

Which Investors Leave Money on the Table? Evidence from Rights Issues*

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Abstract. This study documents patterns of investor behavior around Finnish rights issues. We find that shareholders of issuing companies lost at least €9.9 million in aggregate from 1995 to 2002 by exercising rights too early, selling rights in the open market below their intrinsic value, or leaving rights unexercised. At the investor level, the losses are modest. For example, the median household investor suffered a loss of €135 from not exercising or selling the rights. Investors with small portfolios, inactive trading history, those who know neither of the official languages in Finland, or who are living abroad leave money on the table the most.

JEL classification: G32, D01

Introduction

Investors are prone to making mistakes in investment decisions. For example, they pay high management fees for index funds, even when lower cost funds are available (Elton et al., 2004), exercise American options early (Potesman and Serbin, 2003), execute transactions in wrong stocks (Rashes, 2001), and trade too much (Barber and Odean, 2000). Even CBOT traders have been shown to deviate significantly—in fact, more than the control group of undergraduate students—from the expected utility maximization principle (Haigh and List, 2005). This evidence suggests that some investors make investment mistakes from time to time. However, very few

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papers study the determinants and the economic significance of the mistakes in the whole investor population.

This paper provides evidence on investment mistakes in a new setting, where it is possible to identify the investors that are most prone to making mistakes—and those who take advantage of the mistakes of other investors—and to analyze how expensive the mistakes are.

Rights issues, which are a common seasoned equity flotation method in Europe and Asia, offer a promising research setting for studying investment mistakes.¹ In rights issues, shareholders are given subscription rights, which are in essence short-lived warrants. Basic finance theory predicts that investors should not exercise their rights before maturity, not sell the rights below their fair value, and never leave in-the-money rights unexercised or unsold.

We find evidence against these three basic predictions. First, investors largely ignore the time value of money when deciding when to exercise the rights: the majority of rights exercises occur long before the last exercise day. At least 78% of the households exercise rights before maturity, and even in the category of mutual funds, arguably the most savvy major investor category, at least 26% of the exercises are early.

Second, institutional investors, and especially households, sell rights at low prices. At the same time, smart money takes advantage of the less sophisticated investors. Financial institutions buy rights in the open market and profit at the expense of investors selling their rights for a price below the intrinsic value. Third, we find that a non-trivial fraction of in-the-money rights lapse without compensation.

Altogether, investors left at least €9.9 million on the table in 18 Finnish rights issues between 1995 and 2002 by either selling rights for a price below their intrinsic value (€6.5 million), allowing them to lapse (€3.2 million), or exercising them early (€0.15 million). The aggregate cost amounts to 0.7% of the total issue proceeds, which is roughly 15% of the direct flotation costs of rights issues reported in Bøhren et al. (1997).²

At the investor level, average costs are rather modest. For example, the median household investor suffered a loss of €135 per a rights issue from not exercising or selling the rights. This result is in line with Campbell (2006) and Calvet et al. (2008), who find that, for the average household in Sweden, investment mistakes in the form of inefficient diversification cause only modest losses. Our results are less consistent with Barber et al. (2006), who find that the average individual investor in Taiwan suffers an economically significant loss from stock trading. This

¹ For the UK, see Slovin et al., 2000; for Sweden, Cronqvist and Nilsson, 2005; for Norway, Eckbo and Norli, 2005; for China, Chen and Yuan, 2004; and for Hong Kong, Wu and Wang, 2005.

² From the 18 offerings in the sample, we extract 240,000 observations that originate from 190,000 investors. Our results are robust to adjusting standard errors for clustering at the offering level.

discrepancy may be explained by the fact that, in our study, we have a limited number of rights issues, whereas there are ample opportunities to lose money in daily stock trading.

The average costs of investment mistakes mask considerable cross-sectional variation: 10% of households' losses from not using the rights are above €690 and the maximum wealth loss for households is €60,000. Due to the considerable variation, we examine which factors explain the propensity to leave rights unexercised or unsold. We emphasize two factors: sophistication and direct costs. We find that investors with large portfolios and high trading activity, arguably the more savvy investors, are the least likely to leave rights unexercised. Moreover, investors who live abroad and who are not native speakers of either of the official languages in Finland, are more likely to forfeit their subscription rights without compensation. These are the investors who tend to incur the highest direct costs.

The documented cross-sectional variation in the propensity of leaving money on the table is consistent with earlier literature, which finds a moderating effect of sophistication on a wide menu of investment mistakes. Sophisticated investors suffer less from behavioral biases in 401(k) plans (Agnew, 2006) and the disposition effect (Dhar and Zhu, 2006; Feng and Seasholes, 2005). They also make better diversification decisions (Calvet et al., 2008; Goetzmann and Kumar, 2008), have better portfolio performance (Barber et al., 2006; Grinblatt and Keloharju, 2000), make less mistakes in option trading (Potesman and Serbin, 2003), are less home biased (Grinblatt and Keloharju, 2001b), and are more likely to participate in the stock market (Vissing-Jørgensen, 2003).

Our results have additional implications for corporate financing decisions. The costs that we document can be interpreted as a lower boundary for the indirect costs of friction in a rights issue. When selecting an equity issuance method, the issuer should take these costs into account in addition to the direct issuance costs. Our results also suggest that the indirect costs vary predictably according to investor characteristics and are thus likely to depend on the firm's ownership structure. In some cases, the issuer may overcome the costs by providing an Internet channel for subscriptions or by promoting the rights issue to current shareholders. However, in an extreme case with shareholders composed of very passive investors, the firm may find it more effective to resort to other means of equity issuance, such as underwritten public offerings or private placements. Such reasoning adds to the line of research in corporate finance that argues that shareholder characteristics matter for the choice of equity selling mechanism (Eckbo and Norli, 2005), merger activity (Baker et al., 2007), and payout policy (Baker and Wurgler, 2004).

The remainder of this paper is organized as follows. Section 2 describes the data and Section 3 the relevant institutional details of rights issues in Finland. Section 4 presents the empirical results on investment mistakes in rights issues and Section 5 concludes.

Data

The data for this study come from several sources. Data on the details of all rights issues in Finland from 1995 to 2002 were collected from issue prospectuses and stock exchange releases. There are 18 rights issues altogether, of which six issues were underwritten, and in three offerings, shares were issued simultaneously for two classes of listed stock. In seven cases, shareholders of dual-share class companies were entitled to subscribe for the share class with fewer votes. Furthermore, there are six underwritten issues, of which one issue (Neptun Maritime) was underwritten by seven blockholders and another issue (Done) was underwritten jointly by the arranging bank and a single blockholder. Additional issue characteristics are given in Table I.

A particularly salient feature in the data is the substantial variation in issue size, as shown in Table I: the smallest issues in the sample had only a few hundred participants and net proceeds of less than €10 million, whereas the largest rights issue of a recently privatized telecommunications company had almost 140,000 domestic and registered foreigner participants with proceeds exceeding €1 billion. Because of the considerable issue size variability, we report both the volume weighted and equal weighted results, where appropriate.

Investor level data on rights issue subscriptions and trades are from the Finnish Central Securities Depository (FCSD), which maintains a centralized, official electronic register of all securities transactions for virtually all companies listed on the Helsinki Exchanges (HEX, now a part of OMX Group, Plc). The data comprise daily records for all stock market trades and other transactions, such as equity issue subscriptions, option exercises, and tender offers. Depending on the year, the FCSD data cover 97–100% of the total market capitalization, and thus representativeness is not an issue. The FCSD data run from January 1, 1995 through November 28, 2002, a period that includes both bull and bear markets. More detailed information on the data can be found in Grinblatt and Keloharju (2000).

All transactions in the FCSD data are tagged with a unique investor identification code enabling the computation of portfolio value and composition for each domestic investor in the entire market on every day. The data also contain records of subscription rights. We identify allocations, trades, subscriptions, and removals of unexercised subscription rights from the data to build a complete dataset on investors exercising, trading, or ignoring allocated rights.

In addition, the data include detailed information on the institutional status of every single investor. By using the institutional status information, we group the investors into the following six investor categories: nonfinancial corporations, financial corporations, mutual funds, nonprofit organizations, households, and foreigners. Although this grouping is basically consistent with Grinblatt and Keloharju

Table I. List of rights issues

This table lists characteristics of 18 rights issues in the sample. Three issues included two share classes. Rights issues are classified either as *symmetric* (right to subscribe shares of the same class) or *asymmetric* (shareholders of both classes have a right to subscribe shares with fewer votes). Rights issues are either *uninsured* (underwriter sells shares on a best efforts basis) or *underwritten* (underwriter and/or blockholders have committed to buy all/portion of unsubscribed shares). *Standby arrangement* is an arrangement in which shares unsubscribed in the initial subscription are either subscribed by investors chosen by the board of directors, or on a pro rata basis determined by the volume of initial subscriptions. *Subscription price discount* is calculated as the percentage difference between the subscription price and the cum-rights market price of the share. *Value offered* is the number of shares offered multiplied by the subscription price and *value realized* is the value of shares eventually subscribed. *Number of participants* is the number of domestic investors and registered foreigners who were initially allocated rights. *Subscription period* refers to the period when rightsholders are entitled to subscribe for the shares.

Company Name	General issue characteristics						Subscription period		
	Asymmetric offering?	Underwritten?	Standby arrangement	Value offered, € million	Value realized, € million	Number of participants	Subscription price discount	Begins	Ends
Ålandsbanken B	Yes	No	Yes	4.04	4.04	7,370	-92%	3/27/1995	4/28/1995
Finvest B	Yes	Yes	Yes	11.34	1.01	3,871	0%	4/10/1995	5/10/1995
Ålandsbanken B	Yes	No	No	4.04	4.04	7,835	-70%	4/1/1996	5/3/1996
Efore	No	No	Yes	5.49	5.01	251	-82%	4/1/1996	4/30/1996
Ilkka II	Yes	No	Yes	4.57	4.57	4,741	-66%	5/13/1996	6/14/1996
Raisio Yhtymä V	No	No	Yes	24.12	24.12	12,079	-74%	6/10/1996	7/10/1996
Raisio Yhtymä K	No	No	Yes	12.50	12.50	10,581	a)	6/10/1996	7/10/1996
Atria A	No	No	Yes	28.95	28.74	6,773	b)	5/14/1997	6/16/1997
Stockmann B	Yes	No	No	92.62	92.45	11,265	-84%	5/14/1998	6/12/1998
Neptun Maritime A	Yes	Yes	Yes	88.06	82.91	3,604	-40%	10/29/1998	11/12/1998
Instrumentarium B	Yes	No	No	93.09	92.30	9,162	-32%	12/4/1998	12/18/1998
Ålandsbanken A	No	No	No	5.81	5.78	6,321	-66%	4/6/1999	4/30/1999
Ålandsbanken B	No	No	No	5.13	5.11	8,129	-65%	4/6/1999	4/30/1999
Chips A	No	No	No	6.05	6.05	2,471	b)	5/7/1999	5/31/1999
Chips B	No	No	No	7.48	7.47	989	-96%	5/7/1999	5/31/1999
SSK Suomen Säästäjien Kiinteistöt	No	No	No	2.37	2.16	277	-79%	3/21/2000	4/4/2000
Menire	No	Yes	Yes	15.83	15.82	2,698	-37%	6/7/2000	6/17/2000
Sonera	No	Yes	Yes	1003.77	1003.77	137,934	-56%	11/15/2001	11/28/2001
Technopolis	No	No	Yes	6.86	6.86	2,467	-29%	2/28/2002	3/18/2002
Dome Solutions	No	Yes	Yes	3.96	2.44	1,835	-16%	5/21/2002	6/4/2002
Evon Rifa	No	Yes	Yes	6.07	4.29	5,370	-36%	6/19/2002	7/2/2002
All offers, average				68.20	67.21	11,715	-57%		
All offers, median				7.17	6.46	5,055	-65%		

Notes: a) Share price data unavailable. b) The A-share of Atria was not listed prior to the rights offering.

(2001a), it treats mutual funds as a separate category and pools the general government category with other nonprofit organizations.

The aggregate group of foreigners, which consists primarily of large institutional investors, such as mutual and pension funds, accounts for 40–50% of the total trading volume in HEX. Foreign investors trading in the Finnish stock market have the option to register their stockholdings in their own name or via a domestic financial institution using a nominee account. It is thus impossible to perform an investor level analysis on foreign investors not registered under their own names. Their trades appear in the data under the nominee institution's investor identification number, but with a separate flag for a nominee account trade. In the subsequent investor level analyses, we use data from registered foreigners (who represent only a small fraction of all foreign investors), but we also include observations originating from foreigners registered under nominee accounts in the market level analyses.

Prospectus information and investor level data from FCSD are supplemented with daily stock price and volume data from HEX (number of shares traded, daily close, intraday low, and intraday high), and interest rate data (12-month Helsinki Interbank Offered Rate, HELIBOR, until the end of 1998; 12-month EURIBOR thereafter) from Thomson/Datastream.

Institutional Setting

OVERVIEW OF A RIGHTS ISSUE

The Finnish Companies Act states that the shareholders of an incorporated company have a right to a pre-emptive rights offering in which they can subscribe for shares according to their current ownership stake. Shareholders can waive this right in the shareholders' general meeting by a supermajority of two-thirds. Although raising equity capital through a rights issue has historically been the dominant equity issue method in Finland, during the past ten years, general cash offerings to the investor public at large have been more frequent.

In a rights issue, shareholders are given short-lived tradable warrants, commonly referred to as subscription rights, that are usually deep-in-the-money, as shown in Table I. The length of the subscription period varies from eight to twenty-three trading days, with a median of 18 days. An investor can also sell the rights in the open market. The open market trading period for rights is usually shorter than the subscription period; the sample median is 15 trading days. There is no lock-up period for selling shares subscribed in the rights issue.

Rights not used in the initial subscription are forfeited without compensation. Some brokers have a policy of selling the rights in the open market if a shareholder fails to give instructions to the broker by the end of the subscription period. This

was also the case in the issue of Sonera, a major company with a dual listing on the NYSE.³ The prospectus states that the rights agent of American Depositary Shares will automatically attempt to sell any rights if no instructions are given prior to the beginning of the last subscription day. Yet, it must be emphasized that no law or regulatory mechanism exists to protect ignorant shareholders who fail to exercise or sell their subscription rights.

COMPENSATING INTEREST AND STANDBY ARRANGEMENTS

Until the beginning of 1999, companies which raised equity capital through a rights issue paid compensating interest to investors who exercised their rights before a pre-specified date, hereinafter referred to as the last interest compensation day. Compensating interest, with annual rates varying from 4% to 8%, was paid to entice investors to exercise their rights early, so that the whole equity issue would not be jeopardized, should the market price of the underlying stock fall below the subscription price during the subscription period. From a shareholder's perspective, it may make sense to prematurely exercise rights before the last interest compensation day if the interest rate exceeds the shareholder's opportunity cost of capital. In the twelve issues which paid a compensating interest, the median length between the last interest compensation day and the last exercise day was 11 days.

From 1999 onwards, no issuing company paid compensating interest. Hence, in all issues in the latter half of our sample period, a shareholder would not benefit from exercising rights prior to the last subscription day. However, because of short maturity and substantial subscription price discount, the time value of a subscription right was low in all but one issue.⁴

Finnish rights issues often have arrangements for selling shares left unsubscribed in the initial subscription, i.e., standby agreements. The Finnish Companies Act does not explicitly state to whom the option to purchase unsubscribed shares should be given. In two issues, unsubscribed shares were allocated on a pro rata basis to shareholders with a signed subscription precommitment. In eleven issues, the shareholders' general meeting approved the motion to give the board of directors

³ It is impossible to accurately determine which shareholders have made an agreement with their broker to sell subscription rights by default, as this is confidential information between the broker and the shareholder. However, an anonymous broker, who acted as a market maker in Sonera's subscription rights, was able to identify from time-stamped HEX-transaction files block trades originating from shareholders who had not given instructions to the broker. These sales constituted up to 8.7% of the total rights sales volume for the broker in question. By using this estimate, the volume of sales by initial rightholders, and the fact, in Table 2, that 0.21% of shareholders left their rights unexercised, we estimate the proportion of investors who have a sell by default agreement to be 74%. Details of this calculation are available from the authors upon request.

⁴ The only issue with subscription price discount less than 15% was Finvest B. Subscription price discounts are reported along with other descriptive statistics in Table I.

the power to decide on allocating the unsubscribed shares. In two cases, the large shareholders had given an explicit commitment to purchase any unsubscribed shares after the initial subscription. Five issues did not have any standby arrangements. As there are various rules to deal with unsubscribed shares, and they typically concern either a small number of shareholders or a small fraction of shares, we choose not to study them in detail.

TAX CONSIDERATIONS

Domestic individuals, nonfinancial corporations, financial corporations, and most foreign investors must pay capital gains tax, while mutual funds and nonprofit institutions are tax-exempt at the investor level. The tax consequences of a rights issue are straightforward. No immediate tax comes due if an investor subscribes for shares in a rights issue, and capital gains fall due in the fiscal year in which the shares are eventually sold. The tax basis for computing capital gains is the subscription price. The Finnish tax law applies the FIFO-principle in determining the order of shares sold. Given the FIFO-principle and share price dilution due to subscription price discount, subscribing for shares in a rights issue postpones capital gains tax. For example, consider an investor who has bought 100 shares at €10 each, and the current market price of a share is €15. Also, assume that the company announces a rights issue in which for every old share owned one new share can be subscribed at €5. On the ex-rights day, the share price drops to €10. When the investor subsequently sells 100 shares at a market price of €10, no capital gains tax fall due because the current market price equals the purchase price for the first 100 shares sold.

In contrast, selling subscription rights in the open market triggers an immediate capital gain. A capital gains tax between 25% and 29% falls due for 70% (in 1995–1998) or 80% (in 1999–2002) of the proceeds, if the rights have been allocated to a shareholder.⁵ If subscription rights are purchased in the market, the capital gains tax basis is the purchase price. Given the different tax consequences of selling subscription rights and subscribing to shares in a rights issue, taxable investors do not have an incentive to sell subscription rights at their fair (or lower) value. If the investor has realized capital gains from the fiscal year or tax-loss carry forwards from the previous three years, she is at most indifferent between subscribing and selling rights at their intrinsic value.

⁵ Capital gains tax is due on 50% of the proceeds if, and only if, the shares have been held for more than ten years.

Empirical Results

We begin this section by analyzing the three decisions in a rights issue: timing of exercise, selling rights, and leaving rights unexercised. We document patterns in investor behavior around these decisions and calculate the costs that investor incur from investment mistakes. We also analyze how the decisions vary between different investor categories to shed light on how trading experience and financial literacy affect the tendency to leave money on the table.

In Table II, we report simple descriptive statistics of the rights issues in the sample. The table shows that the rights issues are on average almost fully subscribed. The equally weighted average initial subscription rate is 85% and the median initial subscription rate is 99%. The underwriter was left with unsold shares in three issues. Moreover, in three other issues that were not underwritten, more than 5% of shares remained unsold.⁶

Investor level descriptive statistics are reported in Table III. The average subscribing domestic individual investor has a portfolio with a market value of €54,000 and she does not trade during the preceding 255 trading days (about one year). The corresponding figures for institutional investors are €7.3 million and 671 trades.

EARLY EXERCISE OF SUBSCRIPTION RIGHTS

In the first analysis, we study how investors time their subscriptions. As a right is essentially an American call option, it is not optimal to exercise it early, unless the underlying stock pays a sufficiently large dividend. In our data, no early subscription is entitled to a dividend, so investors should not exercise their rights until maturity.⁷

Previous studies have found evidence on early exercise in the options market. Diz and Finucane (1993) document that in the S&P 100 index options market, over 20% of all exercises are early. The authors conclude that transaction costs, dividends, and the wild card feature of index options fail to explain at least 12.4% of the early exercises. With common stock call options, Finucane (1997) reports that 8% of early exercises are nonattributable to ex-dividend day or transaction costs. Engström (2002) also finds evidence on early exercise in the Swedish equity call

⁶ Table II also reports an interesting empirical detail related to the literature on the choice of seasoned equity flotation method. On average (median), initial shareholders sold 4.04% (2.34%) of their rights to other rightholders, and 7.35% (2.36%) to outside investors. Eckbo and Masulis (1992) observe only the trading volume of rights, and with a lack of better information, assume that all rights will be sold to outside investors. However, the results in Table II suggest that a sizeable fraction of the rights trading volume is attributable to trades among initial rightholders.

⁷ Dividends are paid once a year in Finland, and in all issues except one (Technopolis), the subscription period did not coincide with the ex-dividend day. In the issue of Technopolis, investors exercising rights before the ex-dividend day received new shares with no entitlement to a dividend from the previous fiscal year.

Table II. Descriptive statistics on rights issues

This table presents a descriptive analysis of 18 rights issues in the sample. The columns under *distribution of shares offered* list the number of shares offered and the percentage of shares subsequently subscribed, underwritten, and unsold. The columns under *distribution of rights traded* list the percentage of rights traded. The column *% of rights sold to non-rightholders* corresponds to the net percentage of rights sold by domestic shareholders and registered foreigners to investors who did not initially hold rights, and the *% of rights sold to other rightholders* the number of rights sold to other rightholders. The column *% of rights sold by nominee rightholders* corresponds to the net percentage (negative value corresponds to a net purchase) of rights sold by foreigners registered under nominee accounts.

Company name	Offered shares, million	Distribution of shares offered				Distribution of rights traded			
		% subscribed in initial subscription	% subscribed through over-allotment option	% underwritten	% unsold	% of rights sold to non-right-holders	% of rights sold to other right-holders	% of rights sold by nominee right-holders	
Ålandsbanken B 1995	2.40	100.00	0.00	0.00	0.00	0.52	1.66	33.28	
Finvest B	13.49	8.91	0.00	74.14	16.95	2.36	1.13	0.00	
Ålandsbanken B 1996	0.80	100.00	0.00	0.00	0.00	2.24	5.38	15.41	
Efore	0.82	91.33	0.00	0.00	8.67	9.33	2.34	3.82	
Ilkka II	0.54	95.35	4.65	0.00	0.00	7.90	6.62	0.00	
Raisio Yhtymä V	1.79	98.97	1.03	0.00	0.00	18.04	1.87	100.00	
Raisio Yhtymä K	0.93	97.44	2.56	0.00	0.00	6.50	5.56	-4.17	
Atria A	4.30	99.29	0.00	0.00	0.71	68.96	4.90	-52.18	
Stockmann B	7.34	99.82	0.00	0.00	0.18	8.55	12.95	13.73	
Neptun Maritime A	43.63	18.21	75.94	0.00	5.86	4.50	0.99	5.07	
Instrumentarium B	3.95	99.15	0.00	0.00	0.85	9.14	16.05	21.64	
Ålandsbanken A 1999	0.86	99.47	0.00	0.00	0.53	0.93	7.13	48.03	
Ålandsbanken B 1999	0.76	99.64	0.00	0.00	0.36	2.21	3.44	13.28	
Chips A	3.00	99.76	0.00	0.00	0.24	0.00	0.00	0.00	
Chips B	3.70	99.92	0.00	0.00	0.08	0.15	0.05	0.00	
SSK	14.10	91.10	0.00	0.00	8.90	3.34	1.39	0.00	
Menire	3.52	96.15	3.78	0.00	0.06	0.39	6.19	20.48	
Sonera	371.77	99.79	0.21	0.00	0.00	0.95	1.82	-12.37	
Technopolis	2.92	97.78	2.22	0.00	0.00	8.06	4.89	0.00	
Done Solutions	24.73	27.23	34.48	38.30	0.00	0.01	0.14	0.00	
Evox Rifa	86.69	63.82	6.91	29.27	0.00	0.04	0.38	0.00	
<i>All offers, average</i>	28.23	84.91	6.27	6.75	2.07	7.35	4.04	9.81	
<i>All offers, median</i>	3.70	98.97	0.00	0.00	0.08	2.36	2.34	0.00	

Table III. Descriptive statistics on investors who were allocated rights

This table presents descriptive statistics on the sample of investors who exercised rights in issues that did not pay compensating interest. *Portfolio value* is reported in thousands of euros. *Number of trades* corresponds to the total number of stock market trades during 255 trading days (≈ 1 year) preceding the last cum-rights date. Language dummies indicate the FCS registry language of the investor if it is other than Finnish. *Gift* is the fraction of currently owned shares of the issuing company which have been acquired as a gift, and *Bequest* the fraction of inherited shares. Foreigners include investors registered in their own name and exclude investors registered under nominee accounts because investor characteristics are not available for nominee accounts.

	Average	Median	Min	Max	Standard deviation	Skewness	Kurtosis
Panel A: Households, $N = 229,569$							
Continuous variables							
Portfolio value (€1000)	54.03	6.49	0.00	61,810.72	421.17	54.73	5,192.64
Number of trades	13.32	0.00	0.00	14,370.00	115.11	59.42	5,588.37
Age	48.09	50.00	0.00	93.00	17.72	-0.20	2.62
Dummy variables							
Swedish	0.18	0.00	0.00	1.00	0.39	1.64	3.68
Not Finnish or Swedish	0.00	0.00	0.00	1.00	0.02	46.29	2,143.51
Domiciled abroad	0.01	0.00	0.00	1.00	0.12	8.29	69.78
Female dummy	0.33	0.00	0.00	1.00	0.47	0.73	1.53
Gift	0.01	0.00	0.00	1.00	0.10	9.76	97.67
Bequest	0.01	0.00	0.00	1.00	0.09	10.75	116.47
Panel B: Institutions, $N = 13,260$							
Continuous variables							
Portfolio value (€1000)	7,382.30	28.12	0.00	5,030,921.00	90,922.62	32.08	1,435.53
Number of trades	671.58	4.00	0.00	1,482,257.00	15,033.54	77.08	7,220.40
Dummy variables							
Swedish	0.25	0.00	0.00	1.00	0.43	1.17	2.37
Not Finnish or Swedish	0.01	0.00	0.00	1.00	0.12	8.36	70.87
Domiciled abroad	0.12	0.00	0.00	1.00	0.33	2.27	6.17
Nonfinancial corporation	0.66	1.00	0.00	1.00	0.47	-0.67	1.45
Financial corporation	0.04	0.00	0.00	1.00	0.18	5.04	26.37
Mutual fund	0.01	0.00	0.00	1.00	0.08	11.75	139.07
Nonprofit institution	0.14	0.00	0.00	1.00	0.35	2.03	5.10
Foreigner	0.15	0.00	0.00	1.00	0.36	1.91	4.65

options market, but the proportion of early exercised calls is considerably lower, only 2% of all exercises. Potesman and Serbin (2003) report that investors threw away more than \$250,000 by exercising call options traded on the Chicago Board Options Exchange before maturity.

For every exercise in our data, we observe the settlement date instead of the actual exercise date. However, as every settlement must occur after the exercise, all settlements before the last possible exercise day represent unambiguously early exercise. In Figure 1, we plot the timing of all exercises in the twelve issues which

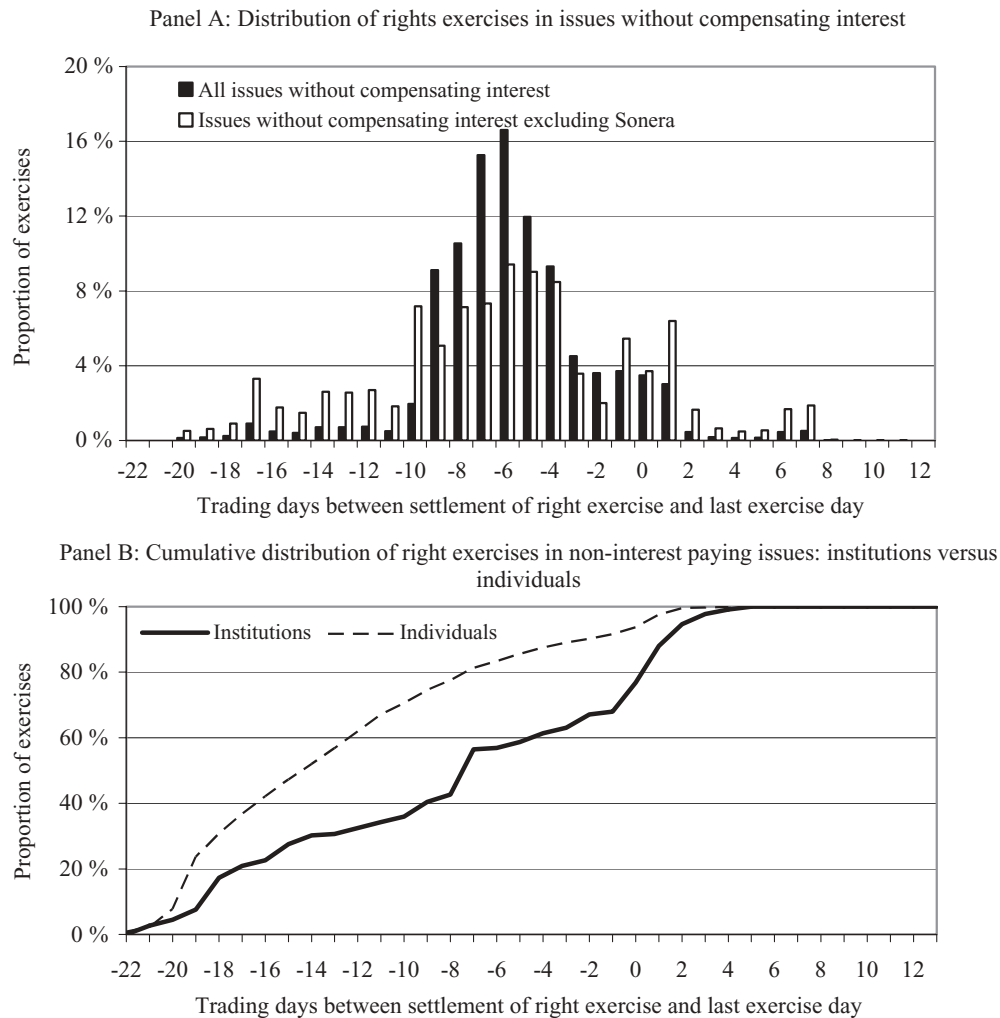


Figure 1. Distributions of rights exercises. Panel A plots the distribution of settlement dates for subscribed shares in the twelve issues without compensating interest. The distribution of settlement dates is plotted separately for all observations, and for all observations without the single largest issue, Sonera. The number in the x -axis indicates the number of days between the settlement of shares (the actual exercise date for rights is unknown) and the last possible exercise day. There are 167,199 observations in the sample. Panel B plots the volume weighted distribution of right exercise settlement dates in rights issues which paid no compensating interest for an early exercise.

paid no compensating interest, and thus provided no incentive for an early exercise. To make sure that our conclusions on exercise timing are not affected by the single largest issue, Sonera, the results are plotted separately with and without Sonera.

The results in Figure 1, Panel A, show that a considerable number of exercises occur before maturity. In fact, exercises before the last subscription day account for 77% of the observations in the full sample (and for 96% in the issue of Sonera). Hence, the vast majority of investors in the sample voluntarily forewent their option to wait and deliver the funds on the last possible day. These results suggest that the proportion of early exercises is much larger in rights issues than in the regular options market, as reported in Diz and Finucane (1993), Finucane (1997), Engström (2002), and Poteshman and Serbin (2003). There are two likely reasons for this. First, the rights are very short-lived compared to the options studied in other papers. Second, the average rightholder is likely to be much less sophisticated than an investor active in the option market.

We also investigate the distribution of subscription right settlement dates in six issues that paid compensating interest. The key finding of this unreported analysis is that there are a substantial number of early exercises that are not entitled to compensating interest, but which are not at maturity either. Altogether, at least 17.8% of the exercises neither capture the compensating interest, nor are at maturity. More detailed results of this analysis are available from the authors upon request.

Next, we investigate timing of exercises by investor categories. Not surprisingly, institutional investors tend to exercise their subscription rights closer to maturity. This result is shown in Figure 1, Panel B, where we plot the issue volume weighted cumulative percentage of right exercise settlements relative to the last subscription day separately for households and institutions.⁸ Despite having a smaller fraction of early exercises than households, at least 75.8% of the institutional investors exercised rights prematurely in the twelve issues without compensating interest. Table IV further shows that among the institutions, mutual funds and financial corporations are the least likely to exercise before maturity.

Table IV also shows that investors lost €0.15 million by exercising rights early.⁹ At the investor level, the median household suffers a trivial loss of only €0.13. Even in the extreme case, the loss incurred by early exercise was €335. These numbers are low, which is not surprising given the low time value of money for delivering

⁸ We also graph the equally weighted proportion of early exercises by computing the cumulative percentage of exercises separately for each issue and then taking the average. The results are similar and available from the authors upon request.

⁹ The costs of early exercise can be broken down into two components. First, an investor loses the time value of money for delivering the exercise funds too early. Second, an investor also loses the time value of the option to wait and make sure that the market price of the underlying stock does not fall below the subscription price before the maturity of the subscription right. The lost time value of the latter component is negligible due to the short life of the subscription right and substantial subscription price discount to the current market price. By using the Black and Scholes (1973) option pricing formula, we estimate the value of the latter component to be approximately €12,400 for all exercises in the data (€6,800 for households and €5,600 for institutions). Further details of this calculation are available from the authors upon request.

Table IV. Wealth loss resulting from early exercises

This table reports the time value of money lost by shareholders exercising their rights before the last subscription day. The sample covers all 18 Finnish rights issues from 1995 to 2002. In an issue without compensating interest, an exercise is classified as early if the settlement occurs strictly before the last subscription day. In an issue with compensating interest, the settlement of shares must occur between maturity and the second trading day following the last interest compensation day; the settlement lag is very seldom more than two trading days. The wealth loss for early exercise is computed as Σ Volume of shares subscribed $\times$ Subscription price $\times (1 - e^{-rt})$, where r = the 12-month risk-free interest rate (HELIBOR/EURIBOR) and t = the fraction of the year between the subscription settlement day and the last exercise day. *Proportion of early exercises*, *volume weighted* is calculated from the full sample, while *proportion of early exercises*, *equal weighted* is computed by first calculating the fraction of early exercises in every issue and then taking the average of all issues.

	Total wealth loss for early exercise, €	N, early exercises	N, all observations	Proportion of early exercises, volume weighted	Proportion of early exercises, equal weighted	Investor level wealth loss, €			
						Average	Median	Min	Max
Nonfinancial firm	15,416	5,250	7,340	0.72	0.48	2.94	0.29	0.00	1,210
Financial corporation	7,738	234	587	0.40	0.35	33.07	0.82	0.00	924
Mutual fund	1,279	33	125	0.26	0.19	38.74	9.71	0.04	295
Nonprofit	15,076	959	1,844	0.52	0.49	15.72	1.32	0.00	2,099
Household	53,375	150,461	192,876	0.78	0.54	0.35	0.13	0.00	335
Foreigner	55,779	1,967	2,811	0.70	0.57	28.36	0.28	0.00	3,958
All investors	148,661	158,904	205,583	0.77	0.54	0.94	0.13	0.00	3,958

exercise funds too early. Early exercises may thus be explained by the fact that the time value lost in an early exercise could have been smaller than the opportunity cost of logging in twice to the Internet or making an additional phone call to the stockbroker during the offering period.

SELLING RIGHTS BELOW INTRINSIC VALUE

Investors who do not want to subscribe for shares in a rights issue can sell their rights. However, they should not accept a price below the intrinsic value of the rights because an alternative strategy of subscribing and selling the shares could yield higher proceeds.¹⁰ Existing results on trading in rights and securities similar to rights suggest that rights are usually traded below their intrinsic value. Hietala (1994) documents several violations of stochastic dominance boundaries in the Finnish rights market. Similar evidence on the inefficiency of the subscription rights market is reported for Singapore in Poitras (2002). Furthermore, Ikäheimo et al. (2006) document that Finnish employee stock options, in essence warrants with much longer maturity, trade at significant discounts (Finnish employee stock options are tradable unlike in many other countries).

We start by testing whether the subscription rights are traded on the open market at fair values. For this purpose, it is necessary to define a benchmark valuation method. As described in Section 3.1., Finnish subscription rights are short-lived, deep-in-the-money warrants. Because of these characteristics, we value rights simply by their intrinsic value. Throughout this paper, the fair value of a right is calculated as

$$V = \text{MAX}(0, S - Xe^{-rt})N, \quad (1)$$

where V is the value of a single right, S the daily closing price of the underlying stock, X the subscription price of the right, N the number of shares that can be subscribed with one right, r the interest rate (12-month HELIBOR or EURIBOR), and t the fraction of the year between the transaction day and the last possible day for exercise.¹¹ For the analysis on subscription right transaction prices, we exclude the following observations with no transaction price data available:

¹⁰ An investor facing binding borrowing constraints and who ends up owning subscription rights on the ex-rights can sell the old shares and subscribe for new shares if the market price for subscription rights is below the intrinsic value. In the issue of SSK Suomen Säästäjien Kiinteistöt and Neptun Maritime, selling the old shares yielded proceeds lower than the amount required to subscribe for new shares. Trades in the subscription rights of these two issues contribute to less than 7.5% of the total absolute wealth transfer reported in Table VII.

¹¹ Equation 1 is consistent with the argument in Galai and Schneller (1978) that there is no need for an explicit adjustment for dilution to value a warrant. In an efficient market, the value of the underlying stock should always reflect the dilution caused by the outstanding warrants—an investor can, at any time, exercise the warrants and sell the shares at the current market price S .

1. Transactions in HEX not executed through the HETI trading system (e.g., block trades negotiated privately between buyer and seller)
2. Transactions outside HEX with American Depositary Shares

Table V compares subscription right transaction prices with their intrinsic value given by Equation 1. The deviations in Table V are computed by dividing the difference between the transaction price and intrinsic value by the intrinsic value: negative value corresponds to a transaction below the intrinsic value. Deviations can be interpreted as the existence of dominated securities because selling a right for a price less than the intrinsic value is dominated by a strategy of exercising the right and selling the subscribed shares.¹²

What does Table V tell us? First, it is obvious that shareholders who are allocated rights tend to sell them below their intrinsic value: for all but one share class in one issue (Chips B), the average transaction price is lower than the intrinsic value. As an extreme example, in three issues the volume weighted price discount is more than 50%.

Second, the largest rights issue in our sample, Sonera, has the smallest transaction price deviations from the intrinsic value: both the equally and volume weighted average and the median price deviation are only 1%. This result is probably explained by limits of arbitrage. In the case of Sonera, arbitrageurs were able to purchase subscription rights and simultaneously establish a short position through the regular options market at EUREX. For other shares, regular options did not exist and this strategy was thus not possible. Short selling was also very difficult for other shares than Sonera.¹³

Next, we study which investors profit and lose from trading. For this purpose, we define a wealth transfer as the difference between the transaction price and the intrinsic value of a right given by Equation 1 multiplied by the transaction volume. A transaction at a price which is lower (higher) than the intrinsic value incurs a wealth gain (loss) to the buyer and, correspondingly, a wealth loss (gain) to the seller.

¹² Taxes enter the decision by increasing the incentive of a taxable investor to exercise rights instead of selling them, as discussed in Section 3.3. Given this incentive, an investor subject to taxes should not sell rights for a price equal to, or lower than, the intrinsic value.

¹³ An institutional framework for short-selling has existed in HEX with stock loans since the end of 1995. However, short-selling is costly, and the securities lending market for all but the most traded shares is rather illiquid. The required margin for selling short is 125% of the underlying asset's current market value. In addition, a short seller must pay an annual premium to the lender (typically 1–3% of the underlying asset's market value), and additional transaction costs to HEX, which effectively has a monopoly in securities lending. Given the high costs and the illiquid securities lending market for all but the most traded shares, it is unlikely that arbitrageurs used stock loans to sell short stocks other than that of Sonera.

Table V. Subscription right transaction price deviations from the intrinsic value

This table reports results for a comparison of actual open market transaction prices with the intrinsic value of a right. The intrinsic value of a subscription right is calculated as $\text{MAX}(0, S - Xe^{-rt})N$, and the deviation as (Transaction price – Intrinsic value) / Intrinsic value, where S = the daily close price of the underlying stock, X = the subscription price of the right, r = the 12-month HELIBOR/EURIBOR, t = the maturity of the right (fraction of a year), and N = the number of shares that can be subscribed with one right. The sample covers all subscription right transactions on all trading days in which the trading volume of the underlying stock was nonzero. The transaction price data are unavailable for subscription rights attached to American Depositary Shares and other transactions not executed through the HETI trading system. The six leftmost columns report results for the distribution of price deviations.

Descriptive statistics on transaction price deviations from intrinsic value							
Rights issue	Mean	Median	Volume weighted mean	Min	Max	St.dev.	N
Ålandsbanken B 1995	−0.06	−0.06	−0.08	−0.13	−0.01	0.03	477
Finvest B	a)						53
Ålandsbanken B 1996	−0.05	−0.05	−0.04	−0.08	−0.01	0.02	1,134
Efore	−0.04	−0.04	−0.06	−0.29	0.03	0.07	65
Ilkka 2	−0.03	−0.02	−0.03	−0.11	0.03	0.04	167
Raisio Yhtymä K	−0.05	−0.04	−0.04	−0.13	0.01	0.03	289
Raisio Yhtymä V	−0.03	−0.03	−0.04	−0.13	0.03	0.03	584
Atria A	−0.16	−0.16	−0.16	−0.24	−0.07	0.04	77
Stockmann B	−0.09	−0.07	−0.09	−0.31	0.01	0.05	1,356
Neptun Maritime A	−0.66	−0.41	−0.66	−0.86	0.08	0.23	484
Instrumentarium B	−0.15	−0.17	−0.16	−0.39	0.29	0.11	2,475
Ålandsbanken A 1999	−0.08	−0.03	−0.12	−0.26	0.01	0.06	108
Ålandsbanken B 1999	−0.09	−0.11	−0.10	−0.20	0.02	0.06	407
Chips A	−0.09	−0.09	−0.11	−0.14	−0.04	0.04	29
Chips B	0.03	0.02	0.02	−0.02	0.08	0.02	22
SSK	−0.85	−0.87	−0.86	−0.94	−0.29	0.09	82
Menire	−0.13	−0.15	−0.10	−0.35	0.72	0.17	887
Sonera	−0.01	−0.01	−0.01	−0.23	0.17	0.07	22,105
Technopolis	−0.63	−0.66	−0.64	−0.78	−0.22	0.10	495
Done Solutions	−0.01	−0.01	−0.01	−0.01	−0.01	0.00	1
Evox Rifa	−0.01	−0.01	−0.01	−0.01	−0.01	0.00	13
N, full sample							31,330
Average of all issues	−0.16	−0.15	−0.17	−0.28	0.04	0.06	
Median of all issues	−0.07	−0.06	−0.09	−0.22	0.01	0.05	
Pooled sample value	−0.07	−0.03	−0.04	−0.94	0.72	0.14	

a) Deviations from theoretical value cannot be calculated because the intrinsic value of right was zero on all trading days.

We compute the cumulative wealth transfer separately by using the daily close, high, and low prices of the underlying stock.¹⁴ This ensures that intraday price variations do not affect any conclusions made from using closing prices. Calculating the intrinsic value of a right by using the intraday low price of the underlying stock gives the lower boundary of wealth loss to selling shareholders. Correspondingly, using the intraday high gives the upper boundary of wealth loss to sellers.

Figure 2 plots the cumulative wealth gains and losses for the six investor categories. The magnitude of the wealth transfer for those initial rightholders who sold their rights is graphed in Panel A. Correspondingly, Panel B graphs wealth transfer for all investors in the category. If the members of a particular investor category buy rights below fair value and sell above fair value, this will show up as a net gain in Panel B, although initial rightholders of the investor category would suffer wealth losses on aggregate.

Panel A in Figure 2 demonstrates the net wealth loss to initial shareholders who sold their rights in the open market. As would be expected on the basis of the results in Table V, shareholders selling their rights are adversely affected by the low transaction prices: the aggregate wealth loss is at least €0.5 million for all investor categories except for mutual funds. When we use the daily closing price to calculate the intrinsic value of a right, the total combined pre-tax wealth loss to all selling shareholders is €6.5 million, or 0.46% of the total issue proceeds. Furthermore, the €6.5 million estimate is conservative, since taxes are ignored: those investors who sell rights are taxed for almost the full proceeds, whereas exercising rights and selling the subscribed shares generally postpones capital gains tax.¹⁵

As shown in Panel B, institutional investors take advantage of investors who sell their rights at too low prices. Nonfinancial corporations, mutual funds, brokers, investment banks, and commercial banks (the last three investor groups are in the financial corporation category) take advantage of the depressed prices by buying rights in the open market, while household investors, nonprofit organizations, and foreigners lose money. Financial institutions acquire the greatest profits from trading rights. The selling financial institutions lost €1.5 million altogether, while the aggregate wealth transfer to all financial institutions was €2 million.

What is distinct in our results is that foreigners, who have been previously shown (Grinblatt and Keloharju, 2000) to outperform households in the Finnish stock market, sold their rights at excessively low prices. This result may obtain because we have a different set of foreigners due to two restrictions. First, we include only foreigners registered in their own name. Second, we consider all foreigners, not only

¹⁴ We make one exception: Sonera. During the subscription right trading period, there was a difference of at least 8% between the intraday low and high price on every trading day. When computing wealth gains and losses for Sonera, we replace intraday high and low prices with the daily closing price.

¹⁵ See details of investor level capital gains taxation in Section 3.3.

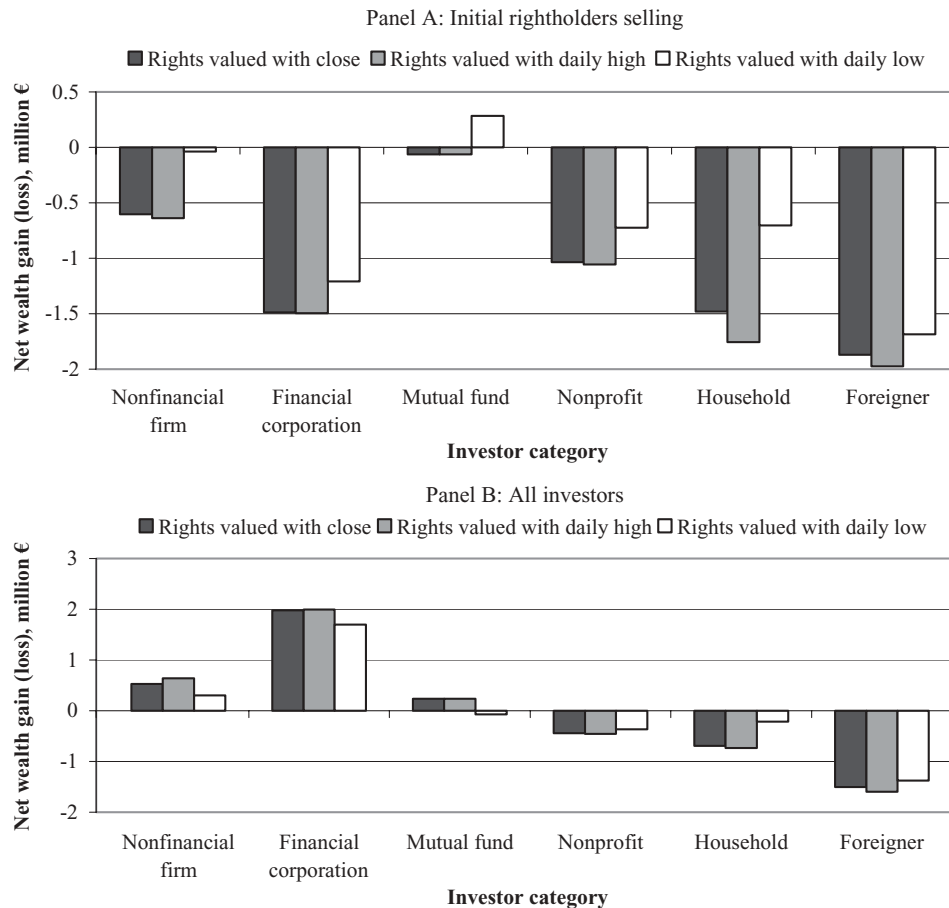


Figure 2. Net wealth transfer resulting from trades of subscription rights by investor category. The graph in Panel A shows the net wealth transfer to initial rightholders subsequently selling all or some of their rights in the open market. Panel B shows the net wealth gain (loss) for the investor category by including sales and purchases of initial rightholders and investors who did not initially hold rights. Wealth transfer for a trade in subscription rights is calculated as $(P - \text{MAX}(0, (S - Xe^{-rt}) \times N)) \times \text{Volume}$, where P = the transaction price, S = the current price of the underlying stock, X = the subscription price of the right, r = the 12-month HELIBOR/EURIBOR, t = the maturity of the right, N = the number of shares that can be subscribed with one right, and Volume the number of rights traded. The sample includes subscription right transactions for which subscription right price data are available, and the underlying stock had nonzero volume on the transaction day. In the Sonera rights issue, intraday high and low prices of the underlying stock are replaced with daily closing prices. There are 60,364 trades in Panel A and 93,195 trades in Panel B. Foreigners registered under nominee accounts are not included in the analysis.

Table VI. Wealth transfer resulting from trading in subscription rights

This table reports descriptive statistics on wealth gains and losses of investors trading rights in the open market. The statistics are based on the investor level distribution of total wealth gains and losses computed separately over all initial shareholders in all 18 issues, all trades in the issue of Sonera (Panel B), and all trades in the remaining 17 issues (Panel C). *Number of investors* corresponds to the number of investors in the category who traded subscription rights at least once during the sample period. *% of losers* is the fraction of investors whose cumulative result from trading subscription rights is negative. To compute wealth gain (and correspondingly wealth loss) from a trade, subscription rights are valued at their intrinsic value given by Equation 1. Min, max, average, and median of *wealth transfer* are the respective figures from the distribution of wealth gains and losses. The sample includes investors who were initially allocated rights and outside investors. Foreigners registered under nominee accounts are not included in the analysis.

				Investor level wealth transfer, €			
	Total wealth transfer, €	Number of investors	% of losers	Average	Median	Min	Max
Panel A: Initial shareholders, all 18 issues							
Nonfinancial firm	−602,733	1,339	74.6	−450	−11	−67,808	20,691
Financial corporation	−1,488,188	79	81.0	−18,838	−142	−1,048,785	46,129
Mutual fund	−62,573	22	68.2	−2,844	−101	−26,110	16,664
Nonprofit	−1,036,273	380	86.1	−2,727	−75	−303,213	7,407
Household	−1,481,496	30,662	73.1	−48	−5	−47,334	5,604
Foreigner	−1,871,589	424	68.9	−4,414	−11	−1,434,732	97,688
Panel B: All shareholders, rights issue of Sonera							
Nonfinancial firm	197,249	789	60.8	250	−4	−67,808	167,255
Financial corporation	823,011	86	38.4	9,570	186	−8,088	125,437
Mutual fund	233,882	24	16.7	9,745	4,526	−26,110	48,798
Nonprofit	−467,382	356	72.8	−1,313	−44	−303,213	133,746
Household	−512,441	13,480	75.6	−38	−7	−47,757	25,034
Foreigner	−177	222	61.7	−1	−9	−2,194	4,831
Panel C: All shareholders, remaining 17 issues							
Nonfinancial firm	529,478	1,625	61.3	326	−4	−67,808	188,589
Financial corporation	1,979,858	102	49.0	19,410	1	−85,858	595,005
Mutual fund	237,374	27	33.3	8,792	5,125	−26,110	48,798
Nonprofit	−439,214	433	70.9	−1,014	−30	−303,213	133,746
Household	−691,282	33,662	67.8	−21	−4	−47,757	25,034
Foreigner	−4,625	437	62.0	−11	−5	−4,913	4,831

those that invest in the 16 largest stocks, as in Grinblatt and Keloharju (2000). These restrictions result in a sample of foreigners who probably have smaller portfolios and lower trading activity.

Further results in Table VI indicate that there are both winners (investors with positive cumulative net result from trading) and losers (investors with negative cumulative net result from trading) in the population of financial institutions. In

the rights issue of Sonera, 17% of the mutual funds and 38% of the other financial institutions ended up in the red by trading subscription rights, whereas the corresponding percentages are 33% and 49% in the remaining 17 issues.

Costs reported in Table VI for the average household investor are much higher than for the early exercise, although they still are quite low. The wealth loss for the average household who was initially allocated rights equals €48. The observations are heavily centered on the mean, as only 10% of the costs are higher than €100.¹⁶

LEAVING RIGHTS UNEXERCISED OR UNSOLD

Perhaps the most damaging investment mistake is failing to exercise or sell the rights. In this section, we investigate how costly this behavior is. To assess the costs, we compute wealth losses under two alternative strategies.

Under the first strategy, we assume that instead of forfeiting rights without compensation, an investor will sell the subscription rights on their last trading day at the daily volume weighted market price. We use five conditions, which must hold simultaneously, to make sure that forfeitures are not due to direct transaction costs, low value of the rights, or low liquidity. These conditions ensure that we do not classify a forfeiture of rights as an investment mistake in situations where it makes sense to leave rights unused, i.e., when direct transaction costs are very high or market liquidity is very low. The five conditions are:

1. *Transaction costs.* The value of lapsed rights must be at least €27, the largest minimum brokerage commission for a trade.
2. *Minuscule value of rights.* The value of lapsed rights must be at least 0.1% of the investor's portfolio value. This condition assures that the rights are not of extremely low importance to an investor.¹⁷

¹⁶ Investors may sell rights at low prices to avoid ending up with an odd lot of shares after the rights offering. Odd lots usually correspond to very small trade sizes, and thus involve high proportional brokerage fees. An investor also faces indirect costs from delayed execution, as trades involving odd lots are usually executed with a considerable lag. We analyze this issue by calculating the proportion of investors who trade in the market for rights, separately for cases in which an investor ends up with an odd lot or an even lot. If odd lots affect the propensity to trade rights, investors who end up with them should be more likely to sell rights. The untabulated results suggest that individual investors who end up with an odd lot tend to trade less (15%) in the market for rights than investors with even lots (17%). This pattern is similar for institutions with 21% and 22%, respectively. The wrong directionality and small differences in the proportions suggest that odd lots are not a major factor affecting the propensity to trade in the market for rights.

¹⁷ Although the transactions for forfeited subscription rights of unregistered foreigners are disaggregated, the identities of foreign nominee account investors are unknown. For this reason, it is impossible to calculate the portfolio values of unregistered foreigners. We therefore ignore condition 2 for nominee account investors.

3. *Liquidity of the underlying stock.* Cumulative volume for the underlying stock (volume $\times$ close price) on the last subscription day plus the following five trading days must be strictly greater than the value of shares that can be subscribed with the rights. This condition ensures that the market for the underlying stock must be liquid enough to absorb the subscribed shares and that the market price for the underlying share is accurate to value the rights.
4. *Audit trail of investor's trading records.* The investors' FCSD registry entries must have an unambiguous audit trail. This condition is not satisfied for less than 0.1% of investors with technical entries, such as corrections and combinations of book-entry accounts.
5. *Liquidity of the market for rights.* There must be at least ten open market transactions in subscription rights on their last trading day. This condition for sufficient liquidity is consistent with Poteshman and Serbin (2003).

Under the second strategy, we assume that the investor would have exercised the rights and sold the shares. We augment condition 1 by using the intrinsic value given by Equation (1) to value subscription rights rather than their market value. Conditions 2 to 4 are as in the first strategy. Because the second strategy involves selling the underlying stock, we also add a condition for the liquidity of the shares, defined as

6. *Liquidity of the underlying stock.* The cumulative volume of the underlying stock (volume $\times$ close price) on the last subscription day, plus the following five trading days, must be at least €0.1 million.

In Table VII, we report the total amount of wealth lost by investors who forfeited their rights without compensation. The results indicate that a large number of investors allowed their subscription rights to lapse, thereby suffering wealth losses that totaled about €3 million. At the investor category level, a large number of households forfeit their rights without compensation. In contrast, financial institutions are the least likely to leave rights unexercised. Mutual funds have zero observations classified as an investment mistake, whereas financial corporations forfeited rights on only two occasions.

Figure 3, Panel A depicts the relative frequency of unexercised rights for the six investor categories. The results are in line with the findings for wealth losses reported in Table VII: financial institutions have a very low proportion of unexercised rights (less than 0.5%), whereas for all other investor categories, the proportion is more than 1%.

There is great variation in the value of lapsed rights at the investor level. For the median shareholders, the value of unexercised rights is rather small. The median loss for households is between €118 and €135, and well below €1,000 for institutional

Table VII. Wealth loss resulting from unexercised rights

This table documents conservative estimates for the amount of wealth loss suffered by investors who fail to exercise or sell their subscription rights. Panel A assumes a strategy of selling the rights in the open market on the last trading day for subscription rights. Panel B describes the wealth loss assuming a strategy of exercising rights on the last subscription day and selling the subscribed shares in the open market. For an observation to qualify as an investment mistake, the following conditions must be met. First, the value of unexercised rights must be more than €27 or 0.1% of the investor's portfolio value, whichever is higher. In Panel A, rights are valued at transaction volume weighted price on the last trading day of the subscription rights. In Panel B, rights are valued at $\text{MAX}(0, S - X) \times N$, where S = the current price of underlying stock, X = the subscription price of the right, and N = the number of shares that can be subscribed with one right. Second, the cumulative trading volume during the last subscription day and the following five trading days must be higher than the value of shares that can be subscribed with the rights. Third, in Panel A, there must be at least ten trades in subscription rights on their last trading day. Fourth, in Panel B, the cumulative trading volume of the underlying stock must be at least €0.1 million during a period which spans from the last trading day for the subscription rights until the fifth subsequent trading day. Fifth, the investors' FCSD entries must have an unambiguous audit trail.

	Total wealth loss, €	Number of investors	Investor level wealth loss, €			
			Average	Median	Min	Max
Panel A: Wealth loss assuming sold rights						
Nonfinancial firm	62,191	106	587	182	28	5,643
Financial corporation	810	2	405	405	135	675
Mutual fund	0	0	0	0	0	0
Nonprofit	118,216	22	5,373	500	38	84,632
Household	999,525	2,616	382	135	28	60,049
Foreigner	2,186,344	138	15,843	600	31	706,066
Total	3,367,086					
Panel B: Wealth loss assuming exercised rights						
Nonfinancial firm	163,056	98	1,664	160	31	111,303
Financial corporation	1,125	2	562	562	191	933
Mutual fund	0	0	0	0	0	0
Nonprofit	48,686	19	2,562	222	29	34,283
Household	811,856	2,534	320	118	27	24,325
Foreigner	2,199,068	136	16,170	628	30	687,233
Total	3,223,790					

investors. Such losses can be attributed to opportunity costs that deter investors from using the rights.

However, in many cases, lapsed rights are too valuable to be reconciled with reasonable costs. In the extreme case, the value of the lapsed rights is as high as €706,000. For households, the highest estimate for wealth loss is €60,000, and in 162 cases, the household wealth loss exceeds €1,000. For these investors, it appears

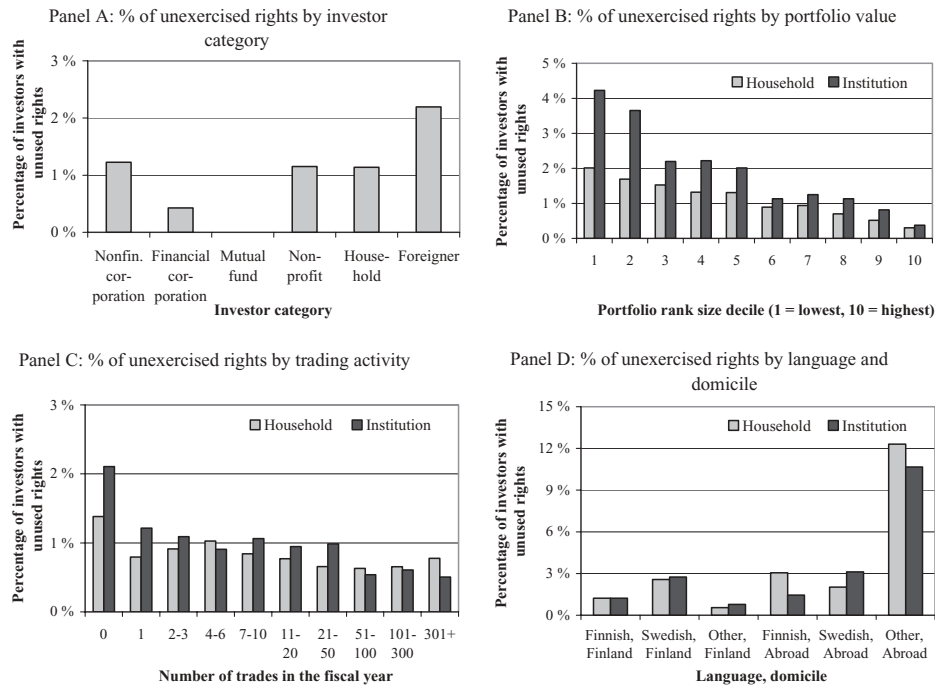


Figure 3. Univariate distributions for unexercised rights. The graphs plot the relation between investor characteristics and the percentage of investors failing to exercise or sell rights. When an investor fails to exercise or sell rights, the observation is classified as an investment mistake if the following four conditions are met. First, the value of unexercised rights is at least €27 (right valued as $(S - X) \times N$, where S = the last exercise day closing price of the underlying stock, X = the subscription price, and N = the number of shares that can be subscribed with one right). Second, the value of unexercised rights must be at least 0.1% of the investor's portfolio value. Third, the cumulative volume of the underlying stock during the last exercise day, plus the following five trading days, must be at least €0.1 million and higher than the value of exercisable shares. Fourth, the investor's FCSD registry entries for subscription rights must have an unambiguous audit trail. Panel A plots the percentage of unexercised rights by investor category, Panel B by portfolio value, Panel C by trading activity, and Panel D by investors' language and domicile. In Panel D, there are three language groups: Finnish, Swedish, and other (any language other than either of the two official languages, Finnish or Swedish). These three language groups are subsequently divided into investors living in Finland and those living abroad. The number of observations in each panel is 243,681. Foreigners registered under nominee accounts are not included in the analysis.

implausible that they forfeit the rights because of reasonable opportunity costs. Either investors have been hit by personal or family crisis that make following the market very costly or they are completely ignorant of their holdings. The large cross-sectional variation begs the question of what factors explain the tendency to leave rights unused.

DETERMINANTS OF LEAVING MONEY ON THE TABLE

In this section, we analyze which factors contribute to leaving money on the table. Our base line analysis concentrates on the determinants of leaving rights unexercised, but we also report results for early exercise.

Univariate Results

Explanations for leaving money on the table include sophistication and direct costs. Some investors may be unaware of owning rights due to, for example, inactivity in the market. Such ignorance may lead to forfeiture of the rights. Alternatively, investors may know that they have been allocated rights, but they lack the financial literacy (or the ability to seek advice) to sell or exercise the rights.

Both ignorance and lack of financial literacy are likely to decrease with more trading activity and higher stakes in the market. Earlier studies find that investors with higher income and net worth tend to be savvier in their investment decisions (e.g., Grinblatt and Keloharju, 2000; Agnew, 2006; Calvet et al., 2008; Goetzmann and Kumar, 2008). In addition, List (2003) and Feng and Seasholes (2005) find that market experience attenuates behavioral biases.

Figure 3 reports the percentage of unexercised rights by portfolio value decile by pooling all domestic investors, except for households, into a single group labeled institutions. Perhaps not surprisingly, Panel B indicates that the tendency to forfeit the rights decreases almost monotonically with portfolio value.¹⁸ Another clear cross-sectional result emerges when we relate the fraction of forfeiting the rights to trading activity in Panel C. The fraction of unexercised rights is highest (1.6% for households and 2.8% for institutions) for investors who did not trade at all during the preceding 255 trading days (about one year). These results suggest that investors who lack the financial literacy to understand what to do with the rights or who are ignorant of the market tend to leave rights unexercised.

The third explanation involves direct costs that deter shareholders from exercising their rights. Costs of gathering information, transaction costs, and opportunity cost of time, or a combination of all three, could be too high for some investors, and thus they allow their rights to lapse. This explanation follows from Grossman and Stiglitz (1980): if there are costs of becoming informed, it may make sense not to become informed.

Foreigners are likely to face the highest costs. International phone calls to brokers, acquiring information on the investment decision, and being updated on the institutional details are examples of costs that are higher to investors domiciled abroad. In

¹⁸ We also plot the relative frequency of unexercised rights by the number of stocks in the investor's portfolio. The graph (unreported) is almost identical to the graph in Panel B.

addition, not being able to communicate in either of the official languages is likely to further increase the costs.

Panel D shows that for investors living abroad and who speak neither of the official languages, the fraction of unexercised rights is substantial: more than 12% for households and more than 10% for institutional investors. The difference is statistically significant for Finnish- and Swedish-speaking investors with a p -value less than 0.001. The result is consistent with the notion that investors domiciled abroad and not fluent in either of the official languages allowed their rights to lapse because of higher costs.

Regressions

We further assess the effect of sophistication and direct costs by explaining the failure to exercise or sell the rights. We use a logit regression, where the dependent variable is an indicator taking the value of 1 if the investor fails to exercise or sell rights, 0 otherwise. We estimate the model separately for households and institutional investors and assume that an investor could have exercised the rights, the first strategy in Section 4.3. The results are very similar for the second strategy, assuming sold rights, in Section 4.3. We control for offering fixed effects.

We first analyze the most obvious proxies for sophistication: portfolio value and trading activity.¹⁹ Table VIII shows that the coefficients for portfolio value and trading activity are negative and strongly significant, just as would be expected on the basis of the earlier univariate results. This result is highly significant for both institutions and households, but stronger for the former group. This result is probably explained by the fact that institutions are a much more heterogeneous group of investors than households. The large variation in portfolio value within institutions (reported in Table III) supports such a conjecture.

We also investigate the effect of other variables that are likely to be correlated with sophistication and thus, investment mistakes. It is plausible that shareholders' age influences exercise decisions. On the one hand, older investors usually have a longer stock market history and are thus more experienced. On the other hand, older shareholders may be adversely affected by cognitive aging and thus leave rights unexercised.

To investigate the age hypotheses, we include age as an explanatory variable in the regression. To account for a non-linear relation between age and forfeiture of rights,

¹⁹ Due to time-variation in portfolio values, we use portfolio value rank within an issue rather than the absolute value to proxy for sophistication. The portfolio value rank variable is defined as $1 - (\text{Investor's portfolio value rank in the rights issue}) / (\text{Total number of observations in the issue})$. The investor with the smallest portfolio within an issue has a portfolio rank of 0, and correspondingly, the investor with the largest portfolio has a portfolio rank value close to 1.

Table VIII. Regressions of the determinants of leaving money on the table

This table reports results from regressions that analyze the determinants of investors' propensity to leave money on the table, either by exercising rights early or failing to exercise or sell them. Early exercise is modeled with a duration model, with the dependent variable defined as the number of days from the first settlement date of subscription rights. The estimated hazard function is lognormal. The sample includes all share subscriptions in rights issues that paid no compensating interest. Failing to exercise or sell is modeled with a logit model, where the dependent variable takes the value of 1 if the investor leaves rights unused, zero otherwise. Leaving rights unexercised is considered as an investment mistake if all four conditions described in Figure 3 are met. Independent variables in both duration and logit models are as defined in Table III, except for *Portfolio value rank*, which is defined as $1 - (\text{Investor's portfolio size rank in the rights issue}) / (\text{Total number of investors in the rights issue})$. Age is divided into four categories and each category is assigned a dummy variable (older than 65 years is the omitted category). The undistributed estate dummy is not available for the early exercise regression due to small variation within the sample. The logit models include dummies for issues with at least 10 observations for both values of the dependent variable; all other issues are pooled into one group. In the sample of institutions, the dummy for non-financial institutions is omitted. Financial corporations and mutual funds are combined into one group; the latter group has no observations with a dependent variable value of 1. Foreigners include only registered foreign investors. Asterisks mark significance at standard levels (** for 1%, * for 5%, and * for 10%, respectively).

Regression	Failing to exercise or sell		Early exercise	
Dependent variable	Binary: 1 for leaving rights unexercised, 0 otherwise		Number of days from first settlement date in the data	
Specification	Household	Institution	Household	Institution
Portfolio value rank	-1.30*** (-15.72)	-2.12*** (-7.15)	0.01*** (6.25)	0.02* (1.73)
Ln (Number of trades + 1)	-0.15*** (-7.28)	-0.07 (-1.21)	0.01*** (15.62)	0.02*** (22.31)
Swedish	-0.59*** (-7.86)	-0.50* (-1.83)	0.05*** (19.57)	0.05*** (5.29)
Not Finnish or Swedish	0.72 (1.31)	2.07*** (5.31)	0.01 (0.81)	0.03 (1.47)
Domiciled abroad	0.69*** (5.33)	0.77** (2.17)	0.03*** (5.24)	0.05*** (2.92)
Undistributed estate dummy	0.39*** (2.60)		NA NA	
Female dummy	-0.17*** (-3.88)		-0.003** (-2.46)	
Age 0 to 29	0.29*** (3.93)		0.05*** (26.60)	
Age 30 to 44	0.46*** (6.80)		0.05*** (28.80)	
Age 45 to 55	0.06 (0.86)		0.03*** (17.08)	
Age 55 to 65	-0.08 (-1.03)		0.02*** (8.85)	

Table VIII. (Continued).

Regression	Failing to exercise or sell		Early exercise	
Dependent variable	Binary: 1 for leaving rights unexercised, 0 otherwise		Number of days from first settlement date in the data	
Specification	Household	Institution	Household	Institution
% of shares gained as a gift	−0.38 (−1.64)		0.02*** (3.09)	
% of shares gained as a bequest	−0.54* (−1.67)		0.05*** (5.85)	
Financial corporation or mutual fund		−0.20 (−0.28)		0.06*** (5.80)
Nonprofit institution		0.20 (0.82)		−0.01 (−1.26)
Foreigner		−0.57 (−1.48)		−0.03** (−2.30)
Offering effects	Yes	Yes	Yes	Yes
Pseudo- R^2	0.09	0.14	NA	NA
χ^2	3,169.49	342.12	35,973.76	3,760.50
Number of observations	229,565	13,044	157,818	9,562

we divide age into five categories and assign a dummy variable for each category (with age higher than 65 years as the omitted category). Our results suggest that younger investors are more likely to forfeit the rights. This finding is inconsistent with Korniotis and Kumar (2008), who find that younger investors perform better in common stock investments.

We also find that Swedish-speaking investors are less likely to leave rights unused. The coefficient for the Swedish-speaking dummy is of the same magnitude for institutional investors and households, but only marginally significant for institutions because of the smaller sample size. This result could be explained by the fact that in Finland, the Swedish-speaking minority has traditionally held more financial wealth: longer tradition in stock market investing nurtures financial literacy.²⁰ Investors who have obtained the shares as a bequest are less likely to leave rights unexercised, a finding which may be interpreted as the coefficient of the Swedish-speaking dummy: financial literacy increases with a history of stock market participation.

²⁰ Using data from the entire Finnish population, Karhunen and Keloharju (2001) document that 15.7% of Swedish-speaking and 11.6% of Finnish-speaking individuals own shares. Furthermore, the investment wealth of an average Swedish-speaking investor is three times as large as that of an average Finnish-speaking investor.

Because gift giving creates tax-planning opportunities for investors familiar with Finnish tax law, we expect that the tax-savvy investors who have received shares as a gift are more likely to exercise their rights.²¹ The coefficient is negative, as expected, although it lacks statistical significance.

The FCSD data also flag accounts belonging to deceased individuals whose assets are managed by a person appointed by claimants of the undistributed estate. The results in Table VIII indicate that assets of undistributed estates are under worse management than the assets of the average private investor: the coefficient is positive and significant in both specifications, and thus undistributed estates fail to exercise or sell rights more often. The most likely explanation for this finding is a combination of low financial literacy and ignorance. An heir or an appointed lawyer managing the assets of the undistributed estate may not have been aware of the inherited stocks at the time of the rights issue. Additionally, investors who have bought stocks themselves may be more knowledgeable than investors who have recently inherited stocks.

The results also support the role of direct costs in leaving money on the table. We find that the dummy for domicile outside Finland is positive and significant. Hence, investors who live abroad are more likely to leave their rights unexercised. The results also indicate that the coefficient for the language other than Finnish or Swedish is positive and highly significant for the sample of institutional investors, suggesting that not communicating in the native language makes it more costly to exercise the rights.

It is worth noting that the variables related to direct costs explain little of the variation in the decision to leave the rights unused. The pseudo- R^2 of the regression in the first column of Table VIII decreases by 0.1 percentage points when the dummies for domicile outside Finland and for not communicating in the native language are left out. In contrast, excluding the variables related to experience and financial literacy decreases the explanatory power by 2.6 percentage points. The corresponding reductions for institutions are 1.8 and 4.6 percentage points, respectively.

In addition to analyzing the failure to exercise or sell the rights, we perform a similar analysis on the timing of exercises. We model the timing decision with a

²¹ More precisely, gifts worth up to €3,400 can be donated tax-free every three years. There is also a basis step-up for calculating capital gains when shares worth up to €3,400 are transferred to another party as a gift. For example, if an investor donates shares with a purchase price of €20 and the current market price is €30, €30 is used as the basis for calculating capital gains when the receiving party subsequently sells the shares. In addition, when donating shares worth more than €3,400, a flat gift tax of €85–€5,735, plus a variable gift tax between 10% and 16% for the value exceeding €3,400, must be paid upon transfer. In this case, no capital gains tax is due when the shares are eventually sold.

duration regression using a lognormal duration distribution.²² The earliest exercises are settled nine days before maturity and we assign them a dependent variable value of zero. Correspondingly, for settlements at maturity, the dependent variable takes the value of nine. Thirty-two settlements (0.02% of all observations) occur at least two days after maturity. As these observations can be unambiguously identified as delayed settlements, we assign them a dependent variable value of ten.

Because the length of the subscription period varies between issues and different rights issues have different average settlement lags, we include offering fixed effects in the regression. Issues for the same company, but different stock series that run simultaneously are treated as one offering. To make sure that issues that paid compensating interest do not affect the results, we run the regressions with data on the twelve issues that paid no compensating interest.

The overall picture from the duration regressions, reported in the last two columns of Table VIII, is consistent with results on leaving rights unused. Portfolio value, trading activity, and Swedish-speaking dummies are positively associated with the timing decision; in other words, investors who are more experienced and are more likely to be financially literate tend to exercise their rights later. Shareholders that have received the shares through bequests or gifts are also more likely to exercise later. The age dummies show that younger investors tend to exercise their rights later, suggesting that the result on young investors leaving rights unused should be interpreted with caution.

The dummy for investors living abroad is positive, suggesting that foreigners exercise their rights later. The explanation for this finding may be a technical one: a letter to a broker containing instructions to exercise the rights takes longer to reach its destination from the United States than from Finland. Similarly, scheduling a phone call between two countries in different time zones (there is a seven-hour time difference between New York and Helsinki) is likely to take longer.

We perform some robustness checks to validate our results. The standard errors in Table VIII may suffer from dependence within an offering, a problem that we account for by employing two methods. First, we adjust the standard errors for clustering at the offering level. Second, we take the approach of Fama and Macbeth (1973), which has also been utilized by corporate finance scholars (e.g., Cornelli and Goldreich, 2001; Hoberg and Prabhala, 2006), and estimate the models separately for each issue, calculate the average coefficient for each variable, and check whether the average coefficient is different from zero. The overall impression from this exercise is that the majority of the coefficients remain statistically significant,

²² We choose this distribution in order not to overly restrict the shape of the hazard function as the lognormal distribution allows the function to switch between positive duration dependence (hazard function is upward sloping) and negative duration dependence (hazard function is downward sloping). Our results are not, however, particularly sensitive to other functions, such as the exponential and loglogistic function.

although some lose their significance due to their weak statistical power. As an additional robustness check, we run the regressions by including investor random effects to account for unobserved investor heterogeneity. The results are very similar to those obtained without the random effects.

Conclusions

This paper examines investor behavior in rights issues. Evidence from 18 rights issues suggests that even with conservative estimates, investors lost at least €9.9 million by exercising subscription rights early, selling their rights below the intrinsic value, or forfeiting their rights without compensation. The total loss is equivalent to 0.7% of the total issue proceeds, which is roughly 15% of the direct flotation costs of rights issues reported in Bøhren et al. (1997).

The finding that thousands of investors left money on the table by not selling or exercising their rights provides a mirror image of the too-active investors described in Barber and Odean (2000). While it seems that the very active part of the household population pays a penalty for their excess trading activity, our results indicate that the most inactive investors are characterized by lack of financial literacy and ignorance of the market, which lead them to leave money on the table. For the median investor, the loss from not selling or exercising rights is, however, rather small. We estimate that the median household investor suffered a loss of €135 from not exercising or selling the rights.

The typical investor who leaves money on the table in a rights issue is an individual with a small portfolio, infrequent trading activity, and who is not a native speaker of either of the official languages. As expected, financial institutions with large portfolios and high trading activity are at the other end of the spectrum, and they even take advantage of the actions of less savvy investors by buying subscription rights at depressed prices.

The results in our paper leave unanswered the question of whether the behavior of less sophisticated investors causes the prices of the rights to be depressed. This is an interesting topic that we leave for future research.

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