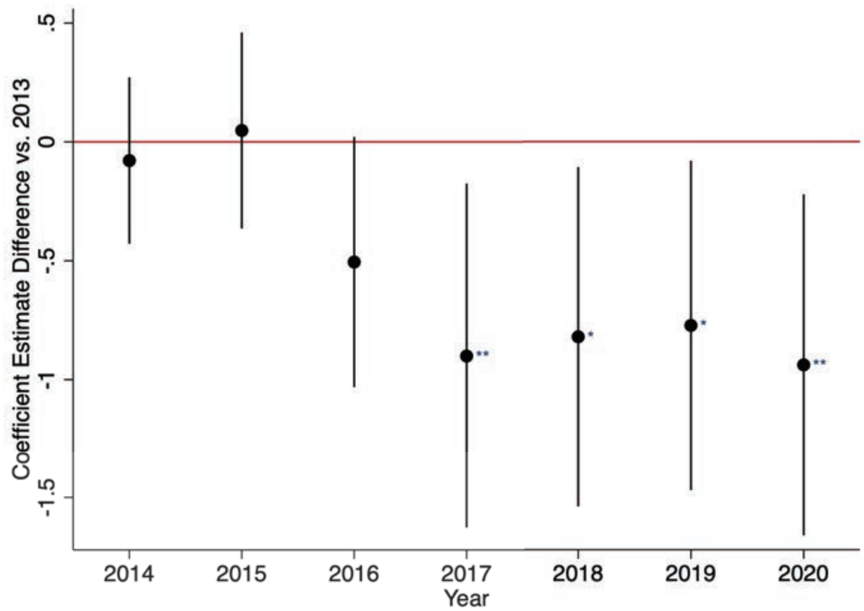
Note: Figure 6a displays the time series of quarterly sales of variable annuities around the DOL fiduciary rule. Figure 6b displays the time series of quarterly sales of variable and fixed index annuities around the DOL fiduciary rule.

Figure 7: Sales around DOL Fiduciary Rule by High vs. Low Expense Ratios



Note: Figure 7 displays the time series of quarterly variable annuity sales around the DOL fiduciary rule by expense ratios. High-expense variable annuities are defined as those with expense ratios that are in the top quartile of all variable annuities offered as of 2013Q1. Low-expense variable annuities are defined as those with expense ratios that are in the bottom quartile of all variable annuities offered as of 2013Q1.

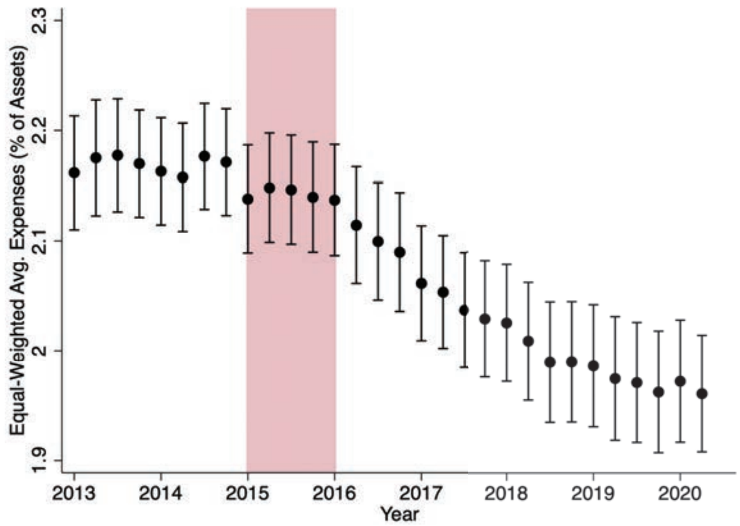
Figure 8: Sales Expense Sensitivity by Year



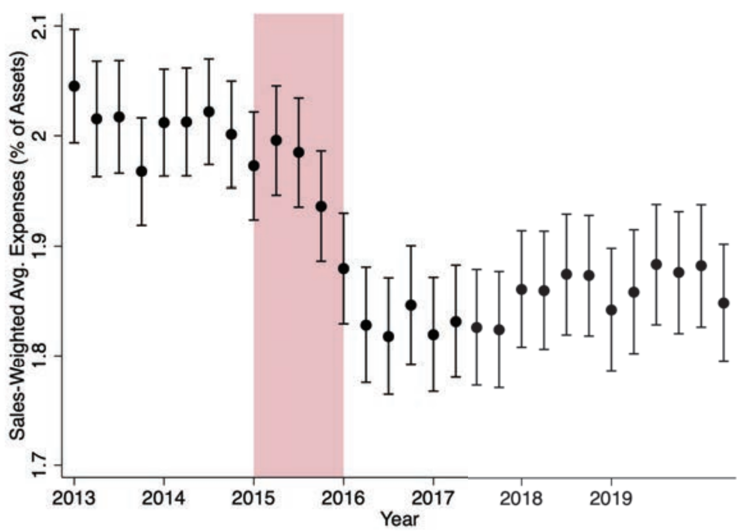
Note: Figure 8 displays the coefficient estimates of the sales expense ratio sensitivity for each year s, α_s, relative to 2013 with a regression specification mirroring column (5) of Table 8 where we allow α to vary yearly. Observations are at the variable annuity by quarter level over the period 2013-2020. Error bars correspond to the 90% confidence intervals with standard errors clustered by variable annuity. *** p<0.01, ** p<0.05, * p<0.10.

Figure 9: Average Expense Ratios around DOL

(a) Equal-Weighted Average Expense Ratios around DOL



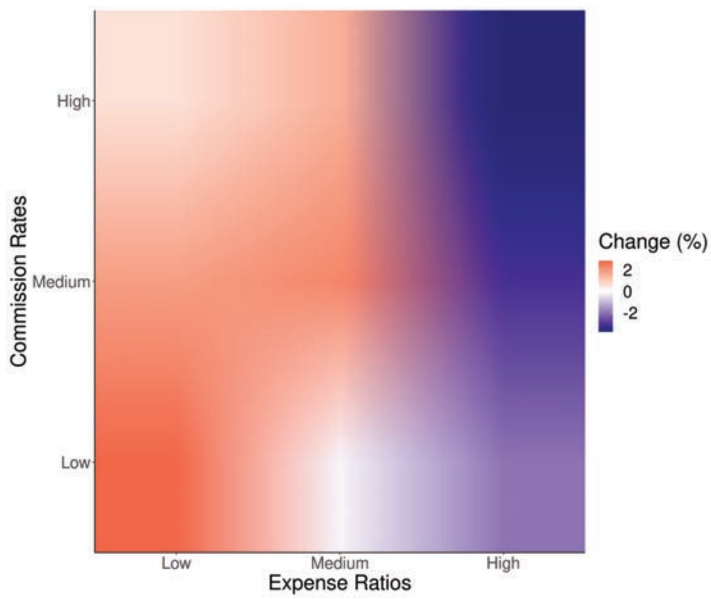
(b) Sales-Weighted Average Expense Ratios around DOL



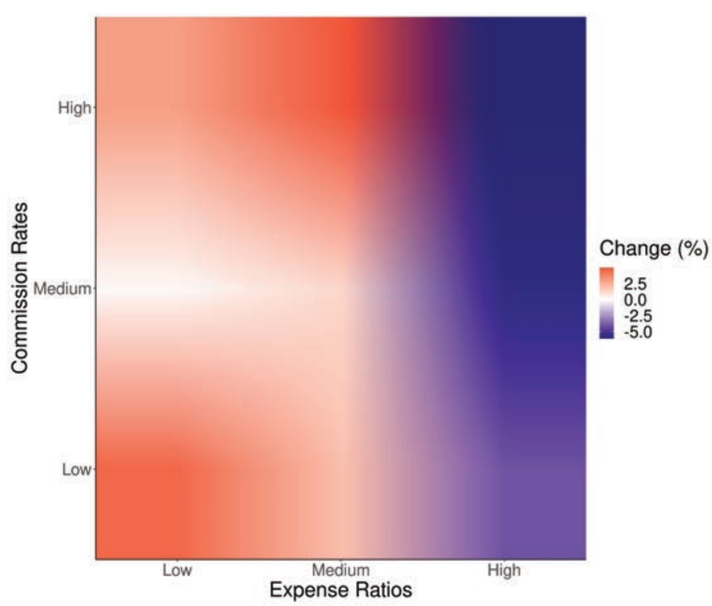
Note: Figure 9a displays the time series of the equal-weighted average expense ratios of open variable annuity products around the DOL fiduciary rule. Figure 9b displays the sales-weighted average expense ratios. Error bars correspond to the 95% confidence intervals.

Figure 10: Product Market Composition Change around DOL

(a) Changes in Number of Products Offered

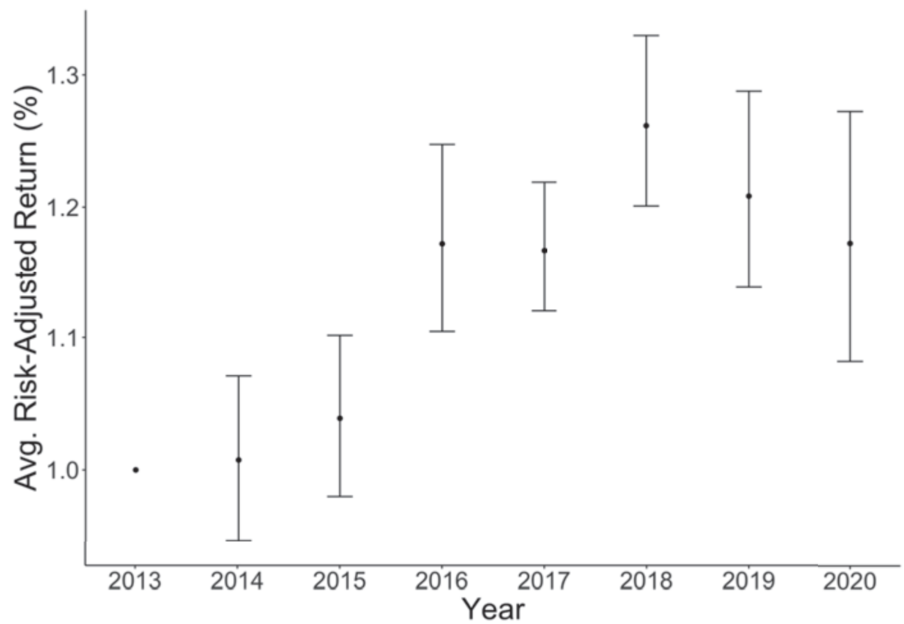


(b) Changes in Sales Volumes around DOL



Note: Figures 10a and 10b plot the changes in the number of products available for sale and the market shares in the time period before (2013-2015) and after (2016-2020Q2) the issuance of the DOL fiduciary rule by commission rates and expense ratios. Number of products available for sale is defined as the total number of variable annuity products available for sale in each of the nine equally-spaced regions of the product space, where the expense ratio and commission rate cutoffs for each region are based on the 2013-2015 (pre-DOL) product space distribution, so the plot presents changes in each product space post-DOL relative to the pre-DOL levels of the same product space. Changes are expressed as percentages of the pre-DOL levels. Increases are represented in red, decreases are represented in blue, and no change is represented in white.

Figure 11: Changes in Investor Risk-Adjusted Returns Surrounding the DOL Proposal



Note: Figure 11 displays how average annuity investor surplus, measured in terms of risk-adjusted returns, changed surrounding the Department of Labor fiduciary rule. We calculate the change in investor surplus using the parameter estimates reported in column (5) of Table 10. We calculate the average annuity investor surplus among those investors who purchased annuities. To account for the fact that the change in investor surplus is constructed from estimated utility parameters, we construct 90% confidence intervals via bootstrap where we draw 1,000 sets of parameters from the estimated parameter distribution (column 5 of Table 10) and recompute the change in investor surplus.

Table 1: Summary Statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Quarter Sales (Millions)	16,156	94.5	284	0.00015	4,011
Policy Assets (Millions)	16,156	3,019	21,549	0	439,012
Captive Sales (Millions)	16,156	32.7	208	0	4,011
Non-Captive Sales (Millions)	16,156	49.0	163	0	3,005
Expense Ratios	16,156	2.23	0.44	0.25	4.20
Num. Subaccounts	16,156	97.2	55.7	1	535
Num. Objectives	16,156	16.9	5.14	1	33
Average Alpha	16,156	-0.098	0.20	-1.52	1.23
Commissions	16,156	6.06	2.36	0	16

Note: Table 1 displays the summary statistics corresponding to the variable annuity database. Observations are at the variable annuity by quarter level over the period 2005Q1-2020Q2. Expense Ratios, Average Alpha, and Commissions are measured in percentage points. Expense Ratios include both product-level expenses (M&E, administrative, and distribution charges) and average subaccount expenses. Num. Subaccounts is the number of subaccounts that are open for investment for each variable annuity each quarter. Num. Objectives is the number of distinct investment objectives across all subaccounts that are open for investment for each variable annuity each quarter. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Commissions are upfront commission rates as discussed in Section 2.1.

Table 2: Variable Annuities Sales

VARIABLES	(1) ln(Sales)	(2) ln(Sales)	(3) ln(Sales)	(4) ln(Sales)	(5) ln(Sales)
Expense Ratios (α)	-0.79***	-0.83***	-1.11***	-0.52***	-0.42**
	(0.24)	(0.24)	(0.26)	(0.19)	(0.21)
Commissions (γ)	0.100**	0.098**	0.092**	0.16***	0.18***
	(0.043)	(0.044)	(0.046)	(0.041)	(0.043)
Roll-Up Rate Fee			-0.75*	-0.69*	-1.00*
			(0.44)	(0.41)	(0.57)
Num. Subaccounts			0.0069***	0.011***	0.0098***
			(0.0025)	(0.0027)	(0.0030)
Num. Objectives			0.0057	0.025	0.043
			(0.029)	(0.033)	(0.037)
Long Lock-Up			0.59***	0.61***	0.55***
			(0.21)	(0.18)	(0.19)
Average Alpha			1.52***	2.23***	2.56***
			(0.52)	(0.43)	(0.57)
Observations	17,259	17,259	16,147	16,147	15,644
R-squared	0.017	0.039	0.134	0.380	0.462
Time FEs		X	X	X	X
Other Controls			X	X	X
Insurer FEs				X	
Insurer-Time FEs					X

Note: Table 2 displays the results corresponding to a linear regression model (eq. 1). Observations are at the variable annuity by quarter level. The dependent variable is log variable annuity sales. The independent variables Expense Ratios, Commissions, Average Alpha, and Roll-Up Rate Fee are measured in percentage points. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. Long Lock-Up is a dummy variable indicating that the product has an above the median lock-up period. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, and roll-up rate fixed effects (i.e., a fixed effect for each roll rate). Standard errors are clustered at the variable annuity level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table 3: Variable Annuities Sales across Share Classes

VARIABLES	(1) ln(Sales)	(2) ln(Sales)
Expense Ratios (α)	-3.26***	-3.28***
	(0.28)	(0.28)
Commissions (γ)	0.13***	0.14***
	(0.041)	(0.041)
Long Lock-Up		0.27
		(0.20)
Observations	681	681
R-squared	0.751	0.752
Product Set-Quarter FEs	X	X

Note: Table 3 displays the results corresponding to a linear regression model (eq. 1) across share classes of the same product set. The dependent variable is the log quarterly sales of each share class. Observations are at the share class by quarter level. A product set is defined as the set of all share classes of the same product. The independent variables Expense Ratios and Commissions are measured in percentage points. Long Lock-Up is a dummy variable indicating that the product has an above the median lock-up period. Standard errors are clustered at the product set level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table 4: Variable Annuities Sales - Instrumental Variables

VARIABLES	(1) ln(Sales)	(2) ln(Sales)	(3) ln(Sales)	(4) ln(Sales)
Commissions	0.19***	0.18	0.17***	0.50***
	(0.042)	(0.15)	(0.055)	(0.12)
Expense Ratios	-0.55**	-1.03	-0.89***	-2.88***
	(0.22)	(0.75)	(0.26)	(1.09)
Observations	13,528	13,528	9,377	9,377
R-squared	0.123		0.418	
Time FEs	X	X	X	X
Other Controls	X	X	X	X
Insurer-Time FEs			X	X
OLS	X		X	
IV-1		X		
IV-2				X

Note: Table 4 displays the instrumental variable results corresponding to a linear regression model (eq. 1). Observations are at the variable annuity by quarter level. The dependent variable is log variable annuity sales. The independent variables Expense Ratios and Commissions are measured in percentage points. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e., a fixed effect for each roll rate), whether the product has an above the median lock-up period, Average Alpha, and Roll-Up Rate Fee. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. Following Koijen and Yogo (2021), in column (1), we also control for AM Best Rating by converting the rating to a cardinal rating measure, with 0 coded for ratings D or worse or not-rated and 175 for A++ based on AM Best's risk-based capital guidelines. IV-1 and IV-2 denote estimation using each of the two sets of instrumental variables constructed as defined in Section 4.1. IV-1 refers to the Koijen and Yogo (2021) instruments and IV-2 refers to the instruments based on the cost of constructing a variable annuity. We restrict the sample of the OLS estimation to the sample used in the corresponding IV estimation. Standard errors are clustered at the variable annuity level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table 5: Variable Annuities Sales by Distribution Channel

(a) Non-Captive Sales

VARIABLES	(1) ln(Sales)	(2) ln(Sales)	(3) ln(Sales)	(4) ln(Sales)	(5) ln(Sales)
Expense Ratios	-0.20	-0.24	-0.46*	-0.43**	-0.29
	(0.23)	(0.23)	(0.25)	(0.21)	(0.22)
Commissions	0.088*	0.081*	0.095**	0.14***	0.16***
	(0.045)	(0.045)	(0.044)	(0.043)	(0.044)
Observations	14,204	14,204	13,259	13,258	12,863
R-squared	0.005	0.028	0.152	0.395	0.489
Time FEs		X	X	X	X
Other Controls			X	X	X
Insurer FEs				X	X
Insurer-Time FEs					X

(b) Captive Sales

VARIABLES	(1) ln(Sales)	(2) ln(Sales)	(3) ln(Sales)	(4) ln(Sales)	(5) ln(Sales)
Expense Ratios	-1.35***	-1.32***	-1.43***	-0.63*	-0.68
	(0.41)	(0.43)	(0.40)	(0.35)	(0.42)
Commissions	0.028	0.034	0.063	0.084	0.10
	(0.089)	(0.087)	(0.088)	(0.10)	(0.11)
Observations	5,179	5,179	4,818	4,818	4,470
R-squared	0.049	0.066	0.223	0.562	0.586
Time FEs		X	X	X	X
Other Controls			X	X	X
Insurer FEs				X	X
Insurer-Time FEs					X
Test for Equality of Coefficients					
Expense Ratios (α)	0.02**	0.02**	0.02**	0.04**	0.59
Commissions (γ)	0.56	0.63	0.52	0.75	0.62

Note: Table 5 panels (a) and (b) display the results corresponding to a linear regression model (eq. 1). Observations are at the variable annuity by quarter level. The dependent variable is log variable annuity sales of non-captive brokers in panel (a) and log variable annuity sales of captive brokers in panel (b). The independent variables Expense Ratios and Commissions are measured in percentage points. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e., a fixed effect for each roll rate), whether the product has an above the median lock-up period, Average Alpha, and Roll-Up Rate Fee. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. In panel (b), we also test whether captive and non-captive broker sales have the same relationship with expense ratios and commissions and report the corresponding p-values. When testing the coefficients, we compare the columns with the same sets of controls (i.e. panel (a) column (1) vs panel (b) column (1), panel (a) column (2) vs panel (b) column (2), etc.). Standard errors are clustered at the variable annuity level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table 6: Broker Incentives: Commissions vs. Other Annuity Characteristics

VARIABLES	(1) Commissions	(2) Commissions	(3) Commissions	(4) Commissions	(5) Commissions
Expense Ratios	1.90***	1.91***	1.70***	0.70***	0.66**
	(0.26)	(0.27)	(0.28)	(0.26)	(0.30)
Roll-Up Rate Fee			-0.15	0.55	0.80
			(0.47)	(0.39)	(0.55)
Num. Subaccounts			-0.0035	-0.013***	-0.013***
			(0.0031)	(0.0028)	(0.0032)
Num. Objectives			-0.0019	0.087***	0.093***
			(0.028)	(0.032)	(0.036)
Long Lock-Up			0.86***	0.66***	0.69***
			(0.19)	(0.18)	(0.20)
Average Alpha			-0.96*	-0.64*	-0.81
			(0.52)	(0.37)	(0.53)
Constant	1.85***				
	(0.63)				
Observations	17,259	17,259	16,147	16,147	15,644
R-squared	0.129	0.132	0.188	0.520	0.535
Year-Quarter FEs		X	X	X	X
Other Controls			X	X	X
Insurer FEs				X	
Insurer-Time FEs					X

Note: Table 6 displays the results corresponding to a linear regression model (eq. 3). Observations are at the variable annuity by quarter level. The dependent variable is the commission rate paid to the broker and is measured in percentage points. The independent variables Expense Ratios, Average Alpha, and Roll-Up Rate Fee are measured in percentage points. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. Long Lock-Up is a dummy variable indicating that the product has an above the median lock-up period. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, and roll-up rate fixed effects (i.e., a fixed effect for each roll rate). Standard errors are clustered at the variable annuity level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table 7: Broker Misconduct and VA Product Expense Ratios

VARIABLES	(1) Complaint	(2) Damages Granted	(3) Misconduct	(4) Misconduct per year
Expense Ratios	0.23***	5,887.77***	1.64***	0.24***
	(0.07)	(1,829.05)	(0.54)	(0.06)
Firm Size	0.03**	631.37**	0.19*	0.03***
	(0.01)	(305.72)	(0.10)	(0.01)
Insurer AUM	0.05	2.41	-0.14	-0.03
	(0.07)	(1,773.79)	(0.65)	(0.07)
Observations	353	353	353	353
R-squared	0.20	0.10	0.11	0.20
Dep. Variable Mean	0.19	3,696	5.35	0.38

Note: Tables 7 displays the results corresponding to a linear regression model (eq. 4). Observations are at the brokerage firm by year level. The independent variable Expense Ratios is the sales-weighted average expense ratios of all products the brokerage's affiliated insurer sells in a given year. The dependent variables are: the total number of variable annuity-related complaints against the brokerage firm each year in column (1); the pecuniary damages granted to complainants each year in column (2); the fraction of broker agents who have any prior misconduct disclosures in column (3); the fraction of broker agents who have had a misconduct disclosure in the given year in column (4). All dependent variables are divided by the number of broker agents the brokerage firm employs in the given year, per 100 brokers. Firm Size is the number of broker agents employed by the insurer in a given year scaled by 1000 for readability. Insurer AUM is the log total variable annuity assets under management by the insurance company in a given year. Dep. Variable Mean reports the mean of each dependent variable for comparison. Standard errors are clustered at the brokerage level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table 8: Variable Annuities Sales around DOL Fiduciary Rule

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ln(Sales)	ln(Sales)	ln(Sales)	ln(Sales)	ln(Sales)	ln(Sales)
Expense Ratios	-1.03***	-0.58**	-1.46***	-0.88***	-0.99***	-0.56**
	(0.36)	(0.28)	(0.36)	(0.29)	(0.36)	(0.28)
Expenses $\times$ DOL	-0.75**	-0.54**			-0.83**	-0.58**
	(0.32)	(0.22)			(0.38)	(0.25)
Commissions	0.12*	0.23***	0.14**	0.25***	0.10	0.22***
	(0.067)	(0.057)	(0.067)	(0.055)	(0.065)	(0.054)
Commissions $\times$ DOL			-0.040	-0.031	0.034	0.020
			(0.048)	(0.042)	(0.055)	(0.045)
Observations	6,426	6,426	6,426	6,426	6,426	6,426
R-squared	0.127	0.502	0.123	0.500	0.127	0.502
Time FEs	X	X	X	X	X	X
Other Controls	X	X	X	X	X	X
Insurer FEs		X		X		X

Note: Table 8 displays the results corresponding to a linear regression model (eq. 5). Observations are at the variable annuity by quarter level over the period 2013-2020Q2. The dependent variable is log variable annuity sales. The independent variables Expense Ratios and Commissions are measured in percentage points. DOL is a dummy variable indicating that the year is equal to or greater than 2016 and corresponds to the issuance of the DOL fiduciary rule. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e., a fixed effect for each roll rate), whether the product has an above the median lock-up period, Average Alpha, and Roll-Up Rate Fee. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. Standard errors are clustered at the variable annuity level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table 9: Variable Annuities Sales around DOL Rule by Minimum Purchase Threshold

VARIABLES	(1) ln(Sales)	(2) ln(Sales)	(3) ln(Sales)	(4) ln(Sales)	(5) ln(Sales)
Expense Ratios	-0.97***	-0.99***	-1.12***	-0.87***	-0.85***
	(0.33)	(0.34)	(0.36)	(0.29)	(0.31)
Commissions	0.10*	0.11*	0.11*	0.23***	0.23***
	(0.060)	(0.061)	(0.066)	(0.058)	(0.063)
ln(Min. Amount)	-0.13*	-0.14*	-0.12	-0.016	-0.022
	(0.067)	(0.081)	(0.082)	(0.063)	(0.073)
ln(Min. Amount) $\times$ DOL	-0.079***	-0.063	-0.096	-0.027	-0.0068
	(0.015)	(0.065)	(0.069)	(0.047)	(0.075)
Observations	6,518	6,518	6,214	6,214	5,962
R-squared	0.058	0.060	0.134	0.503	0.532
Time FEs		X	X	X	X
Other Controls			X	X	X
Insurer FEs				X	
Insurer-Time FEs					X

Note: Table 9 displays the results corresponding to a linear regression model (eq. 6). Observations are at the variable annuity by quarter level over the period 2013-2020Q2. The dependent variable is log variable annuity sales. The independent variables Expense Ratios and Commissions are measured in percentage points. The independent variable ln(Min. Amount) is the natural log of the minimum amount of dollars required to invest in a variable annuity. DOL is a dummy variable indicating that the year is equal to or greater than 2016 and corresponds to the issuance of the DOL fiduciary rule. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e., a fixed effect for each roll rate), whether the product has an above the median lock-up period, Average Alpha, and Roll-Up Rate Fee. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. Standard errors are clustered at the variable annuity level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table 10: Demand Estimates

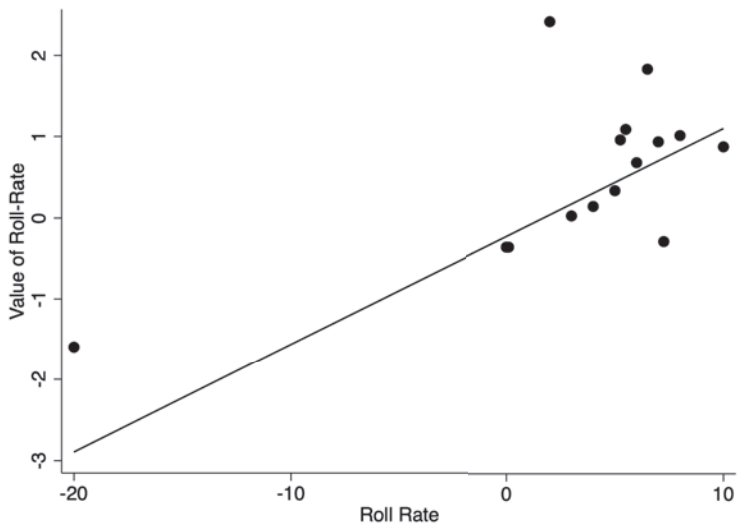
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Reduced Form Parameters:									
Commissions (γ_1)	0.18***	0.28**	0.59***	0.17***	0.33**	0.56***	0.24***	0.30*	0.64***
	(0.043)	(0.14)	(0.13)	(0.044)	(0.14)	(0.12)	(0.082)	(0.18)	(0.20)
Expense Ratios (γ_2)	-0.42**	-1.61**	-3.05***	-0.29	-1.35*	-2.54***	-1.15***	-1.66	-4.15***
	(0.21)	(0.74)	(0.92)	(0.22)	(0.80)	(0.85)	(0.43)	(1.10)	(1.60)
Other Controls	X	X	X	X	X	X	X	X	X
Time-Insurer FE	X		X	X		X	X		X
IV-1		X			X			X	
IV-2			X			X			X
Sample	Full	Full	Full	Pre 2016	Pre 2016	Pre 2016	Post 2016	Post 2016	Post 2016
Observations	15,644	12,550	8,688	12,199	9,750	6,306	3,441	2,796	2,379
Structural Parameters:									
ω	0.27***	0.12**	0.23***	0.34*	0.12**	0.26**	0.18**	0.12**	0.12***
	(0.10)	(0.051)	(0.085)	(0.18)	(0.061)	(0.11)	(0.080)	(0.047)	(0.041)
σ	1.62***	0.53***	0.45***	2.26**	0.64**	0.55**	0.83***	0.30***	0.17***
	(0.55)	(0.19)	(0.17)	(1.11)	(0.28)	(0.23)	(0.30)	(0.10)	(0.06)

Note: Table 10 displays the results corresponding to a linear regression model (eq. 9). Observations are at the variable annuity by quarter level. The dependent variable is log variable annuity sales. The independent variables Expense Ratios and Commissions are measured in percentage points. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e., a fixed effect for each roll rate), whether the product has an above the median lock-up period, Average Alpha, and Roll-Up Rate Fee. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. We estimate the model using OLS in columns (1, 4, and 7) and estimate the model using instrumental variables in the other columns, instrumenting for commissions and expense ratios. IV-1 refers to the Koijen and Yogo (2021) instruments and IV-2 refers to the instruments based on the cost of constructing a variable annuity as described in Section 4.1. Standard errors are clustered at the variable annuity level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Online Appendices

A Additional Figures and Tables

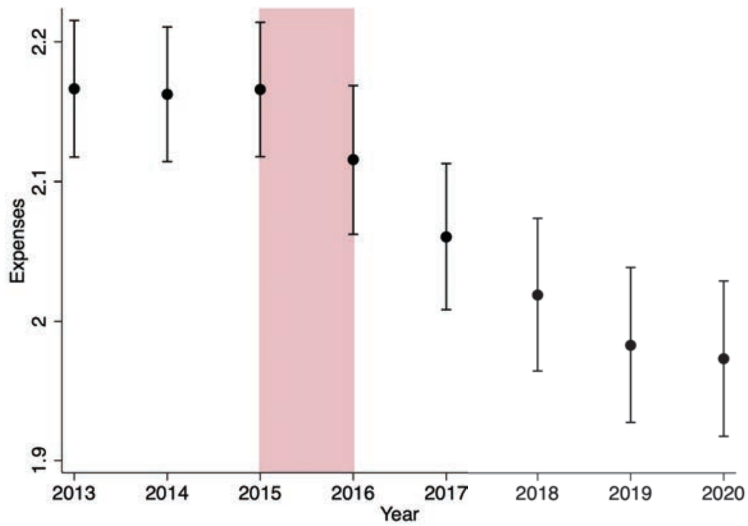
Figure A1: Estimated Roll-up Rate Fixed Effects vs. Roll-up Rate



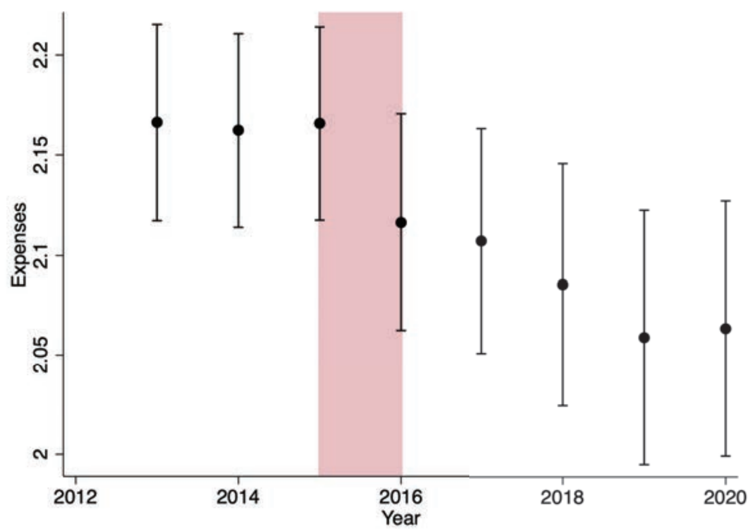
Note: Figure A1 displays a binned scatter plot between the estimated roll-up rate fixed effects and the corresponding roll-up rate. The fixed effects estimates correspond to column (5) of Table 2.

Figure A2: Changes Surrounding the DOL Rule: Expenses

(a) Avg. Expenses on All Products (New and Existing)

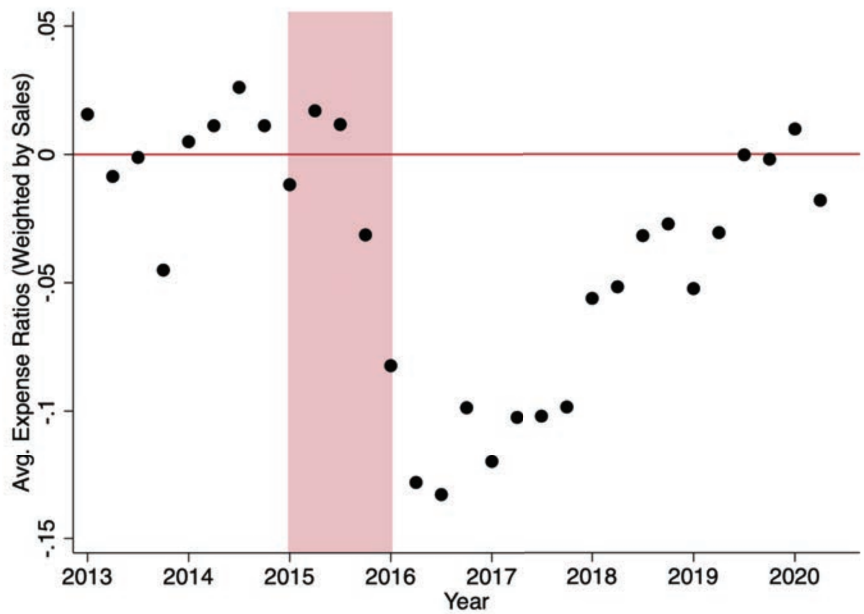


(b) Avg. Expenses on Existing Products



Note: Figure A2a displays the equal weighted average of variable annuity expenses across all variable annuities available for sale. Figure A2b displays the equal weighted average of variable annuity expenses across all variable annuities available for sale that were initiallly launched prior to the issuance of the DOL rule (i.e., prior to 2016). Observations are at the variable annuity by quarter level. Error bars correspond to the 95% confidence intervals and are clustered by variable annuity.

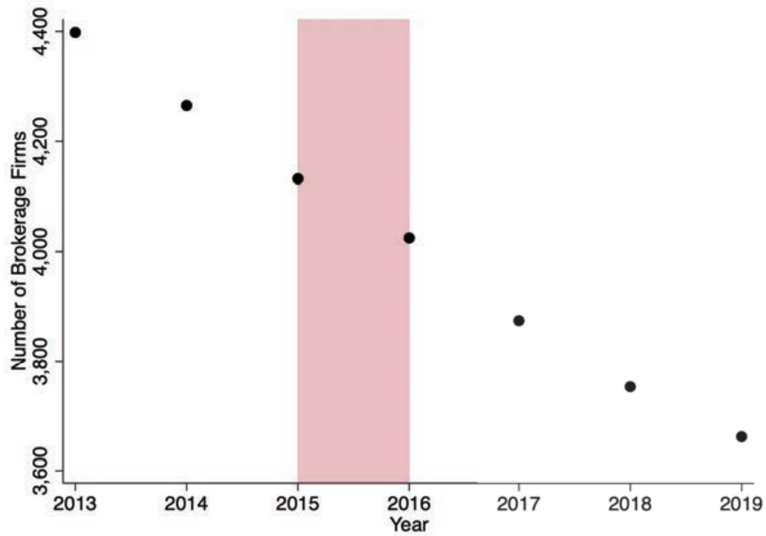
Figure A3: Sales-Weighted Average Expense Ratios around DOL, Relative to Pre-Trend



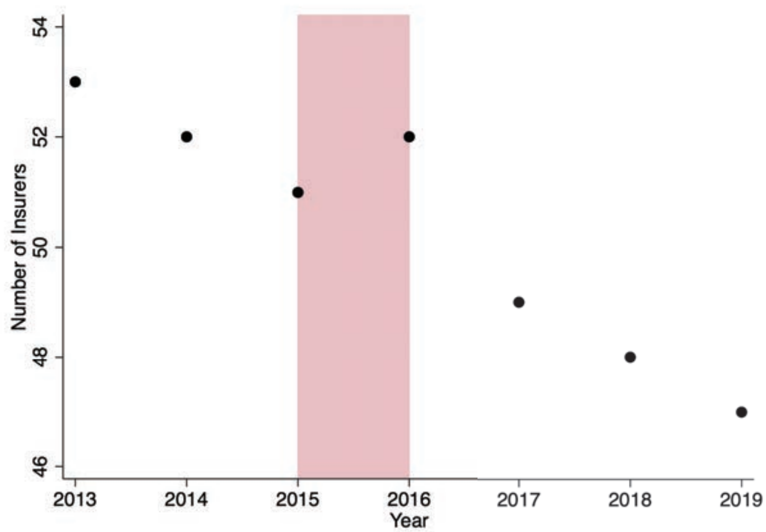
Note: Figure A3 displays the time series of the sales-weighted average expense ratios of variable annuity products around the DOL fiduciary rule after subtracting out a linear pre-trend. The average expense ratios is measured in percentage points. The linear pre-trend is estimated on the period before the DOL proposal, i.e. 2013-2015.

Figure A4: Changes Surrounding the DOL Rule: Number of Brokerages and Insurers

(a) Number of Brokerage Firms



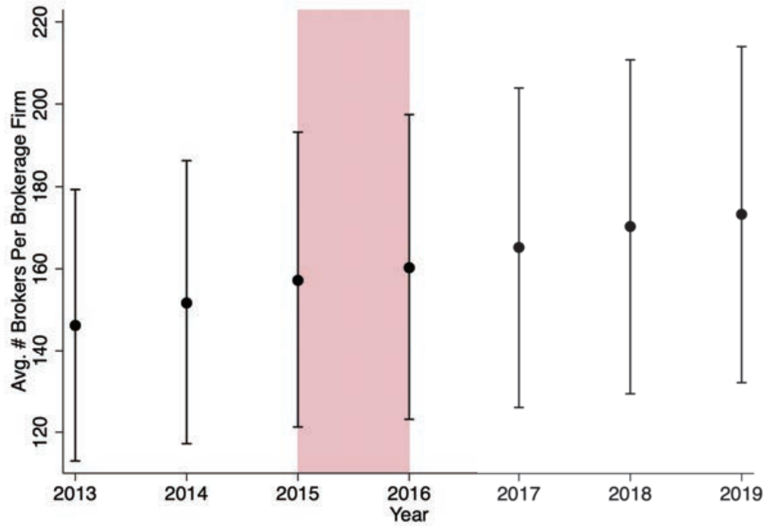
(b) Number of Insurers



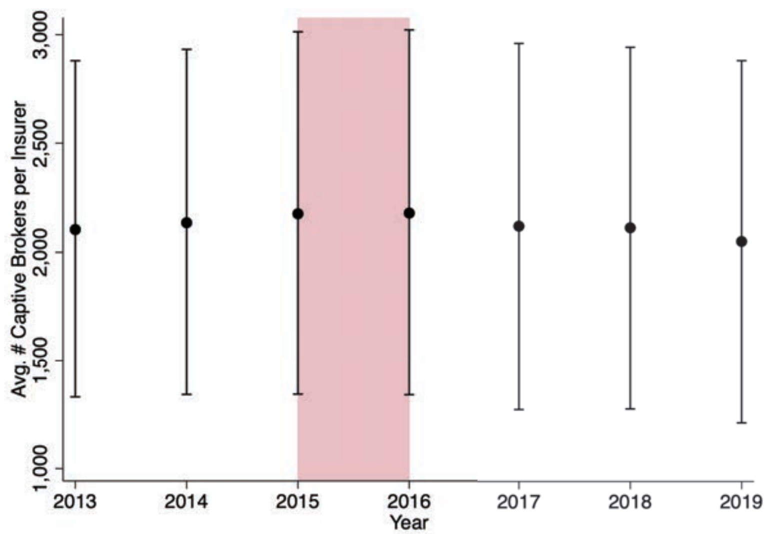
Note: Figure A4a displays the number of active brokerage firms in the U.S. over the period 2013-2019. Figure A4b display the number of insurers that sell variable annuities in the U.S over the period 2013-2019.

Figure A5: Changes Surrounding the DOL Rule: Firm Size

(a) Avg. Broker Employment: All Brokerage Firms

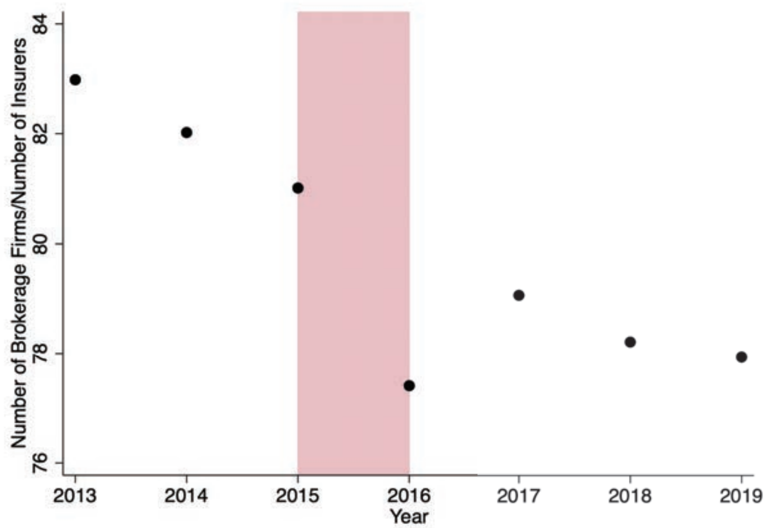


(b) Avg. Broker Employment: Insurance Firms



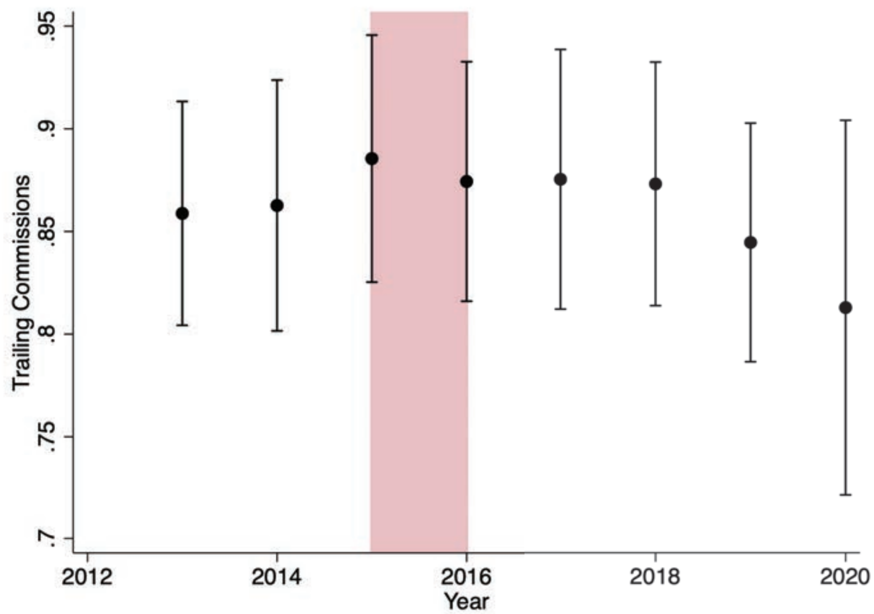
Note: Figure A5a displays the average number of brokers employed at each brokerage firm in the U.S. over the period 2013-2019. Figure A5b displays the average number of brokers employed at each insurer firm in the U.S. over the period 2013-2019.

Figure A6: Changes Surrounding the DOL Rule: Number of Brokerage Firms / Number of Insurers



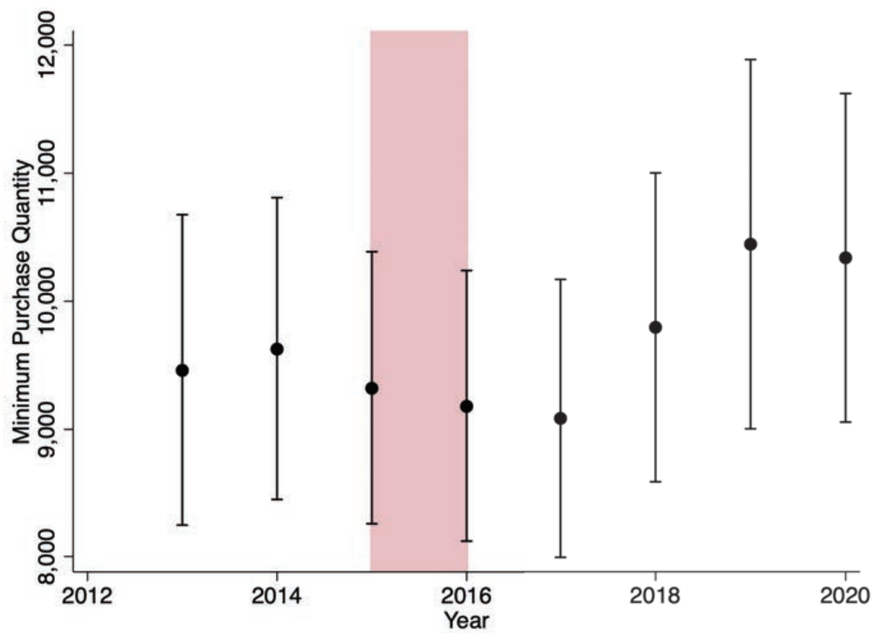
Note: Figure A6 displays the number of active brokerage firms in the U.S. divided by the number of insurers that sell variable annuites in the U.S. over the period 2013-2019.

Figure A7: Changes Surrounding the DOL Rule: Trail Commissions



Note: Figure A7 displays the equal weighted average of variable annuity trail commissions across all variable annuities available for sale. Observations are at the variable annuity by quarter level. Error bars correspond to the 95% confidence intervals with standard errors clustered by variable annuity.

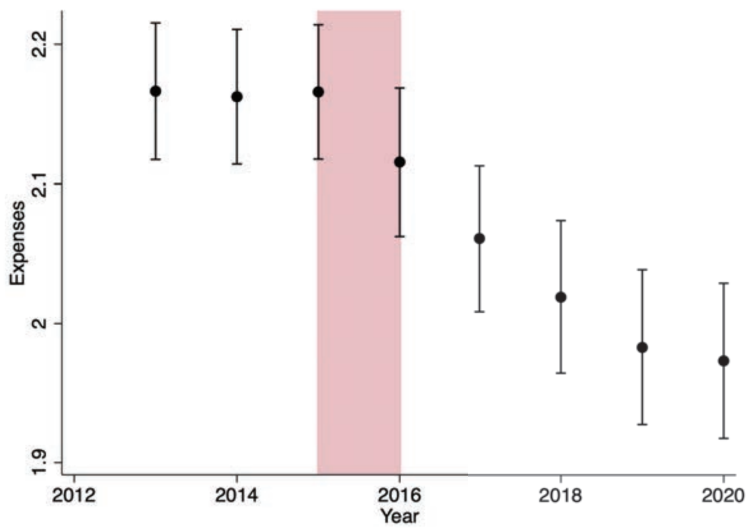
Figure A8: Changes Surrounding the DOL Rule: Minimum Purchase Quantity



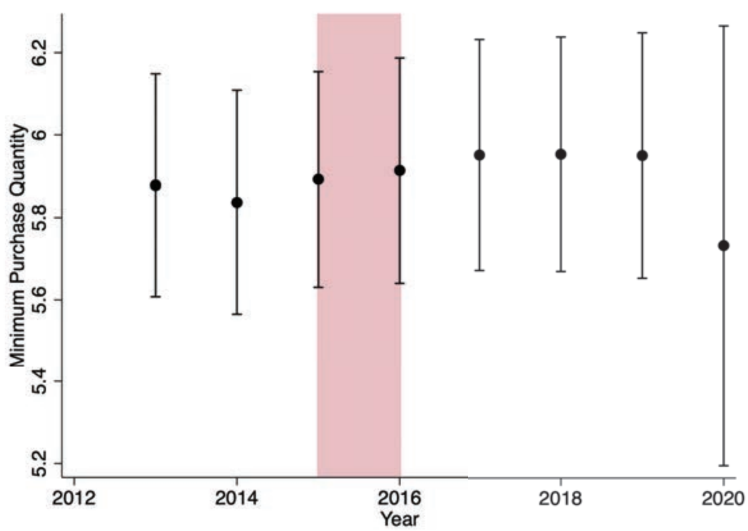
Note: Figure A8 displays the equal weighted average minimum purchase amount across all variable annuities available for sale. Observations are at the variable annuity by quarter level. Error bars correspond to the 95% confidence intervals with standard errors clustered by variable annuity.

Figure A9: Changes Surrounding the DOL Rule: Equal Weighted Expenses and Commissions

(a) Expenses (Equal Weighted)



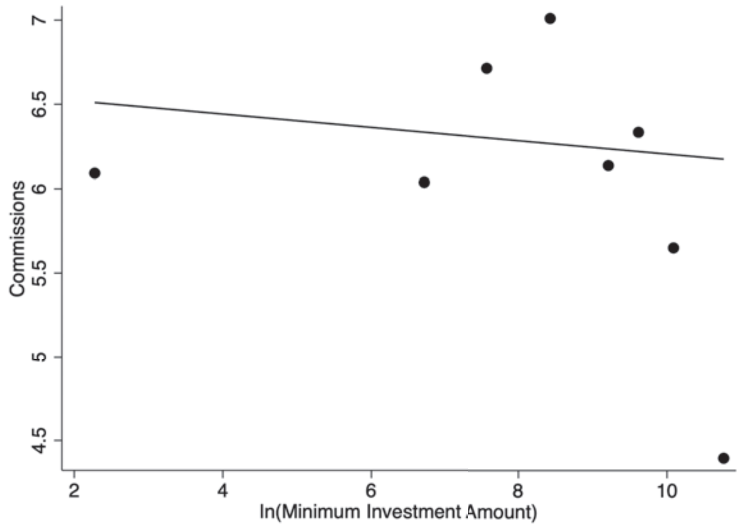
(b) Upfront Commissions (Equal Weighted)



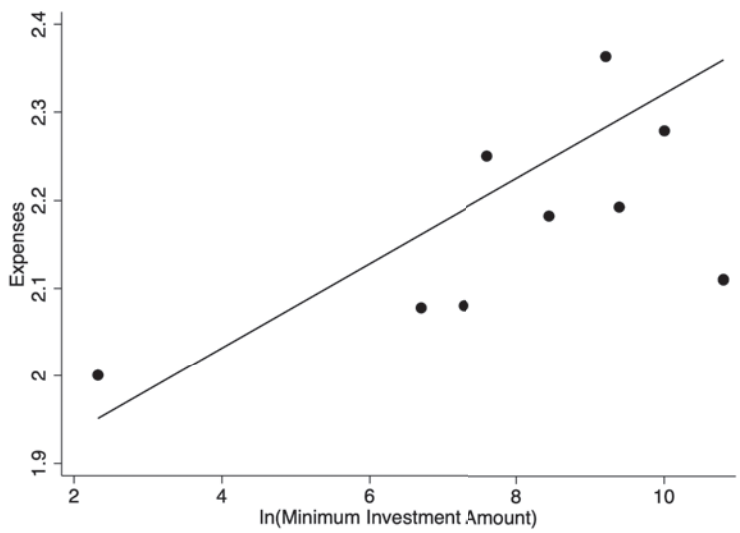
Note: Figure A9a displays the equal weighted average of variable annuity expenses across all variable annuities available for sale. Figure A9b displays the equal weighted average of variable annuity upfront commissions across all variable annuities available for sale. Observations are at the variable annuity by quarter level. Error bars correspond to the 95% confidence intervals with standard errors clustered by variable annuity.

Figure A10: Expenses and Commissions vs. Minimum Investment Ammounts

(a) Upfront Commissions vs. Minimum Investment Amount

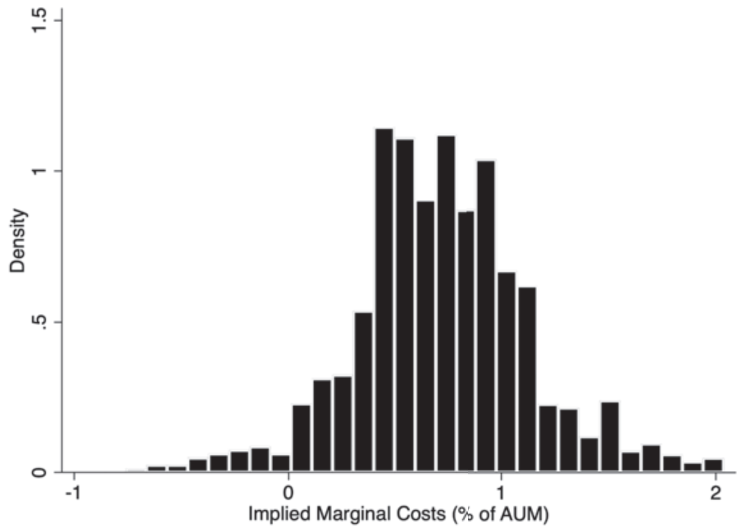


(b) Expenses vs. Minimum Investment Amount



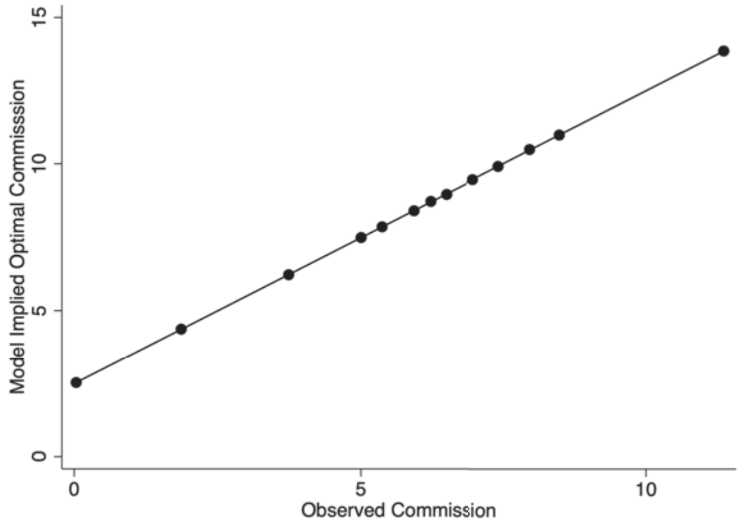
Note: Figure A10a displays a binned scatter plot of variable annuity commissions versus the log of the minimum investment amount. Figure A10b displays a binned scatter plot of variable annuity expenses versus the log of the minimum investment amount. Observations are at the variable annuity by quarter level.

Figure A11: Model Implied Marginal Costs



Note: Figure A11 displays an insurer's annual marginal cost of operating a variable annuity as implied by our model.

Figure A12: Model Implied Commissions



Note: Figure A12 displays a binned scatter plot of observed commissions versus the implied optimal commissions from our model. The results suggest that observed commissions are roughly 2pp lower than what is optimal.

Table A1: Subaccount Investment Objectives

	Frequency
Growth	97%
Growth and Income	95%
Money Market	91%
Foreign Stock	91%
CorpBond - General	86%
CorpBond - High Yield	86%
Money Market - Government	83%
Balanced	81%
World Stock	78%
Government Bond - General	76%
Small Company	73%
Income	70%
Specialty - Real Estate	66%
Diversified Emerging Market	65%
Asset Allocation	64%
Aggressive Growth	59%
Worldwide Bond	58%
Equity Income	54%
World Bond	53%
Specialty - Utilities	51%

Note: Table A1 displays the top 20 most common investment objectives of subaccounts as defined by Morningstar. Frequency denotes the percentage of all variable annuity contracts that have at least one subaccount with the corresponding investment objective available for investment. Observations are at the variable annuity by quarter level over the period 2005-2020Q2.

Table A2: Variable Annuity Benefits Availability

Benefit	Frequency
Return of Premium Death Benefit	85%
Highest Anniversity Value Death Benefit	49%
GLWB	31%
GMWB	27%
GMAB	21%
Purchase Payment Credit	15%
Account Value Only Death Benefit	14%
GMIB	10%
Hybrid Income Guarantee	7%

Note: Table A2 displays the benefit options available for purchase for each product. Frequency denotes the percentage of all variable annuity contracts that have at least one rider with the given benefit option available. Observations are at the variable annuity by quarter level over the period 2005-2020Q2.

Table A3: Variable Annuities Sales - Control Function

VARIABLES	(1) ln(Sales)	(2) ln(Sales)
Expense Ratios	-0.73***	-2.86***
	(0.24)	(0.79)
Commissions	0.24***	0.25***
	(0.052)	(0.051)
Control Function		2.24***
		(0.80)
Observations	8,508	8,508
R-squared	0.477	0.482
Time FEs	X	X
Other Controls	X	X
Insurer-Time FEs	X	X
Control Function		X

Note: Table A3 displays the control function results corresponding to a linear regression model (eq. 1). Observations are at the variable annuity by quarter level. The dependent variable is log variable annuity sales. The independent variables Expense Ratios and Commissions are measured in percentage points. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e., a fixed effect for each roll rate), whether the product has an above the median lock-up period, Average Alpha, and Roll-Up Rate Fee. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. Control Function is the control function that is constructed according to Online Appendix B. Column (1) reports the estimates without the control function and column (2) reports the estimates with the control function. We restrict the sample of the OLS estimation in column (1) to the sample used in the corresponding control function estimation in column (2). Standard errors are clustered at the variable annuity level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table A4: Variable Annuities Sales, Age and Size Restriction Heterogeneity

VARIABLES	(1) ln(Sales)	(2) ln(Sales)	(3) ln(Sales)	(4) ln(Sales)	(5) ln(Sales)
Expense Ratios	-0.76***	-0.50**	-0.42*	-0.60	-0.56*
	(0.24)	(0.20)	(0.22)	(0.41)	(0.30)
Expenses × DOL				-0.87**	-0.50*
				(0.40)	(0.29)
Commissions	0.085*	0.17***	0.19***	0.096	0.23***
	(0.050)	(0.046)	(0.050)	(0.076)	(0.061)
Commissions × DOL				0.037	0.044
				(0.056)	(0.048)
Observations	13,922	13,922	13,344	5,899	5,899
R-squared	0.168	0.411	0.491	0.191	0.519
Time FEs	X	X	X	X	X
Other Controls	X	X	X	X	X
Insurer FEs		X	X		X
Insurer-Time FEs			X		

Note: Table A4 displays the results corresponding to Tables 2 and 5, controlling for minimum and maximum owner age restrictions and minimum purchase thresholds. Observations in columns (1)-(3) are at the variable annuity by quarter level over the period 2005-2020Q2. Observations in columns (4)-(5) are at the variable annuity by quarter level over the period surrouding the DOL rule, 2013-2020. The dependent variable is log variable annuity sales. The independent variables Expense Ratios, Commissions, Average Alpha, and Roll-Up Rate Fee are measured in percentage points. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e., a fixed effect for each roll rate), whether the product has an above the median lock-up period, fixed effects for each minimum and maximum owner age, and the log of the minimum purchase threshold. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. Minimum purchase threshold is the minimum amount that an investor is required to pay to be eligible to purchase the annuity. Standard errors are clustered at the variable annuity level and are in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A5: Summary Statistics for Share Classes Subsample

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Quarter Sales (Millions)	681	156	236	0.0025	1,231
Policy Assets (Millions)	681	943	1,817	0	13,896
Captive Sales (Millions)	681	16.1	58.2	0	316
Non-Captive Sales (Millions)	681	118	171	0	1,129
Expense Ratios	681	2.46	0.33	1.30	2.94
Num. Subaccounts	654	98.7	30.8	53	153
Num. Objectives	654	16.9	2.68	11	23
Average Alpha	654	-0.16	0.21	-0.79	0.40
Commissions	681	5.47	2.13	0	8

Note: Table A5 displays the summary statistics corresponding to subset of products in the share classes analysis described in Section 4.1.1. Observations are at the variable annuity by quarter level over the period 2005Q1-2020Q2. Expense Ratios, Average Alpha, and Commissions are measured in percentage points. Expense Ratios include both product-level expenses (M&E, administrative, and distribution charges) and average subaccount expenses. Num. Subaccounts is the number of subaccounts that are open for investment for each variable annuity each quarter. Num. Objectives is the number of distinct investment objectives across all subaccounts that are open for investment for each variable annuity each quarter. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Commissions are upfront commission rates as discussed in Section 2.1.

Table A6: Demand Estimation: First-Stage Regression

	(1)	(2)	(3)	(4)
VARIABLES	Commissions	Expenses	Commissions	Expenses
IV Expense 1			-303	169
			(1,125)	(203)
IV Expense 2			461	-60.9
			(2,652)	(484)
IV Expense 3			-456	-67.6
			(1,620)	(242)
IV Expense 4			5,116	752
			(3,140)	(520)
IV Expense 5			-1,332	-258
			(1,376)	(260)
IV Expense 6			-1,405	180
			(2,579)	(473)
IV Expense 7			1,616	123
			(1,788)	(299)
IV Expense 8			-3,921	-802
			(2,970)	(506)
IV Expense 9			2,488**	-152
			(1,151)	(208)
IV Expense 10			-2,286	126
			(2,576)	(444)
IV Expense 11			-3,515**	198
			(1,741)	(320)
IV Expense 12			3,943	41.1
			(3,289)	(562)
IV Expense 13			-531	276

	(1,259)	(225)
IV Expense 14	513	-269
	(2,570)	(441)
IV Expense 15	532	-278
	(1,760)	(317)
IV Expense 16	-1,791	58.6
	(3,097)	(534)
IV Commission 1	1,077	-675
	(3,382)	(589)
IV Commission 2	-1,837	395
	(5,988)	(1,159)
IV Commission 3	2,058	270
	(5,147)	(740)
IV Commission 4	-15,457*	-2,850**
	(8,307)	(1,414)
IV Commission 5	2,674	767
	(3,986)	(737)
IV Commission 6	5,237	-427
	(5,920)	(1,132)
IV Commission 7	-3,754	-160
	(5,522)	(894)
IV Commission 8	10,789	2,620*
	(7,821)	(1,384)
IV Commission 9	-6,746**	197
	(3,137)	(577)
IV Commission 10	6,248	761
	(5,807)	(1,008)
IV Commission 11	9,463*	-421
	(5,032)	(943)

IV Commission 12			-11,041	-822
			(8,138)	(1,480)
IV Commission 13			2,911	-569
			(3,408)	(607)
IV Commission 14			-1,965	-50.9
			(6,052)	(1,068)
IV Commission 15			-3,055	783
			(5,096)	(925)
IV Commission 16			6,745	176
			(7,538)	(1,446)
Reinsurance Share	0.0020	-0.00010		
	(0.0012)	(0.00019)		
Reinsurance Share Sq.	1.9e-06	-1.0e-07		
	(1.8e-06)	(2.8e-07)		
Reserve Valuation	0.83**	0.26***		
	(0.39)	(0.045)		
Reserve Valuation Sq.	-0.30***	-0.10***		
	(0.079)	(0.013)		
Life Ins. Commissions (1st Year)	0.033***	0.00034		
	(0.0060)	(0.00081)		
Life Ins. Commissions (1st Year) Sq.	-0.000032***	-3.3e-07		
	(5.5e-06)	(7.4e-07)		
Life Ins. Commissions (Amount)	0.76***	0.055		
	(0.19)	(0.034)		
Life Ins. Commissions (Amount) Sq.	-0.041***	-0.0029		
	(0.013)	(0.0023)		
Life Ins. Commissions (Total)	0.24**	0.037*		
	(0.12)	(0.019)		
Life Ins. Commissions (Total) Sq.	-0.018***	-0.0018**		

	(1)	(2)	(3)	(4)
	(0.0057)	(0.00089)		
AM Best Rating	-0.019*	0.00053		
	(0.010)	(0.0018)		
Observations	12,550	12,550	8,688	8,688
Time FEs	X	X	X	X
Other Controls	X	X	X	X
Insurer-Time FEs	X	X	X	X
OLS				
IV-1	X	X		
IV-2			X	X
Joint F-Stat		84.64		11.36

Note: Table A6 displays the first-stage regression estimates corresponding to eq. (1). Observations are at the variable annuity by quarter level. The dependent variable is the Commission rate in columns (1) and (3) and Expense ratios in columns (2) and (4), both in percentage points. Reinsurance Share is the the ratio of reinsurance reserve credit on variable annuities to gross amount of variable annuity reserves. Reserve Valuation is the log of the ratio of gross amount of variable annuity reserves to total related account value. Life Ins. Commissions (1st Year) is the commissions as a percent of first year (or one-time) premiums of ordinary life policies. Life Ins. Commissions (Amount) is the commissions as a percent of the amount of ordinary life policies issued. Life Ins. Commissions (Total) is the commissions as a percent of the total premiums of ordinary life policies. AM Best Rating is the adjusted cardinal rating measure, with 0 coded for ratings D or worse or not-rated and 175 for A++ based on AM Best's risk-based capital guidelines. Cragg-Donald F-statistics are reported. Standard errors are clustered at the variable annuity level and are in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A7: Variable Annuities Sales: Subaccount AUM-Weighted Expenses and Alphas

VARIABLES	(1) ln(Sales)	(2) ln(Sales)	(3) ln(Sales)	(4) ln(Sales)	(5) ln(Sales)	(6) ln(Sales)
Expense Ratios	-0.38*	-0.58***	-0.65***	-0.73**	-0.92***	-0.89**
	(0.20)	(0.22)	(0.22)	(0.35)	(0.35)	(0.36)
Expenses × DOL				-0.81**	-1.07***	-0.98***
				(0.41)	(0.37)	(0.38)
Commissions	0.18***	0.19***	0.15***	0.11*	0.15**	0.15**
	(0.043)	(0.044)	(0.045)	(0.065)	(0.068)	(0.068)
Commissions × DOL				0.024	0.0059	0.0064
				(0.058)	(0.056)	(0.057)
Observations	15,644	13,335	15,644	6,195	5,282	5,282
R-squared	0.462	0.470	0.408	0.119	0.133	0.127
Expenses	AUM	Equal	AUM	AUM	Equal	AUM
Alphas	Equal	AUM	AUM	Equal	AUM	AUM
Other Controls	X	X	X	X	X	X
Quarter FEs				X	X	X
Insurer-Quarter FEs	X	X	X			

Note: Table A7 displays the results corresponding to a linear regression model (eq. 1) with subaccount AUM-weighted expense ratios and subaccount AUM-weighted CAPM alphas. Observations are at the variable annuity by quarter level over the period 2013-2020Q2. The dependent variable is log variable annuity sales. The independent variables Expense Ratios and Commissions are measured in percentage points. DOL is a dummy variable indicating that the year is equal to or greater than 2016 and corresponds to the issuance of the DOL fiduciary rule. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e., a fixed effect for each roll rate), whether the product has an above the median lock-up period, Average Alpha, and Roll-Up Rate Fee. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. Standard errors are clustered at the variable annuity level and are in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A8: Variable Annuities Sales around DOL Fiduciary Rule (excluding 2015Q1-2016Q1)

VARIABLES	(1) ln(Sales)	(2) ln(Sales)	(3) ln(Sales)	(4) ln(Sales)	(5) ln(Sales)	(6) ln(Sales)
Expense Ratios	-0.99***	-0.58*	-1.47***	-0.92***	-0.99***	-0.58*
	(0.37)	(0.30)	(0.36)	(0.30)	(0.37)	(0.30)
Expense Ratios × DOL	-0.74**	-0.55**			-0.74**	-0.55**
	(0.36)	(0.28)			(0.36)	(0.28)
Commissions	0.11	0.14**	0.12*	0.15**	0.11	0.14**
	(0.066)	(0.060)	(0.068)	(0.061)	(0.066)	(0.060)
Commissions × DOL			-0.021	-0.019		
			(0.054)	(0.049)		
Observations	5,403	5,403	5,403	5,403	5,403	5,403
R-squared	0.106	0.447	0.103	0.445	0.106	0.447
Year-Quarter FEs	X	X	X	X	X	X
Other Controls	X	X	X	X	X	X
Insurer FEs		X		X		X

Note: Table A8 displays the results corresponding to a linear regression model (eq. 5). Observations are at the variable annuity by quarter level over the period 2013-2020Q2, excluding the period between the announcement of the rule (February 2015) and the formal issuance of the rule (April 2016), 2015Q1-2016Q1. The dependent variable is log variable annuity sales. The independent variables Expense Ratios and Commissions are measured in percentage points. DOL is a dummy variable indicating that the year is equal to or greater than 2016 and corresponds to the issuance of the DOL fiduciary rule. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e., a fixed effect for each roll rate), whether the product has an above the median lock-up period, Average Alpha, and Roll-Up Rate Fee. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. Standard errors are clustered at the variable annuity level and are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table A9: Expense and Commission Rate Changes in Product Space around DOL Rule

VARIABLES	(1) Expenses	(2) Expenses	(3) Expenses	(4) Commissions	(5) Commissions	(6) Commissions
DOL (Year>2015)	-0.079***	-0.088***	-0.039***	0.062	0.085	0.061
	(0.021)	(0.017)	(0.015)	(0.097)	(0.078)	(0.084)
Observations	7,783	10,292	7,392	8,226	8,226	7,392
R-squared	0.007	0.408	0.561	0.000	0.466	0.559
Insurer FEs		X	X		X	X
Other Controls			X			X

Note: Table A9 displays the results corresponding to a linear regression model. Observations are at the variable annuity by quarter level. The dependent variable is the expense ratio in columns (1)-(3) and commission rate paid to the broker in columns (4)-(6), measured in percentage points. The independent variable DOL is an indicator for whether the year is greater than 2015. Other Controls include dummy variables for whether riders of each of the four main types (i.e. GLWB, GMWB, GMAB, and GMIB) are available, whether the product offers a rider with a roll-up rate, roll-up rate fixed effects (i.e., a fixed effect for each roll rate), whether the product has an above the median lock-up period, Average Alpha, and Roll-Up Rate Fee. Average Alpha is the average net-of-expense CAPM alpha across subaccounts within a variable annuity product in the previous five years. Roll-Up Rate Fee is the fee of the roll-up rate of each variable annuity each quarter. Other Controls also include Commissions in column (3) and Expenses in column (6). Standard errors are clustered at the variable annuity level and are in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

B Alternative Estimation Methods

In this appendix section, we describe the methodology we used to construct the instrumental variables in our main analyses as well as the control function approach.

B.1 Instrument Construction

B.1.1 Instruments Based on Reinsurance Shares and Reserve Valuations

Following Koijen and Yogo (2021), we include as an instrument the reinsurance share of variable annuities, which is defined as VA reinsurance reserve credit as a percentage of VA gross reserves. Also following Koijen and Yogo (2021), we include the log of variable annuities reserve valuation as an instrument. For each variable annuity sold by insurer j in year t, both of these two variables are measured at the end of year $t-1$. In addition, we also include these two variables' squared terms as instruments. We control for insurers' ratings transformed to numeric values between 0 and 175, following Koijen and Yogo (2021). We match variable annuities sales by insurer j in quarter q to insurers' latest available rating before quarter q.

In addition, we also include as instruments insurer k's commissions on ordinary life policies in the year before each of insurer k's VA product j's inception. Because we do not have data on insurers' commission rates for life policies, we proxy for them using data from insurers' statutory financial filings. Specifically, we calculate three measures: commissions as a percentage of first-year (or one-time) premiums of ordinary life policies, as a percentage of total premiums of ordinary life policies, and as a percentage of the amount of ordinary life policies issued. We also include the squared terms of these three variables.

B.1.2 Instruments Based on Costs of Constructing Variable Annuities

We construct a second set of instruments based on the costs of constructing variable annuities that vary at the variable annuity-quarter level. Let $\mathcal{K}_j$ denote the set of subaccounts offered as part of variable annuity j where subaccounts are indexed by k. The insurer charges expenses f_j to the annuity investor, and pays some unobserved (to the econometrician) expenses θ_{jkl} to the mutual fund provider l. If θ_{jkl} were known, then θ_{jkl} would be a potential natural cost shifter. We construct a proxy for θ_{jkl} based on the expenses the mutual fund provider charges for its corresponding mutual fund products. The mutual fund providers that create subaccounts for variable annuities often create very similar mutual funds that are offered to mutual fund investors. For each subaccount k created by mutual fund provider l for annuity j, we calculate the mutual fund provider's average expense ratio e_{lk} across all other mutual funds offered by provider l that are in the same Morningstar market category (e.g., Small Value Equity, Global Real Estate, etc.) as subaccount k. We then construct our instrument Z_j^{Exp} at the variable annuity level where we take the average of e_{lk} across all subaccounts included in the set $\mathcal{K}_j$. In particular, we construct several versions of the instrument using different aggregation methods by (1) defining the mutual fund provider l separately at the parent company and subsidiary levels, (2) averaging across all other mutual funds offered by l equally and AUM-weighted, (3) including and excluding institutional (i.e. non-retail) mutual funds, and (4) averaging across all subaccounts of a VA product equally and AUM-weighted. The four choices result in 16 total instrumental variables.

We then instrument for commissions based on the expected net present value of revenue generated by the variable annuity. The underlying assumption is that upfront commissions paid to the broker will be a function of the expected revenue generated by the annuity, which depends on expenses and the expected duration of the variable annuity, and brokers and insurers bargain over the surplus, which is a function of the total expected revenue. Given expenses, f_j, the net present value of revenue is given by $f_j E_j\left[\sum_{\tau=1}^{T}\frac{1}{(1+r)^\tau}\right]$, where T is the maturity of the annuity, which is stochastic, and r is the discount rate. For each annuity, we calculate the duration $D_{jt} = E_j\left[\sum_{\tau=1}^{T}\frac{1}{(1+r_t)^\tau}\right]$ using the 10 year Treasury rate as the discount rate and under the assumption that T is uniformly distributed over the period $[T_j^{min}, 20]$ where T_j^{min} is the earliest variable annuity j can be withdrawn without penalty and we assume annuities automatically mature after 20 years. Because f is endogenous, we then construct our instrument as $Z_{jt}^{Comm} = Z_{jt}^{Exp} \times D_{jt}$. While our assumptions about the maturity of an annuity are slightly ad-hoc, which produces potential measurement error, we find that our instrument is highly relevant. The exclusion restriction requires that the interaction of the expected duration of the variable annuity interacted with our cost shifters Z_{jt}^{Exp} are orthogonal to demand shocks.

B.2 Control Function Approach

We also address the endogeneity of expenses using a control function approach (Petrin and Train (2010)) where we explicitly model the unobserved (by the econometrician) component of variable annuity demand that is anticipated by insurers. The idea is that by explicitly modeling the insurer's expense-setting decision as a function of exogenous variable annuity characteristics and costs, we can recover the portion of the unobservable term that is anticipated and thus creates the endogeneity problem. Below we describe the underlying assumptions and procedure in detail.

In our baseline demand setup, a broker's indirect utility of selecting variable annuity j for investor i can be written as:

$$v_{bij} = \frac{\omega}{\sigma}(c_j) + \frac{1-\omega}{\sigma}(-f_j + X_j'\beta + \xi_j) + \zeta_{bij}. \tag{11}$$

The concern is that ξ_j is correlated with the variable annuity characteristics. If insurers partially observe ξ_j prior to setting annuity characteristics, then those characteristics will be endogenous. Using the control function approach, we account for the endogeneity problem by explicitly controlling for the portion of ξ_j that is observed by insurers prior to setting product characteristics. We write ξ_j in terms of the part that is known ex-ante by the insurer (ι_j), which creates the potential endogeneity problem, and the idiosyncratic component (ϵ_j):

$$\xi_j = \iota_j + \epsilon_j. \tag{12}$$

As shown below, if ι_j is known or can be estimated, we can effectively control for the endogeneity problem for all potentially endogenous variable annuity characteristics (expenses, commissions, etc.). We assume that insurers incorporate information about ι_j when setting variable annuity expense ratios. An insurer sets expense ratio f_j as a function of exogenous observable annuity characteristics (X_j), costs (Z_j), and additively separable unobservable term ϑ_j:

$$f_j = F(X_j, Z_j) + \vartheta_j. \tag{13}$$

Insurers will incorporate information about the anticipated demand shock ι_j when setting expenses such that the unobservable term ϑ_j will incorporate the insurers' information about the anticipated demand shock ι_j. Following Petrin and Train (2010), we assume that that ι_j and ϑ_j are distributed jointly normal with variances σ_ι and σ_ϑ respectively, and correlation ρ such that we can write the conditional expectation of ι_j as a linear function of ϑ_j:

$$\iota_j = E[\iota_j|\vartheta_j] + \varsigma_j = \rho(\frac{\sigma_\iota}{\sigma_\vartheta})\vartheta_j + \varsigma_j. \tag{14}$$

Given this setup, we can rewrite the broker's indirect utility as:

$$\nu_{bij} = \frac{\omega}{\sigma}(c_j) + \frac{(1-\omega)}{\sigma}(-f_j + X_j'\beta + \rho(\frac{\sigma_\iota}{\sigma_\theta})\vartheta_j + \varsigma_j + \epsilon_j) + \zeta_{bij} \tag{15}$$

where the unobservable terms ς_j, ϵ_j, and ζ_{bij} are orthogonal to the set of covariates (c_j, f_j, X_j) by construction, and the error term ϑ_j is the endogenous portion of the unobservables that is potentially correlated with all or a subset of the covariates (c_j, f_j, X_j). The idea behind the control function approach is that we estimate the first-stage equation eq. (13) to recover $\hat{\vartheta}_j$, and then include $\hat{\vartheta}_j$, the control function, as a control when estimating our demand specification such that the unobservable term $\frac{(1-\omega)}{\sigma}(\varsigma_j + \epsilon_j) + \zeta_{bij}$ is orthogonal to the covariates $(c_j, f_j, X_j, \hat{\vartheta}_j)$.

To estimate the model using the control function approach, we first need to estimate eq. (13) to recover the term $\hat{\vartheta}_j$. We assume that $F(X_j, Z_j)$ is linear in its arguments such that

$$f_{jt} = \phi_1 X_{jt} + \phi_2 Z_{jt} + \vartheta_{jt} \tag{16}$$

where we control for variable annuity characteristics in X_{jt} and our cost shifter Z_{jt}. One empirical challenge when estimating the control function ϑ_j, is that the researcher needs an instrument Z_j, such as a cost shifter, that is correlated with how a firm sets its expense ratio but that is otherwise uncorrelated with demand for variable annuities. We construct our instrument based on the cost of creating a variable annuity Z_{jt}^{Exp} as described above.

C VA Data Set Construction

In this appendix section, we describe the construction process of our main variable annuity data set.

C.1 Data Set Overview

We use two data sets to extract information on variable annuity characteristics. The first one is Morningstar Principia, in the format of historical CD-ROM series, for each quarter from 2005 to 2012. The second data set is Morningstar Annuity Intelligence ("AnnuityIntel"), a web-based database offering the latest information on variable annuity products, which we extracted once in October and November 2019 and updated again in September 2020. Both data sets contain information including the insurance company underwriting the product, expenses, sales, and asset under management, as well as benefit options available (e.g. GLWB). For each policy, the data sets also provide characteristics of the subaccounts towards which the variable annuity policyholders can allocate their investments. Data on the subaccounts include names of the funds, their investment objectives, and expenses. Each observation in the final data set is a product-quarter observation. In Principia, all variables are time-varying at the variable annuity by quarter level. In AnnuityIntel, product sales and subaccount alphas are time-varying, whereas data on subaccounts (i.e. subaccount expenses, the number of subaccounts, and the number of investment objectives) are static. In AnnuityIntel, product expenses are time-varying based on the static expenses we extract from the web-based database and construct the time series of historical expenses based on reported expense changes for each product. The availability of different types of benefits and guarantees, their roll-up rates, and fees, are also time-varying based on the open and close dates of the benefits available for each product. Finally, the commission rate data is extracted from the SEC prospectuses, which are most commonly filed at an annual frequency for each product.

C.2 Merging Process

The merging process takes two steps. In the first step, we match variable annuities by name across the two data sets. In the second step, we construct the panel of product characteristics and sales information that we use in our analysis across Morningstar Principia and AnnuityIntel.

C.2.1 Matching Contracts by Name

We first match the variable annuities by name between Principia and AnnuityIntel. There are 2348 unique variable annuities in the Morningstar Principia data set and 2356 in AnnuityIntel. Not all products are offered continuously throughout the coverage periods of Principia and AnnuityIntel, as there are products that are in Principia and discontinued before September 2020, when we last extracted the AnnuityIntel data. Likewise, some products in AnnuityIntel were opened for sale after 2013 and thus not in Principia. Furthermore, some products have different names between Principia and AnnuityIntel, and some products also have had name changes within each respective data set. To address these issues, we matched the products by a hierarchical order of criteria as follows: (1) contract name, (2) insurance company, (3) RMSE of total net assets, and (4) open dates. We are able to match 1802 of the 2077 contracts (86.7%) in Principia with a corresponding contract in AnnuityIntel, and 2,077 out of the 2,356 contracts (88.2%) in AnnuityIntel with a corresponding contract in Principia.

C.2.2 Constructing Panel of Product Characteristics

We then construct the characteristics and sales information of each product in each quarter as follows. First, for sales data, we used the AnnuityIntel data since AnnuityIntel provided a continuous time series of sales data for all products from 2005 to 2020. Second, for characteristics for which the Principia data set recorded a value for the product-quarter, we took the Principia value as the value for that product-quarter. Then, we filled in quarters outside the Principia coverage range with historical product characteristics as follows. For product expenses, such as M&E and administrative expenses, we manually collected information from AnnuityIntel on the historical levels of these fees and a history of all their changes, where available. For subaccount characteristics, including subaccount expenses, the number of subaccounts available, and the number of investment objectives, we collect data on each individual subaccount from AnnuityIntel and match each subaccount to the variable annuity products the subaccount is an investment option for. For the number of subaccounts and investment objectives, we tabulate for each variable annuity product the number of subaccounts it offers as investment options and the number of distinct investment objectives of the subaccounts, as measured by the Morningstar prospectus categories. We then compute the total expense ratio as the sum of the product expenses and average subaccount expenses for each variable annuity product. Finally, for riders and other benefits offered, we collect characteristics of the benefits, including the type (e.g. GLWB, GMWB), the roll-up rate, the fee, and open and close dates from AnnuityIntel. To calculate a single roll-up rate and roll-up rate fee for each variable annuity in each quarter, we follow Koijen and Yogo (2021) and use the average roll-up rate and roll-up rate fee in the order of GLWB, GMWB, GMIB, and GMAB. For example, if a variable annuity has a GMWB but not a GLWB available for purchase in a given quarter, we use the average roll-up rate and roll-up rate fee of the GMWB.

D Timeline of the DOL Fiduciary Rule

This appendix lists the timing of the main events surrounding the DOL fiduciary rule.

- On February 23, 2015, then-president Obama announced the proposal.[37]
- On April 14, 2015, the DOL proposed the new regulation.[38]
- On April 8, 2016, the DOL formally issued the rule, with an effective date of June 7, 2016, and an applicability date of April 10, 2017.[39]
- On April 7, 2017, the applicable date of a part of the rule was delayed to June 9, 2017, and the applicable date of the other part was delayed to January 1, 2018.[40]
- On August 31, 2017, the compliance date was further delayed to July 1, 2019.[41]
- On March 15, 2018, the Fifth Circuit Court of Appeals vacated the fiduciary rule.[42]
- On May 22, 2019, the DOL announced it would revisit the rule.[43]
- On July 7, 2020, the DOL formally reinstated the pre-2016 rule.[44]

[37] https://obamawhitehouse.archives.gov/the-press-office/2015/02/23/fact-sheet-middle-class-economics-strengthening-retirement-security-crac [accessed 5/19/2021]

[38] https://www.dol.gov/newsroom/releases/ebsa/ebsa20150655 [accessed 5/19/2021]

[39] https://s3.amazonaws.com/public-inspection.federalregister.gov/2017-04096.pdf [accessed 5/19/2021]

[40] https://www.federalregister.gov/documents/2017/04/07/2017-06914/definition-of-the-term-fiduciary-conflict-of-interest-rule-retirement-investment-advice-best [accessed 5/19/2021]

[41] https://https://www.govinfo.gov/content/pkg/FR-2017-08-31/html/2017-18520.htm [accessed 5/19/2021]

[42] http://www.ca5.uscourts.gov/opinions/pub/17/17-10238-CV0.pdf [accessed 5/19/2021]

[43] https://www.pionline.com/article/20190523/ONLINE/190529920/dol-to-revisit-fiduciary-rule-by-december [accessed 5/19/2021]

[44] https://tax.thomsonreuters.com/blog/dol-reinstates-pre-2016-fiduciary-rule-and-proposes-new-prohibited-transaction-exemption-for-investment-advice-fiduciaries/ [accessed 5/19/2021]

E Supply-Side Problem

E.1 Framework

We write insurer k's profits as a function of variable annuity sales and the associated markup. Let $\mathcal{J}_k$ denote the set of variable annuities issued by insurer k. For each dollar of annuity $j \in \mathcal{J}_k$ sold, the insurer pays the broker an upfront commission c_j and earns the markup $\mu_j = f_j - \kappa_j$ for each year the annuity is outstanding, where f_j is the variable annuity's expense ratio and κ_j is the marginal running cost of operating a variable annuity. We can then write the insurer's profits as

$$\pi_k = M \sum_{j \in \mathcal{J}_k} s_j [PV_j (f_j - \kappa_j) - c_j]$$

where M is the size of the market, s_j is the market share of annuity j, and PV_j denotes the present value of the annual profit margin. The term PV_j depends on how long the variable annuity will be outstanding and the corresponding discount rate. For convenience, we assume that PV_j is constant across all variable annuities such that $PV_j = PV$, where PV is a scalar factor.

We initially assume that insurers play a multi-product differentiated Nash Bertrand expense setting game. The insurer's problem is then to set expenses f_j to maximize its expected profits

$$\max_{f_j \, \forall j \in \mathcal{J}_k} M \sum_{j \in \mathcal{J}} s_j [PV(f_j - \kappa_j) - c_j],$$

which yields the corresponding set of first order conditions for each variable annuity $j \; \forall j \in \mathcal{J}_k$

$$s_j + \frac{\partial s_j}{\partial f_j} \left[(f_j - \kappa_j) - \frac{c_j}{PV} \right] + \sum_{l \in \mathcal{J}_{k,-j}} \frac{\partial s_l}{\partial f_j} \left[(f_l - \kappa_l) - \frac{c_l}{PV} \right] = 0. \tag{17}$$

The term $\sum_{l \in \mathcal{J}_{k,-j}} \frac{\partial s_l}{\partial f_j} \left[(f_l - \kappa_l) - \frac{c_l}{PV} \right]$ reflects how changing expenses f_j impacts demand for insurer k's set of other variable annuities, denoted $\mathcal{J}_{k,-j}$. Given the demand system developed in Section 6 of our paper, we can write the above first order condition as:

$$\frac{1}{\left(\frac{1-\omega}{\sigma}\right)} = f_j - \kappa_j - \frac{c_j}{PV} - \sum_{l \in \mathcal{J}_k} s_l \left[(f_l - \kappa_l) - \frac{c_l}{PV} \right]. \tag{18}$$

Note that in the above expression we directly observe market shares, expenses, and commissions; we also observe an estimate of $\left(\frac{1-\omega}{\sigma}\right)$ from our demand estimation exercise (Section 6) and can proxy for PV using the expected life of the variable annuities and the corresponding discount rate. Thus, we can use the first order condition (eq. 18) to estimate each insurer's marginal cost of operating variable annuity j, κ_j.

E.2 Calibration/Estimation

We use the estimated parameters from Section 6 to calculate the implied marginal cost for each variable annuity. Given the estimated parameters ω and σ and data $\{f\}$, $\{s\}$, $\{c\}$, and PV, we can invert each insurer's system of first order conditions to solve for the marginal cost κ_j of producing each variable annuity j. Consistent with our earlier assumptions in the paper we compute $PV = 8.56$ under the assumption that each variable annuity is outstanding for 15 years and the appropriate discount rate is 8%. Figure A11 displays the distribution of marginal costs (κ) that we recover from inverting eq. (18) as of 2015Q4. The average marginal cost is 78bps per annum, which seems reasonable given the potential money paid to subaccount managers and the general cost of running a variable annuity. The results indicate that, on average, an insurer earns a markup of 0.80% on total variable annuity assets. In NPV terms this implies that for each $1,000 of variable annuity sold the insurer earns $69. This is remarkably similar to the average commission a broker earns for selling a variable annuity (6.10%) and implies that insurers and brokers on average split the surplus roughly 50/50.

Observing the distribution of estimated marginal costs (κ) provides insight into whether firms are optimally setting variable annuity expenses as described above. If we recover marginal costs κ that are implausibly large, it would imply that, according to the supply side of our model, insurers are setting expenses that are too high. Conversely, if we recover marginal costs κ that are implausibly small, it implies that insurers are setting expenses too low.

E.3 Extension: Optimality of Commissions

We can also use this simple framework to analyze the optimality of commissions. The insurer's problem is then to set commissions c_j to maximize its expected profits:

$$\max_{c_j \, \forall j \in \mathcal{J}_k} M \sum_{j \in \mathcal{J}} s_j [PV(f_j - \kappa_j) - c_j],$$

which yields the corresponding set of first order conditions for each variable annuity j $\forall j \in \mathcal{J}_k$.

$$-s_j + \frac{\partial s_j}{\partial c_j} \left[PV \left(f_j - \kappa_j \right) - c_j \right] + \sum_{l \in \mathcal{J}_{k,-j}} \frac{\partial s_l}{\partial c_j} \left[PV \left(f_l - \kappa_l \right) - c_l \right] = 0 \tag{19}$$

Given the demand system developed in Section 6 of our paper, we can write the above first order condition as:

$$\frac{1}{\left(\frac{\omega}{\sigma}\right) PV} = f_j - \kappa_j - \frac{c_j}{PV} - \sum_{l \in \mathcal{J}_k} s_l \left[(f_l - \kappa_l) - \frac{c_l}{PV} \right]. \tag{20}$$

Given the estimated parameters ω, σ, and $\{\kappa\}$ and data $\{f\}$, $\{s\}$, and PV, we can invert each insurer's system of first order conditions (20) to solve for the optimal commission c_j for each variable annuity j. Figure A12 displays the optimal commission we estimate versus the observed commission data. The results suggest that the observed commission is roughly 2pp lower than the optimal commission. Our structural demand estimates in Section 6 of the paper indicate that brokers are very sensitive to commissions, as indicated by the estimated parameter $\widehat{\frac{\omega}{\sigma}}$, which is why insurers should offer them higher commissions.

However, we add the caveat that our supply-side is perhaps too simplistic to rationalize the price and commission setting behavior in this industry. For example, commissions and expenses enter both the utility and cost functions linearly, which implies that insurers essentially end up in a corner solution if expenses and commissions are jointly determined. For example, increasing commission by 1pp increases the broker's utility by ω while lowering the expenses by 1pp increases the broker's utility by $1 - \omega$. The insurer's cost of raising the broker's commission by 1pp is simply 1pp and the cost of lowering expenses by 1pp is 1pp$\times PV$. Given that we find that $\omega > \frac{(1-\omega)}{PV}$, an insurer would find it optimal to always increase broker commissions rather than decrease expenses. The fact that we obviously do not observe this corner solution in the data, indicates that there is likely some non-linearity in the cost structure. For example, it is possible that the cost of offering commissions is convex, as would be the case if insurers face increased regulatory scrutiny for selling high commission products.