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Selling Company Shares to Reluctant Employees: France Telecom's Experience

Summary

In 1997, France Telecom, the state-owned French telephone company, went through a partial privatization. We adapt a standard neoclassical model to predict how employees might respond to the firm's offer to sell them various classes of shares. Using a database that tracks over 200,000 eligible participants, we analyze employees' decisions whether to participate; how much to invest; and what form of stock alternatives they selected. The results are broadly consistent with the neoclassical model. However, we report four anomalous findings: (1) The firm specificity of human capital has a negligible effect on employees' investment decisions; (2) the amount of funds invested in the stock plans seems driven by a different set of forces than the decision to participate, which we suspect reflects a "threshold effect" that we attempt to measure; (3) employees "left on the table" benefits equal to one to two month's salary by failing to participate; and (4) most participants underweighted the most valuable asset.

Keywords: Employee stock ownership, privatization, portfolio choice

JEL: G30, G11, L33

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In 1997 France Telecom, the then state-owned French telecommunications giant, underwent a partial privatization. French law required the firm to set aside 10% of the offering for employees. France Telecom's management was eager to elicit a high participation rate in the offering, for both political and economic reasons. To induce employees to buy France Telecom shares, the firm offered them four distinct investment vehicles. Three allowed employees to receive larger discounts in return for agreeing to hold the stocks for longer periods, the fourth provided downside protection yet substantial potential for appreciation.

Our paper analyzes the employees' response to the firm's stock offering proposal. We study more than 200,000 past and present France Telecom workers eligible to participate in the offering. For each eligible participant, we have personnel data including their age, tenure, rank, gender, and employment status (civil servant, non-civil servant, retiree, or former employee). We also have information on the number and type of shares requested and obtained for each employee. We ask a set of simple, related questions: Does neoclassical theory help to explain *which* employees would buy shares, *how much* they would buy, and what "*flavor*" of shares they would prefer?

Our data bears out many predictions from the standard model: Workers with higher financial wealth and salary participate at a higher rate and invest more. Consistent with the notion that as retirement horizon decreases, risk aversion increases, we find that older workers tend to participate less. Workers whose undiversified human capital fluctuates with the fate of their employer should be reluctant to invest in their employer's shares. We look for evidence of this human capital effect by examining whether tenure -a standard measure of the firm-specificity of human capital- is related to employee decisions with respect to the France Telecom offering. We find some evidence of a human capital effect on investing decisions, but the magnitudes are quite small.

We also find anomalies that the standard model cannot explain. We document unexpected and economically significant sub-optimal investment choices by France Telecom employees. Many completely shunned the most attractive investment vehicle offered to them – the downside-protected stock-based asset. Most interestingly, we find that employees' decisions *whether* to participate in the offering and *how much* to contribute are driven by different factors. Several groups of employees–especially former employees and retirees–participated less

frequently, but conditional on participating, invested more. This result is consistent with a simple "fix" to the standard model: Introducing some sort of search or analysis costs which has to be exceeded before investment occurs. We measure this threshold in a latent variable framework and find that unless employees were interested in investing at least FF 18,750 ($ 3,160), they didn't participate at all. Employees apparently are willing to forego benefits equal to one or two months' salary rather than spend time to understand the offer. Where the firm lowers this cost through marketing and support, participation is substantially higher, suggesting that these effects are material. In essence, our results quantify the value of marketing or advising in investment decision making.

The remainder of the paper is organized as follows: Section I discusses the offer that France Telecom made to its employees. Section II reviews our adaptation of the neoclassical investment decision-making model and discusses its predictions as applied to our problem. Section III describes the data and the variables we use. Section IV provides the core of the empirical analysis, in which we report on the three aspects of employee response: The decision to participate, the quantity of funds invested, and the nature of the selected portfolios. We examine the cross-sectional dispersion of employee choices as a function of observable characteristics. Section V presents a brief conclusion.

I. The challenge of selling company stock to France Telecom employees

Even though the French government wanted workers to hold their privatized firms' stock for political and economic reasons, and employers want employees to own stock for incentive reasons, selling a firm's stock to its employees is inherently tricky. Blue collar workers may have limited financial resources to invest, and workers with undiversified human capital may prefer to invest financial assets outside the firm.[1] Even if an employee's status makes it hard to fire him or her, the employee's firm-specific human capital can suffer when the firm underperforms, in that increases in salary and promotions can become more scarce, or forced job

1. Meulbroek [2001] models the discounts that poorly diversified managers might require to hold call options on company stock and finds discounts of up to 50 percent of market values. The discount required for holding restricted stock is significantly lower due to the lower return risk in stock relative to options. In theory, holding stock could be a hedge for employees, if layoffs induced postive stock price reactions. However, Hallock [1998] documents that layoff announcements are associated with *negative* stock price reactions, although the reaction to any specific layoff

relocations more common. Selling France Telecom stock to its employees was even more challenging for various structural reasons: First, French individual investors had limited experience with direct equity-holding, and might have been very reluctant to buy stock.[2] Second, many France Telecom employees had *chosen* to be civil servants, perhaps indicating a low tolerance for bearing risk or a minimal interest in the private sector. Finally, France Telecom's privatization met throughout the process with political opposition from the firm's unions.[3]

For France Telecom management, a high participation rate by employees in the offering was an important objective: It would strengthen the legitimacy of the move to privatization.[4] Yet France Telecom could not simply give the shares to its employees. For example, French privatization law capped the permissible stock price discount at 20%. Thus simply lowering the stock price until employees were willing to buy was not feasible, and the managers of the privatization had to devise a plan around this restriction to induce employees to buy shares.

France Telecom adapted the program initially used by the French *Trésor* (Treasury) and Rhône-Poulenc in 1993.[5] In literature describing the program to employees, the company outlined the principles that dictated the design of the offerings:

> "To make the purchase of France Telecom shares accessible to everyone, the offer reserved for employees follows five principles:
> - Concentrates a majority of benefits on the first few thousand Francs in investment.
> - Helps each of you to finance your investment by offering payment terms and by offering a

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announcement would depend on the reason for the layoff and investor expectations regarding the layoff.

2. According to the *Commission des Opérations de Bourse* (the French stock market regulatory body) about 5 million French individuals held stock in 1997, or about 8% of the population of 60 million. See *Commission des Opérations de Bourse* [1998]. This figure does not include households holding stock indirectly through mutual funds. The equivalent figure for direct stock ownership in the US (from the *Survey of Consumer Finances*) is 19.2% of the population. See Bertaut and Starr-McCluer [2001]. Research showed that less well-to-do French households were less inclined to hold shares. See Arrondel and Masson [1990] and Szpiro [1995]. This suggests that the blue-collar workers and civil servants that made up the bulk of France Telecom's employees were unlikely candidates for participation in the offering.

3. France Telecom's civil servant employees enjoyed job security and a generous pension scheme that privatization could jeopardize. On October 12, 1993, 75% of France Telecom employees went on strike against privatization. In 1996, the company negotiated an agreement with unions that defused employees' fears. Under the deal, the State would keep a stake of at least 51% in France Telecom; current employees would keep their civil servant status even after privatization, while new employees would acquire private sector status; and France Telecom would make a one-time payment to the State to fund its employees' pensions.

4. In earlier French privatizations the government had threatened financial penalties for firms which failed to sell the employee portion of the offering. See Collat and Tufano [1994] for the example of Rhône-Poulenc. No explicit penalties were included in the privatization deal for France Telecom, but the political pressure on management to make the employee offering a success was substantial, and is reflected in large discounts discussed below.

5. See Collat and Tufano [1994].

plan with a bank loan.

- Offers a number of choices, and the possibility of investing in more than one plan at the same time.
- Gives incentives for long-term shareholding to foster the creation of a stable shareholder base.
- Respects the freedom of choice of each employee and guarantees the confidentiality of the operation."

The literature provided to employees was quite detailed and informative, and attempted to explain in simple terms the specifics of the offering. It was, however, substantial, and included a fair amount of legal language. For example, it contained a detailed step-by-step guide for completing the subscription forms as well as graphical illustrations of how the value of the investment depended on the France Telecom stock price. **Appendix A** provides a sample of the documents and **Table I** summarizes the specific terms of the four investments.

Three of the four plans were essentially discounted purchases of stock, where employees' willingness to commit to hold the stock for longer periods of time was rewarded with larger discounts. Benefits came in three varieties: 20% discounts from the offering price; free shares that were awarded if the employee had held his shares for a required holding period; and matching bonuses paid for by the company.[6] These benefits resulted in effective discounts much larger than the 20% price discount. For example, an employee investing FF 1,000 in *Abondix* received 27.5 shares; the same personal contribution would have given only 5.5 shares to an individual investor not eligible for the employee offering – the equivalent of a 80% discount.

The effective discount (including price discount from the offering price, matching bonus given by France Telecom, and free shares) was greatest for *Abondix* and less generous for *Simplix* and *Disponix*. However, the required holding periods were 5, 2 and 0 years respectively, rewarding employees who were willing to hold shares longer with larger discounts. In contrast, the *Multiplix* scheme was quite different: For a fixed contribution, the employee was guaranteed to receive back a prespecified amount of money (like a bond) and also obtained the upside on ten shares. While not described in these terms, *Multiplix* delivered the economics of a bond-plus-call portfolio or alternatively a protected-put position. Legally, this payoff was delivered through a

6. To illustrate, if an employee contributed FF 3,000 to investing in the *Abondix* plan, France Telecom put in another FF 3,000 on the employee's behalf.

peculiar "guaranteed" loan that allowed the employee to buy nine additional shares for each one purchased through personal contributions.[7]

All 174,091 current French employees of France Telecom (or of more than 50%-owned subsidiaries) were eligible to participate. In addition, 30,985 former employees who left the firm between 1991 and 1997 were eligible to participate, but could purchase only two of the four plans (*Simplix* and *Disponix*). The group of former employees includes 22,357 retirees as well as 8,628 former employees who left prior to retirement.

Overall, the share alternatives were quite attractive to the employees. To give a sense, were an employee to invest FF 9,000, he could buy about FF 12,000 of stock under the *Disponix* plan, FF 18,750 under *Simplix* and FF 26,250 under *Abondix*. (These numbers ignore the subsidized financing, avoidance of transaction costs, and tax-free status under *Abondix*).[8] Were he or she able to invest FF 9,000 in *Multiplix*, the employee would receive a package worth between FF 27,000 and FF 40,000, depending on the volatility of France Telecom stock used to value the options.[9] These are substantial benefits, and should be large enough to attract employee attention. Even assuming very low levels of volatility, the downside-protected *Multiplix* is the most attractive investment.

Figure I graphically illustrates the payoffs to *Abondix* and *Multiplix* as a function of final stock price. While there exists a small intermediate region for the stock price in which *Abondix* dominates *Multiplix*, the likelihood of a stock price in this region after five years is small. Assuming log-normal stock returns, an annual volatility of 20% and an expected return of 11% p.a. (including a 3.6% yield from dividends and tax credits), the final payoff to a FF 9,000

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7. What makes this loan peculiar is that the repayment is effected through the withholding of the dividends and tax credits (over the five-year life of the plan) and a variable repayment schedule at maturity that was a function of the ultimate France Telecom stock price. In effect, the loan repayment amount was equal to the positive difference between the value of ten shares less the payoff to the employee described in the text. The loan does *not* entail downside-risk since the employee was *never* required to repay more than the value of his or her shares after five years.

8. The calculations treat free shares received after a one-year or three-year holding period as equivalent to shares received today. This assumption is valid only if the investor has a sufficiently long investment horizon.

9. The value of the *Multiplix* package is calculated using the Black-Scholes formula and assumes that the dividend plus the tax credit yield on France Telecom is 3.6%. We used an annual volatility between 15% and 30% to compute the value of the *Multiplix* package. In this time, implied volatilities of options on the French stock index (CAC 40) ranged between 20 and 30%, implied volatilities on options on British Telecom ranged between 25% and 40%, and implied volatilities on options on Deutsche Telecom ranged from 25% and 40%. While it is not clear that implied volatilities from short-term options are appropriate to estimate the value of the 5-year *Multiplix* package, our

investment into Multiplix exceeds the final payoff to a similar investment into Abondix with a probability of 72%. Furthermore, Multiplix delivers extremely high payoffs in the third region of **Figure I**, which the final stock price is likely to reach. Consequently, the risk-neutral valuations of Multiplix (using the Black-Scholes formula) in the last column of **Table I** are significantly higher than the corresponding values for Abondix.

Taking risk aversion into account, as we do in the model described in Section II, *increases* the attractiveness of Multiplix relative to Abondix further because the Multiplix value is downside protected. To risk-averse investors, Multiplix offers a guaranteed minimum return of 13.4% p.a. for the first FF 2,000 invested, and a guaranteed 6.8% p.a. if the maximum amount of FF 9,000 is invested. What our analysis indicates is that any risk-neutral or risk-averse investor evaluating the two investments *ex-ante* over a range of assumptions about expected returns and volatilities should prefer Multiplix to Abondix, and should choose Multiplix over Abondix unless some of the constraints detailed in **Table II** are binding.[10] At the same time it is trivially true that an investor who strongly expects a final stock price close to the initial public offering price in **Figure I** would choose Abondix over Multiplix.

Under the principle of allowing employees freedom of choice, the program allowed employees to participate in more than one plan. However, the offering had a number of constraints, many of which were binding. The most important of these was that total contributions to the two most generous programs (*Abondix* and *Multiplix)* could not exceed 1/4 of the employees' gross annual France Telecom income. Other constraints are detailed in **Table II**. The constraints were very relevant in limiting employees' choices, as we discuss later in the paper.

With combinations of the four alternatives, employees could create highly customized shareholding packages. Within the limitations above, they could vary the degree to which investments were taxable, the average holding period, the payment options, the average total

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assumptions are probably on the low end of the reasonable range.

10. The usefulness of the downside protection offered by Multiplix was evident in 2002, when this paper was last revised: The France Telecom stock price had fallen below FF 70 (Euro 10) in June 2002 and hence traded in the left-most region of Figure I. From the initial public offering price of FF 182 (Euro 27.7) in October 1997 the stock price rose to above FF 1,300 (Euro 200) in March 2000 but had since fallen to levels below the offer price. Even at this depressed stock price level a Multiplix investors with a FF 9,000 personal contribution would receive FF 12,500 after five years for an effective annualized rate of return of 6.8%.

discount (taking into account discounts, bonuses, and free shares) and the average number of shares with downside protection.

II. Applying investment decision-making theory at France Telecom

How would a utility-maximizing, rational employee (without private information) respond to the France Telecom offer? From the extant literature, a number of relatively simple and commonsensical predictions emerge: Bertaut and Halliasos' [1997] model predicts that employees with more risky human capital would be less likely to participate in the France Telecom offering. Viceira [2001] shows that the demand for risky assets should decline as workers approach retirement, implying that younger workers would be more likely to participate in the risky France Telecom share offering. Similarly, Bodie, Merton, and Samuelson's [1992] model implies greater participation by younger France Telecom workers due to their better ability to counter negative return realizations with higher work effort. If, on the other hand, labor income shocks were positively correlated with the risky asset (as would be expected in the case of employees purchasing France Telecom stock), Viceira demonstrates a negative hedging demand for the risky asset. This would imply that younger workers with more human capital at risk may be less willing to participate in the offering.

Relatively little empirical work addresses how well these models perform in predicting investing behavior. Notable recent exceptions include the papers by Guiso, Jappelli, and Terlizzese [1996], Bertaut [1998], Heaton and Lucas [2000], Guiso, Haliassos and Jappelli [2001] and Vissing-Jorgensen [2002] on household portfolio choice, and the studies by Benartzi [2000] , Benartzi and Thaler [2001], and Choi, Laibson, Madrian and Metrick [2001] on investor behavior in defined contribution retirement plans.

The rich stylized models described above explicitly seek to be generalizeable, not to capture the essence of the specific problem faced by the France Telecom employees. We adapt a standard portfolio selection model to predict which employees were more likely to participate, how much they might invest, and what mix of the four investments they might choose. The model we use (which is described in detail in **Appendix B** available from the authors) is an extension of the standard optimal consumption-portfolio models developed by Samuelson [1969] and Merton [1969,1971]. Instead of creating a generalizeable model of investment, we seek to

stylistically model the specific situation faced by the employees of France Telecom in order to generate testable propositions. In particular, we expand the investment opportunity set to include not only standard riskless and risky investments, but also the firm-specific deals offered by an employer. We explicitly model the holding period requirements and the constraints imposed on these investments. In a number of cases, these constraints are binding and lead to seemingly counterintuitive results. Finally, we incorporate the fact that the proposed investors have non-diversified and uncertain human capital at stake.

We use our simple three-period model to obtain predictions with respect to the employees' decisions about participation, level of investment, and choice of investment vehicle. Starting from a realistic baseline calibration, we analyze the consumption, savings and optimal investment by the worker-investor as a function of his or her relative risk aversion, initial financial wealth, the level of labor income/human capital, the firm specificity of human capital, and the idiosyncratic riskiness of labor income.[11] In Section III, we discuss our empirical proxies for each of these quantities. Selected predictions are summarized in **Table III**. In the table, we highlight those predictions that are not obvious, which are often a result of modeling the constraints under the offering-specific investment choices. The model predicts (a) whether employees will participate (**Panel A**); (b) how much they will invest (**Panel B**), and (c) which assets they will buy (**Panel C**). We discuss the intuition of the key predictions in Section IV of the paper, where we present the results.

III. Data description

Our data set consists of a unique database of 205,076 current and former employees of France Telecom. The data were kindly provided to us by France Telecom's Internal Shareholders Department. For each individual we have data on age, gender, job tenure, job category, and salary grade; whether the employee is currently employed, formerly employed, or retired; and the

11. The standard calibration of the three period model uses the following parameter values: Initial wealth equals FF 200,000 and initial labor income equals FF 180,000 p.a. Using power utility, the relative risk aversion parameter is set to 5 and is varied between 2 and 20. This range relates to extant empirical work, in particular Friend and Blume [1975] and Brav and Géczy [1996]. The individual time preference rate is equal to the risk-free interest rate at 5 percent and the equity premium is set to 6 percent. The risk parameters in the baseline calibration are a 30 percent annual volatility for the France Telecom stock return, a 25 percent volatility for the orthogonal 'market' asset and a 5 percent volatility for the independent labor income shock. ρ, the parameter controlling the covariation between stock

location of the employee's business unit. We also have information on the number of shares demanded and obtained by each employee. Finally, we have the town and the postal code of the employee's home, which we have matched to demographic data from INSEE, the French government statistical agency. **Table IV** provides summary statistics for some of the observed variables. The challenge is to match the empirical proxies from our data to the theoretical determinants of portfolio choice identified in the previous section:

Amount of human capital. The present value of labor income (human capital) is a function of the current level of monthly salary, its growth rate, and the time horizon over which salary will be received. *Current salary* captures the first component and *age* captures the third aspect of human capital, with younger workers generally having more human capital than older workers. We can observe an employee's salary grade, from which we can estimate his or her salary.[12] In addition, we can identify *retirees*, whose human capital (future labor earnings) is presumably small.[13]

Firm specificity of human capital. We have a number of proxies for the firm-specificity of human capital. First, we can identify *former (non-retired) workers* versus *current workers*. The former would have no France Telecom firm-specific capital, as they were no longer in the firm's employ. For current workers, we use *job tenure* as a proxy for firm-specificity of human capital. Prior theoretical and empirical research suggests that tenure is a good measure of this variable.[14] In the empirical analysis, we distinguish the tenure effect between civil servants and non-civil servants. While the firm-specificity of human capital increases in tenure for both

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returns and labor income, is set to 0.1.

12. France Telecom would not reveal individual employee's salary nor divulge the entire mapping between salary grades and salary ranges. They did provide detailed information about this mapping for broad subsets of salary grades (11 to 23, 31 to 33 and 41 to 46), broken down by gender. Based on these six data points, we fit a piecewise linear function to obtain estimates of the intermediate salary levels. All regressions in Section IV have been estimated with salary dummies and the fitted salary estimates. Since there is no information available on salary levels at France Telecom subsidiaries, we retain dummy variables for salary grades.

13. We do not have current salary levels for former, non-retired employees who left between 1992 and 1997 and use their last salary at France Telecom instead. This stale salary data is likely to underestimate the true current salary level if employees leave for better paying jobs.

14. There are two rationales for why higher tenure should be associated with higher salaries and higher firm-specific human capital. Following Becker [1964], an employee's firm-specific skills build up over time. They increase the employee's marginal productivity on the current job, but are useless when the current employment relationship is terminated. Another line of reasoning argues that the quality of the match reveals itself gradually over time (see Jovanovic [1984]). Good matches are more likely to survive than bad matches and result in a higher marginal product and wage payment to the worker. See Topel [1991] and Williams [1991] for empirical evidence.

groups, we would anticipate that the job security implicit in the civil servant status makes this effect less relevant for civil servants.

Idiosyncratic risk in human capital. The possibility of a sudden shock to human capital should affect the worker's investment decision. Here we exploit the differences between the *civil servant employees* of France Telecom and the non-civil servants. The former have much more job security than the latter and thus, we argue have lower levels of idiosyncratic labor shocks.

Financial wealth. We do not directly observe the financial wealth of the workers, but we construct a proxy based on the worker's choice of residence. We match the towns of the worker's residence to the INSEE (French National Statistical Service) database, and use the average income of the households in the same town as a rough measure of wealth. Our logic is that choice of residence is a function of wealth and given the large disparities between towns and neighborhoods, it captures some of the unmeasured variation in household wealth.

Other control variables. To test Viceira's [2001] predictions that time to retirement can affect employee's retirement motives to invest in risky assets, we also control for employees' *age*. Age is a variable that could have many interpretations in this analysis. Not only does it capture years to retirement, but also it affects human capital, financial capital and the ratio of the two.[15] Younger people have large future labor income but smaller financial assets, whereas older people have smaller remaining future labor income and larger financial assets. At some point, financial assets begin to dwindle as people use them to pay for children's education, support of aging parents or retirement, and to capture this non-linearity, we include not only an "age" variable, but a squared age term as well.[16]

Prior research, such as Barber and Odean [2001], suggests that men and women make different investment decisions. They attribute this to differences in self-confidence, but more generally gender differences could reflect other factors as well, such as risk aversion. To account for these differences, we include *gender* as a control variable.

Omitted variable bias and risk aversion. In spite of the uniqueness and breadth of our database, we acknowledge that some potentially very helpful data have not been made available.

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15. See the discussion in Bodie, Merton, and Samuelson [1992].
16. To improve the fit of the second order polynomial, we subtract the mean from age and age-squared when using it as an explanatory variable.

For example, we have no information on employees' marital status, number of children, whether their spouse is an employee of France Telecom, and whether the employee is a homeowner. Clearly, such variables have bearing on France Telecom employees' participation in the share offering. Nor do we have information on employees' promotion history, union affiliation, training, or other portfolio holdings, which may have influenced employees' attitudes toward the offering.

One key variable that will always be unavailable is risk aversion. However, other observable variables could be related to risk aversion. Absolute risk aversion should decrease with total wealth and income. Wealthier workers may be more willing to buy risky assets than less wealthy workers. The decision to become a civil servant may reflect higher risk aversion; if so, civil servants might be less likely to participate in the offering. Risk aversion may change over a person's lifetime, so older people may become more risk averse. Risk aversion could differ between men and women. It is prudent to remember that there is no independent measure of risk aversion and virtually all observable variables may be correlated with it, thus it may be difficult to interpret the empirical results.

IV. Empirical results

Our adapted portfolio selection model (incorporating the program constraints) produces a set of testable predictions, and in this section we examine whether these predictions are borne out by the behavior of France Telecom's current and former employees.

A. Participation and investment intensity

Our model predicts that *all* eligible current and former employees would participate in the France Telecom offering, thus it predicts no cross-sectional variation with respect to participation. This broad prediction is not a unique product of our model; rather it is a result common to all standard portfolio selection models which predict that investors should hold at least some equity.[17] In this instance, the existence of an intentionally "mispriced" equity (the discounted France Telecom shares) only intensifies this predicted tendency. The model does

17. Any portfolio selection model using a differentiable and strictly increasing utility function predicts that an investor should hold a non-negative amount of a risky asset as long as the expected return to this asset is strictly

predict that the *amount* workers will invest should differ across employees. We expect to see more investment by workers who are more able and willing to bear financial risk: Those with lower risk aversion, more financial wealth, more labor income, and whose labor income is less correlated with France Telecom.[18] These predictions are summarized in **Panel B** of **Table III**.

In order for the model to predict less than 100% participation would require introducing some kind of friction into the employees' decision problem or stipulating a minimum required consumption level.[19] In such an extended model, employees whose expected benefits from participation are low would not participate. In general, employees who invest *larger* amounts in our frictionless model would also be *more likely* to participate in a model with frictions.[20] This intuition implies that our predictions for the level of investment might be useful in characterizing cross-sectional differences in participation as well. For this reason we compare our predictions for the level of investment with both the empirical propensities to participate, and the levels of personal investment.

Univariate Analysis. With respect to participation, the standard model is clearly deficient, in that participation was not 100%, but rather 62.8% overall (68% among current employees). See **Table V**, **Panel A**. There are a variety of possible reasons why employees might have passed-up the considerable benefits offered, but many of the obvious explanations had been deliberately addressed by the design of the plans: Because the plans allowed employees to finance their purchases through regular salary withdrawals, short-term liquidity constraints were not at play. The plan explicitly also addressed longer-term liquidity concerns by specifying a series of life events (marriage, birth of a child, separation from the firm, etc.) which would permit investors to exit from their investments even before the required holding period was met. Employees might have feared that even though they would be able to buy shares at a discount to

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larger than the discount rate.

18. It is ambiguous whether workers with more idiosyncratic labor income risk would invest more; the predicted relationship differs for workers depending on their relative risk aversion.

19. For a detailed analysis of a portfolio selection model with a stock market participation cost see Gomes and Michaelides [2002], and the references therein. An alternative approach to introducing frictions is to increase either the individual discount rate or the correlation between human capital and the stock price until some employees are predicted to abstain. The required discount rate and correlation are unreasonably high and we do not pursue this approach further.

20. This intuitive prediction is strictly speaking only correct if the cost of participation does not vary too much in the cross-section. We discuss potential differences in search and analysis costs across employees in Section IV.B.

the IPO price, this price itself might be "too high." However, precedent elsewhere in Europe and in France suggested that privatization IPO prices were historically and intentionally set lower than the market price.[21] Furthermore, the employees bought the stock at a discount to the retail IPO price, which was already at a discount to the price at which institutional investors could buy. Thus we are left with somewhat of a puzzle trying to explain why participation was not universal. Below, we empirically analyze whether the decision to participate was systematically related to any employee characteristics.

Focusing on employees who participated, **Table V, Panel B** shows that the average investment among workers—conditional on participating—was FF 26,554.[22] The empirical distribution of personal contribution (conditional on participating) shows that there were substantial differences in the amounts invested by employees. Given this cross-sectional dispersion, we can test whether the amounts invested, conditional on participating, were consistent with the model.

Multivariate Analysis. We run a Probit regression of the *probability* of participation on individual characteristics to explore what factors affect the likelihood of participation, and a truncated regression of *personal contribution* to test if the model predicts the determinants of the level of participation. This set of specifications allows us to see if the determinants of participation are the same as, or different from, those that determine the amount of investment.[23] We report our results for the Probit regression in **Table VI, Panel A,** and the results for the truncated regression in **Panel B**.[24]

In general terms, the model predicts that employees more able and willing to bear France Telecom risk should invest more. More financially-secure employees, those with higher *labor*

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21. The first day returns of prior French privatizations were 7.17% for UAP, 10.65% for Elf, 16.15% for Rhone-Poulenc, 1.74% for Usinor, -8.29% for Pechiney, and 15.46% for BNP.

22. The baseline calibration of our model predicts a personal investment of FF 26,000.

23. Unlike the Tobit model, the truncated regression framework allows the determinants of the participation decision to differ from the amount of investment decision without merely throwing away zero-investment observations and biasing the results. It can accommodate reasonable deviations from the standard choice setting: for example, even when the optimal contribution level is non-zero, participation may still not occur due to search, information and transaction costs. The truncated regression specification uses a MLE framework, correcting for the bias that would occur if one merely ignored the non-participation data (See Hausman and Wise [1975] or Greene [1993]).

24. Individuals with missing observations on some of the explanatory variables have been eliminated in the regressions in **Table VI**. This reduces the sample size from 205,076 in **Table V** to 167,064 in **Table VI, Panel A,** and to 111,912 in **Panel B**.

income and more *financial wealth,* should invest more (and possibly be more likely to participate). Our data strongly confirm that wealthier employees and better paid employees are more willing to take on firm exposure. Employees' labor income and wealth have a positive and material impact on the likelihood of participating in the offer. In **Table VI**, **Panel A,** there is nearly a monotonically-increasing relationship between salary levels and the propensity to participate, even after controlling for age, tenure, civil servant status and job category. Moving from the lowest salary grade for "ordinary employees" to the lowest salary grade for "middle managers," the probability of participating increases 58 percentage points.

In column two of **Panel A,** we include the estimated salary level; the coefficient on this variable is the most significant determinant of participation. Our proxy for *wealth* also has a positive impact on the likelihood of participation. We incorporate both a wealth term and a square of wealth to allow for nonlinearities in the wealth-participation relationship. The coefficient on wealth is positive and the squared term is negative, which suggests that this relationship flattens off or could even turn around at high levels of wealth. Over the range of data in our sample, the first-order term dominates the squared term for 95-99% of all the employees, producing a positive relationship between wealth and participation for virtually all of the participants in our sample. These findings are consistent with the notion that employees with greater total wealth have lower absolute risk aversion and are therefore more willing to invest in risky assets.

The results for investment levels are similar, with higher-paid workers investing more in the stock-offering plan, as shown in **Table VI, Panel B**. Moving from salary grade 11 to salary grade 31 (31 to 41) results in a FF 10,000 (FF 14,000) increase in personal contribution. Furthermore, wealthier employees invest more.[25] Combining the linear and squared wealth terms, we see that increases in our wealth proxy are correlated with materially higher contribution amounts.[26] These results are consistent with the comparative statics from our model.

Our model predicts a negative relationship between tenure (a proxy for the *firm-*

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25. We estimated the same regression using the ratio of personal contribution to annual salary as the independent variable. The results are qualitatively similar to those presented, and are omitted for brevity.

26. The negative coefficient on the linear term in the INSEE wealth measure is dominated by the positive second order term. This is true for the top 99% of the wealth distribution in both truncated regression specifications in **Table VI**, **Panel B**.

specificity of an employee's human capital) and investment intensity. Long-tenure workers (who presumably have built up more firm-specific human capital) would presumably avoid exacerbating their already poor diversification. Consistent with this prediction, tenure has a negative effect on the likelihood of participation for non-civil servant current employees, who may have felt that their jobs would be most at risk in case France Telecom did poorly. However this tenure effect is small: One standard deviation of tenure above the mean is associated with 0.6% less likelihood of participation. We also find that longer tenure is weakly associated with a smaller personal contribution, especially for current non-civil servants who decrease their personal contribution by FF 460 for each additional year of job tenure. Employees may have fallen prey to a "mental accounting" illusion discussed in the behavioral literature, treating their human capital separately from their financial capital, and neglecting the risk due to the correlation between the two.[27] This conjecture would be consistent with the result by Benartzi [2000] that employees show little reluctance to invest into the stock of their employer in defined contribution plans.

The model has an ambiguous prediction regarding the impact of *idiosyncratic labor risk* on investment intensity. For low levels of relative risk aversion, we predict the net effect on investment intensity to be positive, while for higher relative risk aversion the effect would be negative. Based on the Probit marginals evaluated at the means, civil servants (who are less subject to idiosyncratic labor shocks) are about 7 percentage points less likely to participate than non-civil servants (calculated from the first specification in **Table VI**, **Panel A**). Civil servants also have smaller personal investments, as shown in **Panel B**.

While our model does not include an age variable, other work built on the standard model we adapt predicts that investors closer to retirement will be more risk-averse—and less likely to invest (Viceira [2001]). Our results support this notion. We find that *older employees* are less

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27. See Shefrin and Statman [1993,1994] and Thaler [1985, 1990, 1998]. Equally plausible, employees with longer tenure may feel optimistic about the prospects of France Telecom, and are confident about their knowledge of the prospects of France Telecom. When people are given more information on which to base a forecast or assessment, the accuracy of their forecasts tends to improve much more slowly than their confidence in the forecasts. Thus, additional information can lead to an illusion of knowledge and foster overconfidence (see, for example, Oskamp's [1965] widely cited study, which documents that psychologists' confidence in their clinical decisions increased with more information, but accuracy did not). Loyalty effects may also have been at work in the offering. Employees in the high-salary range may be better performers and therefore feel greater loyalty to France Telecom, and express it through more participation and more personal contribution.

likely to participate in any of the stock purchase plans, with workers one standard deviation older about 4% less likely to participate. In the extreme (evaluating the Probit coefficients at their mean values), we find that retirees are 30% less likely to participate in the stock plan than current workers. However, age is associated with a larger personal contribution (conditional on participating) over almost the entire age range of employees.[28] This finding would be consistent with the idea of a negative hedging demand for company stock by younger employees with more human capital.[29] Why the effect of age is negative in the participation decision but positive for investment amounts is puzzling, and we discuss this type of discrepancy at length below.

Finally, while we have no clear hypothesis for why *gender* should affect the decision to participate in the stock plans, it does have an effect. Women were about 5% more likely to participate than men. This might result from differences in family status: French households are more likely to have two incomes if the woman works than if the man works. It could also reflect differences in risk aversion, or a more careful reading of the plan documents. We merely report the result as consistent with the notion that gender has some impact on this investment decision.

In summary, the neoclassical model predicts that better paid workers, wealthier workers, workers with less tenure, and younger workers should invest more. We find that the first three of these predictions is borne out with the data, and that these same factors affect the likelihood of participating as well. However, gender matters, and age/retiree status has complicated effects on participation and investment levels, which we discuss below.

B. Discrepancies between the participation and personal contribution: A threshold effect

Several employee characteristics have opposite effects on participation and personal contribution. While women are *more* likely to participate than men, conditional on participating, they contribute *less*. The converse is true of retirees and former employees, who are *less* likely to participate, but conditional on participating, contribute *more* (in absolute terms and as a

28. For the first specification in **Table VI**, **Panel B** the positive first order term in age dominates until age 55, and for the second specification in **Table VI, Panel B** the positive first order term dominates until age 77.

29. The hedging demand is negative due to the positive correlation between human capital and stock returns. For a given level of wealth and firm-specificity of human capital, diminishing human capital makes the negative hedging demand smaller in absolute value.

percentage of monthly salary).[30] It is as if the decisions of whether and how much to invest are driven by different factors, rather than as a result from a single optimizing decision. We propose a possible explanation for this finding: It appears that some threshold level of desired investments (latent demand) must be attained for participation to occur.[31] When this threshold is high, participation rates are low, but contributions (if made) are high.

What could account for such a threshold? Our hypothesis, reinforced by our discussions with management, is that the threshold is due to the substantial "cost" (in time and effort) for employees to evaluate the France Telecom offer. The offering documents sent to employees, although clear and informative, were substantial and included a fair bit of legal paperwork.[32] Analyzing the nuances of the four different plans could be taxing, especially for investors unfamiliar with investing. As in models with search costs, self-selection becomes critical: Employees for whom this "analysis" cost is higher are less likely to participate, but conditional on participating will invest more. It would be straightforward to adapt the standard model to be consistent with this explanation: One would merely need to add some fixed cost of investing to the decision-making process.

Testing this explanation is difficult because it is not obvious why this non-monetary fixed cost would vary across groups. Various groups could differ in their innate levels of intelligence or diligence (for example, male employees may have spent less time analyzing the offering in detail than female employees), but we have we no way of measuring these differences. France Telecom assured us that the marketing effort devoted to the offering was spread evenly across current employees, so there is no reason to think that some employees got easier access to information than others.

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30. These findings hold in a multivariate setting. Based on the Probit regression results, former employees were 61 percentage points less likely to participate than current workers. The truncated regression estimates show that former workers invested 21% more than current employees, other things equal.

31. The possibility of threshold levels and fixed (information) costs of stock market participation has been discussed among others by Bertaut and Halliassos [1995], Bertaut [1998], and Vissing-Jorgensen [2002].

32. The basic "Guide for the employee shareholder" was 31 pages long, and included descriptions of the various plans, simulations of employee shareholder wealth depending on stock price scenarios, information on the tax status of the various plans, as well as information on basic stock market mechanisms and terminology. In addition to this basic document, employees eligible for the long-term plans (*Abondix* and *Multiplix*) were given a 16-page, densely packed document explaining the legal status of those plans ("Règlements des Fonds Communs de Placement d'Entreprise"). Finally, the *Multiplix* plan was described in a 20-page document, printed in small font on the letterhead of a notary office.

However, France Telecom management conceded that having former employees and retirees invest in the offering was not a top management priority, and the marketing effort toward them was much lower than toward current employees. The offering was aggressively marketed to current employees, while it was merely made available to former employees or retirees. Current employees could hear presentations on the offer and compare notes with one another, while former employees had to make the decision on their own. We hypothesize that this difference could explain the difference in participation and personal contribution. If "search costs" were lower for current employees, we would expect the determinants of participation and personal contribution to diverge less for current employees than former employees or retirees.[33] Comparing columns between the equivalent specifications in **Panels A** and **B** in **Table VI**, we find that such is the case, lending support to our threshold explanation. This result suggests that marketing has a first-order impact on investment decision-making. Through marketing (information, advice and support) especially for complex financial products, firms can affect the apparent decision-thresholds that investors face. This finding is consistent with Bernheim and Garrett [2001] and Bayer, Bernheim, and Scholz [1996] who find that employer-provided financial education has a positive effect on retirement and non-retirement savings and on participation rates for 401(k) plans in the US.[34]

We measure the apparent size of the thresholds for various subgroups of employees, letting the data tell us the level of latent demand below which certain potential participants have chosen to forgo participating. Combining the estimates from the first-step Probit regressions and the second-step contribution amount regression, we can back out the implied threshold levels for different groups of individuals.[35] The procedure for estimating group-specific threshold levels is

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33. Rather than facing different costs, different potential participants could perceive different levels of benefits, either on the basis of systematically different levels of risk aversion or due to different expectations of the future success of a privatized firm.

34. The “search cost” explanation does not account for all the differences between the participation and the investment decision. Older employees are less likely to participate, but invest more, conditional on participation. This may be due to less familiarity with stock market investments among older workers, increasing the barrier to invest. Female employees were more likely to participate, but invested less, conditional on participation. We do not have a good explanation for this result but suspect that female employees were more willing to analyze the offering material they were sent, even though they may have on average fewer financial resources under control than their male counterparts.

35. This procedure makes two simplifying assumptions: First, we assume that the threshold levels are not functions of the other independent variables, and are the same for all individuals in a subset of individuals. Second, the

detailed in **Appendix C**, available from the authors.

The first column of **Table VII** shows the average threshold level estimates for different subsets of individuals. We find that currently employed male non-civil servants did not participate if their desired (latent) investment was smaller than FF 18,749. We also calculate the monetary values of bonuses, discounts and free shares foregone by non-participants.[36] In essence, we estimate how much money investors at the threshold apparently were willing to "leave on the table" by not participating. It appears that current male non-civil servants were willing to forgo benefits equal to 1.7 month's salary. In *ex post* terms, it is as if employees said that it was not worth their time to evaluate the offering at all unless they were going to invest a fairly sizeable amount. This interpretation is consistent with our salary and wealth results. Better-paid and wealthier workers are not only more likely to surpass this fixed cost threshold, but also to invest more, conditional on participating.

The empirical thresholds for other classes of eligible participants are also shown in **Table VII**. The thresholds (which control for salary levels, wealth, age and last job position) for male retirees and former non-retired employees were 43% and 70% higher than for currently employed men: FF 26,859 and 31,809. These higher thresholds are consistent with the observation that the fixed costs of analysis facing ex-employees were substantially higher than for current employees. This is also consistent with the explanation provided by management. Conditional on overcoming these thresholds, however, both groups invested more than current male workers. Our results are therefore consistent with a marketing explanation—less marketing leads to an increase in thresholds, which lowers adoption except among the most motivated potential buyers.

We find that the amount of money left on the table by forgoing the investment opportunity is smaller for former and retired employees, simply due to the fact that they were not allowed to invest in the two most financially attractive investments. This result may seem

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threshold levels are assumed to be additive across groups. For example, when the baseline threshold is estimated for male currently employed non-civil servants, then the threshold estimate for female currently employed civil servants is the sum of the baseline threshold and the incremental thresholds estimated for women and for civil servants.

36. The calculations make the illustrative assumption that the investor would have chosen a value-maximizing portfolio. Given the structure of the assets offered, this allows us to calculate the benefits the government had to offer to induce individuals to participate. For current employees, the salary-based constraint on the investment into the two long-lived assets has to be taken into account when calculating value-maximizing portfolios. Since former employees and retirees were only eligible for two of the four plans (*Simplix* and *Disponix*), foregone benefits are smaller in their case.

surprising given the higher estimated participation thresholds for former and retired employees, but is consistent with the idea of a non-monetary cost of analyzing the offering: Neither current nor former and retired employees knew the amount of benefits offered without first inspecting the offering documentation.

While our threshold story is plausible, we are open to alternative explanations for the opposite signs of the propensity to participate and the amount of investment. We could have mismeasured wealth more severely for ex-workers. For example, former workers may have been judged wealthy by our INSEE measure ("house-rich") but lacked financial assets ("cash-poor."). But, this would seem to suggest both lower levels of participation and lower levels of contribution as well. Similarly, ex-workers may have higher levels of risk aversion for whatever reason. But this seems somewhat implausible, since they left the safety of the France Telecom job status. And again, it would imply both lower levels of participation and lower contributions. Another possibility is that the differences in participation and investment amounts could be attributed to certain groups of employees attempting to "game" the system by requesting more shares than they actually wanted, in order to end up with a post-rationing amount they desired. However, given the facts in this situation, that seems unlikely.[37] While there are surely alternative explanations, the "threshold explanation" seems robust, if hard to prove. Furthermore, any explanation has to be consistent with the facts that (a) retirees and former employees were less likely to invest; and (b) conditional on investing, contributed more to the plans.

C. Type of offer

While most models of investor decision making examine portfolio allocations between cash and stock, we can examine the composition of the "stock" portfolio. In our model, investors allocate their financial assets among cash, the "market" (stocks orthogonal to their employer's stock), immediately transferable stock in their employer (like *Disponix*, which employees can

37. The rationing rules were not announced in advance, so it may have been difficult to place orders strategically. Further, we were told that employees were surprised that any rationing took place, suggesting that their requested investments were their desired investments. Nevertheless, suppose employees were completely prescient, and could predict how many shares they would be allocated conditional on their requests. It would then be appropriate to analyze the *post-rationing allocations* of shares rather than the original orders. When we repeated the truncated regressions in **Table VI, Panel B** using the *ex post* measure of wealth invested, the results were virtually identical to those we report in the table. This suggests that while gaming may have been a problem, it cannot explain the

immediately sell), restricted but discounted stock in their employer (like *Simplix* or *Abondix*, which offer large discounts but 2 and 5 year holding periods respectively), and a downside-protected investment in their employer (like *Multiplix*).

Given the myriad of rules on the employee stock offering, it is difficult to intuit what the "optimal" choice of portfolio might be. This is why we adapted a portfolio selection model to incorporate not only the full investment choice set, but also the restrictions that go along with the various choices. In general, we would expect the bulk of the portfolios to be invested in the most heavily-discounted choices (*Abondix* and *Multiplix*), and especially in *Multiplix*. *Multiplix* offers the employee (at least) a guaranteed 6.8% annual return on his money, and appreciation on 10 shares for a contribution equal to the cost of one discounted share.

Table V, Panel C reports the actual frequencies with which the different assets are chosen, conditional on participation. As predicted, the two long-horizon plans with large discounts were favored: *Abondix* is the most preferred package, followed by *Multiplix*.[38] We also analyze the frequencies of particular asset *combinations* by different groups of individuals. For current employees, pure *Abondix* is by far the most preferred choice, followed by the *Abondix-Multiplix* combination. Employees heavily weighted their portfolios to long-horizon/high discount offerings with all but 2.2% of eligible participating employees buying *Abondix*, *Multiplix* or both. The average participant selects a plan with a required holding period of 4.6 years, thus heavily tilting his portfolio to the long-horizon plans. In general, the average employee portfolio is very much like the utility-maximizing portfolios we derive from our model. In particular, investors seem undeterred by long holding periods, when these alternatives are heavily discounted.

While this broad result is generally consistent with a neoclassical model, there are substantial deviations from optimal portfolio choices. To understand these deviations, we study selections of *Abondix* and *Multiplix*. Both plans had a holding period of five years, so are comparable on this dimension. Ignoring the constraint that no more than one quarter of annual gross salary can be invested into *Abondix* and *Multiplix* combined, *Multiplix* dominates *Abondix:*

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inconsistency between the determinants of participation and investment amount.

38. The numbers in **Table V, Panel C** do not add to one because portfolios may contain multiple assets.

Multiplix offers more present value per Franc invested and is downside protected.[39] No (weakly) risk-averse investor should choose *Abondix* over *Multiplix* as long as the salary-based constraint is not binding.[40] This strong prediction will hold for any concave, non-decreasing utility function and is testable.

We examine those investors who selected a portfolio that includes some long-term assets (*Abondix* and/or *Multiplix)* and for whom the salary constraints would have allowed to substitute a share of *Multiplix* for *Abondix*. The first criteria ensures that we are looking at workers not deterred by long holding periods, and the second ensures that the employee was not precluded by program rules from holding *Multiplix*. By making this substitution, the investor could have increased the present value of his or her portfolio at no additional cost while simultaneously making the investment safer. Given the matching bonus structure of *Multiplix*, the first FF 2,000 allocated to *Multiplix* earns a guaranteed rate of return of 13.4% p.a. for five years.[41] For a risk-averse investor, this is as close to a "no-brainer" as possible.[42]

The results from this exercise are striking: There are 74,023 participants for which the relevant salary constraint is not binding, and of these 71,253, or 96%, purchase too many units of *Abondix* relative to *Multiplix*.[43] Even more striking, there are 47,136 investors in the sample for whom the salary-based constraint is not binding and who invest in *Abondix*, but do not invest in *Multiplix* at all. Conditional on their willingness to hold an asset with a five-year holding period, this choice is hard to reconcile with utility maximization. These suboptimal decisions are

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39. This is true unless we assume an implausibly low value for the volatility of the France Telecom stock. The only case under which *Abondix* would dominate *Multiplix* for a risk-neutral investor is the case where France Telecom substantially increases its dividend, its volatility is low, and the ex post stock price does not deviate substantially from the IPO price. For most risk averse investors, even this outcome would not permit *Abondix* to dominate *Multiplix*.

40. The situation is slightly more complicated. Since the 50% matching bonus on *Multiplix* is capped at FF 1,000, while the 100% *Abondix* bonus runs up to FF 3,000, there exists a small intermediate range in which it is marginally beneficial to add *Abondix* rather than *Multiplix* to the portfolio. The subsequent analysis takes this complication into account and identifies only those investors who could have increased the value of their portfolio by substituting *Multiplix* for *Abondix*.

41. For the first FF 2,000 invested into *Multiplix*, France Telecom offers a 50% matching bonus and a 25% guaranteed return over five years. Hence the guaranteed annualized return is given by $(1.5*1.25)^{1/5} = 13.4\%$ as long as the constraint on the maximum bonus amount does not bind (see **Table II**).

42. Also see the discussion of the relative values of *Abondix* and *Multiplix* on pages 5 and 6.

43. In order to test whether this strong violation of investor rationality is due to our misestimation of salary levels, we repeat the analysis requiring that an investor be further away from the salary-based constraint than necessary to purchase one unit of *Multiplix*. Since for 75% of the inefficient investors the estimated slack under the constraint is more than FF 10,079, the results are essentially the same.

economically significant: Ordering investors by the amount of money left on the table, the mean inefficient investor could have increased the value of his or her portfolio by FF 7,682 (37.2%) without changing the holding period of the portfolio or bearing any conceivable costs.[44] Since we can perform this test only on investors who invest small amounts relative to their salary income, we can only document this sub-optimal behavior among small and probably less sophisticated investors.

The failure to hold *Multiplix* by this group may demonstrate that investors are deterred by complicated offering schemes, again consistent with the notion that investors faced high fixed analysis costs. *Multiplix* offered employees an ability to invest up to FF 9,000, earn a guaranteed return of at least 6.8% per year (which was guaranteed by Crédit Lyonnais, a French bank), and then earn appreciation on 10 shares. In essence the investor was buying a bank deposit which paid at least 6.8% per year, plus ten at-the-money call options on France Telecom stock. These simple economics were cloaked in much more complicated legal language. For example, the *Multiplix* plan was structured so that the borrower legally "borrowed" money to buy nine additional share through the plan. However, this loan was like no other that the participants (or financial economists) have ever seen. The principal of the loan to be repaid was dependent on the price of the shares at the maturity of the loan, such that the *net payoff* was precisely the appreciation on the ten shares. While the plan documents included tables and language to elucidate the actual economics of *Multiplix*, it would not be difficult for an employee either to misinterpret the legal nuances of the plan, or be so put off by the details as to avoid it altogether. One of the clearer explanations of *Multiplix*, given in the *Guide de l'actionnaire salarié* (the employee shareholder guide) under the heading "The bank loan: A simple and safe means to finance your investment," read as follows:

> *At loan maturity or at the time of the selling of your shares, the bank guarantees the reimbursement of the loan and the interest by deduction from the proceeds of the sale of your shares.*

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44. The median inefficient investor could have increased the value of his portfolio by FF 8,573 (34%), and the 25% and 75% quartile improvements are FF 3,378 (9%) and FF 11,029 (67%) respectively. For 10% of the inefficient investors, the costless value increase would have been larger than FF 12,834 (77%), with a maximum of FF 30,055 (121%).

For the subset of employees who were willing to accept long holding periods and who were not at some binding constraint, we show this factor led them to shun the most attractive investment alternative. The fact that this tendency was strong among investors who invested less overall is consistent with our threshold story: The thresholds for analyzing *Multiplix* were higher than for other types of deals.[45]

Separately, the institutional structure of the France Telecom employee offering enables us to estimate the value that some employees put on liquidity—the ability to sell their France Telecom shares at will. We focus on former employees and retirees, who were restricted to the *Simplix* and *Disponix* plans. *Disponix* could be sold immediately after the offering, and gave a small amount of free shares and discounts. *Simplix* gave more free shares and discounts but had to be held for two years. (In order to receive the free shares, investors had to hold *Simplix* for three years and *Disponix* for one year.) In essence, ex-workers were given a pure choice of discounts versus holding period.

Of the 8,672 participating retirees and former employees, 82% chose to buy only *Simplix* offering high discounts but a two-year holding. As with the current employees, ex-workers were not deterred by longer holding periods. Only 6% chose pure *Disponix*, and 13% combined *Simplix* and *Disponix*. The investors who chose a mix of both types of shares reveal their marginal trade-off between portfolio value and liquidity. We calculate the change in portfolio value for the interior investors when (i) the total investment into *Disponix* is replaced by *Simplix* and (ii) the *Disponix* holding is reduced by one share, and the *Simplix* holding is increased by one share.[46] We find that the average "interior" investor trades off a 12.2% increase in portfolio value for a one-year increase in holding period. We cannot judge this behavior as suboptimal, but it gives a sense of the value that one subgroup places on holding restrictions.

Finally, our adapted portfolio selection model also produces predictions regarding how the composition of the optimal portfolio should vary across participants. Many of these

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45. *Multiplix* investors had to purchase at least one share in one of the other plans (see **Table II**). This may have contributed to the lack of popularity of *Multiplix* for employees. They may have felt that *Multiplix* compelled them to analyze two plans, not one. In this sense, it is perhaps understandable that the threshold for investing in *Multiplix* was higher. On the other hand, employees could have simply bought one share of *Disponix* or *Simplix* and focused the bulk of their analysis efforts and investment on *Multiplix*.

46. Since a unit of *Disponix* costs FF 182 and a unit of *Simplix* only FF 145.60, the difference of FF 36.40 is added to the new portfolio as cash holding.

predictions are the product of the heavily constrained nature of the offer. For example, while employees might strongly prefer *Multiplix* over *Abondix*, the former counts heavily against the constraint that no more than 1/4 of annual labor income can be invested into the two long-lived assets. Each one of the ten implicit calls in a unit of *Multiplix* counts as one share against the constraint, and hence an investor trades off one unit of *Multiplix* against ten units of *Abondix* whenever the constraint is binding. The result is that employees who intend to invest a large amount relative to their labor income will pass up on *Multiplix* and invest into *Abondix* only. **Panel C** of **Table III** reports the predictions of our model for one especially interesting functional characteristic of the portfolios: The fraction of the portfolio with downside protection (invested in *Multiplix*). The empirical analysis is conducted only for employees who chose to contribute and is limited to current employees (as former employees and retirees did not have access to the downside protected plan.) [47]

Table VIII analyzes the fraction of the portfolio invested in *Multiplix*, the plan with downside protection. The dependent variable is the downside-protected proportion of the investors' personal contributions, and the results are from a double-censored Tobit regression. We predicted that the demand for downside protection would be greater for more risk averse employees, those with more firm specific human capital and those with greater labor income. Consistent with the predictions, we find that the downside-protected share is increasing in tenure and that civil servants, whom we expect to be more risk averse, purchase more *Multiplix*. However, the tenure effect is barely significant. Higher labor income tends to increase the downside-protected share, again consistent with the model predictions. Given the limitations on the amount that employees could invest into *Multiplix*, our model predicts a strong negative coefficient on wealth. This prediction is confirmed by the negative coefficient on the INSEE wealth measure. In general, these results on the composition of the portfolio are broadly consistent with our model.

We were concerned that the regression results could reflect the institutional constraints on personal contribution rather than individual preferences. **Table VIII, column B** presents the

47. We performed a similar analysis for the average required holding period chosen by the France Telecom employees, and found that the model predictions were generally consistent with the empirical results for this portfolio characteristic. These results are not reported.

results when the dependent variable is changed to the ratio of chosen downside protection to maximum feasible downside protection. The maximum feasible downside protection is calculated for each investor individually, using his or her chosen level of personal contribution and an estimate of his or her salary level-based constraint. Again we have to discard employees at subsidiaries of France Telecom for this analysis due to lack of salary data.[48]

The results in column four diverge for two explanatory variables from the results in column three: First, the negative effect of wealth on downside protection is no longer significant. This finding is consistent with the model prediction that wealthy investors are likely to be constrained and have to reduce their investment into *Multiplix*. Using the ratio of chosen to maximum feasible downside protection as dependent variable then weakens the negative effect of wealth. Secondly, the positive effect of non-civil servant tenure becomes small and insignificant. This loss of significance is due to the elimination of investors at France Telecom subsidiaries, and also occurs when we exclude these investors from the regression in column three. It appears that the firm-specific human capital effect captured through tenure is stronger for employees at subsidiaries than for employees at the parent company. This difference could be attributed to the fact that adverse effects on employees of the privatization are more likely to be felt at subsidiaries of France Telecom than at the parent company. Employees at subsidiaries may have been concerned about France Telecom divesting subsidiaries after the privatization, and may enjoy less trade union protection than their counterparts at the parent company.[49]

V. Conclusions

Our goal in this paper was to better understand the response to the employee stock offering during the partial privatization of France Telecom. In retrospect, the France Telecom offering was quite successful. The French State sold 23% of France Telecom on October 20, 1997, of which one-tenth (or 2.3% of France Telecom's shares) were earmarked for the employee offering. The offer price for individual investors was set at FF 182, while the price for

48. Running the regression in **Table VIII** using ordinary least squares yields qualitatively similar results.

49. When we eliminate employees at France Telecom subsidiaries from the participation and personal contribution regressions in **Table VI**, the effect of non-civil servant tenure stays negative and significant, but the effect on personal contribution becomes smaller in magnitude. This observation is consistent with the interpretation that employees at subsidiaries are more concerned with the effect of the privatization on their firm-specific human

institutional investors was FF 187. The individual investor tranche was oversubscribed by 2.91 times, while the institutional investor tranche was oversubscribed 20 times.[50] As we have seen, more than 60% of the eligible current and former employees of France Telecom participated in the offering. The first day closing price was FF 206.50, for a one-day return of 13.5% from the individual investor offer price.[51]

The partial privatization of France Telecom offers an interesting setting for analyzing the investment decisions of individuals with human and financial capital at risk. We adapt a standard portfolio selection model to capture the essential features of the decision facing employees, and compare the predictions of our model to the observed participation of France Telecom employees.

At one level, the standard portfolio selection model fails miserably, in that it predicts 100% participation. It also fails to explain why so many investors who were willing to accept long holding periods failed to put at least some of their funds in *Multiplix*, an asset that dominates the other highly discounted and restricted asset.

At another level, however, the model does a quite nice job in explaining the cross sectional variation in investment rates, and to a lesser degree the choice of which employees invested in *Multiplix*. We expected that employees who are better able and willing to bear risk will participate in the stock offerings. We find evidence to this effect. Wealthier workers and those who are better paid are more likely to buy shares in France Telecom, consistent with the predictions of the model, and invest more in the firm. They also invest more in short-horizon assets and less in *Multiplix*, given the plan limitations on their investments in long-horizon assets.

However, we find little evidence that human capital has a sizeable impact on investment decisions. Human capital considerations suggest that former employees should have been the most eager participants, followed by currently employed civil servants, and finally by non-civil servants. We find the opposite pattern. Among current employees, we do find some evidence of

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capital.

50. Employees could submit their requests between October 7 and October 17; non-employee retail investors could do so between October 7 and October 14.

51. The exchange rate around this time was approximately 6 FF/1$US. The percentage of the company sold and the first-day return are somewhat lower than the median values reported in Jones, Megginson, Nash, and Netter [1999].

human capital effects, but they are small: One standard deviation of tenure above the mean is associated with 0.6% less likelihood of participation, and with about 12% less personal contribution, conditional on investing.

Another surprising finding is the divergence in the determinants of the likelihood and amount of investing. We interpret this as evidence of a fixed cost of analysis that gives rise to a threshold effect. If we acknowledge that making investment decisions is hard work, and has some fixed cost element of analysis, then we introduce a friction that gives rise to this effect. It seems that a threshold level of desired investments must be attained for participation to occur, perhaps because of the cost to employees of analyzing the offering. We attempt to measure the size of these thresholds, and find that employees may forgo benefits equal to one to two months of salary by failing to participate. The higher threshold required to understand *Multiplix* is consistent with its lower adoption. We interpret our finding as evidence reminding us of the difficulty that investors have in making financial decisions, and the attendant role for advisors or marketers. This explanation addresses not only the divergence in the cross-sectional determinants of participation and investing, but also the lower-than-expected investing in *Multiplix*.

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Table I

Description of the France Telecom privatization offerings to employees

Summary of the characteristics of the four share programs offered to France Telecom employees during its privatization.

Program	Discount[b]	Matching Bonus[c]	Free Shares[d]	Payment Options[e]	Guarantees	Value Received for FF 9,000 (% Discount)[f]
Abondix[a] **5 years required holding period**	20% off of offer price	‣ 100% for first FF 3,000 ‣ 50% for next FF 6,000 ‣ 25% for next FF 66,000	‣ One for each share purchased up to FF 3000 in free shares ‣ One for each four shares purchased for the next FF 3,860 in free shares	‣ In cash ‣ In three payments over two years ‣ In 36 monthly payments ‣ Through transfer from company pension plan	None	FF 26,250 (66%)
Multiplix[a] **5 years required holding period**	20% off of offer price	‣ 50% for first FF 2000 ‣ Plus 9 x (personal contribution and bonus) as a guaranteed bank loan. ‣ The investor forgoes dividends and tax credit	None	‣ In cash ‣ In three payments over two years ‣ In 36 monthly payments	‣ 25 % return over five years on personal contribution ‣ Guaranteed repayment of the bank loan	30% Volatility: FF 39,962 (77%) 25% Volatility: FF 35,701 (75%) 20% Volatility: FF 31,387 (71%) 15% Volatility: FF 27,048 (67%)
Simplix **2 years required holding period (3 years for free shares)**	20% off of offer price	None	‣ One for each share purchased up to FF 3,000 in free shares ‣ One for each four shares purchased for the next FF 3,860 in free shares	‣ In cash ‣ In three payments over two years ‣ In 36 monthly payments	None	FF 18,750 (52%)
Disponix **No required holding period (1 year for free shares)**	None	None	‣ One for each three shares bought up to FF 6,860 in free shares	In cash only	None	FF 12,000 (25%)

Notes:

a. *Abondix* and *Multiplix* are held in tax-free retirement accounts. The bonus, capital gains and paid dividends are therefore tax-free. Social security contributions (CSG/CRDS) are applicable.

b. The discount is taken of the retail IPO price of FF 182, so that employees only paid FF 145.60 for each one of the discounted assets.

c. The matching bonus is added to the employee's personal investment into the asset. The total bonus added to personal investments into *Abondix* and *Multiplix* combined cannot exceed FF 22,500, and the *Abondix* bonus is allocated before the *Multiplix* bonus.

d. The free shares only vest if the employee holds the assets through the required holding period. The free shares have a global limit of FF 6,860 for all share programs combined. Free share payments will be made to *Disponix* first, then *Simplix*, and last, *Abondix*.

e. The payment plans are interest free.

f. The portfolio values for a FF 9,000 personal investment are calculated assuming a five-year holding period and hence do not take into account when the free shares are received. The calculations for Multiplix assume a risk-free rate of 5%, a dividend rate of 3.6%, and the annual volatilities as stated in the table.

Table II

Constraints limiting employees' total investment and choices between the four investment vehicles

Constraints imposed on the investment choices offered to the current and former employees of France Telecom. The most severe constraint on investor behavior is presented by the rule that no more than 1/4 of annual salary can be invested into the long-lived assets. We find only 169 individuals in the data for whom the FF 9,000 constraint on the *Multiplix* investment binds, but estimate the 1/4 annual salary constraint to be binding for 8,375 individuals. Only 265 individuals requested the maximum amount of shares of FF 823,200.

Asset(s)	Constraints
Abondix* and *Multiplix	Total contributions to these two programs combined could not exceed 1/4 of the employees' gross France Telecom salary. The "loan" implicit in *Multiplix* would count towards this limit. Also, the total bonus added to investments into these assets is capped at FF22,500.
Multiplix	The total personal investment into *Multiplix* could not exceed FF 9,000. Also, before buying *Multiplix*, the employee must have bought at least one share in one of the other programs.
All	The maximum request for shares could not exceed FF 823,200. The bonus and the bank loan implicit in *Multiplix* counted towards this total, while free shares were excluded.
All	Were the employee offering to be oversubscribed, rationing rules would be determined and announced by France Telecom and the government at that time. Formal allocation rules were not announced in advance.

Table III

Predictions of a standard portfolio selection model for the France Telecom offering

Summary of the predictions of a stylized three-period portfolio selection model with power utility and intermediate consumption.

Panel A: Participation

Variable	Predicted Effect on Participation
All current and former employees are predicted to participate.	

Panel B: Level of Investment

Variable	Predicted Effect on Investment	
Risk Aversion	-	Investment falls.
Financial Wealth	+	Investment increases.
Labor Income (Human Capital)	+	Investment increases (at a decreasing rate). The effect is weaker than for financial wealth because of the positive correlation between labor income and stock prices.
Correlation between Labor Income and Stock Price	-	Investment falls.
Idiosyncratic Risk in Labor Income	+/-	Ambiguous effect on investment. The risk in labor income discourages additional risk taking in the financial portfolio. At the same time precautionary savings increase, driving up investment. The net effect on investment is positive for low risk aversion and negative for high risk aversion.

Panel C: Percentage of Portfolio Protected with Puts (Invested in *Multiplix*)

Variable	Predicted Effect on *Multiplix* Investment	
Risk Aversion	+	Downside protected portion increases.
Financial Wealth	-	Downside protected portion decreases. This effect is due to (i) the constraint that no more than 1/4 of annual labor income can be invested into the two long-lived assets, and (ii) to the smaller portion of total wealth in firm-specific human capital.
Labor Income (Human Capital)	+	Downside protected portion increases. This effect is due to the larger portion of total wealth in firm-specific human capital.
Correlation between Labor Income and Stock Price	+	Downside protected portion increases. This effect is due to the increased exposure to stock price risk through firm-specific human capital.

Table IV
Descriptive statistics of characteristics of individuals eligible to participate in France Telecom employee share offerings

Information about the 205,076 employees eligible to participate in the France Telecom share offering scheme in 1997. **Panel A** reports age and job tenure (date of employment through time of offer.) **Panel B** shows the breakdown by type of participant, job category, and gender. **Panel C** presents the sample by salary grade. Salary grade code 11 is the lowest and 46 is the highest salary level. Salary grades 11 to 23 indicate ordinary employees and technicians. In this group the average monthly salary in 1997 was FF 12,562 for men and FF 11,928 for women. 31 to 33 are middle managers, with an average salary of FF 17,104 for men and FF 16,059 for women. Finally, 41 to 46 are managers, with an average monthly salary of FF 25,445 for men and FF 22,548 for women. The numbers of observations in the different categories differ because of missing data.

Panel A

	Age (years)	**Job tenure (years)**
Mean	44. 5	19.9
Standard Deviation	10.4	10.5
Number of observations	200,216	200,606

Panel B

Type of employee	**Number**	**Job category**	**Number**	**Sex**	**Number**
Current employee	174,091	Civil servant	143,781	Male	124,444
Former employee, not retired	8,628	Non civil servant	38,010	Female	80,146
Retiree	22,357				
Total	205,076	Total	181,791	Total	204,590

Panel C

Employee Type (Average Monthly Salary)	**Salary Grade**	**Number**
Ordinary Employees and Technicians (FF 12,562 for men and FF 11,928 for women)	11	1,102
	12	3,066
	13	17,313
	21	41,514
	22	52,000
	23	24,212
Middle Managers (FF 17,104 for men and FF 16,059 for women)	31	4,128
	32	6,559
	33	12,167
Managers (FF 25,445 for men and FF 22,548 for women)	41	4,651
	42	6,981
	43	3,200
	44	1,378
	45	650
	46	161
Executives (n.a.)	-	130
Employees at Subsidiaries:		
Clerical/Technical Employee (n.a.)	-	9,207
Foreman (n.a.)	-	2,664
Manager (n.a.)	-	7,189
Unknown (n.a.)	-	2,650
	Total	200,925

Table V
Offering participation statistics

Panel A shows participation ratios and total number of eligible employees by class of employee: Current, former, retired, civil servant and non-civil servant. **Panel B** shows average personal contributions in Francs of each employee class, and the personal contribution as a fraction of monthly salary. This panel considers only employees who chose to participate in the offering, thus represents contributions conditional on some contribution. The salary levels are estimated as described in the text. The ratios for retirees and not-retired former employees are calculated on the basis of their last salary at France Telecom. **Panel C** shows participation percentages for each of the four assets broken down by employee type, again conditional on participation. Retirees and former employees were not allowed to purchase *Abondix* or *Multiplix*. The percentages do not add up to one as employees could participate in multiple share schemes.

Panel A: Participation Ratios

	All potential investors	**Current employees**	**Currently employed civil servants**	**Currently employed non-civil servants**	**Retirees**	**Former employees (not retired)**
Participation ratio	62.8%	68.0%	66.5%	73.5%	37.8%	21.6%
Eligible number of individuals	205,076	174,091	135,891	38,200	22,357	8,628

Panel B: Personal Investments

	All investors	**Current employees**	**Currently employed civil servants**	**Currently employed non-civil servants**	**Retirees**	**Former employees (not retired)**
Average personal contribution	26,554	26,337	22,597	40,404	25,116	44,253
Average personal contribution / monthly salary	145%	144%	139%	182%	150%	242%
	Current ordinary employees and technicians (Grades 11-23)		**Current middle managers (Grades 31-33)**		**Current managers (Grades 41-46)**	
Average personal contribution / monthly salary	118%		157%		265%	

Panel C: Assets and Asset Combinations

	All investors	**Current employees**	**Currently employed civil servants**	**Currently employed non-civil servants**	**Retirees**	**Former employees (not retired)**
	Assets demanded					
Abondix	90.4%	97.2%	98.2%	93.6%	n/a	n/a
Multiplix	40.9%	44.4%	45.6%	40.1%	n/a	n/a
Simplix	21.8%	16.4%	15.3%	20.5%	92.8%	94.5%
Disponix	11.5%	11.0%	10.9%	11.1%	16.7%	22.5%
	Most popular asset combinations					
Abondix only	41.2%	45.2%	45.2%	45.4%	n/a	n/a
Simplix only	9.4%	1.5%	0.8%	4.2%	66.9%	77.6%
Disponix only	0.8%	0.4%	0.4%	0.6%	4.5%	5.6%
Abondix-Multiplix	28.7%	32.3%	33.3%	28.4%	n/a	n/a
Abondix-Simplix	3.9%	4.0%	3.8%	4.8%	n/a	n/a
Simplix-Disponix	1.4%	0.3%	0.2%	0.8%	9.3%	16.8%
Abondix-Multiplix-Simplix	5.2%	5.9%	5.9%	6.0%	n/a	n/a

Table VI
Analysis of participation in France
Telecom employee share offering program

Panel A shows the Probit analysis, while **Panel B** shows the truncated regression results. In **Panel A,** the dependent variable is a dummy variable that equals one if the employee requested any shares under any of the programs, and in **Panel B** the dependent variable is total employee contribution. The independent variables are tenure, age, age squared, claimant category, salary grade, estimated salary level and job category (not reported). The claimant category dummies are to be interpreted relative to current employees and the salary grade dummies relative to salary level 11, the lowest. Salary levels can only be estimated for salary grades 11 to 46, and salary grade dummies are included for employees at France Telecom subsidiaries. Estimated salary levels and the wealth measure have been divided by 10,000.

PANEL A

		Probit Regression		**Probit Regression**	
		Coefficient	***t*-stat**	**Coefficient**	***t*-stat**
Constant		-0.9184	-14.68	-1.9554	-38.69
Tenure					
	current civil servants	0.0043	5.50	0.0110	14.84
	current non-civil servants	-0.0026	-2.14	-0.0002	-0.21
	former employees	0.0163	9.34	0.0227	13.06
Age		-0.0104	-14.22	-0.0164	-23.47
Age squared		-0.0001	-2.27	-0.0000	-0.81
Civil servant dummy		-0.2201	-10.75	-0.1482	-7.53
Female dummy		0.1484	20.36	0.2551	35.35
Retiree dummy		-0.8422	-14.03	-0.8636	-14.40
Former employee dummy		-1.7318	-47.79	-1.7955	-49.43
INSEE wealth measure		0.0317	6.69	0.0353	7.47
INSEE wealth measure squared		-0.0007	-6.08	-0.0008	-6.92
Salary levels (estimated)				0.1126	92.28
Salary grades (FT)					
	11 (lowest)				
	12	0.6182	11.32		
	13	0.6285	12.59		
	21	0.9463	19.33		
	22	1.1008	22.34		
	23	1.4327	28.63		
	31	1.6064	29.72		
	32	1.7504	33.29		
	33	1.6859	33.10		
	41	2.1134	37.79		
	42	1.8977	36.66		
	43	2.0452	35.71		
	44	2.4434	32.03		
	45	2.1619	25.01		
	46 (highest)	2.7471	13.82		
…at subsidiaries*	Clerical/Technical	0.7598	15.40	1.6469	51.93
	Foreman	1.3774	24.70	2.2997	54.54
	Manager	1.7225	33.35	2.6663	72.53
	Indeterminate	2.0927	27.30	2.9338	45.13
	N	**167,064**		**167,064**	
	Pseudo-R^2	0.0995		0.0914	

PANEL B

		Truncated regression		Truncated regression	
		Coefficient	***t*-stat**	**Coefficient**	***t*-stat**
Constant		22324	4.57	-34240	-11.83
Tenure					
current civil servants		-267	-5.75	-435	-9.63
current non-civil servants		-460	-6.93	-402	-6.06
former employees		-411	-2.84	-439	-3.04
Age		198	4.37	372	8.43
Age squared		-9	-3.51	-8	-3.18
Civil servant dummy		-1586	-1.49	-1066	-1.01
Female dummy		-5490	-13.02	-976	-2.28
Retiree dummy		5970	1.14	2144	0.41
Former employee dummy		7722	2.31	9139	2.73
INSEE wealth measure		-1172	-4.25	-1326	-4.79
INSEE wealth measure squared		61	8.69	68	9.57
Salary levels (estimates)				3993	72.16
Salary grades (FT)					
	11 (lowest)				
	12	1662	0.35		
	13	2262	0.52		
	21	5152	1.20		
	22	9009	2.10		
	23	10996	2.54		
	31	11808	2.66		
	32	14681	3.35		
	33	21473	4.95		
	41	25980	5.91		
	42	44893	10.36		
	43	64107	14.47		
	44	90171	19.37		
	45	119537	23.09		
	46 (highest)	165104	22.97		
…at subsidiaries*	Clerical/Technical	7985	1.83	64196	36.55
	Foreman	16446	3.62	72963	33.19
	Manager	61855	14.20	117945	64.84
	Indeterminate	28679	6.00	85252	33.73
	N	**111,912**		**111,912**	
	Adjusted R^2	0.0918		0.0836	

*Indeterminate refers to employees at both France Telecom and subsidiaries.

Table VII
Threshold levels of investment and foregone benefits

The first column shows the threshold level estimates for different subsets of individuals. A value of FF 18,749 for the reference group of currently employed male non-civil servants implies that individuals of this group have not participated if their desired (latent) investment is smaller than this threshold. **Appendix C** (available from the authors) describes the methodology used to calculate these thresholds. The remaining columns use the thresholds to calculate the monetary value (in bonuses, discounts and free shares) an investor whose latent demand is just below the threshold has foregone. For current employees, the salary-based constraint on the investment into the two long-lived assets has been taken into account. The threshold levels are calculated for three different gross salary levels, corresponding to the averages for ordinary employees / technicians, middle managers and managers. The free benefits for retirees and former employees are calculated from the two short-lived assets only, and no salary-based constraints apply.

Employee characteristic	**Estimated threshold in French Francs**	**Corresponding free benefits foregone by representative employees (annual salary) in French Francs**		
		Average Ordinary Employee and Technician (147,000)	Average Middle Manager (198,000)	Average Manager (288,000)
Currently employed male non-civil servant	18,749	26,213	29,401	34,921
Currently employed female non-civil servant	12,632	24,551	27,657	32,055
Currently employed male civil servant	18,201	26,215	29,403	34,923
Retiree and male non-civil servant	26,859	15,182		
Former employee and male non-civil servant	31,809	16,421		

Table VIII

Chosen downside protection as a function of employee characteristics

Two-sided censored Tobit regressions for downside protection as a function of employee characteristics. The dependent variable in the first column is the fraction of the employee's personal contribution invested in *Multiplix*. The dependent variable in column two is the ratio of chosen to maximum feasible downside protection. This analysis is conducted only for employees who chose to contribute and is limited to current employees (former employees and retirees were not eligible for long-term plans, including *Multiplix*). The independent variables are tenure, age, age squared, claimant category, the INSEE wealth measure, salary grade, and job category (not reported). The claimant category dummies are to be interpreted relative to current employees and the salary grade dummies relative to salary level 11, the lowest. The INSEE wealth measure has been divided by 10,000. Indeterminate refers to employees at both France Telecom and subsidiaries.

	Downside Protection			
	Chosen downside protection		Ratio of chosen to max. feasible downside protection	
	Coefficient	*t*-stat	Coefficient	*t*-stat
Constant	-0.1075	-4.9	-0.2464	-4.98
Tenure				
current civil servants	0.0004	1.79	0.0018	3.64
current non-civil servants	0.001	3.33	0.0006	0.61
Age	-0.0019	-9.05	-0.0036	-7.12
Age squared	-0.0002	-14.96	-0.0004	-14.36
Civil servant dummy	0.0239	5.01	0.0496	4.30
Femal dummy	-0.023	-12.25	-0.0678	-15.63
INSEE wealth measure	-0.0012	-4.05	-0.0007	-0.98
Salary grades (FT)				
11 (lowest)				
12	0.0244	1.03	0.0607	1.15
13	0.0151	0.68	0.0540	1.09
21	0.0401	1.84	0.1006	2.06
22	0.0773	3.55	0.1962	4.02
23	0.1023	4.68	0.2626	5.35
31	0.1078	4.84	0.2606	5.22
32	0.1268	5.75	0.3087	6.24
33	0.1248	5.69	0.3154	6.41
41	0.1355	6.13	0.3412	6.88
42	0.135	6.17	0.3716	7.58
43	0.1425	6.42	0.4145	8.34
44	0.1546	6.72	0.4852	9.44
45	0.1485	5.91	0.5437	9.69
46 (highest)	0.1167	3.4	0.5606	7.36
Clerical/Technical	0.0695	3.14		
Foreman	0.1195	5.26		
Manager	0.1281	5.82		
Indeterminate	0.0543	2.22		
N	**108,298**		**99,044**	

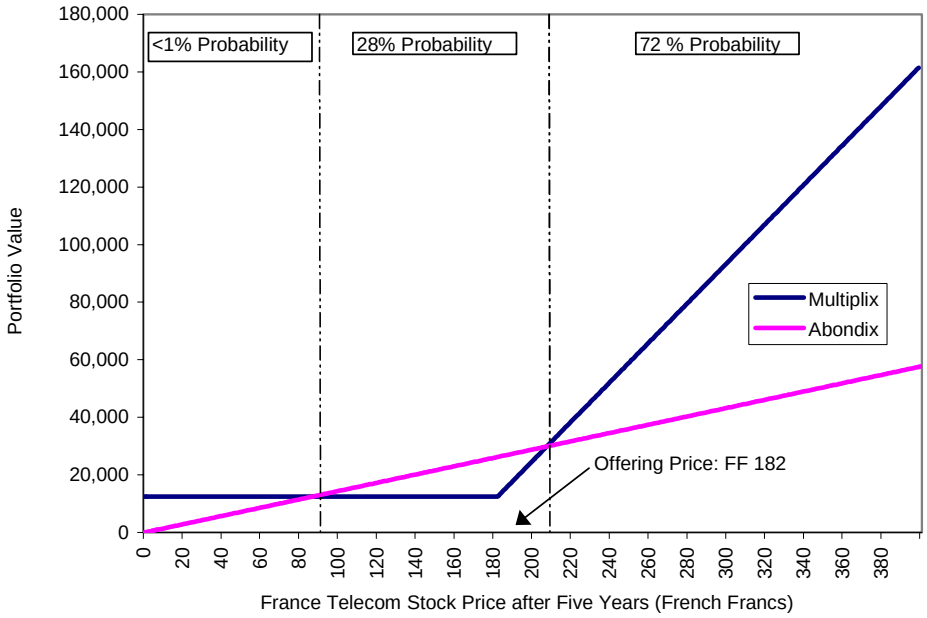


Figure I

Payoff of *Multiplix* vs. *Abondix* for the maximum allowed *Multiplix* investment amount

Final portfolio value after five years of an initial FF 9,000 investment in either *Abondix* or *Multiplix*, including all bonuses and free shares, assuming that the dividend plus tax credit yield on France Telecom is 3.6%. The illustrative *ex ante* probability ranges for the final stock price are calculated assuming log-normally distributed stock returns, a 5% risk-free rate, a 6% equity premium on France Telecom stock, and a 20 percent annualized volatility for the stock return. Calculations of the *ex-ante* values of the different packages are reported in the last column of Table I.

Appendix A: Excerpts from the Employee Offering Prospectus

Exemples indicatifs d'investissement dans la formule Abondix

Ces exemples sont fournis à titre indicatif pour faciliter la compréhension.

La base de calcul est un prix OPF = 200 F, soit un prix de vente pour le personnel de 200 F – 20 % = 160 F.

Le prix de 200 F n'est retenu qu'à titre d'exemple. Le prix réel sera fixé à l'intérieur de la fourchette de prix publiée lors du lancement de l'opération.

Apport personnel envisagé	5 000 F	10 000 F	20 000 F
Abondement théorique	4 000 F	6 250 F	8 750 F
Souscription théorique	9 000 F	16 250 F	28 750 F
Nombre entier d'actions achetées à 160 F	56	101	179
Souscription effective	8 960 F	16 160 F	28 640 F
= dont apport personnel	4 973 F	9 928 F	19 912 F
= dont abondement	3 987 F	6 232 F	8 728 F
CSG/CRDS* à payer sur abondement	148 F	231 F	323 F
Montant à verser par le souscripteur (CSG/CRDS incluses)	5 121 F	10 159 F	28 235 F
Versement en 36 mensualités de :	142 F	282 F	562 F
Actions gratuites attribuées (après 3 ans)	27	38	42
Total des actions détenues au bout de 3 ans	83	139	221
soit un prix de revient par action de :	62 F	73 F	92 F
Valeur de revente potentielle au bout de 5 ans (hors fiscalité à l'échéance) :			
■ si l'action a augmenté de 30 %	21 580 F	36 140 F	57 460 F
soit un gain de :	+ 321 %	+ 256 %	+ 184 %
■ si l'action est restée stable	16 600 F	27 800 F	44 200 F
soit un gain de :	+ 224 %	+ 174 %	+ 118 %
■ si l'action a baissé de 30 %	11 620 F	19 460 F	30 940 F
soit un gain de :	+ 127 %	+ 92 %	+ 53 %

Exemple pour un apport de 10 000 F

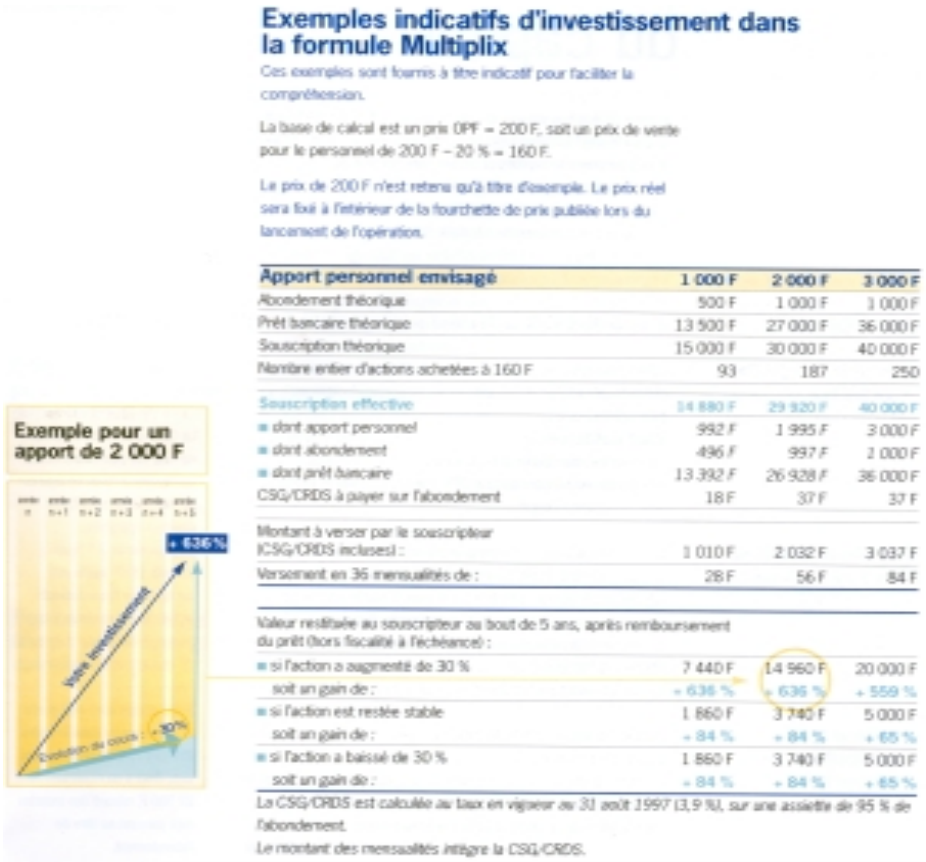
+256 %

Votre investissement

Evolution du cours -30%

Le nombre maximal d'actions gratuites dans cette formule, et pour cette hypothèse de prix de l'OPF = 200 F, est de 42 actions. En effet, le nombre maximal d'actions gratuites dépend du prix de l'action : à titre d'exemple, il serait de 57 actions pour un prix OPF de 150 F et de 85 actions pour un prix OPF de 100 F. Néanmoins, les valeurs de revente potentielles seraient équivalentes à celles mentionnées dans le tableau ci-dessus.

La CSG/CRDS est calculée au taux en vigueur au 31 août 1997 (3,9 %) sur une assiette de 95 % de l'abondement. Le montant des mensualités intègre la CSG/CRDS.



Exemples indicatifs d'investissement dans la formule Multiplix

Ces exemples sont fournis à titre indicatif pour faciliter la compréhension.

La base de calcul est un prix OPF = 200 F, soit un prix de vente pour le personnel de 200 F – 20 % = 160 F.

Le prix de 200 F n'est retenu qu'à titre d'exemple. Le prix réel sera fixé à l'intérieur de la fourchette de prix publiée lors du lancement de l'opération.

Apport personnel envisagé	1 000 F	2 000 F	3 000 F
Abondement théorique	500 F	1 000 F	1 000 F
Prêt bancaire théorique	13 500 F	27 000 F	36 000 F
Souscription théorique	15 000 F	30 000 F	40 000 F
Nombre entier d'actions achetées à 160 F	93	187	250
Souscription effective	14 880 F	29 920 F	40 000 F
= dont apport personnel	992 F	1 995 F	3 000 F
= dont abondement	496 F	997 F	1 000 F
= dont prêt bancaire	13 392 F	26 928 F	36 000 F
CSG/CRDS à payer sur l'abondement	18 F	37 F	37 F
Montant à verser par le souscripteur (CSG/CRDS incluses) :	1 010 F	2 032 F	3 037 F
Versement en 36 mensualités de :	28 F	56 F	84 F
Valeur restituée au souscripteur au bout de 5 ans, après remboursement du prêt (hors fiscalité à l'échéance) :			
■ si l'action a augmenté de 30 %	7 440 F	14 960 F	20 000 F
soit un gain de :	+ 636 %	+ 636 %	+ 559 %
■ si l'action est restée stable	1 860 F	3 740 F	5 000 F
soit un gain de :	+ 84 %	+ 84 %	+ 65 %
■ si l'action a baissé de 30 %	1 860 F	3 740 F	5 000 F
soit un gain de :	+ 84 %	+ 84 %	+ 65 %

Exemple pour un apport de 2 000 F

+ 636 %

Votre investissement

Evolution du cours -30%

La CSG/CRDS est calculée au taux en vigueur au 31 août 1997 (3,9 %), sur une assiette de 95 % de l'abondement.

Le montant des mensualités intègre la CSG/CRDS.

The left column is an excerpt from the offering material for *Abondix*, the heavily discounted asset with a five-year holding period. It contains three sample calculations for personal investments of FF 5,000, FF 10,000 and FF 20,000, and reports the matching bonus paid by France Telecom ("abondement") and the resulting total investment ("souscription théoretique"). It also shows the number of free shares to be delivered, and the total number of shares owned. At the bottom of the table, the final portfolio values and total returns for three different ending stock price scenarios after five years are displayed. For a personal investment of FF 10,000, the employee receives a total five-year return of 256% if the stock price appreciates by 30%, a return of 174% if the stock price is unchanged, and a return of 92% if the stock price falls by 30%. The right column shows similar examples and calculations for *Multiplix*, the downside protected asset with a five year holding period

NOTE: Appendices B and C will be made available from the authors, and would not necessarily be included in the publication version of the paper.

Appendix B
Setup of a simple model of portfolio selection

Our stylized three-period model provides intuition and testable predictions of the determinants of portfolio choice in a setting with risky labor income, incomplete markets and a binding choice of holding period. Markets are incomplete along three dimensions: Firstly, there is no borrowing at either the risky or riskless rate. This extends the liquidity constraints that have gained prominence in the literature on precautionary savings (Deaton [1991], Browning and Lusardi [1996]). Second, idiosyncratic labor income risk is not insurable (Bodie, Merton and Samuelson [1992], Bertaut and Haliassos [1997], Viceira [2001]). Since labor income is exogenous in our model, the associated risk is related to the concept of unavoidable background risk (Gollier and Pratt [1996]). Finally, there are no markets in the long-lived assets between the date of purchase and the maturity date.

There are two distinguishing characteristics of our model. First are the state-dependent period two budget constraints: An investor cannot sell any of the long-lived assets purchased in period one to finance consumption or new investments in period two. Thus the period two consumption and investment decision depends on three factors: The amount of consumable financial wealth, realized period-two labor income, and the value of and composition of the non-consumable portion of financial wealth. Second are the numerous discounts, matching bonuses and free shares as well as the constraints on the amounts that can be invested. It is not clear whether the general predictions from the portfolio selection literature continue to hold with this unusual investment opportunity set, which we therefore model explicitly.

Worker-investors choose their investment and consumption in three periods, subject to shocks to both risky financial assets and risky labor income. The investment choice set -modeled to closely reflect the choices facing the France Telecom workers- includes the assets from the France Telecom offering and the standard risk-free asset and a risky asset unrelated to France Telecom (e.g. an investment in equities unrelated to France Telecom).

In the first two periods, the investor decides about his current consumption and about the composition of his financial portfolio. In period one, the investor has the

choice between five different assets. The first asset is the standard risk-free bond. The second asset is a slightly discounted share in France Telecom. The share can be traded in period 2, and is meant to represent a simplified version of the *Disponix* and *Simplix* products, which have short holding periods in exchange for reduced purchase discounts.[1] To capture the discounts, the investors receive free shares as a function of the number of shares purchased based on the actual terms of the *Disponix* offering.

Additionally, there are two illiquid, long-lived assets based on the France Telecom stock. These assets cannot be sold in the intermediate period, such that any investment has to be held until period three. The first illiquid asset, *Abondix*, is nothing more than the standard France Telecom stock, sold at a 20% reduced price. *Abondix* also comes with a matching bonus and delivers a number of free shares as a function of the number of units purchased. The second long-lived asset, *Multiplix*, is downside protected: Investors have to pay the same price as for *Abondix* and are guaranteed a return of 25% on their personal investment in period three. On top of the guaranteed repayment, investors receive a matching bonus in period one and ten times the positive difference between the period three share price and the period one share price as final payoff. *Multiplix* thus delivers the upside on ten shares for each share purchased, and the guaranteed personal investment is augmented by an additional matching bonus.[2]

The model takes into account the rules applied to the granting of bonuses and free shares in the offering, and incorporates the constraints put on the amounts that can be invested into the long-lived assets.[3]

Finally, the period one investment opportunity set contains a risky asset unrelated to France Telecom. This captures the possibility to invest into the stock market or other risky assets independently from the France Telecom offering. Realistically, one would have to take into account that the French stock market, and probably most risky assets available to French retail investors, are correlated with the return on the France Telecom

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1. In reality, *Disponix* and *Simplix* have different number of free shares, purchase discounts, and holding period tradeoffs, that we do not adequately capture in our simple model. We make this simplification in order to concentrate on the longer-lived assets and to make the model more tractable.
2. For simplicity, we ignore tax considerations and subsidized financing.
3. The rules under which the discounts, bonuses and free shares are granted as well as the relevant

stock. Instead we make the simplifying assumption that the return on the unrelated risky asset is orthogonal to the return on the France Telecom stock.

In period two, the investor has to hold onto any illiquid assets *Abondix* and *Multiplix* bought in period one. The investor then faces the standard consumption-savings decision, and has to allocate any additional savings between the two short-term risky and the riskless asset. The only assets available for investment in period two are risk-free bonds, standard France Telecom shares and the independent risky asset. We assume that the investor receives no utility from bequests and consumes all his wealth in period three. The uncertainty in our model unfolds as follows. The one-period return on the France Telecom share is given by:

(B1) $$R_{FT,t} = R_f + premium + \varepsilon_{FT,t} \text{ for } t = 1,2$$

where R_f is the gross risk-free rate, premium is the equity premium and $\varepsilon_{FT,\mathrm{t}}$ is a mean-zero shock to the stock return between period t and period $t+1$. Similarly, the return on the unrelated risky asset is given by:

(B2) $$R_t = R_f + premium + \varepsilon_t \text{ for } t = 1,2$$

The investor in our model receives labor income in each period. Period one labor income L_1 is known with certainty, but second and third period labor income is risky. It is subject to two random shocks, one of which corresponds to the shock to the France Telecom stock. This formalizes the notion that human capital is a risky asset, and related to the performance of the employing firm. The second shock represents idiosyncratic labor income risk, such as illness, layoffs, or unexpected income windfalls. Shocks to labor income are persistent, such that a shock at t=2 affects income at t=3. Formally, period-two labor income is given by:

(B3) $$L_2 = L_1(1+\rho \cdot \varepsilon_{FT,1}) \cdot (1+\varepsilon_{L,1})$$

where $\varepsilon_{FT,1}$ is the shock to the France Telecom stock return and $\varepsilon_{L,1}$ is a mean-zero idiosyncratic labor income shock. The covariation between labor income and stock returns is strictly increasing in the parameter ρ. Labor income in period 3 continues to be subject to shocks to the France Telecom stock:

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constraints are described in detail in the body of the paper.

(B4) $$L_3 = L_2(1+\rho\cdot\varepsilon_{FT,2})$$

For simplicity, we set the idiosyncratic labor income shock in period three to zero. To prevent our investor from simply hedging the positions in the illiquid assets at *t*=2, we assume that short sales of both risky and riskless assets are prohibited.[4] All three sources of risk -$\varepsilon_{FT,t}$, ε_t and $\varepsilon_{L,t}$- are mutually independent.

The preferences of our investor are described by a constant-relative-risk-aversion utility function, a formulation that is common in the neoclassical portfolio selection literature, and we assume the standard Von Neumann-Morgenstern time-separability conditions. Thus the investor's objective function is to maximize utility of consumption over the three periods, which is given by[5]

(B5)
$$U(c_1,c_2,c_3) = u(c_1)+\delta u(c_2)+\delta^2 u(c_3)$$
and
$$u(c_t) = \frac{c_t^{1-\gamma}}{1-\gamma}$$

where δ represents the time discount factor, and γ is the coefficient of relative risk aversion.

In order to solve the model, we assume that each of the three sources of risk -the France Telecom shock, the shock to the unrelated asset and the labor income shock- can take on only one of two values in each period. We represent the underlying uncertainty in the form of a binomial tree and solve the model numerically by backward induction. Assuming binomial shocks and three sources of uncertainty results in nine decision nodes in the intermediate period. We apply a grid search to the investor's decision problem at each of the intermediate nodes, and to his decision problem in the first period. The standard calibration of the model uses the following parameter values: Initial wealth equals FF 200,000 and initial labor income equals FF 180,000 p.a. before taxes. The relative risk aversion (RRA) parameter is set to 5 and varied between 2 and 20. This

4. Were employees able to sell stock short, they would have immediately purchased infinite amounts of the discounted asset, shorted them and earned arbitrage profits by "monetizing" the discount.

5. Because we are trying to model the tradeoff between liquidity and return, we cannot assume that the investor is maximizing over final wealth, since in that case the portfolio weight on the liquid, low return asset would be zero.

range is arbitrary, but relates to previous empirical work.[6] The individual time preference rate is equal to the risk-free interest rate at 5%, while the equity premium equals 6%. The risk parameters in the baseline calibration are a 30% annual volatility for the France Telecom stock return, a 25% volatility for the unrelated risky asset and a 5% volatility for the independent labor income shock. The outside risky asset has a more attractive Sharpe ratio than the France Telecom stock, capturing the idea that holding (for example) an indexed fund offers in general a more favorable risk-return tradeoff than holding a single stock. The parameter controlling the covariation between stock returns and labor income, ρ, is set to 0.1.

Figure B1 illustrates the model predictions: **Panel A** shows personal contributions in French Franc as a function of relative risk aversion, firm-specificity of labor income, and labor income. **Panel B** illustrates the portfolio allocations among the available France Telecom assets, and **Panel C** shows the predicted average holding period and the fraction of the portfolio that is downside protected, again as a function of the same variables.

References for Appendix B

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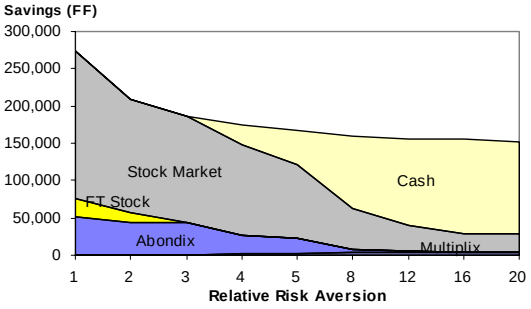
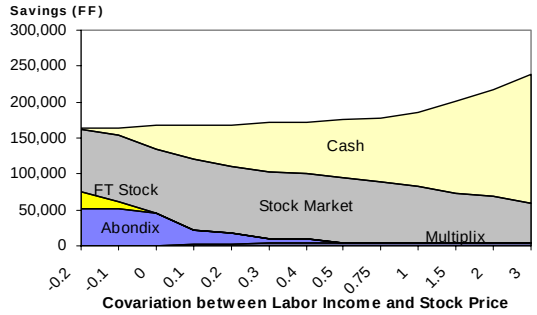
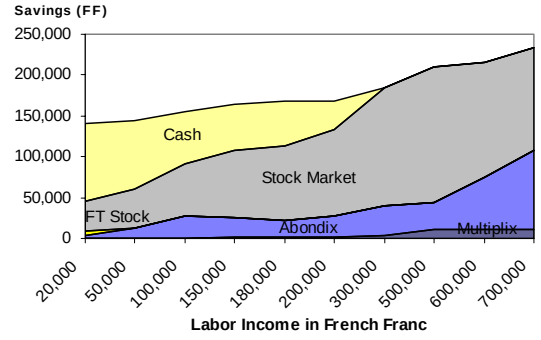
6. See footnote 11 in the body of the text for a discussion of the relevant literature.

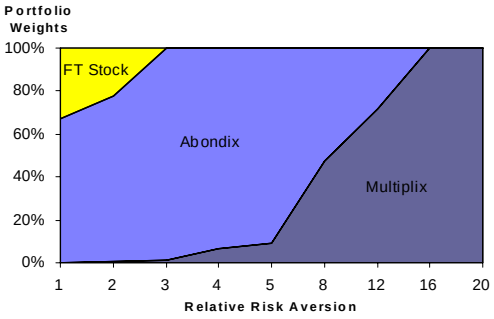
Panel A

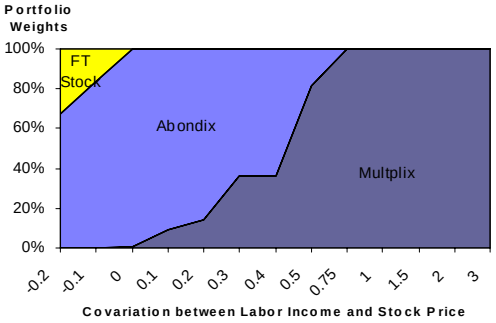


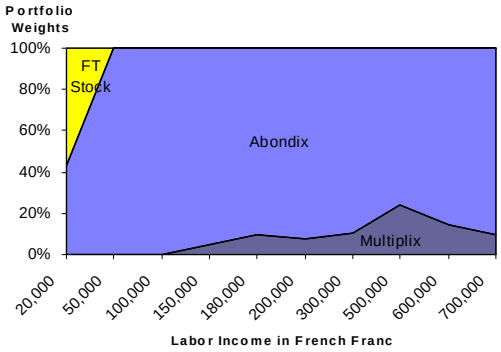




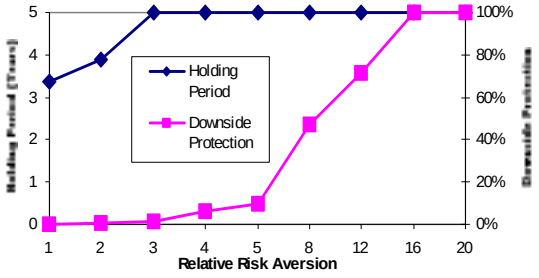
Panel B

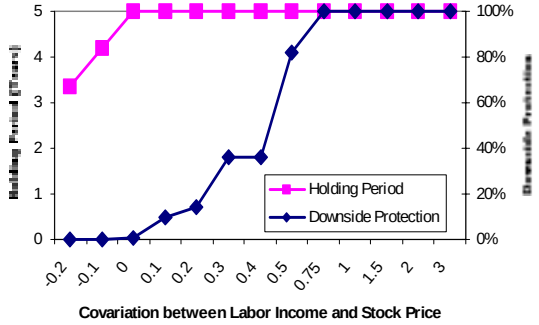






Panel C





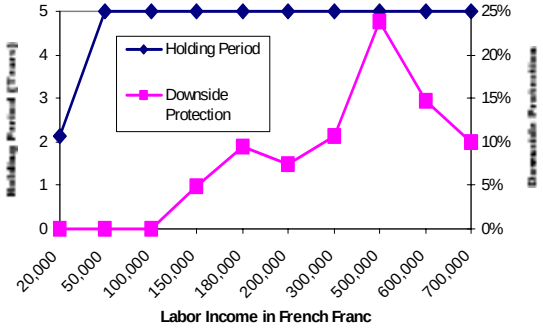


Figure B1
Model-predicted portfolio allocations

Illustration of the model predictions for savings and portfolio selection decisions as a function of relative risk aversion, firm-specificity of labor income (represented by the covariation parameter ρ), and labor income in French Franc. **Panel A** shows the savings (given by financial wealth plus labor income minus consumption), **Panel B** shows the portfolio allocations for participants in the France Telecom offering, and **Panel C** shows the average holding period (in years) of the chosen portfolio, and the fraction of the portfolio that is downside protected through *Multiplix*. All the model variables are set to their baseline calibration, except for the variable being examined.

Appendix C
Estimating the threshold levels

This section describes the methodology for estimating the threshold levels below which latent individual investments would not be observable. The double-hurdle specification is closely related to the censored regression model first proposed by Tobin [1958] and the sample-selection models described by Heckman [1976]. It follows the model of Cragg [1971], in which the first hurdle is a Probit model for participation, and the second hurdle is a censored regression for the contribution level similar to Tobin's model.[1]

We illustrate the methodology for the simple case when there is only one threshold applicable to all individuals. The underlying latent variable model is given by:

$$\begin{aligned} & y_i^* = \alpha + x_i'\beta + \varepsilon_i \qquad \varepsilon_i \sim N(0,\sigma^2) \\ & y_i = y_i^* \ \textit{iff} \ y_i^* \geq K \\ & y_i = 0 \ \textit{otherwise.} \end{aligned} \tag{C1}$$

where y_i* is the latent personal investment, which will be observed if and only if y_i* is larger than some threshold level K. The likelihood function of the standard Tobit model augmented by the threshold effect K is given by:

$$\begin{aligned} L(\alpha,\beta,K,\sigma) &= \prod_{y_i^* \geq K} \Pr(y_i^* \geq K) * f(y_i \mid y_i^* \geq K) \ * \prod_{y_i^* < K} \Pr(y_i^* < K) \\ &= \prod_{y_i^* \geq K} \frac{1}{\sigma}\phi\left(\frac{y_i - \alpha - x_i'\beta}{\sigma}\right) \ * \prod_{y_i^* < K} 1 - \Phi\left(\frac{(\alpha - K) + x_i'\beta}{\sigma}\right) \end{aligned} \tag{C2}$$

Here $\phi(\cdot)$ and $\Phi(\cdot)$ correspond to the standard normal pdf and cdf respectively. The two parts in (C2) correspond to a classical regression model for the non-censored observations and to a Probit-type probability term for the censored observations. The only non-standard feature of this formulation is the appearance of the threshold level as part of the constant term for the censored observations. Note that estimating the model in (C1) as a standard Tobit model amounts to forcing the constants in the censored and the non-censored part to be equal, whereas the correct specification (C2) allows the constant term in the Probit part to be reduced by the

1. For an in-depth treatment of limited dependent variable models with selectivity, see Lee [1983]. A recent application of the techniques employed in this section can be found in Maki and Nishiyama [1996].

threshold level.

Heckman [1976] estimates the standard Tobit model in two steps, using the well known result that the expected value of a non-censored observation can be written as:

$$\text{(C3)} \qquad E(y_i \mid y_i^* \geq K) = \alpha + x_i'\beta + \sigma\lambda\left(\frac{K - \alpha - x_i'\beta}{\sigma}\right)$$

Here $\lambda(\cdot)$ stands for the inverse Mills ratio. An estimate of $\lambda(\cdot)$ can be obtained by defining a dummy variable which takes the value one for participants and zero for non-participants, and running a Probit regression for the participation decision. This provides us with consistent estimates of $(K - \alpha - x_i'\beta)/\sigma$ and hence consistent estimates of $\lambda(\cdot)$. Substituting these into (C3), we can estimate the contribution regression by OLS. This in turn gives us consistent estimates of α and σ. Finally, combining the consistent estimates of α and σ from the contribution regression with the consistent estimate of $(K - \alpha)/\sigma$ from the participation regression, we get a consistent estimate of the threshold level *K*.

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