International Firms of Mystery: The Economics of Global Commodity Trading Firms and Their Potential Contribution to Systemic Risk

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I. Introduction

In the aftermath of the Great Financial Crisis, macroprudential regulatory authorities have undertaken a searching review of firms throughout the financial markets to identify those that could pose systemic risks. This review has extended beyond large banks to encompass money market mutual funds, insurance companies, finance companies, and asset managers. It has even extended to include firms not typically thought of as part of the financial sector, even broadly construed. Commodity Trading Firms (CTFs) are a prominent example. Questions about the systemic risk posed by these firms were first raised by Timothy Lane, Deputy Governor of the Bank of Canada.[1] Moreover the Financial Stability Board evaluated whether CTFs are systemically important, and the UK's Financial Conduct Authority has published a guide discussing regulatory strategies and challenges involving commodity traders.

At present, regulators are mainly asking questions about whether CTFs are systemically important. These queries are somewhat tentative, which reflects the aura of mystery that surrounds these firms, many of which are privately owned and operate out of Switzerland.. This paper attempts to penetrate that aura, in order to

[1] Timothy Lane, Financing Commodity Markets. Speech given to the CFA Society of Calgary, 25 September 2012.

provide a better understanding of what these firms do, and on the basis of this understanding, to evaluate whether they pose systemic risks that would justify subjecting them to regulations similar to those imposed on other entities deemed to be systemically important.

CTFs are a major link in the supply chain connecting commodity producers with commodity processors and ultimate consumers. The centrality of these firms in the global commodity supply system raises several questions. What would be the effect of a failure of one of these firms on the global economy, and the economies of individual countries? What types of economic shocks could lead to the failure of a CTF? What features of CTFs make them vulnerable to these shocks? Are there interconnections between these firms and the financial markets, particularly through their financing relationships with banks and the shadow banking system, which make some CTFs systemically important?

This paper presents an economic analysis of these issues. The analysis provides a conceptual framework for evaluating the economic functions of CTFs, the risks they incur in executing these functions, connections between these firms and the financial sector and the real economy, the potential for CTFs to be the source systemic risks communicated through these interconnections, and the vulnerability of CTFs to systemic shocks, especially those arising in the financial sector.

Three basic conclusions arise from the analysis. First, it is unlikely that a large loss suffered by a single CTF (due, for instance, to a loss suffered on a large speculative position) poses a systemic threat to the broader financial system. Second, although a financial crisis (or other large macroeconomic shock) that leads

to a substantial fall in the demand for commodities also reduces the demand for many (but not all) of the services CTFs supply, the nature of commodity trading, and the structure and capital structures of commodity trading firms makes them substantially more robust to such shocks than systemically important financial institutions. Third, although commodity trading firms engage in various economic transformations, they types of transformations they perform are substantially different from those undertaken by systemically important firms, which makes them less systemically risky. Therefore, it is inappropriate to impose on them a regulatory regime similar to that imposed on large banks and insurers.

The analysis is predominately qualitative in nature. This reflects the need to lay out a basic conceptual economic framework that can be utilized to understand better the functions and risks of commodity trading firms. It also reflects the relative paucity of financial data on many CTFs, many of which are private firms not required to disclose basic financial information.

The remainder of this paper is organized as follows. Section II describes the basic economic functions of commodity trading firms, emphasizing their role as transformers of commodities. Section III identifies and analyzes major risks incurred by CTFs. This section also describes the basic risk management strategies employed by CTFs. Section IV identifies major points of interconnection between CTFs and the financial markets. Section V analyzes the systemic riskiness of CTFs. Specifically, it examines whether (a) individual CTFs pose broader systemic risks, and (b) CTFs are vulnerable to systemic shocks arising in the financial sector or the real economy, and this vulnerability could disrupt global commodity trade with

further adverse consequences for the real economy. Section VI addresses the issue of the transparency (or lack thereof) of CTFs, and how this necessitates caution in evaluating the systemic risk posed by these firms. Section VII uses trade flow data to identify potentially systemically important commodities. Section VIII summarizes.

II. The Economics of Commodity Trading Firms

Commodity trading firms are in the business of transformation. They transform commodities in space, time, and form. Spatial transformations involve the transportation of commodities from regions where they are produced (supply regions) to the places they are consumed, or undergo some interim transformation in form. Temporal transformations involve the storage of commodities. Seasonal regularities in production or consumption (e.g., for agricultural products or heating fuels) or random supply and demand shocks mean that it is seldom optimal to match the amount consumed at any instant with the amount produced at that instant; storage bridges the gap between optimal consumption and production timing. Transformations in form involve the refining or processing of a commodity, such as crushing soybeans to produce oil and meal, or refining crude oil into gasoline, diesel, and other products.

The value of these transformations varies over time due to shocks to supply and demand that affect price levels, and crucially, relative prices/price relationships. For instance, a good harvest in one region of the world results in a price decline there, relative to other regions, that provides an incentive to increase exports from that region to consumption locations. As another example, a global

recession that reduces current demand tends to make commodities temporarily abundant, thereby making it efficient to store them for future use when demand rebounds. Forward prices adjust to these demand shocks to provide the incentive to make this temporal transformation.

Commodity trading firms specialize in the production and analysis of information about supply and demand patterns, price structures (over space, time, and form), and transformation technologies, and the utilization of this information to optimize transformations. In essence, CTFs are the visible manifestation of the invisible hand, directing resources to their highest value uses in response to price signals. Given the complexity of the possible transformations, and the ever-changing conditions that affect the efficient set of transformations, this is an inherently dynamic, complex, and highly information-intensive task.

Trading firms also invest in the physical and human capital necessary to transform commodities. Commodity trading therefore involves the combination of the complementary activities of information gathering and analysis and the operational capabilities necessary to respond efficiently to this information.

Although the foregoing describes the operation of CTFs in general, each firm is unique. Some firms specialize in a relatively small number of market segments. For instance, the traditional "ABCD" firms-ADM, Bunge, Cargill, and Dreyfus-concentrate in agricultural commodities, with lesser or no involvement in the other major commodity segments. As another example, some of the largest trading firms such as Vitol, Trafigura, and Mercuria, focus on energy commodities, with smaller or no presence in other commodity segments. One major trading firm, Glencore,

participates in all major commodity segments, but has a stronger presence in non-ferrous metals, coal, and oil.

CTFs that focus on a particular area, e.g., agricultural, also exhibit diversity the specific commodities and commodity transformations that they trade. For instance, whereas Olam participates in 18 distinct agricultural segments, Bunge focuses on two and other major firms are active in between 3 and 7 different segments.

Furthermore, firms in a particular segment differ in their involvement along the marketing chain. Some firms participate upstream (e.g., mineral production or land/farm ownership), midstream (e.g., transportation and storage), and downstream (e.g., processing into final products or even retailing). Others concentrate on a subset of links in the marketing chain. [2]

III. The Risks of Commodity Trading

Commodity trading involves a myriad of risks. What follows is a relatively high level overview of these risks. Note that some risks could fall into more than one category.

Price risk. Traditional commodity trading involves little exposure to "flat price" risk.[3] In the traditional commodity trading model, a firm purchases (or sells)

[2] For a more thorough description and analysis of CTFs, see Craig Pirrong, The Economics of Commodity Trading Firms (2014).

[3] The "flat price" is the absolute price level of the commodity. For instance, when oil is selling for $100/barrel, $100 is the flat price. Flat price is to be distinguished between various price differences (relative prices), such as a "time spread" (e.g., the difference between the price of Brent for delivery in July and the price of Brent for delivery the following December), or a "quality spread" (e.g., the difference between the price of a light and a heavy crude).

a commodity to be transformed (e.g., transported or stored), and hedges the resulting commodity position via a derivatives transaction (e.g., the sale of futures contracts to hedge inventory in transit) until the physical position is unwound by the sale (or purchase) of the original position. The hedge transforms the exposure to the commodity's flat price into an exposure to the basis between the price of the commodity and the price of the hedging instrument. (I discuss basis risk in more detail below).

Of course, hedging is a discretionary activity, and a firm may choose not to hedge, or hedge incompletely, in order to profit from an anticipated move in the flat price, or because the cost of hedging is prohibitively high.

Moreover, particularly as some commodity firms have moved upstream into mining, or into commodities with less developed derivatives markets (e.g., iron ore or coal), they typically must accept higher exposure to flat price risks.

Commodity prices can be very volatile, and indeed, can be subject to bouts of extreme volatility. Therefore, firms with flat price exposure can suffer large losses. This does not mean that flat price exposure is a necessary condition for a firm to suffer large losses: as an example, trading firm Cook Industries was forced to downsize dramatically as a result of large losses incurred on soybean calendar spreads in 1977. Indeed, many (and arguably most) of the instances in which commodity trading firms went into distress were the not the result of flat price risk exposures, but basis or other spread risks: a spread or basis position that is big enough relative to a firm's capital can create a material risk of financial distress.

Basis Risk. Hedging involves the exchange of flat price risk for basis risk, i.e., the risk of changes in the difference of the price between the commodity being hedged and the hedging instrument. Such price differences exist because the characteristics of the hedging instrument are seldom identical to the characteristics of the physical commodity being hedged. For instance, a firm may hedge a cargo of heavy Middle Eastern crude with a Brent futures contract. Although the prices of these tend to move broadly together, changes in the demand for refined products or outages at refineries or changes in tanker rates or a myriad of other factors can cause changes in the difference between the two.

Although the basis tends to be less variable than the flat price (which is why firms hedge in the first place), the basis can be volatile and subject to large movements, thereby potentially imposing large losses on hedging firms. And as noted above, it is possible to take a position in the basis (or spreads generally) that is sufficiently risky relative to a firm's capital that an adverse basis (spread) change can threaten the firm with financial distress.

Basis risks generally arise from changes in the economics of transformation during the life of a hedge. Changes in transportation, storage, and processing costs affect relative prices across locations, time, and form that result in basis changes. Sometimes these basis changes can be extreme when there are large shocks to the economics of transformation: for example, the explosion of a natural gas pipeline that dramatically reduced transportation capacity into California in late-2000 caused a massive change in the basis between the price of gas at the California

border and at the Henry Hub in Louisiana (the delivery point for the most liquid hedging instrument).

Local, idiosyncratic demand and supply shocks are ubiquitous in commodity markets. A drought in one region, or an unexpected refinery outage, or a strike at a port affect supply and/or demand, and cause changes in price relationships-changes in the basis-that should induce changes in transformation patterns, and CTFs play an essential role in identifying and responding to these shocks.

Basis risks can also arise from the opportunistic behavior of market participants. In particular, the exercise of market power in a derivatives market-a corner or a squeeze-tends to cause distortions in the basis that can inflict harm on hedgers.[4] For instance, it was reported that Glencore lost approximately $300 million in the cotton market in May-July, 2011 due to extreme movements in the basis that were likely caused by a corner of the ICE cotton futures contract. Basis and calendar spread movements are consistent with another squeeze occurring in cotton in July, 2012. Squeezes and corners have occurred with some regularity in

[4] The subject of cornering (a form of manipulative conduct) is obviously hugely sensitive and controversial, but it is has been a matter of contention since modern commodity trading began in the mid-19th century. Rigorous economic analysis can be used to distinguish unusual price movements and price relationships resulting from unusual fundamental conditions, and those caused by the exercise of market power. Craig Pirrong, Detecting Manipulation in Futures Markets: The Ferruzzi Soybean Episode, 6 *American Law and Economics Review* (2004) 72. Stephen Craig Pirrong, Manipulation of the Commodity Futures Market Delivery Process, 66 *Journal of Business* (1993) 335. Stephen Craig Pirrong, *The Economics, Law, and Public Policy of Market Power Manipulation* (1996). Craig Pirrong, Energy Market Manipulation: Definition, Diagnosis, and Deterrence, 31 *Energy Law Journal* (2010) 1. Using the rigorous theoretical and empirical methods set out in these publications it is possible to identify several recent episodes in which it was extremely highly likely that prices and basis relationships were distorted by the exercise of market power. It is important to emphasize that these methods can be used-and have been-to reject allegations of manipulation.

virtually all commodity markets. In the last two years alone, there have been reports (credibly supported by the data) of squeezes/corners in cocoa, coffee, copper, and oil.

Spread risk. From time to time commodity trading firms engage in other kinds of "spread" transactions that expose them to risk of loss. A common trade is a calendar (or time) spread trade in which the same commodity is bought and sold simultaneously, for different delivery dates. Spreads are volatile, and move in response to changes in fundamental market conditions.[5] Spreads can also change due to opportunistic, manipulative trading of the type that distorts the basis.

Margin and Volume Risk. The profitability of traditional commodity merchandising depends primarily on margins between purchase and sale prices, and the volume of transactions. These variables tend to be positively correlated: margins tend to be high when volumes are high, because both are increasing in the (derived) demand for the transformation services that commodity merchants provide.

The demand for merchandising is derived from the demand and supply of the underlying commodity. For instance, the derived demand for commodity transportation and logistics services provided by trading firms depends on the demand for the commodity in importing regions and the supply of the commodity in exporting regions.

[5] For instance, an unexpected increase in demand or decrease in supply tends to lead to a rise in prices for delivery near in the future, relative to the rise in prices for later delivery dates.

This derived demand changes in response to changes in the demand and the supply for the commodity. A decline in demand for the commodity in the importing region will reduce the derived demand for logistical services. The magnitude of the derived demand decline depends on the elasticity of supply in the exporting region. The less elastic the supply, the less of the underlying demand shock reduces the derived demand for logistical services; this occurs because the bulk of the impact of the demand decline is borne by the price in the exporting region rather than the quantity traded, leaving the margin between purchase and sales prices and the quantity of the commodity shipped only slightly affected.

This means that variations in the quantity of commodity shipments, as opposed to variations in commodity flat prices, are better measures of the riskiness of traditional commodity merchandising operations. (Similar analyses apply to the effects of supply shocks, or shocks to different kinds of transformation such as storage or processing.)

It should be noted further that many commodity firms benefit from self-hedges. For instance, a decline in the demand for a commodity (e.g., the decline in the demand for oil and copper during the 2008-2009 financial crisis) reduces the demand for logistical services provided by commodity trading firms, but simultaneously increases the demand for storage services. A firm that supplies logistical services and operates storage facilities therefore benefits from an internal hedge between its storage and logistics businesses; the decline in demand in one is offset by a rise in demand in the other.

These considerations hightlight the danger of confusing the riskiness of commodity prices with the riskiness of commodity trading, i.e., the provision of commodity transformation services. Although changes to underlying supply and demand for commodities affects demand for transformation services, the latter tend to be less volatile (especially when underlying demand and supply are highly inelastic), and there are frequently negative correlations (and hence self-hedges) between the demands for different types of transformations.

Operational Risk. Commodity firms are subject to a variety of risks that are best characterized as "operational", in the sense that they result from the failure of some operational process, rather than a price risk. The list of potential operational risks is large, but a few examples should suffice to illustrate. A CTF that transports a commodity by sea is at risk to a breakdown of a ship or a storm that delays completion of a shipment, which often results in financial penalties.

A particularly serious operational risk is rogue trader risk, in which a trader enters into positions in excess of risk limits, without the knowledge or approval of his firm. The firm can suffer large losses if prices move against these positions. A rogue trader caused the demise of one commodity trading company-Andre & Cie. The copper trading operation of Sumitomo suffered a loss in excess of $2 billion due to rogue trading that lasted nearly a decade.

Contract Performance Risk. A firm that enters into contracts to purchase or sell a commodity is at risk to the failure of its counterparty to perform. For instance, a firm that has entered into contracts to buy a commodity from suppliers and contracts to sell the commodity to consumers can suffer losses when the sellers

default. In particular, sellers have an incentive to default when prices rise subsequent to their contracting for a sales price, leaving the commodity trading firm to obtain the supplies necessary to meet its contractual commitments at the now higher price, even though they are obligated to deliver at the (lower) previously contracted price.

This is a chronic problem in the cotton market, and this problem became particularly acute beginning in late-2010. Initially, many cotton producers reneged on contracts to sell cotton when prices rose dramatically. Subsequently, cotton consumers reneged on contracts when prices fell substantially As a result, several CTFs suffered large losses in cotton that had materially adverse effects on their overall financial performance.

Market Liquidity Risk. Commodity trading (including specifically hedging) frequently requires firms to enter and exit positions quickly. Trading risks are lower, to the extent that it is possible to do this without having a large, adverse impact on prices. That is, trading is less risky, and cheaper, in liquid markets.

Liquidity can vary across commodities; e.g., oil derivative markets are substantially more liquid than coal or power derivatives markets. Moreover, liquidity can vary randomly-and substantially-over time. Liquidity can decline precipitously, particularly during stressed market periods. Since market stresses can also necessitate firms to change positions (e.g., to sell off inventory and liquidate the associated hedges), firms can suffer large losses in attempting to implement these changes when markets are illiquid and hence their purchases tend to drive prices up and their sales tend to drive prices down.

As frequent traders, commodity trading firms are highly sensitive to variations in market liquidity. Declines in liquidity are particularly costly to trading firms. Moreover, firms that engage in dynamic trading strategies (such as strategies to hedge financial or real options positions) are especially vulnerable to declines in market liquidity. Furthermore, to the extent that declines in liquidity are associated with (or caused by) market developments that can threaten CTFs with financial distress, as can occur during financial crises, for instance, liquidity is a form of "wrong way" risk: under these conditions, CTFs may have to adjust trading positions substantially precisely when the costs of doing so are high.

Funding Liquidity Risk. Traditional commodity merchandising is highly dependent on access to financing. Many transformations (e.g., shipping a cargo of oil on a VLCC) are heavily leveraged (often 100 percent) against the security of the value of the commodity. A commodity trading firm deprived of the ability to finance the acquisition of commodities to transport, store, or process cannot continue to operate.

Risk management activities can also require access to funding liquidity. A firm that hedges a cargo of oil it has purchased by selling oil futures experiences fluctuating needs for (and availability) of cash due to the margining process in futures. If prices rise, the cargo rises in value but that additional value is not realized in cash until the cargo is sold at the higher price. The short futures position suffers a loss as a result of that price increase, and the firm must immediately cover that loss of value by making a variation margin payment. Thus, even if the mark-to-market values of the hedge and the cargo move together in lockstep, the cash flows

on the positions are quite different. Maintaining the hedge requires the firm to have access to funding to meet potential margin calls.

Firms can suffer funding liquidity problems due to idiosyncratic factors or market-wide developments. As an example of the first, a firm that suffers an adverse shock to its balance sheet (due to a speculative loss, for instance) may lose access to funding due to fears that it may be insolvent. As an example of the second, a shock to the balance sheets of traditional sources of funding (e.g., a financial crisis that impairs the ability of banks to extend credit) can sharply reduce the financing available to commodity firms.

Funding liquidity is often correlated with market liquidity, and these types of liquidity can interact. Stressed conditions in financial markets typically result in declines of both market liquidity and funding liquidity. Relatedly, stresses in funding markets are often associated with large price movements that lead to greater variation margin payments that increase financing needs. Moreover, declines in market liquidity make it more costly for firms to exit positions, leading them to hold positions longer; this increases funding needs, or requires the termination of other positions (perhaps in more liquid markets) to reduce funding demands.

Currency Risk. Most commodity trading takes place in USD, but CTFs buy and/or sell some commodities in local currency. This exposes them to exchange rate fluctuations.

Political Risk. Commodities are produced, and to some degree consumed, in countries with political and legal systems characterized by a weak rule of law.

Commodity trading firms that operate in these jurisdictions are exposed to various risks not present in OECD countries. These include, *inter alia*, the risk of expropriation of assets; the risk of arbitrary changes in contract terms at which the firms have agreed to purchase or sell commodities; and outright bans on exports.

Such risks exist in OECD economies as well, though to a lesser degree. For instance, OECD countries sometimes intervene in commodity markets in attempts to influence prices. Thus, there is a continuum of political risks, and although some countries pose very high levels of such risk, it is not absent in any jurisdiction.

Legal/Reputational Risk. Various aspects of commodity trading give rise to legal and reputational risks for commodity trading firms. Many commodities are potential environmental hazards, and firms are subject to legal sanctions (including criminal ones) if their mishandling of a commodity leads to environmental damage. These risks can be very large, particularly in oil transportation. Note the 200 million Euro fine imposed on Total arising from the *Erika* incident, or Exxon's massive liability in the *Exxon Valdez* spill; although these are not commodity trading firms, CTFs that engage in oil transportation are exposed to such risks.

Furthermore, commodity trading firms frequently operate in countries in which corruption is rife, making the firms vulnerable to running afoul of anti-corruption laws in the United States, Europe, and elsewhere. Moreover, commodities are sometimes the subject of trade sanctions-which create price disparities of the type that commodity firms routinely profit from; this creates an enticement for trading firms to attempt to evade the sanctions. As a final example, commodity trading firms may have opportunities to exercise market power in

commodity markets; indeed, their expertise regarding the economic frictions in transformation processes that make such kinds of activities profitable and their size make them almost uniquely positioned to do so. The exercise of market power in this way is sometimes referred to as manipulation, or cornering: such actions cause prices to diverge from their fundamental values and leads to distortions in commodity flows.

There are recent examples in which CTFs have been accused of each of the foregoing legal transgressions. This has exposed these firms to legal sanctions and reputational damage. These risks can be substantial. For instance in late-June, 2012 a class action was filed in the United States accusing on major commodity merchant with cornering cotton futures contracts in May and June 2011. Although the CTF has vigorously denied the allegation, the potential exposure is large (in the hundreds of million dollars) and is therefore a material risk that illustrates the potential for contingent liabilities arising from manipulation claims. Given the current environment in which manipulation generally, and commodity manipulation specifically, is the subject of considerable political and regulatory attention, this is a real risk attendant to commodity trading.[6]

Risk Management

Global Commodity Trading Firms engage uniformly tout their expertise in, and emphasis on, risk management. They utilize a variety of tools to achieve risk control objectives. Most notable among these are hedging using derivatives (e.g.,

[6] There are examples of commodity trading firms paying large sums to settle claims of market manipulation. These include Ferruzzi (in soybeans) and Sumitomo (in copper).

selling crude oil futures or a crude oil swap to hedge a cargo of crude oil) and diversification across commodities and integration of different links in the value chain.

As noted above, hedging transforms the nature of a firm's risk exposure from flat price risk to basis risk. These basis risks can be material, also as noted above.

Diversification across commodities makes firm financial performance less dependent on idiosyncratic events in any particular commodity. Given the nature of commodities, particular markets or submarkets are prone to large shocks that can seriously impair the profitability of operating in those markets. Diversification is a way of reducing the overall riskiness of a CTF. This is particularly important for privately-held firms that have limited ability to pass idiosyncratic risks onto diversified shareholders.

Most large CTFs are widely diversified. Many smaller firms are more specialized, and less diversified. The latter are obviously more vulnerable to adverse developments in a particular market.

To quantify the potential benefits of diversification, I have evaluated data on world trade flows by commodity code. Specifically, I have collected data on world imports and exports of 28 major commodities for the 2001-2011 period from the International Trade Centre UNCTAD/WTO. Using this data, I calculate correlations in annual world imports and exports across these 28 commodities. I calculate two sets of correlations between percentage changes in trade flows across commodities. The first set is based on nominal trade flows, measured in US dollars. The second set is based on deflated trade flows. To calculate deflated traded flows, I divide the

nominal trade flow in a given year by the nominal price of the commodity in question, scaled so that the 2001 value is 1.00.[8] The deflated trade flow is a measure of the quantity (e.g., barrels of oil or tons of coal) of each commodity traded in a given year.

Correlations of nominal trade flows across commodities are generally positive. The median nominal import and export correlation is close to 50 percent. However, deflated trade flow percentage changes exhibit much lower correlations. The median correlation for deflated import percentage changes is .065, and the median correlation for deflated export percentage changes is .031. Approximately 40 percent of the correlations based on the deflated flows are negative.

As noted elsewhere, the derived demand for the services of CTFs, and their profitability, is dependent on the quantities of commodities traded, rather than prices. Therefore, the correlations based on deflated data are more relevant for evaluating the potential benefits to CTFs of diversification across commodities. The lack of correlation generally, and the prevalence of negative correlations indicate the potential benefits of diversification across commodities in reducing the variability of CTF risk.

Integration in the value chain also tends to reduce risk. As noted earlier, there can be self-hedges in the value chain, as in the case of storage on the one hand and throughput-driven segments on the other. Moreover, shocks at one level of the

[8] The nominal price for each commodity is based on data provided in the World Bank Commodity Price Data (Pink Sheet) annual average commodity prices. For commodities (such as oil, coal, or wheat) where there are multiple varieties or grades reported (e.g., Brent and WTI; Australian, Columbian, and South African coal), I utilize the simple average of the 2001=1.00 deflators.

value chain often have offsetting effects (or at least, cushioning effects) at others. For instance, a supply shock upstream that raises prices of raw materials tends to depress processing margins. Integrating upstream and processing assets can stabilize overall margins, thereby reducing risk. Again, this is particularly useful for privately held firms that cannot readily pass on risks through the equity market, or for firms subject to other financing frictions. Moreover, it is more valuable across segments of the marketing chain where markets are not available to manage price risk at these stages of the chain are relatively illiquid (e.g., iron ore, alumina and bauxite, or coal).

Diversification and integration are primarily useful in managing risks idiosyncratic to particular commodities or commodity submarkets, e.g., a drought that affects wheat production and hence prices. They are less effective at mitigating systematic shocks that affect all commodity markets, e.g., a global financial crisis, or a decline in Chinese growth (because China is a major importer of all important commodities).[9]

Although commodity trading firms emphasize their risk management orientation and prowess, they have considerable discretion in their ability to manage-and assume-risks.

Risk measurement is a crucial component of risk management. Most commodity trading firms utilize Value-at-Risk as a risk measurement tool. The limitations of this measure are well known. In particular, commodity trading firms

[9] There are some exceptions. As noted previously, some commodity trading activities like storage are profitable when commodity demand is low even though such demand shocks tend to reduce the profitability of other trading company operations

incur model risk (including risks associated with the estimation of parameter inputs). Such model risks have been implicated in large losses in virtually every market and type of trading firm (e.g., banks, hedge funds), and they must be considered a serious concern for CTFs as well, especially given the fact that these firms have extensive involvement in commodities and markets for which pricing, volatility, and correlation information is particularly scarce (especially in comparison to financial markets).

IV. GCTFs and Systemic Risk

A. Introduction

A firm can be systemically important if its financial distress imposes externalities ("spillovers") onto other firms, and these spillovers reduce output in the real economy. There are a variety of channels through which these externalities can propagate. These include destructive and contagious runs suffered by a firm. Alternatively, they can propagate via counterparty credit losses. Here, a firm's bankruptcy causes the insolvency of the firm's creditors, and perhaps the firm's creditors' creditors and so on: the counterparty credit loss can also trigger runs on the counterparties. I consider the susceptibility of CTFs to each of these mechanisms. I also examine the vulnerability of commodity traders to shocks in the financial sector and the real economy, and whether they pose a risk of spreading those shocks to other parts of the economy, or feeding back the shocks to the financial system or real economy in a destabilizing way. I then analyze the relevance to commodity trading firms of other factors identified by the Financial Stability Board Finally as contributing to systemic importance. Finally, I review a few

historical episodes in which commodity firms-and even an entire commodity sector-have experienced large losses and financial distress, with no spillover effects to the financial sector or the broader economy.

B. Contagious Runs

1. Overview

Some firms are subject to inefficient "runs" due to the nature of their capital structure. In a run, creditors withdraw funds from the firm when they question its solvency, or refuse to renew maturing loans, leaving the firm unable to meet its obligations or to fund operations.[10] Runs lead to the inefficient liquidation of the firm's assets or inefficient limitations on its operations. If these inefficiencies are limited to the firm, it is unlikely to be systemically important unless it is very large and central to the financial system, but it is possible that the firm's problems may adversely impact other firms. These could be other commodity trading firms, or the creditors of the firm(s) suffering a run.

One way that this can happen is information contagion. Creditors of other firms draw adverse inferences about the solvency of these firms from the run on the distressed company. They then run from these firms, causing them to contract or fail: this can then spark a round of runs on other firms, including other commodity firms or their creditors.

[10] Runs can also occur due to "sunspots." The canonical analysis of bank runs is Douglas Diamond and Phil Dybvig, Bank Runs, Deposit Insurance, and Liquidity, 91 J. Political Econ. (1983): 401. The literature on global games also provides insights on the causes of bank runs and the inefficiencies they cause. See Stephen Morris and Hyun Song Shin, Global Games—Theory and Applications, in M. Dewatrapoint, L. Hansen, and S. Turnovsky, eds., Advances in Economics and Econometrics (2003).

Another way this can occur is through "fire sales." The financially distressed firm sells assets to meet the demands of withdrawing creditors for funds, or because it cannot renew the funding necessary to carry these assets. If these assets are not perfectly liquid, these sales depress their prices. This reduces the market value of these or similar assets owned by other firms, which can force them into financial distress, leading to runs on them and yet more asset sales.

2. CTF Capital Structure

A firm's capital structure determines its susceptibility to runs. Firms that are (a) highly leveraged, and (b) engage in significant maturity, credit, or liquidity transformation. A bank is of course the canonical run-prone entity. They are highly leveraged, and maturity, credit and liquidity transformations are their primary economic functions are most susceptible to runs.

CTF capital structures do not exhibit the features that make firms vulnerable to runs.

First, in comparison to banks in particular, commodity trading firms are not heavily leveraged. One measure of total leverage is total assets divided by book value of equity. Table 1 presents this measure for 2012 for 18 trading firms for which data are available. This ratio ranges from 2.38 (ADM) to 111 (E.On Global). The average (which is somewhat misleading, due to the presence of the outlier E.On) is 18, and the median is 4.

This measure of overall leverage of commodity trading firms is somewhat higher than non-financial corporations in the United States. As of the end of the

third quarter, 2013, the ratio of assets to equity for such corporations was 2.06.[11] The more asset-heavy firms (e.g., Cargill, ADM, Bunge) have leverage ratios that are similar to those for the US non-financial corporations as a whole: the more asset-light firms are more heavily leveraged. Moreover, as will be discussed in more detail below, the heavier leverage of the more traditional trading firms is somewhat misleading. Much of this debt is short-term and associated with liquid, short-term assets. The net debt of these firms (total debt minus current assets, which is a better measure of their true leverage) is quite low.

Notably, trading firms are much less highly leveraged than banks, to which they are sometimes compared: some have argued that commodity trading firms should be subject to regulations similar to banks. Specifically, for US banks that have been designated Systemically Important Financial Institutions ("SIFIs"), the mean leverage is 10.4 and the median is 10. For European SIFI banks, the mean is 20.6 and the median is 22.5.

Second, the most important factor contributing to financial crises throughout history is the fact that banks engage in "maturity transformation", but commodity trading firms do not. Maturity transformation occurs when banks (or shadow banks) issue short-term liabilities to fund long-term assets. This requires the banks to rollover debts almost continuously in order to fund their assets. When lenders

[11] Board of Governors, Federal Reserve Board, Financial Accounts of the United States, Table B.102. 9 December, 2013. This calculation is based on historical cost data, which makes it more comparable to the accounting data used to determine leverage for trading firms. Based on market values/replacement costs of non-financial assets, the ratio is somewhat smaller: 1.75. Since market values or replacement costs of trading firm assets are not available, I cannot calculate an analogous figure for them.

suspect that a bank, or the banking system in general, is financially unsound, they may not agree to rollover the bank's (or banks') short-term debts as they come due. This renders the bank (or banks) unable to fund their operations, and they collapse. Indeed, balance sheet data indicates that major banks do engage in such maturity transformation.

In stark contrast, available balance sheet information also indicates that commodity trading firms do not engage in bank-like maturity transformation. Indeed, to the extent that commodity trading firms engage in maturity transformation, it is the reverse of the borrow short-lend long transformation that makes bank balance sheets fragile, and which makes banks (and other financial intermediaries) subject to runs and rollover risk. Specifically, for all 17 of the commodity trading firms I have studied, current assets exceed current liabilities. The median ratio of current assets to current liabilities is 1.26. Consequently, one measure of net debt (total liabilities minus current assets) is negative for 8 of the 17 firms. Furthermore, the median ratio of net debt to shareholder equity is very small, taking the value of .014. Since commodity trading firm current assets (primarily hedged inventories and trade receivables) tend to be highly liquid and/or of high credit quality (as is documented below) these figures strongly suggest that as a whole, commodity trading firms run far less liquidity risk than do financial intermediaries like banks or shadow banks.

Third, whereas run prone institutions often engage in liquidity transformation, commodity trading firms do not. For instance, some bank liabilities (e.g., deposits) are used to fund illiquid assets, but the holders of these liabilities use

them as a substitute for cash to meet liquidity needs. These structures are fragile and run prone.

Commodity trading firm liabilities are generally not used as cash substitutes. Moreover, the short-term liabilities they issue tend to fund short-term assets (such as hedged commodity inventories) whereas long term, illiquid assets tend to be funded with long-term liabilities (either bank loans or debt sold in capital markets). Specifically, there is a strong negative correlation (-.51) between the ratio of current liabilities to total liabilities, and firms' fixed asset intensity: fixed assets are likely to be less liquid than other assets on trading firm balance sheets (such as inventories).

Relatedly, there is a strong correlation between the fixed asset intensity of commodity trading firms, and their leverage: more fixed asset (long term asset) heavy firms tend to be less leveraged. For 2012, the correlation between the ratio of fixed assets to total assets and the ratio of total assets to book value of equity (leverage) is -.55. Thus, trading firms that are asset heavy tend to be less heavily leveraged than those that are asset light. Put differently, pure trading firms that own relatively few fixed assets tend to be more highly leveraged than firms that also engage in processing or refining transformations that require investments in fixed assets.

Thus, firms engaged in more fixed asset intensive transformations (such as processing) have a greater proportion of long-term liabilities and lower leverage overall. There is therefore an alignment between the asset and liability structures of commodity trading firms' balance sheets, and this alignment demonstrates that these firms do not generally engage in liquidity transformation.

Fourth, the structure of commodity trading firm debt differs from that of financial institutions that have proved vulnerable to runs or rollover problems. These inefficiencies are the result of a coordination problem among creditors. These are most likely to occur when there are many creditors who act independently: depositors, or money market funds that invest in short-term bank debt are canonical examples. In contrast, the bulk of unsecured commodity firm debt is in the form of revolving credit lines extended by syndicates of banks. Syndication facilitates coordination among creditors.

Fifth, although commodity trading firms engage in some activities that are analogous to "shadow banking", these structures are not vulnerable to runs in the way that some shadow banking activities proved to be during the Financial Crisis. The liabilities that proved toxic during the Crisis (e.g., asset backed commercial paper) were used to fund long-term illiquid assets. In contrast, facilities like Trafigura's securitization of trade receivables issue liabilities with maturities that are typically greater than the maturities of the securitized assets. Moreover, these assets tend to be of high quality: default rates on trade credit tend to be very low.[12]

3. The Potential For Information Contagion

Although run-prone capital structures are a necessary condition for some forms of contagion, they are not sufficient. For the financial distress of a run-prone

[12] An International Chamber of Commerce study of data from 2005-2009 found that for trade credit generally (which includes not just commodity trade finance), default rates averaged .02 percent, and that the rate of defaults did not rise appreciably during the period of the crisis. The Offering Circular from a securitization of Trafigura receivables from 2012 reports default rates on the GCTFs receivables from November, 2004-February, 2012. Default rates are less than .1 percent, and delinquency rates never exceed 2.4 percent and are typically less than .1 percent.

entity to have systemic effects, this distress must have spillover effects on other firms. One spillover channel is informational. There is some dispute as to whether this channel has actually been relevant in practice, and in particular during the recent Financial Crisis. Moreover, the fact that trading firms are generally not run prone means that the contagious run mechanism is unlikely to operate here. Nonetheless, it is worthwhile to consider whether information spillovers can occur, that is, whether the financial distress of one commodity trading firm have implications for the solvency of other commodity trading firms.

Commodity trading firms can experience financial distress for a variety of reasons. Many of the historical episodes of firm failures involved circumstances unique to the firms that did not have implications for the financial conditions of other firms.

One reason commodity firms can fail is a large speculative loss. These speculative losses are often associated with a rogue trader problem. Sumitomo's $2.4 billion copper trading loss is one example. The failure of Swiss trader Andre & Cie is another. The bankruptcy of SEM Group is a third.

Such episodes are specific to the firm suffering the loss. They have few, if any, ramifications for the financial health of other trading firms. Thus, a large speculative loss (particularly if it is primarily attributable to an operational or control failure at the firm) is extremely unlikely to induce creditors of other trading firms to revise downwards their estimations of these firms' financial condition or run on them. Indeed, to the extent that the speculative loss at one firm impairs its ability to

supply transformation services, competitors providing similar services could actually benefit from its problems.

Similar considerations hold for other events that can impose large losses on a trading firm, such as an environmental disaster or a legal problem. [13]

One factor that has arguably caused information-based contagion in past crises is similarities in asset holdings across firms. A large loss at a single firm related to a particular asset can support inferences that other firms are at risk to similar large losses because they are believed to hold the same or similar assets.[14]

Many commodity trading firm assets, notably inventories, are traded in liquid and transparent markets, meaning that the prices of companies' holdings of these assets can be determined with some accuracy. Thus, the revelation of a large loss at a particular company due to the decline in the value of its inventory holdings is unlikely to provide new information about the value of other companies.

Similarly, the value of other assets or operations of commodity trading firms are driven by widely observable factors. For instance, soybean processing margins can be measured with some accuracy based on publicly available prices, and are likely to be highly correlated across firms. A loss driven by a sharp decline in

[13] Some legal actions may have implications for multiple firms to the extent that they reveal illicit practices are widespread in the industry (e.g., price reporting fraud) or indicate increased legal and regulatory scrutiny of trading activities. The SEC investigation of Dynegy's accounting in April 2002 is a possible example. The collapse of the entire merchant energy sector commenced when the investigation was announced. The SEC claimed that Dynegy had overstated cash flows from operations using financial transactions that were common in the merchant sector. This cast doubt on the financial results of other firms.

[14] This effect is often hard to distinguish from the fire sale channel discussed below. Moreover, the recognition of a loss may reveal information about the firm's asset holdings, rather than the price of those assets, which is often observable if those assets are traded.

processing margins would be highly predictable conditional on observable prices, and revelation of distress at a particular firm caused by a collapse in margins would itself provide little new information about the prospects of other firms.

The character of commodity firm creditors also reduces the potential for contagious runs. As noted earlier, banks are the primary lenders to commodity traders. Moreover, major lenders to traders tend to extend credit to multiple trading firms. Thus, a bank creditor of a trading firm is likely to have private information about that firm, and other similar firms. This private information reduces the lender's need to rely on a publicly available signal about the solvency of one firm when evaluating the creditworthiness of others. This reduces the potential for contagious runs.

Put differently, one recent theory of financial crises is that information insensitive credit is an important source of financial fragility: adverse shocks make debt designed to be information insensitive information sensitive instead, resulting in runs on this debt.[15] Commodity firm debt tends to be information intensive bank debt provided by banks that is less vulnerable to sector-wide runs.

A recent event could provide one possible example of what could give rise to information contagion in commodity industries is the metals warehousing scandal in Qingdao, China. It was revealed that the same collateral stored in the port of that city had been used to back loans made by a particular commodity trading firm. This immediately led to suspicions that other trading firms active in the port, and in China generally, could have also been victimized by the fraud.

[15] Gary Gorton and Andrew Metrick, Securitized Banking and the Run on Repo, in Market Institutions and Financial Market Risk (2010).

In sum, the importance of the information contagion channel has been disputed in previous financial crises, and is likely to be even less of a concern in commodity trading.

4. The Potential For Fire Sales

Distressed firms often sell assets to raise cash to meet financial commitments. Moreover, secured lenders sometimes sell the collateral backing loans to failing or failed firms. To the extent that these assets are (a) held by other firms, and (b) are traded in imperfectly liquid markets, the fire sales can depress prices and impose losses on the value of other firms' holdings of these and related assets.

Fire sale externalities are most serious when a firm holds assets that are sufficiently liquid to be tradable on a market, but not so liquid that that large sales do not have a price impact. A consideration of the asset side of commodity trader balance sheets strongly suggests that fire sale problems are unlikely to be a serious concern, especially given the way these assets are funded, bankruptcy law, and the fact that many commodity firm assets are hedged.

Consider commodity inventories, which are typically the largest and most liquid assets held by commodity traders. It is common for traders to finance nearly 100 percent of these holdings, with the inventories serving as collateral for the loans. The firm therefore cannot freely sell these inventories. Moreover, under bankruptcy and insolvency law in most jurisdictions, the lender cannot immediately seize and sell that collateral. (This contrasts to repo collateral in the US.)

Moreover, commodity traders typically hedge their inventories. Thus, even if the sale of inventory by a distressed firm depresses prices, other holders of inventories of the commodities the distressed firm sells are protected against some of the effect of the price decline: the counterparties to the hedging trades bear the loss, which means that much of the price impact is absorbed by the broader capital markets. Moreover, commodity derivatives markets are small relative to derivatives markets overall, and to capital markets. This means that any fire sale effect is unlikely to impose crippling losses on those bearing the risk.

Only to the extent that the inventory fire sales affect the basis, and other firms have the same basis exposures as the distressed firm, will there be a fire sale effect. Given the geographic and quality heterogeneity of commodities, and the fact that (as noted above) major traders tend to be diversified across commodities, basis exposures tend to exhibit relatively low correlation across firms.

Other commodity firm assets are not traded or even tradable. For instance, grain silos or oil terminals or soybean mills cannot be sold like securities or inventories. Thus, they pose no more of a fire sale threat than the physical assets of a financially distressed manufacturing or transportation company.

C. The Counterparty Credit Channel

1. Introduction

The financial distress of a firm can impose credit losses on its counterparties. If these losses are sufficiently large, the counterparties may incur financial distress costs, and may themselves become insolvent, which imposes losses and costs on

their counterparties. Thus, counterparty credit losses are one potential source of systemically important spillovers.

These losses are more likely to be systemically important when the counterparties are fragile, run prone institutions (e.g., banks, money market mutual funds), and/or when the obligations defaulted on are part of long intermediation chains.

I consider debt, derivatives, and securitization as potential sources of counterparty credit exposures. The nature of commodity trading firm liabilities, and their counterparties, makes it unlikely that financial distress at a trading firm or trading firms will have systemic consequences via the counterparty credit channel.

2. Debt

Commodity trading firms borrow extensively to finance their activities. I have already demonstrated that trading firm indebtedness is comparable to that of industrial firms, and that they use short-term bank debt to fund current assets (like inventories) and longer-term debt to fund fixed assets.

In terms of counterparty counterparty credit losses, short-term commodity debt tends to be secured by inventories, or in some cases, receivables. Moreover, the inventories tend to be hedged. The secured nature of this debt limits the potential for credit losses.

Moreover, this debt is not part of long intermediation chains. Instead, commodity traders borrow directly from banks, which retain these claims in their banking books.

Most long-term debt is bank debt, frequently in the form of revolving lines of credit with bank syndicates consisting of a large number of banks. This limits the exposure of any institution to a trading firm. The remainder of commodity firm debt is raised through capital markets, and is largely held by non-fragile, unlevered entities, including sovereign wealth funds, pension funds, insurance companies, and high net worth investors.

3. Derivatives

Commodity trading firms use derivatives extensively, primary as a hedge for their commodity inventories, and priced purchases and sales, and secondarily for speculative purposes. Defaults on derivatives positions would impose losses on derivatives counterparties, which if sufficiently large could have spillover effects.

However, the vast bulk of derivatives that commodity trading firms use are exchange traded and centrally cleared. Central clearing counterparties require the posting of margin. CCPs operate on the "loser pays" principle, and require the margins to be sufficient to cover trading losses in all but the most extreme circumstances. This substantially reduces counterparty credit exposures, and thereby substantially reduces the systemic risks via the derivatives channel.

Commodity trading firms sometimes enter into over-the-counter transactions. These transactions are typically collateralized, at least through variation margin and often through initial margin. Just as with cleared derivatives, margin on OTC contracts limits counterparty credit losses arising from OTC derivatives.

4. Securitization

Commodity trading firms have engaged in limited securitizations, mainly of trade receivables. Outstanding amounts of these liabilities are small, which limits their systemic significance. Moreover, default losses on trade receivables have historically been quite small, even during the Financial Crisis, which further limits the potential for counterparty credit losses. In addition, as noted earlier, these firms not engage in Finally, these securitizations tend to be purchased by non-fragile, unleveraged investors.

D. The Vulnerability of Commodity Trading Firms to Financial System and Macro Shocks

1. Shocks to the Financial System and the Macroeconomy

Commodities are subject to demand shocks. These demand shocks can be commodity specific, or can be macroeconomic in nature, and therefore affect a broad swathe of commodities (especially energy and non-precious metals). The latter type of shocks are more likely to give rise to systemic effects operating through or on CTFs because they are not diversifiable, so I will focus attention on them. Indeed, I will narrow the analysis even more to consider a demand shocks across commodities as a whole that arise from a financial/credit crisis, because such crises have implications for both the demand for CTFs' services, and their ability to obtain the funding necessary to perform their merchandising functions. That is, such a shock is potentially the most threatening to CTFs as a whole.

A decline in demand for a commodity leads to a decline in the (derived) demand for some transformations, notably transportation/logistics and processing/refining, but an increase in the demand for others, notably storage. The

declines in derived demand tend to result in declines in both volumes and margins, thereby reducing the profitability of the firms that engage in the adversely impacted transformations. To the extent that a GCTF also stores commodities, it benefits from an internal hedge that offsets the losses from supplying transformations in space and time.

The magnitudes of these changes in derived demands depend on the magnitude of the demand shock (and hence the severity of the financial crisis) and the elasticities of supplies of the underlying commodities. Since many commodities are highly inelastically supplied, especially in the short run, the effects on margins and volumes, and hence trading firm profits, can be modest.

Trade data provide some insights onto this source of risk to commodity trading firms. Figures 1 through 4 depict data relating to world exports by commodity. (Data related to world imports by commodity behave similarly, so I only present charts on exports.) Figure 1 graphs nominal exports by commodity reported in the ITC data for 2001-2011. Note the large downturns in nominal trade volumes in 2009, reflecting the impact of the financial crisis. Due to the large size of oil and steel and iron exports compared to those for other commodities, Figure 2 graphs nominal exports for all commodities except oil and iron and steel. Virtually all commodities exhibit a noticeable dip in 2009.

As noted above, however, although changes in nominal flows reflect changes in both flat prices and quantities, quantities are the major determinants of commodity traders' margins and profits. Figure 3 depicts annual nominal exports for each commodity deflated by its average annual price (scaled so that the 2001

average price equals 1.00). The impact of the 2008-2009 financial crisis is much less noticeable in the deflated exports than the nominal exports. Only iron and steel exhibits a pronounced dip. Figure 4 presents the deflated exports for all commodities studied excluding oil and iron and steel. These smaller commodities do not exhibit a pronounced decline in deflated exports (a proxy for quantity) in 2009.

These charts strongly support the conclusion that a large demand shock primarily affects commodity prices, and has a much smaller impact on the quantities of commodities traded. Inasmuch as the profitability of commodity trading firms is primarily driven by quantities (to the extent that these firms hedge price exposures), the risk that a large demand shock (like that experienced in 2008-2009) poses to the viability of CTFs is limited.

Demand shocks arising from a macro shock such as a financial crisis also affect the funding needs of commodity trading firms. Crucially, adverse shocks of this nature tend to reduce funding needs and liquidity stresses. Adverse demand shocks reduce prices, thereby reducing the amount of capital necessary to carry inventories of commodities as they undergo transformation processes. Moreover, to the extent that commodity trading firms are typically short derivative instruments (which may be marked-to-market on a daily basis) as hedges of commodity stocks, price declines generate mark-to-market gains on derivatives that result in variation margin inflows. This provides a source of funds to repay credit taken to acquire the inventories. That is, these price declines tend to result in cash inflows prior to obligations to make cash payments, which further ease funding needs of commodity

trading firms. Moreover, since bank loans backed by hedged inventories are typically marked-to-market as well, so the trading firms pass through the margin inflows to their lenders. This provides a source of cash to the banks, which is particularly valuable during periods of financial stress. In effect, the speculators (or long hedgers) who take positions on the other side of the trading firms hedging inventory provide contingent liquidity to the banking system.

Figures 1-4 illustrate this clearly. The nominal value of virtually all commodities traded declined sharply in 2009, but quantities (as proxied for by deflated exports) did not decline substantially, or uniformly across commodities. This decline in nominal trade reflects the pronounced price declines that occurred in late-2008 to mid-2009. Moreover, the sharp decline in the nominal value of a relatively stable quantity of exports means that the financing needed to carry out such exports declined sharply as well.

The decline in funding needs during periods of sharp demand declines resulting from a shock arising in the financial system is particularly beneficial, inasmuch as financial shocks constrain the availability of credit. In this regard, however, it should be noted that the liabilities that CTFs issue to fund their transformation activities are more robust than the liabilities that proved catastrophically fragile (such as ABCP and auction rate securities) in the previous financial crisis. The degree of maturity transformation in much commodity finance is quite limited: short-term, and in some case long-term, liabilities are utilized to fund short-term, "self-liquidating" assets. Moreover, even in the event of default, the funded assets are often readily sold or hedged in liquid derivatives markets; this

limits lenders' risk. Similarly, asymmetric information problems are less severe with commodity collateral (as compared, for example, to CDOs held by SPVs during the crisis), which further reduces the potential for a run by funders.

The non-bank (or shadow bank) funding instruments used by CTFs also compare favorably to shadow bank liabilities that proved problematic-or disastrous-during the crisis. As noted above, some of these non-bank sources of credit are backed by commodity inventories, and others by receivables. Liquidity of the underlying assets and lack of information asymmetry facilitate continued supply of funding of these assets even during times of financial stress. Similarly, the receivables backing securitizations issued by GCTFs tend to have very short maturities, and very low rates of default, even during times of financial market stress.

The risks of funding depend primarily on the type of commodity. More heavily traded commodities with broad and deep derivatives markets (e.g., oil, corn, some non-ferrous metals) pose fewer funding risks than other commodities lacking such markets (e.g., coal, iron ore).

The foregoing analysis implies that GCTFs should be relatively robust, even to large shocks emanating from the financial system. This implication is testable, using data from the 2007-2009 financial crisis. I have reviewed data on ADM, Bunge, Cargill, Vitol, Louis Dreyfus, Mercuria Energy Trading, Glencore, Olam, Wilmar, Trafigura, and Noble.

All of these firms remained profitable throughout the 2007-2009 commodity boom-bust cycle. Between 2007 and 2009 (the nadir of the commodity price cycle),

net income changes ranged between -57 percent (Bunge) and 224 percent (Wilmar) with a median of between 44 percent (Cargill) and 113 percent (Noble).

This sample is dominated by firms that are focused on agricultural commodity trading. Glencore is focused on metals and energy, two notably procyclical commodity sectors: its profit declined 24 percent over the cycle. Trafigura is focused on energy: its earnings rose 85 percent over the boom-bust cycle. Vitol is another energy-focused trading firm, and it experienced a 91 percent increase in income over the cycle. A third energy-focused firm, Mercuria Energy Trading, saw its income rise 122 percent. These figures are worth noting, given the substantial rise, decline, and subsequent rise in oil prices over 2007-2009. This performance likely reflects the fact that economic volatility can create arbitrage opportunities, and serious economic downturns can increase the demand for some transformation activities, notably storage.

The variability in performance across the firms for which data is available, with some companies suffering substantial declines in earnings and other substantial rises over the 2007-2009 commodity cycle (and financial crisis cycle), is inconsistent with the hypothesis that GCTF financial performance is highly sensitive to global economic conditions. This is in stark contrast to other SIFIs. GCTFs would be more likely to create systemic risk if, like SIFIs, their earnings were highly correlated over the cycle.

This is true of large banks, whose profits collapsed during the Crisis. Total profits for the 8 US SIFI banks plunged from $58 billion in 2007 to a loss of $9.8 billion in 2008, and recovered only to $40 billion the following year. European SIFI

banks earned a profit of $114 billion in 2007, but suffered a loss of $16.5 billion in 2008, with profits rebounding to $58 billion in 2009. This performance differs starkly from that of commodity trading firms over this period.

Insofar as GCTFs being a channel by which shocks originating in the financial sector are transmitted to commodity producers and consumers, and via them to the real economy, there is anecdotal and survey evidence, and some empirical evidence, that the recent financial crisis led to a contraction in trade credit. The anecdotal evidence specifically suggests that there has been a contraction of trade credit in commodities specifically; the survey and empirical evidence shows that trade credit contracted, and became more expensive during the crisis.[16] Further, it is well-documented that international trade contracted more sharply than GDP generally during the crisis, and there is some evidence that this trade contraction was "excessive," in the sense that trade declined more during the crisis than would have been predicted given the decline in GDP.[17] Although the trade finance channel has been suggested as the reason for this excessive decline in trade, most empirical evidence does not support this hypothesis.[18] The empirical evidence focuses on

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[16] International Monetary Fund (2009), "Survey of Private Sector Trade Credit Developments" (Washington, D.C., International Monetary Fund, February), www.imf.org/ external/np/pp/eng/2009/022709.pdf.

[17] Mark Wynn, The Financial Crisis, Trade Finance, and the Collapse of World Trade, Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute 2009 Annual Report.

[18] Inessa Love, Trade Credit versus Bank Credit during Financial Crises, in Jean-Pierre Cauffour (ed.), Trade Finance During the Great Trade Collapse (2011). Andrei Levchenko, Logan Lewis, and Linda Tesar, The Role of Trade Finance in the US Trade Collapse: A Skeptics View, in Cauffour (2011). An alternative view is provided by Davin Chor and Kalina Manova, Off the Cliff and Back? Credit Conditions

international trade generally, rather than commodities specifically. Some evidence shows that the effects of the trade credit contraction were most pronounced in firms with few collateralizable assets. Given that many commodities and commodity-related assets are readily used as collateral, this suggests that any impact of a trade credit contraction would be less severe in commodity trades than in trade generally. It further suggests that effects would be more severe for firms, commodities, or nations for which collateralization is more costly (e.g., in jurisdictions where perfecting access to collateral is riskier due to the nature of the legal system).

In sum, commodity trading firms are unlikely to contribute to a positive feedback in which a shock arising elsewhere in the financial system or the real economy imposes loses on the trading firms, which in turn imposes negative externalities on other firms (e.g., banks). This is true for two reasons. First, commodity trading firms are robust to even large shocks in the financial sector and real economy. Second, as noted earlier, financial distress in the commodity trading sector is unlikely to have serious external effects.

2. Supply Shocks

A global supply shock to a major commodity poses substantially different risks to GCTFs, their creditors and their trading partners. A decline in supply, can arise, *inter alia*, from conflict (e.g., oil in the Middle East), natural disaster (e.g., a drought that devastates a major wheat producing region), or political action (e.g., an export embargo). Such a shock causes prices to rise. Such a price rise tends to

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and International Trade During the Global Financial Crisis (2009) http://ssrn.com/abstract=1502911.

cause spikes in funding needs for hedged inventories, and an increase in funding needs generally as due to inelastic demand for most commodities a decline in supply leads to a larger percentage increase in prices, thereby increasing the market value of the commodity. It also tends to reduce the profitability of commodity merchandising, by reducing both margins and volumes. Thus, whereas demand shocks-especially those that hit multiple commodities-have some effects that cushion the impact on GCTFs, all of the effects of supply shocks tend to be detrimental to GCTFs-reducing their margins and volumes, increasing funding needs, and potentially raising funding costs.

A supply shock is likely to occur in a single commodity at any particular point in time, which mitigates their impact on diversified commodity firms, and hence on their creditors, customers, and counterparties. Moreover, the markets for many commodities, even important ones, such as grains, are not large enough relative to overall economic activity such that a supply shock will have macroeconomic impact that can affect financial markets and credit conditions. This limits the potential for adverse feedback loops.

One potential exception is oil. Several peer reviewed economic articles present empirical evidence that adverse oil supply shocks may cause macroeconomic contractions, although it should be noted that this evidence is somewhat controversial because the transmission mechanism is not well

understood. Moreover, evidence for such a link post-1991 is weaker than for the 1970s and 1980s.[19]

Economic contractions also tend to cause deteriorations in credit market conditions. Thus, there is a potential for feedbacks involving CTFs in the aftermath of an oil shock. Such a shock has a direct adverse impact on the profitability of oil trading firms (as just discussed), but the macroeconomic impact tends to reduce the demand for commodities generally, and the credit market impact tends to raise funding costs. These effects affect commodity trading businesses more broadly, with potential knock-on effects in commodity trading volumes.

This suggests that a major oil supply shock is potentially a source of risk to CTFs generally, and *via* them, commodity trade and aggregate economic activity. The severity of this risk depends on (a) the probability of oil supply shocks, and (b) the effect of oil supply shocks on aggregate economic activity.

One consideration offsets this. Large supply shocks often disrupt established marketing channels and supply chains. This increases the demand for firms like CTFs that specialize in matching buyers and sellers, and who have specialized knowledge on the capabilities of producers and the locations of supplies, and the needs of buyers. Relatedly, large supply shocks often result in large and sometimes temporary changes in relative prices across space, time, and variety: CTFs specialize

[19] Evidence on the connection between oil shocks and US economic activity is summarized in James Hamilton, Oil and the Macroeconomy, in S. Durlaf and L. Blume (eds.) New Palgrave Dictionary of Economics and the Law (2008). International evidence is presented in Rebeca Jiminez-Rodriguez and Marcelo Sanchez, Oil Price Shocks and Business Cycles in Major OECD Economies (2008). There is some evidence that the impact of oil price shocks on economic activity has declined in the past two decades.

in monitoring relative prices closely, and identifying circumstances in which relative prices diverge from transformation costs. They can thus profitably exploit relative price volatility. Thus, although reductions in volumes resulting from supply shocks tend to depress traders' margins, the increased demand for intermediation and relative price volatility that accompanies some supply shocks tends to have an offsetting effect.

E. FSB Criteria

1. Introduction

The Financial Stability Board has established five criteria for evaluating whether non-bank, non-insurer ("NBNI") firms are systemically important. They are: size, interconnectedness, substitutability, complexity, and global activities. I have already addressed several of these. I now turn to the others.

2. Size

The FSB has identified assets of $100 billion as a size threshold indicating possible systemic importance. Only one commodity trader exceeds that threshold. The assets of Glencore, the largest commodity trading firm, (which has evolved into a very asset heavy mining firm, more comparable to a Rio Tinto or BHP than a Vitol or Trafigura, or even an ADM) total slightly more than $150 billion: prior to its merger with Xstrata, a miner, its assets were $105 billion. If Cargill, the second largest trading company in terms of assets, were publicly traded it would rank approximately 450th in terms of assets. Comparing just to major banks, Glencore's assets are approximately equal to the 50th largest bank (by assets) in the world. The banks of similar size include Bank Leumi and Bank Hapoalim, hardly household

names outside their home countries. Cargill is comparable in size to the 65th largest bank in the world.

Focusing on SIFIs, the median European SIFI bank has assets of $1.3 trillion, and the median US SIFI bank has assets of $1.18 trillion. Thus, most banks that have been designated as SIFIs have assets that are an order of magnitude larger than the largest commodity trading firms, and two orders of magnitude larger than most commodity trading firms. Thus, the financial distress of even the largest commodity trading firm, or even several of them, would be unlikely to have the same disruptive impact on the financial system as the collapse of a middling-size major bank, let alone a behemoth like Deutsche Bank or JP Morgan.[20]

3. Substitutibility

The FSB states that an entity is more likely to be systemically important if "it is difficult for other entities in the system to provide the same or similar services in a particular business line or segment in the global market in the event of a failure." Several factors affect substitutability, including the concentration of trading firms in a given market segment, the redeployability of a firm's assets, and the extent to which a trading firm extends credit. I consider each in turn.

In the largest and most systemically important commodity sectors, no trading firm has a very large market share, meaning that the loss or impairment of a particular firm would reduce transformation capacity only modestly. For instance,

[20] In January, 2014 the FSB proposed to use an asset value of $100 billion as a threshold to determine whether a non-bank financial corporation should be designated as a SIFI. Since such corporations typically have far more fragile capital structures than commodity trading firms, and since most commodity trading firms have assets less than $100 billion, by the FSB criteria even the largest commodity trading firms are not SIFI.

in the crude oil market, the largest and systemically most important commodity sector, two of the largest traders (Vitol and Trafigura) each account for about 6 percent of freely traded oil. Glencore accounts for approximately 3 percent, and Mercuria 3 percent.[21] Concentrations are somewhat higher in metals Glencore trades about 60 percent of freely traded zinc (although the termination of its off-take agreement with Nyrstar under terms imposed by the European Commission to secure approval of its purchase of Xstrata reduced this concentration); 50 percent of freely traded copper; and 22 percent of freely traded aluminum.[22] The company also accounts for a large fraction—approximately 28 percent—of the global thermal coal trade. Thus, the non-ferrous metals markets are more concentrated and hence more susceptible to a single trading firm's distress, than the oil market.

It is important to note that concentration is small in commodities that represent a relatively large fraction of trade, and that the markets in which concentration is sometimes large represent very small fractions of trade. For instance, depending on the region, oil represents between 3 and 10 percent of imports. This is an appreciable fraction, but concentration in oil trading is quite low,

[21] These figures are from reports on these companies' websites.

[22] These figures are derived from Glencore's IPO Prospectus. Glencore utilizes publicly available data and its own estimates to determine the "addressable" quantities "that are available to a third party marketer such as Glencore." For instance, commodities produced and consumed by a vertically integrated firm are excluded from the calculation. Domestic Chinese production is also excluded, as are volumes sold directly from a producer to an end-user without use of an intermediary. As an example, when calculating its share of thermal coal trade, Glencore utilizes seaborne volume of 692 million MT, out of a total world output of 4,556 m MT. The "addressable" market is typically far smaller than total global output. Based on total global output, Glencore calculates its market share to be 13 percent for zinc, 10 percent for zinc concentrates, 7 percent for copper, 4 percent for copper concentrates, 8 percent for alumina, 9 percent for aluminum, and 4 percent for thermal coal. Glencore considers the total oil market to be accessible to traders.

with the largest firms handling only around 6 percent of trade. In contrast, other commodities represent much less than one percent of imports (or exports), meaning that even if one of the dominant firms in a concentrated market were to disappear, the potential effect on overall trade and economic activity would be trivial. This conclusion is reinforced when one examines trade in commodities as a function of GDP: even oil imports are less than 2 percent of GDP for all regions except Asia, where they are less than 3 percent of GDP.

This means that the failure of a commodity trading firm is unlikely to disrupt severely the trade in any major commodity.

This conclusion is strengthened by the fact that the financial distress of a commodity trader does not loss in the loss of its transformation capacity because its assets are readily re-deployable. Much of the physical and human capital deployed in commodity trading is highly re-deployable. In the event of distress of a trading firm, its physical assets and employees can move to other firms. Moreover, insolvency/bankruptcy laws generally facilitate the continued operation of financially distressed firms, so they can continue to provide transformation services even while in financial distress (although perhaps less efficiently, due for instance, to higher costs of funding, the loss of skilled employees, and poor incentives). These factors limit the duration of the impact of the firm's distress. While redeployment is occurring, or if a firm operates less efficiently while in bankruptcy, customers of the distressed firm will be adversely impacted. This effect will be most acute if the distressed firm has a large share of for a particular commodity or geographic region. However, since such conditions are most likely to occur for smaller-volume

commodities and regions (because there is less concentration in the trade of major commodities in major markets), the broader systemic implications of such disruptions will be minor.

One reason that bank failures can be systemically catastrophic is the central role of banks in the supply of credit, and the facts that there are few substitutes for bank lending generally, and that some borrowers are dependent on particular banks. If banks fail, or become financially distressed in large numbers, they reduce the amount of credit that they supply, which reduces investment and consumption (especially of durable goods) in the economy. Substitutibility is limited because banks possess borrower-specific information that cannot be transferred easily, or utilized efficiently by a financially distressed bank that cannot obtain the funding necessary to extend credit at pre-distress scale.[23]

Commodity trading firms do issue credit to commodity consumers and producers (in the form of prepays, for instance), but ultimately the source of the bulk of this credit is banks. Commodity trading firms commonly purchase payment guarantees from banks when they extend credit to customers: in the case of Trafigura, for instance, approximately 80 percent of the credit it extends is backed by payment guarantees or insurance from banks. Thus, banks bear the bulk of the credit risk, and hence are ultimately the source of credit; the trading firms are basically conduits between banks and customers. To the extent that a particular trading firm has a comparative advantage in serving as a conduit to some customers (because, for instance, its knowledge of the customers' business allows it to monitor

[23] See, for instance, Ben Bernanke, Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression, in Essays on the Great Depression (2000).

them more effectively), the firm's failure would impair the flow of credit to its customers. But there are alternative ways of providing this credit (other trading firms can step in the breach, or the customers can borrow directly from banks), and this mitigates the impact of the failure of the individual firm.

4. Global Activities and Complexity

Commodity traders obviously undertake activities in multiple jurisdictions, which means that to the extent that there are externalities from the failure of a commodity trading firm, they will be widespread. One factor that distinguishes commodity traders from banks deserves comment in this context, however.

The failure of a large international bank so potentially difficult to resolve is that these firms are very complex, with subsidiaries and affiliates often numbering in the hundreds spread across dozens of jurisdictions. In contrast, although most major commodity trading firms have subsidiaries and operations in multiple jurisdictions, they tend to be much simpler in structure than major banks. This facilitates their resolution or restructuring in the event of insolvency.

F. Historical Experience

1. Introduction

The foregoing analysis casts serious doubt on the systemic importance of commodity trading firms. Historical experience provides further reasons to doubt.

2. Large Commodity Trading Firms Have Suffered Large Losses, and Sometimes Failed, With No Systemic Effects

There are few, if any, instances in which the distress of a large firm in the aftermath of a loss suffered by that firm has metastasized into a financial crisis that threatened other firms: indeed, there are many instances of large losses that did not

result in spillovers. In commodities in particular, large losses at Ferruzzi ($4 billion), Metallgesellschaft (over $1 billion), Sumitomo ($2 billion), Constellation (a $10 billion loss in market capitalization), or Amaranth ($6 billion) did not have broader systemic consequences.

The bankruptcy of Enron in 2001 is particularly illustrative. Even though the firm was the largest participant in North American gas and power markets, and the counterparty to myriad derivatives and physical transactions, its bankruptcy did not result in a cascade of failures among its counterparties, or the counterparties of its counterparties.[24]

3. The Meltdown of the Merchant Energy Sector in the US Had No Systemic Consequences

In the immediate aftermath of Enron's failure, the merchant energy sector in the United States underwent a crisis in 2002. There are some similarities between GCTFs and merchant energy companies. Merchant energy companies were in the business of transformation. Their transformations included providing logistical services matching commodity supply and demand, e.g., assembling portfolios of natural gas supply and portfolios of natural gas consumers. They also included transforming fuels (gas and coal, primarily) into electricity. They also viewed themselves as being in the business of providing risk management services to their suppliers and consumers. They were, in essence, commodity intermediaries, just as GCTFs are.

[24] The merchant energy sector in which Enron operated did experience extreme distress some months later, as discussed below. This was the result of adverse market conditions affecting the entire sector, rather than a counterparty contagion beginning with Enron's demise.

The merchant energy model was born in the late-1980s, boomed in the 1990s, and collapsed ignominiously in 2002. The initial harbinger of the industry's demise was the collapse of Enron in late-2001, but Enron's failure was in large part due to failures in non-energy ventures. Beginning in late-April, 2002, the rest of the sector underwent a precipitous collapse. From 25 April, 2002 through the end of May of that year, the equity values of a portfolio of large energy merchants declined by approximately 91 percent. The credit rating of every energy merchant firm was downgraded. Many firms exited the business, and one prominent firm (Mirant) declared bankruptcy.

The implosion occurred because energy merchant firms were exposed to a narrow set of common risks. In particular, merchant energy firms were all exposed to "spark spread risk": they were all, to one degree or another, short fuel (primarily gas) and long power. When spark spreads collapsed due to a combination of economic weakness in the US post-911 and a massive increase in generation capacity that had been built in anticipation of continued strong growth in electricity demand, all of the firms in the sector were adversely affected.

Although merchant energy firms were devastated by the collapse in 2002, it is important to note that (1) there were no knock-on/contagion effects with financial institutions, and (2) there were no pronounced disruptions in the delivery of physical energy. This was despite the fact that merchant energy firms tended to

be relatively highly leveraged, and also had created a variety of shadow banking like liabilities.[25]

The losses in the sector were substantial: the loss in equity market capitalization was approximately $100 billion, and in addition there were substantial losses on the debt of these corporations. (Indeed, these firms were highly leveraged, generally more highly leveraged than the GCTFs for which information is available.) But these losses were borne primarily by real money investors rather than leveraged and systemically important financial institutions. During and after the collapse, assets and contracts were repriced, and either transferred to solvent owners capable of operating the assets and performing on contracts, or operated/performed on by restructured energy merchant firms. Indeed, some assets and contracts were acquired by firms outside the merchant energy sector; large financial institutions, including some SIFIs, took over portions of merchant energy firm's activities. This illustrates that substitutability operates on an economically meaningful time scale in commodities, and that in assessing the degree of substitutability, it is necessary to consider firms (most notably large financial institutions) outside the specific commodity trading sector under consideration.[26] Thus, a large financial disruption to an important group of firms in

[25] For instance, Enron and Dynegy used prepaid swap structures and special purpose entities. Indeed, an announcement that the SEC was investigating the accounting of one of Dynegy's prepaid swap and SPE structures initiated the collapse of merchant energy stock prices.

[26] As another example, a hedge fund (Citadel) and a bank (J.P. Morgan) acquired the portfolio of the hedge fund Amaranth after it suffered large trading losses. Similarly, the assets and contracts of failed energy trading firm the SEM Group, were acquired by financial institutions, most notably Barclays. (The terms of this acquisition are currently the subject of litigation.) In this regard, it should be noted that restrictions

the commodity transformation business need not result in a pronounced disruption in the flow of commodities from producers to consumers

4. A Loss of Transformation Capacity Does Not Necessarily Harm the Real Economy

As noted throughout, one of the primary functions of commodity trading firms is to make transformations in space and time—logistical transformations. Although the foregoing suggests that financial distress does not materially reduce transformation capacity, even if the assets utilized by a distressed trading firm to make these transformations are not redeployed immediately, the impact on the broader economy will almost certainly be minor. Recent experience demonstrates that even a major disruption of the logistical system in a major economic region does not cause an appreciable decline in the world economy. Specifically, the Japanese earthquake and tsunami in 2011 wreaked massive havoc on the single most important trading region in the world, but this had only very small effects on the world economy. These natural disasters seriously disrupted production at numerous firms that played a central role in global supply chains for high value manufactured output. A report prepared under the authority of the Directorate General of the Treasury of France concluded that:

> Japan is a key player in global production chains, particularly in high-technology sectors. Japanese firms account for over 70% of global production in at least 30 technological sectors . . . The triple disaster, which led to a nearly 8% reduction in Japanese products exports in Q2, also caused

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on the ability of commercial banks to participate in commodity markets reduces substitutability and thereby increases commodity market specific risk, and potentially systemic risk as well. Restrictions on bank participation in commodity markets, which are currently being considered by the Federal reserve, create the risk of limiting such remedies in the future.

> disruptions to global supply in some sectors, particularly in electronics and the automotive industry.
>
> Japan also plays a key role in Asian trade where production chains are highly integrated. Schematically, Japan supplies sophisticated intermediate goods to and buys final goods from its Asian partners including China, the pivot of the new international division of labor, which performs assembly and transformation of the semi-finished products. Given the network structure of production processes, a shock affecting an upstream producer can cause strong fluctuations in the economy as a whole, through cascade effects from one firm to another.[27]

Nonetheless, the French Treasury concluded that the effect of the catastrophe on aggregate output was small, even in Asia. It estimates that the effect was .1 point of GDP in China and .2 percentage points for other "Asian dragons" in Q2 2011. Furthermore, it concluded that "the impact is very low" in Europe and the US. Furthermore, it found that "virtually zero" impact for the full year 2011, because of the "restoration of both Japanese production capacity and global supply chains."

The IMF Japan Spillover Report also found that the effects of the earthquake were modest (outside of the automobile industry) and short lived (even in the auto sector).[28]

The Japanese natural disaster caused the destruction of production capacity. The affected capacity was an essential element of a complex supply chain in high value-added industries. Even so, the spillover effects of this destruction were small and fleeting. This demonstrates the resilience of economic activity to the disruption of trade.

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[27] The impact of Japan's earthquake on the global economy. Tresor-Economics Report No. 100 (2012)

[28] International Monetary Fund: Japan Spillover Report for the Article IV Consultation and Selected Issues (2012).

The financial distress of a trading firm would not result in the destruction of any productive assets (although it could impede the efficiency of their use); the assets would be available to be redeployed, or operated by those who control the distressed firm. No single firm, or even multiple firms, is as critical in the global supply chain for large, high value added industries (such as autos and electronics) as the Japanese companies affected by the earthquake and tsunami. Thus, the effects on the broader economy of the financial distress of a large commodity trading firm, or even multiple firms, would almost certainly be smaller, and shorter lived, than the small effects of these natural disasters.

V. Summary and Conclusions

Global commodity trading firms play an essential role in facilitating the flow of vital commodities from producers to consumers. Their importance in the global commodity trade, and the importance of commodity trading to the broader economy, make it vital to understand the risks that these firms pose to the broader economy, and the potential that macroeconomic developments can disrupt the ability of these firms to carry out their intermediation function.

To understand the systemic importance of CTFs, it is essential to recognize their basic economic function: to transform commodities in space, time, and form. These transformations are different in crucial ways from the maturity and liquidity transformations that systemically important financial institutions undertake. The types of transformations CTFs perform are more robust than those that SIFIs undertake, implying that CTFs pose less systemic risk.

Table 1
Total Assets/Book Value of Equity

Arcadia Energy	17.51
ADM	2.39
BP International	5.32
Bunge	2.51
Cargill	2.37
E.On Global	111.07
EDF Trading	4.56
Eni T&S	35.09
Glencore	3.08
Louis Dreyfus .	3.74
Mercuria	84.16
Noble Group	3.80
Olam	4.02
Shell Trading	12.09
Trafigura	7.94
Vitol	4.00
Wilmar	2.76

Figure 1
Nominal Exports by Commodity 2001=1.00

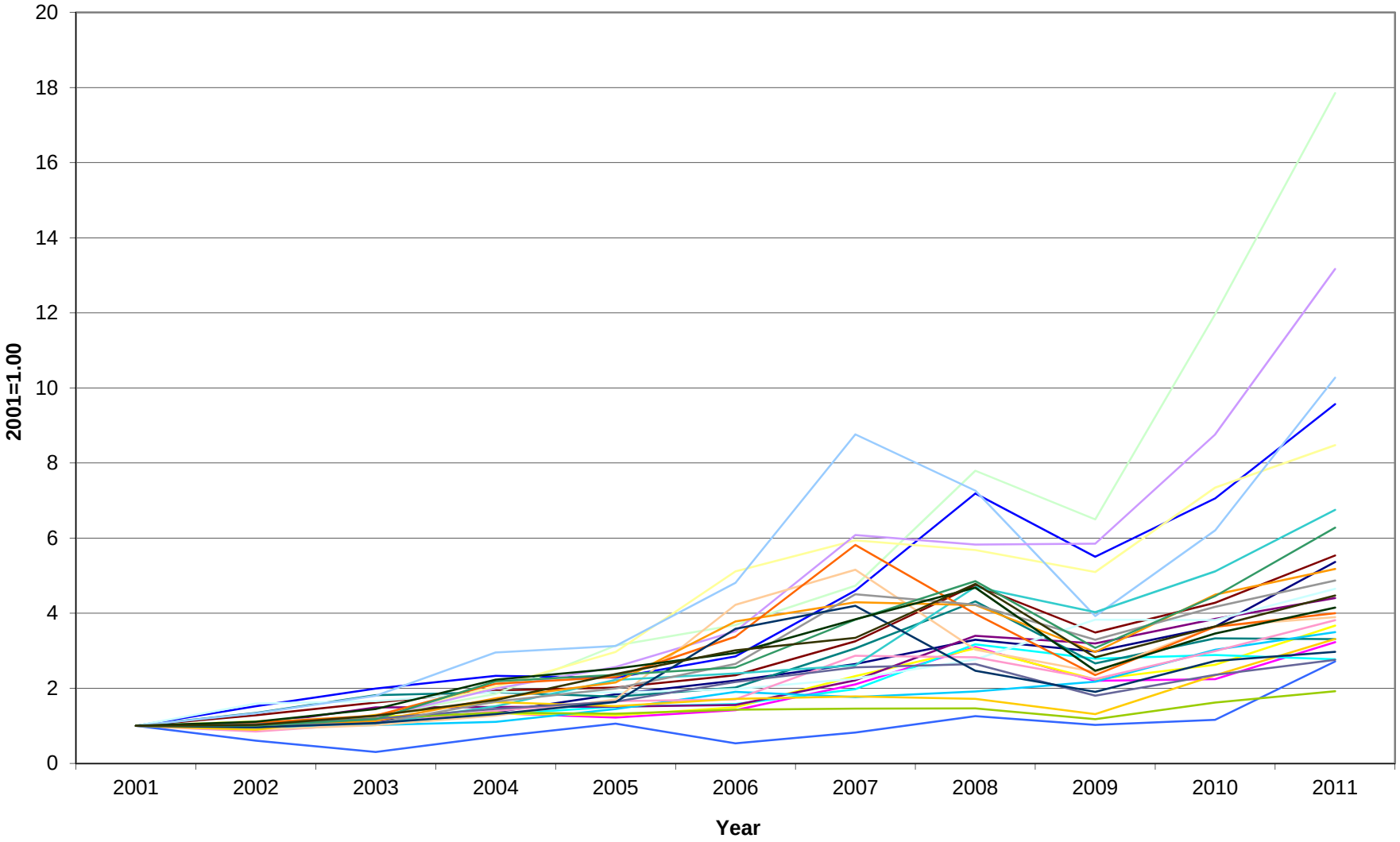

Figure 2
Nominal Exports Ex. Oil, Steel

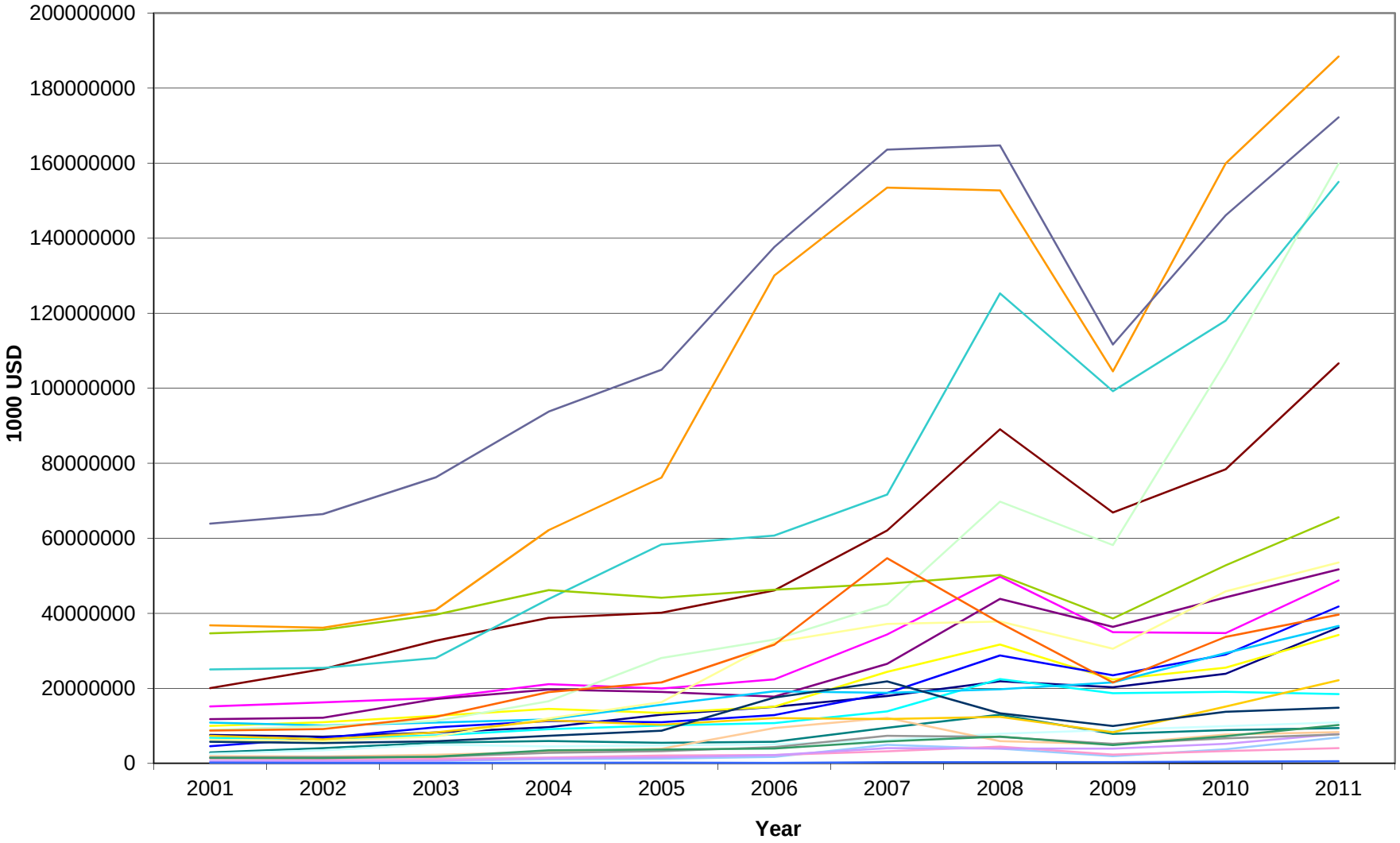

Figure 3
Deflated Exports 2001-2011

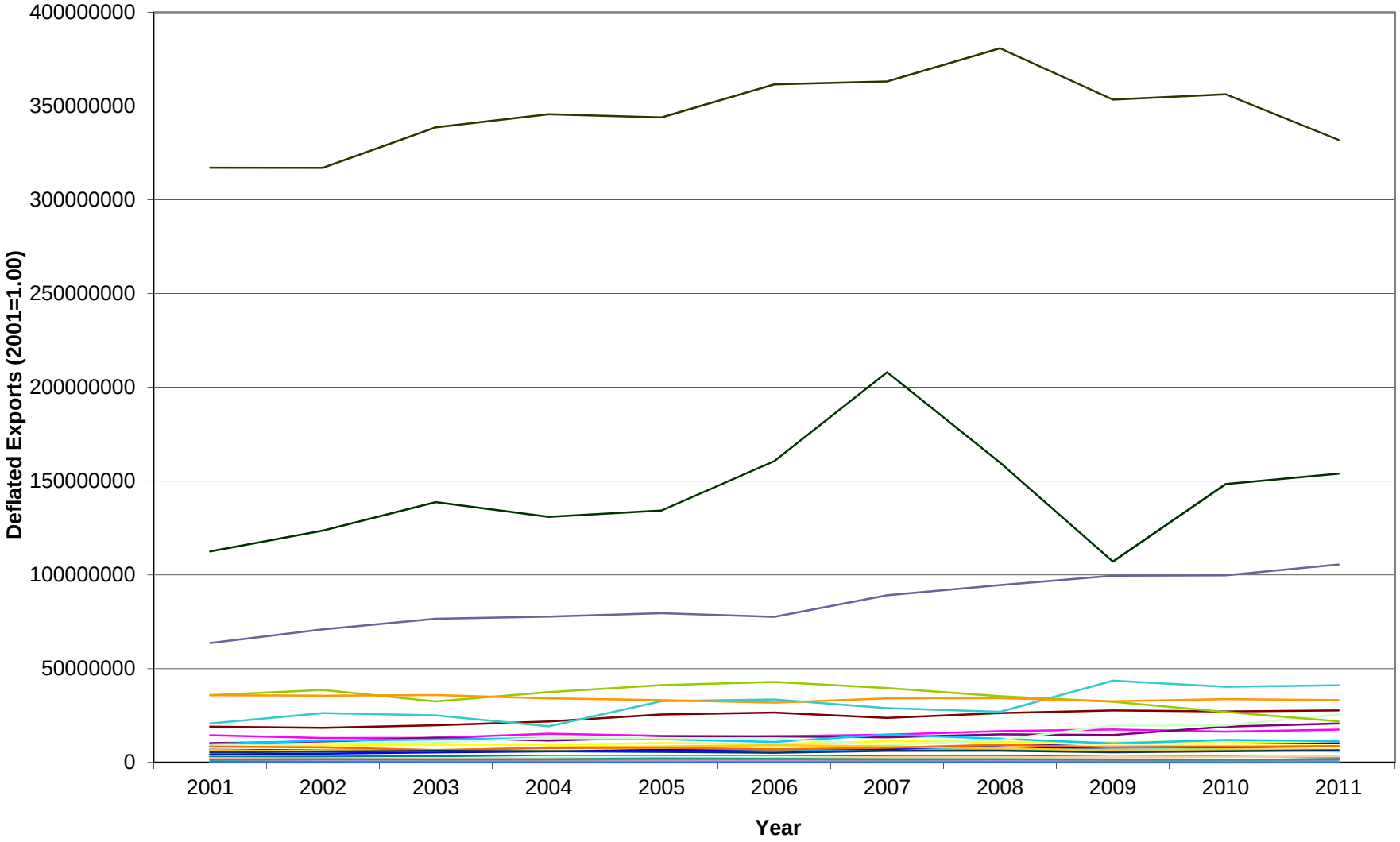

Figure 4
Deflated Exports Ex. Oil, Steel