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The impact of separating research payments from dealing commissions: Evidence from Sweden

Peter F. Pope
Bocconi University

Ane M. Tamayo
London School of Economics

Yang H. Wang †
London School of Economics

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Abstract

This paper studies the impact on sell-side analysts and the stock market of separating research payments from dealing commissions. We exploit an exogenous shock to sell-side analysts' research income in Sweden, caused by several of Sweden's largest asset managers' adoption of the unbundling model (the RPA model) to pay for the equity research purchased from the sell-side. Using a hand-collected dataset revealing analyst location, we find that the introduction of the RPA model coincides with a reduction in the supply of sell-side research services. The RPA model is associated with a reduction in analysts' coverage lists, with some firms losing analyst coverage entirely. This reduction is greater for firms with lower institutional ownership and with lower market value of equity. Moreover, we find that, after controlling for changes in analyst coverage, the adoption of the RPA model is associated with an overall improvement in analysts' research quality, as evidenced by superior earnings forecast ability in the post adoption period. Lastly, we find that the market reacts more strongly to forecast revisions in the post RPA adoption, and the increase in market reaction is mainly attributable to firms with higher institutional ownership and with higher market value of equity. Overall, our results suggest that RPA is associated with an improvement in the information environment for firms with analyst coverage, but some firms suffer a loss of analyst coverage.

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† Contact author: Yang H. Wang, OLD 3.42, Houghton Street, London School of Economics, WC2A 2AE, London, United Kingdom; Email: wangy128@lse.ac.uk. We appreciate the helpful comments of Wenjiao Cao, Stefano Casino, Maria Correia, Katharina Hombach, Ken Lee, Xi Li, Laurence van Lent, Maximillian Muhn, and participants at the 2017 Bolzano-Padova Accounting Summer Camp, seminars at London School of Economics and at Frankfurt School of Finance and Management.

The impact of separating research payment from dealing commissions: Evidence from Sweden

1. Introduction

In January 2018, the European Union issued a new directive changing how asset managers pay for the research services provided by sell-side analysts. Previously, brokers bundled payments for research services with trade execution fees. However, due to the perceived inefficiencies that the bundling model creates, the new Directive states that payments for research and trading execution should be separate. In this paper, we study a new research payment regime in Sweden – the earliest implementer of the new payment method – to test the potential impact of brokerage fee unbundling. Specifically, we study the impact of the change to brokerage fee payments on the information environment, in the form of sell-side analysts' coverage and forecast accuracy.

The extant literature examining sell-side analysts' incentives when choosing firms to cover and when forecasting earnings and other outcomes concentrates on two sources of compensation for their investment research: (1) subsidies from the investment banking department; and (2) the sharing of dealing commissions with brokerage houses' trading operations. One stream of the literature conjectures that a significant portion of analysts' research income is subsidized by the investment banking function within a brokerage house (Lin and McNichols 1998; O'Brien et al. 2005; Michaely and Womack 1999; Dechow et al. 2000). Another stream of papers investigates the impact of analysts' research income coming from dealing commissions when the brokerage house handles investors' trades (Hayes 1998; Irvine 2000; Irvine 2004; Jackson 2005; Cowen et al. 2006). When a brokerage house pays for services (or other perquisites) consumed by asset managers as a result of dealing commissions generated by the brokerage arrangement, this has become known as a "soft dollar" arrangement.

Hence, providing free (or subsidized) research developed within the brokerage house and consumed by the asset manager is a form of soft dollar arrangement.

Soft dollar arrangements are potentially inefficient because they encourage over-consumption by asset managers at asset owners' expense as dealing commissions are higher than they need be. On the supply side, when they are not held accountable for the profitability of their own decisions, analysts have incentives to offer a "waterfront coverage" of firms, i.e., to cover as many firms as possible to solicit asset managers (Edison Investment Research 2013). Sell-side research is effectively an "advertising tool" to attract asset managers. Moreover, as analysts' research income is directly linked to the value (and the volume) of trades executed by brokerage houses under the bundled model, a higher amount of trading volume will generate higher dealing commissions (hence research income) to analysts, creating incentives for analysts to issue optimistically biased forecasts and recommendations. Profit-maximizing brokers required to charge asset managers for the supply of research services will have incentives to better control the supply of research, adjust supply in response to asset managers' demand and allowing the reduction of dealing commissions to the benefit of asset owners.

There is a paucity of empirical evidence on the role of sell-side research in determining dealing commissions, primarily due to lack of data on dealing commission components and the lack of time series variation in commission arrangements. In one of the handful of papers, Maber et al. (2014) use proprietary data to study 'broker votes', an important mechanism to allocate the research income among analysts. They find that brokerage houses use broker votes to indirectly reward analysts for the contribution they make to generating dealing commissions. We do not consider the compensation of individual analysts in this paper, but seek instead to exploit a rare change in the research payments system from the dealing commission to study how a change in compensation for research influences the supply of brokerage research services, with a focus on analysts' coverage decisions and the quality of their research.

Regulators have recently taken an interest in the possible inefficiencies of the bundled research payments system. The European Commission proposed in the Markets in Financial Instrument Directives II (MiFID II) that asset managers be required to establish a separate research payment account (RPA) to handle payments for research. Under the RPA approach, brokerage houses charge asset managers separately for dealing commissions and research payments. Asset managers have to decide whether to bear the costs of research on their own account or pass on the charges to asset owners. Either way, asset managers have incentives to consider carefully the amount they spend on sell-side research service. Hence, the RPA model can mitigate overspending on research services by asset managers. From sell-side analysts' viewpoint, the RPA model breaks the link between the trading volume and research payments. This renders a "waterfront coverage" style – covering a large number of firms – and potentially biased forecasts, unprofitable. As a result, analysts may reduce their coverage lists and provide higher quality research in an attempt to secure their share of research payments.

The European Union implemented MiFID II as recently as 3 January 2018, meaning that EU wide data to test implementation effects unavailable.[1] However, at the beginning of 2015, several of the largest and most influential Swedish asset managers announced that they had decided unilaterally to separate sell-side research payments from the dealing commission as an endorsement of the debate regarding the proposal to unbundle the research payment in MiFID II. The preemptive voluntary adoption of the RPA approach in Sweden provides an interesting setting to generate early insights into how the supply and quality of analysts' research changes in response to the research payment structure.

We predict that the implementation of the RPA payment model creates incentives for Swedish analysts to reduce coverage of firms where the demand for research is low and to

[1] Available at: https://www.esma.europa.eu/policy-rules/mifid-ii-and-mifir. [Accessed: 20 August 2017]

improve the quality of the research they continue to perform. We use a difference-in-differences research design to study the supply of sell-side research by Swedish analysts, where the introduction of RPA in Sweden is likely to have greatest impact. As our starting point, we predict that the number of firms on analysts' coverage list falls with the adoption of RPA in Sweden. We hand-collect the geographical location of analysts covering firms listed on Swedish stock markets. We identify 1,582 analysts, including 223 Swedish analysts. After discarding four Swedish analysts who relocated internationally, we classify 219 Swedish analysts as the treated analysts, and 1,359 non-Swedish analysts as the control group to test the hypothesis within a difference-in-difference design. We find that Swedish analysts, compared to non-Swedish analysts, drop 0.62 firms after the adoption of the RPA model. Secondly, we use firms that are listed on the largest Swedish stock market – Nasdaq OMX Stockholm as the sample, hypothesize and find that Swedish analysts primarily reduce coverage of firms with low institutional investor ownership and low market capitalization. More precisely, after the adoption of RPA in Sweden, firms with low institutional investor holdings suffer a reduction of 0.244 analysts, compared to firms with high institutional investor holdings. In addition, the reduction in analyst coverage among small firms is 0.483 relative to large firms, equivalent to a 50% reduction in the mean of the number analysts following small firms. Thirdly, we use analysts' forecast accuracy as the proxy of research quality to test the change in the research quality after the Swedish RPA adoption. Results show that analysts' forecast errors decrease by 0.33% after the introduction of the RPA model. We further find that the decrease in analysts' forecast error is due to the improvement in analysts' forecast ability, rather than the elimination of supply of forecast by lower quality analysts. Lastly, we find that the market reaction to analysts' forecast revisions increases by 50% with the RPA adoption, and this increase is only significant for firms with high institutional investor ownership and with high market value of equity.

Our paper makes the following contributions. Firstly, it makes the first contribution in the literature on the role of payments for research when bundled with dealing commissions. When studying the effect of the trading volume on analysts' behavior, the extant literature builds the research on the premise of a positive association between analysts' research income and the trading volume. We use a novel setting and study the change of analysts' coverage decision and research quality when this association disappears. Secondly, our paper contributes to the indirect effect of analysts' on the stock market. The change in the research payment structure has a direct impact on analyst coverage, with a reduction in the supply of research for firms with low institutional investor holdings and low market capitalization. Thirdly, we provide early empirical evidence to the newly implemented regulation in MiFID II in terms of the potential unintended consequences of separating research payments from dealing commissions.

The remainder of this study is organized as follows. In the next section, we provide a brief background for the research payment method, discuss the related literature, and develop the hypotheses. In Section 3, we outline the research design. Section 4 presents the various sources of data and gives a general description of the Swedish market. Section 5 reports the primary results and findings. Section 6 concludes.

2. Background, literature review, and hypothesis development

2.1 Background

Asset managers' payment for the sell-side research service is bundled with the trading execution fees under the head of dealing commissions. In the US, the "Safe Harbor" in the Section 28(e) of the Securities Exchange Act (SEA) of 1934 permits asset managers to pay a premium to brokers for additional services in the dealing commission when seeking brokerage services. The additional services may include software, hardware, database access and research reports issued by brokers' research departments. Although the Section 28(e) of SEA requires asset managers to disclose such arrangement, the disclosure can be opaque. Asset managers must disclose the total amount of dealing commissions and the existence of the soft dollar arrangement, but they do not necessarily report the exact amount of the payment for a research service. The reason that the SEC introduced Safe Harbor in the SEA is to protect asset managers from the potential breach of fiduciary duty. Without Safe Harbor, asset managers, in an attempt to avoid litigation by asset owners for breaching fiduciary duty, may be more likely to select brokerage services with the lowest commission fees, regardless of the quality of the service. However, use of soft dollar arrangements and the bundled research payments model is controversial. Advocates argue that soft dollars are an innovative and efficient form of economic organization that benefits investors (Johnsen 2009). Brennan and Chordia (1993) suggest that trading volume could be a proxy for information quality, and asset managers obtaining high quality information may achieve better gross performance. In contrast, the opponents of fee bundling argue that asset managers may abuse the opacity of soft dollars to unjustly enrich themselves (over-spending), leading to inefficient use of asset owners' resources (Blume 1993, Bolge 2009, Erzurumlu and Kotomin 2016).

The brokerage service industry in the EU is similar to the US. Payments for research service are bundled with trading execution fees, and charged to the investors as a whole package under dealing commission. The EU, endorsing the unjust enrichment argument that asset managers overspend on the sell-side research service by using investors' money, took the first step to unbundle research payments from dealing commissions in the recent implementation of the Markets in Financial Instruments Directive II.[2]

2.2 The Bundled Model

[2] Commission Delegated Directive (EU) 2017/593. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017L0593&from=EN. [Accessed: January 20, 2017] Appendix 2 provides more details.

Figure 1 Panel (A) illustrates the bundled model graphically. Asset managers pay for the research service bundled together with the trading execution service under the head of dealing commissions, and then send the invoice for dealing commissions to their clients. The dealing commission is calculated as the trading value multiplied by a fixed rate negotiated between asset managers and brokers ex ante. Having received the dealing commission, brokerage houses split and distribute the commission in a fixed proportion to the research department where sell-side analysts work and the trading department.[3]

Academics, practitioners and regulators have discussed over years the merits and demerits of the bundled model and the so-called soft dollar arrangements, although a negative view seems to prevail. On the one hand, advocates of the bundled model argue that this payment regime is an innovative and efficient form of economic organization, which benefits investors as soft dollars efficiently subsidize asset managers' search for profitable trades (Horan and Johnsen 2000; Johnsen 2009). To the extent that sell-side analysts provide research insights to asset managers in advance of trading, the bundled payment model acts as an ex-ante effective bond that enhances the quality of research and brokerage execution services. As such, the bundled model mitigates agency problems inherent in delegated portfolio management. On the other hand, detractors of the bundled model maintain that the opaqueness of this method of payment may induce asset managers to unjustly enrich themselves at expense of asset owners, without bringing extra return for the fund (Bogle 2009; Blume 1993; Edelen et al. 2012; Erzurumlu and Kotomin 2016). Specifically, under the bundled model, asset managers may treat sell-side research services as a "free good" because they do not bear the cost of consuming such service. Brokerage houses, in turn, may use their research services as an "advertising" tool to solicit business from asset managers. Given that the exact amount spent on research is

[3] The anecdotal evidence from one of the largest brokerage houses in London suggests that the percentages of the commission split are 55% to the research department and 45% to the trading department.

unknown to investors, asset managers may prioritize this research service in the selection of trading execution services provided by brokerage houses (Myners 2001).[4]

Empirical evidence on this matter is relatively scarce. A few studies have examined whether soft dollar arrangements deliver superior returns to investors. In a recent paper using actual amounts of soft dollar research payments and total brokerage commissions for a large number of funds, Erzurumlu and Kotomin (2016) show that higher soft dollar and total brokerage commissions are associated with higher advisory fees but not with higher risk-adjusted fund returns. In the same spirit, Edelen et al. (2012) compare the return performance in funds where the distribution cost is either bundled with brokerage commissions (relatively opaque) or expensed from funds' income statement (relatively transparent). They find that the impact of the opaque distribution cost on fund return is significantly more negative than that of the transparent distribution cost. Although Edelen et al. (2012) focus on the distribution cost, rather than research payments, the opaqueness of brokerage commissions is associated with the poorer performance.

Additionally, the bundled model directly links analysts' compensation to the trading value (or volume), which lays the cornerstone of the literature on analysts' optimism and the trading commission. (Jackson 2005; Cowen et al. 2006; Ljungqvist et al. 2007). The value of trades executed determines analysts' research income so that analysts issuing optimistic forecasts or recommendations could generate more trading commissions, and then more research income.

Around 2006, several countries started to modify the bundled model by suggesting alternative ways to distribute research payments among different brokers. In the US, SEC released guidance regarding the use of *Client Commission Arrangement* (CCA), whilst in the

[4] Anecdotal evidence shows that asset managers are bombarded by research reports. Only a tiny portion of those reports are read by the asset managers. For example, ' …[A]sset managers are bombarded by 1.5 million report and only 5% may actually be read by their clients…' Available at: http://www.economist.com/blogs/schumpeter/2014/05/regulating-equity-research. [Accessed: April 20, 2016]

UK, Financial Service Authority (FSA, the predecessor of the current UK financial regulator – Financial Conduct Authority) introduced the *Commission Sharing Agreement* (CSA).[5,6] Since CCA and CSA are almost identical, we focus on the CSA to describe the *modified bundled model*, depicted graphically in Panel (B) of Figure 1.[7]

Under the CSA, asset managers enter into an agreement to set up an account with their brokers wherein a separate portion of the dealing commission is preserved for the research service. The broker manages the account and distributes the research service payment through a process called "broker votes" to all sell-side research providers who have contributed to the trade. The analyst who has the greatest contribution receives the largest number of votes and then is accordingly allocated the largest portion of the research payment. Thus the research payment does not entirely flow to the broker who provides the trading execution service, which reduces analysts' incentives to provide optimistic opinions (Galanti and Vaubourg 2017).

CSA does not mitigate, however, the opaqueness of research payments in the dealing commission. First, dealing commissions (research payments together with trading execution fees) as a whole are determined by the trading volume. Second, asset owners would not know the precise amount spent on the research service. The over-spending of the sell-side research service continue to exist after the implementation of CSA.[8]

2.3 The Unbundled Model (RPA Model)

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[5] SEC introduces Client Commission Arrangement on July 24, 2006. Available at: https://www.sec.gov/rules/interp/2006/34-54165.pdf [Access August 18, 2018]

[6] UK introduce Commission Sharing Agreement in July 2006. Available at: https://www.theinvestmentassociation.org/assets/files/research/2014/20140218-imadealingcommissionresearch.pdf. [Access October 20, 2015]

[7] One different aspect between CCA and CSA is that the participants in the CCA must be registered broker dealers, and cannot be the "introducing broker". Online available: http://www.integrity-research.com/ccas-versus-csas-when-is-a-commission-not-a-commission/ [Access August 19, 2018]

[8] According to the FSA (2012) survey, "…too few firms (funds) adequately controlled spending on research and execution services…" (Page 7).

ESMA, the EU regulator imposes a strict separation between research payments and execution fees in the recently adopted MiFID II. The Article 13 of the Commission Delegated Directive (EU) 2017/593 specifies the following conditions where the sell-side research service can be provided "…if it is received in return for

a) direct payment by the investment firm out of its own resources;
b) payments from a separate research payment account controlled by the investment firm…" [9]

Thus, the precise amount of the research payment in the Research Payment Account (RPA), in line with trading execution fees, will be presented separately to investors (condition b). Panel (C) of Figure 1 illustrates the RPA model. Under the RPA model, the concepts of the dealing commission and the soft dollar arrangement disappear. The link between research payments and the trading volume does not exist anymore. Alternatively, asset managers can always choose to bear the cost of the research service themselves (condition a). Either asset managers self-financing or using RPA to pay for the research service will radically curb asset managers' overspending of the research service.

MiFID II has officially been implemented within the EU since January 3rd, 2018. However, influenced by the unbundling proposal in the MiFID II regulation in 2014, the Swedish Financial Supervisory Authority (Finansinspektionen – 'FI' hereafter) expressed strong preference for the complete separation of research payments from the dealing commission. FI had a long discussion with the fund management industry about the commission separation in 2014.[10] Furthermore, in the revised Swedish Code of Conduct for fund management companies

[9] Commission Delegated Directive (EU) 2017/593. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017L0593&from=EN. [Accessed: January 20, 2018] More details about Article 13 are presented in Appendix 2.

[10] Available at: http://www.fi.se/Tillsyn/Skrivelser/Listan/Hantering-av-analyskostnader-i-fonder/. This is the letter sent by the FI to the fund management industry about the importance of the rules about best execution and inducements which declares that the management company cannot charge extra fees unless it is in the customers' best interest. [Accessed: April 25, 2016]

issued in 2015 by the Swedish Investment Fund Association (SIFA), the SIFA members are required to separate research payments from the execution service cost.[11] [12] If a member does not comply with the code, this member must provide an explanation for the deviation.[13] Although the SIFA code does not explicitly specify using RPA to pay for the research service, the separation between the research service payment and the execution fee is, in spirit, equivalent to RPA. The burden of imposing the research payment separation varies across asset management companies. Compared to large asset management companies, adopting RPA would be more disadvantageous to small asset management companies for the following reasons. First, small asset managers have fewer resources of doing research than large asset managers. One way to level the playing field is to purchase the sell-side research service. The RPA model decreases the sell-side research purchase in general. The marginal impact of the decrease would be greater on the small asset managers who have fewer resources than large asset managers that possess abundant resources. Second, if asset managers choose to bear the cost of the research purchase by themselves, the research payment would have a greater influence on the small asset management companies with limited budgets on the research purchase. The research payment was previously bundled with the trading execution fees in Sweden. In 2015, some of the largest Swedish asset management companies announced the research payment separation, including Swedbank Robur, SEB and Svenska Handelsbanken.[14]

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[11] Swedish Investment Fund Association (Fondbolagens förening, SIFA hereafter) is an association for both Swedish investment funds and foreign funds which have Swedish subsidiaries or branches. It has collectively 42 members representing the majority of funds in Sweden (http://fondbolagen.se/en/About-us/).

[12] In the Code of Conduct, page 6, "…[c]osts for investment research may be charged with the fund only where the research enhances the quality of the fund management and the unit-holders have been duly informed. This requires that the benefit of the research is considered to correspond to the costs. The costs for research must be separated from the costs for execution of orders…" Appendix 3 presents more details. Available online: http://fondbolagen.se/en/Regulations/Guidelines/Code-of-conduct/

[13] In the Code of Conduct, page 2, "…For Swedish fund management companies, however, the intention are that deviations shall not be permitted when the word "must" is used. Members of the Swedish Investment Fund Association must, in their Annual Reports or on their website, clearly state that they comply with the Code and must provide an explanation for any deviations."

[14] For example, Svenska Handelsbanken states the research payment separating on page 8 in the Information Brochure – Handelsbanken Fund AB, issued on January 12, 2016: "…As of January 1, 2015, expenses for external analyses will be charged separately. These expenses were previously included in the transaction costs. The

These three asset management companies account for a 50% market share in the Swedish asset management market in terms of Assets under Management (AuM).[15] Their adoption provides exploitable data and a feasible setting, albeit containing noise, to study the impact of the RPA adoption on Swedish sell-side analysts and on the Swedish stock market as the early evidence to the newly implemented regulation in MiFID II in terms of the influence of separating research payments from the dealing commission.[16] [17]

2.4 Identifying the treatment group and the control group.

As the largest Swedish asset managers have separated research payments from the dealing commission, we argue that Swedish brokerage houses and analysts are more likely to be affected. Thus we classify Swedish analysts as the treated analysts and non-Swedish analysts as the control group. However, both groups under such identification contains noise that cannot be removed. On one hand, we should bear in mind that asset managers, rather than sell-side analysts, are subject to the RPA model in that the objective of the RPA proposal in the MiFID II is to enhance the efficiency of asset managers using the research budget, alleviate the concern about the inducement, and then mitigate the over-consumption of the research service. Therefore, even though some of the Swedish asset managers adopt the RPA model, Swedish brokerage houses are not restrained from accepting research payments from asset managers who do not use RPA (small Swedish asset managers and non-Swedish asset managers continue using the old bundled model). As one analyst can provide research services to and her brokerage house can receive payment from asset managers either using RPA or bundling it up

expenses for external analyses will be included in the calculation of the annual fee…" Appendix 4 presents more details.

[15] The Riksbank (2014): The Swedish Financial Market 2014: Page 92, Table 14.

[16] The data is noisy because only three of the largest Swedish asset managers switched to RPA. Small asset managers may still use the bundled model. The same sell-side analysts could provide research service to both large and small asset managers. Therefore, separating sell-side analysts who are affected by the RPA from those who are not affected is less likely to achieve. More explanation will be given in the next section.

[17] For simplicity, we use RPA to replace the RPA-equivalent research payment method in the Swedish setting.

with the execution service, separating out the analysts whose brokerage houses only receive research payments through RPA is less likely to achieve. As a result, the treatment group contains noise. On the other hand, the control group may contain noise as well. Swedish asset managers invest globally, meaning that Swedish asset managers in theory need the research services of foreign firms. Then they may pay foreign brokerage houses through the RPA method when they access the international market.[18] Figure 2 depicts the treatment group, the control group and the source of the noise in each group. The three largest RPA-adopting Swedish asset management companies create an exogenous shock to brokerage fees (the top box in the first column). Swedish brokerage houses that receive research payments from these three are affected by the RPA adoption, which are in the treatment group (Arrow 1). Foreign brokerage houses receiving research payments from foreign asset managers are then in the control group (Arrow 5). When foreign brokerage houses receive research payments from the three RPA adopting asset managers, it becomes the noise to the control group (Arrow 4). In the treatment group, the noise comes from foreign institutional investors (Arrow 3) and other Swedish asset managers that do not adopt the RPA model (Arrow 2). Despite the noise born with the identification, we are confident of the power of the setting (the solid arrows). Firstly, we believe that sell-side analysts would mainly serve the domestic asset managers rather than the foreign analysts.[19] Thus, the noise in the treatment group from foreign investors (Arrow 3) and the noise in the control group from Swedish asset managers (Arrow 4) would be trivial. Secondly, in terms of the noise in the treatment group from other Swedish asset management companies that do not adopt RPA (Arrow 2), we believe that the noise would be overwhelmed by the significant market power of the three RPA adopting asset managers.

[18] In the anecdotal evidence (an email from asset managers in SEB), Swedish asset managers do purchase from international brokers but that mainly happens when they need to access the international markets.
[19] In the anecdotal evidence (an email from one of the RPA adopting Swedish asset managers), Swedish analysts are the main research providers to Swedish asset managers.

In addition, the heterogeneity of the treated and controlled analysts' firm coverage may pose a threat to the parallel trend assumption. We argue that analysts mainly cover their domestic firms. In the treatment group, firms are mainly Swedish firms. In the control group, firms have a variety of origins, depending on the location of the analysts covering them. In this regard, although there may be a small group of firms covered by both Swedish analysts and non-Swedish analysts, the majority of firms in the treatment group are different to firms in the control group (Figure 3).

2.5 Hypotheses development

We develop our hypotheses with the understanding of the distinctive features among different payment models and regulators' motivation to shift the bundled model to RPA. The adoption of RPA leads to the curtailment of asset managers' research payments, creating an exogenous shock to brokerage fees, of which a significant portion is distributed to the research department as sell-side analysts' compensation. We expect that the reduced research payments affects analysts' coverage decision and their research quality.

(A) Analysts' coverage decision

We hypothesize that analysts reduce the number of firms in their coverage list with the RPA adoption. Asset managers are obliged to act in the best interests of clients when seeking brokers for the trade execution (Baker and Veit 1998; Game and Gregoriou 2014). Most of the brokers provide not only the trade execution service but also the research service. Asset managers are supposed to assess the quality of the entire package of the service provided by candidate brokers. Under the bundled model, research payments hide behind the mask of the dealing commission, which fends off the enquiries from the investors concerning the spending on the purchase of the research service. In this regard, the research service may become an inducement, inducing asset managers to prioritize the research service over the trade execution service. Goldstein et al. (2009) find that institutional investors tend to concentrate order flows with a few brokers in an attempt to receive extra premium service. On the other hand, sell-side analysts would solicit asset managers by providing a wealth of research service that covers a wide range of stocks (waterfront coverage). Hence both the supply side and the demand side drive the over-production and over-consumption of the research service. However, bombarded by a myriad of research reports, asset managers are unlikely to use all of them, which leads to, from the stance of regulators, a severe waste of investors' money.[20] When switching to the RPA model, the research service will be priced independently based on the quality of the research service rather than the trading volume. Thus, the specific amount of research payments becomes transparent to investors. Under the investors' supervision, asset managers may not be able to consume as much research service as under the bundled model. On this account, with the decrease in research consumption analysts will reduce the research cost accordingly. One of the feasible ways to cut the cost is to stop covering firms that are less likely to bring the research income under the RPA model.

Hypothesis 1: The adoption of RPA reduces the number of firms in analysts' coverage list.

(B) The type of firms being dropped

We expect that analysts under the RPA model selectively remove firms from their coverage list. More specifically, we argue that analysts are more likely to drop the firms whose research are less likely to attract asset managers to purchase under the RPA model. Under the bundled model, sell-side analysts cover a wide range of firms in an attempt to use the "quantity" to solicit asset managers. The cost for covering a firm whose research have little use to asset managers is in a sense subsidized by other research that is valuable to asset managers. Turning to the RPA model, asset managers seek and pay for the research service as well as the trading

[20] ' …[A]sset managers are bombarded by 1.5 million reports and only 5% may actually be read…' Available at: http://www.economist.com/blogs/schumpeter/2014/05/regulating-equity-research. [Accessed: August 25, 2015]

execution service separately. The transparency of research payments would lead to asset managers stopping spending on the research of firms that they have little investment intentions towards. Accordingly, sell-side analysts are more likely to drop the coverage of such firms. To test this hypothesis, we firstly use firms' institutional investor ownership as the directive measure of firms' attractiveness to asset managers. Then we expect that firms with low institutional investor holdings are less attractive to asset managers and experience a greater reduction in analyst following in the post period of the RPA adoption. Secondly, we use the firm size as another proxy of asset managers' investment intention, as institutional investors in general prefer to invest in large firms. In this regard, we expect that small firms in the post-RPA adoption period experience a greater reduction in analyst following than large firms. The hypotheses are as follows:

Hypothesis 2a: After the RPA adoption, the decrease in the number of analysts following the firms with low institutional investor ownership is greater than firms with high institutional investor ownership.

Hypothesis 2b: After the RPA adoption, the decrease in the number of analysts following small firms is greater than large firms.

(C) Analysts' research quality

We predict that the adoption of the RPA model improves the sell-side research quality on average. Firstly, the RPA model increases competitiveness of analysts' labor market. In light of the regulator's objective of proposing RPA, brokerage fees are expected to decrease, and they flow more efficiently to analysts with ability to produce high-quality research. Low-quality research will be forced out of the market gradually. The overall sell-side research market will, accordingly, develop to a high degree of quality. Secondly, the RPA model breaks the link between analysts' income and trading volume, which in turn ameliorates their trading incentive to issue upward biased forecasts and recommendations. Analysts' incentive for issuing optimistically biased opinion has been widely studied. Bradshaw (2011) summarizes six sources that may lead to analysts' upward biased behavior. One of the incentives is trade generation.[21] Under the bundled model, analysts may issue upward biased forecasts and recommendations to inflate trading volume for their brokerage house, thus to generate higher research income from the dealing commission (Jackson 2005; Cowen et al. 2006; Ljungqvist et al. 2007). As the RPA model changes the way that analysts are compensated, analysts will not be rewarded by bringing more trades to their brokerage houses because the research service becomes a distinct product rather than a by-product that come with the execution service. On this account, analysts are compensated by providing high-quality research rather than by offering deliberately biased forecasts or recommendations.

We use forecast accuracy as the proxy to test the improvement in research quality.[22] The reasons are as follows. Firstly, forecast accuracy affects analysts' employment turnover. Analysts who constantly provide less accurate forecasts are more likely to leave the industry, which implies that the equity research market screens analysts' quality by forecast accuracy (Groysberg et al. 2011). Secondly, forecast accuracy remains one of the crucial qualities demanded by asset managers. In Brown et al. (2015), the authors survey 365 sell-side analysts and find that forecast accuracy remains important because analysts' clients (asset managers) demand it, as well as forecasts are the input to the stock recommendations that are highly valued by asset managers.[23] Therefore, forecast accuracy is appropriate to be a proxy of research quality. Our third hypothesis is as follows:

Hypothesis 3: Analysts' forecast accuracy improves after the adoption of RPA.

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[21] The other five sources in Bradshaw (2011) include boosting investment banking fees, currying favor with management, institutional investor relationship, research for hire, and analysts' cognitive bias.
[22] We use forecast accuracy and forecast error interchangeably. High forecast accuracy means low forecast error.
[23] Brown et al. (2015): page 31-34, Table 10.

Now we turn to investigate how analysts improve their forecast accuracy in the post RPA adoption period. We posit two possible channels. Firstly, within the context of the reduced brokerage fees, increased competition in the equity research industry and the weakened incentive for issuing biased opinion, analysts that continue operating in the industry will make a great effort to improve their research quality to secure their jobs. Secondly, analysts may stop covering firms that they are unable to provide good forecast research on. Analysts may have the edge in covering certain firms but not in others. For example, some analysts may have private connections with some firms' management, which would facilitate high-quality research production (Chen and Matsumoto 2006; Brown et al. 2015). As low-quality research becomes a pure loss after asset managers switching to the RPA model, the likelihood of ceasing to cover firms on which they cannot produce high-quality research will be higher among analysts that are influenced by the RPA adoption than unaffected analysts. In this case, analysts do not improve their forecasting ability as in the previous channel, but drop the firms that are hard to analyze. These possible channels are not mutually exclusive. All the forces could drive the quality of the equity research industry to a higher level. Our next hypothesis is therefore as follows:

Hypothesis 4a: The improvement in forecast accuracy in the post-RPA period is due to analysts improving their forecast ability.

Hypothesis 4b: The improvement in forecast accuracy in the post-RPA period is due to analysts ceasing to cover the firms for whom they are unable to provide high-quality research.

(D) Market reaction to analysts' forecast revisions

We hypothesize that the market reaction to analysts' forecast revisions increases with the RPA adoption. First, the market reacts more strongly to revisions of forecasts with higher accuracy (Abarbanell et al. 1995; Stickel 1992; Park and Stice 2000; Gleason and Lee 2003).

In line with Hypothesis 3 that analysts' forecast accuracy improves after the adoption of RPA, In addition, following the Hypotheses 2a and 2b, analysts continue covering large firms and firms with high institutional holdings in the post RPA period. Then we expect that the improvement in analysts' forecast accuracy may mainly occur among large firms and firms with high institutional holdings. On this account, we expect that the increase in forecast accuracy due to the RPA adoption elicit stronger market reaction among large firms and firms with high institutional holdings.

Second, in Hypotheses 2a and 2b we expect that firms with low institutional investor holdings or with low market value of equity lose more analysts. The reduction in analyst following among small firms or low institutional investor holding firms may lead to a reduction of information source. Accordingly, investors may rely more on the remaining analysts and react more strongly to forecasts revised by remaining analysts. Therefore, we expect that an increase in market reaction to forecast revisions in the post RPA period among firms with low market value of equity or with low institutional holdings.

Both arguments support a greater market reaction to forecast revisions in the post RPA period. Then our hypotheses are as follows:

Hypothesis 5a: The market reacts more strongly analysts' forecast revisions in the post RPA adoption period.

Hypothesis 5b: The increase in market reaction to forecast revisions in the post PRA period is greater among firms with higher institutional holdings or with higher market value of equity.

Hypothesis 5c: The increase in market reaction to forecast revisions in the post PRA period is greater among firms with lower institutional holdings or with lower market value of equity.

3. Research design

3.1 Analysts' coverage list shortening

We use a difference-in-difference technique to test Hypothesis 1 within the sample period from 2013 to 2016. The dependent variable is the number of firms followed by each individual analyst within a quarter (*NUMCOM*). As the three largest Swedish asset management companies switched to RPA since 2015, we define an indicator variable, *RPA*, with the value of one for the years of 2015 and 2016, and zero otherwise. Furthermore, we define another indicator variable, *SW*, as the treatment variable, one for Swedish analysts and zero for non-Swedish analysts. [24] Thus, the interaction term, *RPA*× *SW*, captures the change in the number of firms followed by Swedish analysts relative to non-Swedish analysts after the RPA adoption in Sweden. We include a set of analyst-related control variables. Firstly, we add two control variables in line with Clement (1999): analysts' general experience (*GEXP*), defined as the number of years since the analyst provided her first forecast for any firm; and analysts' industry coverage (*NUMIND*), defined as the number of industries followed by each analyst.[25] We expect positive coefficients for both of these control variables because more experienced analysts are expected to follow more firms, and covering more industries may suggest more firms need to be added to analysts' coverage list. Secondly, Groysberg et al. (2011) find that analysts' forecast accuracy is positively associated with their employment turnover. In other words, analysts that cannot provide accurate forecasts have a higher chance of being fired. This is an extreme case of the reduction in the number of firms in analysts' coverage list. In an attempt to control for the ability of analysts' past accuracy (*PACY*), we following the method

[24] We dropped four Swedish analysts that used to relocate between Sweden and other countries during the sample period.

[25] We use the first two digits of the SIC code to define industry. When we merge the data from I/B/E/S and from Compustat Global, only 75.5% number of firms are matched and have been found their SIC codes. Thus the variable *NUMIND* is underestimated.

from Hong and Kubik (2003), according to which we calculate each individual analyst's average forecast accuracy score for the previous year in the following equations:

$$Percentile\ Rank_{ijt-1} = 100 - \frac{Rank_{ijt-1} - 1}{AAF_{it-1} - 1} \times 100 \tag{1}$$

$$PACY_{jt} = \frac{1}{n}\sum_{i}^{n} Percentile\ Rank_{ijt-1} \tag{2}$$

In the above equations, $Rank_{ijt-1}$ is the rank of analyst *j*'s forecast on firm *i* in year *t-1* relative to other analysts who also cover firm *i*.[26] AAF_{it-1} is the number of analysts following firm *i* in year *t-1*. $PACY_{jt}$ is the analyst *j*'s average accuracy scores in year *t-1*. Lastly, we also control for the brokerage house, analyst, and/or quarter fixed effects (*FE*) in different specifications to account for brokerage houses, analysts, and/or time unobservable invariants.[27] The regression is as follows:

$$NUMCOM_{jt} = \alpha_0 + \alpha_1 RPA_t + \alpha_2 SW_j + \alpha_3 RPA_t \times SW_j + \alpha_4 GEXP_{jt} + \alpha_5 NUMIND_{jt} + \alpha_6 PACY_{jt} + FE + \varepsilon_{jt} \tag{3}$$

3.2 Disproportionate reduction in firms' analyst following

To test whether the reduction in analyst following for the low institutional investor holding firms and small firms is more pronounced, we switch the unit of analysis from analyst-quarter (*j, t*) to firm-quarter (*i, t*). We focus only on firms listed on the largest Swedish market and covered by Swedish analysts. The reasons are as follows. Firstly, elaborating on Hypothesis 1,

[26] This is the only place where we use *t* as the year subscript. In the rest of this paper, the subscript *t* represents the time of quarters.

[27] We did not use I/B/E/S broker codes (ESTIMID) to create brokerage house dummy variables because they change when one brokerage house is acquired by another one. Thus, we obtain information of the brokerage houses from analysts' LinkedIn profiles and Bloomberg. Furthermore, subsidiaries of the same brokerage house in different countries share the same broker code. For example, both US Barclays and UK Barclays have the same I/B/E/S broker code "FRCLAYSC". We should treat US Barclays and UK Barclays as two different brokerage houses as analysts work in each firm are less likely to be affected by each other. Therefore, the brokerage house fixed effect includes analysts' location. For example, we have a dummy variable to US Barclays and a different dummy variable for UK Barclays.

Swedish analysts are the major influenced party to the RPA adoption. Secondly, compared to the non-Swedish-market-listed firms, firms that are listed on the largest Swedish stock market are more likely to be covered by Swedish analysts, where the RPA adoption effect would be the greatest.

We use the Ordinary Least Square regression (OLS) to test Hypotheses 2a and 2b. The dependent variable is the number of Swedish analyst following a firm (*SW_AF*). The indicator variable *RPA* is the variable of interest as defined previously. Next, we define dummy variable of *INSTLOW* as the low institutional investor ownership, set the value to one if a firm's institutional investor ownership is less than the median value of all firms at the beginning of each quarter, and zero otherwise. In a similar vein, we define another dummy variable for small firms (*SMALL*) with the value of one if a firm has the market value of equity less than the median value of all firms at the beginning of each quarter. We interact *INSTLOW* (*SMALL*) with *RPA* to test the disproportionate impact of the RPA adoption on the low institutional investor holding (small) firms. In line with the literature (Bhushan 1989; O'Brien and Bhushan 1990; Lang and Lundholm 1996; Liu 2011; Frankel et al. 2006; Barth et al. 2001), we include a set of control variables to account for factors that are associated with firms' analyst following: the market value of equity in the logarithm form (*MV*), stock return volatility (*RETVOL*), correlation between the stock return and the market return (*RSQ*), the market-to-book ratio (*MB*), the percentage of institutional ownership (*INST*), and total intangible assets scaled by total assets (*INTA*). We also include a dummy variable – *OMX*, with the value of one if the firm is one of the OMX30 index constituents and zero otherwise in that stocks in the index are more likely to be followed by analysts. The model is shown as follows:

$$SW\_AF_{it} = \alpha_0 + \alpha_1 RPA_t + \alpha_2 INSTLOW_{it} + \alpha_3 RPA_t \times INSTLOW_{it} + \alpha_4 MV_{it} + \alpha_5 INTA_{it} + \alpha_6 MB_{it} + \alpha_7 INST_{it} + \alpha_8 RETVOL_{it} + \alpha_9 RSQ_{it} + \alpha_{10} OMX_{it} + FE + \varepsilon_{it} \quad (4)$$

$$SW\_AF_{it} = \alpha_0 + \alpha_1 RPA_t + \alpha_2 SMALL_{it} + \alpha_3 RPA_t \times SMALL_{it} + \alpha_4 MV_{it} + \alpha_5 INTA_{it} + \alpha_6 MB_{it} + \alpha_7 INST_{it} + \alpha_8 RETVOL_{it} + \alpha_9 RSQ_{it} + \alpha_{10} OMX30_{it} + FE + \varepsilon_{it} \quad (5)$$

The concern in this setting is that we cannot identify a valid control group. In an attempt to mitigate the potential endogeneity concern, we did a placebo test by shifting the RPA adoption date one-year prior to the actual adoption date. Specifically, we create an indicator variable – *PRE*, equal to one for the quarters after 2013Q4, and zero otherwise, We include both *PRE*, *RPA* and their interaction terms with *INSTLOW* or *SMAL* in the regressions (4) or (5), and expect no significant coefficient on the interaction terms *PRE* × *INSTLOW* or *PRE* × *SMAL*.

$$SW\_AF_{it} = \alpha_0 + \alpha_1 PRE_t + \alpha_2 RPA_t + \alpha_3 INSTLOW_{it} + \alpha_4 PRE_t \times INSTLOW_{it} + \alpha_5 RPA_t \times INSTLOW_{it} + \alpha_6 MV_{it} + \alpha_7 INTA_{it} + \alpha_8 MB_{it} + \alpha_9 INST_{it} + \alpha_{10} RETVOL_{it} + \alpha_{11} RSQ_{it} + \alpha_{12} OMX30_{it} + FE + \varepsilon_{it} \quad (6)$$

$$SW\_AF_{it} = \alpha_0 + \alpha_1 PRE_t + \alpha_2 RPA_t + \alpha_3 SMALL_{it} + \alpha_4 PRE_t \times SMALL_{it} + \alpha_5 RPA_t \times SMALL_{it} + \alpha_6 MV_{it} + \alpha_7 INTA_{it} + \alpha_8 MB_{it} + \alpha_9 INST_{it} + \alpha_{10} RETVOL_{it} + \alpha_{11} RSQ_{it} + \alpha_{12} OMX30_{it} + FE + \varepsilon_{it} \quad (7)$$

3.3 Analysts' research quality

Turning to the test of analysts' research quality, we use the difference-in-difference design again. The dependent variable is forecast error – *FORERR*, defined as the absolute value of the difference between the annual EPS forecast and the actual EPS value, deflated by the stock price two days before the forecast is provided. Then greater forecast error means lower research quality. The test has three dimensions: firm, analyst, and quarter (i, j, t). Two indicator variables, *RPA* and *SW*, are as previously defined, representing the post-RPA adoption period in Sweden and Swedish analysts when the values are equal to one. Then the interaction term $RPA \times SW$ captures the difference in the forecast accuracy improvement between Swedish analysts and non-Swedish analysts after RPA is adopted in Sweden. We control for a set of analyst-related and firm-related variables to alleviate potential omitted variable bias. Most of them have been previously defined. Firstly, in line with Clement (1999) and Mikhail et al. (1997), we control for firm-specific experience (*FEXP*) general experience (*GEXP*), the number of firms covered (*NUMCOM*) and the number of industries followed (*NUMIND*) by each individual analyst. Secondly, in an attempt to measure an individual analyst's past forecast ability, we use the past accuracy score (*PACY*) again. The last analyst-related control variable is forecast horizon (*HOR*), consistent with the finding in Brown (2001) that forecast accuracy improves with the revelation of information as the actual EPS announcement date approaches. We also add a range of firm-level variables to the regression, including the market value of equity in the logarithm form (*MV*), the total number of analysts following a firm (*AF*), the percentage of institutional ownership (*INST*), total intangible assets deflated by total assets (*INTA*), the market-to-book ratio (*MB*), and return volatility (*RETVOL*) (Alford and Berger, 1999; Brown, 1997; Sinha et al., 1997 etc.). Furthermore, in Brown (2001) and Hwang et al. (1996), they find that analysts have larger forecast error if firms report losses or have a declined actual EPS compared to the previous year. Then we include a dummy variable (*LOSS*) equal to one when the actual EPS is negative, and zero otherwise; as well as another dummy variable (*DECL*) equal to one when the actual EPS is less than that in the previous year, and zero otherwise. Lastly, we include firm, quarter and analyst fixed effects (*FE*) in different specifications to control for invariant factors. Based on the above discussion, we have the following research design:

$$FORERR_{ijt} = \alpha_0 + \alpha_1 RPA_t + \alpha_2 SW_j + \alpha_3 RPA_t \times SW_j + \boldsymbol{\beta CONTROL_A} + \boldsymbol{\gamma CONTROL_F} + FE + \varepsilon_{ijt} \tag{8}$$

where $\boldsymbol{CONTROL_A}$ is the analyst-level control variable vector:

- $GEXP_{jt}$, $FEXP_{ijt}$, $NUMIND_{jt}$, $NUMCOM_{jt}$, $PACY_{jt}$, HOR_{ijt}

$\boldsymbol{CONTROL_F}$ is the firm-level control variable vector:

- MV_{it}, $INTA_{it}$, MB_{it}, $INST_{it}$, $RETVOL_{it}$, $LOSS_{it}$, $DECL_{it}$

Next, we test which channel drives the increase in analysts' research quality (Hypothesis 4a and 4b). Firstly, to test Hypothesis 4a, we restrict the sample to analyst-firm pairs appearing both before and after the RPA adoption, and replicate the regression with analyst-firm fixed effects within the restricted subsample. Secondly, to test Hypothesis 4b, we create an indicator variable – *DIS*, which equals to one if analyst-firm pairs appeared in the pre-RPA period but disappeared in the post-RPA period, and zero otherwise. We run a logit model with *DIS* as the dependent variable in the pre-RPA adoption period. If the Hypothesis 4b is as predicted, we shall observe a positively significant on $SW \times FORERR$. The interpretation is that Swedish analysts are more likely to drop a firm from their coverage list in the post-RPA period if they are unable to provide high quality forecasts for the firm, relative to non-Swedish analysts. The regression is as follows.

$$\Pr\left(DIS_{ijt} = 1\right) = \alpha_0 + \alpha_1 SW_j + \alpha_2 FORERR_{ijt} + \alpha_3 SW_j \times FORERR_{ijt} + \boldsymbol{\beta CONTROL_A} + \boldsymbol{\gamma CONTROL_F} + FE + \varepsilon_{ijt} \tag{9}$$

3.4 Market reaction to analysts' forecast revisions

In this section, we use the absolute abnormal return as the proxy of market reaction to test Hypotheses 5a, 5b, and 5c. We conduct the analysis on the firm-day level for Swedish firms that are followed by at least one analyst. The dependent variable, *ABS_ABRET*, is the absolute abnormal return, which is calculated by taking the absolute value of the difference between firms' daily return and the daily OMX Stockholm 30 index return, then converting it to the percentage form.[28] The variables of interest are *RPA*, as defined previously, and *ANALYS*, which is an indicator variable with the value of one for the two-day [0, +1] window when analysts revise their forecasts for firms' quarter or annual earnings. We interact *ANALYS* with *RPA*, and expect a positive coefficient on the interaction term. Analysts providing forecast revisions are clustered with firms' earnings announcement (Keskek et al. 2014). We control for the confounding effect of the earnings announcement by including an indicator variable, *EARN*, for the two-day window when firms announce quarter or annual earnings. We also interact *EARN* with *RPA* to capture the potential impact of RPA on the informativeness of earnings announcement. We control for firm, day, and firm times quarter fixed effects (*FE*) in different specifications.

$$ABS\_ABRET_{it} = \alpha_0 + \alpha_1 ANALYST_{it} + \alpha_2 ANALYST_{it} \times RPA_t + \alpha_3 EARN_{it} \times RPA_t + \alpha_4 RPA_t + FE + \varepsilon_{it} \tag{10}$$

The regression is on the firm-day level and does not the analyst dimension, meaning that this setting has the same endogeneity issue like Section 3.2. In an attempt to mitigate the potential endogeneity concern, we did a placebo test similar to Section 3.2. Specifically, we create an indicator variable – *PRE*, equal to one for the quarters after 2013Q4, and zero otherwise, We include both *PRE*, *RPA* and their interaction terms with *ANALYST* or *EARN*.

[28] The OMX Stockholm 30 index is a stock market index for the Nasdaq OMX Stockholm exchange. It is a the market-value weighted index consisting of the 30 most-traded stocks on the exchange. Online available: https://indexes.nasdaqomx.com/Index/Overview/OMXS30. [Accessed 25 August 2018]

$$ABS\_ABRET_{it} = \alpha_0 + \alpha_1 ANALYST_{it} + \alpha_2 ANALYST_{it} \times RPA_t + \alpha_3 EARN_{it} \times RPA_t + \alpha_4 RPA_t + \alpha_5 ANALYST_{it} \times PRE_t + \alpha_6 EARN_{it} \times PRE_t + \alpha_7 PRE_t + FE + \varepsilon_{it} \quad (11)$$

When testing Hypotheses 5b and 5c, we partition the sample into five equal groups by the quintiles of institutional investor holdings or the market value of equity, and re-run the regression (10).

4. Data Collection

4.1 Collection of analysts' biographical information

The sample period is from 2013 to 2016 and data is collected quarterly. Swedish analysts are the variable of interest. However, we do not have a straightforward database providing analysts' biographical and geographical information.[29] Therefore we hand-collected the data. The steps are as follows and Table 1 Panel (A) reports the statistics:

1) We assume that the majority of Swedish analysts would follow firms that are listed on Swedish stock markets. Hence, we search on DataStream for all the firms whose stock exchanges are labelled with 'Stockholm'. Then we obtain 2,892 unique security codes. After deleting 1,868 codes that do not have valid I/B/E/S firm tickers, 1,024 I/B/E/S firm tickers remained;
2) Using these 1,024 I/B/E/S firm tickers as the input, we search, within the sample period, the Recommendation file and the Target Price file in I/B/E/S, for the record of analysts that appear in these files, in an attempt to obtain their analysts' codes, surnames, initials of their first names and the abbreviations of their brokerage houses. Then we obtain 1,879 unique analysts' codes. The I/B/E/S firm tickers reduce from 1,024 to 565;

[29] Nelson Investment Research Directory used to provide analysts' biographical information, such as their names, brokerage houses, address etc. But it has stopped being updated since 2008.

3) Then we manually match analysts' biographical information and their coverage lists from I/B/E/S with Bloomberg that also provides analysts' full names and coverage portfolio. More importantly, Bloomberg also provides analysts' locations, which enables us to create the treatment group;
4) At last, we verify analysts' locations obtained from Bloomberg by searching analysts' full names and their brokerage houses on LinkedIn. In some cases, the location on Bloomberg is not the same as that on LinkedIn due to the delay in information updating (if the analyst relocates internationally)[30]. Then we search the analyst's name and her brokerage house online to find her latest news, and make a judgment which location is more likely to be the right one.

We have identified 1,582 distinct analysts with their locations successfully. The I/B/E/S firm tickers reduce from 565 to 554. Table 1 Panel (B) reports analysts' geographical distribution.[31] The majority of analysts are from the UK (658 UK analysts), followed by 223 Swedish analysts, 209 analysts from Norway and 151 US analysts. Swedish analysts are the major party influenced by the RPA adoption in Sweden so that we use 219 Swedish analysts as the treatment group and 1,359 non-Swedish analysts as the control group (Panel (C)).[32] Panel (D) reports how analysts from different countries cover these 554 Stockholm listed firms. Swedish analysts cover the most Stockholm listed firms (nearly 80%). Although the number of UK analysts is the largest, they cover less than 30% of these Stockholm listed firms. This suggests that the UK analyst coverage concentrates on a small group of Stockholm listed firms. Norwegian analysts are similar to UK analysts. More than 200 identified Norwegian analysts

[30] It could be that analysts have yet updated their LinkedIn profiles, or Bloomberg has yet captured analysts' latest forecasts information from their new employers.
[31] Twenty-one analysts relocated internationally during the sample period. So the total number of analysts with the identified location reported in Table 1 Panel B is 1,603. After subtracting the replicated 21 analysts, we have 1,582 distinct analysts.
[32] We deleted four analysts that relocated between Sweden and the other countries during the sample period.

cover one third of Stockholm listed firms only. Turning to analysts from other countries, they only cover a tiny portion of Stockholm listed firms.

4.2 Other data collection.

We collect analysts-related data from I/B/E/S, and accounting fundamentals from DataStream and Bloomberg. Firstly, for the Hypothesis 1, the dependent variable is the number of firms followed by each analyst within a quarter (*NUMCOM*). We construct this variable by counting the number of distinct firms to whom analyst *j* had provided any forms of analysts' opinion in quarter *t*. Analysts' opinion includes recommendations, target price and all types of forecasts (earning per share, cash flow per share, short-term, long term etc). Turning to Hypothesis 2, we switch the unit of analysis from the analyst-quarter basis to the firm-quarter basis. We measure the analyst following (*AF*) by counting the number of distinct analysts that issue recommendations, target price or all forms of forecasts for firm *i* in quarter *t*. Then we match them with analysts' biographical and geographical information, and calculate the number of Swedish analysts following a firm (*SW_AF*) as the dependent variable. The extant literature normally uses the issuance of the one-year-ahead EPS forecast to be the proxy of analyst following (Piotroski and Roulstone 2004; Kirk 2011). In this paper, as we conduct the tests on a quarterly basis, some analysts may not provide one-year-ahead EPS forecasts in every quarter. In order to reduce the miscounting of *NUMCOM* and *SW_AF*, we include all forms of forecasts, together with recommendations and target price. With regard to the accounting fundamental variables, we obtain the market value of equity, the market-to-book ratio, intangible assets, total assets and the stock price from DataStream; and institutional ownership from Bloomberg.[33] All variables are on a quarterly basis.

[33] In order to account for the stocks listed on the different stock exchanges denominated in the unit of different currencies, we convert the market value of equity for all stocks into the US dollar by using the currency exchange rates at the end of each quarter.

4.3 General description of Swedish asset management industry and Swedish stock markets.

Swedish asset management companies invest globally. The SIFA report – "Outlook about funds 2015" demonstrates the geographical description of Swedish funds' investment. The net assets in the entire asset management industry under the heading of "Sweden" and "Sweden and Global" amounts to 40% invested in equity investment.[34] There are five stock markets in Sweden, including two regulated markets – Nasdaq OMX Stockholm and Nordic Growth Market; and three multilateral trading facilities – First North Stockholm, Nordic MTF and Aktietorget. Nasdaq OMX Stockholm is the largest, where the listed firms have the greatest analyst following and have an aggregated market value of equity accounting for 99% among the five markets at the end of 2013.[35] Firms listed on the remaining four markets are barely followed by any analyst. In an attempt to ensure the homogeneity of the market and increase the test power for Hypothesis 2, we focus on the firms that are listed on the Nasdaq OMX Stockholm only.

5. Empirical results

5.1 Results for analysts' coverage list reduction

This section presents the results for Hypothesis 1, which is that the RPA adoption reduces analysts' coverage lists. Table 2, Panel (A) reports the descriptive statistics. Swedish analysts on average follow fewer firms and more industries, compared to the non-Swedish analysts. The major difference between Swedish and non-Swedish analysts is the dependent variable – the number of firms followed by an analyst. On average, Swedish analysts follow 8.11 firms whilst non-Swedish analysts cover around 2.76 more firms than Swedish analysts. Panel (C) of Table 2 reports the results of the regressions with different specifications. The coefficient for the

[34] Swedish Investment Fund Association (2015): Outlook About Funds, Page 18.
[35] The Riksbank – The Swedish Financial Market Report (2014), page 55-56.

interaction term $RPA \times SW$ captures the difference of the change between Swedish analysts and non-Swedish analysts in terms of the number of firms in their coverage list after RPA is adopted in Sweden. All models report negatively significant coefficients, ranging from -1.009 to -0.561.[36] In particular, in column (vi), where we include analyst and quarter fixed effects, the estimated coefficient on the interaction term is -0.623, meaning Swedish analysts on average drop 0.623 more firms relative to non-Swedish analysts after RPA is adopted. With respect to other control variables, the number of industries *NUMIND* is positively significant, indicating that analysts following more industries cover more companies. Next, we have positively significant coefficients on analysts' general experience (*GEXP*), which is in line with our assumption that analysts with more experience tend to cover more firms. Lastly, the score for analysts' accuracy in the previous year (*PACY*) has positive coefficients after we introduce fix effect structures, consistent with the expectation that analysts with higher past accuracy are more likely to cover more firms. Overall, the results support Hypothesis 1. The RPA model adopted by Swedish asset managers reduces in analysts' research income. Accordingly, Swedish analysts, as the heavily influenced party, reduce the number of firms on their coverage lists.

5.2 Results for disproportionate reduction in analyst following

In this section, we report the results for Hypotheses 2a and 2b, which is that the reduction in analyst following is greater for firms with lower institutional investor holdings or with lower market value of equity. We focus on Swedish analysts only and firms listed on the Nasdaq OMX Stockholm. During the sample period, 297 firms are listed on Nasdaq OMX Stockholm.

[36] To avoid the issue of perfect multicollinearity, we drop RPA_t when the model includes quarter fixed effect, and SW_j when the model includes analyst or brokerage house fixed effects.

Most of them are in the sectors of Industrials, Financials, Health Care, and Technology. Firms with headquarters in Sweden amount to 273. The remaining 24 firms are from other countries.[37]

Panel (A) of Table 4 reports the statistic description. Swedish analyst following is positively skewed and a number of firms up to 25 percentile have no Swedish analysts followed. Panel (C) of Table 4 reports the results with different specifications. Columns (i) and (ii) present the results for testing the impact of the RPA adoption on the low institutional investor holding firms, while columns (iv) and (v) are for the firms with low market value of equity. The results are consistent with our expectation. In column (i) where we control for firm fixed effect, the coefficient of RPA is insignificant, which indicates that firms with high institutional investor holding are not affected by the RPA adoption. In addition, the interaction term $RPA \times LOWINST$ is negatively significant at 5% level, suggesting that firms with low institutional investor ownership experience a greater reduction in Swedish analyst following. The overall effect of the RPA adoption on the low institutional investor holding firms is 0.240, and significant at 10% level. The result does not change even when we control for both firm and quarter fixed effects in column (ii). The coefficient on the interaction term is 0.244, which amounts to 16% of the mean of the Swedish analyst following for firms with low institutional investor holdings.[38]

Turning to the test for firms with low market value of equity (small firms) in columns (iv) and (v), the RPA variables are insignificant in, indicating that the adoption of RPA does not affect Swedish analysts' coverage decision on large firms. In contrast, the negatively significant coefficient on $RPA \times SMALL$ suggests that the reduction in analyst following is greater among small firms with the RPA adoption in Sweden. Specifically, in column (iv)

[37] For simplicity, we use "Swedish firms" to represent "297 firms listed on the Nasdaq OMX Stockholm" in the following sections.

[38] The mean of Swedish analysts following the low institutional holding firms is 1.54 (untabulated). The coefficient on the interaction term is -0.244, which is 16% of the mean (0.244/1.54=16%)

where we control for firm fixed effect, we have a coefficient of -0.503 on the interaction term, meaning that small firms lose 0.503 more Swedish analysts compared to large firms after RPA was adopted, which is 58% of the mean of Swedish analysts following small firms.[39] Moreover, we conduct the test for the total decrease in analyst following among small firms ($RPA + RPA \times SMALL$) and the result suggests that small firms lose 0.331 Swedish analysts after asset managers adopt the RPA model. The mean of Swedish analyst following for small firms before the RPA adoption is 0.96 (untabulated). The RPA adoption is associated with small firms losing more than one third of Swedish analyst following.

Next, we did a placebo test for the disproportionate reduction in an attempt to mitigate the potential endogeneity concern as we lack a valid control group. We create an indicator variable *PRE*, which takes a value of one if the observation is from 2013 onward, and zero otherwise, and we run the regressions (4) and (5). Columns (iii) and (vi) of Panel (D) in Table 4 reports the results. Consistent with our expectation, we only find the significant coefficients on the interaction term with *RPA*, not *PRE*, indicating that the disproportionate reduction in analyst following is associated with the RPA adoption, not one year prior to the adoption. In sum, we find the evidence that the RPA adoption is associated with greater reduction in analyst following among firms with lower institutional investor ownership and lower market value of equity.

5.3 Results for analysts' research quality

This section presents the results for the tests of analysts' research quality. We firstly use analysts' entire firm coverage to run the regression, which includes firms covered by Swedish analysts only (the A area in Figure 3), firms covered by non-Swedish analysts only (the B area in Figure 3), and firms covered by both Swedish analysts and non-Swedish analysts (the C area

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[39] The mean of Swedish analysts following small firms is 0.87 (untabulated). The coefficient on the interaction term is -0.503, which is 58% of the mean (0.503/0.87=58%)

in Figure 3). As we argued in Section 2.4 that the heterogeneity of firms' location in the treatment and control group may pose a threat to the parallel trend assumption, we further conduct our test with the firms that are covered by both Swedish analysts and non-Swedish analysts within the same year (the C area only in Figure 3). We present both results. Panel (A) of Table 5 shows the descriptive statistics of the variables used in the regression. The average forecast error for Swedish analysts is 1.63%, compared to 1.96% for non-Swedish analysts. In addition, firms covered by Swedish analysts are generally smaller, have lower analyst following, more intangible assets, higher market-to-book ratio, and less negative EPS than firms followed by non-Swedish analysts. Panel (C) of Table 5 reports the results of regressions with different specifications within the sample contains the entire firm coverage (the A, B, and C area in Figure 3). With the attrition of the data process, we have 3,590 firms, 161 Swedish analysts, and 1,212 non-Swedish analysts in the regression. The coefficient on the interactive term captures the result in the difference-in-difference setting. We obtain negatively significant coefficients on $RPA \times SW$ across all specifications, suggesting that Swedish analysts experienced a decrease in forecast error, relative to non-Swedish analysts after the RPA adoption in Sweden.[40] More precisely, in column (iii), where we control for analyst, firm and quarter fixed effects, the coefficient on the interaction term is -0.327, indicating that the forecast error of Swedish analysts decreased by 0.327% more than non-Swedish analysts in the post period of the RPA adoption in Sweden. The average forecast error of Swedish analysts is 1.98% (untabulated). The reduction in Swedish analysts' forecast error amounts to 16.5% of the mean of forecast error, compared to non-Swedish analysts.[41] Panel (D) in Table 5 reports the results within the sample that only contains firms covered by both Swedish analysts and non-Swedish analysts. We find 223 out of 3,590 firms covered both analysts within the same

[40] Similar to models for Hypothesis 1, we exclude *RPA* when the model has quarter fixed effect, and drop *SW* when the model includes analyst fixed effect.
[41] The mean is 1.98%, then 0.327% / 1.98% = 16.5%.

year. The sample size shrinks significantly. The observations drop from 167,468 to 36,505. The results are qualitatively unchanged, relative to that in Panel (C). After controlling for firm, analyst, and quarter fixed effects, we find that the coefficient on the interaction term is -0.262, and significant at 5% level.

Turning to the channels through which the improvement in analysts' forecast accuracy is achieved, we posit two possible channels: (1) analysts improve their forecast ability per se (Hypothesis 4a); and (2) analysts stop issuing forecasts for firms that they are unable to provide high-quality forecasts on (Hypothesis 4b). Column (iv) of Panel (C) and Panel (D) in Table 5 reports the results of testing the first possible channel. We restrict the sample to analyst-firm pairs appearing in both pre- and post-RPA period, and run the regression with the analyst-firm fixed effect. The results are very similar to the full sample. Specifically, in Panel (C) forecast error for Swedish analysts decreases by 0.379% relative to non-Swedish analysts after the RPA is adopted in Sweden. Thus the result is consistent with the Hypothesis 4a where the improvement in forecast accuracy is attributable to the improvement in analysts' forecast ability. With respect to the second possible channel that Swedish analysts are more likely to drop the firms if they are unable to provide high quality forecasts, we do not find any evidence to support this hypothesis. Table 6 reports the results. The coefficient on the interaction term is not significant at any conventional level, indicating that the likelihood of dropping coverage between Swedish analysts and non-Swedish analysts is not significantly different.

5.4 Results for the market reaction to analysts' forecast revisions

This section reports the results for the test of the market reaction to analysts' forecast revisions. Table 7, Pane (B) presents the overall results in different specifications, which are consistent with our hypotheses. Specifically, in column (ii) where we control for firm times quarter fixed effect and day fixed effect, the estimated coefficient on *ANALYST* is 0.14 and significant at 1% level. This suggests that the daily market reaction to analysts' forecast revisions is on average 0.14% higher than that without forecast revisions before the RPA adoption. In addition, we obtain a positively significant coefficient of 0.07 on *ANALYST* × *RPA*, indicating that the market reaction to forecast revisions increases by 50% in the post RPA period, relative to that in the pre-RPA period. Turning to the earnings announcement dummy (*EARN*), the estimated coefficient is 1.4 and significant at 1% level. This compares to the mean of the daily absolute abnormal return, 1.53 (%), as reported in Panel (A). When firms announces their earnings, the absolute abnormal return almost doubles. However, we do not find any change in the informativeness of earnings announcements with the RPA adoption, as the interaction term, *EARN* × *RPA*, is not significant at any conventional level. Columns (iii) and (iv) of table 7 report the placebo tests. We continue finding significant coefficients on the interaction term of *ANALYST* with *RPA*, but fail to find that with *PRE*, indicating that the increase in the analyst forecasts' informativeness is associated with the RPA adoption, not one year prior to the adoption.

Next, we report the results for Hypotheses 5b and 5c in Panels (C) and (D) of Table 7. The results support Hypothesis 5b that the increase in market reaction is greater among firms with higher institutional investor holdings or with higher market value of equity. Specifically, in Panel (C), the coefficients on the interaction term *ANALYST* × *RPA* are only significant in the groups of 4^{th} and 5^{th} quintiles (high institutional holdings), but not significant in the groups of first three quintiles. The results for the firm size partition in Panel (D) are similar to the institutional holding partition. We find positively significant coefficients on *ANALYST* × *RPA* when the quintile of the market value of equity is 4^{th} or 5^{th}.

Collectively, we find that the market reaction is greater to analysts' forecast revisions in the post RPA period. In addition, we partition the sample by firms' institutional holdings or the market value of equity, and find that the increase in market reaction to forecast revisions is only significant among firms with high institutional investor holdings or with high market value of equity.

6. Conclusion

This paper examines how sell-side analysts respond to the change in asset managers' research payment method. Several of Sweden's largest asset managers separate research payments from dealing commissions by using the RPA model, leading to an overall reduction in analysts' research income. We firstly find that reduce their coverage lists with the introduction of the separation. Moreover, we find that the reduction in analyst coverage is greater for firms with lower institutional investor ownership and with lower market value of equity. Secondly, we find that the overall research quality has improved in the post period of the RPA adoption, and the improvement is attributable to the improvement in analysts' forecast ability, rather than the elimination of supply of forecast by lower quality analysts. Lastly, we use the absolute abnormal return as the proxy of market reaction, and find an increase in market reaction to forecast revisions with the RPA adoption. We further that this increase is only significant for firms with high institutional investor ownership and with high market value of equity.

A number of caveats apply to this paper. First, the setting was born with noise. Swedish analysts are not perfect to serve as the treatment group because they may provide research services to asset managers who continue using the bundled model. In a similar vein, non-Swedish analysts as the control group may be influenced by the RPA adoption in Sweden if those largest Swedish asset managers are also their important clients. Second, the way that we collect data may bring noise. Ideally, to create a control group, we need to identify analysts that do not provide any service to Swedish asset managers. Our control group have non-Swedish analysts that have history covering Swedish firms, so that they may serve Swedish asset managers as well. Therefore, the result we obtained is biased towards no result. Third, the causality for testing the disproportionate reduction and the increase in market reaction to forecast revisions is a concern, as we cannot identify a valid control group. Although we did a placebo test for the disproportionate reduction that find no disproportionate reduction in analyst following before the RPA adoption, we cannot completely address this issue. Fourth, sell-side analyst research services are more than just issuing forecasts and recommendations. Other services such as corporate access and broker-hosted conferences are also valuable to asset managers (Brown et al. 2015). Due to the data limitation, we are unable to measure them easily at this stage, which is a fruitful research area in future if data are available.

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Appendix 1: Definition of variables

Firm-level variables		
Variable Name	Description	Source
ABS_ABRET	The absolute abnormal return in the percentage form, calculated by taking the absolute value of the difference between firms' daily return and the daily OMX Stockholm 30 index return.	DataStream
AF_SW	The number of Swedish analysts issuing any form of forecasts (EPS, CPS, one-year-ahead, two-year-ahead etc), recommendations, or target price to a firm within a quarter.	I/B/E/S
ANALYST	Dummy variable, with the value of one if any analyst provides forecast revisions on the day and the next day ([0, +1]), and zero otherwise.	I/B/E/S
DECL	Dummy variable, set equal to one if the firm's EPS is lower than that in the previous year, and zero otherwise.	I/B/E/S
EARN	Dummy variable, with the value of one if a firm makes an earnings announcement on the day and the next day ([0, +1]), and zero otherwise.	I/B/E/S
INST	The percentage of institutional investor ownership.	Bloomberg
INTA	Intangible assets scaled by total assets, multiplied by 100.	DataStream
LOSS	Dummy variable, set equal to one when actual EPS is negative, and zero otherwise.	I/B/E/S
LOWINST	Dummy variable, set equal to one when the firm has the institutional ownership lower than the median of all firms at the beginning of each quarter, and zero otherwise.	DataStream
MB	Market value of equity divided by book value of equity.	DataStream
MV	The market value of equity in the logarithm form.	DataStream
OMX30	Dummy variable, set equal to one if the firm is one of the OMX30 Index constituents, and zero otherwise.	Bloomberg
RETVOL	Standard deviation of daily stock returns within each quarter.	DataStream
RPA	Dummy variable. It equals to one when the observation is from the period after RPA is adopted in Sweden, and zero otherwise.	
PRE	Dummy variable. It equals to one when the observation is from 2014 onwards, and zero otherwise.	
RSQ	R-squared from a regression of daily stock return on the market return (the return of OMX30 index) within each quarter.	DataStream
SMALL	Dummy variable, set equal to one when the firm is defined as a small firm, and zero otherwise. Small firms are defined as the market value of equity of the firm is less than median of all firms at the beginning of each quarter.	

Analyst-level variables		
Variable Name	Description	Source
BROSIZE	The number of analysts employed within a brokerage house within a quarter.	I/B/E/S
DIS	Dummy variable, set value of one if the analyst-firm pairs disappeared in the post RPA adoption period, and zero otherwise.	I/B/E/S
FEXP	Firm-specific experience in the logarithm form. Firm-specific experience is measured as the number of years from the analyst's first opinion on the specific firm to present.	I/B/E/S
FORERR	Analyst forecast error, defined as the absolute value of the difference between the one-year ahead EPS forecast and the actual EPS, scaled by the stock price two days before the issuance of the forecast, then times 100.	I/B/E/S
GEXP	General experience in the logarithm form. Analysts' general experience is measured as the number of years from the analyst's first opinion on any firm to present.	I/B/E/S
HOR	Forecast horizon in the logarithm form. Forecast horizon is the number of days between the date when the forecast is issued and the date when the actual EPS is announced.	I/B/E/S
NUMCOM	Total number of firms covered by an analyst.	I/B/E/S
NUMIND	Total number of industries (two-digit SIC codes) covered by an analyst.	I/B/E/S
PACY	Analyst relative accuracy score in the previous year, which is calculated in line with the method in Hong and Kubik (2003).	I/B/E/S
SW	Dummy variable, set equal to one when the forecast is issued by an analyst who locates in Sweden, and zero otherwise.	I/B/E/S, *LinkedIn*

Appendix 2: The full Article 17 in the Commission Delegated Directive (EU) 2017/593

The Research Payment Account related rules in MiFID below is taken from the Commission Delegated Directive (EU) 2017/593. Online available: http://data.europa.eu/eli/dir_del/2017/593/oj

L 87/516 EN Official Journal of the European Union 31.3.2017

Article 13

Inducements in relation *to research*

1. Member States shall ensure that the provision of research by third parties to investment firms providing portfolio management or other investment or ancillary services to clients shall not be regarded as an inducement if it is received in return for either of the following:

(a) direct payments by the investment firm out of its own resources;

(b) payments from a separate research payment account controlled by the investment firm, provided the following conditions relating to the operation of the account are met:

(i) the research payment account is funded by a specific research charge to the client;

(ii) as part of establishing a research payment account and agreeing the research charge with their clients, investment firms set and regularly assess a research budget as an internal administrative measure;

(iii) the investment firm is held responsible for the research payment account;

(iv) the investment firm regularly assesses the quality of the research purchased based on robust quality criteria and its ability to contribute to better investment decisions.

With regard to point (b) of the first subparagraph, where an investment firm makes use of the research payment account, it shall provide the following information to clients:

(a) before the provision of an investment service to clients, information about the budgeted amount for research and the amount of the estimated research charge for each of them;

(b) annual information on the total costs that each of them has incurred for third party research.

2. Where an investment firm operates a research payment account, Member States shall ensure that the investment firm shall also be required, upon request by their clients or by competent authorities, to provide a summary of the providers paid from this account, the total amount they were paid over a defined period, the benefits and services received by the investment firm, and how the total amount spent from the account compares to the budget set by the firm for that period, noting any rebate or carry-over if residual funds remain in the account. For the purposes of point (b)(i) of paragraph 1, the specific research charge shall:

(a) only be based on a research budget set by the investment firm for the purpose of establishing the need for third party research in respect of investment services rendered to its clients; and

(b) not be linked to the volume and/or value of transactions executed on behalf of the clients.

3. Every operational arrangement for the collection of the client research charge, where it is not collected separately but alongside a transaction commission, shall indicate a separately identifiable research charge and shall fully comply with the conditions set out in point (b) of the first subparagraph of paragraph 1 and in the second subparagraph of paragraph 1.

4. The total amount of research charges received may not exceed the research budget.

5. The investment firm shall agree with clients, in the firm's investment management agreement or general terms of business, the research charge as budgeted by the firm and the frequency with which the specific research charge will be deducted from the resources of the client over the year. Increases in the research budget shall only take place after the provision of clear information to clients about such intended increases. If there is a surplus in the research payment account at the end of a period, the firm should have a process to rebate those funds to the client or to offset it against the research budget and charge calculated for the following period.

6. For the purposes of point (b)(ii) of the first subparagraph of paragraph 1, the research budget shall be managed solely by the investment firm and shall be based on a reasonable assessment of the need for third party research. The allocation of the research budget to purchase third party research shall be subject to appropriate controls and senior management oversight to ensure it is managed and used in the best interests of the firm's clients. Those controls include a clear audit trail of payments made to research providers and how the amounts paid were determined with reference to the quality criteria referred to in paragraph 1 (b) (iv). Investment firms shall not use the research budget and research payment account to fund internal research.

7. For the purposes of point (b)(iii) of paragraph 1, the investment firm may delegate the administration of the research payment ac-count to a third party, provided that the arrangement facilitates the purchase of third party research and payments to research providers in the name of the investment firm without any undue delay in accordance with the investment firm's instruction.

8. For the purposes of point (b) (iv) of paragraph 1, investment firms shall establish all necessary elements in a written policy and provide it to their clients. It shall also address the extent to which research purchased through the research payment account may benefit clients' portfolios, including, where relevant, by taking into account investment strategies applicable to various types of portfolios, and the approach the firm will take to allocate such costs fairly to the various clients' portfolios.

9. An investment firm providing execution services shall identify separate charges for these services that only reflect the cost of executing the transaction. The provision of each other benefit or service by the same investment firm to investment firms, established in the Union shall be subject to a separately identifiable charge; the supply of and charges for those benefits or services shall not be influenced or conditioned by levels of payment for execution services.

Appendix 3: Swedish Code of Conduct for fund management companies

This graph presents the codes relating to the research payment separation in Sweden, taken from the page 6 in Swedish Code of Conduct for fund management companies issued on 26 March 2015. Online available at: http://fondbolagen.se/en/Regulations/Guidelines/Code-of-conduct/

Fondbolagens förening
SWEDISH INVESTMENT FUND ASSOCIATION

External distribution
The fund management company should, by means of written agreements with distributors, work to ensure that the distributor undertakes to comply with the Swedish Investment Fund Association's Guidelines for marketing and information by fund management companies, in connection with his or her brokering of the fund management company's funds.

The fund management company must provide the distributor with the necessary product information and support with regard to the fund management company's fund products so that best practices regarding financial advice can be maintained.

Brokers and other trading partners
The fund management company must have a documented process for choosing brokers and other trading partners. When choosing partners for the execution of orders, the partner's ability to provide investment research must not be taken into account.

Costs for investment research may be charged with the fund only where the research enhances the quality of the fund management and the unit-holders have been duly informed. This requires that the benefit of the research is considered to correspond to the costs. The costs for research must be separated from the costs for execution of orders.

The above mentioned must be monitored by the Board of Directors or the CEO.

Appendix 4: An excerpt from the Information Brochure of Handelsbanken Fund AB

This graph presents the announcement from one of the Swedish asset management companies, Handelsbanken, separating the research payment (expenses for external analyses) from the dealing commissions in the Information Brochure (page 8).

Online available https://www.medirect.be/getdocument.aspx?id=103670455

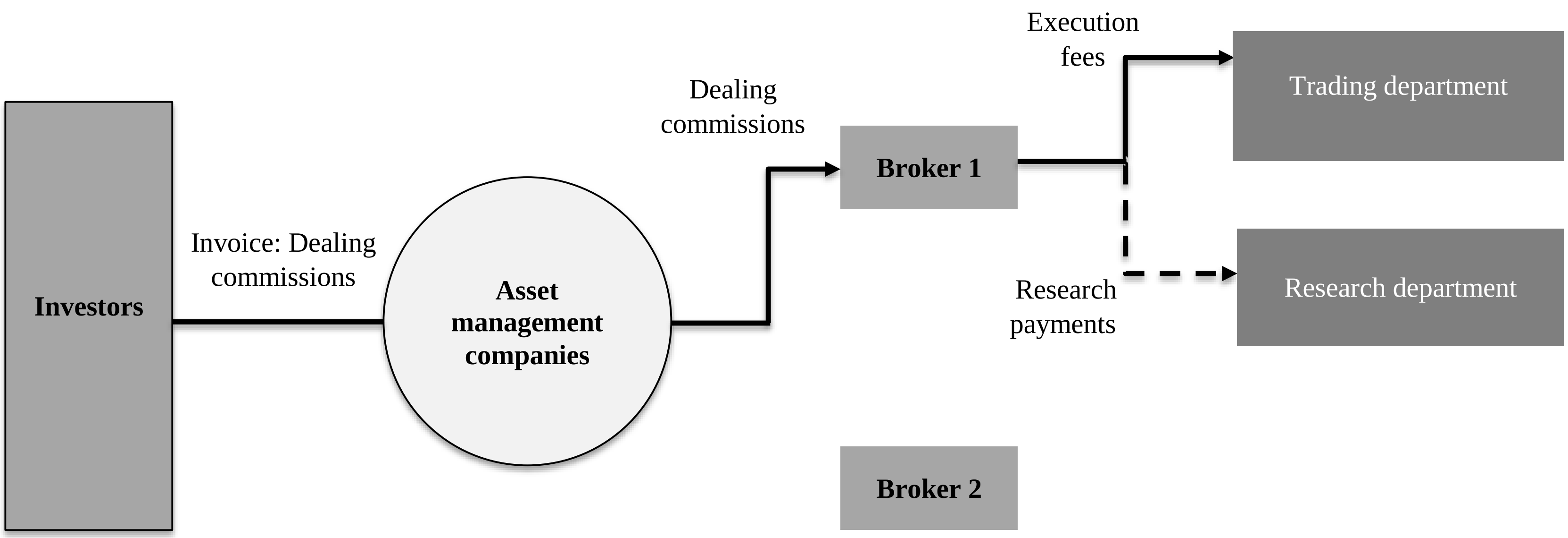
Information Brochure - Handelsbanken Fonder AB

January 12, 2016

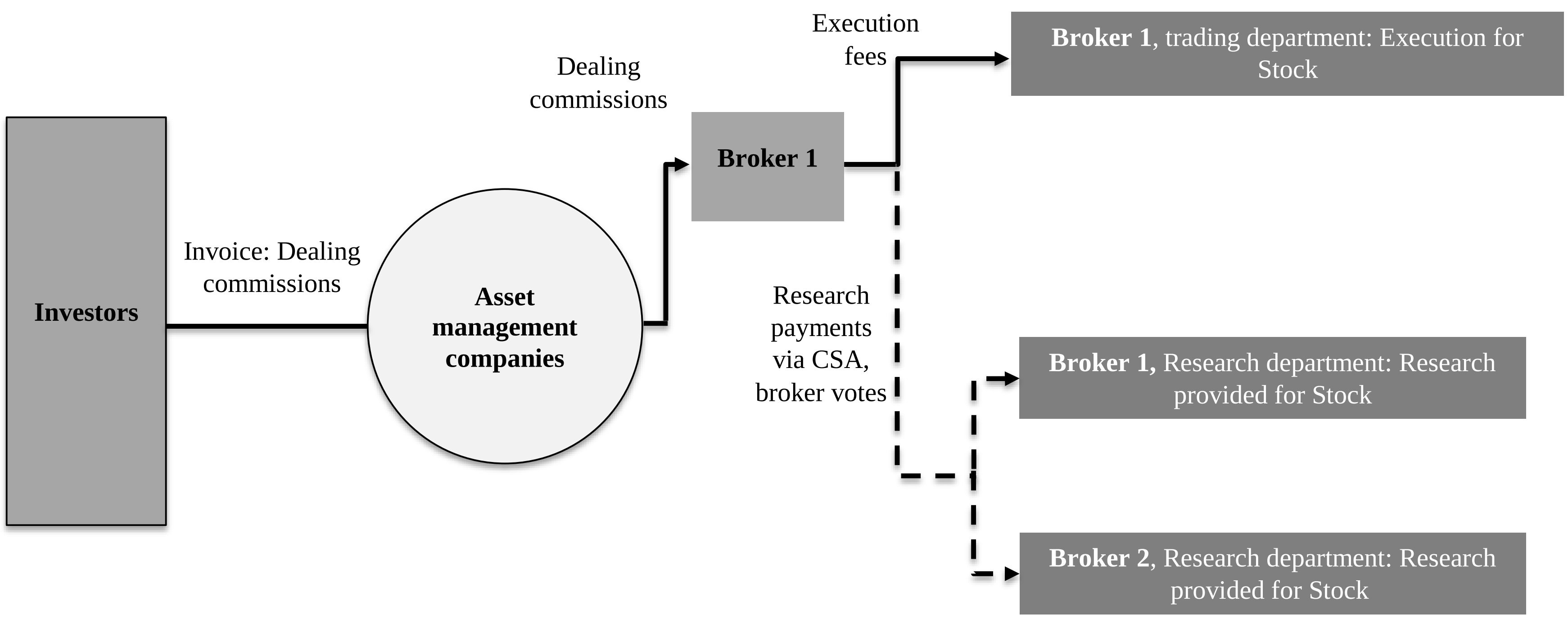
In practice, costs are deducted from each fund in the same manner as the management fee. However, the research firms invoice the Management Company on a quarterly basis, while the funds benefit daily from the purchase of the analyses. As of January 1, 2015, expenses for external analyses will be charged separately. These expenses were previously included in the transaction costs. The expenses for external analyses will be included in the calculation of the annual fee.

Figure 1: The Bundled Model, Commission Sharing Agreement (CSA), and Research Payment Account (RPA)

Panel (A): The Bundled Model



Panel (B): The Modified Bundled Model – Commission Sharing Agreement (CSA)



Panel (C): The Unbundled Model – Research Payment Accounting (RPA)

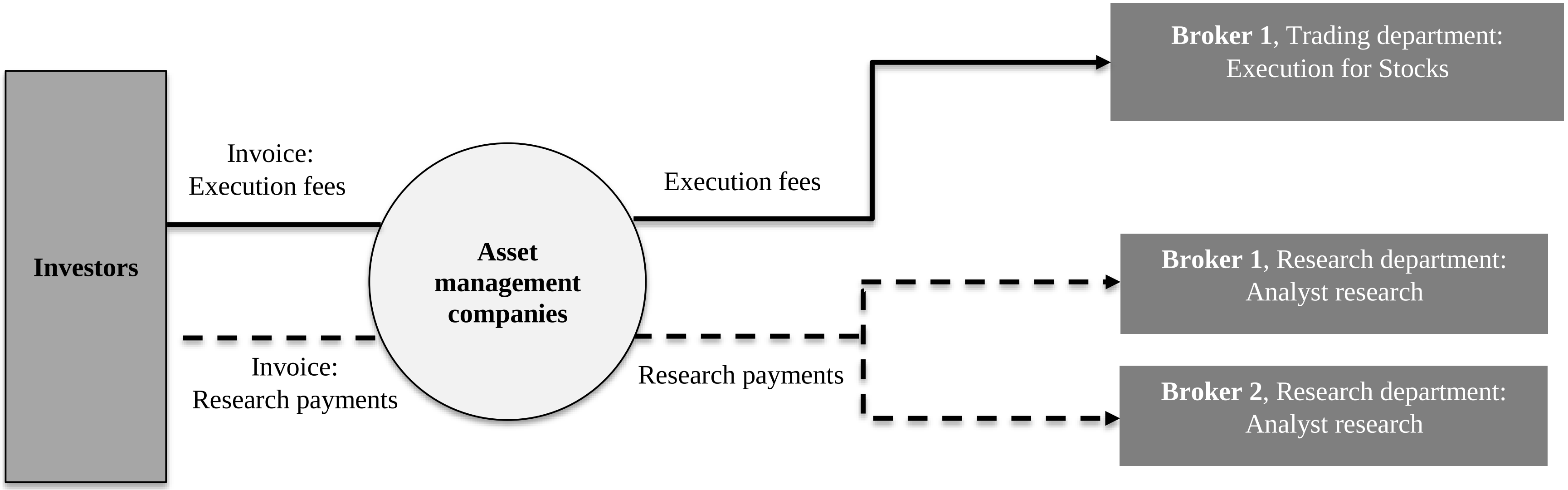


Figure 2: The identification of the treatment group and the control group

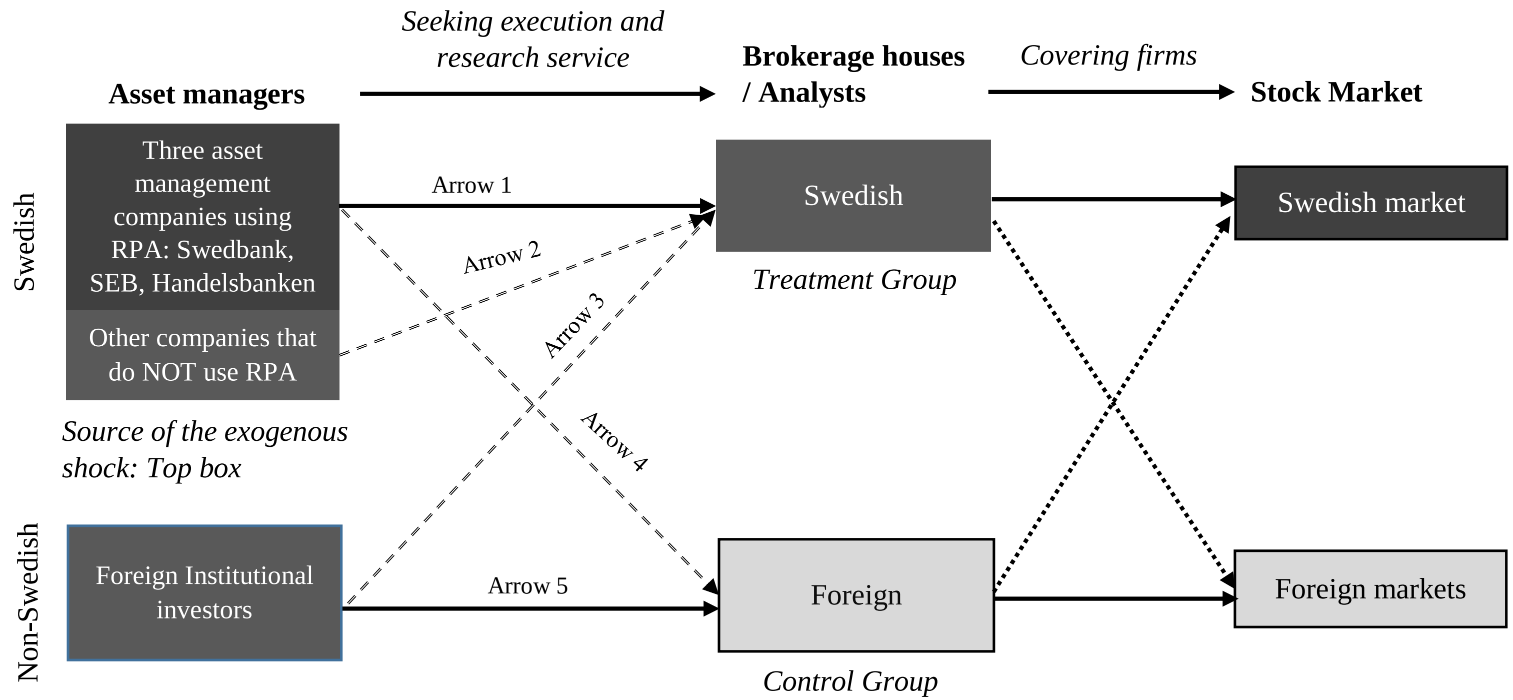


Figure 3: Firm coverage of analysts in treatment group and control group

This graph shows the firms covered by analysts in the treatment group and/or in the control group. The oval with solid line represents firm coverage by Swedish analysts (treatment group). The oval with dotted line represents firm coverage by non-Swedish analysts (control group). The A area are firms covered by Swedish analysts but not by non-Swedish analysts. The B area are firms covered by non-Swedish analysts but not by Swedish analysts. The C area are firms covered by both Swedish analysts and non-Swedish analysts.

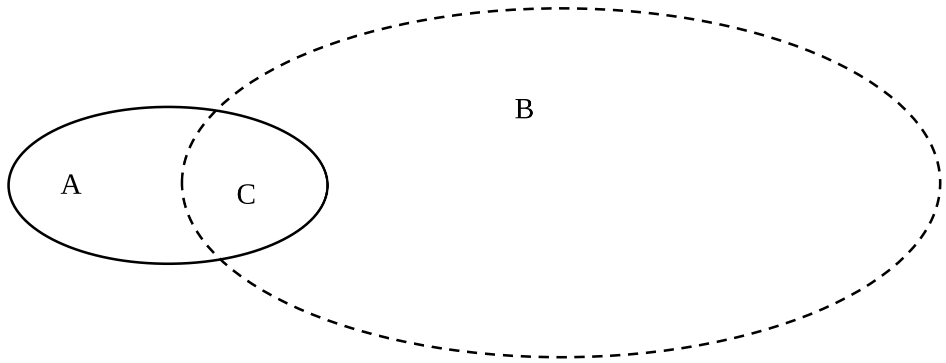


Table 1: The identification of analysts' location

This table reports the process of identifying analysts' location, the geographical distribution of identified analysts, and the number of firms covered by analysts from each country. The data is hand collected from I/B/E/S, Bloomberg and LinkedIn. Panel (A) reports the process of identifying analysts' location. Panel (B) shows the locations of all analysts identified. Panel (C) presents the analysts that are chosen in the treatment group and the control group. Panel (D) reports the number and the percentage of Stockholm listed firms covered by analysts from each country.

Panel (A): The process of identifying analysts' location

From DataStream	Number	Number	Number
Firms labelled as "Stockholm listed"		2,892	
Less firms that do not have a valid I/B/E/S tickers	*1,868*		
Firms with I/B/E/S tickers		1,024	
Merge these 1,024 tickers with all I/B/E/S files within 2013 to 2016			
Firms remained (tickers not found in I/B/E/S are deleted)		565	
Number of analysts covering these 565 firms		1,879	
Manually identifying the location of these 1,879 analysts			
Number of analysts identified		1,582	
Number of firms covered by identified analysts			*554*
Number of I/B/E/S error codes (one code with multiple names)		264	
Number of analysts unidentified		33	

Panel (B): Geographical distribution of identified analysts

Location	Number	Percent
UK	658	41.0%
Sweden	223	13.9%
Norway	209	13.0%
US	151	9.4%
France	69	4.3%
Canada	68	4.2%
Germany	42	2.6%
Finland	39	2.4%
Denmark	22	1.4%
Netherlands	20	1.2%
Russia	19	1.2%
Switzerland	18	1.1%
Lithuania	11	0.7%
South Africa	8	0.5%
Italy	7	0.4%
Poland	6	0.4%
India	5	0.3%
Australia	4	0.2%
Spain	4	0.2%
Austria	2	0.1%
Czech Republic	2	0.1%
HK	2	0.1%
Korea	2	0.1%
Portugal	2	0.1%
Tunisia	2	0.1%
Brazil	1	0.1%
Ireland	1	0.1%
Malaysia	1	0.1%
Mexico	1	0.1%
New Zealand	1	0.1%
Singapore	1	0.1%
Turkey	1	0.1%
United Arab Emirates	1	0.1%
Total	1,603	100%
less analysts relocated internationally	*21*	
Distinct analysts identified	1,582	

Panel (C): Treatment group and control group

Treatment Group	
No. of analysts in Sweden	223
Less no. of analysts used to relocate between Sweden and other countries	*4*
No. of analysts in the treatment group	**219**

Control Group	
No. of non-Swedish analysts in the control group	**1,359**

Panel (D): Number of Stockholm listed firms covered by analysts from each country

Total number of Stockholm listed firms covered by identified analysts	**554**	(denominator)

Firms covered by analysts from …	Number	Percent
Sweden	431	77.8%
Norway	197	35.6%
UK	164	29.6%
US	68	12.3%
France	64	11.6%
Finland	56	10.1%
Denmark	42	7.6%
Lithuania	32	5.8%
Netherlands	31	5.6%
Germany	23	4.2%
Canada	21	3.8%
Russia	18	3.2%
India	9	1.6%
Italy	8	1.4%
Spain	8	1.4%
Switzerland	5	0.9%
South Africa	5	0.9%
Tunisia	4	0.7%
Australia	3	0.5%
Czech Republic	3	0.5%
Poland	2	0.4%
Austria	2	0.4%
Korea	2	0.4%
Portugal	2	0.4%
Brazil	1	0.2%
HK	1	0.2%
Ireland	1	0.2%
Malaysia	1	0.2%
Mexico	1	0.2%
New Zealand	1	0.2%
Singapore	1	0.2%
Turkey	1	0.2%
United Arab Emirates	1	0.2%

Table 2: The number of firms on analysts' coverage list

This table reports the descriptive statistics and results for Hypothesis 1 – the adoption of RPA reduces the number of firms in the analyst coverage list. The analysis is on the analyst-quarterly basis. The pre-adoption period is from 2013Q1 to 2014Q4, whilst the post-adoption period is from 2015Q1 to 2016Q4. The treatment (control) group has 218 Swedish (1,402 non-Swedish) analysts during the sample period. In this table, the dependent variable is *NUMCOM*, which is defined as the number of firms followed by each individual analyst within a quarter. *SW* is the indicator variable for the treatment group, equals to one for Swedish analysts, and zero for non-Swedish analysts. *RPA* is the indicator variable, equals to one when the observation is from post-RPA period (1 January 2015 onwards), and zero otherwise. *GEXP* is analysts' general experience in the natural logarithm form. General experience is measured as the number of years from when the analyst issued her first analyst's opinion for any firms to present. *NUMIND* denotes the number of two-digit SIC industries followed by each individual analyst. *PACY* denotes the relative accuracy score of an analyst in the previous year, which is calculated in line with Hong and Kubik (2003). Panel (A) presents descriptive statistics for variables used in the regression. Panel (B) reports Pearson (below diagonal) and Spearman (above diagonal) correlations. The correlations significant at the 5 percent level are shown in bold. Panel (C) outlines the results. All the regressions are clustered at the analyst level and the quarter level. Robust standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level respectively.

Panel (A): Descriptive statistics

Treatment: SW=1								
Variable	N	Mean	S.D.	Min	0.25	Median	0.75	Max
NUMCOM	1,733	8.11	4.47	1	5	8	11	26
RPA	1,733	0.51	0.50	0	0	1	1	1
GEXP	1,733	2.29	0.86	0.22	1.56	2.51	3.07	3.42
NUMIND	1,733	3.39	2.23	1	2	3	4	10
PACY	1,733	54.47	16.01	14.64	44.29	54.38	64.62	88.08

Control: SW=0								
Variable	N	Mean	S.D.	Min	0.25	Median	0.75	Max
NUMCOM	14,528	10.87	6.93	1	6	10	14	34
RPA	14,528	0.49	0.50	0	0	0	1	1
GEXP	14,528	2.25	0.81	0	1.66	2.3	3	3.43
NUMIND	14,528	2.81	1.89	1	1	2	4	10
PACY	14,528	53.49	13.16	14.64	45.54	53.73	61.45	88.08

Panel (B): Correlation Matrix

		(1)	(2)	(3)	(4)	(5)	(6)
(1)	*NUMCOM*		**0.10**	**-0.12**	**0.23**	**0.41**	-0.00
(2)	*RPA*	**0.10**		0.01	**0.07**	**0.02**	**-0.06**
(3)	*SW*	**-0.12**	0.01		**0.02**	**0.08**	**0.02**
(4)	*GEXP*	**0.19**	**0.07**	**0.02**		**0.16**	-0.01
(5)	*NUMIND*	**0.42**	**0.03**	**0.09**	**0.15**		0.00
(6)	*PACY*	-0.01	**-0.07**	**0.02**	**-0.02**	0.00	

Panel (C): Results for testing the reduction in the number of firms on analysts' coverage lists

Dependent variable: *NUMCOM*						
Variables	i	ii	iii	iv	v	vi
RPA	1.183***	1.125***	1.216***		0.753**	
	(0.256)	(0.257)	(0.273)		(0.289)	
SW	-2.619***	-3.314***				
	(0.376)	(0.319)				
RPA × *SW*	-1.009***	-0.649**	-0.561**	-0.605**	-0.572*	-0.623**
	(0.333)	(0.230)	(0.251)	(0.249)	(0.280)	(0.275)
GEXP		1.267***	1.311***	1.277***	2.929***	1.702***
		(0.166)	(0.145)	(0.146)	(0.462)	(0.550)
NUMIND		1.411***	1.267***	1.262***	2.046***	2.043***
		(0.088)	(0.060)	(0.060)	(0.068)	(0.068)
PACY		-0.001	0.012**	0.012**	0.009**	0.008*
		(0.007)	(0.005)	(0.005)	(0.004)	(0.004)
No. of Ob.	18,127	16,261	16,241	16,241	16,216	16,216
R-squared	0.027	0.228	0.544	0.549	0.791	0.794
Broker FE	No	No	Yes	Yes	No	No
Analyst FE	No	No	No	No	Yes	Yes
Quarter FE	No	No	No	Yes	No	Yes

Table 3: General description of Nasdaq OMX Stockholm

This table reports the distribution of firms listed on the largest stock market in Sweden: Nasdaq OMX Stockholm by countries of headquarters in Panel (A) and by industries in Panel (B). These firms are used to test the Hypotheses 2a and 2b – the disproportionate reduction in firms' analyst following.

Panel (A): Countries of headquarters

Country	No. of firms	Percent
Sweden	273	91.9%
Canada	7	2.4%
Switzerland	5	1.7%
United Kingdom	3	1.0%
Denmark	2	0.7%
Finland	2	0.7%
Belgium	1	0.3%
Luxembourg	1	0.3%
Malta	1	0.3%
Poland	1	0.3%
Russia	1	0.3%
Total	297	100%

Panel (B): The industry distribution

Industry	No. of firms	Percent
Industrials	77	25.9%
Financials	58	19.5%
Health Care	40	13.5%
Technology	33	11.1%
Consumer Goods	28	9.4%
Consumer Services	28	9.4%
Basic Materials	19	6.4%
Oil & Gas	6	2.0%
Telecommunications	6	2.0%
Utilities	2	0.7%
Total	297	100%

Table 4: Disproportionate reduction in firms' analyst following

This table reports the descriptive statistics and results for Hypotheses 2a and 2b – after the RPA adoption, the decrease in the number of analyst following among the low institutional holding firms and small firms is greater than firms with high institutional holdings and large firms. The test is conducted on 297 firms that are listed on the largest Swedish stock market – Nasdaq OMX Stockholm. The analysis is on the firm-quarterly basis. The pre-adoption period is from 2013Q1 to 2014Q4, whilst the post-adoption period is from 2015Q1 to 2016Q4. The dependent variable is *AF_SW*, which is measured by the number of Swedish analysts following a firm listed on Nasdaq OMX Stockholm within each quarter. *RPA* is the indicator variable, equals to one when the observation is from post-RPA period (1 January 2015 onwards), and zero otherwise. *PRE* is the indicator variable, equals to one from 1 January 2014 onwards, and zero otherwise. *LOWINST* is a dummy variable, set equal to one when the firm has the institutional investor ownership lower than the median of all firms at the beginning of each quarter, and zero otherwise. *SMALL* is an indicator variable, equals to one when the firm is defined as a small firm. Small firms are defined as when the firm's market value of equity is less than the median of all firms at the beginning of each quarter, and zero otherwise. *MV* represents the market value of equity in the logarithm form. *INTA* indicates the percentage of intangible assets, and is calculated as on the total intangible assets, scaled by total assets. *MB* is the market-to-book ratio and measured by dividing the market value of equity by the book value of equity. *INST* denotes the percentage of institutional investor ownership for a firm within each quarter. *RETVOL* is the stock return volatility within each quarter. *RSQ* is the R-squared from the market model of the individual stock return on the market return. *OMX* is an indicator variable and takes the value of one if the firm is one of the OMX30 Index constituents, otherwise zero. Panel (A) presents descriptive statistics for variables used in the regression. Panel (B) reports Pearson (below diagonal) and Spearman (above diagonal) correlations. The correlations significant at the 5 percent level are shown in bold. Panel (C) outlines the results. All the regressions are clustered at the firm level and the quarter level. Robust standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level respectively.

Panel (A): Descriptive statistics

RPA=0								
Variable	N	Mean	S.D.	Min	0.25	Median	0.75	Max
AF_SW	1,909	2.58	2.52	0	0	2	4	10
SMALL	1,909	0.51	0.50	0	0	1	1	1
MV	1,909	7.78	2.07	2.19	6.18	7.61	9.3	12.78
INTA	1,909	24.63	22.68	0	1.56	20.04	38.92	82.60
MB	1,909	2.82	2.86	0.31	1.13	1.98	3.37	20.69
LOWINST	1,909	0.50	0.50	0	0	1	1	1
INST	1,909	46.88	24.12	0.01	28.11	47.6	64.99	100
RETVOL	1,909	0.02	0.01	0	0.01	0.02	0.02	0.14
RSQ	1,909	0.12	0.15	0	0.01	0.05	0.16	0.72
OMX	1,909	0.11	0.32	0	0	0	0	1

RPA=1								
Variable	N	Mean	S.D.	Min	0.25	Median	0.75	Max
AF_SW	2,181	2.51	2.59	0	0	2	4	11
SMALL	2,181	0.49	0.50	0	0	0	1	1
MV	2,181	8.11	1.95	2.60	6.73	8.06	9.49	12.78
INTA	2,181	26.12	24.10	0	1.65	21.33	42.84	82.60
MB	2,181	3.17	3.19	0.31	1.24	2.21	3.85	20.69
LOWINST	2,181	0.48	0.50	0	0	0	1	1
INST	2,181	51.60	23.67	0.21	32.93	53.06	69.91	100
RETVOL	2,181	0.02	0.01	0	0.02	0.02	0.03	0.14
RSQ	2,181	0.17	0.19	0	0.02	0.09	0.26	0.72
OMX	2,181	0.10	0.30	0	0	0	0	1

Panel (B): Correlation Matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	*AF_SW*		-0.03	**-0.66**	**0.76**	**0.09**	**0.13**	**-0.39**	**0.42**	**-0.41**	**0.51**	**0.46**
(2)	*RPA*	-0.01		-0.02	**0.09**	0.02	**0.07**	-0.02	**0.10**	**0.12**	**0.16**	-0.02
(3)	*SMALL*	**-0.65**	-0.02		**-0.86**	**0.06**	**-0.12**	**0.34**	**-0.37**	**0.42**	**-0.52**	**-0.35**
(4)	*MV*	**0.76**	**0.08**	**-0.81**		**-0.06**	**0.17**	**-0.37**	**0.41**	**-0.49**	**0.61**	**0.52**
(5)	*INTA*	**0.05**	**0.03**	**0.08**	**-0.09**		**0.22**	**-0.16**	**0.20**	**0.14**	**-0.05**	-0.02
(6)	*MB*	0.03	**0.06**	-0.03	**0.06**	-0.01		**-0.09**	**0.14**	**0.05**	0.02	**0.04**
(7)	*LOWINST*	**-0.39**	-0.02	**0.34**	**-0.36**	**-0.14**	-0.01		**-0.81**	**0.17**	**-0.24**	**-0.23**
(8)	*INST*	**0.40**	**0.10**	**-0.37**	**0.37**	**0.18**	0.03	**-0.78**		**-0.15**	**0.26**	**0.19**
(9)	*RETVOL*	**-0.32**	**0.04**	**0.33**	**-0.41**	**0.12**	**0.10**	**0.17**	**-0.16**		**-0.34**	**-0.25**
(10)	*RSQ*	**0.56**	**0.15**	**-0.50**	**0.64**	**-0.11**	**-0.05**	**-0.23**	**0.22**	**-0.26**		**0.40**
(11)	*OMX*	**0.54**	-0.02	**-0.35**	**0.61**	**-0.06**	0.02	**-0.23**	**0.18**	**-0.17**	**0.51**	

Panel (C): Results for testing the disproportionate reduction in analyst following

Dependent variable: *AF_SW*						
	Low institutional ownership			**Small size**		
	i	ii	iii	iv	v	vi
RPA	0.017			0.172		
	(0.143)			(0.138)		
LOWINST	0.084	0.103	0.062			
	(0.081)	(0.080)	(0.099)			
RPA × *LOWINST*	-0.258**	-0.244**	-0.283**			
	(0.104)	(0.105)	(0.102)			
PRE × *LOWINST*			0.082			
			(0.083)			
SMALL				0.247	0.268	0.348*
				(0.162)	(0.160)	(0.167)
RPA × *SMALL*				-0.503***	-0.483***	-0.405***
				(0.125)	(0.126)	(0.114)
PRE × *SMALL*						-0.163
						(0.098)
MV	0.073	0.137	0.136	0.056	0.120	0.120
	(0.092)	(0.086)	(0.086)	(0.090)	(0.087)	(0.087)
INTA	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
MB	-0.011	-0.009	-0.009	-0.008	-0.006	-0.006
	(0.012)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)
INST	0.003	0.004*	0.004*	0.002	0.003	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
RETVOL	-1.410	-1.231	-1.175	-1.124	-0.920	-0.994
	(2.036)	(1.994)	(1.994)	(1.745)	(1.770)	(1.777)
RSQ	0.134	0.523**	0.526**	0.056	0.404*	0.391*
	(0.301)	(0.240)	(0.239)	(0.283)	(0.211)	(0.214)
OMX	0.298	0.247	0.249	0.226	0.186	0.180
	(0.412)	(0.394)	(0.394)	(0.421)	(0.415)	(0.421)
Observations	4083	4083	4083	4176	4176	4176
Adjusted R-squared	0.904	0.910	0.910	0.907	0.912	0.912
RPA + PRA × *LOWINST*	-0.240*					
	(0.118)					
RPA + PRA × *SMALL*				-0.331***		
				(0.128)		
Firm Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effect	No	Yes	Yes	No	Yes	Yes

Table 5: Analysts' research quality

The table reports the test for analysts' research quality. Panel (A) reports descriptive statistics. In this table, *FORERR* is the dependent variable, which is defined as analyst forecast error and calculated by taking the absolute value of the difference between the one-year-ahead EPS forecast and the actual EPS, scaled by the stock price two days before the forecast is provided, then multiplied by 100. *SW* is the indicator variable for the treatment group, equals to one for Swedish analysts, and zero for non-Swedish analysts. *RPA* is the indicator variable, equals to one when the observation is from post-RPA period (1 January 2015 onwards), and zero otherwise. *MV* represents the market value of equity in the logarithm form. *AF* is the total number of analysts following a firm within each quarter. *INTA* indicates the percentage of intangible assets scaled by total assets. *MB* is the market-to-book ratio and measured by dividing the market value of equity by the book value of equity. *RETVOL* is the stock return volatility within each quarter. *LOSS* is a dummy variable, and equals to one when the actual EPS is negative, and zero otherwise. *DECL* is a dummy variable, and equals to one when the current actual EPS is less than the EPS in the previous year. *HOR* denotes the forecast horizon in the logarithm form. Forecast horizon is the number of days between the date when the forecast is provided and the date when the actual EPS is announced. *FEXP* is the analyst's experience to a specific firm in the logarithm form. Analyst's experience to a specific firm is measured as the number of years since the analyst provides her first analyst's opinion on the specific firm to present. *GEXP* is analysts' general experience of being an analyst in the logarithm form. Analysts' general experience is measured as the number of years from when the analyst issued her first analyst's opinion for any firms to present. *NUMCOV* and *NUMIND* are total numbers of firms and industries that one analyst covers within each quarter respectively. *PACY* denotes the relative accuracy score of an analyst in the previous year, which is calculated in line with Hong and Kubik (2003). Panel (B) reports Pearson (below diagonal) and Spearman (above diagonal) correlations. The correlations significant at the five percent level are shown in bold. Panel (C) outlines the results. Columns (i) to (iv) report the results in the full sample. Column (v) reports the result within the sample restricting to analyst-firm pairs appearing in the both pre- and post-adopting period. All the regressions are clustered at the analyst level and the quarter level. Robust standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level respectively.

Panel (A): Descriptive statistics

Treatment: SW=1								
Variable	N	Mean	S.D.	Min	0.25	Median	0.75	Max
FORERR	15,739	1.63	3.91	0	0.19	0.57	1.48	35.09
RPA	15,739	0.52	0.50	0	0	1	1	1
MV	15,739	7.76	1.72	3.82	6.61	7.82	8.94	12.19
AF	15,739	13.17	9.68	1	5	10	21	61
INTA	15,739	26.64	22.14	0	6.24	24.43	41.55	77.43
MB	15,739	3.25	3.70	-8.58	1.50	2.51	3.75	26.44
RETVOL	15,739	0.02	0.01	0	0.01	0.02	0.02	0.06
LOSS	15,739	0.09	0.29	0	0	0	0	1
DECL	15,739	0.39	0.49	0	0	0	1	1
HOR	15,739	5.26	0.52	3.43	4.79	5.35	5.67	5.90
FEXP	15,739	1.49	0.85	0	0.79	1.49	2.19	3.11
GEXP	15,739	2.46	0.81	0.13	1.83	2.8	3.12	3.42
NUMCOM	15,739	10.48	4.36	1	7	10	13	26
NUMIND	15,739	4.16	2.43	1	2	3	5	11
PACY	15,739	55.36	14.58	0	46.64	55.42	64.28	100

Control: SW=0								
Variable	N	Mean	S.D.	Min	0.25	Median	0.75	Max
FORERR	155,560	1.92	4.67	0	0.14	0.51	1.58	35.09
RPA	155,560	0.51	0.50	0	0	1	1	1
MV	155,560	8.63	1.80	3.82	7.46	8.68	9.93	12.19
AF	155,560	18.93	9.53	1	11	19	26	61
INTA	155,560	20.3	20.31	0	2.16	13.62	33.72	77.43
MB	155,560	2.98	3.96	-8.58	1.15	2.01	3.53	26.44
RETVOL	155,560	0.02	0.01	0	0.01	0.02	0.02	0.06
LOSS	155,560	0.20	0.40	0	0	0	0	1
DECL	155,560	0.45	0.50	0	0	0	1	1
HOR	155,560	5.24	0.55	3.43	4.83	5.35	5.69	5.90
FEXP	155,560	1.40	0.79	0	0.78	1.39	1.99	3.11
GEXP	155,560	2.40	0.75	0	1.82	2.48	3.06	3.49
NUMCOM	155,560	15.2	8.54	1	9	13	20	45
NUMIND	155,560	3.47	2.20	1	2	3	5	11
PACY	155,560	53.92	11.37	0	47.27	54.24	60.79	100

Panel (B): Correlation Matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1)	*FORERR*		**0.01**	**0.02**	**-0.30**	**-0.17**	**-0.19**	**-0.33**	**0.26**	**0.25**	**0.11**	**0.16**	**-0.04**	**-0.05**	**0.00**	**-0.03**	**-0.03**
(2)	*RPA*	**0.02**		0.00	0.00	**-0.03**	**0.01**	**-0.01**	**0.24**	**0.04**	**-0.05**	**-0.03**	**0.04**	**0.07**	**0.10**	**0.03**	**-0.06**
(3)	*SW*	**-0.02**	0.00		**-0.14**	**-0.17**	**0.09**	**0.07**	**-0.05**	**-0.08**	**-0.03**	**0.00**	**0.03**	**0.03**	**-0.17**	**0.09**	**0.03**
(4)	*MV*	**-0.29**	0.00	**-0.14**		**0.72**	**0.15**	**0.25**	**-0.47**	**-0.30**	**-0.03**	**-0.01**	**0.16**	**0.11**	**-0.01**	**-0.14**	**-0.02**
(5)	*AF*	**-0.16**	**-0.03**	**-0.17**	**0.71**		**0.05**	**0.03**	**-0.22**	**-0.11**	**0.04**	**0.01**	**0.17**	**0.09**	**0.02**	**-0.12**	**-0.02**
(6)	*INTA*	**-0.12**	**0.03**	**0.09**	**0.11**	0.00		**0.36**	**-0.19**	**-0.14**	**-0.01**	**0.01**	**0.03**	**0.07**	**-0.14**	**0.12**	0.00
(7)	*MB*	**-0.13**	**0.01**	**0.02**	**0.17**	**0.01**	**0.12**		**-0.27**	**-0.27**	**-0.10**	**-0.01**	**0.01**	**0.08**	**-0.05**	**0.12**	0.00
(8)	*RETVOL*	**0.32**	**0.20**	**-0.06**	**-0.49**	**-0.20**	**-0.17**	**-0.13**		**0.41**	**0.07**	**0.01**	**-0.09**	**-0.05**	**0.11**	0.00	**-0.01**
(9)	*LOSS*	**0.30**	**0.04**	**-0.08**	**-0.32**	**-0.10**	**-0.11**	**-0.13**	**0.47**		**0.24**	**0.00**	**-0.07**	**-0.07**	**0.07**	**-0.07**	**0.01**
(10)	*DECL*	**0.08**	**-0.05**	**-0.03**	**-0.03**	**0.04**	**-0.01**	**-0.08**	**0.08**	**0.24**		**-0.01**	**-0.01**	**-0.02**	**0.02**	**-0.03**	**0.00**
(11)	*HOR*	**0.06**	**-0.04**	**0.01**	**-0.01**	0.00	**0.01**	**-0.01**	**-0.02**	0.00	**-0.01**		**-0.02**	**-0.02**	**-0.02**	**0.00**	**0.00**
(12)	*FEXP*	**-0.04**	**0.04**	**0.03**	**0.17**	**0.17**	**0.01**	0.00	**-0.09**	**-0.07**	**-0.01**	**-0.02**		**0.44**	**0.10**	**0.04**	**0.02**
(13)	*GEXP*	**-0.05**	**0.06**	**0.02**	**0.12**	**0.10**	**0.06**	**0.04**	**-0.05**	**-0.06**	**-0.01**	**-0.02**	**0.46**		**0.19**	**0.13**	**0.01**
(14)	*NUMCOM*	**0.01**	**0.10**	**-0.16**	**-0.01**	**0.04**	**-0.13**	**-0.03**	**0.15**	**0.10**	**0.03**	**-0.02**	**0.09**	**0.21**		**0.33**	**-0.05**
(15)	*NUMIND*	**-0.04**	**0.03**	**0.09**	**-0.12**	**-0.11**	**0.08**	**0.04**	**-0.02**	**-0.07**	**-0.02**	0.00	**0.04**	**0.13**	**0.42**		**-0.05**
(16)	*PACY*	**-0.01**	**-0.06**	**0.04**	**-0.02**	**-0.02**	0.00	**0.01**	**-0.01**	**0.01**	0.00	**0.01**	**0.02**	0.00	**-0.06**	**-0.04**	

Panel (C): Results for analysts' forecast accuracy within the sample of analysts' entire firm coverage

Dependent variable: *FORERR*				
	Full sample			Restricted sample
Variables	i	ii	iii	iv
RPA	-0.092			
	(0.107)			
SW	0.049	0.061		
	(0.167)	(0.120)		
RPA × SW	-0.636***	-0.324**	-0.327*	-0.379*
	(0.156)	(0.142)	(0.157)	(0.181)
MV	-0.332***	-1.636***	-1.610***	-1.542***
	(0.039)	(0.181)	(0.186)	(0.212)
AF	-0.014**	-0.021	-0.020	-0.020
	(0.005)	(0.012)	(0.012)	(0.013)
INTA	-0.011***	-0.001	-0.000	-0.002
	(0.002)	(0.007)	(0.007)	(0.008)
MB	-0.064***	0.008	0.006	0.007
	(0.010)	(0.012)	(0.012)	(0.014)
RETVOL	78.227***	23.609**	23.157**	21.441**
	(8.992)	(8.031)	(7.926)	(9.739)
LOSS	1.975***	1.135***	1.139***	1.058***
	(0.155)	(0.124)	(0.122)	(0.144)
DECL	0.200***	0.336***	0.335***	0.366***
	(0.052)	(0.048)	(0.049)	(0.052)
HOR	0.546***	0.466***	0.471***	0.445***
	(0.064)	(0.032)	(0.030)	(0.033)
FEXP	0.108**	-0.015	-0.008	0.260*
	(0.042)	(0.016)	(0.020)	(0.135)
GEXP	0.011	-0.007	0.349	0.165
	(0.054)	(0.015)	(0.223)	(0.284)
NUMCOM	-0.018**	-0.001	-0.007*	-0.008
	(0.007)	(0.003)	(0.004)	(0.005)
NUMIND	-0.036	0.004	0.018	0.019
	(0.023)	(0.007)	(0.016)	(0.021)
PACY	-0.007**	-0.003**	0.003	0.004
	(0.002)	(0.001)	(0.002)	(0.002)
Observations	167,468	167,468	167,468	128,698
Adjusted R2	0.163	0.591	0.598	0.606
Firm FE	No	Yes	Yes	No
Analyst FE	No	No	Yes	No
Quarter FE	No	Yes	Yes	Yes
Firm × Analyst FE	No	No	No	Yes
No. of firms	3,590	3,590	3,590	2,560
No. of Swedish analysts	161	161	161	122
No. of non-Swedish analysts	1,212	1,212	1,212	969

Panel (D): Results for analysts' forecast accuracy within the sample of Swedish and non-Swedish analysts' common firm coverage

Dependent variable: *FORERR*				
	Full sample			Restricted sample
Variables	i	ii	iii	iv
RPA	-0.334**			
	(0.123)			
SW	-0.058	0.140*		
	(0.127)	(0.068)		
RPA × SW	-0.196	-0.279***	-0.262**	-0.319**
	(0.143)	(0.089)	(0.111)	(0.126)
MV	-0.745***	0.007	0.036	0.055
	(0.122)	(0.354)	(0.366)	(0.395)
AF	0.048***	-0.019	-0.016	-0.020
	(0.013)	(0.020)	(0.020)	(0.020)
INTA	-0.008***	0.028*	0.029*	0.027
	(0.002)	(0.014)	(0.014)	(0.017)
MB	-0.012*	0.003	0.002	0.003
	(0.006)	(0.003)	(0.004)	(0.003)
RETVOL	61.221***	9.420	8.070	4.474
	(13.175)	(8.798)	(8.527)	(8.397)
LOSS	0.221	0.332	0.395*	0.335
	(0.178)	(0.217)	(0.207)	(0.238)
DECL	-0.022	0.103**	0.110**	0.191***
	(0.061)	(0.044)	(0.045)	(0.055)
HOR	0.335***	0.336***	0.372***	0.317***
	(0.058)	(0.070)	(0.067)	(0.071)
FEXP	0.178***	0.014	0.008	0.158
	(0.041)	(0.015)	(0.030)	(0.195)
GEXP	-0.080*	-0.025	0.227	-0.099
	(0.045)	(0.021)	(0.238)	(0.361)
NUMCOM	0.008	0.006*	0.008	0.014
	(0.006)	(0.003)	(0.007)	(0.008)
NUMIND	-0.077**	-0.013	-0.024	-0.038
	(0.027)	(0.012)	(0.025)	(0.033)
PACY	-0.007**	-0.004**	0.003	0.002
	(0.003)	(0.002)	(0.002)	(0.003)
Observations	36,505	36,505	36,505	28,027
Adjusted R2	0.163	0.591	0.598	0.595
Firm FE	No	Yes	Yes	No
Analyst FE	No	No	Yes	No
Quarter FE	No	Yes	Yes	Yes
Firm × Analyst FE	No	No	No	Yes
No. of firms	223	223	223	188
No. of Swedish analysts	153	153	153	107
No. of non-Swedish analysts	864	864	864	541

Table 6: The test of the likelihood of analysts dropping firms in the post-RPA period

This table reports the results of the likelihood of Swedish analysts dropping firms in the post-RPA period, compared to non-Swedish analysts, which is conducted in a logistic model with the last forecast provided by each analyst for each firm in the pre-RPA period only. The dependent variable is an indicator variable – *DIS,* and equals to one when the analyst-firm pairs appear in the pre-RPA period but disappear in the post-RPA period, and zero otherwise. *FORERR* is the dependent variable, which is defined as analyst forecast error and calculated by taking the absolute value of the difference between the one-year-ahead EPS forecast and the actual EPS, scaled by the stock price two days before the forecast is provided, then multiplied by 100. *SW* is the indicator variable for the treatment group, equals to one for Swedish analysts, and zero for non-Swedish analysts. *RPA* is the indicator variable, equals to one when the observation is from post-RPA period (1 January 2015 onwards), and zero otherwise. *MV* represents the market value of equity in the logarithm form. *AF* is the total number of analysts following a firm within each quarter. *INTA* indicates the percentage of intangible assets scaled by total assets. *MB* is the market-to-book ratio and measured by dividing the market value of equity by the book value of equity. *RETVOL* is the stock return volatility within each quarter. *LOSS* is a dummy variable, and equals to one when the actual EPS is negative, and zero otherwise. *DECL* is a dummy variable, and equals to one when the current actual EPS is less than the EPS in the previous year. *FEXP* is the analyst's experience to a specific firm in the logarithm form. Analyst's experience to a specific firm is measured as the number of years since the analyst provides her first analyst's opinion on the specific firm to present. *GEXP* is analysts' general experience of being an analyst in the logarithm form. Analysts' general experience is measured as the number of years from when the analyst issued her first analyst's opinion for any firms to present. *NUMCOV* and *NUMIND* are total numbers of firms and industries that one analyst covers within each quarter respectively. Panel (B) reports Pearson (below diagonal) and Spearman (above diagonal) correlations. The correlations significant at the five percent level are shown in bold. Panel (C) outlines the results. All the regressions are clustered at the analyst level. Robust standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level respectively.

Panel (A): Descriptive statistics

Variable	N	Mean	S.D.	Min	0.25	Median	0.75	Max
DIS	82,549	0.24	0.43	0.00	0.00	0.00	0.00	1.00
SW	82,549	0.09	0.29	0.00	0.00	0.00	0.00	1.00
FORERR	82,549	1.78	4.05	0.00	0.14	0.51	1.56	30.09
MV	82,549	8.55	1.80	3.83	7.42	8.59	9.80	12.17
AF	82,549	18.73	9.84	1.00	11.00	18.00	26.00	61.00
INTA	82,549	20.25	19.78	0.00	2.52	14.20	33.72	75.05
MB	82,549	2.96	3.70	-7.06	1.20	2.04	3.43	25.10
RETVOL	82,549	0.02	0.01	0.00	0.01	0.02	0.02	0.06
LOSS	82,549	0.17	0.38	0.00	0.00	0.00	0.00	1.00
DECL	82,549	0.47	0.50	0.00	0.00	0.00	1.00	1.00
FEXP	82,549	1.37	0.77	0.00	0.78	1.34	1.95	3.05
GEXP	82,549	2.35	0.76	0.00	1.74	2.42	3.03	3.46
NUMCOM	82,549	13.89	7.91	1.00	8.00	12.00	18.00	41.00
NUMIND	82,549	3.46	2.19	1.00	2.00	3.00	5.00	11.00

Panel (B): Correlation Matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	*DIS*		**0.02**	**0.11**	**-0.12**	**-0.11**	**0.01**	**-0.06**	**0.05**	**0.04**	**0.03**	**-0.16**	**-0.15**	**-0.03**	**0.00**
(2)	*SW*	**0.02**		**0.05**	**-0.14**	**-0.18**	**0.09**	**0.05**	**-0.03**	**-0.06**	**-0.01**	**0.04**	**0.03**	**-0.17**	**0.08**
(3)	*FORERR*	**0.08**	**0.01**		**-0.30**	**-0.19**	**-0.15**	**-0.31**	**0.24**	**0.25**	**0.11**	**-0.05**	**-0.06**	**-0.03**	**-0.03**
(4)	*MV*	**-0.14**	**-0.15**	**-0.29**		**0.78**	**0.11**	**0.23**	**-0.52**	**-0.33**	**-0.02**	**0.15**	**0.14**	**-0.01**	**-0.13**
(5)	*AF*	**-0.11**	**-0.17**	**-0.18**	**0.76**		**0.05**	**0.06**	**-0.31**	**-0.17**	**0.05**	**0.17**	**0.12**	**0.01**	**-0.12**
(6)	*INTA*	**0.01**	**0.09**	**-0.10**	**0.07**	0.00		**0.32**	**-0.14**	**-0.12**	**0.03**	**0.04**	**0.06**	**-0.15**	**0.12**
(7)	*MB*	**-0.05**	**0.02**	**-0.13**	**0.15**	**0.02**	**0.08**		**-0.20**	**-0.21**	**-0.09**	**0.03**	**0.09**	**-0.02**	**0.12**
(8)	*RETVOL*	**0.07**	**-0.05**	**0.29**	**-0.51**	**-0.28**	**-0.12**	**-0.08**		**0.39**	**0.05**	**-0.12**	**-0.08**	**0.06**	**0.01**
(9)	*LOSS*	**0.04**	**-0.06**	**0.32**	**-0.35**	**-0.16**	**-0.09**	**-0.09**	**0.46**		**0.19**	**-0.06**	**-0.08**	**0.04**	**-0.07**
(10)	*DECL*	**0.03**	**-0.01**	**0.08**	**-0.01**	**0.05**	**0.03**	**-0.08**	**0.05**	**0.19**		**-0.02**	**-0.03**	**-0.01**	**-0.05**
(11)	*FEXP*	**-0.16**	**0.05**	**-0.04**	**0.16**	**0.17**	**0.03**	**0.01**	**-0.12**	**-0.06**	**-0.02**		**0.43**	**0.09**	**0.05**
(12)	*GEXP*	**-0.16**	**0.03**	**-0.05**	**0.14**	**0.12**	**0.06**	**0.04**	**-0.08**	**-0.07**	**-0.02**	**0.45**		**0.19**	**0.12**
(13)	*NUMCOM*	**-0.03**	**-0.16**	**-0.02**	**-0.01**	**0.03**	**-0.14**	**-0.03**	**0.08**	**0.05**	**-0.01**	**0.08**	**0.20**		**0.32**
(14)	*NUMIND*	0.00	**0.08**	**-0.04**	**-0.11**	**-0.12**	**0.08**	**0.05**	**-0.03**	**-0.07**	**-0.04**	**0.05**	**0.12**	**0.42**	

Panel (C): Regression results

Dependent variable: Pr(*DIS*=1)			
Variables	i	ii	iii
SW	0.155	0.034	-0.240
	(0.196)	(0.192)	(0.253)
FORERR	0.040***	0.018**	0.000
	(0.006)	(0.008)	(0.006)
SW × *FORERR*	0.006	0.009	0.013
	(0.017)	(0.015)	(0.023)
MV		-0.103*	-0.115
		(0.061)	(0.087)
AF		-0.005	0.028***
		(0.009)	(0.008)
INTA		0.004	0.007
		(0.002)	(0.006)
MB		-0.017*	0.020***
		(0.010)	(0.007)
RETVOL		3.097	2.432
		(4.506)	(3.218)
LOSS		-0.074	0.143*
		(0.111)	(0.083)
DECL		0.118*	-0.056
		(0.061)	(0.050)
FEXP		-0.344***	-0.461***
		(0.059)	(0.070)
GEXP		-0.289***	-0.274***
		(0.080)	(0.093)
NUMCOM		0.009	0.025**
		(0.015)	(0.012)
NUMIND		0.008	-0.027
		(0.044)	(0.043)
CONSTANT	-1.258***	1.151***	1.688
	(0.083)	(0.447)	(1.278)
No. of Ob.	82,549	82,549	66,702
Pseudo R-squared	0.006	0.101	0.217
Firm Fixed Effect	No	No	Yes
Quarter Fixed Effect	No	Yes	Yes

Table 7: Market reaction to forecast revisions

This table reports the results of the change in the market reaction to forecast revisions with the RPA adoption. The analysis is on the firm-day basis among the Swedish firms followed by at least one analyst. The dependent variable, *ABS_ABRET*, is the absolute abnormal return in the percentage form, calculated by taking the absolute value of the difference between firms' daily return and the daily OMX Stockholm 30 index return. *RPA* is the indicator variable, equals to one for the post-RPA period (1 January 2015 onwards), and zero otherwise. *PRE* is the indicator variable, equals to one from 1 January 2014 onwards, and zero otherwise. *ANALYST* is the dummy variable, with the value of one if any analyst provides forecast revisions on the day and the next day ([0, +1]), and zero otherwise. *EARN* is the dummy variable, with the value of one if a firm makes an earnings announcement on the day and the next day ([0, +1]), and zero otherwise. Panel (A) presents descriptive statistics for variables used in the regression. Panel (B) reports the overall results. Panel (C) presents the results partitioned by quintiles of institutional investor ownership. Panel (D) reports the results partitioned by quintiles of the market value of equity. All regressions are clustered at the firm and day levels. Robust standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5% and 1% level respectively.

Panel (A): Descriptive statistics

Variable	N	Mean	S.D.	Min	0.25	Median	0.75	Max
ABS_ABRET	278,238	1.53	1.69	0.00	0.44	1.01	1.96	10.01
RPA	278,238	0.53	0.50	0.00	0.00	1.00	1.00	1.00
PRE	278238	0.77	0.42	0.00	1.00	1.00	1.00	1.00
ANALYS	278,238	0.12	0.33	0.00	0.00	0.00	0.00	1.00
EARN	278,238	0.02	0.13	0.00	0.00	0.00	0.00	1.00

Panel (B): Overall results

	i	ii	iii	iv
ANALYST	0.13***	0.14***	0.14***	0.14***
	(0.02)	(0.02)	(0.03)	(0.02)
EARN	1.38***	1.40***	1.41***	1.44***
	(0.07)	(0.07)	(0.09)	(0.09)
RPA × *ANALYST*	0.08***	0.07***	0.08***	0.08***
	(0.03)	(0.02)	(0.03)	(0.03)
RPA × *EARN*	-0.01	-0.00	0.02	0.04
	(0.08)	(0.08)	(0.09)	(0.09)
PRE × *ANALYST*			-0.00	-0.01
			(0.03)	(0.03)
PRE × *EARN*			-0.06	-0.09
			(0.11)	(0.11)
Observations	278,238	278,237	278,238	278,237
Adjusted R-squared	0.196	0.226	0.196	0.226
Firm FE	Yes	No	Yes	No
Firm × Quarter FE	No	Yes	Yes	Yes
Day FE	Yes	Yes	No	Yes
No. of days around *ANALYST* before RPA [0, +1]		17,345		
No. of days around *ANALYST* after RPA [0, +1]		19,087		
No. of days around *EARN* before RPA [0, +1]		2,612		
No. of days around *EARN* after RPA [0, +1]		2,742		
Number of unique firms before RPA		275		
Number of unique firms after RPA		305		

Panel (C): Results partitioned by quintiles of firms' institutional investor ownership

Quintile of Institutional ownership	**1 (Low)**	**2**	**3**	**4**	**5 (High)**
ANALYS	0.22**	0.20***	0.15***	0.10***	0.12***
	(0.09)	(0.04)	(0.03)	(0.03)	(0.03)
ANALYS × *RPA*	0.08	0.08	-0.00	0.12***	0.07*
	(0.13)	(0.05)	(0.04)	(0.03)	(0.04)
EARN	1.44***	1.20***	1.45***	1.49***	1.40***
	(0.19)	(0.14)	(0.13)	(0.12)	(0.14)
EARN × *RPA*	-0.02	-0.16	0.05	0.04	-0.06
	(0.23)	(0.20)	(0.16)	(0.16)	(0.15)
Observations	53,146	53,380	53,638	53,579	53,394
Adjusted R-squared	0.200	0.195	0.243	0.248	0.220
Firm × Quarter FE	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes
No. of days around *ANALYST* before RPA [0, +1]	698	2,064	3,591	5,179	4,211
No. of days around *ANALYST* after RPA [0, +1]	975	2,305	3,801	5,907	4,424
No. of days around *EARN* before RPA [0, +1]	228	434	536	596	558
No. of days around *EARN* after RPA [0, +1]	244	432	521	661	640
Number of unique firms before RPA	81	97	103	100	83
Number of unique firms after RPA	104	124	133	131	100

Panel (D): Results partitioned by quintiles of firms' market value of equity

Quintile of the market value of equity	**1 (Low)**	**2**	**3**	**4**	**5 (High)**
ANALYS	0.20*	0.22***	0.30***	0.12***	0.08***
	(0.11)	(0.08)	(0.05)	(0.03)	(0.02)
ANALYS × *RPA*	0.05	0.14	-0.04	0.13***	0.06***
	(0.16)	(0.10)	(0.07)	(0.04)	(0.02)
EARN	1.70***	1.53***	1.28***	1.22***	1.42***
	(0.19)	(0.15)	(0.18)	(0.11)	(0.12)
EARN × *RPA*	0.18	-0.19	0.01	0.14	-0.07
	(0.28)	(0.18)	(0.21)	(0.14)	(0.11)
Observations	55,739	55,322	54,396	55,090	55,043
Adjusted R-squared	0.162	0.153	0.202	0.219	0.285
Firm × Quarter FE	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes
No. of days around *ANALYST* before RPA [0, +1]	556	1,135	1,906	4,361	8,580
No. of days around *ANALYST* after RPA [0, +1]	445	1,122	2,227	4,575	9,516
No. of days around *EARN* before RPA [0, +1]	258	398	474	640	676
No. of days around *EARN* after RPA [0, +1]	166	368	540	700	778
Number of unique firms before RPA	68	81	79	75	59
Number of unique firms after RPA	69	89	98	83	67