INTRODUCTION

Questioning Finance

Access

This book tells the story of a financial innovation from the inside. But one might legitimately ask: Do we really want another insider's account? Are we not already paying a high price for having left insiders to organize financial markets at their convenience for too long? If financial operators acknowledge that they erred, then the accounts that they give of their inability to control a situation that went out of control are short of illuminating. Threatened as scapegoats of a major financial crisis, those who have attempted to articulate the failure of the financial system usually spend more time shifting the blame over to another group of experts than shedding light on the system's inherent complexity. When experts are in a bubble, it is safe to burst it open, but not just any tool will reveal its inner complexity. Indeed, who will gain an intellectual grasp of these financial innovations and their ripple effects without a firm grip on the technical mechanisms that triggered the current collapse?

In this book, I neither sing the praise of the wunderkind of the booming financial engineering world nor do I encourage the trial of a "den of thieves." Rather, I invite the reader to travel with me and observe one of the actors of a play gone sour, without initial prejudices about finance, markets, and big money. Instead of hasty and premature judgments, it is more fruitful to paint an accurate portrait of the manufacture of complex finance. The identity of financial operators, the name of the bank, counterparts (clients), and the name of the software I document and analyze have been disguised. The point of *Codes of Finance* is not to uncover "juicy stories," but rather to shed light on the intellectual and organizational consequences of financial engineering.

I entered General Bank in January 2000 and left it in July 2001. I did fieldwork there in my capacity as a PhD student in "economics of innovation." The people who recruited me cared little about my actual training or the ques-

tions that would occupy me as an apprentice scholar. They let me in because I was attending one of the prestigious master's programs in mathematical finance at the Universite Paris 6 Jussieu.[1] Students of this program were required to spend six months as interns in a bank. This opportunity became my fieldwork. Another reason they accepted me—a more obscure one, although one that explains some crucial features of the General Bank population—was my "education."[2] I came to the bank as a student of one of the *Grandes Ecoles*, and although I did not brag about it, it inevitably came up in the interviews with my employers. It immediately eased my introduction to the bank. General Bank may not have been a den of thieves, but it was unquestionably a den of alumni of elite schools, selectively cultivating peers rather than searching the general work force for vacancies. I transferred three times in the bank, occupying successively the position of research assistant (early 2000), trader assistant (spring 2000), and middle-office manager (2001). The first position entailed designing an overhaul of market research in the fixed-income trading room. The second position brought me to the equities and derivatives trading room, the main site of this investigation. There, I was asked to design an application to rationalize the circulation of information between traders, engineers, and salespeople. My third and last position was in the middle office of the fixed-income room. I was in charge of remodeling their exotic derivative products and managing their transfer from one database to another. Fortunately for me and for the research agenda I had set for myself, these positions allowed me to meet all the other actors of the investment banking unit of General Bank: I ended up spending a year and a half documenting the product that the bank was hailing as a revolution in market finance.

The perspective of this book is that of an outside observer who lived in and around a bank and made himself a quasi-expert.[3] But it was not just any bank: General Bank was one of the central actors in the financial revolutions of the 1990s. This French bank was the darling of the financial derivatives markets: It repeatedly won the award of "best derivatives house" of the year given by *Risk* magazine, one of the bibles of the discipline.[4] It was the epitome of financial engineering, pioneering a new economic landscape for firms and individuals willing to bring high-tech finance to their lives. More recently, in January 2008, General Bank also made the headlines, albeit for less savory reasons: Kevin Voldevieille, a trader, fraudulently convinced his management to allow him to invest far above his limits.[5] This now infamous trader spent a few years working in the exact same sites that this book documents. He started his career in the little-known and unglamorous back offices of General Bank, and he made his way to the site of all envy: the trading room, also roamed by our more anonymous Alan. I crossed paths with Voldevieille but never got the chance to study him personally. As I started investigating the fancy world of the front office, I realized that most of the action—and the most interesting actions—were taking place in the back office. Both Voldevieille and I were at General Bank to understand the consequences of highly structured financial

products—laden with mathematics and equipped with the latest computing technologies—on the maintenance of the bank.

When Voldevieille's scheme was exposed, English-speaking commentators reveled in depicting the typical French arrogance and the lack of adequate risk supervision. They immediately adopted a mix of psychological and sociological approaches to understanding what had led such a young, hard-working, and successful member of the French middle class to spin such a tangled web of document fabrication and database manipulation. These accounts contained a number of the stock prejudices that journalists often invoke to pepper their pieces with cultural veracity: Parisian versus provincial opposition; class society; monopoly of power in the hands of polytechnicians; hubris of the French way of engineering finance. Voldevieille was a modern version of Rastignac, the famous character created by French writer Honore de Balzac: aspiring and striving, ready to bend the rules laid down by the established elite to make a name in Parisian circles. Few pieces went further than this storyline or questioned whether their repetition of the word "French" was adding much light in uncovering the fraudulent strategies used by Voldevieille and to his ability to go unnoticed for so long.

Although these writings comforted a few readers' worldviews, they often focused on cultural platitudes and did not help much in understanding the underlying causes of such behaviors. *Codes of Finance* documents financial innovation *as it took place* in a French bank. Its scene is the new financial district of La Defense on the western edge of Paris. Yet, it is not primarily a book about France or French characters. The "old boy network" culture experienced during my recruitment is not particularly French. Every elite education institution operates along these lines; anthropologist Karen Ho, for example, has recently shown how graduates from Harvard, Princeton, Stanford, and MIT select incoming interns among the ranks of their alma maters (Ho, 2009). Similarly, the kinds of experiments that General Bank entertained were carried forth simultaneously in other countries. Swiss bank *Union des Banques Suisses* had initiated the move toward similar products and French engineers had learned from its failure. U.S. banks were also in full swing trying to devise similar formulas.

An exclusively cultural account, focused on national specificities and overlooking the technicality of financial innovation, would inflate factors that were not central to the vicissitudes of the General Bank enterprises.[6] This lesson was learned from the methods of Actor Network Theory scholars and from one of its most fruitful applications, offered by Bruno Latour (1993) in his study of the failure of a *personal public transportation* system, *Aramis.* In discarding a blunt cultural approach, I do not assume a sphere of finance, detached from its context; rather, I expect the relevant issues to surface in the course of the investigation. The preeminence of engineers in French higher administration and boards of directors of major companies is of major import. The freedom that financial engineers enjoyed in the trading room, the support that they received from other engineers at higher levels, and the rela-

tive lack of supervision that they experienced in their interactions with the risks department all came from their perceived importance. Yet, this prestige alone would not have allowed them to steer the bank into one of the riskiest finance operations. In the venture that this book documents, the companion pieces of these powerful engineers—CGPs, products of the engineers' financial imagination—have to be seen as the primary characters if we are to understand the story about to unfold.

The Population in and around the Bank

Inside General Bank, communities with different and distinct expertises collaborate around whatever product is pushed. It is worth highlighting these groups to give visibility to the chaotic nature of the conversations circling around the products; an added payoff is to get a sense of their relative location in the bank. Because the purpose of this study is to track the ripple effects of innovative products on the bank as an institution, it is useful to lay out the *functions* that this methodology will discover through its meandering. Front, middle, and back offices will feature in the coming account, but not as the cleanly distinct entities that the functional approach offers. If the dream of the CGP designers was to dissipate geographic differences by designing a product that straddled Paris, Tokyo, New York, and any other Exchange around the globe, this book will tell a story of highly localized practices and competing idioms struggling to live up to the blueprint of a global financial product.[7]

Front Office

The front office of a bank is the best-known operation center that this book will document. Yet, I argue that its perceived status has hidden some of its most interesting features. It is a profitable site to study because, through its tortured topography, the stability of the firm comes into play. It is, first, a site of exceedingly secretive calculations among engineers, salespeople, and traders collectively designing new products. Secrecy rules here, as these products cannot be protected by patents: derivation of value achieved by the bank never lasts long in the face of intense competition. Simultaneously, it is also a site of great porosity. In the front office, clients get involved in the very design process, inviting themselves into the already crowded chorus of traders, engineers, and legal advisors. Traders also hedge their products here by tempering them with the daily changes of underlying markets. Front offices are worth a close look, as the tension between secrecy and transparency in the trading room is fully observable.

The trading room's financial and quantitative engineers (quants) are closest to the formal expression of products. Quants[8] were brought to the trading rooms when derivative products started to lend themselves to precise calcu-

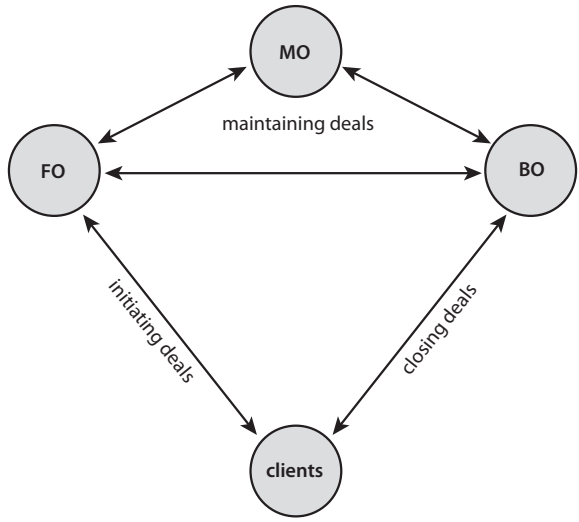

Figure 2. Sequences of Intervention in the Making of the Deal
This diagram presents one topography of the font/middle/back offices. As the story unfolds, other topographies will emerge.[10]

lative methods imported from mathematics and physics. For quants, prices can be studied either as equations to be solved or as Brownian motions[9] to be simulated. Financial engineers, in contrast, bring a less quantitative perspective to financial products. They are responsible for the final version of the contracts between the bank and its clients. They do not create these formulas from scratch. Instead, they devise them based on the complex interactions between the bank's salespeople and the traders' experience of the market. For all their differences, these two groups do not labor in isolation. Long conversations have to take place between financial engineers and quants to bridge different approaches to what a price is and how mathematical formulations of a financial product should be understood.

Also in the front office, the traders are in charge of the daily hedging of their portfolios of products. They buy and sell to make sure that the bank will be able to honor each product's payoff without incurring a loss, and they also seek to benefit from market opportunities. This activity allows them to develop an expertise akin to that of the financial engineers in the trading room: each needs to figure out how much a contract will be worth in a week, a month, or a couple of years. Yet, their paths to understanding the fluctuations in the values of these products are not always compatible.[11] Traders are immersed in the market, surrounded by "noises" that they factor into their analyses—data that would be ignored by financial engineers working with mathematical price functions instead of actual market prices.

The salespeople in the trading room work very closely with the traders and the financial engineers when new products are issued. They believe they understand whether a new product will sell and generate a large profit or whether it will go unnoticed, hidden by the growing list of products offered by competitors. The descriptions generated by this prominent group reflect their interactions with the bank's clients. Inserting themselves, via the proximity of salespeople, into the cozy conversation of the trading room, clients open this conversation up to an outside world populated by competitors and other agencies. Clients, too, want to control their risks and to tailor financial products to their specific needs.[12]

Salespeople want the bank to issue as many contracts as possible: this represents their bonus, a quasi-direct function of the number of transactions from the desk. Whether a contract turns out to be a good deal for the bank when it comes to term, and whether all the payments have been made, is of no direct relevance for salespeople. That last consideration is crucial to the traders and, to a lesser extent, engineers. Their remuneration is a function of the performance of their portfolios of products. If they are managing products that cause the bank to lose money, they and the financial engineers and quants are first to be chastised. The salespeople are only selling: they are neither designers nor managers of the products, hence they escape the regular inquiries of cause and effect.

Middle Office

The middle-office operators have much looser task definitions. To put it briefly, they stand between the front office and the back office. Whereas the front office sits closest to the clients and closest to the sites of transaction (Exchanges on which traders buy and sell, invest the clients' money, and hedge their portfolios), the middle office bridges two centers within the bank. Middle-office operators check information flowing between the hectic world of the trading room and the steadier, slower world of the back office. A position in the middle office is not prestigious compared with that of traders or of front-office engineers. In some instances, middle offices have been made irrelevant when transactions are so straightforward that back-office staff and traders can communicate smoothly without the need of an interpreter.[13] At General Bank, their task was still much needed, and some of them were located close to the front office—in the same room.[14] Much to their frustration, they were located in the trading room but did not engage in front-office activities.

Back Office

If the middle-office operations are not easy to describe without entering further into the activities and the types of products, back-office functions are much easier to grasp. "Records" is the word that captures the predominant

task. Back-office operators deal with past and current transactions with a focus on data accuracy that traders do not always understand. Front-office populations are focused on prices and investment opportunities: they monitor market changes on a daily basis and with an attention to very high frequencies. Seconds are their relevant units of intervention. Back-office operators look at deals across a different timescale. Their emphasis is on accurate records and on meticulously respected due dates—notions often derided by traders. Back-office managers scrupulously check on deals and make sure payments are processed on a timely basis. Closing prices, start dates, and end dates are their universe. Every day, they track indices and stock prices and fill out electronic forms that end up feeding databases preciously guarded. Yet, the designs of these products and the reversibility clause dearest to the clients add complication to the function described thus far. In the course of retrieving market information, checking product characteristics, and general maintenance, the back office crosses paths with the front office, the middle office, and the clients. When contracts must be amended on the fly, the temporal division of labor between traders and back-office managers undergoes a shift that rubs against the privilege of front-office employees.

This tension created by the unstable product–client combination comes from the two-headed nature of the bank. During the negotiations, the front office speaks for the bank through the salesperson and the trader; once the contract has been signed, the back office takes over and conducts the client relationship. This bifurcation would work fine if the contract were not occasionally to morph midway through its term, forcing back and front offices to become partners for a day in a new round of negotiations with the client. Whereas the goal of these products was to contract the dispersion of financial markets into one place—the bank—and invent a global financial vehicle, these very products had the unexpected consequence of exacerbating fragmentation in the bank. Overlapping prerogatives, conflicting speaking rights for the bank, and porosity threatened the balance of power and the orderliness of General Bank.

Beyond Front, Middle, and Back Offices

Close to the back office—but technically different and organizationally very different from the back office—two other centers interact with the front office–middle office–back office chain of circulation. The accounting department and the risk department act as satellites of the chain: they have elliptical orbits and come and go more or less frequently. Whereas the two external determinants of trading-room activities were thus far the client and the markets for hedging, the risk and accounting departments introduce other important figures to this story. Investors in publicly traded companies have been increasingly vocal over the past thirty years. Central to their concerns as investors is their ability to see through the opaque corporate structures that

banks such as General Bank generate. The CGP belongs to a family of products that has triggered much worry among investors due to the customization that these products force on the bank. Contracts carried for up to fifteen years would be fine if only they could be assessed before their term. If these contracts evade the accounting capture that the bank offers its current and prospective owners, they are seen as black boxes. Their value cannot be assessed and investors' strategies cannot be adjusted accordingly. In a nutshell, and most problematically, these products do not have a price. In response to the challenges raised by the customization of these products and as part of a movement in tune with the growing power of investors over managers, the boundaries of managerial control in the bank have been increasingly tested.

Who is peripheral and who is central in the composition of financial products are stakes that are fiercely fought over by the communities who partake in the definition of the CGP. Studying this class of products shows how the design of a seemingly innocuous new financial vehicle can shake the common language of a bank, and beyond the bank itself, the financial industry that struggles to make sense of the potential consequences of its ripple effects on markets. The disruptive power of such innovative products shakes off the clean distinction of these groups into front, middle, and back, as well as insiders and outsiders in a way that is not trivial. With the main actors (operators and products) now visible, it is possible to present the main topics of *Codes of Finance*—derivation materializes, and its consequences on the world of operators and on the bank itself become tangible.

Topics

A difficulty of this book comes from the very definition of its object (CGPs). Surprising as it may sound, even among those who design, trade, and manage CGPs, it is not possible to define them unequivocally. Engineers will summarize them as "a zero-coupon and a call option"; back-office managers will see them as "a contract and 32 quarterly fixing dates"; traders will define them as "the indices' futures hedging scheme"; clients will define them as "aggressive insurance." The dispersion of their definition along the network of operators is a challenge for the social scientist setting out to describe what is at stake in these products. Any definition that I offer at the start of my analysis runs the risk of simply adding another competing definition to the chorus of existing definitions, put forth in other venues.[15] Definitions thus become the central characters in this research.[16]

Financial Conversations: Codes, Models, and Secrets

The frequent issuance of new products by the trading room prompts a proliferation of codes and models that offer new perspectives on their proper-

ties.[17] In the context of the bank, differentiation multiplies cognitive handles on the product: all the definitions of a CGP mentioned above are right and they are all useful to their users but this multiplication also jeopardizes the unity of the bank. Each local language draws boundaries around an isolated "clan" and hinders the communication demanded by the sensitivity of these products.

The simultaneous push to issue more and more customized products—designed for the idiosyncratic needs of customers in the context of an assembly-line mentality—adds to the puzzle of designing special codes. It is easy to reckon the magnitude of problems created by the conflict between customization and mass production: If Alan had the luxury of real customization and was to deal with only a few products, he would keep them closely under his sight. There, they would stand at his fingertips. Yet, in real life Alan's products exist in different formats—scattered between his computer's hard drive, a server shared with the rest of the trading room, still other digital versions on his assistant's workstation, and a few other paper versions at a couple of sites a few floors above. And that multiplication of the product into many versions is true for each and every one of them. So, faced with such a proliferation of versions, coding them is not a luxury: it is the only survival strategy of traders overwhelmed with documents, whose characteristics must be at their *quasi-fingertips* on demand. Codes and models invented to describe and manipulate products are technologies of *adjustable distance* and simplification. These technologies accept the loss of the *whole* of each product—no longer under the gaze of the trading-room operators—in return for the relevant features of *all* the products.[18]

The dilemma here is, again, simple. Should operators use an arbitrary language and arbitrary characterizations to describe their products, they might quickly lose track of their value to the bank. They will also endanger the bank by postponing communication around the characteristics of the product. Deciding how to speak about and define these products is a nontrivial operation as a result, as the struggle between the demand for precision and the *sociality* of these products gets in the way.[19] An example of this tension will clarify things.

A language widely shared in General Bank—as in most banks across the world— was that of profit and loss (P&L); that is, how much money the bank was making on the product under scrutiny at the time of the calculation. One of the reasons for such a widespread use of this language stemmed from its apparent market stamp. These quasi-experimental conditions, amidst a world fraught with a large variety of idioms, proved a blessing for this study. It seemed to submit other idioms to the market test. P&L seemed to be the raison d'être of such products, so much so, in fact, that it would shut out other languages. However, even this test, as specific as it was, could not help from remaining open-ended and underdetermined. Although P&L appeared to limit the variety of idioms to the one-dimensional, scientific, and final ac-

count of the return yielded by the financial products, the actual reality was far from the case. The notion of profit was constantly reshaped by conflicting languages and by the perimeter of its circulation in the bank. Whether one looked at the CGP dealt by the trader alone or the CGP maintained by the long list of operators working in the wake of its issuance, its relevant characteristics changed substantially. These products' value was site-sensitive, so that a notion so alluring as profit captured only portions of their career. Indeed, profit can span different lengths of time (over a year, a week, etc.), and it needs an accounting apparatus to reduce multiple financial engagements into a single economic metric.[20] Profit is sometimes pure liquidity—the holding of cash in the present, without any claims over the future—but it rarely comes down to this perfect form, as the calculation of P&L usually takes place while the assets are still on the market, that is, no longer or not yet liquid. They cannot be withdrawn temporarily, measured, and then silently returned to the markets. They are experimented upon in vivo.[21]

If P&L is a public code—used by most banks and present in all traders' minds at bonus time, but already open to challenges as to the perimeter of calculation, it is not surprising that such profit-driven institutions as banks are also sites of many other less public forms of product categorization and modeling. These more private codes are designed with a view to better capture and control the risky properties unleashed by these innovative products. The tensions created by innovations are well known. Old notions do not do justice to new realities; radically new notions disrupt conversations around existing objects and tend to leave the current audience behind. This tension is exacerbated in the financial industry by the need to maintain secrecy while allowing for *multiple* bodies of experts to congregate around the *same* product, among thousands of like products. In a booming labor market that facilitates the movement of operators from bank to bank, secrecy protects the precious, short-lived, and exclusive know-how of the bank. The bank struggles to figure out how to invest time and money developing new specialized local languages while retaining a work force that could easily transfer these languages to more rewarding competitors. Legal protections through confidentiality pledges do little to maintain secrecy: most of the knowledge gained is neither formal nor codified and it is easy for a trader to carry ways of categorizing products or portfolios to competing banks.

Codes are everywhere in the bank: one finds them in the primitive forms of conversation between traders and salespeople, as well as in a more articulate form when quants design models to capture the relevant price features of a product or portfolio. On-the-go classifications simplify in ways similar to the transformations achieved by a scientific model. In both cases, traders and quants need to invent appropriate ways of sorting out these products and their versions so that they can respond to their calls. That is the meat of the code puzzle: to take good care of the product, the classifications and the codifications achieved need to respect their seams.

Codes are refrains. They turn chaos—"organized" chaos, in a bank in search of ever-more profit and turned into a market with fierce competition among different traders—into order through simplification. Gilles Deleuze offers penetrating, if difficult, insights in a theory of the code as refrain in *A Thousand Plateaus* (1987 [1980]). He defines refrains as always simultaneously cognitive and topographical: they bring order into the world by acting as frames that pacify the chaos of the surrounding activities that threaten to shatter each and every form of stability. Simultaneously, refrains also define topographies. Often, they are used with a special intent to set the boundaries of understanding: enabling some, disabling others.[22] They can only be uttered in special situations, within a circle of authorized operators and distant enough from others not privy to their formulas and their powers to decode. Traders and engineers do not share the computer codes of their pricers with the salespeople: they strive fiercely to retain their monopoly as price makers over that crucial instrument in the room so that they can exclude every other employee from that zone. Salespeople do not share with the back-office manager the detailed history of the deals they have negotiated with their biggest clients or the written notes they have on these clients. During the tense period of product issuance, they engage in complex dances with clients across the perimeter of the bank. When mastered, the codes put the operator in control of his or her perimeter and help define his or her milieu. These codes offer an entry into the competitive topography of the bank: all operators want to make money by selling as many contracts as possible, but they also have to borrow circuitous routes to achieve that goal. Some need to use computer programs churning out prices, while others need to accumulate information about clients to better anticipate their preferences.

The Problematic Nature of the Firm Selling Complex and "Sticky" Finance

If the first unit of analysis in this book is the CGP, the site of analysis is the firm. I conducted fieldwork there; most interviews also took place there and if I radiated outward to further understand the extended business of CGP and its calibration by clients, I always followed channels of information that tied back to the firm.[23] But focusing on the bank was not just a decision made for the sake of simplicity and feasibility. Dwelling on this manufacture of profit and documenting the mechanisms used in achieving its goals offered a unique access into the contradictory nature of a financial firm, torn apart by the two imperatives of being a closed, self-sustaining legal unit while serving customized financial services to clients who did not hesitate to trespass its boundaries. This self-annihilating feature of finance is best understood by documenting the series of operators dancing around the products: the product designers sit (literally) next to the traders who maintain and hedge these products; this small population inhabits the same building as back-office operators, who wrap up the contract and make sure that, at least for a while, the commercial relation is

closed for good. Yet, the very design of the product introduces much disruption in that division of labor and challenges the stability of the firm.

Scholars of finance have documented sites other than firms, bringing much clarity to their mechanisms. Among these sites, Exchanges have attracted attention for their centrality to the emergence of a mass market and to the long-sought desire to show what modes of organization are most conducive to transactions.[24] This study does not indulge in documenting another Exchange, because it focuses on a stage of financial innovation that precedes the orderly working of Exchanges. When products are first released, their space of circulation is not yet settled; they strive for a market, initially just a niche in the distant future. Their prospect as Exchange listings usually lies far ahead. In some cases, when their business model is based on constant transformations—as was the case of CGPs—they can only survive outside of Exchanges that impose standardization. Exchanges are fascinating sites of dense interactions but the relative orderliness of their functioning can easily hide the even more fascinating moment of product design.

Exchanges have long been sites of financial innovation, with new contracts created to attract business and generate revenue fees. Yet, *Codes of Finance* deals with a different kind of financial innovation, based on the derivation of excess information produced by existing Exchanges. Unlike Exchanges, General Bank does not involve all the parties in its deal. Its operating principle is that of an asymmetric transfer, and its success as a derivation hinges precisely on that absence of reciprocity. The Exchange could itself issue such contracts, but it would need to have the same infrastructure as General Bank to be in a position to hedge such risky positions and it would also need to be a global actor operating on many other Exchanges. These characteristics are quite the opposite of those of the Exchange, which is grounded and central. The main interest in studying General Bank comes from the tension created by its need to capture the excess information produced by Exchanges while maintaining a speed and mobility that protects it from being caught up and made to face the duty of reciprocity, built in the institutional principles of Exchanges.

The design of these financial products and the subsequent imperative to maintain them make for a unique look into the manufacture of profit, but one of the features that engineers have built into the CGP adds a further interest to the study of an innovative firm. By design, these are long and sticky commercial relations: the bank and the client are on board, and they have to coexist, regardless of the moving economic conditions and the likely change of prospect for the success of the deal. In other words, when a predefined set of events occurs, the client is given the opportunity to redesign the letter of the contract in order to benefit from it. A company goes bankrupt and is no longer publicly traded; two companies merge and carry new risks; an index's composition changes. These are the conditions that can authorize a CGP client to become an engineer and redesign the contract.[25] This forced coexistence is different from the regular customer-service clauses embedded

in most commercial contracts. Customer services limit the ability of the client to alter the parameters of their deals after the transaction. The definition of the good and its customary use ("cats not to be dried in the microwave oven" and other common-sense tips) stabilizes the relation. The definition choreographs a series of roles that have to be played by the manufacturer, the customer, and the commodity, and it is in place to protect the customer from faulty manufacturing as much as to protect the manufacturer from relentlessly litigious customers. What CGPs propose works against this stabilization and exacerbates the contention around the liability created by the service. Although the bank and its clients agree on many things through the contract, much can still be negotiated once the contract has been written up and signed. Clients who are otherwise kept at a distance from the design of products find here the occasion to weigh in on some key contractual terms and subvert the division of labor between service providers and service users.

At the same time, the firm is also a problematic site of conversation inasmuch as the operations conducted there require the mobilization of all the bodies of experts reviewed in the previous section. As with most international banks, General Bank had offices in all major economic centers. Some of the biggest of these foreign offices featured trading rooms dedicated to dealing financial securities traded on the local Exchanges. General Bank was in London, New York, and Tokyo, among other economic centers, to increase its exposure to local businesses and to be situated closer to major Exchanges. "Distributed firms" are common in the financial industry, but the trading-room engineers in Paris not only relied on their local branches to carry out some of the operations that they designed, they also tried to make two philosophies of the firm coexist: a centralized site where French traders maintained the products, and a globalized service needing constant attention at all its nervous articulations, (i.e., at all the local foreign offices concerned with its hedging necessities). The firm finds itself strangely *crowded from a distance*: many bodies of experts and embarrassingly present clients, who take advantage of a contractual clause that keeps a door open into an institution that values secrecy. As this book will document in great detail, this globalized product hedged from Paris ended up tearing the firm apart.

The lack of a unique and stable site for these transactions of services—that have no clear material configuration if it was not for their contractual apparatus—makes the bank a conflicted entity. Several decades ago, Ronald Coase (1937), in his article "The Nature of the Firm," launched what was to become a research program and one of the most written about questions in economics. Coase was trying to understand why firms exist in market economies and why organizations with their *rules-based coordination*, as opposed to *price-based transactions*, are sometimes more efficient forms. According to Coase, the moment of transition from a market efficiency to a firm efficiency is decided by the costs incurred by market transactions.[26] The Coasian insights force us to question the boundaries of firms and to understand how the

specific characteristics of a firm's business act as incentives for more or less tight organizational forms. This research program has given birth to a schism between sociologists and economists around the question of the nature of the firm. This study does not take sides but rather leverages the rare access to a bank—in the process of designing products and animating their markets—to resuscitate the Coasian question. Yet, the tension that occurs from having to organize and innovate new products demanding to be simultaneously in and out of the bank creates an added twist. Capturing and exploiting information entails some form of organization, whereas the imperative of mobility pulls General Bank toward a lighter structure.

A firm such as General Bank is itself a Coasian case study. It is a complex organization with several units carrying different businesses, but the reward system of the market activities (Alan and his colleagues designing and taking care of products) is premised on measures of performance and achievement that usher in a market-flavored competition between employees. At the same time, the enforced secrecy around these activities caused by the very volatile recipe for success with financial innovation, sets all sorts of barriers around the bank against competing banks. Yet, this tension between the reward system and the nature of the financial knowledge is further exacerbated by the design of products, which require constant back and forth between the organization and the outside markets (i.e., the clients and the Exchanges on which traders hedge their products). These vectors of communication thin the organization and undermine the roles buttressing it amidst a chaotic and intensely competitive environment.

In this study, I add to the usual Coasian concern for the firm a special attention to the nature of the products that are its raison d'être. A close study of the circulation of the products and operators within the allegedly bounded firm displays a much more complex topography than the market/organization dichotomy hints at. In truth, the two polar notions that frame the Coasian approach bracket the varieties of disruptions that innovative products and services can usher into an organization operating on markets. *Codes of Finance* goes beyond that dichotomy and documents the limits of this form of financial innovation. What happens to a firm endeavoring to sell a financial product that is never quite sold (a blow to the market) and that needs to be hedged on a daily basis (a blow to the organization)?

Bodies of Finance

The etymology of the word firm reminds us that there is a spatial element to the term. It is solid and resistant, enduring and steadfast. Yet, is it groundedness that financial firms need most? Firms also denote that which can be trusted—with the notable Italian contraction of the holding (*la firma*) and of the guarantee provided by the signature (*la firma*) of the business owner. But how does trust travel thousands of miles, when operators such as Alan are

stuck in their seats and when firms do not move?[27] A tension tears apart the firm. Ubiquity is General Bank's aim, but it is grounded firmly on the western edge of Paris. General Bank's engineers design financial products that derive their value from economic activities unfolding in remote places *and* they need to keep in contact with these places and their Exchanges. They are the sites where traders manage the risk entailed by the issuance of these global beasts, and they are there either in person or under some sociotechnical extension that immediately exposes them to possible disruptions. Ideally, the firm would need to literally span these Exchanges, *enabling* a collective of traders to live up to the dream of the globalized CGP, but that would create other conversations and negotiations among traders and engineers dispersed across the globe and remove General Bank even further away from the project of a purified economic vehicle, contracting the world economy into a formula. *Codes of Finance* documents the clash between the dream of ubiquitous and instantaneous finance and the necessary bodies that strain to achieve this version of a purified economy. Financial engineers would do away with the bodies of the bank altogether in their wildest vision: the physical bank provides resistance to the purification of the economy into prices, and nothing but prices. They slow down what could be body-less transactions and, going back to Coase's dichotomy, they are part of the costly organization.

"Bodies" needs to be understood broadly here.[28] They are the predictable *flesh-and-bones* bodies of traders striving to seamlessly convey the message of the products they have in charge. But they are also the instruments heavily populating the trading room roamed by Alan and his colleagues, mathematical models simplifying the products' prices, and binders containing folders with all the versions of the products. What unites these multiple instantiations of bodies is their inability to differ quickly *on their own*. In an environment in which the ability to change and redirect one's course upon the slightest modifications of prices is key, bodies stand out as slow.[29] They can certainly transform themselves when they connect with other entities—other bodies with more or less momentum—but left by themselves, they will stick to their trajectories. And the survival of the trading room hinges on quick reorganizations. From that perspective, bodies are central to the story of CGPs because they are the instantiation of the organization and its dreaded Coasian transaction costs.

Financial engineers designing CGPs think beyond the bodies of finance: they envision products freed from the weight of the organization and able to live up to the dream of prices reacting to other prices. This dream of ethereal financial engineering—happily overlooking the cost of communication—painfully meets those bodies that deliver the message that derivations of value do not come without costs. The CGP, through its bold projection as a global product deriving its value from dispersed financial places, fuels the dream of a space- and time-free world where economic activities are all part of a global village. This dream is easy to propagate and to entertain *on paper*,

and that is what General Bank's clients were receiving. That is *where* they were investing their money. Traders and the other operators in charge of maintaining the contracts experienced, as wine connoisseurs will appreciate, much more *full-bodied* operations. They were the ones affected by these innovations because the speed built into the hedging blueprint of CGPs and the imperative that their risks be balanced by continuous hedging on Exchanges across the world exceeded greatly their ability *qua* isolated traders. CGPs were no angels despite their engineers' confidence that they were the closest things to a godly invention.[30]

The curse of bodies experienced by traders unable to live up to the engineers' ethereal financial blueprints became a blessing and a resource when the business of derivation developed by General Bank's exotics desk started to become an asset itself and the prospect of it being turned into a commodity materialized. When investors started to take a close peek at these operations—not as clients of CGPs but as shareholders and potential owners of a lucrative unit, detachable from the rest of the bank and sellable to competitors willing to catch up quickly—what used to be itself a sophisticated subject of calculation became an object of financial calculations. General Bank's financial operators who were so far working to exacerbate the project of finance by pushing the economic gesture of derivation to its extreme, suddenly became its most committed critics. Instead of creating purified economic bodies as prices, they organized their activities around a tentacular information software that pervaded the various activities involved in pricing by maintaining the precious products and integrating them strongly into the rest of the bank. Becoming a body again, in the midst of a corporate governance culture that preached the modularity of firms and their reduction to prices, was an achievement.

Deleuze's concept of assemblage is useful to describe the tension between the efforts to articulate the engineered opacity of these new products and the resistance to commoditization through technical tentacular integration.

> a multiplicity which is made up of heterogeneous terms and which establishes liaisons, relations between them, across ages, sexes and reigns—different natures. Thus the assemblage's only unity is that of a co-functioning: it is a symbiosis, a "sympathy". It is never filiations which are important, but alliances, alloys; these are not successions, lines of descent, but contagions, epidemics, the wind. (Deleuze and Parnet, 2002, 69)

None of these efforts—articulation and integration—entail homogeneity. Rather, they gather different bodies and discover solutions to the problems at hand. In one case, the imperative is to make a new product talk and express its unique risks and promises by penetrating its formula. In the other case, ruling out the commercial isolation of a unit in the bank is important. In one case, the assemblage produces a price and an assessment of risk; in the other,

it engineers a magma-like organization and blurs the seams of the unit by anchoring its core to the rest of General Bank's business in such a way that no price can be attached to the exotics desk.

Financial engineering pushes the limit of the bank as a firm. It creates services that both need organization for various teams of operators and at the same time strive for constant mobility. This tension seizes all of the holdings of the trading room, whether operators or instruments, rules or space organization. This imperative draws a fault line that cuts through previous divisions (operators vs. products; space vs. discipline) and makes fruitful another gradient based on the *animation* of the network that the room tries to stimulate. The success of CGP depended on the happy integration of these bodies through a rhythm that would carry the information intact from one end of the network to the other.