

The Developing Carbon Financial Service Industry: Expertise, Adaptation and Complementarity in London and New York

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Abstract. London and New York are the world's pre-eminent financial centers. They are essential in processing the financial transactions of the global economy. The circumstances that have given rise to and maintained the preeminence of these centers are well explored in the literature. Less attention has been paid to the importance of these financial centers in organizing the complementary institutions, services, and products of functional and developing markets. This article looks at the role of London and New York, particularly the complementarity of existing financial infrastructure, in developing a new carbon market. I argue that developing a market from existing financial infrastructure through complementarities is more efficient because it economizes on sunk costs, relies on the marginal pricing of new initiatives, and generally reduces the costs of infrastructure development. Therefore, new markets are best constructed using existing market infrastructure or by developing complementary processes within existent market systems. I investigate three levels of complementarity between (existent and new) markets and within the new carbon market: the complementarity of expertise and information, the complementarity of institutions and services, and the complementarity of market systems. Case studies constructed from expert interviews conducted with banks, brokerages, intermediaries, legal firms, consultancies, and wire services in London and New York are used to support the argument. This paper concludes by commenting on the significance of the financial service centers (geography) where the market is developed.

Keywords. Complementarities, Carbon Markets, Market Development, Global Finance, Economic Geography

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Introduction

The relative strength and positioning of London and New York at the heart of modern financial capitalism is a thoroughly debated topic. A considerable body of scholarly work has investigated the positioning of these financial service giants, the circumstances that have produced their prominence and the implications for the operation of modern economies (Berger, Demsetz, & Strahan, 1999; G. L. Clark, 2005; Kindleberger, 1974, 1995; Roe, 1994; Sassen, 2001; Thrift, 1994). A common theme in the literature is the necessity of proximity for social connection. The survival of these centers despite the fragmenting pressures of technological revolution speaks to the importance of geographic location. Cities are essential to the creation, growth and function of market economies, particular in their ability to establish financial service centers (Gehrig, 2000). The city centers of London and New York provide the institutions and expertise to process a number of markets.¹ In turn, the operation of multiple markets reinforces the importance of these city centers. As Clark (2002) argues, the complementarity provision of a range of services in a single location is a critical factor in the maintenance of financial service centers.

The developing carbon markets present a unique opportunity to examine the importance of established geography in market formation. Carbon markets have begun to develop in Europe and the United States as a governance mechanism to reduce green house gas emissions.² The markets differ from other markets in terms of the scope of government

¹ The term markets is meant to broadly encompass a range of socio-economic institutions and actors, and services that enable the production and distribution of particular goods and services.

² In Europe the EU Emissions Trading Scheme is a direct result of the Kyoto protocol. In this market compliance parties must demonstrate emissions reductions or trade either European Union Allowances (EUAs) or Certified Emissions Reductions (CERs) to meet compliance. For an overview of the scheme see (Watanabe & Robinson, 2005). In the United States a number of both regulatory and voluntary market initiatives have developed on the regional and national level. The Northeastern States are developing the Regional Greenhouse Gas Initiative (RGGI), California has established a trading initiative (AB32) and the Lieberman Warner bill has

involvement—the commodity of exchange is a regulatory creation and emissions reductions are registered and verified by governments. Nevertheless, carbon emissions trade like other commodities and a market for carbon emissions is growing in Europe and in the United States (Hasselknippe, 2003).³ As this article aims to demonstrate, the financial service centers of London and New York are playing an important role in developing the financial infrastructure to process the carbon markets. The timing and potential scope of the carbon market provide an invaluable opportunity to deepen our understanding of market formation. As a consequence, this paper and its analysis of the mechanism used to develop the carbon markets make a unique contribution to understanding the development and function of markets in a modern context.

This article aims to demonstrate that complementarity of institutions, services and expertise is critical to the development of new carbon markets. The carbon markets are being constructed from existing financial infrastructure. Complementarity between the carbon market and nested market systems is also a critical factor in maintaining the relevance of geographic location. Complementarity within and between market systems (borrowing from and adapting structures that are complementary to existing market processes) allows for the infrastructure of the carbon market to be developed slowly while the market maintains a level of functionality. As such, developing a market from existing financial infrastructure through complementarities is more efficient because it economizes on sunk costs, relies on the marginal pricing of new initiatives, and generally reduces the costs of infrastructure development.

been introduced to the House and Senate to create a nation-wide cap and trade system (Hamilton, Bayon, Turner, & Higgins, 2007; Hasselknippe, 2003).

³ It should be noted that the market for trading emissions is also growing in other areas such as Japan and Australia, and that UNFCCC CERs are produced through the Clean Development Mechanism (CDM) around the globe. However, for reasons of scope, the focus of this article is the trade and financialization of carbon emissions reduction credits in the United States and Europe.

This article provides a comprehensive analysis of three levels of complementarity that help to develop the carbon markets: complementarity of information and expertise, complementarity of institutions and services, and complementarity of market systems. I argue that through these levels of complementary development, the carbon markets will become embedded within a system of other markets. The embeddedness of financial infrastructure within a financial service city reflects the need to organize transactions in space and time. Market operation is a process that requires the coordination of information and expertise. At the moment the financial infrastructure—institutions and capital that develop carbon projects and enable the trade and transfer of carbon products—for the carbon market is largely being developed in London and New York (Bloomberg, 2007).

This article uses a case study approach to study the development of carbon markets in London and New York with a focus on the role of complementarities to situate a new market within an established market network. This paper uses close dialogue, interviews guided by a pre-determined set of questions and conducted on a confidential basis with no citation rights (G. L. Clark, 1998). Each interview has been qualitatively cross-checked with other interviews to verify the findings. Since this paper seeks to describe and conceptualize the developing carbon market and its agents, a qualitative approach is appropriate. As with all methodologies, it has drawbacks. In particular, perspectives and experiences of individuals are not always accurate representations of actions or facts (Berry, 2003). However, the triangulation of result confers rigor and credibility to the conceptualization (Strauss & Corbin, 1990). A key prerequisite for this rigor is access, as only the testimony of key market makers and decision makers will afford an acceptable level of confidence in the findings (Goldstein, 2003). In this study, the cases are built over the course of numerous interviews with experts from banks, brokerages, intermediaries, legal firms, consultancies,

and wire services in London and New York. Owing to the sensitive nature of the issues under discussion, all interlocutors are anonymous.

Proceeding in four sections, this article examines the use of complementary mechanisms to develop a new market for carbon emissions. The first section explores the concept of complementarity within economic geography, particularly to understand the development of new markets. Section 2 analyzes the use of complementary expertise and information to develop the carbon market's products. Section 3 analyzes the complementarity of institutions and services. Section 4 investigates the role of complementary market systems. The article concludes by commenting on the efficiency of complementary market development and significance for embedding market geographies.

1. Market Development through Complementarities

1.1 Complementarities and Embeddedness

The function of markets has been explored from a range of theoretical perspectives. The sociological approach is concerned with the role of theory and agency in shaping market processes. A more economic approach is concerned with the role of complementary institutions, services, and products in evolving a market to a more sophisticated system. The developing carbon market provides a good opportunity to examine these approaches in the modern context. The carbon market is distinct from predecessors that were established decades in the past, both because of its genesis within a regulatory context as well as the milieu of the techno-communications era. These factors could enable carbon markets to develop in different regional contexts and to utilize more innovative, carbon specific methods of operation. Despite the possibly unique nature of the carbon markets, I argue that

traditional frameworks of complementarity and embeddedness are relevant to carbon market development. Complementarity occurs across and within two key market structures—the relationship between developing institutions of the market and the relationship between developed and developing market system. The market becomes embedded by developing within an existent market infrastructure. Performance according to this infrastructure complements and helps develop the carbon market, but at the same time has the effect of locking it into the format of an already established system.

From the sociological standpoint, market theory is critical to the development and stabilization of market processes (Callon, 1998; Cetina, 2005; Litterman, 2003). Theory both describes *and performs* market function. Donald MacKenzie argues that once theory is operationalized by market actors, it becomes operative, performing and reifying functions it originally was used to describe. In this respect theory is an engine that helps shape and drive the market, not a camera which simply records it (Cetina, 2005). Agentially, theory acts on the market by informing the participants as to the boundaries, contexts, and rules of a market as well as providing them a language through which to communicate (Callon, 1998; Glasmeier, 1990). These theories help define markets as socio-economic networks of embedded inter-firm relationships (Grabher, 1993)

Litterman's equilibrium approach takes this a step further and suggests that markets are never truly in a state of equilibrium and are constantly driving towards stabilization (Litterman, 2003). Together the sociological and equilibrium approaches emphasize the importance of market agents in structuring market processes. For the carbon market these theories suggest that both economic theory and the interaction of market agents will shape the actual function of the carbon markets. While there is little theory that specifically addresses the carbon

market, its legislative design has undoubtedly been influenced by theory.⁴ Likewise, the agency of market actors will undoubtedly play a role in shaping the market processes. Specifically, the carbon market will be shaped by the routines and expectations of operation, and the types of products and services that are provided within the existing financial markets that are lending shape to its development.

The economic approach stands in contrast to the expectations arising from sociological theories. Merton and Bodie's functional approach suggests that markets must not only be maintained, but also that they must be driven towards a state of functionality (Merton and Bodie 2004). Certain processes, such as the innovation of financial products are necessary to drive this evolution. Institutions and intermediaries not only compete with but complement each other, co-evolving to dissipate transaction costs or behavioral patterns that prevent markets from functioning efficiently. For example, the complementarity of rival bulge-bracket firms and financial products has been essential to the development and growth of London's financial industry (G. L. Clark, 2002). The cost of obtaining additional output is less if the level of several operations is varied. Consequently, many of the operations within a firm are complementary (Richardson, 1990). The market is driven towards functionality by the complementarities of financial institutions through the creation of innovative products and services.

Richardson (1990) recognizes four types of complementarities within firms, which have the impact of reducing variable, fixed, and sunk costs. Sunk costs can be easily identified in the capital and technological infrastructures firms must have if they are to enter a market and to repel potential competitors. *Type 1* complementarities exist when firms are able to switch resources within or between firms to adjust output without adjusting input. This type of

⁴ The EU Emissions Trading Scheme was adapted from the U.S. market for SO₂ and can be traced to the theories of pricing externalities of Ronald Coase (1968) and John Dales (2002).

complementarity discounts both variable and fixed costs and may do so such that the added mandate is of no added cost. For example a firm may direct one of its financial consultants to specialize in a new product or services, capturing new clients without increasing costs. *Type 2* complementarities allow a group of firms purchasing more of the same input to collectively increase the returns of scale, thus individually lowering the cost of production for each firm. For example, a number of firms may reduce sunk costs by investing in a technology or platform (Armstrong, Cowan, & Vickers, 1994). . *Type 2* complementarities can be found in mature financial geographies like London, where a firm can join an already provided infrastructure of market execution, accruing its benefits without accruing the associated costs of development. *Type 3* complementarities exist where there is a close association between the demand for one good or service and other goods or services. The purchase of one product is actually comprised of a closely associate set of products. For example, the purchase of an equity may require a complimentary service like a compliance service to transfer the asset. Similarly, *Type 4* complementarities exert multiplier effects such that economic activity in one sector will produce income and employment widespread throughout the entire economy adding to the overall flow of demand and supply. A firm can act as a broker, sharing a mandate with a different firm providing needed specialty services. *Type 4* complementarities are particularly relevant in creating financial service centers.

As Clark (2002) points out, each type of complementarity is present in the global financial services industry. Complementarities need not reside exclusively within a firm; they may be present and shared between firms. Shared complementarities allow firms to be very small and highly specialized and yet operate in a symbiotic market relationship with bulge-bracket firms. Shared complementarities reduce the operating costs not only of individuals firms, but of the market networks constituted by these firms. The typology of complementarities helps to illustrate the functionality of a market. What is not clear is how the typology applies to a

newly developing market. Of particular interest is the case of the carbon market, which is being developed within an existing market infrastructure. I argue that in this case complementarities not only reduce the cost of operation within or between firms, but the costs of construction of a new market system. Specifically, Type 2, 3, and 4 complementarities are market complementarities; they decrease the costs between institutions or within market networks because several institutions are operating together.

1.2 Complementarities Applied to a Developing Market

Complementarities also reduce the operating costs of markets. In particular, I argue the construction of a new market is most efficiently accomplished by embedding it within a complimentary host market. By doing so, the expertise, institutions, and service providers required to operate the market need not be constructed at great expense from the ground up. Instead, expertise is borrowed from existing institutions, which are integrated into an operational market much like firms using Type 2 and Type 3 complementarities to increase productivity without increasing costs. Specialized market institutions like carbon portfolio managers do develop, but they coordinate with already established bulge-bracket institutions to liquidate carbon emissions (Type 3).

The new market can begin to operate, as a hybrid of new and existent market structures and processes, much more quickly than if a full set of institutions had to be established to process the market (Type 2). Likewise complimentary products, such as basket commodities which link carbon to other commodities are used to help the carbon market develop (Type 3). The potential drawback is that the new carbon market adopts the structure of the host market system. The services and products follow an established logic of securitization and transfer. Innovation may occur, but it is bounded within an already structured system. Additionally,

the new carbon market becomes embedded within the geographic location of its development (Type 4), reinforcing the importance of the financial service industry where the market develops.

The remainder of the paper illustrates the process of market development within three levels of complementarity. The first level of complementarity is financial expertise and information. Expertise from bulge-bracket legal and financial institutions is used to define carbon products and to develop mechanisms of financialization and trade. The second level of complementarity is complementarity of institutions and services. Carbon markets are developed both by startup boutique firms providing unique services and by bulge bracket firms which transfer expertise and lend depth and credibility to the market. The third level of complementarity exists between market systems. Development of the carbon markets within financial service centers provides mutual benefit. The carbon markets benefit from an established network of expertise, capital and clients, while the financial service centers benefit from a boost in activity and reaffirmation of their importance.

2. Complementarity of Expertise and Products

The financial services needed to process the development of carbon markets—project finance, product development and carbon transfer—are provided by Professional Services Firms (PSFs). Knowledge at both the individual and collective levels is the cornerstone of the value-added services provided PSFs (Skyrme, 1999). Knowledge, whether explicit (articulated or stored in media) or tacit (embodied in the individual) is the key mechanism of value creation and innovation within professional services (Beaverstock, 2004; Gertler, 2003). Knowledge and information transfer is the essence of market function. The issue of

how knowledge is transferred within the financial service industry is therefore of critical importance to the development of new market infrastructure.

Tacit and explicit knowledge are mutually complimentary elements because tacit knowledge can only be converted into explicit knowledge through interaction and socialization (Nonaka, 1995). Without interaction or codification, tacit knowledge cannot be successfully embedded within a time-specific moment and spatial context (Howells, 2002). As such, the organization of PSFs to maximize face to face contact is important to knowledge transfer (Sassen, 2001). This is one of the reasons for the agglomeration of complementary service firms within financial service centers. Furthermore, PSF success relies on trust and reciprocity built through peer group interaction (von Krogh, Ichijo, & Nonaka, 2000). The knowledge stored within the financial service sectors of London, New York and is ultimately the knowledge required to operate a market system. This knowledge exists within the firms employees and must be transferred through social processes.

The benefit of structuring a developing market within a developed market system is achieved through proximity and access. New firms are able to adapt financial knowledge and expertise, in addition to physical infrastructure. Processing a market requires considerable knowledge and expertise as well as established routines of operation (Fligstein, 1996). Rather than develop market expertise wholesale, the carbon markets are acquiring knowledge from firms with extensive experience processing other market systems. Of particular importance is the legal expertise to structure property rights (carbon commodities products) and the expertise to facilitate carbon trading and finance. Firms transferring knowledge to the carbon market utilize both Type 2 and Type 3 complementarities to capture carbon market activity.

2.1 Property Rights and Legal Expertise

The construction of the carbon market requires the legislation of an entirely new range of products and services. The Clean Development Mechanism (CDM) and European Emissions Trading Scheme (EU ETS) establish a range of new products including AAUs, RMUs, CERs, ERUs and EUAs (Grubb, Vrolijk, & Brack, 1998).⁵ In addition to basic products, the market is developing a series of secondary products—futures, options and swaps, and securitized carbon products like guaranteed CERs and basket commodities—linking carbon with other energy and weather derivatives. Standardization and verification present important challenges to the creation of new carbon products. The easiest and perhaps most efficient way to legitimate these products while maintaining certainty in their operation is to mimic existing market products and processes (Campbell & Lindberg, 1990; North, 1990). Since carbon specific institutions have not yet developed to provide the legal services required for the processing and contracting of carbon products, underwriting the creation of new carbon projects and products depends on existing legal expertise in other markets.

A number of established legal institutions are active in the carbon space. Three of the largest international bulge-bracket legal firms specifically boast a range of carbon activities on their websites. Clifford Chance was “the first law firm to form an Environmental and Climatic Trading Group...[which] spans 17 jurisdictions and includes over 70 lawyers and allows us to offer an unrivalled pool of emissions trading expertise across Europe, Asia, the Americas and the Middle East ” (Clifford Chance, 2008). Brown Rudnick has a dedicated Climate and Energy Group built on “an interdisciplinary model, combining lawyers from each of Brown

⁵ Assigned Amount Units (AAUs) and Removal Units (RMUs) are assigned under the Kyoto Protocol to Annex I countries. Certified Emissions Reductions (CERs) are offset units, which are produced by Clean Development Mechanism (CDM) projects, and Emissions Reductions Units (ERU) are produced by Joint Implementation (JI) projects. CERs and ERUs can be used to offset a certain percentage of an Annex I countries emission target and can be traded under the EU ETS. European Union Allowances (EUAs) are the standard unit of trade for the EU ETS. In addition, Verified Emissions Reductions (VERs) are traded on voluntary markets.

Rudnick's offices with expertise in a range of areas...[that] leverage each other's expertise to provide fully integrated solutions to participants in the growing carbon and renewable energy marketplace" (Brown Rudnick, 2008). Baker McKenzie is explicit regarding the linkage between their general operations and their carbon section: "Baker & McKenzie's Global Climate Change, Clean Energy and Emissions Trading Group works as a single team which combines general commercial and energy law expertise with the firm's expertise in environmental law, project finance, major projects, international trade, taxation and public international law" (Baker McKenzie, 2004). These firms are clear that the legal expertise in carbon trading is drawn from established firm expertise and operates in a complimentary fashion to a number of other energy and environment products and services.

Interviews conducted with individuals working in legal firms and in brokerages, banks, and exchanges who use the legal services of firms in London and New York revealed insights about the importance of legal expertise, the role of knowledge transfer in developing the market, and the use of complementary firm activities and products to provide carbon specific services.⁶ One interlocutor working in a large legal institution to analyze and document carbon projects spoke of the importance of legal knowledge to develop the new market:

We provide legal services for banks and other financial institutions including hedge funds, private funds, utility organizations and governments. Any movement of emissions credits or any constructed contract requires legal assessment. The clients we work with are long-term clients. Our carbon team does the initial work and then the other legal services that are required can be provided in-house.

In this firm a team of specialists drawn from several intra-firm sectors has been created to understand and process legal services for developing carbon projects and products. The

⁶ As with all interviews, questions may be raised about the reliability and representation of the data, including the potential for bias, non-universality and misinterpreted analysis. The advantages and disadvantages of interviews will not be discussed here, but are discussed at length by Bryman (2001). The interview findings were triangulated and corroborated with firm and sectorial specific, official and unofficial sources (journals and in-house publications); and with the firm websites.

expertise for this team has been transferred from other sections of the firm generating a Type 1 complementarity. The firm then benefits from a Type 2 complementarity as carbon partners provide services requiring additional complimentary legal services (provided in house) such as custodial assessment and securitization.

While regulatory institutions such as the CDM Executive Board and DEFRA provided much of the initial standardization of carbon products, the extension and trading of products requires independent legal expertise. In all cases, carbon standardization and trade mimic and compliment products in other markets (Watanabe & Robinson, 2005).⁷ The transfer of expertise from established markets ensures that the products operate in a tried and functional matter, and that disputes over contracts are settled through established mechanisms.

Furthermore, the transfer of expertise creates a set of complementary legislated products and contracts, which observe the same fundamental structures and rules of operation as other commodities such as oil and gas. These complementarities allow for the commodities to be compared and linked.

The greatest challenges that exist in developing the carbon markets are the legal and market risks arising from the uncertainties which surround new, legislated products and services.

There are considerable regulatory uncertainties, such as the successful registration of projects under the CDM. The delayed operation of key elements of the Kyoto Protocol—the International Transaction Log for example—and the prospect of linkage between the different international, national and regional schemes creates uncertainty within the market (Christiansen, Arvanitakis, Tangen, & Hasselknippe, 2005). Changing mechanisms and inter-linkage might change the operation of products, and will certainly affect the price of

⁷ EUAs, AAUs and CERs for example resemble RECLAIM trading credits (RTC), the traded unit in the long-established U.S. Regional Clean Air Incentives Market for reducing nitrogen oxides and sulfur oxide emissions. The traded units are all measured as 1 tonne of emissions reduction equivalent.

carbon commodities. The lack of certainty regarding these mechanisms and future developments reflects the immature nature of the carbon markets. Knowledge and expertise transfer from established markets helps to develop and add certainty to the market. An interlocutor from a large legal firm asserted the importance of legal knowledge in developing the market.

What does it mean to actively develop something? The idea [of carbon trading] found resonance and something was designed. The market follows. We are facilitating interactions amongst participants, which creates denser interactions and more interactions. Our role in developing the market comes to an extent through regulating client's expectations of interaction...Before no one knew how to trade. When clients first started trading, they questioned how to do this. That is changing.

These comments were supported by the vice president of a brokerage in London:

The market started with a couple of PR deals. When the market was initiated there was not so much financial sophistication. What was important was what sort of things to write into contracts. The legal expertise to write the contracts was essential to get the market going.

Legal firms provide the knowledge required to increase the number of transactions within the carbon space and to smooth the operation of these transactions. The repetition of practice creates a legal precedent complemented by well-established precedents for managing other market transactions. As the vice president suggests, standardization of practice adds certainty to a new and uncertain carbon market and increases the number of transactions. The use of established legal expertise for complimentary services further enhances education of and familiarity with the market.

The utility of transferring legal expertise to the carbon market is two fold; 1) it reduces the cost of developing new expertise, and 2) it grounds the carbon market in a common operating framework to other complementary markets. Firms reducing emissions have an easier time navigating the carbon market system because it resembles existing market systems. The

shared framework boosts activity and confidence in the market and links it into a broader market network.

2.2 Carbon Trading and Finance

A number of scholars have argued that location is significant for the creation of information related to the structure of financial products (G.L. Clark & O'Connor, 1997). Larger, established locations with institutional structures that facilitate information and fund transfer have an advantage in structuring new products (Howells, 2002). Since the nature of information varies in systematic ways according to the characteristics of products, a critical dimension of this institutional structure is the role of market as centers of information collection and the formal exchange places of specialist expertise (Bond, 1994). The competitiveness of financial centers is based less on the costs of routine production and more on the management of scarce talent (Florida, 2002).

The largest bulge-bracket financial service companies tend to be functionally centralized according to expertise rather than dispersed according to the specific needs of geographic markets (Clark, 2002). Inevitably, there is a symbiotic relationship between the pool of talent and the provision of financial services in global financial centers. The collection of talent into these centers may also be a reflection of the reliance upon existing financial expertise to structure new services and products. The agglomerated expertise embodied in the bulge-bracket firms is essential to develop markets (Grabher, 1993). Financial intermediaries such as exchanges, banks and brokerages help develop and improve the liquidity of carbon trading. As with legal firms, these institutions use Type 2 inter-firm complementarities to transfer expertise from existing sectors and develop carbon information.

Interviews with key individuals in financial institutions in London and New York highlighted the same themes. Interlocutors concurred regarding the importance of financial expertise in investment banks to develop products for the carbon market. However, the expertise and models for structuring carbon products are borrowed. The expertise of bulge-bracket investment banks in particular allows these institutions to securitize carbon credits and increase market liquidity. A number of different individuals concurred that the expertise needed to develop carbon products and finance is in bulge-bracket banks.

Banks are developing products; they have the power to secure the risks. We give input to the banks about what types of products to develop. The products are all fruit of index volatility and traded volume. —Vice president of a brokerage, London

The market was first and foremost regulation, but in taking it from compliance to an operational market, the banks did that. For example, they produced standardized contracts for CERs earlier this year. They have brought liquidity to the market. The expertise has been built quickly because it is has been brought from other energy, power and gas markets. They are just like the carbon market—like all markets in a way. Banks understand commodity markets. —Director of carbon analysis and consulting firm, London

As these individuals suggest, large banks have the expertise to develop carbon products.

These institutions provide a range of financial services and products, and can often handle the full spectrum of a client's financial needs by providing the services through complimentary in-house institutions (Type 3 complementarity). The advantage held by bulge-bracket firms for developing new products comes from both the talent and information of their employees and from its ability to distribute the product through a well-established client network. These firms with headquarter offices in London and New York often employ thousands of individuals in a single building. Both the services provider and the client interested in complimentary services benefit from the centralization of expertise in a single location. In addition, the expertise to develop new carbon products can easily be borrowed or transferred from other units within the firm.

The expertise for developing products and projects is extremely borrowed from other markets. We learn from similar market links and structures. The products and expertise are mostly transferred, provided cross-business...Investment banking and commodities are needed. We get people who structure commodities to understand the opportunities in carbon markets. —Carbon emissions originator at an investment bank, London

We will create new products, but the expertise is borrowed. People will be brought in from other markets. Carbon is a commodity at the end of the day. They have underlying delivery, and the mechanisms are the same. Nothing will be reengineered.. —Associate director at an investment bank, New York

We are developing products like letters of credit (from banks) in India and forward credits...There is very little new expertise in the market. Most of the services and products are borrowed from already established markets. Portfolio trading is already used in mortgages, letter of credits are applied from wind farms, etc. —Carbon originator at an investment bank, New York

Bulge-bracket financial institutions are well-situated to mobilize and capitalize upon expertise from a range of other markets. Using these firms' expertise, carbon products can be structured to mirror products in other markets. Although carbon undoubtedly has its peculiarities, it is being poured into a standard commodities mold. Even if less innovative, borrowing carbon market expertise and product structures is an efficient way to develop the market. Carbon products can be cost-effectively developed and integrated with complimentary products from other markets because they share the same basic structure. The bulge-bracket firms that develop the products can additionally process them in the same way that they handle other commodities, providing Type 3 complimentary services in house, such as custodial and clearing services.

Another aspect that advantages carbon development in large bulge-bracket financial institutions is the sheer capital capacity of the firms. They are able to manage the risks and uncertainties of carbon emissions because they have a greater source of capital to hedge against, and calculated systems to manage the risks. In the sense that the products are innovative, the most innovative products are designed to hedge carbon specific risks.

When we buy from projects, or finance projects we are not sure of the total volume of credits that will be delivered, so we bundle projects into one portfolio, and issue guaranteed credits (which we will back with cash if the credits are not supplied). We have developed a new tranche product, by which we split the credits of a carbon project into risk groups. —Carbon originator at an investment bank, New York

Banks are so important in a risky market because they will not go out of business or not honor commitments. Working with banks is important to manage the risks. —Carbon associate at an investment bank, London

Our VERs are all done through swap. We work with [investment bank partners]. We put the deal together, and get the partners to step into the contract and we have a swap of VERs. The counter-parties like [the banks] because they increase confidence...They take the credit risk. If the fund goes bankrupt, the bank will still pay for the transaction. —Director of environmental finance at a hedge fund, London

One of the greatest challenges for the growth of the carbon market is undoubtedly managing the risks of developing and trading carbon credits. The regulatory uncertainty post 2012 (when the first phase of the Kyoto Protocol expires), and the long-term lifecycle of carbon emissions introduces instability into the carbon markets. The stability provided by bulge-bracket institutions—using established financial infrastructure to hedge risks, standardize carbon products, and boost liquidity—cannot be underestimated. Borrowing expertise and financial infrastructure from well-established market systems speeds the development of the carbon market and increases its sophistication. Nevertheless, it also locks the carbon market into an established system of operation, and a positive feedback loop that structures the financial geography of the market. The financial service centers lend complimentary expertise to the developing market, and in turn, the market feeds the growth of the financial centers where it is developed (Type 4 complimentary).

3. Complementarity of Institutions and Services

Complementarity applies across firms as well as within them. Inter-firm complimentary allows the market operation to be shared between bulge bracket firms and specialized boutique firms. Firm complementarity might be described to drive market development in

three stages. In the first stage, the market is initiated by small specialist firms. The firms begin to operationalize the market but do not have the scope and depth of expertise to fully develop the market. In the second stage, bulge-bracket firms institutionalize and expand the market.⁸ In the third stage of development, the expertise of boutique firms fills specialist niches neglected by bulge-bracket service providers. Some firms are forced to exit, and new partnerships develop between bulge-bracket and boutique firms to provide complementary services. In addition, bulge-bracket and boutique firms target different sectors of the market to provide complementary client coverage. The pattern of development among consultancies and news wire services demonstrates the balance of power and competition between bulge-bracket and boutique firms in emerging carbon markets.

3.1 Consultancies and News Wire Services

The way information and access is provided to market users is an interesting study in the complimentary relationship of bulge-bracket and boutique firms. Interviews indicate that there is growing business between both types of firms, but they may be serving slightly different clientele and that they are developing different segments of the market. Bulge-bracket firms attract clients from other operations in their firms. Their client networks provide them an obvious advantage. Boutique firms rely on name recognition and gain clients by providing specific and unique services. As such, they may be reaching a more general clientele, or clients interested in specific carbon activities. The advantage of boutique firms comes from their carbon specific focus and development of expertise and services that encompasses the entire carbon credit lifecycle.

A number of bulge-bracket firms provide consulting and news wire services to the carbon markets. Notable among these are Reuters, which provides publicly available carbon specific wire service (Reuters, 2008c). On the consulting side, ICF International, a large bulge-bracket private analysis and consulting firm, provides carbon specific analysis (ICF International, 2008). ICF consults with governments on the development of carbon legislation. At the same time a series of carbon specific newswire and consultancy services have developed, including Point Carbon, New Carbon Finance, and Ecosystem Marketplace. These services provide a range of carbon specific services from news wires to carbon forecasting.

Our database plays a role in developing the market. It is needed for people to have transparency. We bring transparency. We are also helping people to go informed into the market, which makes them more likely to participate. As such we are a market facilitator. —Director of carbon analysis and consulting firm, London

We are primarily supplying information to the financial services industry. However, we also supply policy makers (certainly at the White House) with information...we provide information on pricing, and market participation/development. Our services are provided through terminals like computers at institutions that subscribe to distribute information round the clock. There is also a news/information center on the web, and a subscription based service. —Journalist at a newswire service, New York

We are definitely playing a role in developing the market. As a consultancy, we help companies understand and interact with the market. We make compliance participation less onerous. We help governments structure the markets and play a facilitator role. It is a profit incentive for us. —Consultant of a carbon analysis and consulting firm, London

As highlighted by these comments the specialist and bulge-bracket firms have different strategies for providing service. The large newswire service focuses on established clients and providing a service that complements activities in other markets. The boutique services in contrast emphasize their provision of specialized services, in particular unique pricing databases. They emphasize their role as information providers who are developing the market by informing sectors that would otherwise not have access or information.

Nevertheless, a number of individuals interviewed suggested that the use of either type of service is not exclusive.

We get news from a number of service providers including Reuters, Bloomberg and Point Carbon. —Associate director at an investment bank, New York

We use Point Carbon, Environmental Finance, Energy Risk, Ecosystem Marketplace, which are mostly UK based. We also use Reuters. I use them quite a lot. They provide good news sources...and also New Carbon Finance. —Vice president at an investment bank, New York

News wire services by their nature demand a number of service-providers to maintain the overall quality and integrity of the service. For the developing carbon markets, the services of bulge-bracket wire services and boutique consultancies are used together. However, the carbon markets are still in very early stages of development. The eventual outcome of these service providers shed insight on the nature of market development. If the carbon markets experience enough growth, it is possible that the boutique firms will become bulge-bracket firms with their own entrenched market networks. Whether or not they will out-compete generalist providers is an empirical question. At the moment, the two types of firms work in a complementary fashion.

3.2 Banks and Carbon Asset Developers

Another aspect of the developing market is partnerships between boutique firms providing specialist services and bulge-bracket firms providing capital and generalist services.⁹ For example, Credit Suisse has recently taken a 10 percent stake in carbon project developer

⁹ Although three have been highlighted, the pattern of purchasing has become a market trend, with a number of other financial institutions partnering with carbon asset developers to provide a more complete range of carbon services. Camco International and Gaian Capital and Tudor Investment Corporation have announced that they have entered into a letter of intent to launch the Climate Leaders' Joint Venture, an equity investment joint venture to finance projects that reduce greenhouse gas emissions and generate emissions credits (Reuters). Merrill Lynch has bought a minority stake in clean energy project developers Russian Carbon Fund (Reuters, 2008b). Citigroup bought a stake in UK-based Sindicatum Carbon (Reuters, 2007). In addition, ABN Amro and Citigroup helped launch Ecosystem Marketplace, the world's first online information platform for the growing international trade in ecosystem services (PRNewswire, 2005).

EcoSecurities Group for 44 million Euros (Reuters, 2007). Similarly, Morgan Stanley has purchased a 38 percent stake in MGM International, one of the carbon market's largest developers of emission reduction projects (Cohen, 2008). In addition, in August it launched Morgan Stanley Carbon Bank for the voluntary carbon markets, which operates in conjunction with Det Norske Veritas (DNV), an international provider of emissions data certification. Under this partnership, clients compile their emissions inventory and calculate their carbon footprint, which DNV verifies and certifies. Morgan Stanley's Commodities Group then procures and cancels carbon credits equivalent to a client's verified carbon footprint. Carbon credits are procured from various sources including from Morgan Stanley's own direct investments in emission reductions as well as those of MGM International (Morgan Stanley, 2008).

The relationship between financial service institutions and carbon asset developers is not exclusive to bulge-bracket financial institutions. Climate Change Capital Investing Group is a boutique bank with two carbon funds dedicated to investing in emission reduction projects in emerging markets. They aim to provide attractive returns that demonstrate the economic opportunity in creating a low carbon economy (Climate Change Capital, 2008). In April of 2007, Climate Change Capital acquired Quality Tonnes, a global carbon asset developer involved in a wide range of carbon project services (Quality Tonnes, 2008). These relationships are based on the combination of well-established financial expertise and capital with expertise specific to the development of carbon projects and creation of carbon credits.

The organizations highlighted above are not necessarily the organizations that have been interviewed. However, these publicly acknowledged relationships drew considerable attention among the interviewees. They provide good examples of the types of developing complementarities in the market between existent and developing expertise.

[Carbon Asset Developer] is the one of the largest publicly traded companies, and the value to [our institution] is its engineers and their expertise. They develop a project, take a company through each of its steps, which is important because the process is very bureaucratic, and they monitor the project. They provide the on the ground project expertise. [Our institution] provides the financial expertise and investment capital, and we work as a team. So we can tell a client that they will invest in a project, but only if the client hires [carbon asset developer], which helps make a stronger project, and a greater likelihood of expected credit returns. —Carbon originator at an investment bank, New York

Our primary activities are to hold a portfolio of offsets to supply to clients. We are not planning to do project finance. Our plan is to acquire someone who does project development. For example, [Lists banks that have purchased stakes in project developers]. We are planning a similar type of relationship with an organization in the U.K...we need project expertise, brand name, and a secure offset provider. — Vice president at an investment bank, New York

Banks produce guaranteed CERs and pay a premium for the insurance risk. Primary CERs are cheaper because they are close to the source of credits. We are a good partner for the delivery of credits, but we cannot guarantee the credits. We structure the portfolio in a way to reach niches in the market we cannot otherwise reach. We want to partner with banks and other financial institutions to do this. —Resource manager in a carbon asset developer, London

From the perspective of the banks, the carbon asset developer provides specialist knowledge and experience planning and initiating carbon projects as well as managing the scientific and bureaucratic aspects of the process. As with the wire services and consultancies, the carbon asset developers provide a brand name and recognition of a unique service. From the perspective of the carbon asset developers, the banks provide financial expertise, capital, and stability. Carbon asset developers provide primary credits and banks provide liquidity and hedge risks to securitize or guarantee the credits. The expertise of the two types of firms is complementary (Type 3) and together they are able to provide a service that individually would be difficult if not impossible to provide.

4. Complementarity of Market Structure

The final level of complementarity exists between market structures. As financial centers, London and New York are suitable sites for the development of new markets. They host the

full infrastructure—institutions, finance and expertise—needed to process a market’s operation. I have argued that building a new carbon market by borrowing services and expertise from established markets and integrating it into the market infrastructure is the most efficient way to develop the market. A number of sunk costs are foregone, the time of expertise development is shortened, and both the existing and developed market receive a boost in activity from Type 2 and 3 complementarities. The generation of the new market is itself a Type 4 complementarity; it exerts multiplier effects as the purchase and production of carbon products and services add to the overall flow of demand and supply and thus produce income and employment widespread throughout the entire service center.

The relationships between the developing carbon market and the developed market system also embed the market’s financial infrastructure. Once firms have established headquarters in London or New York, they may open and expand to subsidiary markets, but they are unlikely to shift their core expertise and operation. Likewise, once the format and content of carbon services and products becomes ingrained it is unlikely to be dramatically redesigned (Ottaviano & Thisse, 2001, p. 177). The argument presented here is that the construction of new market systems is a geographic and path-dependent process. No matter how developed communication systems become to liberalize the geography of interaction, even new markets cannot escape the legacy of conglomerated financial service centers (Wójcik, 2007).

In the past, the need for financial conglomeration was in part for the need to process economic transaction. Kindleberger for example argues that “financial centers are needed not only to balance through time the savings and investments of individual entrepreneurs and to transfer financial capital from savers to investors, but also to effect payments and to transfer savings between places” (Kindleberger, 1974, p. 6). Kindleberger’s rationale for financial service centers focuses on the processing of payments. Electronic processing has arguably

nullified the need for geographic proximity. Similarly, Johnson distinguishes international financial centers, such as New York City and London, from regional financial centers. Hong Kong, Singapore and Panama are largely hosts to foreign financial institutions that find it convenient to locate offices there, rather than magnets of financial power in their own right (Johnson, 1976). From Johnson's perspective, the development of financial centers results in part from the accumulation of capital, which makes these centers magnets of financial power. Nonetheless, the rationale for organizing financial operations in particular geographies is very much a social one.

The core of market operation is the management of knowledge. The interaction with clients, competitors and suppliers alike is critical to the management of knowledge. As such 'face-to-face' processes are still undertaken in specific spaces, which leads to the agglomeration of economic geographies (Amin & Thrift, 1992; Leamer & Storper, 2001). The intensity and proximity of such interactions and socialization, despite increasing technological capacity such as teleconferencing adds to the critique of O'Brien's (1992) 'end of geography' argument (Morgan, 2004). Proximity is important to the development of new markets. This article has explored the use of complementary expertise and services to develop a new market. Ultimately, the expertise needed to develop and manage the space-time transactions of the carbon markets is not just complementary but also proximate.

On the boutique-firm side, carbon market institutions are situating in London and New York in part to have access to the market networks that complement their service provisions. In part, they are seeking access to the bulk of capital and clients that arise from the volume of business transactions processed in these cities. On the bulge-bracket firm side of the market, the firms which have the capacity (in terms of expertise and capital infrastructure) to lend support to the development of the carbon market are already situated in large financial service

centers like London and New York. They help to conglomerate the carbon market in these centers. Establishing the carbon markets in London and New York is intuitive because they have the infrastructure to manage a global commodity network. As numerous financial interviewees point out, carbon emissions are a commodity or can be handled as a commodity. Financial service centers process and redistribute carbon credits, which are harvested around the globe, to developed economies. These centers lend weight to the development of the carbon market. In exchange, the development of the carbon market advantages these centers by expanding their economic opportunities.

The carbon markets are embedded in a complementary market network system shared between London and New York.¹⁰ If the market achieves the political support in the U.S. and Asia needed to become a truly global market, it will require the processing support of a number of regional centers. The use of complementary market systems to develop the carbon market has undoubtedly shortened the time and added stability to its development. In Europe, the EU ETS was operationalized in only three years (Sterk, Braun, Haug, Korytarova, & Scholten, 2006). The placement of the carbon market where it can take advantage of complementary institutions and expertise has also locked in the market. It is innovative in that it is ultimately a regulated governance mechanism, but it is becoming (if not already become) institutionalized into existing norms and procedures of market operation.

¹⁰ The analysis here has not unknowingly ignored the role of Tokyo in the triad of a seamless global market place (G. L. Clark, 2002). Tokyo is undoubtedly important in the operation of the global market economy (Edgington & Haga, 1998). However, although Japan has ratified the Kyoto protocol and is perhaps the largest purchaser of voluntary emissions reductions, it is already very efficient and has only a fraction of the greenhouse gas emissions of the United States, China and India (Hamilton et al., 2007). Several studies have indicated that Tokyo is on the decline for years in terms of relative position when compared with other Asian centers (Reed, 1980). Additionally, much evidence suggests that Singapore and Hong Kong are rising financial centers in Asia (Beaverstock, 2002; Hodjera, 1950; Lu & Yu, 1999; Mainelli & Yeandle, 2007; Monetary Authority of Singapore, 2007). To be fair, the role of Asian financial centers in the development of the carbon markets, and the impact of these markets on the positioning of these centers deserves further attention. While I would like to recognize the importance of an Asian center for processing the carbon market, the analysis of these centers is beyond the scope of this study.

Conclusion

Financial service centers like London and New York have risen to prominence in the global economy for a number of reasons. Their ability to attract capital and talent makes them vibrant and dynamic. While there is much competition in these centers, their multiple service components are complementary and have a unifying effect. They are also able to extend and embed in new markets like the carbon market. This article has examined the use of complementarities to develop new carbon markets within established market systems.

Market complementarity functions on three levels: 1) its expertise is essential to defining new products and methods of operation 2) it enables the market functionality through the provision of complementary services, 3) it integrates and amplifies the operation of market systems. At all levels, it is a process that occurs both within market systems (across institutions services and products) and between new and existent market systems.

Complementarity helps to develop the markets more quickly and efficiently than would otherwise be possible, by transferring expertise and infrastructure and minimizing costs.

The development of a new market, particularly a market with enough potential scope and scale to require independence, amplifies the complexity of complementarities. It is likely the carbon market will be a trillion dollar (or euro) market within the next decade. Since it is being built largely from the existing financial industry of London and New York, the importance of these cities is underscored. Eventually, the carbon market will be large enough to require its own complete set of market institutions, products and services. The nature of the complementary market development undoubtedly locks the market's operation into an established framework. Boutique firms like EcoSecurities, Camco and Climate Change Capital may eventually become the goliaths of the carbon market, yet they have established their headquarters in London and New York, and are integrating into the financial centers.

The growth of carbon markets will require regional centers in other cities, but the heart of the market, e.g. its institutions, is in these financial service centers and cannot escape their legacy.

Because the bulk of capital exists in service centers like London and New York, developing institutions naturally gravitate towards them (Cetina, 2005). However, the importance of these centers is both financial and social. The development of carbon markets using specialized boutique expertise and borrowed bulge-bracket expertise illustrates the role of complementarity and mimicry of financial centers in developing and situating a new market within their geographic bounds. Once developed the carbon market will have enough scope to operate independent of other markets. Based on the findings here, we should expect the carbon market will continue to operate in a complementarity fashion with other markets. The complementarity of these market systems will help to maintain its geographic binding. There is undoubtedly innovation in developing carbon products and institutions, and thus in the eventual market system, and yet it is built from and to an extent limited to mimicry of an existing market system. The mimicry and complementarity of the carbon market speaks to the power of geographic location despite technological development that would otherwise make geography irrelevant.

This article highlights the importance of financial service centers in developing new carbon markets. However, the analysis is temporally limited. The markets are very dynamic and their status deserves further attention once they are more developed. In addition, analysis of other regions such as Asia and Russia, which are also important to the development of the carbon markets is beyond the scope of this paper. The role of financial service centers within these regions also deserves attention. Nevertheless, this study provides an early baseline upon which future research can be compared. It also opens the question of the relationship

between space and time in operation of market centers. Future research should investigate the particular role of each financial center in managing space-time, and the financial and social relationships of different carbon market geographies.

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