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An Emerging Geography of Intangible Assets: Financialization in Carbon Emissions Credit and Intellectual Property Markets

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Abstract

In this article we investigate how two cases of 'intangible assets,' carbon emissions credits and intellectual property, shift the balance of economic activity between and across regions. Carbon emissions credits and intellectual property portfolios require predictable and enforceable property rights regimes to gain and retain value. Hence these assets and the intermediaries that trade them generally operate within advanced economies. Our analysis highlights several findings. First, large, integrated TNCs play a key role in the emerging markets for these intangible assets by driving investment, directing acquisitions, and influencing the structure and character of the assets themselves through the regulatory regimes that define them. Second, the public policy interests in innovation and sustainability shaping the governance structures that assign these assets with property rights do not alter their fundamental operation as financial instruments. Thus these intangible assets are more than efforts to codify and fix a market price to the externalities of the production processes of carbon emissions and research. They also create geographic sites of alternative, competitive investment. We suggest that these assets produce a geography that both siphons off capital from production sites and isolates assets in privileged financial and investment capitals.

Keywords: Innovation Markets, Regional Development, Financialization, Carbon Markets

1. Introduction

In January of 2011, news agencies reported the theft of $40 million US of carbon emissions permits attributed to the Czech Republic precipitating the temporary shutdown of trading of carbon emissions permits in the European Union Emissions Trading System (EU ETS). The cyber-theft was discovered by a market participant, Blackstone Global Ventures (BGV), when the firm found 475,000 carbon permits missing from an account (Harrison 2011).

The US-based National Public Radio reported, "A cyber-theft like that would not have happened 20 years ago, nor would a carbon emission allowance have had any value 20 years ago. What this theft proves, the president of the International Emissions Trading Association says, is that in Europe carbon emission allowances are now seen as commodities like gold or wheat"(Gjelten 2011). In order to track down the missing permits, BGV posted a 'missing permits alert' on its corporate website along with serial and tracking numbers for the missing permits. This list provides a small window into the geographic scope of the EU emissions trading system and the sophistication of the financial services firms which operate in it (Ventures 2011).

As the EU ETS sought to reassure participants of the security of both the credits themselves and the markets in which they are traded, participants in intellectual property markets were nervously watching the licensing, litigation, acquisition, and auction activities of a number of "intellectual property investment funds." Notable among these is the Intellectual Ventures, a firm holding a portfolio of over 30,000 assets spanning dozens of technology classes.

The development of innovative financial instruments is a common feature of modern capitalism. Futures contracts have been traded on exchanges like the Chicago Board of Trade since the Civil War. However, the rapid proliferation of innovative financial instruments in recent years has followed a different pattern from past experience. Futures contracts originated in the agricultural sector and developed geographically---near the markets in which the futures were traded. The application of futures to other sectors was gradual, not rapid.

Today, the development of innovative instruments such as complex derivatives, swaps, and options for intellectual property and carbon emissions credits extends across sectors and across regional and national boundaries. These innovative instruments influence production costs and firm strategies at an altogether broader scale (Clark and Wojcik, 2007). The rapid proliferation of new asset categories for investment capital results in a geography that is not characterized by physical production but rather by the capacity of institutions and regulatory regimes to commodify innovative assets such as the production externalities (carbon emissions) and production inputs (intellectual property) and to further assign, track, transfer, and enforce associated property rights. The disinvestment in regions (and most regional economies) that follows increased financialization is also well understood (Clark 1989; Clark 1993; Corbridge, Martin et al. 1994; Martin, Sunley et al. 2002; Pike 2005).

In this article, we argue that carbon emissions credits and intellectual property, just like other sorts of financial instruments, fit the definition of fictitious

capital described by David Harvey as "money that is thrown into circulation as capital without any material basis in commodities or productive activity" (Harvey 2006, p. 95) because they are increasingly part of speculative rather than investment markets. As with other 'exotic' financial instruments---futures, securities and related derivatives---their value is dependent on receptive regulatory regimes with the power to enforce and adjudicate property rights (La Porta et al., 1998). The value of these commodities is speculative and cannot be ascertained reliably outside of the narrow political and geographic boundaries in which they are traded.

Because these assets require the institutional and labor market specializations of financial services and regulatory regimes capable of allocating, tracking, transferring, and enforcing property rights assigned to fictitious capital, their possible locations are determined by a combination of baseline political contexts and factor conditions. In other words, these intangible assets produce a geography based on specialization in the process of financialization. The resulting economic geographies produced by this fictitious capital are a combination of those generated by the financial service industry ('casino capitalism' minus the off-shoring) and the underlying industries from which the markets developed (Strange 1986; Christopherson 1993; Christopherson 2011).

In our case studies we outline the overlapping firm networks in these markets for fictitious capital and map the role of financial services intermediaries in the exchange of these assets. We examine how these emerging forms of 'fictitious capital' produce different patterns in the spatial organization of economic activity apart from more familiar maps of production networks and industrial districts (Holland 1976; Harvey 1982)Our analysis produced several findings. First, large, integrated, TNCs play a key role in the emerging markets for these intangible assets by driving investment, directing acquisition, and influencing the structure and character of the intangible assets themselves through the regulatory regimes that define them. Second, the public policy interests in innovation and sustainability shaping the governance structures that assign these assets with property rights do not alter the fundamental operation of these assets as financial instruments. Finally, we suggest that these intangible assets produce a geography that both siphons off capital from production sites and isolates assets in privileged financial and investment capitals.

2. A Geography of Intangible Assets

In this article, we locate innovation as a pre-production process. It is decoupled from production itself and increasingly packaged as free-standing intellectual property products sold and traded on and as "innovation markets." Similarly, we locate carbon emissions credit exchange as a post-production market (Knox-Hayes 2010). In both cases, the markets are related to production processes but IP and carbon emissions credits function as innovative financial instruments.

The understanding of innovation as a category of production activity has changed dramatically in recent years. Innovation has long been understood in two distinct forms both deeply influenced by rapid technological change: *product*

innovation (associated with job creation) and *process* innovation (often associated with the substitution of technology for labor) (Glasmeier 1991; Glasmeier 2000). Recently, within economic geography, the discussion has focused on the various spatial implications of tacit and codified knowledge and the different geographies these categories of knowledge produce (Gertler 2003; Moulaert and Sekia 2003; Boschma 2005; Simmie 2005; Tödtling, Lehner et al. 2006; Clark, Huang et al. 2010).

In the overall production process, innovation has long served as a critical part of pre-production---developing, designing, and codifying what can be produced and how. Vertical disintegration coupled with outsourcing and the dispersal of supply chains has lead to the increasing de-linking of pre-production processes---dependent on design, development, and financing functions---from the production process itself in both manufacturing and services (Glasmeier 2000; Bryson, Daniels et al. 2004; Christopherson and Clark 2007b; Dicken 2011). As a consequence, an increasing number of firms focus only on pre-production. These firms can be both spatially and organizationally distinct from any commercialization of their inventions. In fact, in many industries, pre-production (design, development, planning) and post-production (marketing, advertising, product and policy management) functions are far more likely to co-locate with other pre- or post-production operations than with the underlying production process itself (Bryson and Rusten 2010; Clark 2011).

Each of our examples is traded and codified independent of any underlying production. In this way, each market appears to mimic patterns familiar from the futures and derivatives markets in financial services. However, we challenge traditional notions that financial services necessarily enhance productive growth (Sinha, 2001; King and Levine, 1993). Building on Schumpeter, these perspectives suggest that finance performs a basic service of pooling investment to facilitate the development of large-scale entrepreneurship (Rajan and Zingales, 1998). Financial institutions are also thought to be better able to develop the skills and experts to evaluate entrepreneurial activity (Boyd and Prescott, 1986). As King and Levine explain:

> Financial systems influence decisions to invest in productivity enhancing activities through two mechanisms: they evaluate prospective entrepreneurs and they fund the most promising ones. Financial institutions can provide these research, evaluative, and monitoring services more effectively and less expensively than individual investors; they also are better at mobilizing and providing appropriate financing to entrepreneurs than individuals. Overall, the evaluation and sorting of entrepreneurs lowers the cost of investing in productivity enhancement and stimulates economic growth (King and Levine, 1993 p. 515).

Although there are undoubtedly merits to the traditional services that financial institutions provide, such as pooling investment, mitigating risks and developing specialized expertise, this is no longer the extent of what financial service firms do. We suggest that in recent years new forms of financial innovation have been developed by the financial services industry that work in contradiction to

productive economic growth. Through IP and carbon markets, for example, these institutions create assets, which move capital but do not facilitate innovation and production.

We investigate where the firms and intermediaries in these markets---IP and carbon emissions---are located and why. Further, we track the actors involved in the proliferation of non-productive assets. The trade of intellectual property and carbon credits is not based on the present or future exchange of a material product, but rather on ideas and aspirations. We argue that these non-productive assets act as fictitious capital that produces a different economic geography than productive capital. First, the geography of creating and exchanging non-productive assets privileges the same regional economies as the financial services. Both share parallel processes and practices regarding the management of largely virtual and disembodied capital flows. Such capital flows cluster in agglomeration economies possessing specific and specialized institutional networks that protect property rights and sophisticated modes of market exchange (Merton, 1987). Examples of such factor conditions include firm networks and specialized labor markets.

Carbon emissions credits and patent portfolios require predictable and enforceable property rights regimes to gain and retain value. Hence these assets and the intermediaries that trade them tend to operate within advanced economies, and more specifically in London and New York (Knox-Hayes 2009). As with other "exotic" financial instruments---futures and related derivatives---their value is dependent on receptive regulatory regimes with the power to enforce and adjudicate property rights. The value of these assets is speculative and cannot be ascertained reliably outside of the narrow political and geographic boundaries in which they are traded (Knight f 2011). In a simple sense, the market sets the price and the market exists because of artificial demand created from policy not because the assets have any underlying use value. In other words, non-productive assets represent the transfer of all use value to exchange value.

On an operational level, a patent allows the holder to prevent the productive exercise of that intellectual property by other entities. Carbon emissions credits allow the holder to continue production while generating externalities deemed excessive. In both cases, the assignment of the property right sanctions firm behavior, which is broadly recognized as disadvantageous from a social perspective. Specifically, the property rights limit innovation in IP markets and distribute allowances to pollute in carbon emissions markets.

The geography of these markets is delinked from regional production networks. It pulls capital away from regional economies engaged in production and concentrates capital in regional financial centers representative of high technology venture capital nodes and regions specializing in energy futures trading (Soja 1989; Castells 2000; Soja 2000). Thus these emerging asset (futures) markets become more than efforts to codify or internalize externalities of the production processes of carbon emissions and research and fix a market price to them. They also create geographic sites of alternative (competitive) investment. We argue that any acknowledgement of the disembodied nature of fictitious capital flows and the virtual nature of these firm networks requires also a recognition of the geographies produced by the regulatory regimes and specialized institutions required for their

free flow. Finally, we comment on the implications of the geography of non-productive capital circulation for regional policy.

3. The Cases

3.1 Intellectual Property Capital Markets: Patent Portfolios and the Rise of Defensive Aggregators

3.1.1 Intellectual Property Markets

During the last decade, the investment world has engaged in pointed debates about the allocation, enforcement, and exercise of intellectual property rights. More specifically, these debates have examined how patents are granted and defended. There are two critical elements of these debates. The first element is the growing realization that "the value of patents depends on the reasons for which they are pursued and held" (Coughlin 2007). The second element is the emergence of IP as a tradable asset class by newly developed firms functioning primarily as IP aggregators and intermediary holding companies. These two elements underscore a relatively new phenomenon in the world of innovation and pre-production: the assignment of tradable value to the "inventive idea" independent of its potential for production or the practice of its commercialization. The UK's Intellectual Property Office describes the increase in IP assets as follows: "The value of tangible assets, such as machinery and factory premises, has been superseded by intangible assets that now represent over 80 percent of the market capitalization for the S&P 500." (UK IPO 2011).

Among the firms engaged in this trade are "non practicing entities" or NPEs. These firms purchase, hold, auction, license, and litigate patents rather than pursue the commercialization of the inventions the patents represent. NPEs are often related to the venture capital industry and/or involved with the high-technology start-ups in industries such as information and communications technology (ICT) and software (Zook 2005; Lohr 2010).

Recent public policy debates about the assignment and enforcement of IP rights have focused on possible reforms to the patent system. These reforms are, in part, an attempt to mitigate predatory litigation by entities known as 'patent trolls.' These firms troll for patents by buying up IP from other firms (including bankrupt high-technology firms selling assets at auction as well as other research and development entities), without the intention of commercializing the inventions. Instead these firms hold the IP and wait until a 'practicing' firm exercises a technology that infringes (or potentially infringes) on the patent rights it has strategically aggregated.

The firm strategy of a patent troll is to generate an income stream by exercising the property rights associated with patents rather than by commercializing inventions. By settling or winning ensuing lawsuits or compelling practicing firms to pay licensing fees to continue commercializing inventions, the patent troll employs an innovative and lucrative firm strategy.

However, perspectives differ on the true intentions behind these firms and the strategies they deploy. There is greater variation among NPEs than the patent troll story alone would indicate. Nathan Myhrvold, the CEO and co-founder of Intellectual Ventures explained the purpose of his own firm---often referred to as a patent troll ---in a 2010 article in Harvard Business Review, "Our goal is to make applied research a more profitable activity that attracts vastly more private investment than it does today so that the number of inventions generated soars" (Myhrvold 2010, p. 41). In the same article, Myhrvold advocates explicitly for the development of 'patent backed securities' as components of an 'invention capital industry' (Myhrvold 2010, p. 50). In effect, the aim of this advocacy (and activity) is the formal creation of a new asset class comprised of IP as a free-standing speculative investment asset.

The rise of these NPE firms has promoted proposals for policy changes in the national and international regulatory frameworks governing IP rights. For example, the US Senate passed a bill in March 2011 to shift the country from its peculiar reliance on a "first to invent" standard for assigning patent rights to the dominant international standard of "first to file." While this legislation is unlikely to become law in its current form, it is a reminder of the stark contrast between the US and international standards. This variation again highlights the importance of regulatory regimes (and hence jurisdiction and geography) in the assertion and assignment of IP rights.

As policymakers have debated the allocation of IP rights, much less attention has been focused on the development of the firm networks specialized in IP acquisition and trading, their geographic distribution, and how and whether those firm networks support or detract from regional development. While policymakers have begun to recognize the tension between *innovation for invention* and *innovation for production* capital markets, proposals for firm regulation remain almost entirely nonexistent. Instead, subtle policy preferences have emerged. For example, although more than a quarter of patent applications in the US come from California, the USPTO recently announced that its first satellite office will open in Detroit rather than Silicon Valley (Wyatt 2011).

The growth in NPEs has struck alarm bells for many other actors engaged in invention and particularly those invested in the sale and licensing of patent rights. Myhrvold argues that the implications for other invention actors are generally positive: streamlining returns to invention and aligning incentives for inventors, providing funding to academic institutions engaged in applied research and streamlining valuation of university-based inventions, providing production firms with "one-stop" patent shopping, and promoting rapid and efficient technological innovation benefiting "society at large"(Myhrvold 2010).

The formulation of patents, and particularly sets or pools of patents, as tradable assets apart from the production process is not new. Terms like patent pools, patent thickets, and patent blocking have been in the lexicon for some time. In the past, large technology firms typically created patent pools within their own research and development divisions. However, new firm strategies have emerged since the mid-1990s---in concert with developments in the financial services

industry. These firm strategies, in creating a new market for trading IP, also create a new site for investment.

3.1.2. Typologies, Firm Strategies and Patent Portfolios

As the firm strategies around patent aggregation have developed, two major types of NPEs can be identified: 1) defensive patent aggregators and 2) "offensive" IP holders. Both firm types purchase and stockpile IP with no direct commercialization intention (and often no capacity for production internal to the firm). Instead, the firms pursue a set of strategies aimed at developing income streams from the value assigned to the IP itself. In this way, these firm strategies are consistent with Myhrvold's call for an "invention capital market."

NPEs solicit capital investors (venture capitalists, investment portfolios, large firm capital management) in order to fund purchases of IP portfolios (often from dissolving high-technology firms). Indeed, an intellectual property "market" was recently opened in Chicago, IXPInternational, which "provides a marketplace for the trading of IP rights, thereby establishing a necessary and efficient platform through which companies can adhere to the better business practice of not infringing on third-party IP rights, as opposed to risking litigation" (IPX 2011).

In some sense, this IP capital market 'rationalizes' the connection between venture capital and small, start-up high-technology firms by codifying small firm innovation. The IP market trades on the potential of start-up firms represented by the patents they hold. Innovation potential has been the focus of the venture capital investment in start-up firms all along. The IP capital market narrows the time horizons---removing the longer time horizon toward the initial public offering and/or product commercialization. In other words, the IP capital market allows actors to trade on the value of patents or the patent pool held by a firm rather than the commercial potential of any particular small firm that owns the IP. This narrows the time horizon for the acquisition or buy-out firm strategy of many high-tech start-ups. Large firms acquire the core IP rather than other elements of the firm (personnel, managerial capacity, or business plan).

One analyst summed up the difference between investing in the patent and the small firm as follows:

> …most of the patent portfolios of small firms have an increase in value early in the life of the firm when it is able to acquire venture capital backing. Later, in the life of the firm, the technology represented by the patent portfolio either sinks or swims. A minority of the firms and their portfolios increase greatly in value, while, for most of the firms, the value decreases to zero. Thus, even in a situation where most patents are not maintained, small portfolios as a group are still, on average, valuable enough to justify the expense of generating them (Coughlin, 2007 p. 388).

An NPE (or an IP division within a larger firm) maintains a patent portfolio to 1) defend current market territory (technology class or product), 2) extract

licensing revenues from competitors or "interlopers," or 3) create and participate in an "invention capital market." From that starting point, firms can then pursue a number of income streams. First, an NPE can **hold and license** a pool of patents to practicing firms in support of that client firm's commercialization strategy. Simultaneously, the NPE can strategically acquire additional IP that it finds valuable. In this scenario, an NPE may also conduct its own targeted research program and pursue patents from its internal research and development operation to enhance and augment the IP it acquires through the invention market. Intellectual Ventures falls into this category with investors such as Nokia, Intel, Apple and Sony investing in its holdings (Kellner 2005).

In a second strategy, an NPE may **aggregate and auction** its patent portfolio either to other NPEs or to practicing firms. The business section of the New York Times has described these auctions in colorful terms:

> But the masterpieces at this auction were not paintings, but patents. Among the bidders were investors and funds that use intellectual property as a mix of lottery ticket and protection racket. They license patents to companies that might need them and sue those that they believe are already infringing on their newly purchased ideas. Other bidders were corporations looking perhaps for good ideas to exploit, and much more likely, to keep patents out of the hands of those investors that could well lead to costly legal bills. (NYT 2009)

And in yet a third strategy, an NPE can **sue practicing firms** that infringe on its IP holdings and negotiate a financial settlement or pursue a legal ruling. It is this third strategy that is most closely associated with "patent trolling" activities.

Finally, an NPE may function as a **membership organization**, acquiring IP on behalf of a set of clients or member firms and functioning as a "patent pooling intermediary." In the intermediary scenario, an NPE may employ variations on the three other strategies depending on its membership class, technology portfolio, or individual market niche. In practice, the membership-based intermediaries tend to pursue a strategy granting licenses to member firms and eventually selling or donating patents that prove of limited interest. These intermediaries combine patent pooling and patent portfolio strategies using both initial investment and membership dues and fees to fund their acquisitions and operations.

Membership organizations are of particular interest because of their hybrid firm strategies and their function as intermediaries between small firm invention and large firm production. Two dominant NPEs function as membership-based "defensive patent aggregators": Allied Security Trust and RPX Corporation (Gomes 2009). Both firms acquire, hold, license, and sell IP resources on behalf of their members, most of whom are large firms due to the significant membership fees. For example, the dues for RPX member firms range from $40,000 and $5.2 million annually and the dues for Allied Security Trust are $250,000 with each member also required to put in escrow $5 million for future patent purchases (Computers 2010a; Computers 2010b). The stated intention is to acquire and retain patent portfolios in areas of interest to members.

Defensive patent aggregators are IP investment firms themselves. Their role goes beyond "defending" their membership from out-of-the-blue infringement claims by stockpiling and holding patents in technology classes of interest to their members (Acello 2009; Preston 2010). Their acquisition capabilities are funded through 1) venture capital/equity funds and/or 2) membership fees and dues. However, the business model for defensive patent aggregators is relatively new and adapting quickly. Allied Security Trust and RPX Corporation are similar to trade associations in their membership structure and advocacy on behalf of their industry's interests. However, a third firm involved in defensive patent work, Patent Freedom, provides firms with portfolio information and tracking data on aggressive NPEs with a record of suing practicing firms. Patent Freedom provides this data on a fee basis on a consulting model explicitly to help firms minimize infringement claims for patent trolls.

The firm strategies of these defensive patent aggregators, as well as their membership lists, tell a story about how the IP market has developed as a site of investment and exclusion rather than innovation (see Table 1). For example, RPX Corporation specifically states that it never intends to assert the patent rights it holds. Instead, it holds patents (more than 1,500 by the end of 2010) on technology classes of strategic interest to its member firms. In so doing, RPX insulates these firms from potential litigation by forming an IP boundary or buffer zone around a new technology or product that a member firm seeks to exercise (Computers 2010b).

Although this strategy avoids the aggressive lawsuit strategy that characterizes other non-performing entities like IV or Acacia, it is debatable whether this hold and aggregate model encourages innovation and commercialization beyond the formal patenting of the initial invention. In some contexts, this firm strategy is referred to as 'patent troll insurance.' RPX (originally funded by Index Ventures, KPCB, and Charles River Ventures) recently announced that it would issue an initial public offering in order to raise $100 million to acquire additional patents. Its business model resulted in $33 million in 2009 and it was on pace to make twice that in 2010. In May 2011, RPX began trading on the NASDAQ under the "RPXC" ticker heading. The IPO exceeded initial expectations.

Insert Chart I: Intellectual Property Markets

3.2 Carbon Emissions Markets: Allowances, offsets and the property rights of production

3.2.1 Carbon Emissions Markets

There are several markets through which carbon credits are traded. The most familiar is the European Union Emissions Trading System (EU ETS), which caps the emissions of over 10,000 installations in Europe (Kossoy and Ambrosi 2009). Under the Kyoto protocol, the EU ETS is linked to the Clean Development Mechanism (CDM). The CDM is the primary international market for offset trading, and has helped to establish a global market for greenhouse gas emissions

(Hasselknippe 2003; Watanabe and Robinson 2005). The CDM allows countries with emission -reduction commitments (Annex 1 parties) under the Kyoto Protocol to offset some of their emissions from emission reduction projects. The outputs of CDM projects are Certified Emission Reductions (CERs), units of greenhouse gas reduction that have been generated and certified. Each CER is measured as equivalent to one ton of carbon dioxide (tCO2e).

Carbon markets trade two main commodities: allowances and offsets. But there are also a range of derivatives of these commodities such as futures, options and swaps that can be traded. The CDM Executive Board (EB) operating under the United Nations Framework Convention on Climate Change (UNFCCC) and the European Commission are the regulatory agencies responsible for issuing allowances and offsets. The first step in constructing both the information they contain and the value they represent is registering them. EUAs are first assigned in a national registry. In theory these have regional ties, as they are managed by the 27 member states of the EU. However, as the case of the stolen credits demonstrates, in practice the registries are completely virtual and can be accessed from any location. CERs experience a more drastic movement as they are first produced in a developing country then aggregated onto an international registry before being moved to one of the national registries in Europe where they are sourced to the European marketplace. Once registered the credits become quickly divorced from their region of production (Bumpus and Liverman 2008). At this stage the credits are comprised solely of information: a serial number, date of production, location, statement of original ownership and record of transfer. The realization of their value is achieved by financial service firms, which market and sell the credits, usually within an established financial center (Knox-Hayes 2010).

3.2.2. Typologies, Firm Strategies and Carbon Portfolios

The growth in the production of emissions assets lies not so much in the actual reduction of emissions, but in the intermediary services that generate the market for trading. In addition to compliance parties, other entities seeking to become active in the market for profit, experimentation or CSR generate the demand for emissions credits. Key intermediary actors aggregate and exchange offsets and allowances for these parties, once the credits have been created and registered by the CDM Executive Board (offsets) or the European Commission (allowances). **Carbon aggregators** originate the carbon projects in developing countries in partnership with leading firms, and aggregate the credits from these projects back into Europe. The aggregators will often transfer the credits to the portfolio of an investment bank with which they have an established partnership. **Investment banks** and large utility companies provide most of the finance to develop the projects**,** and establish portfolios of credits, which they sell to their clients and bring to market through carbon brokerages and exchanges**. Carbon brokerages** link buyers and sellers of the credits. The brokers identify buyers through their extensive network of clients or sometimes source the credits through exchanges, such as the European Climate Exchange. **Exchanges** provide a forum for buyers and sellers to meet, but also hedge the delivery risk associated with trying to

register credits through the CDM. Often the exchange will operate as the clearinghouse for credits, such that buyers and sellers are not trading directly with each other but instead with the exchange. Increasingly both allowances and offsets can be traded on exchanges, but the majority of trades are still done over the counter (Kossoy and Ambrosi 2009). Chart 2 provides key information on the geographies and strategies of the leading intermediary firms in each of these categories collected from the firm's websites. Along each step of the movement of the credit, from source producer to registry to aggregated portfolio to exchange, the intermediaries transferring the credit acquire a transaction cost such that a credit once produced for 8 Euro per ton sells for 12 Euro per ton. The transfer of the credits into derivatives can produce additional value (up to 30 percent of the value of a reduction credit). In effect the valuing of the allowances and the offsets through trade produces value-added economy for service industries in the financial services where they are primarily traded.

[Insert Chart 2: of Carbon Typologies]

3.2.3 Carbon brokers and aggregators

The key CDM development and exchange firms are carbon aggregators and carbon brokerages. The aggregators' strategies focus on establishing CDM projects in developing countries such as China, India, Indonesia and Vietnam and pooling the credits from these projects for sale in European financial centers. The brokers' strategies focus on distributing the credits to compliance and CSR buyers and developing new financial products.

One of the leading firms for carbon aggregation is EcoSecurities, "a recognized carbon market pioneer that has amassed one of the industry's largest and most diversified portfolios of carbon credits" (EcoSecurities 2011). EcoSecurities employs a number of strategies for its clients: **credit sourcing**—helping project developers to assess project viability and to guide them through the CDM system, **developing CDM emission reduction projects**—registering projects with the CDM executive board, **selling carbon credits**—providing services (in partnership with JP Morgan Chase) for trading, risk management, sales, marketing and commercialization strategies, **carbon offsetting**—supplying offsets from an extensive portfolio to meet a buyer's needs (credit types, risk appetite, volumes, terms and technologies), and **consulting—**providing greenhouse gas management and climate change strategies in a number of fields including renewable energy, energy efficiency, sustainable land use, forestry, environmental finance, policy and emissions trading. In order to succeed as a carbon aggregator, the company needs the technical skills to develop the projects and the expertise to navigate the bureaucracy of the CDM. Carbon aggregators must understand the complex technical procedures of registering, monitoring and evaluating CERs. As EcoSecurities advertises on its website, its value-added comes from its technical expertise in developing carbon projects:

> Our team has over 14 years of unrivalled experience in the CER creation process, having created a wide range of CDM methodologies, developing the very first project in the world to be registered by the CDM Executive Board) the NovaGerar landfill project) and structuring one of the first projects in the world to receive issued carbon credits (La Esperanza) (EcoSecurities 2011).

EcoSecurities has recently been acquired by JP Morgan Chase, and now links its technical skills to and financial expertise and financial capital. The acquisition of EcoSecurities matches the trend of small carbon specialist firms being acquired by large and established investment banks, which can develop emissions trading as a new source of investment and revenue. The merger allows for the financing of CDM projects and development of a CER revenue stream to be incorporated into established financial logics and to be managed by JP Morgan Chase. Indeed in justifying the acquisition JP Morgan Chase suggested that "EcoSecurities had successfully realized value from sourcing, developing and trading emission reductions" (Reuters 2009). By bringing capital investments to developing projects and sourcing emissions credits to Europe, carbon aggregators create a new geography of investment. Yet, the aggregators are ultimately managed by and bring these new avenues of investment back into established financial geographies.

Brokers shape regulation, make markets (in connecting clients and developing financial instruments) and bring clients into the markets. A leading carbon brokerage is Cantor CO2e, a subsidiary of Cantor Fitzgerald. The main strategy of the brokerage is to **make markets** by linking buyers and sellers, advising their strategies of trade and influencing the structure and shape of emissions commodities and emissions trades. CantorCO2e provides a range of other financial services including strategy consulting, facilitating auctions of credits, negotiating contracts, introducing investors to projects and structuring forward sales to enable project developers to fund their investments. To some extent the provision of these services has helped to generate the emissions markets. The regulatory agencies define the property rights of trade, but intermediaries such as the brokerage lay the foundations and create standards for exchange. CantorCO2e has played a considerable role in thereby defining the shape of global emissions markets:

> CantorCO2e – its staff and its predecessors – has been at the forefront of the development of environmental markets since they were first conceived. We have given thousands of hours of our time to develop markets that work financially, while maintaining environmental integrity. We have helped design all of the world's major environmental trading schemes – we have developed market rules, developed methodologies, advised on standards – and of course we have been instrumental in transferring billions of dollars to environmental projects world-wide (CantorCO2e 2011).

As CantorCO2e claims, they and other brokerages have linked channels of finance in the financial centers to new avenues of investment and revenue generation in emissions trading. In this way the brokerages also provide considerable innovation in their ability to structure carbon products such as futures contracts that mirror other types of commodities.

The company balances its carbon brokerage with operations in energy and innovation markets. The overlap between products such as carbon emissions and oil commodities allows the company to enhance its influence and to bring clients to the carbon markets. The company explains: "CantorCO2e brings new energy to the marketplace, enabling clients to execute the emissions leg of the trade alongside the oil, and at the same time looking forward to renewable energy and biofuels" (CantorCO2e 2011).

Due to the production of basket commodities (structured financial instruments that incorporate several different commodities into a single product), carbon emissions markets closely track the price of oil and other energy commodities (Kossoy and Ambrosi 2009). In shaping the very format of the markets from the methodologies of developing credits, to the mechanisms of trading to the structure of the financial instruments, brokerages such as CantorCO2e have leveraged considerable power over the markets. As in the case of the carbon aggregators, the brokerages help to define the markets and to nest them in existing financial logics and existing institutions. CantorCO2e remains after all a subsidiary of Cantor Fitzgerald. These financial actors structure a new avenue and new geography of investment away from production towards abstracted sources of financial capital.

3.2.4 New Geographies of Production and Mechanisms of Valuation

The CDM directly moves value across regions. The point of the carbon reductions is that energy efficiency is cheaper to accomplish in developing countries because they are less efficient. The low hanging fruit, activities such as switching lighting, generating electricity from landfill gas, and retrofitting buildings are much cheaper options than renovating utility infrastructure or developing new energy technologies, which are the only options left to more efficient countries (Creyts 2007). As a result lower cost energy efficiency projects from developing countries are used to offset emissions from developed countries. In other words, there is a movement of efficiency programs from the global North to the global South, and through programs such as CDM energy improvements move from countries of Western Europe to developing countries such as China, India and Brazil. While the CDM allows for the transfer of resources from Europe to these developing countries, there are concerns that the developing countries will be left worse off in the future when they are subject to emissions regulation, because they will have sold the low-hanging fruit and will experience a greater share of the costs to make the same reductions their European predecessors have already made (Lohmann 2009; Leichenko, OíBrien et al. 2010).

Additionally, the nature of the financial exchange is such that developing countries do not receive the full value of these initiatives. A large percentage of the

costs associated with the exchange of CERs are not the production of emissions reductions but rather the transaction costs. In addition to the standard transaction costs of search, negotiation and enforcement, CERs experience a number of regulatory costs associated with the monitoring, evaluation and verification of their existence (Chadwick 2006). The size of transaction costs is specific to each product; however in extreme cases at the outset of the CDM in 2005 credits were being produced for several cents or a few euros in places like China and sold on to the European market for 20 euros. Legal firms and brokerages that were bringing the products to market in Europe were securing the vast mark up. In response the Chinese government set a price floor of 8 euros per ton on CERs produced in China in 2005. For reference, CERs currently trade at 12 euros per ton. Although the credits are produced in disparate geographies, the majority of the firms that accumulate capital from transaction costs are located in financial centers such as London and New York. As a result the offset and allowance products concentrate capital in these financial centers.

It is difficult to measure the impact of emissions trading on emissions reductions in isolation of other factors such as economic change. Beyond their connection to potential emissions reductions, the credits themselves have no material use. They are purely products of exchange. They can be exchanged either for cash value or to meet a regulatory requirement. As such the credits represent the embodiment of value into processes of exchange. Not surprisingly, the largest motivational factor for the trade of CERs is financial return (Betz, Rogge et al. 2007). Furthermore, the financial value of the credits is artificial. Without the regulatory regimes (in this case primarily the EU ETS) that underlie and create demand, the value of the allowances would cease to exist, and the value of the offsets would be uncertain.

At the primary level the credits only have value so long as there is a regulatory requirement to reduce emissions. However, even this tangible connection to a use value of regulatory requirement becomes obscured once the credits are abstracted as derivatives. Here the value of the credits lies solely in the parameters of hedging against price fluctuations and other types of risk. Although derivative credits may keep their value irrespective of the requirements underlining the base commodity, the value of hedging against risk is itself to some extent useless if the credits themselves cease to exist. In any case, as with patent markets, the carbon emissions markets represent alternative sites of investment that allow for the abstraction of capital and its quick turnover and accumulation back into the financial centers.

4. Conclusions and Policy Implications: *Versus the Regions*---The Opportunity Costs of Fictitious Capital

It is widely acknowledged among policymakers, industry actors, and academic observers that the lessons of the financial services crises of the late 2000s have not been fully understood or applied to regulatory reforms. This awareness underscores the importance of research on the exchange and codification of

intangible assets and the ways in which regulatory regimes shape the firm strategies of both intermediary firms and lead firms. This analysis is a step in that direction. However it is by no means a complete assessment of these complex cases. That being said, this analysis underscores several key points that serve as guideposts for future research.

First, large, integrated, TNCs play a key role in both of these emerging markets. Such firms (including but not limited to LG, Samsung, Nortel, Goldman Sachs, GE and Microsoft) finance the acquisition of IP and carbon emissions credit assets by third party intermediaries and set the strategic priorities in each market. In other words, TNCs determine which assets are acquired and thus which assets gain value. TNCs should not then be viewed as 'market takers' in this context but as 'market makers.'

Second, while this debate about the role of TNCs is not new, it is important to acknowledge that the IP markets and carbon emissions credit markets are operating just like markets for other financial instruments (Dicken and Malmberg 2001; Agrawal and Cockburn 2003; Christopherson and Clark 2007a). The public policy interests in innovation and sustainability that shape the governance structures that assign these assets particular property rights do not alter the fundamental operation of these assets in---and as---capital markets. In other words, underlying policy values should not be confused with the operations of financial markets.

Third, as our analysis demonstrates, TNCs are shaping the regulatory frameworks that create and govern these markets. And, they are subsequently using their leverage in the emerging markets to set priorities for investment (Christopherson and Clark 2007c). Because these markets are essentially speculative---markets we characterize explicitly as 'fictitious capital markets'---the value of the underlying assets is determined by those who are willing to pay.

As an illustration of how intertwined the financial services industry and speculative capital investment is with these emerging assets, it has recently come to light that US mortgage giant Fannie Mae and carbon brokerage CantorCO2e patented a 'collateralized carbon obligation' in 2005 with plans to link energy improvements in mortgaged homes to the exchange of carbon credits once a regulated market was created in the US. The collateralized carbon obligation was designed to operate as a mirror of the collateralized debt obligations, which have been implicated as a source of the recent financial crisis (Corsi 2010).

Fourth, aside from extending investment opportunities for TNCs and creating exotic financial instruments, these emerging markets produce a set of small business services intermediaries operating very much as they do in the financial services industry more broadly. In the emerging markets for carbon emissions credits and IP, these intermediary firms are often initiated and later absorbed by large client firms. They are highly specialized investment actors with the dexterity to adapt their firm strategies to both the needs of client firms and shifts in the policy environment. They are concentrated in financial services hubs (London and New York) with some additional distribution towards high-tech nodes where venture capital intermediaries are a key part of the labor market.

Finally, there are implications of these intangible assets for small, innovative and emerging firms interested in the *production* of critical commercializable

technologies. It is hard to argue that these assets, and the property rights that create them, lower barriers to entry for small firms. Further, the acquisition and pooling of IP apart from the underlying production capacity of the firm where the IP was developed minimizes the need for venture capital investment in risky and unproven start-ups. While the acquisition of high-tech start-ups by large firms when an innovation becomes commercially valuable is not new, this emerging IP market allows large firms to acquire the IP from start-ups before they start at all (and at a lower price as the value of the IP is potential commercial viability rather than actual commercial viability). This is a particular policy concern when it comes to the development of green and sustainable technologies by small firms that could easily be stymied by this web of barriers to commercialization set up by public policies and the strategic actions of TNCs and intermediaries.

In addition to the issue of power asymmetries between large and small innovative firms, these markets also present another barrier to investments in both established and emerging practicing entities. With the ongoing development of viable and relatively secure (in terms of property rights protections by regulatory regimes) sources of investment in intangible assets, investors have fewer and fewer reasons to invest in production. Production has both a slower internal rate of return and less liquidity. In other words, these financial instruments carry with them significant opportunity costs for the broader economy and particularly for those regions outside of the network of global capital flows. The disembodiment of fictitious capital from places of production suggests profound implications for development policy as it amplifies existing patterns of uneven development.

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Chart I: Intellectual Property Markets

THE INTELLECTUAL PROPERTY MARKET	FIRM NAME	TARGETED TECHNOLOGY CLASSES	MEMBERS/INVESTORS	FIRM STRATEGY	LOCATION(S)
Defensive Patent Aggregator	ALLIED SECURITY TRUST	Imaging, software, telecom, storage, circuits, medical, network, datacom	▪ 7 of the original 11 members: Sun Microsystems, HP, Cisco Systems, Google, Ericsson, Motorola, and Verizon ▪ 18 total members as of 01/2011 including: Avaya, IBM, Intel, Oracle, Philips, Research in Motion	▪ "Catch and release" model: ▪ Identifies and purchases high tech patents on the open market ▪ Sells/Auctions through intermediaries like Red Chalk Group, Patent Profit Int'l, Pluritas ▪ Promises no profits for the trust and no lawsuits ▪ Members define interests	NJ
Defensive Patent Aggregator	RPX CORPORATION	Consumer electronics and PCs, e-commerce and software, media content and distribution, mobile communications and devices, networking, and semiconductors	▪ Recent IPO; trades on NASDAQ as of May 4, 2011 ▪ Original Investors include: Kleiner Perkins, Charles River Ventures and Index Ventures ▪ 77 members as of 1/2011: Cisco, IBM, Dell, HP, Intel, Motorola Mobility, Novell, Palm, Qualcomm, Red Hat, RIM, Microsoft, Nokia, SAP, Verizon, Walgreens, Atheros Communications, Broadcom, Hynix Semiconductor, Integrated Device Technology, Sony	▪ "Patent Troll Insurer" ▪ Has pledged never to assert or litigate the patents in its portfolio ▪ Holds over 1,500 US and international patents and patent rights ▪ Licenses patent rights in its portfolio back to members ▪ RDX team defines interest	SFO
NPE Tracking and Consulting	PATENT FREEDOM	Semiconductor, software applications market, financial services, Communications Equipment, System Infrastructure Software Market, Communication Services, Computing, wireless, software applications development and deployment market, consumer electronics, imaging, industrial manufacturing, components, consumer goods, biotech, medical devices and pharmaceuticals, and retail	▪ Unknown members but membership is limited to "any operating company, law firm, or other entity that derives the majority of its revenues from the sale of products or services other than services involving the sale, enforcement, or licensing of intellectual property"	▪ Consultancy on NPE activities and patent portfolio and holding companies; subscription service based	?

THE INTELLECTUAL PROPERTY MARKET	FIRM NAME	TARGETED TECHNOLOGY CLASSES	MEMBERS/INVESTORS	FIRM STRATEGY	LOCATION(S)
NPE	INTELLECTUAL VENTURES MANAGEMENT LLC	Approximately 30,000 patents in agriculture, automotive, communications, computer hardware, construction, consumer electronics, ecommerce, energy, financial services, health technologies, information technology, life sciences, materials science, medical devices, nanotechnology, physical sciences, security, semiconductors, and software Primarily licenses in: software, consumer electronics, financial services, mobile phone, and ecommerce industries	▪ Licensees include HTC, Samsung, and SAP	▪ Generally has used investors to fund the acquisition of a large patent portfolio that generates licensing fees ▪ In 12/2010 filed its first patent infringement claims ▪ Previously associated with smaller start-up patent holding firms---Pragmatus AV LLC, InMotion Imagery Technologies, Oasis Research LLC, Webvention LLC, and Picture Frame Innovations who filed infringement claims on patents once owned by IV.	Bellevue, WA
NPE	ROUND ROCK RESEARCH LLC	Primarily computer memory chips: 4,500 patents acquired from Micron Technology Inc. 12/2010 (Micron retained license rights)	▪ Founded by John Desmarais	▪ 2nd largest patent holding company ▪ Represented by Desmarais LLP in lawsuits ▪ Non-practicing entities, or companies that don't sell the technology or services for which they hold patents,	Mount Kisco, New York
NPE	ACACIA RESEARCH	Audio/Video Enhancement, Computer Memory Cache Coherency, Computer Simulation, Credit Card Fraud Protection, Data Encryption & Product Activation, Digital Media Transmission (DMT®), Digital Video Production, Dynamic Manufacturing Modeling, Enhanced Internet Navigation, High Capacity Compact Disks, Image Resolution, Interactive Television, Laptop Connectivity, Multi-Dimensional Bar Codes, Network Data Storage, Resource Scheduling, User Activated Internet Advertising, Web Conferencing & Software Collaboration	▪ Largest publicly traded patent holding company ▪ Examples of licensees: AMD, Boston Scientific, Dell, Exxon, GE, Hewlett Packard, Hitachi, IBM, Intel, LG Electronics, Microsoft, Nokia	▪ Patent enforcement as revenue for business for investors and lawyers (Bryson, Daniels et al. 2004) ▪ Recent success in licensing large corporate patent portfolios: in the first three quarters of 2010 the company took in approximately $119 million (more than double same period a year before).	Newport Beach, CA (LA region)
IP Traders and Exchanges	IPX INTERNATIONAL	Any	▪ Founded by Ocean Tomo LLC	▪ "The world's first financial exchange focused on intellectual property" ▪ Provides financial products and services related to intellectual property, including expert testimony, valuation, research, ratings, investments, risk management and transaction and to create a marketplace for IP exchange ▪ Develops and OT300 index and asserts that 80percent of firm value is held in intangible assets (IP)	Chicago (offices in Boston, Greenwich, Houston, Orange County, Paris, and San Francisco)

Chart II: Carbon Markets

CARBON MARKET FINANCIAL SERVICE FIRM EXAMPLES	FIRM NAME	ACTIVE MARKETS	FIRM STRATEGY	INVESTORS/MEMBERS	HEADQUARTER LOCATION(S)
Carbon Brokerage	CANTORCO2E	▪ Operates on all the Kyoto markets (CDM, JI and European emissions trading), the USA compliance markets, and the voluntary carbon market ▪ Geographical active in: US, Canada, Asia/Pacific, Europe, Latin America	▪ Brokers carbon credit exchange ▪ Provide continuous and customized auctions ▪ Develops financial instruments ▪ Assists in carbon emissions foot-printing	▪ Wholly-owned subsidiary of Cantor Fitzgerald	New York and San Francisco
Carbon Financial Advisor/ Investor	CLIMATE CHANGE CAPITAL	▪ CCC's investment portfolios focus on the asset classes: Carbon Finance (most are CDM projects in China, India, South East Asia, the Former Soviet Union and the US); Private Equity; Property and Energy Infrastructure	▪ Investment manager and advisory group ▪ Manages funds with c. US$1.5 billion of commitments and aims to provide attractive returns to investors, demonstrating the financial opportunity associated with a low carbon economy ▪ Provides financial, strategic and policy advice to energy-intensive industries, financial institutions, clean technology companies and governments	▪ Acquired the business and assets of QualityTonnes (carbon aggregator) ▪ Manages the Ventus Funds, the largest group of funds specifically targeted at the UK renewable energy sector. ▪ Investors include some of the world's largest pension funds such as the Universities Superannuation Scheme, SNS REAAL N.V., Alliance Trust PLC, Mitsui and Co Ltd	London
Investment Bank	JPMORGAN CHASE	▪ Operate on CDM, JI, EU ETS and Voluntary markets ▪ Origination, sale and trade of carbon credits globally	▪ Finance CDM and JI Projects ▪ Manage carbon credit portfolio ▪ Provide advising and financial services to compliance and other carbon credit buyers	▪ In 2009 acquired carbon aggregator EcoSecurities	London and New York
Exchange	EUROPEAN CLIMATE EXCHANGE	▪ Trade of derivative contracts on three types of carbon credit: ICE ECX EU allowances (EUAs), ICE ECX Certified Emission Reductions (CERs) and the world's first ICE ECX Emissions Reductions Units (ERUs)	▪ Provide liquidity to the carbon markets ▪ Full service carbon exchange and clearing house ▪ Manage the product development and marketing for ECX Carbon Financial Instruments (ECX CFIs) ▪ Facilitate the trading, risk management, hedging and	▪ ECX is a member of the Climate Exchange Plc group of companies. Other member companies include the Chicago Climate Exchange ("CCX"). ▪ Climate Exchange Plc is listed on AIM on the London Stock Exchange, and was bought in April 2010 by Intercontinental Exchange (ICE)	London

			physical delivery of Emission Allowances and Certified Emissions Reductions units in the EU ETS		
Carbon Aggregator	ECOSECURITIES	▪ Active on CDM, JI and voluntary markets globally	▪ Sourcing and developing emission reduction credits from greenhouse gas emission reduction projects. ▪ Developing CDM emission reduction projects; selling carbon credits; carbon offsets and the voluntary market; ▪ CDM and JI methodology development ▪ Advisory and consulting services	▪ Wholly-owned indirect subsidiary of JP Morgan Chase.	Oxford