NOT TOO BIG TO FAIL

Systemic Risk, Regulation, and the Economics of Commodity Trading Firms

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INTRODUCTION AND SUMMARY

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 (FSB) 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.

Some regulators have questioned whether some of these firms are "too big to fail," and hence pose a threat to the stability of the financial system, necessitating subjecting them to additional regulation akin to that imposed on banks.

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

Commodity Trading Firms Under Scrutiny

Global commodity traders have been subject to considerable attention in the aftermath of the financial crisis. The debate over commodity trading firms has been impeded by the fact that CTFs are wrapped in an aura of mystery: there is a pervasive lack of understanding of what these firms do and how they do it.

Trading firms are intermediaries that undertake various transformations of physical commodities like oil, metals, and grain, but the transformations they perform are very different than the transformations that banks undertake in their role as financial intermediaries. This paper attempts to penetrate that aura, in order to provide a better understanding of the functions of these firms, and on the basis of this understanding, to evaluate whether they pose systemic risks that would justify subjecting them to regulations (notably capital requirements) similar to those imposed on other entities (notably banks) deemed to be systemically important.

Although CTFs are currently exempt from the EU rules governing capital requirements for financial institutions, this exemption is set to expire, and unless it is extended, these firms will be subject to Capital Requirements Directive IV (CRD IV), just as banks are (**SEE BOX 1**). Since a primary purpose of bank capital requirements is to reduce systemic risk, subjecting CTFs to such requirements cannot be justified if they do not pose systemic risks similar to those inherent in banks.

A Framework for Analysing the Potential Risk of CTFs

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 of systemic risks communicated through these interconnections, and the vulnerability of CTFs to systemic shocks, especially those arising in the financial sector. Furthermore, I evaluate the likely impact of binding capital requirements imposed on CTFs.

Why Imposing Capital Requirements on CTFs is not the Answer

Two basic conclusions arise from the analysis.

First, CTFs are unlikely to create systemic risks, certainly not on the scale of banks. This is true for many reasons. Most notably, CTFs are not excessively leveraged; their liabilities are not fragile because they do not engage in maturity or liquidity transformations; the risks of contagious runs and fire sales are low; they can continue to supply transformation services even when in financial distress; they are not major suppliers of credit; and their financial performance is not highly procyclical. In all of these ways, CTFs are very different from banks. That is, although commodity trading firms engage in various economic transformations, the types of transformations they perform are substantially different from those undertaken by systemically important firms, which makes them less systemically risky.

Second, capital requirements would impose costs on CTFs. Binding requirements would force CTFs to contract, obtain excessive amounts of costly equity, or both. Moreover, if sufficiently onerous, they could induce some privately-held trading firms to go public, which would dilute managers' incentives and reduce the alignment of interests between owners and managers. In the absence of any offsetting benefits in the form of reductions in systemic risk, these costs of capital requirements are a pure waste. Moreover, these costs will be largely (and perhaps completely) borne ultimately by commodity producers (in the form of lower prices of untransformed commodities) and commodity consumers (in the form of higher prices of transformed commodities).

Thus, there is little if any justification for subjecting commodity trading firms to CRD IV. This would not reduce materially systemic risk, but would increase the costs of commodity trading, to the detriment not just of trading firms, but of the producers and consumers of commodities.

BOX 1

CAPITAL REQUIREMENTS DIRECTIVE IV (CRD IV)

In July, 2013, the Capital Requirements Directive IV entered into European law. Firms regulated under the Markets in Financial Instruments Directive II (MiFID II) are subject to CRD IV.

MiFID-regulated firms are subject to the prudential capital requirements of the CRD IV (which implements Basel 3 in the EU) unless any exemptions apply.

Under MiFID I commodity trading houses which traded physically delivered commodities contracts (e.g., futures contracts) or commodities as an ancillary service, that is, essentially for hedging purposes, were exempted from much of MiFID, and in particular were exempt from the capital requirements.

MiFID II amends this provision.

- First it extends the definition of a financial instrument to include physically delivered commodity derivatives and those commodities not explicitly covered by the Regulation on Energy Market Integrity and Transparency REMIT, namely gas and electricity. With a transition period, therefore, MiFID II will apply to most oil and coal contracts, as well as most other commodity derivative contracts on agricultural, soft, energy, and metals products, other than very short-term "spot" contracts.
- Moreover, while some exemptions remain in place for pure electricity and gas traders, most non-financial services participants will in the future have to be authorized and capitalized as MiFID firms if they trade these financial instruments. In other words the commercial exemption has been limited.

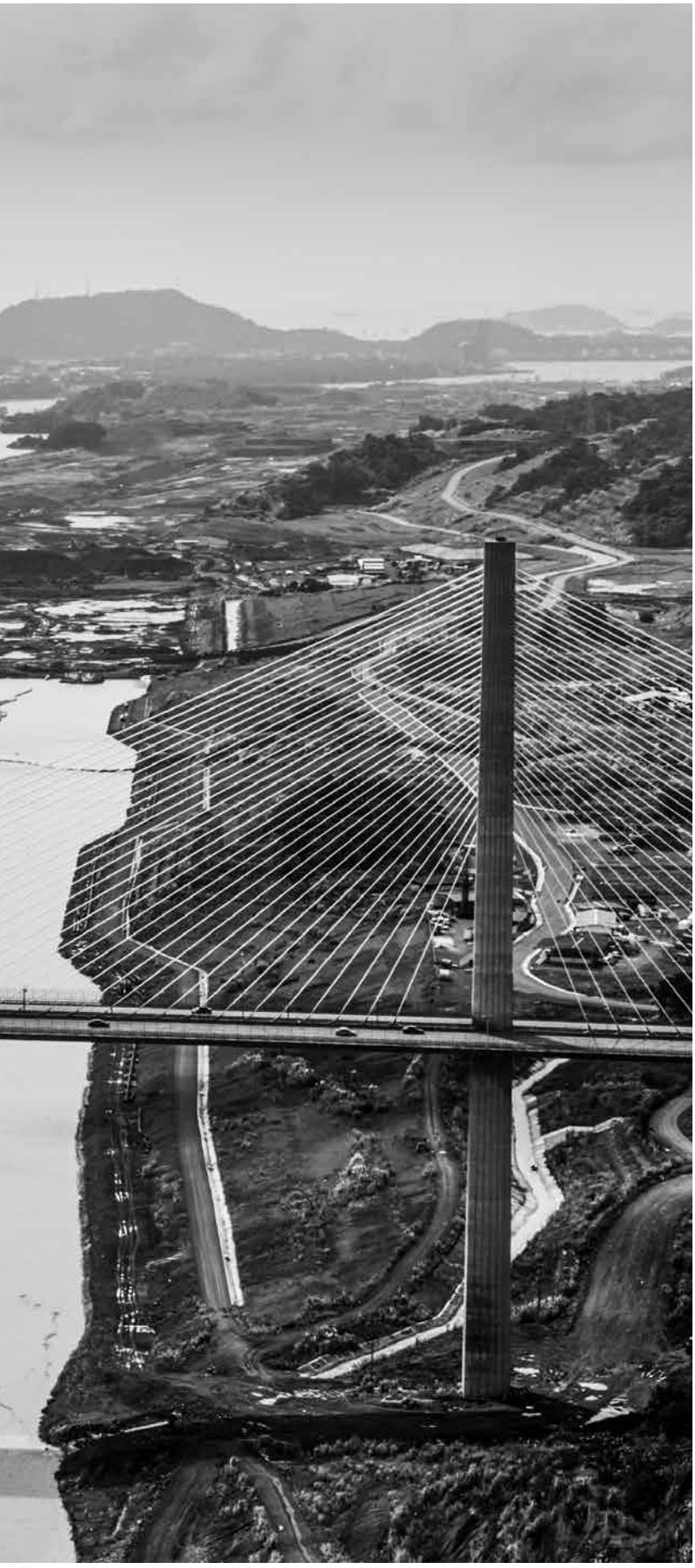
Together, these provisions mean that MiFID II rules will apply to CTFs, and that as a result they will be subject to EU Basel capital rules.

These rules specify:

- Minimum capital levels (8 percent of risk weighted assets, including 6 percent Tier 1 capital and 4.5 percent Common Equity Tier 1);
- Five different capital buffers;
- Two liquidity buffers; and
- Eventually a leverage ratio (which will be based on the ratio of Tier 1 capital to total assets).
- In addition, CRD IV imposes restrictions on compensation that will limit the variable component of compensation (e.g., bonuses) to a multiple (of between 1 and 2) of fixed compensation (salary).

Because capital requirements are based on risk weighted assets, the level of capital will depend in particular on credit, foreign exchange and counterparty risk, as well as operational risk. Risk mitigation techniques, most notably the use of collateral, affect the required level of capital.

While this methodology is not new, the base capital that will need to be held under Basel, based on the size of potential exposures, could well be large, especially for commodity trading firms that rely extensively on leverage to finance commodity inventories. The rules are very complex, therefore, it is impossible to quantify the exact impact without a detailed understanding of the CTFs that would be affected by subjecting them to CRD IV.



THE ECONOMICS OF COMMODITY TRADING FIRMS

Commodity trading firms (CTFs) perform a basic and essential economic function. They add value by identifying and optimizing transformations in commodities that reconcile mismatches between supply and demand. Specifically, they transform commodities:

- **In space** – through transportation of commodities from regions where they are produced to places they are consumed
- **In time** – through storage that bridges the timing between consumption and production
- **In form** – through refining or processing for final consumption.

The value of these transformations differ over time due to shocks in the supply and demand cycle. CTFs specialize in the analysis of these patterns, price structures, and price relationships. They direct resources to their highest value throughout the transformations.

CTFs transform commodities in space, time, and form

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.

They specialize in information-intensive analysis...

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.

...and invest in physical and human capital

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 and Mercuria, focus on energy commodities, with smaller or no presence in other commodity segments. Trafigura is a large energy and metals trader, but does not trade agricultural commodities. 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 in 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 three and seven 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]

2 For a more thorough description and analysis of CTFs, see Craig Pirrong, The Economics of Commodity Trading Firms (2014).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THE RISKS OF COMMODITY TRADING

Risk management is central to the operations of CTFs. They face several overlapping categories of risk, which are examined in this section:

- Price risk
- Basis risk
- Spread risk
- Margin and volume risk
- Operational risk
- Contract performance risk
- Market liquidity risk
- Funding liquidity risk
- Currency risk
- Political risk
- Legal/reputational risk.

CTFs can reduce risk:

- Through **diversification** – by trading in multiple commodity markets
- Through **integration** – by owning assets across the value chain that provides opportunities to self-hedge.

They are subject to a myriad of regulations depending on the activities they undertake and the jurisdictions in which they take them.

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.

Hedging practices limit CTF exposure to "flat price" risk...

Price Risk

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

... but basis risk is a potential problem

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.[5] 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 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

Spreads tend to be volatile

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.[6] Spreads can also change due to opportunistic, manipulative trading of the type that distorts the basis.

Margin and Volume Risk

Margins are usually high when volumes are high

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.

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 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.

Variations in the quantity of commodity shipments are better measures of risk

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 highlight 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 risks are a key challenge

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.

Reliability of a counterparty is central to contractual risk

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 varies across commodities and over time

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 force 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 at the precise moment when the costs of doing so are high.

Funding Liquidity Risk

CTFs lacking funding cannot continue to operate

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 and market liquidity often correlate

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.

Political risk exists everywhere in varying degrees

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.

Environmental hazards need to be considered...

... as well as the potential of reputational risks

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 EUR 200 million fine imposed on Total arising from the *Erika* incident, or Exxon's massive liability in the *Exxon Valdez* spill (though it should be noted that Exxon's ultimate liability turned out to be far smaller than the initial awards); 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.

RISK MANAGEMENT

Global Commodity Trading Firms 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., 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 reduces the effects of any one specific shock...

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.[8] 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.[9] 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.

... as does integration in the value chain

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 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, integration is a particularly useful way to manage risk in commodities where the markets for hedging instruments 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).[10]

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 tools have their limitations

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 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).

REGULATION

CTFs are highly regulated

Commodity trading firms are commonly said to be "unregulated." It is true that they are not subject to some regulatory requirements that other entities (namely banks) are. For instance, commodity trading firms need not obtain licenses like banks. But it is flatly incorrect to say that traders are unregulated. They are subject to a panoply of regulations, which depends on the activities that they undertake and the jurisdictions in which they undertake them. For instance, commodity merchants that trade listed or OTC derivatives must comply with the rules and regulations pertaining to the products and markets that they trade. In particular, they are subject to the swap dealer registration provisions of the Dodd-Frank Act: the trading arms of Cargill, BP, and Shell have registered as swap dealers under DFA. Similarly, they will be subject to regulations relating to pricing benchmarks when those come into effect. Trading firms that participate in European gas and power markets are subject to Remit, and those that trade in US gas and power markets are subject to FERC oversight. Traders

must comply with laws such as the Foreign Corrupt Practices Act, environmental and labor laws and regulations of the countries in which they operate, and the full range of laws relating to fraud and accounting. They must often obtain licenses to operate facilities in various countries.

Thus, commodity trading firms are highly regulated. An important question is whether they should be subject to regulations intended to reduce systemic risk of the type that banks are subject to: they are not currently subject to capital requirements which are intended in part to mitigate systemic risk. Answering this question requires an understanding of the causes and effects of systemic risk.

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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).

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.

5 Jack Farchy, Cotton trading costs Glencore $330 million, Financial Times, February 7 2012. Glencore 2011 Annual Report.

6 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.

7 The commodities included can be supplied upon request. The data were accessed using the ITC's Trade Map system.

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.

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.

SOURCES OF SYSTEMIC RISK

Systemic financial risk triggers significant adverse effects on the real economy. According to the G-10 and the Financial Stability Board (FSB), the imposition of externalities onto other firms are a necessary condition for a potential source of systematic risk.

A firm's level of debt and the structure of its debt are important sources of systemic risk. Highly leveraged firms play a role in most financial crises. Fragile capital structures exist because financial intermediaries perform maturity and liquidity transformations. This creates susceptibility to bank runs and bank-run-like behavior.

Multiple financial institutions must be affected simultaneously for a truly systemic event to occur. They may be susceptible to the same economic shock; or a single institution may impact another set of entities via

- **Direct interconnections** – through counterparty credit channels and derivatives
- **Indirect interconnections** – through "contagious runs" and "fire sales."

When intermediaries' financial condition is sensitive to macroeconomic conditions, they can accentuate the effect of the initial downturn.

Now that I have reviewed the economics of commodity trading firms, I turn attention to the issue of systemic risk: together these analyses will provide the basis for an evaluation of the systemic risk of commodity traders and the appropriate regulatory regime for these firms. Regulatory changes adopted since the great financial crisis of 2007-2008, and the great recession that followed, are intended to reduce systemic risk, and CTFs may be subjected to some of these regulations.

Systemic financial risk triggers significant adverse effects on the real economy

There are a variety of definitions of systemic risk. The most commonly cited definition was produced by the G-10 in 2001:

- Systemic financial risk is the risk that an event will trigger a loss of economic value or confidence in, and attendant increases in uncertainly about, a substantial portion of the financial system that is serious enough to quite probably have significant adverse effects on the real economy. Systemic risk events can be sudden and unexpected, or the likelihood of their occurrence can build up through time in the absence of appropriate policy responses. The adverse real economic effects from systemic problems are generally seen as arising from disruptions to the payment system, to credit flows, and from the destruction of asset values.
- Two related assumptions underlie this definition. First, economic shocks may become systemic because of the existence of negative externalities associated with severe disruptions in the financial system. If there were no spillover effects, or negative externalities, there would be, arguably, no role for public policy. In all but the most highly concentrated financial systems, systemic risk is normally associated with a contagious loss of value or confidence that spreads to parts of the financial system well beyond the original location of the precipitating shock. In a very highly concentrated financial system, on the other hand, the collapse of a single firm or market may be sufficient to qualify as a systemic event.
- Second, systemic financial events must be very likely to induce undesirable real effects, such as substantial reductions in output and employment, in the absence of appropriate policy responses. In this definition, a financial disruption that does not have a high probability of causing a significant disruption of real economic activity is not a systemic risk event.

The Financial Stability Board advances a similar definition:

- The risk of disruption to the flow of financial services that is (i) caused by the impairment of all or parts of the financial system; and (ii) has the potential to have serious negative consequences for the real economy.
- Fundamental to this definition is the notion that systemic risk is associated with negative externalities and/or market failure and that a financial institution's failure or malfunction may impair the operation of the financial system or the real economy.

Other definitions include that of Federal Reserve Chairman Ben Bernanke in a letter to Senator Bob Corker in 2009: "Systemic risks are developments that threaten the stability of the financial system as a whole and consequently the broader economy, not just that of one or two institutions." Stanford Professor John Taylor offers a three-part test to determine whether systemic risk exists, and the analysis that follows adheres to this test. Taylor says for a risk to be systemic, (i) there must be a risk of a large triggering shock (such as a natural disaster or the failure of a firm or firms), (ii) there must be a risk of the shock propagating through the financial system via contagion or chain reaction, and (iii) the financial disruption must affect the broader macro-economy.

Externalities imposed on other firms can cause systemic financial risk

According to these definitions, 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. The G-10 and the FSB both explicitly recognize that such externalities are a necessary condition for a firm or group of firms to be a potential source of systemic risk, and that externalities are also a necessary condition to justify the imposition of regulations on this firm or firms.

Like Tolstoy's unhappy families, all financial crises are unhappy affairs in their own way: the source(s) of externalities, and the ways that a crisis develops, differ from episode to episode. Nonetheless, there are factors that are common to most crises, and to the entities at the center of them. These factors are therefore relevant in determining whether a particular entity, or group of entities, pose a systemic risk.

Leverage

Highly leveraged entities play a central role in most financial crises

Highly leveraged entities play a central role in most financial crises. Large numbers of banks and investment banks have either failed, or been at risk of failure, during historical crises: indeed, financial crises are often referred to as "banking crises." Banks and investment banks are typically highly leveraged [11]. Other crises have involved highly leveraged trust companies, structured financial vehicles that fund asset purchases primarily with debt, or highly leveraged hedge funds (e.g., LTCM).

The amounts of gearing of affected institutions are very high, typically at least ten-to-one, but sometimes forty-to-one or more. High leverage means that small declines in asset values can force firms into financial distress. Through a variety of mechanisms, discussed in more detail below, financial distress at certain firms can have systemic consequences, depending on the nature of the firms' leverage, interconnections between firms, and their ability to supply intermediation services while in distress.

Fragile Leverage

The structure of debt is another source of risk

Not just the level of debt, but the structure of debt, has been an important source of systemic risks. In particular, the entities involved in most crises have had fragile capital structures that are susceptible to runs, or run-like behavior. Bank deposits–and bank runs–are the canonical example. Bank deposits are payable on demand and subject to a sequential service constraint. When depositors suspect that a bank is insolvent, or will not be able to pay on demand, each has an incentive to withdraw their funds before others do in order to minimize the likelihood of suffering a loss. A bank may have insufficient liquid assets to meet these demands, and fail. A run equilibrium almost always exists, and even a solvent bank can fall victim to a run [12].

Other entities have fallen victim to run-like phenomena. Money market funds that provide demandable claims are one example. Special Purpose Vehicles funded with short-maturity claims (e.g., asset-backed corporate paper) are another. Continued operation of an intermediary funded by short-term debt requires it to roll over that debt repeatedly. Doubts about its solvency can lead owners of maturing debt to refuse to repurchase the intermediary's new debt. Refusal to refinance maturing debt is analogous to depositors withdrawing funding from a bank.

Maturity and liquidity transformations result in fragile capital structures

Fragile capital structures exist because financial intermediaries perform maturity and liquidity transformations. Maturity transformation involves using short-term debt to fund the purchase of assets with longer maturities. For instance, a bank may use demand deposits to fund mortgage or corporate loans with maturities measured in years. Another example is the use of short-maturity (with maturities as short as a day) repurchase agreements ("repo") to fund purchases of long-dated bonds. This maturity mismatch means that an entity must constantly refinance the debt that funds its assets, and failure to do so can lead to its failure.

Liquidity transformations occur when banks issue claims (such as demand deposits) that are close substitutes for currency and use the proceeds to purchase illiquid assets (i.e., assets that can only be sold quickly at a substantial discount). Thus, when creditors refuse to renew their funding of a firm, it must dispose of its assets at a low price. Liquidity transformations are frequently related to maturity transformations, as short-term debt is often more liquid than long-term loans/assets.

Runs are an inefficient equilibrium in a coordination game between depositors/purchasers of short-term debt. Consider a bank run. If no other depositors withdraw, an individual depositor has no incentive to withdraw except to pay for consumption.

However, if an individual depositor believes that a large number of other depositors will withdraw their funds, he has an incentive to withdraw even in the absence of a consumption need in order to ensure that he can redeem all his funds: if he waits, and a sufficient number of other depositors withdraw, the bank may not be able to pay his claim in full. Thus, runs can be a self-fulfilling phenomenon, and can occur for reasons unrelated to the solvency of a financial institution. These runs can be inefficient, because they lead to the premature sale or termination of illiquid investments.

Depositors may decide to run based on a signal about the financial condition of an institution. Depositors are more likely to run from weaker institutions than stronger ones, but equilibria can exist wherein depositors run from weak but solvent institutions, leading to inefficient liquidation of their assets.

Coordination failures are most likely to occur when a financial intermediary is funded by a large number of creditors who make decisions independently.

Interconnections

Multiple financial institutions must be affected for a systemic event to occur

For a truly systemic event to occur, multiple financial institutions must be affected simultaneously. This can occur because they are all susceptible to the same economic shock. Alternatively, it can occur because institutions are interconnected, and a shock can propagate from an institution or group of institutions to a larger set of entities. These interconnections can be direct or indirect.

They can be connected directly through credit channels and derivatives...

Direct connections are typically in the form of a counterparty credit channel. Institution A borrows from B which borrows from C. A's financial distress may prevent it from repaying B, which may force it into financial distress, which can in turn imperil C, and then C's creditors, and on and on.

Derivatives can also connect institutions directly. A's financial distress can prevent it from paying what it owes on a derivatives contract executed with B, which can jeopardize B's financial condition, which in turn damages B's creditors (which can include its derivatives counterparties).

...or indirectly via contagious runs and fire sales

There are two major indirect connections. The first is contagious runs. A run on one entity may lead the creditors (e.g., depositors) of others to infer that these institutions are also at risk of insolvency. Runs may therefore occur on these other intermediaries.

The second channel is asset "fire sales." A distressed institution experiencing a run or an inability to refinance maturing debt may sell assets in order to raise cash to pay off withdrawing depositors or maturing liabilities. If the sold assets are imperfectly liquid, and the sales are in sufficient quantity, these sales cause their prices to fall. This imposes losses on other institutions holding these assets, or related ones. These losses may induce the affected institutions to sell assets, exacerbating the price declines. They may also cause their creditors to run.

These indirect channels are more likely to be important when institutions hold similar portfolios of assets. When a given institution suffers a loss on a particular class of investment, creditors of other institutions are more likely to draw adverse inferences about them when they hold similar assets. Similarly, a distressed institution's asset sales have more severe adverse consequences to those holding similar assets, so fire sale problems are most widespread and acute when many institutions hold similar portfolios.

Affected Institutions Cannot Supply Systemically Important Intermediation Services When in Financial Distress

A truly systemic event adversely affects the real economy. Financial distress does not necessarily have this effect: it can merely redistribute wealth from one group of agents to another. Efficient processes for handling insolvency can permit a troubled firm to operate its assets, or facilitate the transfer of these assets to others who can operate them.

However, financial distress impairs the ability of financial intermediaries to supply credit. This occurs because they cannot fund the credit they extend to their customers, or because of "debt overhang" problems: the benefits of positive value investments

accrue to the creditors of distressed institutions rather than the equity holders, which limits their incentive to undertake them. (This is sometimes referred to as the "zombie bank" phenomenon.) Since many industrial and service firms are dependent on credit, and credit from particular intermediaries with whom they have built relationships, impairment of the ability of these intermediaries to supply credit can force their borrowers to curtail output. This reduction in output can have knock-on effects, as declines in the values of suppliers of goods and services can harm their creditors.

This is sometimes referred to as the "bank lending channel", because historically it has been associated with financial distress at banks, and because banks have been the primary suppliers of credit in most economies. However, the phenomenon is not limited to banks, especially in economies in which non-banks are important suppliers of credit. For instance, repo markets or securitizations funded with corporate paper are subject to run-like phenomena that can restrict the supply of credit through these channels.

Sensitivity to Macroeconomic Conditions

The values of the assets of banks or other important providers of credit may decline as the economy weakens. If this asset value decline is sufficiently large to lead to runs or fire sales that weaken the financial condition of credit suppliers, the resulting contraction in credit can exacerbate the initial decline in economic activity. Thus, when intermediaries' financial condition is sensitive to macroeconomic conditions, they can accentuate the effect of the initial downturn.

Contractions in credit exacerbate the initial decline of economic activity

The structure of the assets held by intermediaries can affect their susceptibility to macroeconomic shocks. For instance, the structure of AAA senior and supersenior CDOs backed by mortgage loans diversified away exposure to declines in real estate prices in particular geographic markets, but made their values extremely sensitive to broad-based, nationwide declines in prices[13]. Put differently, these securities were exposed to substantial "wrong way risk."

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11 Section IV presents data on bank leverage during the Great Financial Crisis of 2007-2009.

12 A run equilibrium is a steady state in which it is rational for an individual to attempt to withdraw funds if everyone else does. It is a type of self-fulfilling prophecy. A run equilibrium can be inefficient if it causes the failure of a solvent institution, or if it causes the institution to sell some of its long-maturity, illiquid assets at distress prices in order to meet the demands of the running depositors.

13 J. Coval, J. Jurek, and E. Stafford, Economic Catastrophe Bonds, 99 American Economic Review (2009) 628. J. Gregory, Counterparty Credit Risk (2013).

COMMODITY TRADING FIRMS AND SYSTEMIC RISK

CTFs do not pose substantial systemic risks.

- They are not heavily leveraged
- Their capital structures are not fragile – they do not engage in maturity or liquidity transformations.
- They have syndicated lending channels – which mitigate coordination problems among creditors.

"Shadow banking" structures are not widespread among CTFs, and they are not vulnerable to contagious runs.

Large losses of a single trading firm do not have implications for the financial conditions of other firms. Hedged inventories also protect CTFs from fire sales. The vast bulk of derivatives that CTFs use are exchange traded and centrally cleared, further mitigating exposures and interconnections.

The economic performance and financial condition of CTFs are not acutely procyclical. Financial distress is unlikely to cause a marked decline in the supply of commodity transformation services.

Thus regulations for banks and other systemically risky institutions are ill-suited for CTFs.

CTFs do not pose substantial systemic risks

A detailed examination of the financing and operations of commodity trading firms demonstrates that when evaluated by the criteria just identified, CTFs do not pose substantial systemic risks, especially in comparison to large Systemically Important Financial Institutions ("SIFIs"), notably banks.

CTFs Are Not Heavily Leveraged

They are not heavily leveraged...

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 17 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.[14] 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 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.

TABLE 1
TOTAL ASSETS/BOOK VALUE OF EQUITY

Arcadia Energy Pte	17.51	Louis Dreyfus B.V.	3.74
Archer Daniels Midland	2.38	Mercuria Energy Trading	5.06
BP International Ltd	5.32	Noble Group	3.80
Bunge Ltd	2.51	Olam	4.02
Cargill	2.37	Shell Trading International	12.09
E.On Global	111.07	Trafigura	7.94
EDF Trading	4.56	Vitol	4.00
Eni Trading & Shipping	35.09	Wilmar	2.76
Glencore	3.08		

CTF Capital Structures Are Not Fragile Because They Do Not Engage in Maturity or Liquidity Transformations

... and they do not engage in maturity transformations

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.

Moreover, 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.

In contrast, 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).

Firms with more fixed assets tend to be less leveraged

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.

These results contradict assertions that commodity trading firms that have become more asset heavy have become "too physical to fail." [15] According to this view, commodity traders have financed investments in physical assets using debt. This makes them more vulnerable to financial distress, and (allegedly) given their size, governments may respond by bailing them out, thereby creating a moral hazard. The actual data show that more asset heavy firms are less leveraged, casting serious doubt on this theory. [16]

Syndicated Lending Mitigates Coordination Problems

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 of banks or money market funds who 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.

Most CTF debt is extended by syndicates of banks, which facilitate coordination problems

Commodity Trader "Shadow Banking" Structures Are Not Fragile

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

Default rates on trade credit tend to be low

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. [17] Further, at present, securitization of receivables, and other forms of commodity-related shadow banking (e.g., securitization of inventories), are not widespread, and represent a small fraction of commodity trading funding.

Limited Risk of 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 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.

Speculative losses of a CTF are unlikely to have an effect on other trading firms

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. [18]

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. [19]

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 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.

CTF creditors are less vulnerable to contagious sector-wide runs

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.[20] 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. The acute opacity of storage operations in China, compounded by the government's decision to block access to the warehouses, increases the risk of contagion. That said, no contagion has yet occurred in this situation, but it is an example of a scenario in which commodity traders could be subject to it.

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.

Fire Sale Risk is Limited

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 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.)

Hedged inventories protect CTFs from fire sales

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. Moreover, these assets tend to be highly idiosyncratic and not marked to market on

accounting statements, meaning that even if a firm sells them at a distressed price, effects on other firms are limited. Thus, they pose no more of a fire sale externality threat than the physical assets of a financially distressed manufacturing or transportation company.

Direct Interconnections of CTFs to Banking System Via Debt Are Unlikely to Pose a Systemic Risk

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 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.

CTF debt is not a liability to major lending banks

Moreover, commodity firm debt represents small fractions of the assets and equity of major commodity lending banks. The total liabilities of 18 major trading firms represent 27 percent of the total equity of 35 major banks that are important commodity lenders. These liabilities represent only 3.5 percent of the loans held by these banks and 1.5 percent of their assets.

These ratios likely represent an upward biased measure of bank exposure to commodity trading firms because: (1) only a fraction of the liabilities of commodity trading firms are in the form of bank debt; and (2) the lenders analyzed represent only a subset of the banks that lend to commodity traders.[21] Moreover, as noted above, many of the liabilities of commodity traders to banks are secured, meaning that the credit exposure of banks to the trading firms is smaller than the gross borrowing figures would suggest. These small ratios therefore indicate that the direct exposure of banks to commodity traders is *de minimis*, and that the bank-commodity trader lending channel is therefore unlikely to be a direct source of contagion.

Most CTF Derivatives Exposures Are Cleared, Which Mitigates Exposures and Interconnections

Most CTF derivatives are cleared, which reduces counterparty credit exposure

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.[22]

Further, most commodity trader derivatives are hedges, rather than speculative.

Thus, they tend to reduce the risks of financial distress. Moreover, losses on derivatives used as hedges are largely offset by gains on other positions. This reduces the likelihood that a commodity trading firm will default on a losing derivatives position, thereby imposing losses on its counterparties. Defaults on hedges are highly unlikely except in the event of extreme adverse moves in the basis. These can occur, but are extremely rare. See **CASE STUDY 1** for a discussion of one such episode.

Variation margin causes liquidity risk

The main risk arising from cleared (or uncleared but margined trades) is the liquidity risk associated with variation margin. Variation margining requires payment of losses as they are incurred: this is precisely how clearing mitigates credit exposure. These payments must be in cash, which necessitates access to liquidity. Commodity trading firms manage this liquidity risk, but there are circumstances in which liquidity problems can cause financial distress.

Consider a trader that is short futures against inventory of a commodity that is financed by a bank. Futures are marked-to-market daily, but the loan is typically marked less frequently, usually on a weekly basis. That is, on a weekly basis the bank will disburse cash to the trader if the value of the inventory rises. This timing mismatch means that in the event of a price spike, the commodity trader will need to pay variation margin immediately, but will not receive additional funds from the bank for as much as a week. Unless the trader has sufficient liquidity on hand to meet the margin call (or can obtain an accelerated payment from its lenders), it is at risk of defaulting on its futures contracts (because failure to pay variation margin puts the holder of a futures position into default).

Future positions and collateral timing mismatches can cause a default

Another default scenario relates to basis risk. An adverse movement in the basis can cause the mark-to-market loss on the futures position to exceed the mark-to-market gain on the inventory held as collateral. Even in the absence of a timing mismatch between the marking-to-market of the futures position and the marking-to-market of the collateral, this can force the trader into default unless it has access to sufficient liquidity to cover the difference between the loss on the futures position and the gain on the collateral.[23]

Losses arising from a default on futures fall in the first instance on the defaulting trader's broker, and if the broker is unable to cover them, on the default fund of the clearinghouse that clears the futures contract: this default fund is typically capitalized by large brokerage firms, which are now mainly subsidiaries of large banks. This represents a potential interconnection between commodity trading firms and the broader financial system.

Although margin calls are theoretically a channel through which an adverse commodity price shock can be communicated from commodity trading firms to banks and other financial institutions, there are no recent examples of this occurring in practice. Even large commodity trading losses have not had a systemic effect via this channel. In fact, large intermediaries sometimes profit by assuming a financially distressed trading firm's derivatives portfolio at a favorable price. For instance, JP Morgan and Citadel profited handsomely by assuming natural gas trader Amaranth's large derivatives portfolio at extremely favorable prices in September, 2006. Similarly, Barclays acquired SEM Group's large oil futures and options portfolio at below-market prices in June, 2008.

Commodity Trading Firm Profits Are Not Markedly Procyclical

Risks are more likely to be systemic when they are procyclical

A shock to demand or supply for a commodity that imposes losses on commodity trading firms could, in theory, have a systemic impact through one of the channels considered above.

The foregoing analysis demonstrates that these channels are unlikely to be a source of systemic risk. Even putting aside that analysis, the fundamental nature of the commodity trading business mitigates the impact of demand and supply shocks on commodity firm profitability.

CTFs are less prone to shocks in prices

In particular, commodity trading firms' profits are relatively insensitive to the most concerning type of shock: economy-wide (macro) demand shocks. If commodity trading firms were at risk of severe losses at the same time as the economy is doing poorly, the potential for systemic risk would be greater, as the losses could be passed on to the broader financial system precisely at the time that it is already more likely to be under stress. That is, risks are more likely to be systemic in nature when they are procyclical. But basic economics and some empirical evidence demonstrate that some fundamental considerations damp the procyclicality of commodity trading firms' performance.

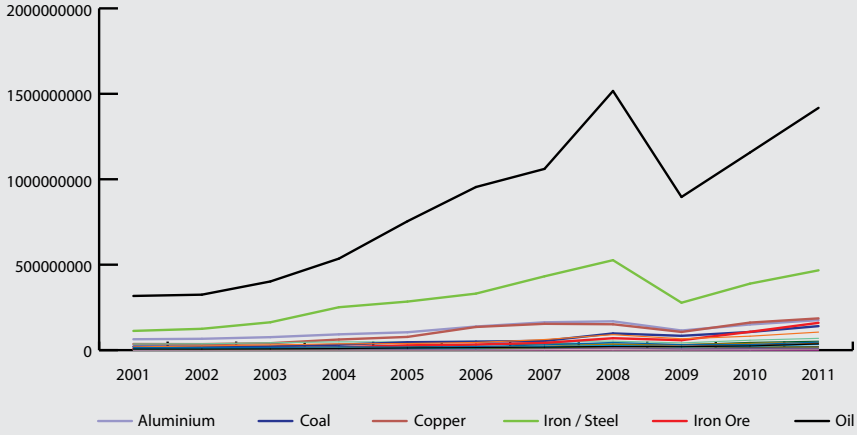
The modest (if any) procyclicality of commodity trading firm profits derives from two factors. First, since commodity supply and demand tends to be highly inelastic, prices bear the brunt of adjustment to demand shocks, and trading volumes and margins fluctuate much less in response to these shocks. Since commodity firm profits are driven by volumes and margins, this means that their profits exhibit far less sensitivity to shocks than do prices. Even if prices are highly procyclical, trading firm margins and volumes are likely to be substantially less so, precisely because prices are so sensitive to demand shocks.

Storage also serves as a hedge to demand declines

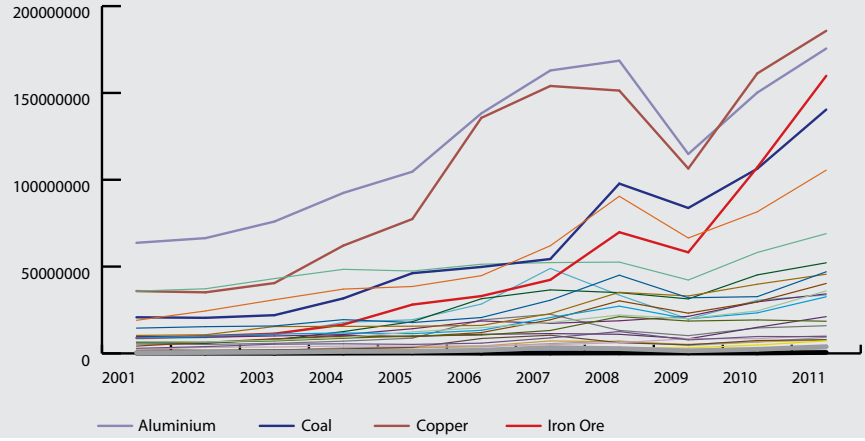
Second, commodity trading firms often engage in a variety of countercyclical transformations, such as storage. These serve as a natural hedge to demand declines.

Consider the sensitivity of a CTF's profits to a decline in demand for a commodity: this demand decline could be the result of a recession or financial crisis. This decline in demand for the commodity affects the commodity trading firm, but indirectly because the demand for its transformation services is a derived demand. The impact of the

1 NOMINAL EXPORTS



2 NOMINAL EXPORTS EXCLUDING OIL & STEEL



shock on derived demand depends on the magnitude of the demand shock 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.

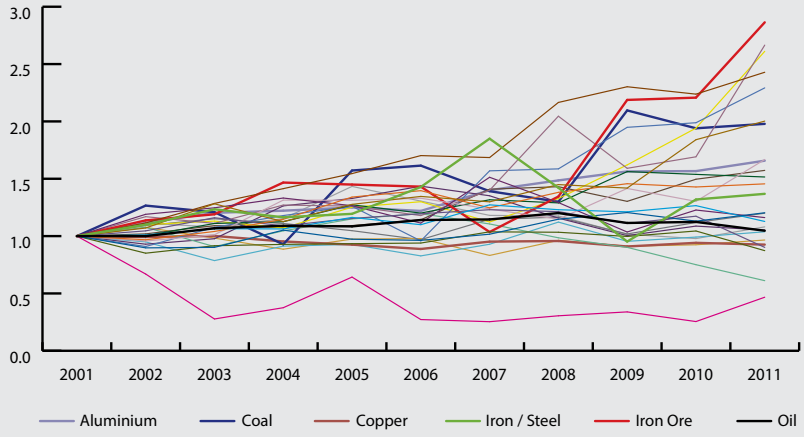
Trade data provide some insights onto this source of risk to commodity trading firms. Figures 1 through 4 depict data relating to world exports by commodity. (Data related to world imports by commodity behave similarly, so I only present charts on exports.) Figure 1 graphs nominal exports by commodity 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.

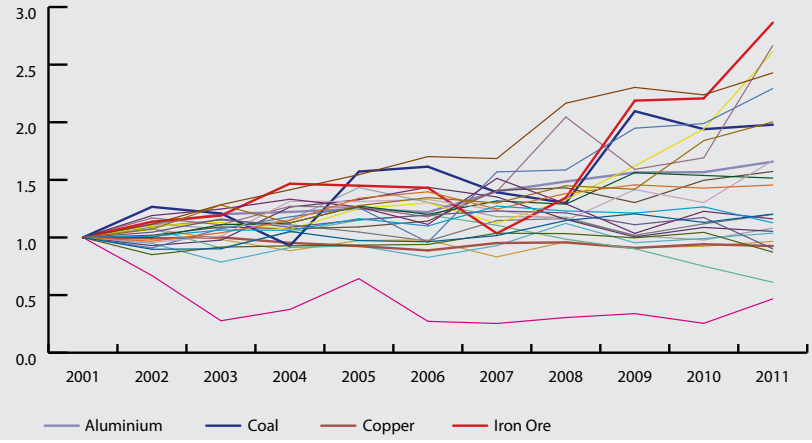
These charts strongly support the conclusion that a large demand shock primarily affects commodity prices, and has a much smaller impact on the quantities of

Large demand shocks primarily affect commodity prices

3 DEFLATED EXPORTS, 2001=1.00



4 DEFLATED EXPORTS EXCLUDING OIL & STEEL, 2001=1.00



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. If they can weather a demand shock, moreover, they cannot be a channel through which a macro shock is reinforced and intensified.

This conclusion is strengthened when it is recognized that some commodity firm transformations are countercyclical. In particular, an adverse demand shock increases the demand for storage, and for the services of firms that operate storage assets and store commodities. This leads to a rise in the profitability of storage operations, which offsets in whole or in part the adverse effect of a demand decline on other transformations, such as logistics. Many major commodity trading firms operate storage assets and engage in commodity storage, and therefore benefit from this self-hedge.

Demand shocks also affect the funding needs of commodity trading firms. Crucially, adverse shocks of this nature tend to reduce funding needs and liquidity stresses: funding needs of commodity firms are strongly countercyclical. 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, 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 through 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.

Recent events in the oil market demonstrate this point clearly. The 40 percent decline in oil prices over the last half of 2014 reduced the funding needs of oil traders by approximately the same amount.

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.

CTFs are not susceptible to large macro shocks...

The foregoing analysis implies that CTFs should be relatively robust, even to large macro shocks, including a sharp decline in demand associated with a financial crisis. 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.

...as seen in the 2007-2009 financial crisis

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 and industrial metals: its earnings rose 85 percent over the boom-bust cycle. Vitol is another even more 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 price cycle (and financial crisis cycle), is inconsistent with the hypothesis that CTF financial performance is highly sensitive to global economic conditions. This is in stark contrast to other SIFIs. CTFs 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 financial crisis. Total profits for the eight 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.

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.

Supply Shocks Can Reduce CTF Profitability But These Shocks Are Unlikely to Have Adverse Systemic Effects

Global supply shocks can result from conflicts, natural disasters or political action

A global supply shock to a major commodity poses different risks to CTFs, their creditors, and their trading partners than do demand shocks. A decline in supply of a commodity 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 cause spikes in funding needs for hedged inventories, and an increase in funding needs generally. 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 CTFs, all of the effects of supply shocks tend to be detrimental to CTFs–reducing their margins and volumes, increasing funding needs, and potentially raising funding costs.

They reduce margins and volumes for CTFs

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.

An oil supply shock may have macroeconomic consequences

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.[24]

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.

Intermediation and relative price volatility can offset a supply shock

One important 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 of 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 in monitoring relative prices closely, and identifying circumstances in which relative prices diverge from transformation costs. They can therefore 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.

Financial Distress Does Not Seriously Impair the Supply of CTF Transformation Services

In systemically important commodity sectors, no trading firm has a very large market share

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, in the crude oil market, the largest and systemically most important commodity sector, the largest trader (Vitol) accounts for about 6 percent of freely traded oil. Mercuria, Glencore, and Trafigura handle somewhat smaller tonnages than Vitol, and their market shares are in the 3-4 percent range. Twenty-five concentrations are somewhat higher in metals. Glencore trades about 50 percent of freely traded copper and 22 percent of freely traded aluminum.[26] 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, with the largest firms handling only around 6 percent of trade. In contrast, other commodities represent much less than 1 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.[27]

This conclusion is strengthened by the fact that the financial distress of a commodity trader does not result 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.

The failure of a CTF is unlikely to disrupt trade in any major commodity

CASE STUDY 2 provides an extended discussion of the collapse of merchant energy firms in the US in 2001. This episode illustrates that trade in commodities can continue to occur, and the assets that facilitate this trade can continue to operate, even in the face of the simultaneous financial distress of a large number of major trading firms.

CASE STUDY 3 examines the aftermath of the Fukushima earthquake and tsunami, which resulted in the physical disruption of logistics networks throughout Asia. It shows that even such extensive physical disruption does not necessarily lead to a substantial or persistent decline in real economic activity. This casts further doubt on they systemic importance of commodity traders who supply logistical transformation services.

CTFs Are Not Major Suppliers of Credit

Banks are central to credit supply, but CTFs are not

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. Substitutability 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.[28]

Commodity trading firms do issue credit to commodity consumers and producers (in the form of prepayment agreements, 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.

Moreover, when commodity traders do extend credit, it tends to be short-term, with maturities of around 30 days. This corresponds to the time-frame of trades, which reflects the fact that trading firms typically provide only trade credit.

Alternatives to credit funding exist in the event of a firm's failure

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 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.

In sum, CTFs do not possess the characteristics that have contributed to historical systemic crises. They are not heavily leveraged, their leverage is not fragile, and their economic performance and financial condition is not acutely procyclical. They are unlikely to be vulnerable to contagious runs or fire sale externalities. Financial distress is unlikely to cause a marked decline in the supply of commodity transformation services.

Put simply, commodity trading firms are markedly different from the intermediaries (like banks) that have been at the center of past financial crises. Regulations that are appropriate for banks and other systemically risky institutions are therefore ill-suited

for a fundamentally different type of intermediary engaging in fundamentally different types of transformation activities.

FINANCIAL STABILITY BOARD (FSB)

CTFs do not pose systemic risks based on FSB criteria

The foregoing analysis evaluates the systemic risk of commodity traders based on a set of factors that economists have identified as contributing to systemic risk. In the past five years, regulators have attempted to create criteria that can be used to determine whether particular entities create systemic risk. In particular, 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.

Size

The asset size of most CTFs do not meet requirements of systemic importance

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 about $155 billion, making it the 175th largest public firm in the world by assets. 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 banks, Glencore's assets are approximately equal to the 27th largest regional bank in the world (Allied Irish Bank). Cargill is comparable in size to the 70th largest regional bank in the world (Halkbank of Turkey). All of the major systemically important banks are far larger than even the largest commodity traders.

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.[29]

Substitutability

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 showed above that most commodity market segments–in particular the largest ones, such as petroleum and industrial metals–are not highly concentrated; that the assets of financially distressed firms can continue to operate either under insolvency protection, or via transfer to a healthy entity; and that CTFs are not important suppliers of credit. Thus, the financial distress of a CTF is unlikely to result in a material decline in the supply of the transformation services it performs.

Global Activities and Complexity

CTFs tend to have simpler structures than most major banks

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.

14 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.

15 Diego Valiante, Price Formation in Commodities Markets: Financialisation and Beyond, CEPS Task Force Report (2013).

16 There are other difficulties with this view. First, whereas financial institutions are often the beneficiaries of explicit government support (deposit insurance, central bank lending), commodity trading firms are not. Second, as discussed elsewhere, and in particular in Case Study 2, whereas banks in financial distress must contract their supply of transformation services (notably credit), commodity trading firms can continue to supply their transformation services even when in financial distress, or the assets of distressed firms can be transferred to healthy ones and continue to operate. Thus, there is little potential for an adverse impact on the real economy of trading firm financial distress that could induce governments to take extraordinary measures to bail them out. Third, as discussed below, the direct exposure of the financial system and financial intermediaries to the credit risk of commodity traders is not large enough that even widespread bankruptcies among commodity traders would threaten the viability of the banking or financial system.

17 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 CTFs 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.

18 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.

19 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.

20 Gary Gorton and Andrew Metrick, Securitized Banking and the Run on Repo, in Market Institutions and Financial Market Risk (2010). Information insensitive debt is a loan or security with a value that is so likely to make its full promised payment that there is little or no incentive for market participants to collect information about it or its issuer. For instance, "supersenior" AAA collateralized debt obligations ("CDOs") were backed by so much collateral relative to promised payments that at the time the securities were issued it was considered almost certain that the purchasers of these securities would receive all promised interest and principal payments. In the event, the value of the collateral (particularly subprime mortgages in the United States) declined so much due to the declines in housing prices in the US that doubts arose about whether full payments would in fact be made. This gave market participants an incentive to investigate the securities and their underlying collateral to assess their value. Thus, these CDOs went from information insensitive to information sensitive due to the declines in housing prices in the US.

21 The fact that the sample of commodity traders is only a subset of all trading firms that borrow from banks introduces a source of offsetting bias. Since the firms included represent the largest commodity trading firms, it is likely that they represent the bulk of commodity trading firm debt to banks. Moreover, these large firms would be the most likely to be systemically important.

22 Furthermore, OTC commodity derivatives represent a small fraction of OTC derivatives overall. According to Bank of International Settlements data, as of June 30, 2014, the notional value of commodity OTC contracts (excluding gold) represented .2 percent of total OTC derivatives outstanding. The gross market value of OTC commodity derivatives contracts accounted for only 1.36 percent of the gross market value of all OTC derivatives. Commodity trading firms accounted for only a portion of these commodity derivatives contracts. Thus, commodity traders represent only a small fraction of SIFI OTC derivatives exposures, and hence represent a commensurately small source of systemic risk via the OTC derivatives counterparty risk channel as compared to other derivatives counterparties.

23 This occurred to several small cotton traders in 2008. This episode is discussed inCase Study 1.

24 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. S. Brown, M. Yucel, and J. Thompson, Business Cycles: The Role of Energy Prices (2003). L. Killian, Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market, 99 American Economic Review (2009) presents evidence showing that most of the movements in oil prices in the past two decades have been driven by fluctuations in real economic activity, rather than by supply shocks that have affected real economic activity as well as prices. 25 These figures are based on reports on these companies' websites.

26 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. Glencore at one time traded 60 percent of freely traded zinc, but the divestiture of Nystar to achieve antitrust approval of its merger with Xstrata substantially reduced this share.

27 This is particularly true since freely traded quantities represent only a fraction of total flows of any commodity, meaning that the proportion of the quantities at risk to the distress of any commodity firm or firm for any commodity (other than oil, which is assumed to be 100 percent freely traded) are smaller than the market share figures cited would suggest.

28 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).

29 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.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DISRUPTIONS IN TRADE AND ECONOMIC RESILIENCE

This paper has argued that Commodity Trading Firms do not pose systemic risks. In fact it can be argued that even quite serious recent events posing potential threats to physical trade have had little lasting effect on the global economy. In other words, the international trading system is highly resilient to shocks affecting individual countries or firms.

This section contains three case studies that aim to illustrate these points:

- **The distress in the US cotton market that occurred in March 2008**, when some cotton traders could not meet margin calls, but larger players in the market coped and marketing of US cotton continued as normal.
- **The 2002 crisis in the US electricity market**, when a number of merchant energy firms experienced financial distress, but losses were largely absorbed by equity investors, banks suffered immaterial losses, there were no derivative defaults and no significant effect on power supplies.
- **The Fukushima earthquake and tsunami in March 2011**: a major disruption to the logistical system in a major economic region had only small and temporary effects on the global economy.

CASE STUDY 1

DISTRESS IN THE COTTON MARKET, MARCH 2008

Cotton merchants contract to purchase cotton from farmers before the crop is harvested, and sometimes before it is planted. This subjects the merchants to various risks, including the risk that farmers will default on their contractual obligations, and price risk. To manage price risk, traders sell futures contracts in quantities roughly equal to their forward purchases from farmers.

This contracting and hedging expose merchants to basis risk and funding risk. Traders must meet margin calls when futures prices rise, and they usually obtain credit from banks to secure the necessary liquidity. The loans are usually secured with the merchants' contracts with farmers. Basis risk and funding risk interact: if the basis moves adversely at the same time prices rise, the margin calls are larger than the rise in the value of collateral, and the traders are at risk of having insufficient credit to meet variation margin obligations.

This occurred in early-March 2008. On 3 March, 2008, the price of cotton futures rose by about 11 cents/pound, or about 15 percent. Moreover, the basis, which was normally approximately -6 cents/pound, fell to -25 cents/pound. Merchants needed to meet large margin calls. The large move in the basis meant that the value of the collateral did not increase commensurately to the size of the margin call, which made it difficult for the merchants to obtain the necessary funding. Some reduced their futures positions, and some faced financial distress.

One trader, the US subsidiary of venerable Paul Reinhart AG, faced a margin call of $100 million. It was unable to meet its obligations to its lenders, and was forced to restructure its loans: the lenders demanded, and obtained, greater control over the firm's operations. Reinhart actively sought takeover offers. Other cotton merchants, including Weil Brothers and Dunavent, were financially stressed as a result of the extreme adverse move in the basis. [1]

Reinhart eventually declared bankruptcy in October, 2008. [2] Weil Brothers decided the cotton market was too risky and exited in 2010. Dunavent was sold to the largest US merchant, Allenberg Cotton. The largest merchants, including Allenberg (a subsidiary of Louis Dreyfus) and Cargill continued to operate unhindered during this episode.

These events illustrate several points.

First, they show a specific kind of market price movement–a large, rapid, adverse movement in the basis–that can put trading firms under financial stress. The rapidity of the movement is important. The basis moved more, but over a longer period, in May-July 2011, without causing similar dislocations.

Second, they demonstrate the importance of liquidity/funding risk, and the interaction between basis risk and funding risk.

Third, specialized, medium-sized trading firms suffered financial distress, but larger, more diversified trading firms (such as Cargill and Olam) did not. As another example, the large diversified merchants suffered large losses due to large adverse moves in the basis in 2011 (Glencore lost as much as $300 million, and Noble's losses were reported to be around $200 million), but these losses did not threaten their financial viability. [3] Diversification allowed these large firms to weather a dislocation in one of the many commodities that they traded.

Fourth, US cotton was marketed normally despite the financial distress of major merchants, although some farmers were harmed by Reinhart's bankruptcy. These farmer losses were as largely the result of what the bankruptcy court ruled to be Reinhart's banks' "inequitable conduct" in exploiting the company's weak financial condition.

1 See Colin A. Carter and Joseph P. Janzen, The 2008 Cotton Price Spike and Extraordinary Hedging Costs (2009) for an extended analysis of this episode.

2 Reinhart fell victim to the opportunistic actions of its lenders. These lenders, including Wells Fargo and Bank of America, extended credit to Reinhart to permit Reinhart to re-establish its short hedges. The banks demanded that Reinhart pledge its contracts with farmers as collateral, but crucially forbid Reinhart from performing on these contracts without the banks' permission. Further, the banks swept Reinhart's futures brokerage accounts and removed all variation margin inflows as prices fell: banks obtained approximately $180 million dollars in this way. Prices declined to below 50 cents/pound by October. Reinhart was unable to perform on its contracts with farmers, and was forced to declare bankruptcy. The bankruptcy court deemed the banks' conduct to be inequitable, and subordinated their claims. In re Paul Reinhart Inc., Case No. 08-35283-HDH-11, JOINT DISCLOSURE STATEMENT PURSUANT TO 11 U.S.C. § 1125 IN SUPPORT OF DEBTOR'S AND OFFICIAL UNSECURED CREDITORS' COMMITTEE'S JOINT PLAN OF LIQUIDATION UNDER CHAPTER 11 OF THE UNITED STATES BANKRUPTCY CODE.

3 Javier Blas and Kevin Brown, Noble boss quits on first loss in 14 years, Financial Times, November 10, 2011. The company attributed the loss to cotton market activities. Its stock price fell 27 percent when the loss was announced.

CASE STUDY 2

US MERCHANT ENERGY MELTDOWN, APRIL – MAY 2002

After the deregulation of US natural gas markets (in the 1980s and early-1990s) and US power markets (in the 1990s) a new type of firm emerged: the energy merchant. Unlike traditional utilities that sold gas and power at regulated rates in a geographic service territory, energy merchants bought and sold gas and power at market prices. These firms evolved rapidly in the 1990s. They provided a variety of goods and services, including purchasing gas upstream, and supplying it to downstream customers under a variety of contracts. They also sold power at market-based rates. Further, they provided "risk management" services, effectively permitting their customers to manage the price and volume risks incidental to gas and power.

These firms were analogous in many ways to commodity trading firms in terms of the services they provided, but differed in some ways. For instance, merchant energy firms were somewhat more fixed-asset intensive ("asset heavy") than traditional commodity traders. Energy merchant assets included midstream investments (e.g., gas pipelines) and downstream assets (e.g., power plants).

In their peak year, 2001, the ratio of fixed to total assets for 7 leading energy merchants ranged from .3 (Aquila) to .8 (AES). By comparison, in 2012, for the most asset heavy traditional commodity traders, this ratio ranged from .23 to .44. Moreover, the energy merchants were somewhat more leveraged than asset-heavy commodity trading firms. The ratio of book value of equity to total assets for the energy merchants in 2001 ranged from .13 (Calpine) to .36 (AES), with most of the firms having ratios below .2. In contrast, in 2012 for asset-heavy commodity traders, this ratio ranged from .25 to .42.

Similar to commodity traders, one of the major risks faced by energy merchants was spread risk, the most important of which was "spark spread risk." The spark spread is the difference between the price of power and the cost of the fuel (e.g., natural gas) required to generate it. Spark spreads were robust in 2000 and 2001, especially in California, and energy merchants earned large profits. In late 2001, however, the industry's fortunes changed dramatically. Due to the post-9/11 weakening of the American economy, the easing of extraordinary market conditions in California, and the completion of large amounts of new generating capacity, spark spreads declined sharply, and merchant energy firm profits plunged.

As a result, the merchant energy sector in the United States underwent a crisis in 2002.[1] 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. Bond prices also fell substantially. The credit rating of every energy merchant firm was downgraded. Many firms exited the business, and one prominent firm (Mirant) declared bankruptcy.

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.[2]

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. But these losses were borne primarily by real money investors rather than leveraged and systemically important financial institutions, and the losses suffered by banks were too small to have any material impact on their financial position: indeed, some large banks benefited by purchasing assets and contracts from distressed merchant energy firms at favorable prices. There were no major derivatives defaults.

In sum, 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, firms outside the energy sector acquired some assets and contracts; 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.[3] Thus, a large financial disruption to an important group of firms in the commodity transformation business need not result in a pronounced disruption in the flow of commodities from producers to consumers.

This episode also sharply contradicts recent assertions that by becoming more fixed-asset intensive (itself a dubious assertion), commodity trading firms have become "too physical-to-fail."[4] No energy merchant was bailed out by the US government or any state government. No financial institution received government assistance to address losses suffered as a result of the energy merchant meltdown. The companies restructured their debt, and sold assets and contracts to financially sound entities. The assets continued to operate, and deliveries continued to be made under the contracts, making it unnecessary for governments to intervene to ensure the continued flow of gas and power from producers to consumers.

1 The crisis in the sector is sometimes associated with the demise of Enron, which declared bankruptcy in December 2001. However, Enron's collapse was not attributable to its energy merchant operations, which appear to have been profitable. Other, non-energy, ventures (e.g., bandwidth) proved to be loss-makers, and much of the company's fraudulent financial engineering was intended to paper over these losses. The merchant sector as a whole experienced only modest stock price declines in the immediate aftermath of Enron. The crisis occurred began over four months after the bankruptcy.

2 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.

3 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 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.

4 Diego Valiante, Price Formation in Commodities Markets: Financialisation and Beyond, CEPS Task Force Report (2013).

CASE STUDY 3

THE FUKUSHIMA EARTHQUAKE AND TSUNAMI, MARCH 2011

As noted throughout, one of the primary functions of commodity trading firms is to make transformations in space and time–logistical transformations. Although the analysis of substitutability in the main text 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.

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 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.[1]

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).[2]

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.

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.

1 The impact of Japan's earthquake on the global economy. Tresor-Economics Report No. 100 (2012).
2 International Monetary Fund: Japan Spillover Report for the Article IV Consultation and Selected Issues (2012).


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THE COSTS OF CAPITAL REQUIREMENTS

The lack of systemic risks arising from commodity trading firms means that regulatory constraints on their activities to reduce systemic risk are unwarranted. Imposing capital requirements incurs costs that have little or no offsetting benefit.

Binding capital requirements have several consequences on CTFs:

- They constrain the ability of CTFs to choose their capital structures
- They cause CTFs to shrink or issue additional equity
- They cause CTFs to shed assets and reduce diversification
- They could force some privately held trading firms to go public. This would dilute managers' incentives and reduce the alignment of interests between owners and managers.

Producers and consumers are adversely affected by the additional costs of capital requirements. Inefficiencies on the CTF's capital structures raise costs on transforming commodities in space, time, and form, which are passed up and down the value chain.

Regulatory constraints will have little benefit and increase costs for CTFs

The lack of any systemic risks arising from commodity trading firms means that regulatory constraints on their activities imposed with the intent of reducing systemic risk will produce little, if any, benefit. What's more, such restrictions will impose costs. In particular, imposing capital requirements similar to those imposed on banks will produce costs with little or no offsetting benefit.

Capital requirements constrain the ability of commodity trading firms to choose their capital structures. When information is costlessly available to all, and complete contracts that specify all actions and obligations under every possible contingency are costless to negotiate, execute, and enforce, capital structure choices are irrelevant. That is, the value of a firm is independent of its capital structure.[30] In the real world where information is costly, the costs of information differ among individuals, and complete contracts are prohibitively costly to execute and enforce, however, capital structure can affect firm value. Under these circumstances, firms have incentives to choose capital structures that maximize their value. Moreover, binding constraints on firm capital structure choices destroy value. Furthermore, those who buy from the affected firms and those who sell to them are damaged by these constraints.

Both debt and equity are costly, and firms have an incentive to choose the mix of debt and equity, and the structure of debt contracts, to control and balance these costs. Prominent in these are information costs and so-called "agency costs." Agency costs arise when a particular form of contract provides imperfect incentives to economic agents (such as the managers of a firm).

One example of an agency cost associated with debt is that a leveraged firm's managers, acting in the interests of equity holders, have an incentive to take on excessively risky projects even if they reduce the value of a firm. This incentive exists because the losses of equity holders are limited (by limited liability) but they can capture the upside: in contrast, creditors' gains are capped if the risky project turns out well (they get at most what they are promised in the debt contract) but they incur losses when it does not. Another example of an agency problem is underinvestment associated with debt overhang. The benefits of a value-enhancing investment by a highly leveraged firm accrue largely to its creditors, rather than equity holders: managers acting in the interests of the latter therefore have a weak incentive to undertake such an investment. Debt has other costs as well, including the deadweight costs incurred in bankruptcy (which can include legal expenses, agency costs, and the costs of negotiating with creditors).[31]

Firms can manage these costs through various means, including *inter alia* the amount of debt, choice of debt maturity structure, project finance, the use of secured debt, debt covenants, and the use of monitoring intensive bank debt or less monitoring intensive public debt. The costs and benefits of these variables vary by firm and by industry, and as a result, different firms make different choices.

Equity, and in particular public equity, is also costly. One source of cost is information asymmetry. Potential purchasers of a firm's equity are likely less informed than its managers, and will only purchase shares at a discount to true value because they understand that a firm has a greater incentive to sell stock when it is overvalued. The more severe the information asymmetry between managers and outsiders, the larger the discount, and the more costly is public equity. Public equity also entails agency costs. A primary benefit of public equity is that it permits a more efficient allocation of risk via diversification, whereby no individual shareholder invests a substantial fraction of his wealth in a single firm. However, this diffusion of ownership limits the incentive of shareholders to monitor or control managers: each shareholder bears the costs of her monitoring efforts, but the benefits accrue to all shareholders. Given limited monitoring and control by equity holders, managers can take actions that destroy value and harm shareholders. They can shirk: for instance, they may exert too little effort to control costs. They can consume excessive perquisites or engage in costly empire building.

That is, with diffuse ownership, the interests of shareholders and managers are often substantially misaligned, resulting in inefficient actions by managers.

The costs of equity can be economized by limiting its use. Debt financing is one way of economizing on equity, but there are other ways. Specifically, since the primary benefit of outside equity is to allocate risk, firms can economize on equity by using other risk management tools, such as hedging of price risk through derivatives or the use of insurance. Indeed, some firms that can allocate large amounts of risk to derivatives or insurance market participants can eschew the use of public equity altogether. Such privately held firms sharply reduce the misalignment of interests of owners and managers because the owners are the managers. Private ownership provides high-powered incentives to managers to maximize value. This is an important consideration in commodity markets, as I discuss in detail below.

Reducing debt and increasing equity are costly to firms

In the absence of regulations or legal restrictions, firms choose the mixture of debt and equity, and the structure of debt, in order to economize on the costs. Binding capital requirements force firms to hold more equity and less debt than they would otherwise choose, which necessarily increases costs.

Firms can respond to capital requirements by reducing debt, increasing equity, or a combination of both. All of these adjustments are costly.

Holding equity constant, reducing debt requires a firm to reduce assets. In the case of a commodity trading firm, this can include holding smaller inventories, extending less credit to customers, and divesting fixed assets such as terminals or processing plants. All of these adjustments are costly.

Consider reductions in inventories. Commodity traders hold inventories to permit rapid responses to supply and demand shocks. Holding inventories buffers the price impact of these shocks, so reductions in inventories results in more volatile prices. Moreover, the lower inventory requires greater adjustments in production and consumption in response to demand and supply shocks: these adjustments are costly.

Next consider the divestment of fixed assets such as commodity handling terminals. Asset ownership by commodity trading firms economizes on transactions costs arising from opportunism and holdups.[32] For instance, if a storage facility is not owned by the owner of the inventory it holds, the storage facility owner can attempt to extract additional payments from the owner of the inventory when the latter attempts to load out his stocks in response to a demand shock: the owner of the facility can credibly threaten to delay load out if his demand for higher payment is not met. This can induce wasteful haggling between the facility owner and the storer, inefficient delays in responding to demand shocks, and the holding of suboptimally small quantities of inventories. Responding to a capital requirement by shedding such assets increases transactions costs.

Further, due to scale economies in particular business segments, when shedding assets in response to capital requirements, trading firms are unlikely to do so proportionally across all segments. Instead, firms are likely to exit some commodities altogether. This tends to reduce diversification, thereby raising risk. It also tends to increase market concentration.

In sum, responding to a capital requirement by reducing assets increases the costs commodity trading firms incur to transform commodities. This increase in costs has a variety of consequences. Transformations that affected firms continue to undertake will be more costly; some transformations will be undertaken instead by firms that do it less efficiently than the affected firms; and the quantity of transformations undertaken will fall. In economic terms, the supply curve for transformations will shift up, the price of transformations–the gross margin between the price paid by commodity consumers and the price received by commodity producers–will rise, and the quantity of transformations will fall. This decline in quantity imposes deadweight losses on the real economy.

The ability to hedge major risks makes private ownership efficient for CTFs

The other margin on which firms can respond to the imposition to a binding capital requirement is to issue equity. Since before the imposition, firms will have chosen the mix of debt and equity that equates the marginal costs of each, such an issuance will raise firms' cost of capital.

This is likely to be a particularly important consideration in the commodity trading sector, because private firms play a more important role in this sector than in any other. Two of the largest agricultural trading firms are private, as are two of the largest energy traders. Most medium- and small-sized trading firms are private.

Private ownership is feasible and efficient for commodity traders because risk transfer via hedging and insurance is a viable alternative to allocating risks to equity investors.[33] As noted earlier, commodity flat prices are very risky, but these risks can be hedged cheaply for major commodities through highly liquid futures and swap markets. Moreover, commodity traders can use insurance (and guarantee) markets to transfer credit risks and some operational risks. Few other industries have similar abilities to transfer and manage risks, and as result, many commodity traders have been able to exploit the efficiencies of private ownership, notably the strong incentive effects of an alignment of ownership and management interests.

Privately owned firms cannot issue public equity in response to the imposition of a binding capital requirement, and issuing shares to outside private equity investors dilutes the ownership share (and hence the incentives) of managers. Thus, to retain private ownership, these firms can only respond to a binding capital requirement by reducing assets, and therefore incurring the costs discussed above. This further implies that some commodity trading activity would be shifted from private firms that supply it at low cost to other firms that incur higher costs to do so. Moreover, some trading activities that should be supplied will be foregone altogether.

The costs that some private firms incur to shrink their balance sheets in response to the imposition of a capital requirement could be so great that they will determine that it is cheaper to go public (or perhaps to sell equity to private investors). But cheaper does not mean free. To the contrary, going public forces firms to incur the agency costs of outside equity. Most notably, it would attenuate the high-powered incentives inherent in private ownership, in which the owners are the managers who internalize to a higher degree the costs and benefits of their decisions than do the managers of public firms with diffuse ownership.

In sum, binding capital requirements are costly because they force firms to undertake costly adjustments on two margins. Capital requirements cause commodity trading firms to shrink, or to issue additional equity. Both of these adjustments are costly. Capital requirements are likely to be particularly costly in the commodity trading sector because it relies heavily on private ownership, which makes adjustment on the equity issuance margin especially costly.

Capital requirements also impose a compliance burden on affected firms, even if they are not binding. Indeed, capital requirements are complex and highly abstruse, making it especially costly to perform the requisite calculations, ensure compliance, and audit adherence. These costs fall primarily on the affected firms, but regulatory authorities also incur costs to monitor compliance of the firms that they regulate. It is likely that the costs will be most burdensome for small- to medium-sized commodity traders. This would create a source of scale and scope economies that would tend to increase concentration in the commodity trading sector.

The compensation restrictions in CRD IV also have the potential to adversely impact the efficiency of CTFs. These firms tend to rely on high-powered incentive systems that include a substantial variable (bonus) component. CRD IV restricts the ratio of variable to fixed compensation at 1:1: subject to shareholder approval this ratio can be increased to as high as 2:1. This constraint is likely to be binding for many of the most productive employees of CTFs, and therefore weaken their incentives to maximize value. Any such attenuation in incentives tends to reduce the efficiency of CTFs.

Of course the owners of commodity trading firms will bear some of the costs of capital requirements, but others will bear costs as well. In particular, producers and consumers of commodities will be adversely affected. Inefficient constraints on the capital structures of trading firms will raise the costs of transforming commodities in space, time, and form, and these higher costs are passed up and down the value chain. Transformation costs drive a wedge between the price consumers pay for transformed commodities and the price producers received for untransformed ones. Increasing these costs widens this wedge, thereby driving up costs for consumers and driving down revenues for producers. Thus, regulations on the financial choices of trading firms affect the real economy.

Capital requirements impose inefficient constraints along the value chain

30 This is the well-known Modigliani-Miller Theorem.
31 Debt can have benefits. Tax advantages are one notable example. The relatively low tax rates faced by many commodity trading firms reduces the relevance of tax considerations as a determinant of capital structure.
32 Craig Pirrong, The Economics of Commodity Trading Firms (2014).
33 Craig Pirrong, The Economics of Commodity Trading Firms (2014). R. Gilson and C. Whitehead. Deconstructing Equity: Public Ownership, Agency Costs, and Complete Capital Markets. 108 Columbia Law Review (2008) 231.

CONCLUSION

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.

Thus, there is little if any justification for subjecting commodity trading firms to CRD IV. This would produce no material reduction in systemic risk, but would increase the costs of commodity trading, to the detriment not just of trading firms, but of the producers and consumers of commodities.

Making permanent commodity traders' exemption from CRD IV does not mean that these firms are "unregulated." Their operations are subject to a wide variety of laws and regulations. Fundamental economic considerations demonstrate, however, that capital requirements are one type of regulation of commodity firm that would bring little (if any) benefit but impose substantial costs.