Completing Markets with Contracts: Evidence from the First Central Clearing Counterparty*

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Abstract

I study the real effects a contracting innovation that suddenly made financial markets more complete: central clearing counterparties (CCPs) for derivatives. The first CCP to provide full insulation against counterparty risk was created in Le Havre (France) in 1882, in the coffee futures market. Using triple difference-in-differences estimation, I show that central clearing changed the geography of trade flows Europe-wide, to the benefit of Le Havre. Inspecting the mechanism using trader-level data, I show that the CCP was instrumental both to mitigate adverse selection issues and to solve a "missing market" problem. Increased risk-sharing possibilities enabled more gains from trade to be realized. The successful contractual innovation quickly spread to new exchanges.

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1 Introduction

The degree of (in-)completeness of financial markets is critical for economic outcomes. When agents cannot perfectly share risks, the economy is subject to wider fluctuations (Acemoglu and Zilibotti, 1997). As such, macroeconomic models where shocks are amplified by financial frictions typically prevent agents from perfectly hedging (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997). However, the degree of market completeness is not exogenous, as often assumed: markets can be made more complete via financial contracting (Allen and Gale, 1988). Throughout history, a number of contractual innovations – from the bill of exchange to limited liability – increased the set of traded securities and contributed to long-term growth (North, 1991). Yet, it is challenging to empirically identify a causal impact of changes in market completeness on real outcomes.

In this paper, I study the real effects of one contracting innovation that suddenly increased the degree of market completeness: central clearing counterparties (CCPs) for derivatives. As an experiment, I use the creation of the *Caisse de Liquidation des Affaires en Marchandises* (*CLAM*) in the market for coffee futures in Le Havre (France) in 1882. Before that date, earlier clearinghouses, e.g., in Liverpool or New York, were only offering netting services to facilitate the settlement of transactions. The contractual innovation brought about by the CLAM is to fully insulate futures traders against counterparty risk. Specifically, for the first time, a clearing institution interposed itself between traders, becoming a buyer to any seller and a seller to any buyer, so as to guarantee the execution of contracts. If bilateral default risk is high ex ante, central clearing completes financial markets by ensuring that derivatives pay off as contractually planned. The contractual arrangement invented by coffee traders in Le Havre then spread worldwide and, after the 2008 financial crisis, central clearing became mandatory globally for standardized derivatives.

I hand-collect rich archive data and conduct an empirical analysis that yields two contributions. The first one is to show that greater risk-sharing opportunities with derivatives had a significant causal impact on trade flows in underlying commodities. The creation of the CLAM arguably satisfies exogeneity requirements: it did not follow any specific pre-trend in trade flows in Le Havre, and was heavily debated by

traders who did not foresee its impact on trade flows. For identification, I estimate a triple difference-in-differences model. The three sources of variation in trade flows I exploit are (i) before and after 1882, (ii) between Le Havre and other European markets where clearing is not introduced, and (iii), within Le Havre, between coffee and other commodities that remain uncleared. The specification enables ruling out many confounding factors, such as commodity-specific and harbor-specific demand and supply shocks. Another appealing feature of this setup is that both coffee and the commodities used in the control group (e.g., tea or cocoa) are not produced in Europe. Therefore, the effect I identify is a pure trade effect that cannot reflect poor production conditions for a given commodity in an importing region or country.

The estimation results show a positive and significant effect of the introduction of central clearing on coffee trade flows in Le Havre. I first estimate the triple difference-in-differences model within France, comparing trade flows in Le Havre with 22 other harbors. I find that the share of coffee imports entering France increased by 11.1 percentage points relative to control commodities. Then, I address residual endogeneity concerns by replicating the estimation with cotton trade flows. Indeed, while the CLAM was created to mitigate counterparty risk on coffee futures, it also accepted clearing of cotton futures. In this case, the creation of the CLAM was exogenous to conditions in the cotton market. Yet, the results also hold when focusing on cotton trade flows, using other textiles as control.

Next, I extend my analysis at the European scale and reconstruct trade flows in cleared and control commodities for 7 countries. I show that central clearing changed the geography of trade flows Europe-wide: after 1882, a significantly larger share of coffee entered Europe in Le Havre, was warehoused there, and eventually reexported to neighboring countries. The share of coffee imports from France by the sample countries increased by 2.9 to 7.3 percentage points, relative to control commodities. I also provide suggestive evidence that central clearing helped smoothing coffee consumption in France. Finally, I support my quantitative results with narrative evidence. Many contemporaries wrote that the CLAM boosted trade in Le Havre and, within less than ten years, nine other European futures exchanges had introduced CCPs. Therefore, the contractual innovation quickly spread.

As a second contribution, I pin down the mechanism through which central clearing affected trade flows. First of all, several requirements must be met for the increase in market completeness to be the main channel. Most importantly, it must be that counterparty risk hinders trade before central clearing, and is reduced afterwards. Consistent with this idea, I show that central clearing was invented following a global crisis in coffee markets during which counterparty risk dislocated trade. I then show that the CLAM was explicitly designed to mitigate counterparty risk, with high equity, high margin requirements, and a chairman of the board with a strong reputation of honesty. Other requirements for the increase in market completeness to explain the results are that traders indeed make use of the CCP, and that trading volume in futures – not just in physical commodities – increases. I show evidence that both requirements are verified. Remarkably, even though the use of the CLAM was costly and not mandatory, an overwhelming majority of traders were using it. Furthermore, the fact that the CCP was widely used enables ruling out alternative channels through which trade flows could have been affected. In particular, both contract standardization and price transparency increased with the creation of the CLAM. However, if investors were primarily valuing any of these two features, they could free-ride on the CLAM, by benefiting from standardization and transparency when trading, while not using costly central clearing. However, there is no evidence of such free-riding.

I then dig deeper into the mechanism and distinguish between two channels through which markets can be made more complete. One possibility is that central clearing solves an adverse selection problem: absent the CCP, uninformed traders in futures markets fear trading predominantly with low-quality counterparties. They therefore accept to trade only at a price discount (Akerlof, 1970; Gorton and Pennacchi, 1990). Anticipating this discount, high-quality counterparties self-select out of the market. Another possibility is that central clearing solves a "missing market" problem. Specifically, if bilateral probabilities of default are known but there are no traded insurance contracts to insure against them, a CCP completes markets by offering this insurance (Biais et al., 2012, 2016). If this is the case, high-quality traders should be more prevalent in the data before central clearing. Indeed, market participants are ex ante unwilling to trade with participants known to have a high probability of default. Thus,

the two channels are associated with opposite predictions about the composition of the pool of traders. In my case, data on the pool of futures traders is not available. I thus test predictions empirically with data on the pool of physical coffee traders, based on the idea that greater access to futures enhances ability to trade in physical markets. I collect daily data on these traders and, for each of them, the date at which they start operating and cease operations.

I run two tests and find partial evidence consistent with both channels. First, I find that the share of low-quality traders, defined as traders who cease operations within two years, is low before central clearing (8.2%) and does not drop after a CCP is in place. This is inconsistent with adverse selection being significant for this group of traders: it is as if their quality had already been revealed. Therefore, for long-established traders, the main effect of central clearing was to solve a "missing market" problem. Second, I find evidence consistent with adverse selection significantly affecting new traders, defined as traders who entered the market in the preceding two years. The share of such agents, with no or little established reputation, increased significantly after the creation of the CLAM. I additionally find a surge in entry of new coffee traders following the creation of the CLAM. Thus, for new traders, the main effect of central clearing was to eliminate informational barriers to entry in futures markets.

A final question in terms of contract design is whether the increase in market completeness brought about by central clearing could have been obtained with simpler contractual arrangements. Relying on historical sources, I argue that this was not the case. The CLAM was created at a time when importers had large coffee stocks and cash needs. Loans collateralized with coffee (or outright coffee sales) were not possible, due to adverse selection with financiers about coffee grades. Coffee sales with uncollateralized forward repurchases avoided this adverse selection problem but were not possible due to high counterparty risk on forward contracts. Collateralization with high-quality assets was costly, both because the opportunity cost of such assets was high, and due to technological constraints. Compared to bilateral collateralization, a CCP reduced the cost of posting high-quality assets: traders could benefit from multilateral netting of margin calls across counterparties, and collateral was posted in

only one place. Therefore, central clearing was arguably the most efficient arrangement to solve the contracting problem faced by coffee traders.

Related literature

This paper is first related to the literature on market incompleteness and macroeconomic outcomes. It is well-understood that market incompleteness prevents resources from being optimally allocated (Acemoglu and Zilibotti, 1997). Relatedly, financial amplification mechanisms in macroeconomic models typically prevent agents from perfectly hedging (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Brunnermeier and Sannikov, 2014), and volatility disappears from these models when risk-sharing is possible (Krishnamurthy, 2003; Di Tella, 2018). Recently, Davila and Philippon (2017) model the real effects of "incompleteness shocks". While theoretically clear, the relation between market completeness and real allocations is hard to empirically pin down, partly because the degree of market completeness is not readily measurable. I show a case where a change in market completeness is causally linked to real outcomes.

Furthermore, my paper relates to the literature on how contracts and institutions can complete markets and enable gains from trade to be realized (Allen and Gale, 1988; North and Thomas, 1973; Greif, 2006). A number of contractual innovations throughout history fostered long-term growth, including insurance mechanisms (De Roover, 1945) or bills of exchange and payments clearing (Börner and Hatfield, 2017). I show that central clearing is another contractual innovation that fostered long-distance trade. Relatedly, the relationship between finance and growth has been intensely studied (Levine, 2005). That said, I am not aware of previous papers – including in the trade literature – showing a causal relationship between the ability to hedge and trade flows.

Finally, the paper is linked to the growing literature on central clearing. Existing papers study CCP design (Biais et al., 2016; Koeppl et al., 2012), netting (Duffie and Zhu, 2011), collateralization (Duffie et al., 2015; Menkveld, 2017; Cruz Lopez et al., 2017) and defaults (Bignon and Vuillemey, 2018). The closest paper to mine is by Bernstein, Hughson, and Weidenmier (2017), who show a reduction in counterparty risk premia in the US equity market after the establishment of the NYSE clearinghouse

in 1892. The main difference with my paper is that I do not focus on the effect of central clearing on the pricing of cleared derivatives, but study real effects on trade flows in underlying assets.

2 Theory and hypotheses

In complete markets, risk can be shared cross-sectionally and intertemporally to maximize the efficiency of allocations. Markets can be made more complete through financial contracting between agents (Allen and Gale, 1988). Consider a case where hedging instruments exist before the CCP is in place, but the agents who trade them have a non-zero probability of default. Central clearing is a contracting innovation that completes financial markets by ensuring that contracts pay off as planned.[1] I formulate one main hypothesis.

Hypothesis 1. ***(Trade flows)*** *After the introduction of a CCP, trade flows in commodities underlying centrally cleared future contracts increase relative to trade flows in commodities with no centrally cleared future contracts.*

Hypothesis 1 follows from the fact that more complete markets enable more risk-sharing, thus more gains from trade to be realized. This hypothesis has a corollary.

Corollary 1. ***(Consumption)*** *After the introduction of a CCP, consumption of commodities underlying centrally cleared future contracts becomes smoother relative to consumption of commodities with no centrally cleared future contracts.*

Indeed, risk-averse agents should exploit any new risk-sharing opportunity to smooth consumption.

While Hypothesis 1 follows from theories of market incompleteness, two distinct channels can explain why CCPs make markets more complete. First, there is an "adverse selection channel", relying on the idea that the key friction that impairs market functioning before central clearing is an information problem. Specifically, consider a situation where agents are asymmetrically informed about default probabilities, and some agents are better able to identify high-quality counterparties (that is, those with a

[1] An implicit assumption is that the CCP has enough resources so that its probability of default is zero. In Section 5.1, I argue that the probability of default of the CLAM was indeed close to zero.

low probability of default). Then, uninformed agents fear trading predominantly with "lemons" who will not be able to make good on their contractual promises. Therefore, they choose to participate in the market only at a price discount (Gorton and Pennacchi, 1990; Dang et al., 2017). Anticipating this, high-quality traders self-select out of the market (Akerlof, 1970). In this context, CCPs complete financial markets by making hedging contracts information-insensitive: contract value becomes insensitive to agents' private information about bilateral default risk. After central clearing is in place, uninformed agents no longer fear to be adversely selected, while high-quality traders re-enter the market. The ability to trade risk-sharing contracts increases.

The second potential channel through which market completeness increases is a "missing insurance channel". In this case, the friction impairing market functioning before central clearing is the lack of an insurance market to trade counterparty default risk (Biais, Heider, and Hoerova, 2012). This form of incompleteness can arise for exogenous reasons, or from transaction costs, but the key difference with the adverse selection channel is that it does not arise from an information problem. Whenever bilateral default risk cannot be insured, bilateral risk-sharing contracts become less valuable. In this case, CCPs complete financial markets by eliminating counterparty risk, thus by making financial contracts better risk-sharing instruments. It is as if a new security with different payoffs was introduced.

To distinguish between these two channels, theory makes distinct predictions about the composition of the pool of traders around the introduction of central clearing. If adverse selection is significant ex ante, the fraction of low-quality traders (those with high unobservable probability of default) should drop with central clearing. Indeed, after a CCP is in place, high-quality traders re-enter the market as price discounts for counterparty risk disappear. A related prediction is that new traders – for which asymmetric information concerns are arguably larger – also become more prevalent after central clearing. Instead, if markets are incomplete but there is no asymmetric information, then trading before central clearing should be concentrated among traders with a low observable probability of default. When a CCP is in place, either traders with high default risk can enter the market (since counterparties no longer worry about default risk), or they are kept away from the market by the CCP, for example

via high margin calls. To summarize, while the adverse selection channel predicts that the average quality of the pool of traders increases with central clearing, the missing market channel predicts that it decreases.

3 Historical background and data

I describe the creation of the CLAM, its functioning, and the data used in the analysis.

3.1 Historical background

In the second half of the 19th century, the North-Western part of Europe was the most active trade area globally. Both free-trade policies and technological progress (steamboats replacing sailboats) boosted intra-European and transatlantic trade. Harbors such as Antwerp, Hamburg, Le Havre, Liverpool and Rotterdam were intensely competing to attract trade flows. Le Havre was the largest French harbor in this "Northern range", and the second largest harbor in France, after Marseille.

The market for physical coffee had one main characteristic. While coffee was produced in distant countries, primarily Brazil, it was not stored in these countries. After the crops, coffee was exported to European harbors to be warehoused. Then, whenever demand was rising in a region, short-distance intra-European boats would transfer it from the warehouse to this region. The strength of a harbor was thus reflected in the magnitude of its imports from producing countries and in the amount of its stocks.

Long-distance trade gave rise to significant price risk, both for importers and for dealers warehousing physical commodities.[2] To mitigate price risk, forward sales and purchases had existed for centuries. Starting in the 1860s, the standardization of contracts led to the creation of organized futures markets. Thus, trading was centralized. Clearinghouses created in markets such as Liverpool also centralized the settlement of transactions, but did not insulate traders against counterparty risk. In Le Havre, bilateral futures transactions were concentrated between well-established trading houses and uncollateralized. Reputation was the main guarantee against counterparty risk.

[2]Other risks were those associated with moral hazard when contracting with agents in distant countries (Greif, 1993) and the risk that boats sink (De Roover, 1945).

3.2 The creation and functioning of the CLAM

The first CCP insulating traders from counterparty risk was created following a crisis in global coffee markets in 1880-1881 (see Appendix B.1 for details). Fears of counterparty risk were large and trading houses' reputation was not sufficient anymore to sustain trade. In Le Havre, a group of well-established coffee traders assembled to create the *Caisse de Liquidation des Affaires en Marchandises* (*CLAM*) as a limited liability corporation.[3] The CLAM started operating on December 16th, 1882. Compared to pre-existing clearinghouses, the contractual innovation was for the CCP to substitute itself to original parties in a transaction, and to insulate traders against bilateral default risk. To successfully arise, a CCP needs coordination of sufficiently many traders.[4] In Le Havre, close ties between the first equity holders – including family ties – allowed overcoming coordination problems (see Appendix B.2 for details).

Remarkably, the functioning of the CLAM was similar in most respects to that of modern CCPs. After two traders agree on a transaction, they report it to the CLAM, which becomes counterparty to each of them. Subsequently, the CLAM eases the settlement of trades, via multilateral netting, and insulates each trader against the default of its initial counterparty. The CLAM has two main instruments to protect itself against the default of traders. First, each counterparty must be a broker domiciled in Le Havre, which is akin to a membership requirement. Second, the CLAM calls variation margins every day from traders realizing losses (based on changes in their position's market value). Variation margins must be received within one day. Furthermore, at the inception of any trade, an initial margin is paid, to protect the CCP in case a trader defaults on variation margins. When a trader defaults on margin calls, the CLAM seeks to immediately liquidate its position, in order to return to a matched book. Potential losses arising from the liquidation of a trader's position are first borne by this trader's initial margins.[5] If initial margins are insufficient, residual losses are borne by the CCP's equity. This last point is the main difference with mod-

[3] In the US, the 1880 crisis led to the creation of the Coffee Exchange in the City of New York, also in 1882. This exchange had no CCP insulating traders against counterparty risk (Emery, 1896).

[4] The incentive for a trader to use a CCP depends on the fraction of other traders using it, due to network externalities arising from multilateral netting (Duffie and Zhu, 2011). Such externalities imply that mutually beneficial CCPs may not emerge due to coordination failures.

[5] For a CCP, losses arise from price changes between the time at which a trader lasts posts variation margins and the time at which the liquidation of its position is complete.

ern CCPs: the CLAM did not have a default fund or other loss-sharing mechanisms between surviving members ("default waterfall").

3.3 Data

I reconstruct the history and functioning of the CLAM using archive sources described in Appendix A. I found early rulebooks, annual reports, board minutes, legal acts containing exhaustive lists of equityholders, and a number of descriptive accounts by contemporaries about the CLAM's operations. I further collect data from the *Bulletin de correspondance* a daily newspaper published by Le Havre's exchange. This includes daily data on future prices and quantities traded, as well as daily data on the identity of traders in physical coffee.

For my main tests, I additionally collect yearly data on trade flows in coffee and other relevant commodities for France and 7 other European countries over the 1877-1888 period. These data are obtained separately from each country's customs statistics (see Appendix A.2 for detailed sources).

4 Central clearing and trade flows

In this section, I show that the reduction of counterparty risk in Le Havre' futures market led to a significant change in trade flows Europe-wide.

4.1 The event

To assess the effect of central clearing on trade flows, I use the introduction of the CLAM as an experiment and estimate triple difference-in-differences models. The identification of a causal effect relies on exogeneity requirements: central clearing should be as good as randomly assigned, both with respect to treated harbors and to treated commodities. My setting has several features such that exogeneity requirements are arguably satisfied.

Regarding the treated harbor, the CLAM was a response to heightened counterparty risk in Havre. However, there is no evidence that risk was higher in Le Havre than in other markets. For example, Appendix B.1 shows that it was much lower

than in New York, where all three largest trading houses had failed. Relatedly, central clearing was not introduced at a moment when Le Havre became more or less attractive for trade flows in general. As seen in Figure 2, total imports and exports in Le Havre, either in volume or in value, do not exhibit a specific trend before 1882-1883. Furthermore, central clearing was an heavily debated innovation, and evidence shows that traders had no clear understanding of what its effects on trade flows would be. Depitre (1907, p. 162) writes that "At the beginning, opinions were strongly divided in the commercial circles in Le Havre. A number of important trading houses refused to participate in the CLAM and several of them avoided any relationship with it."[6] Similarly, the costs and benefits of central clearing remained debated abroad for years. In the New York Coffee Exchange the introduction of central clearing was debated multiple times by the Board of Managers, but never adopted (Emery, 1896). In Hamburg, the commodity exchange was long convinced that the costs of a CCP outweigh its benefits (Fuchs, 1891). In this context, it is unlikely that traders in Le Havre adopted central clearing because of the pre-existing knowledge that it would boost trade flows.

Then, regarding the treated commodity, the CLAM was explicitly set up to mitigate counterparty risk in the market for coffee futures. However, from the very beginning, it also accepted other commodities for clearing, primarily cotton. In the case of cotton, remaining concerns about the endogeneity of the treatment is thus absent. In Section 4.3, I show that the results obtained for coffee trade flows hold equally well when focusing on cotton trade flows.

4.2 Triple difference-in-differences estimation

For identification, there are three sources of variation: (i) variation before and after December 1882, (ii) within trade flows in coffee, variation between Le Havre and other harbors, and (iii) within trade flows in Le Havre, variation between coffee and other uncleared commodities. The existence of these sources of variation enables ruling out confounding explanations relying either on commodity-specific or on harbor-specific

[6] In Appendix B.2, I document that some of the largest coffee traders indeed did not initially contribute to the CLAM. Even among the founders, 8 out of 50 shareholders opposed the proposed functioning during the general assembly in which the CLAM's rulebook was approved.

demand and supply shocks. My main specification jointly exploits these sources of variation in a triple difference-in-differences model. Focusing first on France's imports and exports, I use as specification,

$$\begin{aligned} Share_{cht} &= \alpha + \beta_1 \cdot CCP_{ht} + \beta_2 \cdot Cleared_c \cdot Post_t \\ &\quad + \beta_3 \cdot CCP_{ht} \cdot Cleared_c + \mu_t + \mu_{ch} + \epsilon_{cht}. \end{aligned} \tag{1}$$

In (1), $Share_{cht}$ is the share of France's imports of commodity c in harbor h in year t.[7] CCP_{ht} equals one if there is a CCP in place in harbor h it year t. $Cleared_c$ is a dummy variable equal to one for coffee and zero for other commodities that remain uncleared. Finally, $Post_t$ equals one for years strictly after 1882. The coefficient of interest, β_3, captures the effect of introducing a CCP in Le Havre specifically on coffee trade flows, after controlling for changes in Le Havre's trade activity that are common to all cleared and uncleared commodities (captured by β_1), and for changes in coffee trade activity after 1882 that are common to all harbors (captured by β_2).

I first estimate Equation (1) on the full set of 23 French harbors, over the period 1877-1888 (that is, 6 years before and after the treatment).[8] As control commodities, I use so-called "colonial commodities". This corresponds to the commodity group in which coffee is classified in customs data, and includes cocoa, pepper, sugar, tea, and tobacco. For identification, one advantage of this setup is that these commodities are not produced on European soil. Therefore, changes in trade flows cannot reflect changes in home production. Table 1 reports the share of French imports by commodity arriving in the main harbors in the 1877-1882 period preceding the creation of the CLAM. As can be seen, Le Havre was by far the most important harbor for coffee trade flows (60.5% of total imports), and also a large market for tobacco (34.9%), cocoa (32%) and pepper (21.2%).

The regression estimates are displayed in Table 2. The baseline estimate, in column (1), shows that the share of coffee imports arriving in Le Havre increased by 11.1% (significant at the 1% level) after the creation of the CLAM, relative to control

[7] The reason for using commodity-level import shares as dependent variables is that I do not have to separately account for changes in trade flows coming either from changes in import volume or from changes in import prices.

[8] Throughout the paper, I refer to "harbors," even though some entry or exit points for commodities include a few cities on land borders.

commodities. The magnitude of the effect is economically large. Compared to a pre-clearing share of 60.5%, this represents an increase in coffee imports for Le Havre of 18.3%.

This baseline result is robust to alternative specifications of the control group. In column (2), I re-estimate the baseline specification after excluding sugar from the control group, since sugar is also produced in Europe. The magnitude of the effect remains of similar magnitude (9.2% versus 11.1%) and equally significant. In column (3), the control group is the sum of all imports at the harbor-level. The estimated effect of introducing the CLAM (a 17.7 percentage points increase in the share of coffee) is even larger than in the baseline specification. Finally, in column (4), I estimate the same regression as in column (3) but with exports as dependent variable. The estimated effect is larger than for imports, as the share of Le Havre's coffee exports within France's exports increases by 24.7 percentage points. Therefore, all regression results show that the introduction of central clearing had a large positive effect on trade flows within France.

While large, the magnitude of the estimated effect is realistic. Indeed, as discussed in Section 3.1, coffee imported to Europe was not consumed immediately, but warehoused and potentially re-exported within Europe. This storage activity exposed dealers to price risk. Therefore, the ability to hedge price risk was a key determinant of the place in which commodities were warehoused. Consequently, the creation of the CLAM increased hedging ability, and led to a change in the geography of imports – not primarily because more coffee was consumed in Le Havre, but because more stocks were held in Le Havre. This can be seen from Column (5) of Table 2, which re-estimates Equation (1) using the share of French stocks for each commodity as dependent variable. I find that the share of French coffee stocks in Le Havre increased by 15 percentage points after 1882, relative to stocks of other commodities.

4.3 Estimation with other commodities

A potential endogeneity concern is that unobserved characteristics simultaneously led to the adoption of clearing and made coffee trade more attractive in Le Havre around 1882. To rule out this concern, I systematically read local newspapers in 1882, and

do not find any mention of omitted factors. To get further reinsurance, I construct a formal test. Indeed, while the CLAM was created to address issues in the coffee market, other commodities – primarily cotton – also became centrally cleared.[9] The introduction of clearing in the cotton market is thus fully exogenous.

I reestimate the triple difference-in-differences model in Equation (1) with either raw cotton or the sum of raw cotton and cotton textiles as treated commodities. The control group includes either raw wool, or the sum of raw wool, wool textiles and silk textiles. The estimation results, in Columns (1) and (2) of Table 3, show a positive and significant effect of central clearing on cotton imports, relative to other textile imports. The magnitude of the effect is similar to that obtained for coffee, with an increase in the share of cotton imports between 7.2% and 14.2% depending on the specification. The endogeneity of the treatment is thus unlikely to be a major concern in coffee trade regressions.

The same test can be reproduced for subsequent years, when additional commodities became eligible for clearing. One of the very first commodities to be added was indigo, in 1887. In Column (3) of Table 3, I reestimate Equation (1) with indigo as treated commodity and the sum of all imports as control, over a 1882-1890 window. I again find a positive and significant effect of central clearing on imports. Since the event date in this case is not the same as for coffee and cotton, this test alleviates the concern that previous results were driven by factors specifically related to these commodities in 1882.

4.4 Europe-level trade flows

I turn to the impact of central clearing on trade flows at a broader scale, and ask whether European countries import a larger share of their coffee from France after 1882.[10] Separately for each sample country i, I estimate the difference-in-difference

[9] The third commodity eligible for clearing in December 1882 was lard (*saindoux*). There is unfortunately very limited information on the central clearing of lard futures and on lard trade flows.

[10] The ideal test would be to check whether European countries import a larger share of their coffee from Le Havre (not just from France) after 1882. However, archival data report only the country of origin, not the harbor of origin of imported goods. As shown in Section 4.2, Le Havre significantly increased exports after 1882, relative to other French harbors. Therefore, if European countries import more coffee from France, it is most likely coming from Le Havre.

equation,

$$\begin{aligned} Trade^{i}_{cpt} &= \alpha + \beta_1 \cdot CCP_{pt} + \beta_2 \cdot Cleared_c \cdot Post_t \\ &\quad + \beta_3 \cdot CCP_{pt} \cdot Cleared_c + \mu_t + \mu_{cp} + \epsilon^{i}_{cpt}, \end{aligned} \tag{2}$$

where p indexes countries other than i and $Trade_{cpt}$ is the share of imports in country i of commodity c from country p at date t. Furthermore, CCP_{pt} equals one for France after 1882, while other terms are the same as in Equation (1). Equation (2) is estimated for the following countries: Belgium, Germany, Hamburg, Italy, Netherlands, Norway and Sweden.[11] The composition of the control group always includes colonial commodities, but the composition varies for each country based on data availability. Table 4 shows that, before the introduction of the CLAM, France's exports of colonial commodities to the sample countries were low overall.

The estimation results, in Table 5, show that central clearing had a significant effect on trade flows Europe-wide. All European countries in the sample increase the share of their coffee imports from France after the CLAM is in place, and this increase is significant in all cases, except for Italy.[12] Interestingly, the magnitude of the effect is relatively similar across countries, ranging from 2.9 percentage points for Hamburg to 7.3 percentage points for Germany. Economically, these magnitudes are large. Indeed, as seen in Table 4, pre-treatment import shares from France were between 2 and 3% in several cases (Hamburg, Netherlands, Norway, Sweden). The estimates therefore imply that, for these countries, imports from France were multiplied between 2 and 3 times. In Germany, where the pre-treatment import share for coffee was only 0.9%, the effect is even larger. These results are consistent with the idea that, while more coffee was warehoused in Le Havre after the creation of the CLAM, a significant part was re-exported to other European countries. Thus, access to better hedging instruments reinforced the role of Le Havre as a hub for coffee trade in Europe.

[11] I treat Hamburg as a separate country. Indeed, while a large number of German states were part of the *Zollverein* (customs union), Hamburg joined only in 1888. Therefore, there are separate customs statistics for Hamburg and for Germany over my sample period. Furthermore, I do not include the UK because import data for colonial commodities are not broken down by European countries of origin.

[12] A tariff war between France and Italy started in 1887 and led to a sharp drop in Italian imports from France in 1888. When re-estimating Equation (2) from 1878 to 1887 only, the estimated coefficient for Italy equals 0.054 and is significant at the 10% level (p-value of 0.051).

4.5 Narrative evidence

The econometric evidence is supported with narrative evidence. Indeed, several contemporaries noted the positive impact of central clearing on coffee trade flows in Le Havre. In front of a parliamentary commission on futures markets, coffee dealers declared in 1897 that "since 1880, imports have increased so much that, within a few years, Le Havre has become the largest market globally."[13] A few years later, Depitre (1907) wrote that "it is not disputable that the creation of the CLAM significantly contributed to maintain the preponderance and to foster the commercial development of the harbor of Le Havre." Interestingly, foreign commentators reached a similar conclusion. In the United States, Emery (1898) writes that "it is well-known that the establishment of future trading in Le Havre in 1881 greatly increased the coffee business of that port at the expense of Hamburg." Similar quotes exist in German sources.[14]

Moreover, indirect evidence that central clearing was beneficial to trade activity in Le Havre can be obtained by studying the reaction of competing harbors. When it became clear that the increase in trade in Le Havre was attributable to the CLAM, other European markets introduced CCPs. Within ten years, nine European exchanges had CCPs in place: Paris (1885, 1887), Antwerp (1887), Hamburg (1887), Amsterdam (1888), Marseille (1888), Magdeburg (1889), Reims (1890), Leipzig (1890) and Roubaix-Tourcoing (1892). In cases where documentation is available, it is clear that the adoption of central clearing was motivated by the successful experiment in Le Havre.[15] Therefore, the contractual innovation spread quickly to other markets.[16]

4.6 Consumption smoothing

I now provide suggestive evidence that central clearing helped smoothing coffee consumption in France. My sample period offers a good laboratory, in the form of a global negative production shock, which I use to study cross-country differences in the response of coffee consumption. While less cleanly identified than results on trade flows,

[13] In *Rapport Gustave Dron*, Commission chargée d'examiner les propositions de lois concernant les marchés à livrer et l'agiotage sur les denrées et marchandises, Chambre des députés, 1898, p. 117.
[14] See the excerpt from *Denkschrift für Handelskammer* cited by Sayous (1898, p. 280).
[15] For Hamburg, the other main coffee market in Europe, see Becker (2002) and Rischbieter (2011).
[16] In the US, according to Moser (1998), the first CCP was established in 1891 in Minneapolis.

the findings on consumption are nonetheless important given the role of this variable in any economic theory.[17]

The shock I study is displayed in Figure 3: coffee prices boomed by 140% within a few months in 1886-1887, due to bad crops in Brazil. This shock has the appealing feature that it is posterior to the creation of the CLAM but precedes the creation of CCPs in other European markets. Furthermore, while food consumption is typically hard to measure, coffee consumption can be precisely assessed, since there is no home production of coffee in Europe. I obtain yearly data on coffee consumption in 11 European countries from the US Department of Agriculture (Graham, 1912).

The main result can be seen in Figure 4. While world coffee consumption fell by 17.6% between 1886 and 1887, European consumption (excluding France) by 16.6%, German consumption by 17.7%, French consumption fell by only 6.0%. I then focus more precisely on cross-country differences within Europe, showing data for 11 European countries in Table 6. This table shows that France has the smallest drop in coffee consumption between 1885 and 1887. The fact that France exhibits a smoother coffee consumption can also be seen when looking separately at the main drop (1886 to 1887, in Column 2) and at the rebound (1887 to 1888, in column 3).[18] Finally, while all French harbors reduced coffee stocks in 1886 and 1887, Le Havre's stocks decreased by 64.4%, from 73 million tons in December 1885 to 26 million tons in December 1887. Overall, these results are consistent with Corollary 1, according to which central clearing helps smoothing coffee consumption.

5 Mechanism

In this section, I dig into the mechanism explaining the effect of central clearing on trade flows. I find that central clearing made markets more complete by mitigating both an adverse selection problem and a "missing market" problem.

[17] The ideal test would be to estimate Equation (2) using price-elasticities of commodity consumption as dependent variables. However, price-elasticities cannot be reliably estimated with yearly data and a relatively short time window.

[18] Two anomalies are Romania and Italy, where an increase in consumption is reported in 1887. However, both countries reported large drops in consumption in 1886 (-14.4% and -54.0% respectively), while other countries do not. One possibility is that, for these two countries, consumption is not measured at the same moment of the year. This is why my favorite measure is the total drop between 1885 and 1887.

5.1 Completing financial markets: Preliminary evidence

For an increase in market completeness to explain the results on trade flows, four requirements must be met: (i) counterparty risk before the introduction of central clearing must be high enough to significantly impair trade, (ii) the CCP must be credible to significantly reduce counterparty risk, (iii) investors must use the CCP to a significant extent, and (iv) trading activity in futures must increase. All four requirements are met.

Concerning (i), the CLAM was created following a long period of high counterparty risk. As discussed in Appendix B.1, there is abundant narrative evidence that global coffee markets could not efficiently function in 1880-1881, following a large drop in coffee prices. Figure A1 also shows that the number of active commodity traders decreased between 1880 and 1883, consistent with counterparty risk being high. Additionally, in Le Havre, traders had massively increased coffee stocks in 1881-1882, to bet on a price reversal. As they became cash-constrained, counterparty risk for potential financiers was large. Sayous (1898) reports that "as the future looked highly uncertain, one needed [...] to find a way to reduce the risks for capitalists."

Then, with respect to (ii), several elements show that the founders of the CLAM explicitly sought to create a credible and robust institution to fully eliminate counterparty risk. Indeed, the CLAM was established with the support of several reputable families, as discussed in Appendix B.2. As Depitre (1907, p. 162) notes, "the founders chose, as chairman of the board, W. Iselin, a highly reputed trader, from an excellent and very old trading house importing coffee, and notoriously staying away from speculative deals." Moreover, only 25% of the equity (2,000,000 FRF) was initially paid-in, so as to retain a callable buffer of 75%. Furthermore, the CLAM started operations with stringent collateral requirements, which were deemed excessive by some members but were not lowered. At the founding general assembly (8th December 1882), several participants complained about the magnitude of initial margins. Then, according to the minutes, "Mr. Le Normand [one of the founders] answers that the company is above all a financial company: the members of the assembly are shareholders before being brokers or dealers; one should consider the general interest of the company, not the particular interest of each shareholder; if initial margins are lower, the decrease

may be advantageous for some counterparties, but disadvantageous for the company and its shareholders." It is also notable that, in subsequent years, the CLAM was never at risk of defaulting on its commitments.

In support of requirement (iii), there is evidence that virtually all traders were very soon using the CLAM, in spite of early opposition by some trading houses. This is remarkable, given that there was no requirement to centrally clear transactions executed in the exchange. For example, De Rousiers (1903, p. 172) writes: "No law, no local rule require anyone to register futures transactions at the CLAM; however, all serious businessmen in Le Havre use it. Through their daily actions, for more than 20 years, they give a strong support to the CLAM, they recognize that its discipline is not uselessly tough [...] and very few of the critiques would dare engaging in a bilateral transaction that would not be centrally cleared." Furthermore, according to Depitre (1907), even traders who explicitly wanted to avoid the CLAM after its creation were using it after just a few months. The fact that the CLAM was widely used is also evident from its early and high profitability, discussed in Appendix B.3. For example, the CLAM was already able to pay dividends in 1883.

Finally, regarding (iv), the trading volume in futures increased markedly soon after the creation of the CLAM. To show this, I collect daily data on trading volume from the *Bulletin de correspondance*, and plot it in Figure 5. As can be seen, between the six months preceding the creation of the CLAM and the following six months, the trading volume in coffee futures increased by 303% on average.

5.2 Completing financial markets: The mechanism

I now dig deeper into the mechanism and try to distinguish between the adverse selection channel and the "missing market" channel. These two channels can be distinguished based on their predictions about changes in the composition of the pool of traders around the introduction of central clearing.

While trader-level data on futures transactions are not available, I collected daily data on the names of individual traders in the spot coffee market (from the *Bulletin de correspondance*). I thus rely on the assumption that, in the cross-section of traders, a greater access to futures markets positively correlates with access to the spot market.

I collect these data for a period covering one year before and after the creation of the CLAM. Furthermore, from yearly registers of commodity traders (*Almanach du commerce du Havre*), I find for each of them the year in which they started and ceased operations.[19] Panel A of Table 7 describes the data using two-sample t-tests comparing the number and concentration of traders around the creation of the CLAM. The average number of traders increased both at daily and monthly frequencies (by 0.7 and 3.7 traders respectively), while the concentration of trading activity – measured by the Herfindhal index – decreased. While this increase in the set of traders is consistent with both the adverse selection and the "missing market" channels, I now conduct two tests to distinguish between them.

As a first test, I study the share of low-quality traders, defined as traders who exit the market within the subsequent two years. Specifically, I estimate

$$Share_t = \alpha + \beta \cdot Post_t + \epsilon_t, \tag{3}$$

where $Share_t$ is the share of transactions executed by low-quality traders and $Post_t$ is a dummy variable equal to one after the creation of the CLAM. If adverse selection is large before the CLAM, the coefficient β is expected to be negative. Indeed, after the CLAM is in place, high-quality traders find it more valuable to enter the market, while low-quality traders may be excluded from the market if collateral requirements play a screening role. I report estimates of Equation (3) in Panel B of Table 7. The estimated share of low-quality traders over the entire sample period is relatively low (8.2%) and, most importantly, the coefficient β on $Post_t$ is not significantly different from zero. The fact that the share of low-quality traders does not change around the creation of the CLAM is inconsistent with the idea that adverse selection due to their presence was large. Since these traders had been operating for years, their quality had arguably been revealed (at least with a reasonable level of confidence). If this is the case, I conclude that the main effect of central clearing for long-established traders was to solve a "missing market" problem.

[19] In the trade-level data, counterparties are not always identified, but this does not change with the creation of the CLAM. There are 2,200 trader-day observations, corresponding to 83 unique traders. Only two of them cannot be matched to data on the start and end dates of operations. Furthermore, the reason for exiting the market is not known.

As a second test, I study the share of new traders around the creation of the CLAM, defined as traders who entered the market in the preceding two years. Indeed, the above argument about trader quality being partially revealed requires traders to have been active in the market for some time; this is arguably not the case for new traders. I re-estimate Equation (3), with the share of transactions executed by new traders as dependent variable. Estimates, also in Panel B of Table 7, show that this share significantly jumps after central clearing is in place. In terms of magnitude, it is multiplied by a factor of three, from 4.8% to 14.7%. This result is consistent with the idea that new traders, whose reputation is not yet established, faced significant adverse selection problems. In sum, there were informational barriers to entry before the CLAM was in place. To further support this idea, I collect trader identities from yearly registers until 1886. As seen in Figure A1, there was significant entry of new commodity traders after 1883. Among them, those explicitly identified as coffee traders increased from 43 in 1882 to 55 in 1886.[20]

To conclude, I find partial evidence consistent with both the "missing market" and the "adverse selection" channels. In the subset of long-established traders, adverse selection was not a major issue, and the introduction of the CLAM compensated the absence of a market to trade counterparty risk. In the subset of new traders, the CLAM eliminated adverse selection and removed informational barriers to entry.[21]

5.3 Other potential mechanisms

Next, I rule out alternative mechanisms that could explain my results.

Price transparency

A first possibility is that the trade results are due to an increase in price transparency associated with the creation of the CLAM. As Figure 6 shows, public price information shifted from an approximative discussion of prices (left panel) to a detailed price schedule for each maturity (right panel) on the day the CLAM opened. The-

[20] These figures do not reflect the total number of houses involved in coffee trading. Indeed, many of them dealt with several commodities and did not explicitly identify as coffee traders.

[21] Given that the CLAM was created by established traders (see Appendix B.2), they must have agreed to lose part of their informational rents to new entrants. This suggests that, in their view, the "missing market" problem was in itself an important concern.

oretically, price transparency should reduce price dispersion and informational rents, increase matching efficiency and allow more gains from trade to be realized (Duffie, Dworczak, and Zhu, 2017; Martin, 2018).

This mechanism is unlikely to be dominant here. First, while it is true that price transparency improved, it didn't do so only for traders in Le Havre. In the 1880s, prices were quickly disseminated by telegraph to all other European markets, and to the United States.[22] Thus, if price transparency improved in all markets, we should not expect the trade effect to be localized in Le Havre. Second, the futures exchange and the CLAM were separate entities, so that one could trade futures and choose not to clear them with the CLAM. Therefore, if traders had been primarily seeking price transparency, they could have engaged in free-riding, by benefiting from price information while avoiding the costs associated with using the CLAM. Instead, as discussed, virtually all traders were clearing trades through the CLAM, and the CLAM earned significant profit out of clearing fees from the first year of operations.

Standardization

A second possible mechanism to explain the trade effects could be the increase in contract standardization that coincided with the creation of the CLAM. Specifically, a futures markets was created in Le Havre in 1881, slightly more than a year before the creation of the CLAM. At that time, futures became more standardized. Standardization further increased with the creation of the CLAM, as one single coffee grade became publicly quoted. Standardization makes contracts more liquid. Indeed, due to the existence of externalities in liquidity provision decisions, a single traded future is more liquid than multiple contracts (Pagano, 1989). Moreover, if all investors trade standardized grades, the concern that some investors have private information specific to a given grade is lower. Therefore, bid-ask spreads – a compensation for adverse selection – are lower (Gorton and Pennacchi, 1993) and risk-sharing is easier.

This alternative explanation can be ruled out based on already mentioned arguments. Most importantly, if investors were primarily seeking standardized contracts regardless of whether they are centrally cleared, they could free ride on the CLAM. This is inconsistent with the fact that virtually all transactions were centrally cleared.

[22] The first transatlantic telegraph cable started operating in 1866 (Steinwender, 2017).

Second, while the use of the CLAM was restricted to counterparties located in Le Havre, trading was open to investors in other markets. Therefore, if the availability of trading more standardized contracts was a dominant force, there is no reason why the effect should be concentrated in Le Havre.

Why is the effect localized?

While other mechanisms are inconsistent with a localized effect in Le Havre (since price transparency and standardization increased for virtually anyone), several elements suggest that markets became more complete only for traders localized in Le Havre. Indeed, while *trading* was open to any investor, *clearing* was easier for traders located in Le Havre. First of all, any counterparty to the CLAM had to be located in Le Havre. Counterparties located outside Le Havre could thus only clear trades via a broker. Moreover, the ability to pay margin calls, was more limited for counterparties outside Le Havre, due to technological reasons. Finally, the CLAM could refuse to register transactions in case it lacked information about counterparties, which was more likely to occur for distant counterparties. Due to these features, it is reasonable to conclude that the creation of the CLAM made markets more complete predominantly for traders in Le Havre.

5.4 Central clearing vs. other contracts

Theoretically, a remaining question is whether the increase in market completeness due to central clearing could have been achieved without a CCP. Relying on a description of the market by Sayous (1898), partially reproduced in Appendix B.1, I argue that simpler contractual arrangements could not be equivalent to a CCP.

In 1882, coffee importers faced a specific contracting problem. To operate long-distance boats, they typically relied on advances from banks or wealthy individuals (Dany, 1900). In the months leading up to the creation of the CLAM, importers in Le Havre had bought large amounts of coffee, following a large crop, to store it in the expectation of future high prices. However, the magnitude of the purchases had been such that importers were cash constrained, and needed liquidity to continue operations. To solve this problem, several contractual solutions were possible.

A first possibility could have been for importers to borrow from financiers by pledging coffee stocks as collateral. However, as mentioned by Sayous (1898), such loans "could not attract capitalists and speculators who ignored differences in coffee quality." In other terms, coffee was not a good collateral because of adverse selection concerns: financiers feared ending up with the worse grades of coffee. Therefore, collateralized loans were not feasible. For the same reason, coffee sales to financiers in order to raise cash were not feasible.

To solve this adverse selection problem, the solution had to rely on the use of term transactions. Namely, financiers could buy coffee but only with an agreement to resell at a future date and at a price decided immediately. In principle, this arrangement avoids adverse selection concerns about the quality of collateral, provided that the counterparty is indeed able to buy back the coffee at maturity.[23] However, there is no reason why counterparties would never default at maturity, especially since their exposure to prices was high, due to the size of their stocks. As Sayous (1898) confirms, one needed "to find a way to reduce the risks for capitalists." Therefore, uncollateralized forwards were not feasible.

Lastly, the question is whether collateralized forwards, instead of a CCP, could work. As mentioned, collateral needed to be information-insensitive, and could thus only include cash or high-quality securities. However, evidence shows that the cost of posting such collateral was high. In addition to being cash-constrained, importers faced transaction costs associated with bilateral margin calls: posting collateral required visiting every counterparty to deliver and collect securities (which were paper certificates). Relative to this situation, the creation of a CCP reduced the cost of posting collateral. First, all collateral was posted in one place.[24] Second, and most importantly, by becoming direct counterparty to every transaction, the CLAM could offer multilateral netting facilities, that is, call margins based on the net position of any given trader across all of its counterparties. Therefore, creating a CCP was more cost-efficient than the collateralization of bilateral futures. Sayous (1898, p. 280) confirms that outright sales together with cleared futures were taking place: "[financiers]

[23] This is akin to a repurchase agreement (repo). Holmström (2015) justifies the existence of repos precisely as a way to borrow while avoiding adverse selection concerns about the quality of collateral.

[24] According to its rulebook, the CLAM accepted cash and securities (at its discretion) as collateral.

bought in the spot market to resell in the term market".

6 Conclusion

I study the real effects of central clearing, a contracting innovation that suddenly made financial markets more complete. After its introduction for coffee futures in Le Havre in 1882, central clearing significantly changed the geography of trade flows in France and Europe: for cleared commodities, trade flows increasingly went through Le Havre. Regarding the mechanism, central clearing both mitigated adverse selection issues and resolved a "missing market" problem.

While central clearing proved beneficial when first introduced, one should remain careful when drawing implications for current debates about mandatory central clearing. There are at least two novel elements to be taken into account. First, central clearing in the 1880s was voluntary. Instead, mandatory clearing may create new agency problems, since CCPs now have more captive clients and potentially benefit from implicit guarantees. Second, the CLAM was closely resembling a member-owned institution. In contrast, for-profit CCPs – which are now common – may be less inclined to manage risk so as to avoid externalities that impair the market's functioning. More research is needed on the optimal design of CCPs when regulation is in place.

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Table 1 – Share of France's main harbors in colonial commodities trade - 1877 to 1882

This table reports the share of total French imports arriving in seven major harbors. We report shares for coffee, for the five commodities in our main control group, as well as for total imports (both in volume and value). The shares are averaged over the period from 1877 to 1882, and thus correspond to the period just before the creation of the CLAM.

	Share of total French imports arriving in:						
	Bordeaux	Dunkerque	Le Havre	Marseille	Nantes	Paris	Rouen
Cocoa	0.322	0	0.320	0	0.114	0.226	0
Coffee	0.105	0.001	0.605	0.216	0.017	0.034	0.012
Pepper	0.065	0	0.212	0.665	0.058	0	0
Sugar	0.088	0.007	0.063	0.341	0.201	0.278	0.001
Tea	0	0	0	0.921	0	0.079	0
Tobacco	0.272	0.071	0.349	0.264	0	0.007	0
Total (volume)	0.082	0.076	0.117	0.169	0.014	0.025	0.058
Total (value)	0.069	0.058	0.201	0.255	0.012	0.118	0.030

Table 2 – Triple difference-in-differences estimation – French trade flows

This table displays the results from the estimation of Equation (1). It is estimated on the sample of 23 French harbors. In columns (1) to (3), the share of total imports of commodity c in harbor h in year t is used as dependent variable, while column (4) uses the share of total exports and column (5) uses the share of total stocks. In columns (1), the control group includes colonial commodities, specifically: cocoa, pepper, sugar, tea and tobacco. In column (2) the control group includes the same colonial commodities except sugar. In column (3), the control group includes the sum of all imported goods. In column (4), the control group includes the sum of all exported goods. The creation of the CLAM occurred in December 1882. Data is at a yearly frequency over the period 1877-1888. Standard errors are in parentheses. *, ** and *** refer respectively to statistical significance at the 10%, 5% and 1% levels.

	Dependent variable:				
	Share of imports	Share of imports	Share of imports	Share of exports	Share of stocks
$CCP_{ht} \cdot Cleared_c$	0.111***	0.092***	0.177***	0.247***	0.158***
	(0.020)	(0.019)	(0.008)	(0.018)	(0.037)
$Cleared_c \cdot Post_t$	-0.004	-0.004	-0.007***	-0.010***	-0.014
	(0.004)	(0.004)	(0.001)	(0.003)	(0.011)
CCP_{ht}	0.049***	0.069***	-0.016***	0.013	0.029*
	(0.008)	(0.008)	(0.005)	(0.012)	(0.015)
Control group	Colonial	Colonial	Total	Total	Colonial
Incl. sugar	Yes	No	-	-	Yes
R^2	0.944	0.953	0.991	0.964	0.878
N. Obs.	1,656	1,380	552	552	772

Table 3 – Triple difference-in-differences estimation – Other commodities

This table displays the results from the estimation of Equation (1) with commodities other than coffee. It is estimated on the sample of 23 French harbors. In all columns, the share of total imports of commodity c in harbor h in year t is used as dependent variable. In column (1), the treated commodity is raw cotton, while control commodity is raw wool. In column (2), the treated commodities and raw cotton and cotton textiles, while control commodities are raw wool, wool textiles and silk textiles. In column (3), the treated commodity is indigo, and the control group is the sum of all imported goods. Cotton started being centrally cleared in December 1882, while indigo was cleared in 1887. Data is at a yearly frequency over the periods 1877-1888 (for cotton) and 1882-1890 (for indigo). Standard errors are in parentheses. *, ** and *** refer respectively to statistical significance at the 10%, 5% and 1% levels.

	Dependent variable: Share of imports		
	Cotton (raw)	Cotton (raw and textiles)	Indigo
$CCP_{ht} \cdot Cleared_c$	0.142***	0.072***	0.046***
	(0.020)	(0.015)	(0.010)
$Cleared_c \cdot Post_t$	-0.006	-0.003	-0.002
	(0.004)	(0.003)	(0.002)
CCP_{ht}	-0.171***	-0.036***	0.000
	(0.014)	(0.009)	(0.007)
Control group	Raw	Raw and textiles	Total
R^2	0.966	0.932	0.984
N. Obs.	552	1,380	414

Table 4 – Share of colonial commodities imports from France - 1877 to 1882

This table reports the share of total imports of colonial commodities of Belgium, Germany, Hamburg, Italy, Netherlands, Norway and Sweden that arrive from France. The list of reported colonial commodities depends on the availability of data in country-level customs data. Import shares are averaged over the period from 1877 to 1882, and thus correspond to the period just before the creation of the CLAM.

	Share of imports arriving from France:						
	Belgium	Germany	Hamburg	Italy	Netherlands	Norway	Sweden
Cinnamon	-	-	-	0.208	-	-	0.003
Cocoa	0.642	-	0.124	0.396	-	-	0.020
Cocoa and tea	-	0.031	-	-	-	-	-
Coffee	0.126	0.009	0.020	0.217	0.028	0.027	0.024
Molasses	0.256	-	-	0.610	0.004	0.152	0.058
Black pepper	-	-	0.037	-	-	-	0
Chili pepper	-	-	0.018	-	-	-	-
All pepper	-	-	-	0.196	-	-	-
Spices	-	0.007	-	-	0.008	-	-
Sugar	-	0.140	0.000	-	0.002	-	-
Sugar - raw	-	-	-	0.098	-	-	0.003
Sugar - refined	0.452	-	-	0.124	-	-	0.114
Tea	0.073	-	-	0.241	0.000	0.001	0
Tobacco	0.021	0.001	0.042	0.005	0.019	0.000	0
Vanilla	-	-	0.108	0.645	-	-	-
Other	-	-	-	-	-	0.005	-

Table 5 – Triple difference-in-differences estimation – European trade flows

This table displays the results from the estimation of Equation (2). It is estimated separately for each of the following countries: Belgium, Germany, Hamburg, Italy, Netherlands, Norway, Sweden. The dependent variable is always the share of imports of commodity c from country p in year t. The control group includes all main colonial commodities, whose exact list depends on the country. The creation of the CLAM occurred in December 1882. Data is at a yearly frequency over the period 1877-1888. Standard errors are in parentheses. *, ** and *** refer respectively to statistical significance at the 10%, 5% and 1% levels.

	Dependent variable: Share of imports from country p						
	Belgium	Germany	Hamburg	Italy	Netherlands	Norway	Sweden
$CCP_{pt} \cdot Cleared_c$	0.062**	0.073*	0.029*	0.030	0.058**	0.047**	0.041*
	(0.030)	(0.044)	(0.017)	(0.027)	(0.029)	(0.023)	(0.024)
$Cleared_c \cdot Post_t$	-0.002	-0.004	-0.000	-0.001	-0.003	-0.001	-0.001
	(0.003)	(0.011)	(0.002)	(0.004)	(0.007)	(0.004)	(0.005)
CCP_{pt}	-0.005	-0.008	0.014**	-0.094***	-0.000	-0.051***	-0.019**
	(0.009)	(0.019)	(0.006)	(0.008)	(0.012)	(0.009)	(0.008)
Control group	Colonial	Colonial	Colonial	Colonial	Colonial	Colonial	Colonial
R^2	0.854	0.808	0.931	0.828	0.884	0.910	0.899
N. Obs.	1,648	864	3,735	4,080	1,368	1,728	2,484

Table 6 – Coffee consumption during the 1887 price boom

This table reports percentage changes in coffee consumption in 11 European countries during the 1887 coffee price boom. Columns (1), (2) and (3) respectively report changes between 1885 and 1887, between 1886 and 1887, and between 1887 and 1888. Countries are sorted based on the magnitude of their drop in coffee consumption between 1885 and 1887. Data is from Graham (1912).

	% Change in coffee consumption		
	1885 to 1887	1886 to 1887	1887 to 1888
France	-0.066	-0.064	0.065
Switzerland	-0.122	-0.195	-0.031
Romania	-0.123	0.024	0.103
Austria	-0.130	-0.150	0.070
Germany	-0.138	-0.176	0.126
Portugal	-0.189	-0.186	0.163
Sweden	-0.253	-0.287	0.067
Belgium	-0.292	-0.309	0.376
Russia	-0.326	-0.306	0.223
Norway	-0.332	-0.400	0.502
Italy	-0.395	0.314	-0.017

Table 7 – Pool of traders around the event

This table describes the pool of coffee traders around the creation of the CLAM. Panel A describes the data by performing two-sample t-tests comparing three variables one year before and one year after the creation of the CLAM ("Pre" and "Post", respectively): the number of distinct traders per day, the number of distinct traders per month, and the Herfindhal index (HHI) computed based on each trader every month. In Panel B, I report estimates of Equation 3. In Column (1), the dependent variable is the share of trades executed by traders who will cease to operate in the following two years. In Column (2), the dependent variable is the share of trades executed by traders who started operation in the past two years. Data on trading is collected at a daily frequency from the *Bulletin de correspondance* and relates to traders in physical coffee only. Data on new and defaulting traders is collected from the *Almanach du commerce du Havre*. The sample period is January 1882 to December 1883, and the CLAM was introduced on 16 December 1882. Standard errors are in parentheses. *, ** and *** refer respectively to statistical significance at the 10%, 5% and 1% levels.

Panel A: Description of coffee trading data

	Pre	Post	Post − Pre	p-value	N. Obs
Number of traders / day	3.440	4.147	0.706***	(0.000)	578
Number of traders / month	23.454	27.166	3.712**	(0.042)	23
HHI traders / month	0.071	0.063	-0.007*	(0.091)	23

Panel B: Composition of the pool of coffee traders

	Dependent variable:	
	Share of trades by members near distress	Share of trades by recent members
$Post_t$	-0.004	0.099***
	(0.014)	(0.014)
Constant	0.082***	0.048***
	(0.010)	(0.010)
R^2	-0.002	0.074
N. Obs.	577	577

Figure 1 – Sample of French harbors and main customs

This map shows the sample French harbors and main customs used in our sample when estimating Equation (1). There are 22 entry/exit points in metropolitan France, plus one in Corsica (not mapped). Le Havre is denoted with a red dot. The two points within land – Rouen and Paris – are on a river connected to the ocean (the Seine), and had standalone customs. The full list of harbors is given in Appendix A.3. Note that the French territory was smaller during our sample period than it is today, due to the takeover by Germany of Alsace and Moselle in 1871.

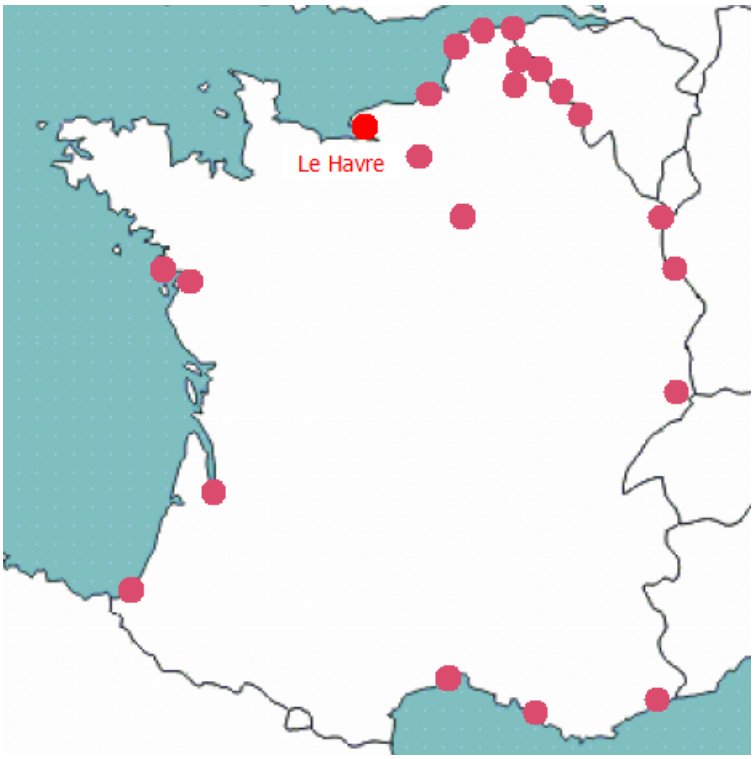


Figure 2 – Share of French imports/exports in Le Havre

This figure plots the share of French imports and exports respectively arriving in Le Havre and leaving from Le Havre. The shares are plotted for imports and exports both in volume (weight in 100 kilograms) and in value (current FRF). The dotted vertical line corresponds to the creation of the CLAM in December 1882.

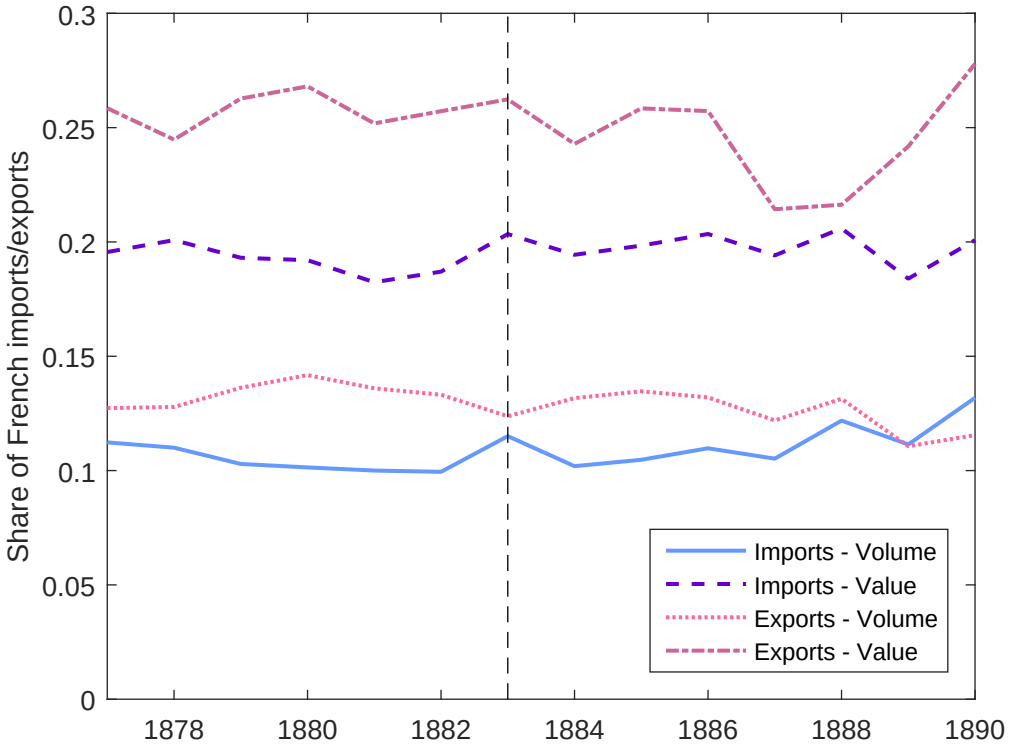


Figure 3 – The 1886-1887 coffee price boom

This figure shows monthly coffee prices in FRF/ton over the 1878-1893 period. The 1886-1887 price boom is due to exceptionally low crops in Brazil, the largest producing country worldwide. Data is based on prices in Hamburg. Source: Tapolski (1896), converted into FRF/kg.

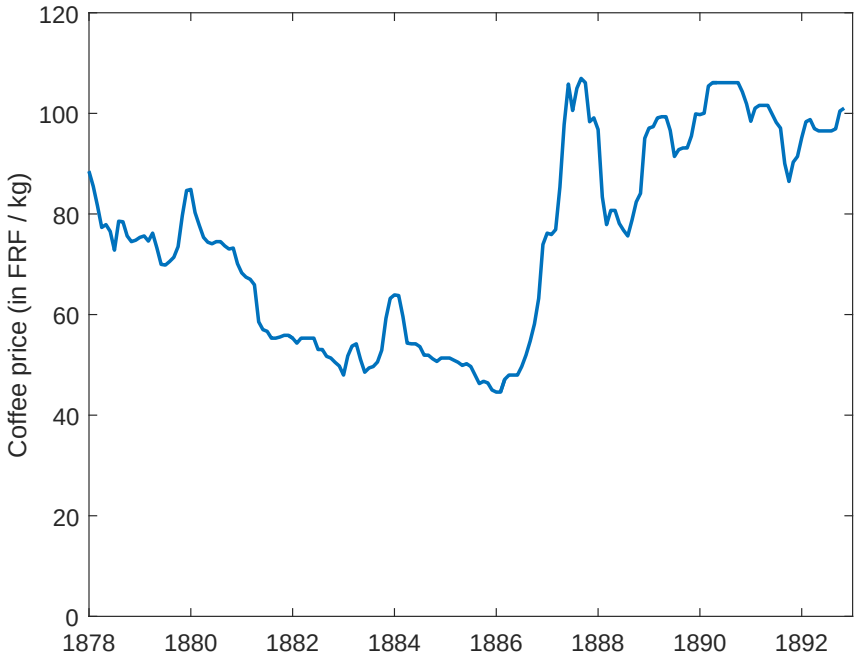


Figure 4 – Coffee consumption during the 1887 boom

This figure plots log-consumption of coffee, net of a fixed effect, during the 1887 coffee price boom. Coffee consumption is shown for France, Germany, Europe (excluding France and Germany) and for the world (excluding Europe). The dashed vertical line indicates year 1887, when the coffee price boom took place. Data is from Rufenacht (1955).

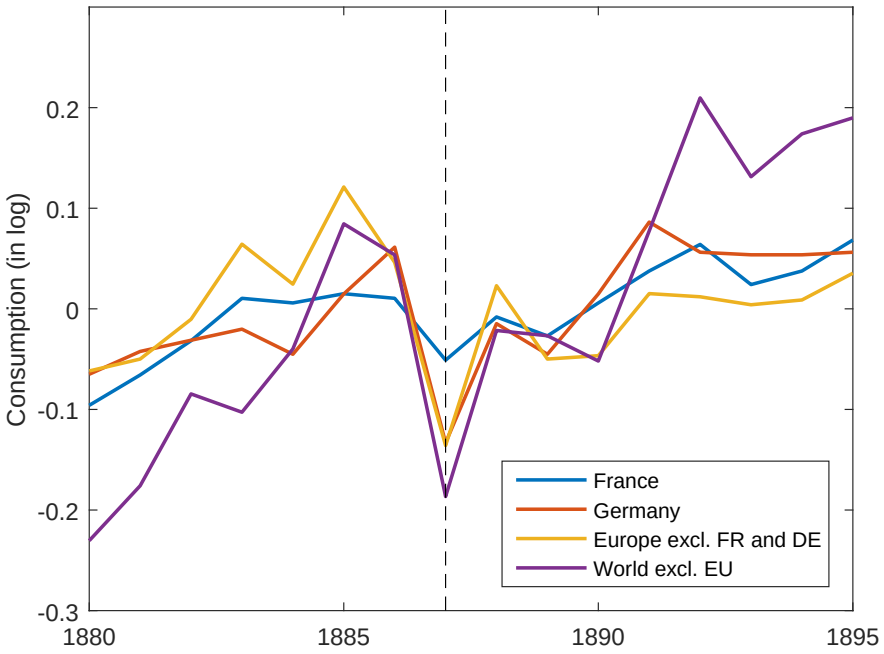


Figure 5 – Trading volume in coffee future

This figure plots the trading volume in coffee futures at a daily frequency. The volume is expressed in thousand bags (1 bag ≈ 60 kilograms). The dotted vertical line corresponds to the creation of the CLAM in December 1882.

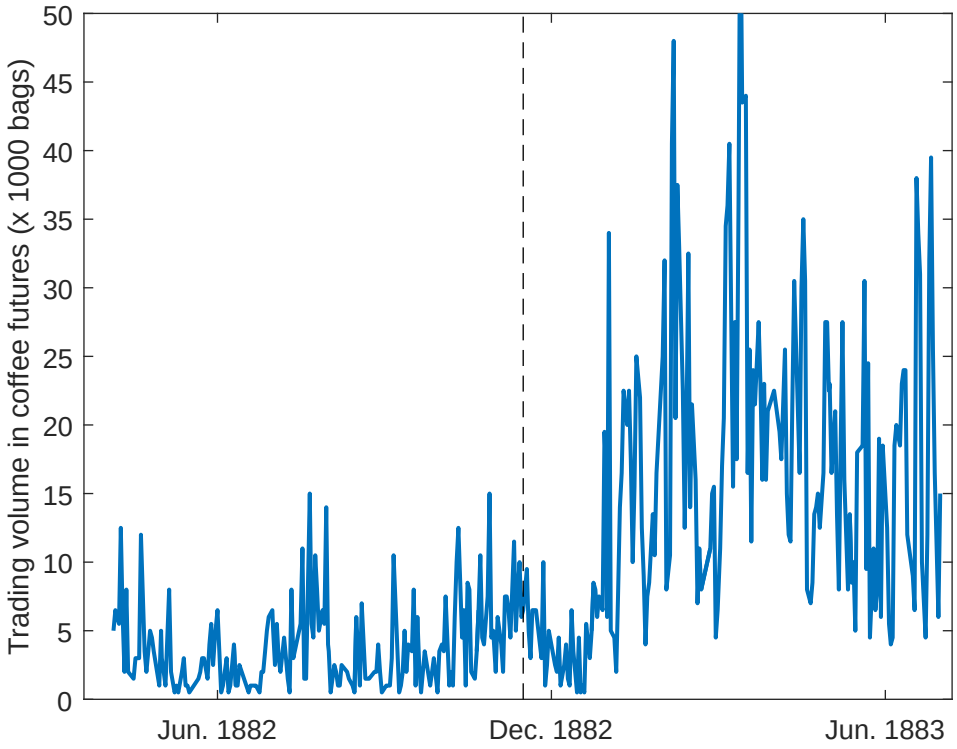
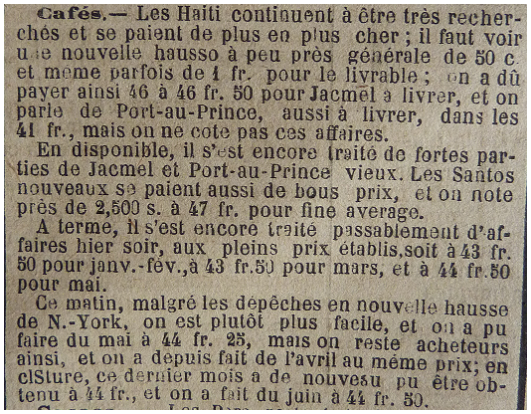


Figure 6 – Improvement in price transparency

This figure plots two excerpts from a local newspaper, the *Courrier du Havre*, on the last day before the CLAM started operations (December 15th, 1882) and on the first day of operations (December 16th, 1882). In the left panel, one can read "One may have paid 46 to 46.50 fr. for Jacmel [a grade of coffee] to deliver, and one talks about Port-au-Prince [another grade of coffee], also to deliver, around 41 fr., but there are no quotations for this." In the right panel, precise prices are given for each tradable maturity.

December 15th, 1882



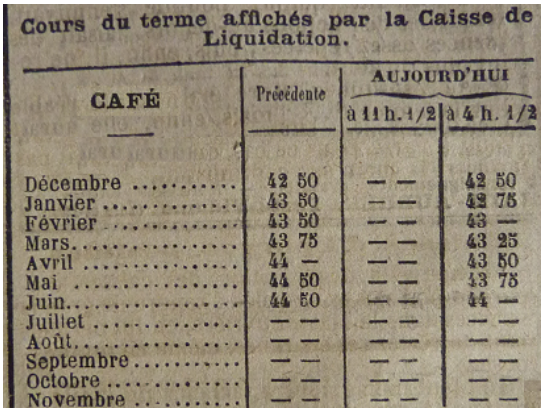
Cafés.— Les Haïti continuent à être très recherchés et se paient de plus en plus cher ; il faut voir une nouvelle hausse à peu près générale de 50 c. et même parfois de 1 fr. pour le livrable ; on a dû payer ainsi 46 à 46 fr. 50 pour Jacmel à livrer, et on parle de Port-au-Prince, aussi à livrer, dans les 41 fr., mais on ne cote pas ces affaires.

En disponible, il s'est encore traité de fortes parties de Jacmel et Port-au-Prince vieux. Les Santos nouveaux se paient aussi de bons prix, et on note près de 2,500 s. à 47 fr. pour fine average.

A terme, il s'est encore traité passablement d'affaires hier soir, aux pleins prix établis,soit à 43 fr. 50 pour janv.-fév.,à 43 fr.50 pour mars, et à 44 fr.50 pour mai.

Ce matin, malgré les dépêches en nouvelle hausse de N.-York, on est plutôt plus facile, et on a pu faire du mai à 44 fr. 25, mais on reste acheteurs ainsi, et on a depuis fait de l'avril au même prix; en clôture, ce dernier mois a de nouveau pu être obtenu à 44 fr., et on a fait du juin à 44 fr. 50.

December 16th, 1882



Cours du terme affichés par la Caisse de Liquidation.

CAFÉ	Précédente	AUJOURD'HUI à 11 h. 1/2	AUJOURD'HUI à 4 h. 1/2
Décembre	42 50	— —	42 50
Janvier	43 50	— —	42 75
Février	43 50	— —	43 —
Mars	43 75	— —	43 25
Avril	44 —	— —	43 50
Mai	44 50	— —	43 75
Juin	44 50	— —	44 —
Juillet	— —	— —	— —
Août	— —	— —	— —
Septembre	— —	— —	— —
Octobre	— —	— —	— —
Novembre	— —	— —	— —

A Data sources

I rely on the following sources.

A.1 Archive sources

- **Archives municipales du Havre** (Le Havre): Data are from four main sources.
  - I obtained data on coffee prices, trading volume in futures, traders in physical coffee, as well as a large number of telegraphic messages from the *Bulletin de Correspondance de la Bourse du Havre* (collection starting in 1880; reference code: *PER012*).
  - I consulted a daily local newspaper, the *Journal du Havre* (reference code: *PER071*), for general information about the local environment in the 1880s.
  - I collected lists containing the identity of all commodity traders from yearly registers, the *Almanach du commerce du Havre*, for the years 1876-1886.
  - I consulted several boxes and files related to coffee trade, but information is very limited, due to the destruction of most archives in Le Havre during World War II bombings.
- **Archives départementales de Seine-Maritime** (Rouen): From the archives of the notary Pierre Léon Cheuret (reference codes: *2E64\169* to *2E64\327*), I obtained the first rulebook of the CLAM, minutes from general assemblies, as well as the legal acts founding the corporation (including a detailed list of shareholders with their equity stake, in file numbered *2E64\225*).
- **Archives nationales du monde du travail** (Roubaix): Contains the version of the CLAM's rulebook as revised in 1884, and extracts from annual reports from 1883 to 1890 (reference code: *65AQ-A-614*).

A.2 Data on commercial flows

Yearly data on commercial flows at the commodity level are obtained country by country from the following sources. Data is collected from 1877 to 1888.

- **France**: *Tableau général du commerce de la France avec ses colonies et les puissances étrangères*, Direction générale des douanes.
- **Germany**: *Handel des deutschen Zollgebiets mit dem Auslande* in: *Statistisches Jahrbuch für das Deutsche Reich*, Statistisches Reichsamt.

- **Hamburg**: *Tabellarische Übersichten des hamburgischen Handels*
- **Italy**: *Movimento commerciale del Regno d'Italia*, Direzione generale delle gabelle.
- **Netherlands**: *Jaarstatistiek Handel – Koningrijk der nederlanden statistiek van den in-, uit- en doorvoer*, Departement van Financiën.
- **Norway**: *Tabeller vedkommende Norges Handel in aaret ...*, in *Norges officielle statistik, ny raekke*, Udgivne af det Statistiske Centralbureau.
- **Sweden**: *Commerce collegii underdåniga berättelse för år ...*, in *Bidrag till Sveriges officiela statistik - Utrikes handel och sjöfart*, Kongl. Boktryckeriet.

A.3 Sample of French harbors

The harbor-level sample includes the following cities: (1) Avricourt, (2) Bayonne, (3) Belfort Petit-Croix, (4) Bordeaux, (5) Boulogne, (6) Calais, (7) Cette, (8) Corse, (9) Dieppe, (10) Dunkerque, (11) Jeumont, (12) Le Havre, (13) Lille, (14) Marseille, (15) Nantes, (16) Nice, (17) Pagny, (18) Paris, (19) Roubaix, (20) Rouen, (21) Saint-Nazaire, (22) Tourcoing, (23) Valenciennes-Blancmisseron.

B Additional historical background

This appendix presents additional historical background. Section B.1 describes the crisis that led to the creation of the CLAM. Section B.2 shows that close ties between the founders of the CLAM helped to overcome coordination problems. Section B.3 shows evidence on the profitability of the CLAM. Section B.4 lists relevant references not cited in the main text.

B.1 The 1880 coffee crisis

The 1880 crisis started primarily in the US. It is best known from the reminiscences of a coffee trader, (Wakeman, 1914, Chap. "The Great Coffee Trade Failures of 1880"). A few additional useful elements are given by Brunn (1931) for the US and by Sayous (1898) for the French case. I complement these elements with contemporary newspapers and other archives.

Between 1870 and 1873, bad crops in Brazil raised global coffee prices and induced farmers to scale up production. The US market was then dominated by three importers known as the "Trinity": B. G. Arnold (New York), Bowie Dash & Company (New York) et O. G. Kimball & Company (Boston). These large importers benefited from high prices until 1878-1879, when the coffee trees planted earlier in the decade reached maturity (coffee plants take several years to mature). Faced with abundant crops, the Trinity engaged in massive purchases for two years in order to maintain high prices. In 1880, the arrival of a new abundant crop made it impossible for them to continue supporting prices. Therefore, coffee prices started to collapse. This triggered a wave of failures by the end of 1880. All three members of the Trinity ultimately defaulted, as well as other smaller US importers.

There is strong evidence that the 1880 crisis was associated with elevated levels of counterparty risk that impaired the functioning of the US coffee market. For example, Wakeman (1914, p. 139) writes on December 9th: "Absolutely no market. [...] There was no attempt to do business, everyone being suspicious of his neighbor. None of the larger firms escaped suspicion, and many did not know if they would be the next to go." Brunn (1931, p. 111) summarizes: "A chaotic situation therefore pervaded the coffee trade during the months of October, November and December 1880. What with the successive failures of the firms comprising the syndicate and the resultant dumping of their large stocks on the market, complete demoralization prevailed. There was little or no attempt to do business. Everyone suspected his neighbor. Even the larger firms did not escape suspicion. Thus the situation which faced the coffee trade in 1881

was indeed one of uncertainty. It appeared that the end of the old methods of doing business had been reached, so new and improved methods were sought."

Based on available sources, in particular local newspapers, there is no evidence that the 1880 crisis was as severe in Europe as in the US.[25] However, the crisis was felt and trading conditions are sometimes described as "depressed".[26] To obtain a measure of the rough extent of the crisis, I collected yearly data on commodity professionals active in the harbor of Le Havre between 1876 and 1886, for the *Almanach du commerce du Havre* (a registry of firms). After excluding professionals with no direct role in commodities trading (e.g., bankers and warehouses), I plot the measured number of commodity traders every year in Figure A1. While this figure should be interpreted with caution – since it includes traders of all commodities and not just coffee –, a slowdown of activity is observed precisely in 1880. Indeed, the total number of traders dropped by about 5%, from around 430 to 410. Given the importance of coffee trading within Le Havre at the time, this chart is consistent with the view that the 1880 crisis was felt locally.

However, the increase in counterparty risk that gave rise to the CLAM is not directly linked to the crisis but follows it. While coffee prices had been dropping sharply, triggering failures in the US, a group of traders in Le Havre took this opportunity to build up large coffee stocks. Their large inventories then gave rise to a contracting problem described by Sayous (1898, p. 279-280): "The coffee traders of Le Havre took, following excellent crops and in the expectation of bad ones, a very large long position: They stored considerable amounts of coffee, for a quantity reaching 1,400,000 bags. Importers soon had no more free cash and had to wait. Where could the necessary capital come from? No one wanted, in such circumstances, make loans without real guarantees; but warrants by their nature could not attract capitalists and speculators who ignored the differences in coffee qualities.[27] Furthermore, as the future looked highly uncertain, one needed not only to overcome the problem of the *individuality* of each coffee batch, but also to find a way to reduce the risks for capitalists. A new regulation of the futures markets, closely linked to the creation of a *central clearing counterparty*, was considered the best solution given the state of affairs. Indeed, holders of capital, bankers, or even individual investors came in without fearing the insolvency of counterparties [...] the crisis was solved." It is therefore clear that, as in the US case, counterparty risk was material in Le Havre and prevented the coffee

[25] We have focused most of our searches on Le Havre. For Hamburg, Becker (2002) and Rischbieter (2011) do not mention major waves of failures.

[26] See, for example, the *Bulletin de correspondance* on December 9th and 10th, 1880.

[27] A warrant is a financial instrument that enables borrowing by pledging commodities stored in a warehouse as collateral.

market from operating efficiently. Furthermore, as discussed in Section 5.4, this testimony gives a precise idea of the contracting problem faced by traders in Le Havre and helps understanding why the creation of a CCP could solve problems that simpler contracting arrangements, such as collateralization, could not solve equally well.

B.2 The founders and members of the CLAM

This appendix discusses how characteristics of trading circles in Le Havre contributed to the successful creation of the CLAM. Specifically, close ties between a number of old and important trading houses – including often family ties – helped to overcome two problems. First, the CLAM could immediately benefit from a good reputation. Second, the joint participation of several trading houses solved a coordination problem inherent to the creation of CCPs: the benefits from using a CCP increase with the number of investors using it (Duffie and Zhu, 2011; Duffie et al., 2015).

The foundation of the CLAM was initially inspired by the reorganization of coffee trade in New York (creation of the *Coffee Exchange in the City of New York* in 1882, including a clearinghouse which was not insulating traders from counterparty risk). Depitre (1907, p. 160-161) gives the following details: "During the year 1881, a trader from Le Havre, Mr. Le Normand, went to the US to study the organization of futures markets in New York, Chicago, Baltimore, and other main commercial cities.[28] He saw how futures transactions were generally guaranteed by margins that brokers and dealers were calling from each other: perhaps he also attended the negotiations that led to the creation, early in 1882, of a coffee clearinghouse in New York. When he came back, he disseminated the results of his study to several traders from Le Havre who were importing coffee and cotton and who, at the same time, could also speculate on these commodities. These traders decided to complete and improve the techniques used in the US and to create a special clearinghouse, which would concentrate all transactions and guarantee their execution. The initiative of the creation was taken by the main trading houses in Le Havre: Latham et Cie, Jung et Himely, Lamothe et Cie, Busch et Cie, etc.[29]"

To get a more precise idea on the founders of the CLAM, I obtained from the notarial archives the legal act of foundation of the company. The main shareholders are listed in Table A1. Several features are noticeable. First of all, the largest shareholder was Emmerick Le Normand, who had initiated the study on the market's reform (25

[28] In some documents, the spelling "Lenormand" is also used.

[29] "Lamothe" is spelled Lamotte in the notarial archives. Furthermore, Busch is not one of the shareholders in 1882; he only appears as an equityholder in 1885.

out of 200 shares). Second, some of the shareholders are among the most active coffee traders in Le Havre. This can be seen by comparing names to the trader-level data used for the tests in Section 5.2. However, many large traders are also absent and seem not to have participated to the creation of the CLAM. This is consistent with anecdotal reports that some of the largest trading houses opposed the creation of the CLAM. Third, a brief genealogical search shows that several of the main shareholders of the CLAM had close family ties.[30] This is in particular the case of the families Latham (20 shares), Jung (8 shares), Iselin (3 shares), who are linked together and with a few smaller shareholders (Kronheimer, Pochet, Senn). Emmerick Le Normand (25 shares), who became vice-president of the board, was linked – although not through family ties – with some other large shareholders, Macleod (10 shares) and Dennis (6 shares).[31] While central clearing involves significant network externalities and can give rise to free-rider problems (i.e., everyone finds it optimal to join a CCP only after sufficiently many other traders have joined), these close ties can explain why the original coordination problem could be solved: a critical mass of traders were committed to use the CCP. The member-owned structure – with most of the shareholders being either commodity brokers or dealers – ensured that they had an interest to do so.[32] Instead, several CCPs created in other cities in subsequent years did not manage to solve this coordination problem and had to close down quickly due to the lack of business (see Depitre, 1907, for examples).

Soon after its creation, the CLAM was successful and expanded its base of equity holders. According to Depitre (1907, p. 162), "the usefulness of the CLAM was soon appreciated and, at the end of 1884, there was an attempt to create a competing clearinghouse, whose equity was quickly subscribed.[33] This attempt ended up with a merger, that took place at the beginning of 1885." The notarial act signed for the foundation of this second society shows a significant expansion of the equity base (4,000,000 FRF) and of the membership. Some of the founders subscribed new shares (Le Normand, Latham) but, most importantly, most of the largest coffee traders who did not initially participate to the CLAM then became shareholders of the new en-

[30] For the genealogical search, I relied mostly on "*Michel de la Roche (1775-1852), ses aïeux et descendants*", by Charles Rufenacht (available in the municipal archives in Le Havre, reference *GEN030*), and on the website www.geneanet.org.

[31] In a notarial act signed on May 29, 1883, Le Normand gives power to Macleod and Dennis to manage his business.

[32] The member-owned structure was also preserved via the voting mechanism. According to the statutes of the CLAM, none of the equity holders could have more than 10 votes in the general assembly, even with more than 10 shares. Therefore, no member could become to important relative to other members.

[33] I did not find the notarial act corresponding to the foundation of this company. Either it was a project that was never finalized, or the act was not made with the same notary as for the CLAM.

tity: Breckenridge, Busch, Couvert, Postel, Rivière, Schmidt, etc. There was thus a clear attempt to integrate users of the CCP as equity holders. This arguably gives more incentives for traders to clear their transactions, but also to ensure the smooth functioning of the CCP.

B.3 Profitability of the CLAM

This appendix discusses the profitability of the CLAM, using data from annual reports (1883 to 1890 are available) combined with data reported in Depitre (1907).

Most importantly, the volume of cleared operations was high from the very beginning. The volume of cleared transactions equaled 185.8 million FRF in 1883, the first year of operations. It increased massively to 922.4 million FRF in 1884, consistent with the fact that many traders that had initially been reluctant to use the CLAM turned to it after several months. After the reorganization of the CLAM and the increase in equity in 1885 (see Appendix B.2), the volume then continued to grow to reach a maximum in 1887, equal to 2,478 million FRF. These high numbers reflect the fact that an overwhelming majority of futures transactions were cleared. Unfortunately, no breakdown between operations on coffee, cotton, or other commodities, is available.

Due to this volume of operations, the CLAM was profitable starting in 1883 – its first full year of operations. Figure A2 shows that income from interest and fees was high in 1883-1884, and did not subsequently increase much more – but became more stable from 1890 onwards. Consequently the CLAM could pay dividends starting in 1883 (72.5 FRF / share). In addition to paying dividends, the CLAM could use its income to retain earnings and increase reserves. Anecdotal evidence also suggests that the attempt by a group of traders unrelated to the CLAM to create a competing CCP in 1884 (as discussed in Appendix B.2), was also motivated by the high profitability of the CLAM.

B.4 Additional references

I used the following references (not cited in the main text) to get further information about the historical context or to cross-check information about the CLAM or other relevant aspects of the coffee market.

Delcambre, P. (1907). *Les Caisses de liquidation et les opérations à terme sur marchandises*, H. Morel.

Fauchère A. (1927). *Le Café. Production, préparation, commerce.* Société d'éditions

géographiques, maritimes et coloniales.

Findeisen, F. (1917). *Der Kaffeehandel*. Heinrich John.

François, G. (1897). Les chambres de compensation et les caisses de liquidation. *Bulletin de l'Institut International de Statistique, 10*, 76-94

Garvens, W. (1905). *Kaffee. Kultur, Handel und Bereitung im Produktionslande*. Verlag von Carl Brandes.

Gülpen, A. van (1896). *Terminhandel und Währung*. Carl Heymanns.

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Table A1 – Equity holders of the CLAM

This table displays the largest equity holders of the CLAM at its foundation (6th November 1882). The total equity capital was 2,000,000 FRF, broken down in 200 shares with a notional value of 10,000 FRF each.

	Occupation	Number of shares	Equity amount	Paid-in amount
LENORMAND Emmerick	–	25	250,000	62,500
LATHAM Richard	Dealer	20	200,000	50,000
MACLEOD Edouard	Broker	10	100,000	25,000
LIONNET Charles	–	10	100,000	25,000
CHAMBRELAN Eugène	Dealer	9	90,000	22,500
JUNG Frédéric	Dealer	8	80,000	20,000
GAUSSEN Eugène	Broker	8	80,000	20,000
DENNIS Félix	Broker	6	60,000	15,000
DE HEYDEC Charles	Broker	6	60,000	15,000
LEFRANCOIS Emile	Broker	5	50,000	12,500
LAMOTTE et Cie	Dealer	5	50,000	12,500
KOCH Frédéric	Broker	5	50,000	12,500
FOERSTER Frédéric	Dealer	5	50,000	12,500
DURAND Jacques	Broker	4	40,000	10,000
CALLIGE Louis	Broker	4	40,000	10,000
LAUDE Alphonse	Broker	3	30	7,500
ISELIN William	–	3	30	7,500
HOFFMANN Francis	–	3	30	7,500
HOFFMANN Charles	Broker	3	30	7,500
FOSSAT Alexandre	Broker	3	30	7,500

Figure A1 – Number of commodity traders in Le Havre

This figure plots a measure of the number of commodity traders (all commodities combined) at a yearly frequency in Le Havre, over the 1876-1886 period. Data is from yearly copies of the *Almanach du commerce du Havre* and sums the number of commodity professionals active in the harbor at the beginning of the year. I exclude a few observations for which the occupation is not directly related to commodities trading (notably bankers and warehouses). I include observations for which the occupation is missing (about 15% of the data). The first vertical dashed line (in red) corresponds to the 1880 coffee crisis, which started in the second half of 1880. the second vertical dashed line (in black) corresponds to the creation of the CLAM in December 1882.

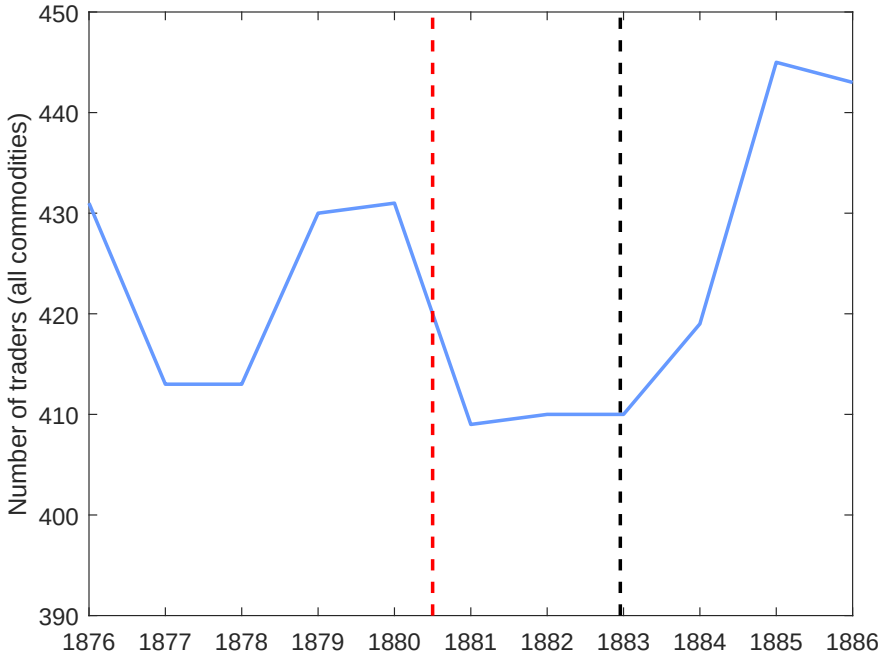

Figure A2 – Profitability of the CLAM

This figure plots two measures of profitability of the CLAM over the period 1883-1906. The solid line plots total income from interest and fees, in million FRF (left scale). The dotted line plots the dividend per share, in FRF (right scale). Data in from Depitre (1907, p 163-164).