DEVELOPMENT, TRANSITION, AND CRISIS IN THE INTERNATIONAL SYSTEM, 1870-2009

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ABSTRACT

Heather-Leigh K. Ba: Development, Transition, and Crisis in the International System, 1870-2009
(Under the direction of Thomas Oatley)

Globalization expands markets and improves efficiency by increasing competition, which in turn fosters economic growth and development, but it also increases the risk of economic volatility and crisis. In this dissertation, I use complex systems theory, network analysis, and recent development in post-Keynesian economics to devise a systemic theory of financial crisis that links the structure and pattern of financial and trade interdependencies to the prevalence and virulence of financial crises. In Chapter 1, I outline the core theory, and I test it using network statistics, including a new measure of network centralization I develop based on the Opsahl et al (2010) measure of centrality. I employ a new type of network model, called the Temporal Network Autoregressive Model, that allows me to model country level characteristics as a function of system structure and to properly account for system-level interdependencies. My empirical findings from this analysis are several. First, I show that the prevalence of financial crisis increases as globalization results in a higher degree of connectivity and a less centralized distribution of economic activity between countries; Highly centralized systems reduce the likelihood that a country experiences a financial crisis. The scale of contagion, however, has decreased due to a higher level of economic hegemony on the part of the US in the post-WWII period. Second, countries which are more integrated into trade and capital markets are more likely to experience a financial crisis. Third, contagion from a financial crisis increases if it originates in the most central country. Fourth, the more a country trades with the hegemon, the more likely they are to experience contagion from a crisis originating there. Fifth, contagion originating from outside the hegemon is less likely to spread to countries that trade more with the hegemon. Finally, contagion that results from a crisis that originated outside of the most central country is more severe in non-hegemonic systems.

In Chapter 2, I elaborate and test an important implication of the theory I present in Chapter 1 using data from the 19th and early 20th centuries. In a globalized and hegemonically organized international economy, the economic fundamentals and policy choices of the hegemon often have spillover effects for peripheral economies. This is a well recognized dynamic of the contemporary political economy, but it was true during the first age of globalization as well. Motivated by literature examining the impact of the US macroeconomic conditions on other economies throughout the international system, applies the systemic theory of financial crisis from Chapter 1 to the long 19th century, when British hegemony reigned. I argue that a hierarchical distribution of economic activity in the international system during the 19th century meant that the financial cycle of Great Britain influenced the financial conditions in peripheral countries, ultimately helping to cause financial crisis. Evidence from financial crises which occurred in the long 19th century supports this theory.

In Chapter 3, I test the implication of my systemic theory of financial crisis during the contemporary period of globalization and American hegemony. Numerous scholars have studied the effects of the US macro-economy on the economies of peripheral countries. For example, they have examined the consequences of the US Federal Reserve discount rate changes for investment in developing countries. I argue the hierarchical distribution of economic activity in the contemporary international system also means that the financial cycle of the United States influences the financial conditions in peripheral countries that lead to financial crisis. Cross-sectional time series evidence from 1970-2011 using both quarterly and annual data supports this theory.

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My favorite part of an academic paper is the acknowledgements, for it is here that we are reminded of the truth that knowledge is never the result of individual effort; It is always, thankfully, a collective endeavor. So here, I take opportunity to thank the community of individuals who have contributed their time and energy to the development of my ideas. Fortunately for me, it is not a short a list.

My greatest debt of gratitude must go to my family, and in particular my parents, Monica and Raymond Sommerville. Without the love and support they gave me, I would not have the confidence or motivation to go forth in the world and attempt to offer to it whatever ability I possess. When I was a single parent, struggling to defend my prospectus, my father, who was battling terminal cancer, lived with me and helped me to care for my son. My mother worked a full time job and ran a business so I did not have to worry too much about whether my graduate stipend and part time job paid me enough to meet all of my and my son's needs. As parents and role models, they exceeded every possible expectation anyone could have of them. I am incredibly fortunate in this regard.

My next round of gratitude is best prefaced by an anecdote. Growing up, my mother, who was an ardent feminist, repetitively imparted to me a bit of relationship wisdom: "Heather," she would say, "there are only 10 good men on the planet at any one time. If you find one, you've beaten the odds. Keep him." As I have gotten older, I realize she may have been a bit off in her estimate. Regardless, I somehow lucked out completely, and found 6 off them! Five of these six let me keep them on my dissertation committee! To Timothy McKeown, Thomas Carsey, Justin Gross, and Cameron Ballard-Rosa: your intellect, creativity and generosity have not gone unnoticed or unappreciated by me. I am truly lucky to be the recipient of your advice and feedback! To Thomas Oatley, my adviser and intellectual idol (second to Susan Strange, of course), I fear I will never be

able to repay you for the kindness, patience, and support you have given me these past 5 years – I can not thank you enough. Academia can be a nasty place, but you five are a refuge. Last, but certainly not least, on the "10 good men on the planet" list is Wilfred Herman Drath IV. So many times in my life I wondered if I would find an equal to share it with (especially after a divorce and a longer-than-desired bout as a single mother). I don't know what I did to deserve you, but having you around has made my life and Bo's better than I ever hoped (less the million dollar bank account of course, but no one's perfect). I can't thank you enough for being an incredible partner and friend.

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Development, Transition, and Crisis in the International System

1.1 Introduction

Following the bursting of China's housing bubble in 2015 and a subsequent deceleration in Chinese productivity, Brazil's already slow growth collapsed completely, unemployment rose, and private sector wages fell. Lower Chinese demand for Brazilian exports such as oil, iron ore, and soy beans was a major cause of the economic slowdown. At the same time, Chinese foreign investment in Brazil declined as nervous investors turned instead to traditional investment safe havens such as the US real estate market (Searcy and Bradsher 2015). Today, political crisis looms large in Brazil and the country now seems to teeter on the brink of default. Brazil's recent downturn illustrates the downside of economic globalization. Globalization expands markets and improves efficiency by increasing competition, which in turn fosters economic growth and development, but it also increases the risk of economic volatility and crisis.

The financial contagion generated by the Asian financial crisis and the 2008 financial crisis led economists and political economy scholars to recognize and examine the dynamics of volatility produced by contemporary levels of economic globalization. For example, scholars have examined the role of trade and financial linkages in transmitting contagion from crises (Abeysinghe and Forbes 2001; Glick and Rose 1999; Blanchard et. al. 2010). Oatley et al (2013) link the structure of international financial linkages to the virulence of contagion from the 2008 financial crisis. Contagion is likely a major reason for the increased number of financial crises since the mid-1980s (see figure 1). What is less appreciated, however, is the role these linkages play in transmitting or diffusing the conditions that help cause crises in the first place. Not only are countries that are more

integrated more likely to experience contagion in the wake of a crisis, but they may also be more likely to experience large fluctuations in external financing that affect domestic credit cycles and real sector productivity, fostering credit and asset bubbles that precede financial crises.

In this paper, I present a systemic theory of financial crisis that links the structure and pattern of financial and trade interdependencies to the prevalence and virulence of financial crises. My main motivation for this theory is the Hegemonic Stability Theory (HST), the foundational research program in the field of international political economy, and one of the first system-level theories of financial crisis. Charles' Kindleberger's *World in Depression* (1973), the basis for the broader IPE research program, argued that the depth and severity of the Great Depression was attributable to the structure of the international system, conceptualized as the distribution of power. More specifically, Kindleberger argued that the stability of the international system requires a single dominant state (a hegemon) to dictate the rules of interaction among states in the international system and to fulfill five counter-cyclical functions in the wake of an international financial crisis: providing a market for distress goods, producing a steady if not counter cyclical flow of capital, maintaining a re-discount mechanism for providing liquidity when the monetary system is in crisis, managing the structure of foreign exchange rates, and providing a degree of coordination of domestic monetary policies. According to Kindleberger, when a hegemon declines, it will be less able and less willing to provide these public goods. Thus, a declining hegemon is able to stem the tide of a financial crisis. These dynamics, concluded Kindleberger, make hegemonic systems more stable than non-hegemonic systems.

The HST research program was ultimately abandoned after scholars showed that the logic of collective action theory did not require the existence of a hegemon for public goods to be provided (Snidal 1985). However, there was an additional, though more implicit, structuralist dimension of Kindleberger's theory not evaluated by subsequent IPE research program. I argue that when interpreted through the lens of complexity and network sciences, Kindleberger's HST proves prescient.

The application of complex systems theory and network theory to the field of IPE is a recent development. Oatley et al (2013), in a pioneering paper, map the international financial system using network analysis and bilateral data on international bank claims and cross border portfolio investment flows. They demonstrate that the international financial system indeed exhibits characteristics of a complex adaptive system, in that multiple simple actors (banks, individual investors, governments) interact with one another without a central coordinating mechanism in response to both external stimuli and each other. When aggregated, these interactions have a persistent, hierarchical structure. Furthermore, they explain that the hierarchical structure of the financial system holds implications for how and why the 2008 financial crisis was so virulent. They emphasize that the "robust yet fragile" nature of the hierarchical structure of the international financial system means that crises that originate in countries at the core of the system are more likely to spread through the entire system, but that crises originating in less integrated countries produce little contagion. In other words, hierarchical, hegemonic, systems are highly stable.

When interpreted through the lens of complex systems theory, the causal relationship identified by Kindleberger between the structure of the international economy and its instability at the time of the Great Depression is perfectly logical. The decline of Britain and the ascendance of the Unite States within the international economy during the first quarter of the 20th century meant that the structure of the international economy became, for a period, flatter, or less hierarchical. Not incidentally, the international system proved quite susceptible to an economic shock that occurred in one of the two most central countries. While Kindleberger may have placed undue emphasis on the provision and role of stimulative policies as a mediating variable for achieving stability, the core proposition of his theory is valid for many of the same reasons he highlighted throughout his historical exegesis: the dynamics of the complex economic interdependencies that constitute the global economy. [1]

[1]In Kindleberger's theory, the structure of economic exchange in the international economy(hegemony), not merely relative size, made the implementation of counter cyclical policies during British Hegemony both possible and more likely. For example, Kindleberger argues that while Britain

The remainder of this paper is structured as follows. In subsection two, I review existing theories of financial crisis and position my own theory within the post-Keynesian economic paradigm. Re-articulating the hegemonic stability theory requires micro and macro economic theories of crisis, consistent with Charles Kindleberger's thinking on the subject. Advances in post-Keynesian economics have accomplished this. In subsection three, I present the basic tenets of my theory, projecting post-Keynesian economic theories of crisis on to the international level and applying the insights of complex systems theory and network science to understand how the structure of the international economy can facilitate or attenuate financial crises. I then propose several testable hypotheses. In subsection four, I use network statistics to describe the evolution of the international system since 1870, and develop network measures that operationalize the variables I hypothesize to be at work. In subsection four, I employ a new network model developed by Leifeld and Cranmer (2016) to formally test my hypotheses regarding the causal role of the structure of the international economy in causing financial crises. In subsection five, I rely on logistic and linear regression to demonstrate a correlation between the structure of the international economy, countries' positions in it, and the dynamics of financial

made a conscious decision to avoid protectionism, it was not a philanthropic decision. Rather, Britain's willingness to maintain liberal trade policies reflected the size and strength of its export sector compared to its import-competing sector: "Maintaining a market for distress good can be regarded as another form of financing. [...] lph[;Britain clung to free trade from 1846 [...] until 1916. After 1873, she was not growing rapidly, but continued to adhere to free trade since her declining industries were exporters rather than importcompeters. [...] The contrast is with SmootHawley Tariff Act of 1930 (p293-4)." This feature of Britain's domestic economy was inextricably related to its position among other countries in the world economy. As the manufacturing capital of the world, Britain imported raw materials and exported manufactured goods. Britain's counter cyclical lending was also a function of its relative position. During periods of domestic economic expansion, foreign lending was reduced, and replaced with increased purchases of imports from abroad. During periods of recession, Britain increased foreign lending. Furthermore, he writes: "It happened that in Britain, from 1873 to 1913, foreign lending and domestic investment were maintained in continuous counterpoint. Domestic recession stimulated foreign lending; boom at home cut it down. [...] In the 1920s, United States foreign lending was positively correlated with domestic investment, not counterpoised. (p.293)" British decline and American ascendance meant these dynamics were upended – Sterling lost its position as the predominant reserve currency, London was no longer the world's major financial center and creditor, and the two countries conducted similar levels of trade. Therefore, no single country had an incentive to maintain free trade, or provide counter cyclical financing. Furthermore, it became more difficult for a single country to provide the lender of last resort function because competition for gold reserves increased, as reserve levels became both tighter and more equally distributed. This meant that greater cooperation among multiple states would be necessary to counteract the negative effect of economic shocks on productivity, and while possible, this cooperation ultimately proved unattainable (For a discussion of these changed dynamics see Eichengreen 1984 and 1987).

contagion. My empirical analysis shows that the prevalence of financial crisis throughout the network increases as globalization results in a higher degree of connectivity and a less centralized distribution of economic activities between countries. Moreover, the scale of contagion resulting from crises has declined over time, and this is attributable to a consolidation of American economic hegemony over the course of the 20th and early 21st centuries. My results show that countries who trade more with the hegemon are more likely to catch contagion from it, and less likely to catch contagion from crises originating elsewhere.

1.2 Orthodox and Heterodox Theories of Financial Crises

The 2008 financial crisis motivated a great deal of research in the fields of economics and international political economy on the causes of financial crises . In the years since the Great Recession, scholars have advanced our understanding of the *international* determinants of financial crises and have developed heterodox micro and macro economic theories of financial crises. This new reserach provides a stronger theoretical foundation to earlier literature on financial crises by Hyman Minsky and Charles Kindleberger. Generally, theories of financial crisis focus on either the domestic or international level, and are premised on either orthodox neoclassical/neo-Keynesian economics (also known as the new neoclassical synthesis or NNS) or more recent post-Keynesian economic theories. The theory presented in this paper builds on recent developments in post-Keynesian economics, projecting the micro and macroeconomic theories on to the international level of analysis with the goal of understanding how the economic cycles of national economies interact in the global economy to produce financial crises. I will review this literature more in-depth while giving a broader overview of NNS and domestic-level explanations of financial crisis.

Most mainstream economic theories of financial crisis are premised on NNS economic models. NNS economics takes a mostly static view of the economy and financial markets, in which aggregate market activity is interpreted as a linear function of individual "representative" market actor behavior, which is rational, fully (or partially) informed,

and utility maximizing. Dynamic stochastic general equilibrium (DSGE) models of the macro-economy, the efficient market hypothesis theory of financial markets (EHM), and the capital asset pricing model (CAPM) are the archetypal models of the NNS paradigm that dominates mainstream economics and finance.

The chief limitation of NNS economic theories of financial crisis lies in the fact that the economic theories on which they are premised predict that large outlier events, such as financial crises, should not occur. In fact, the cyclical behaviour of financial markets in general is not well explained by equilibrium economics. Cycles are, in essence, excess volatility, and this excess volatility suggests that prices can move above and below their real value for no fundamental reason. Instead, this volatile behaviour is dismissed as "animal spirits" or "mass psychology" (Shiller 2003, 84). According to the paradigm, massive events such as the sub-prime crisis, Black Monday (October 19, 1987), and the 1929 stock market crash are essentially statistical impossibilities. A large drop in the stock market such as the 22 percent drop of Black Monday is a twenty standard deviation event, which would be expected to occur only once every 260 million trillion years (Sornette 2003, 50). Thus, for adherents of the NNS, extreme market events must be a result of "exogenous shocks" because the probability that they develop endogenously is vanishingly small.

Domestic sources of exogenous shocks pervade most of the NNS research on financial crises. For example, the quality of financial institutions is a popular explanation. In recent years, though, scholars have turned their attention to international explanations, such as globalization. Arguably, the most common explanation for financial crisis within orthodox economics is the role of government, either the presence or absence of governmental institutions, or the nature of government regulation. Explanations that favor the role of government in causing financial crisis point either to the lack of a lender of last resort function (deposit insurance and liquidity assistance provided by a central bank), bank regulations such as capital adequacy ratios and exit rules, or changes in government regulation of bank and investment bank operations (Rochet 2009; Taylor and Quintyn 2002). A related strand of literature in political economy draws attention to the role of

regime type in determining many of these variables, such as the quality of central banking and financial industry regulation (Franzese 1999 and 2000; Keefer and Stasavage 2003). Alternatively, critics of regulation argue that such programs simply induce moral hazard and make banking crises more likely (Demirgüç-Kunt and Detragiache 2002).

Beyond institutional explanations, scholars have also focused on real macroeconomic, fiscal, and monetary conditions that produce banking crises (reversing the direction of causality from crisis causing a productivity shock to productivity shock causing crisis). Krugman (1979), for example, is an early example of research identifying either unsustainable levels of government debt or balance of payment problems as the cause of currency crises that eventually push the financial sector in to crisis. Similarly, research by Krugman (1999) focuses on the role of capital flows in determining exchange rates, which can affect the quality of financial portfolios. Kaminsky and Reinhart (1999) along with Reinhart and Rogoff (2010), study the incidence of combination (sovereign debt-monetary-financial) crises. There is also a broad literature in political economy that studies the effect of regime type and regime structure on fiscal policy, monetary regime choice, and trade and investment liberalization, which is relevant here as well. This literature considers how variables such as veto-players, ruling coalition strength, election rules and timing, transparency, democratic accountability, and political parties contribute to the policies and institutions that are often correlated with economic and financial instability(Broz 2002; Bernhard, Broz, and Clark 2002; Bernhard and Leblang 2002; Hallerberg 2002; Stasavage 2003). With regard to externally generated financial crisis, political institutions and regimes are clearly a piece of the puzzle. The broader question, and the one I am concerned with in this paper, is whether there is an inherent quality of markets, as human systems, that makes them prone to crisis, such that industry regulation, and monetary and fiscal policy choices may matter at the margin, affecting scale, or timing of the crisis but not acting as the primary impetus.

While most theories of financial crises that exist within mainstream economics focus on domestic causes (institutions, regulation, government intervention, fiscal policy and monetary policy), the 2008 financial crisis spawned a wave of research examining

the *international* economic drivers of financial crisis. Ben Bernanke, Chairman of the US Federal Reserve at the time of the 2008 financial crisis, proposed that the crisis was caused by a global savings glut, generated by the export led growth models and artificially low currency values of Asian countries like China (2005, 2007, 2010). This global savings glut fueled the US current account deficit, and, he argued, the corresponding surge of capital inflows funded the housing bubble that preceded the crisis. His theory was complemented by new research on the role of net capital inflow surges. This research proposes that large surges of international investment followed by a "sudden stop" of investment precipitate financial crises by yielding higher interest rates, currency depreciation, and slower growth(Reinhart and Reinhart 2008; Caballero 2010; Kose et al 2009; Fratzscher 2012).

Largely due to the macroeconomic framework that undergirds them, these recent theories of economic crisis have some major shortcomings. First, while Bernanke speculated that savings rates in Asia funded the US housing bubble, over half of the gross capital inflows to the US in the lead up to the crisis came from Euro area countries and the UK (25 percent from here alone), not China or emerging Asia. Following the crisis, it was capital flows from Europe and Canada that collapsed, not flows from Asia (Borio and Disyatat 2011, p.15-16). Second, while evidence of a correlation between net capital flow surges, stops, and crises is strong, there is still limited theoretical basis within mainstream economics to explain why net surges of investment (synonymous with current account imbalances) should cause financial crisis. While a current account imbalance may be an indication of fiscal deficiencies (high national debt) which can lead to productivity problems, current account imbalances can also be completely benign (as most economists thought they were in advance of the 2008 financial crisis). There is a laundry list of countries with current account surpluses (net flow deficits) that have experienced financial crisis.[2]

[2]"As highlighted by Hume and Sentance (2009), countries with large current account surpluses also had credit booms, including China from 1997 to 2000 and more recently, India from 2001 to 2004, Brazil from 2003 to 2007 and, one could add, economies in the Middle East in recent years. Moreover, going further back, the huge credit boom that preceded the banking crisis in Japan also occurred against the backdrop of a large current account surplus. And the same is true of the major boom in the 1920s

If, as orthodox economics indicates, only the dynamics of the real economy (savings and investment) matter for explaining financial crisis, then it may make sense to focus on net capital flows and current account imbalances. If, however, the financial sector is itself an influential institution within the real economy that plays a critical role in determining growth and productivity by providing financing (which is different, though related to savings and investment, because it is not, in fact, constrained by savings), such measures will not be sufficient. As critics such as Forbes and Warnock (2012), Broner et al (2013) and Milesi-Ferretti and Tille (2011) have noted, net flows and current account balances provide limited information about the state of a country's financial system. First, net flows cannot distinguish between changes in domestic and international investors. Second, current account deficits and net flow measures capture only claims on a country arising from real trade in goods in services. Financial crises are primarily liquidity shortages, the result of over-leveraging within the financial system, but net flows and current accounts tell us very little about how a country is involved in international financial intermediation (borrowing and lending) since purely financial transactions are netted out of these measures. The fact that the financial system is often the source of instability itself, as was clearly the case in many of the greatest financial crises in history, suggests the need to assess the state of the financial sector directly, as well as its purely financial transactions with financial sectors in other countries. Doing this may require thinking outside of the NNS box. [3]

There have long been critics of equilibrium economics, and the frequency of financial crises over the past century and a half has long been acknowledged as the Achilles heel of the NNS paradigm.[4] Furthermore, even its proponents have acknowledged that the

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that preceded the banking crisis and Great Depression in the United States (Eichengreen and Mitchener 2003)." Borio and Disyatat 2011, p.6

[3]See Sornette, D. (2003), Why Stock Markets Crash (Critical Events in Complex Financial Systems), Princeton University Press, Princeton, NJ. for discussion of exogenous versus endogenous causes of financial crises

[4]Morishima, Michio. "Equilibrium, Stability and Growth" (1964) ; Debreu, G. (1974), "Excess Demand Functions", Journal of Mathematical Economics 1, 15–23. ; Sonnenschein, H. (1972), "Market Excess Demand Functions", Econometrica 40, 549–563.; Saari, D. G. and C. P. Simon (1978), "Effective Price Mechanisms", Econometrica 46, 1097–1125. ; Sornette, D. (2003), Why Stock Markets Crash

microfoundational assumptions of this economic orthodoxy are less than accurate.[5] Alternative paradigms, though, have been few and far between. Since the 2008 financial crisis, this is beginning to change. A heterodox school of economics called post-Keynesianism has begun to apply advances in complexity and network sciences, accompanied by a more diverse mathematical and statistical toolkit, to the challenge of modeling and analyzing business and financial markets. Arguably, this is the closest any heterodox theory of economics has come to providing a real alternative to equilibrium economics.

Post-Keynesian economic theories embrace an altogether different set of assumptions about market actors. In post-Keynesian economics, market actors exhibit a heterogeneous set of interests, have access to only incomplete information, and sometimes utilize imperfect information processing strategies, especially those based on heuristics. Post-Keynesian economic theories assume that markets are created, as other complex systems are, via a non-linear aggregation process. This non-linear aggregation process de-emphasizes the importance of microfoundations and modeling individual level interactions. However, there are several scholars who have worked to model this non-linear aggregation process using the tools of agent based modeling. Most notably, the work of Didier Sornette has provided insight as to how individual attributes affect asset exchanges such that financial bubbles can occur (Harras and Sornette 2011; Sornette 2014). Instead, post-Keynesian theorists opt to model markets at the system level, as a dynamic flow of money between groups of market actors who may behave similarly. To date, post-Keynesian economics is still a hodgepodge of heterodox economic theories, coalescing mainly around their rejection of equilibrium economics, as well as their acceptance of the theory of endogenous money creation. A brief explanation of the theory of endogenous money is warranted because it is essential to understanding the Post-Keynesian theory

(Critical Events in Complex Financial Systems), Princeton University Press, Princeton, NJ. Minsky, Hyman, 1982a. Can it happen again? A reprise. Challenge 25 (3), 5–13. ; Minsky, Hyman, 1982. Can "It" Happen Again?: Essays on Instability and Finance. M.E. Sharpe, Armonk, N.Y

[5]See Sharpe's self-assessment in Sharpe, W.F. 1970, Portfolio Theory and Capital Markets, McGraw-Hill, NY, 104-113; and Fama and French's evaluation in which they admit: "Unfortunately, the empirical record of the model is poor-poor enough to invalidate the way it is used in applications. The CAPM's empirical problems may reflect theoretical failings, the result of many simplifying assumptions." (2004:25-32)

of financial crisis.

The Canadian economist Basil Moore is the primary theorist of endogenous money (Moore, 1979, 1983, 1988). In contrast to the orthodox 'money multiplier' model of credit money creation, where base money is created by the central bank and then multiplied by banks as they extend credit, Moore argued (citing Holmes 1969), that: "In the real world banks extend credit, creating deposits in the process, and look for the reserves later." (Alan Holmes 1969, p. 73) This observation was empirically confirmed by Kidland and Prescott, who conclude:

> There is no evidence that either the monetary base or M1 leads the cycle, although some economists still believe this monetary myth... if anything, the monetary base lags the cycle slightly... The difference of M2–M1 leads the cycle by even more than M2, with the lead being about three quarters. (Kydland and Prescott, 1990, p. 12)

Furthermore,

> The fact that the transaction component of real cash balances (M1) moves contemporaneously with the cycle while the much larger nontransaction component (M2) leads the cycle suggests that credit arrangements could play a significant role in future business cycle theory. Introducing money and credit into growth theory in a way that accounts for the cyclical behavior of monetary as well as real aggregates is an important open problem in economics.

In NNS economics, the problem of incorporating money in to macroeconomic models is long standing, and attempts to do so often produce results that do not match empirical data (Bhattacharjee and Thoenissen 2007); Money, in the orthodox framework, is often not modeled explicitly. It is assumed to serve the function of a commodity-based money, which ultimately implies that an economy is virtually indistinguishable from a barter system. The challenge of building an integrated financial macroeconomic model was taken up by the Italian economist Graziani, (2003, 1989, 1990, 1995), who tackled the problem by building a flow model of the economy where token money is exchanged between payers and payees, but mediated by banks, who are ultimately responsible for creating the token money used. The banking system thus makes the exchange of commodities and labor possible by creating money. Graziani's simple accounting based model of the

macro-economy used standard calculus-based mathematics and suffered from an inability to explain the growth or expansion of the money supply, and thus how borrowers can repay debt and make profits (Keen 2006). However, Graziani's model marked a transformation in the economic role of the financial sector, from one of neutral mediator, merely translating savings to investment, to that of money creator.

With this transformation of roles for the banking sector, comes the ability of banks to affect economic growth, interest rates, demand for assets, and, in turn, asset-prices. Most notably, this makes possible the formation of bubbles, as Hyman Minsky (1977,1992) and Charles Kindleberger (1978, 2005) originally conceived of them. The original post-Keynesians, Minsky and Kindleberger both argued that capitalist market systems tend to experience strong cycles of debt inflation and deflation, perpetuated by feedback among market actors who exhibit an air of *irrational exuberance*. For Minsky, the financial system was the key to understanding financial bubbles since banks allocate credit which make production and economic growth possible. Credit creation, according to Minsky and Kindleberger, is a function of investor and producer expectations, and being as these are rarely, if ever, fully informed and fully accurate, they can get carried away. This means that positive feedback occurs among market actors as credit facilitates investment, which stimulates exchange in commodities, employs labor (generating wages), and increases demand along with consumption and/or savings. As production expands and growth speeds up, demand for assets intensifies as expectations of positive returns on assets increases, completing the positive feedback loop and inducing a state of disequilibrium in the economy. For Minsky and Kindleberger, cycles and bubbles were a natural feature of capitalist markets because individuals were fundamentally less than rational – limited in foresight and processing capacity, and inclined to imitate each other. The largest advances in the field of Post-Keynesian theory have been made by economist Steve Keen, who has successfully employed a double book-keeping system dynamized by the application of differential equations to produce a monetary macro-economic model that endogenously produces the types of business and financial cycles actually observed in economic systems (Keen 2009a,b, 2008, 2010, 2011).

The central insight of post-Keynesian economics is that economies experience financial cycles and that these financial cycles ultimately cause financial crises. Contemporary scholars who study financial cycles define them similarly to business cycles – the pattern of expansion, peaks, contractions, and troughs that occur in an economy's asset prices (with an emphasis on property prices) and credit prices(Drehmann et al., 2012). These cycles are the result of "self-reinforcing interactions between perceptions of value and risk (property prices), [and] attitudes towards risk and financing constraints (credit), which translate into booms followed by busts." (Borio 2014) The financial cycle is distinct from the business cycle, in that it is much longer (16 to 20 years versus 8 years for the average business cycle) but it sometimes coincides or aligns with the business cycle, because financial and real sectors are inextricably linked.[6] The period from 2000 to 2007 in the United States is an example of an alignment of the two cycles. As was also the case in 2008, the peak of financial cycles are usually associated with a period of financial distress. Figure 1.1 is an attempt by Drehmann, Borio and Tsatsaronis (2012) to plot the US financial cycle from 1970 - 2012. They utilize turning-point analysis and frequency-based filters applied to data on credit, the credit-to-GDP ratio, property prices, equity prices and an aggregate asset price index that combines property and equity prices to construct the time-series.

Drawing on the insights and terminology of complex systems science more generally, we can further understand the existence of financial cycles as the natural bi-product of complex systems with two distinct features: balancing feedback loops and goal seeking agents (Meyers 2010). Within financial markets, agents buy and sell with the goal of making a profit. Balancing feedback loops imply the presence of both positive and negative feedback loops. In the context of financial markets, positive feedback loops occur when the purchase of one type of asset motivates other agents to purchase the same type of asset, a behaviour known as herding. Negative feedback loops constrain the positive feedback loops. Two possibilities for negative feedback loops in financial markets in-

[6]In standard neo-Keynesian economics the mechanism for this is Bernanke's Financial Accelerator, in Post-Keynesian economics this is explained through the process of endogenous money creation

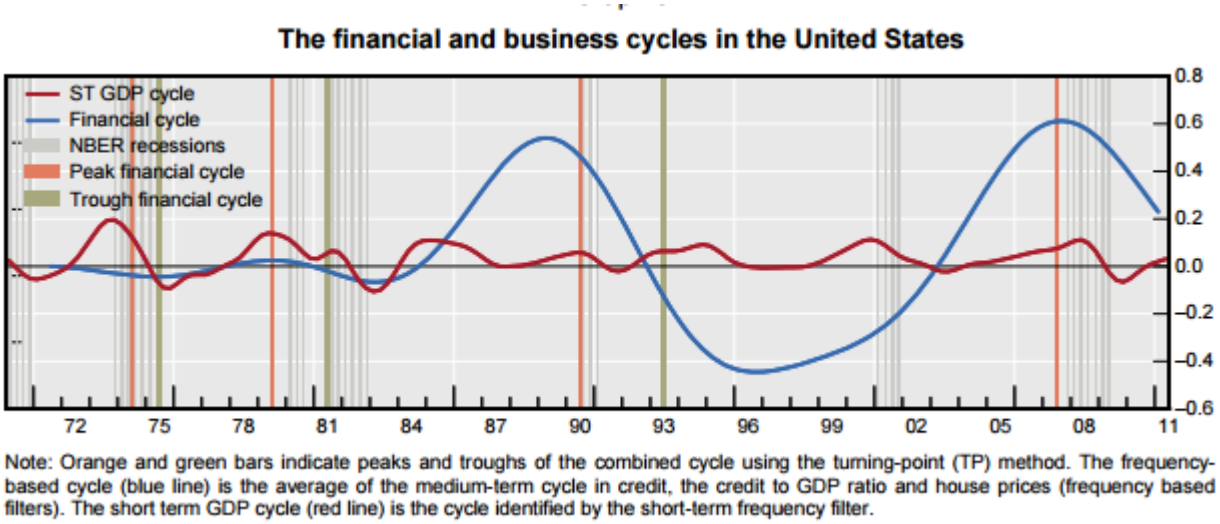


Figure 1.1: US Financial Cycle 1970 - 2011
Source: Drehmann, Borio, and Tsatsaronis(2012)

clude real sector productivity, and investor risk tolerance. Essentially, investors tolerate speculation regarding the value of particular class of assets for only so long before they must face the reality of actual performance, or, alternatively, some investors begin to bet against the value of the asset.

In additional to empirical evidence on the role of financial cycles in producing crisis, Didier Sornette has pioneered the use of non-linear modeling to produce theoretical models of financial cycles that culminate in crises. Corsi and Sornette (2014), for example, produce a non-linear stochastic model that captures the feedback between real and financial sectors. In their model, credit creation is determined by the market value of the financial asset employed as collateral in bank loans, resulting in a feedback loop between financial prices an" that results in a crash and/or economic recession.

While most research on financial cycles has focused on cycles at the national level, some recent research has also identified them at the international level as well. Helene Rey has received international attention of her theory of a *global* financial cycle. As Rey explains:

> There is a global financial cycle in capital flows, asset prices and in credit growth. This cycle co-moves with the V I X , a measure of uncertainty and risk aversion of the markets.[...]The global financial cycle is not aligned

> with countries' specific macroeconomic conditions. Symptoms can go from benign to large asset price bubbles and excess credit creation, which are among the best predictors of financial crises.[...] One of the determinants of the global financial cycle is monetary policy in the centre country, which affects leverage of global banks, capital flows and credit growth in the international financial system. Whenever capital is freely mobile, the global financial cycle constrains national monetary policies regardless of the exchange rate regime. (Rey 2015:1)

Research on global and international financial cycles is in the early stages, but other international economic research examining a similar phenomenon among countries' business cycles (and, to a lesser extent, consumption and investment) is also worth noting. Economists have shown that both trade and financial integration increase synchronization between countries' GDP (Frankel and Rose 1998; Imbs 2004). To date, this literature has reached varying conclusions about the extent to which trade and financial integration affect GDP correlations (Stock and Watson 2005), among which countries this effect is robust and consistently observed (Kose, Prasad, and Terrones 2003; Kose Otrok, and Prasad 2008), and the reasons why this may occur (Baxter and Kouparitsas 2005). Nonethe-less, economists generally accept the phenomenon, though still treat it as a puzzle due to the fact that these empirical observations contradict heterodox dynamic general equilibrium theory predictions (Backus,Kehoe, and Kydland 1993).[7]

Within the post-Keynesian economic framework, the existence of a global financial cycle, or a synchronization of national financial cycles, makes complete sense, as does synchronization of business cycles. As countries integrate economically to form a single, global economy, production, consumption, and investment all occur across borders, as firms, households, and governments interact or even exist trans-nationally. This means that the system of individual market actors whose interactions and transactions in aggregate constitute production, consumption, and investment are not geographically isolated, and instead form a single global system in which developments or changes among actors in one part of the system can quickly spillover to actors in other parts of the system

[7]Dynamic general equilibrium theory predicts that because capital flows follow interest rate differentials, negative output correlations should result. Since investment drives productivity, this should mean more steady, consistent, and highly correlated consumption.

through both real and financial linkages. In this context, synchronization between the behavior of nationally aggregated sets of actors who interact frequently with each other seems logical and obvious; it is the result of many, individual, formerly rather isolated human systems, becoming one. But how do we make sense of the disproportionate influence the U.S. economy seems to exert on the global financial cycle, as described by Rey (2015)? Certainly the size and influence of the US economy is a contributing factor, but how can we understand, observe, and study this synchronization process?

I argue that applying complexity and network sciences to study the structure of the international economy can illuminate the pattern of economic globalization, and the synchronization of national economies. Furthermore, understanding how the financial cycles that give rise to financial crises at the national level interact, such that economic and financial developments in some economies can affect these same conditions in other countries, will also elucidate how economic and financial globalization affects financial stability. Specifically, I argue that when conceptualized as a complex system of trade, capital, and foreign currency exchanges, there is a direct connection between a hierarchical and less densely connected structure of the international economy and its susceptibility to systemic financial crisis. I propose that as the international economy flattens (becomes less hierarchical) and becomes denser (more potential economic exchanges between countries are actualized), the number of financial crises is likely to increase due to the propensity for financial conditions to spillover from one country to another, creating the conditions for bubbles. Furthermore, the location of a crisis' epicenter and the system's degree of hierarchy and connectivity determine the level of contagion experienced by other countries in the system in the wake of the crisis. Together, these two assertions form a broader system-level theory of financial crisis, which I outline fully in the next subsection.

1.3 System Structure, System Evolution, and Financial Crises

Over the past century and half, the stability of the global economy has largely been linked to the existence and stability of a single preponderant economic power – a hegemon. Britain occupied this position in the long 19th century. The United States assumed the

role from the early 1950s onward. These hegemonic periods have facilitated economic development in other countries in the system that have implemented export-led growth models and (to varying extents) opened their borders to foreign capital. The hegemon has imported goods from peripheral countries, and exported capital to them. As development occurs, the position of countries within the system changes. Sometimes, as occurred during the first quarter of the 20th century between Britain and the United States, a transition happens at the core of the system as one or more countries rise to parity with the hegemon. More typically, countries move from the periphery toward the core, as European countries and some Asian countries did in the second half of the 20th century. I argue that these changes in the structure and hierarchy of the global economy precipitate global financial crises and affect the scale of the resultant contagion.

To investigate how these changes result in crisis, I conceptualize the international system as a multiplex, or multi-dimensional network. Whereas a one dimensional network connects nodes (countries) via edges (quantity of imports and exports, for example), a multiplex connects nodes across multiple edges. Cranmer, Marucha and Menninga (forthcoming), for instance, model the international system as a multiplex network consisting of three types of international relationships: trade, democracy, and international governmental organization membership.

In the multiplex of the international economy, individual actors, governments, and firms within countries import and export goods and services, buy and sell financial assets, trade currencies, and hold foreign currencies as reserves. The international economy therefore also encompasses all three dimensions – trade, investment, and monetary exchange – and activity in any one dimension is affected by the pattern of activity in the other dimensions. While any one dimension may do a decent job approximating the structure and hierarchy of the larger multiplex system, there are likely nuanced differences. For instance, if we were to examine recent financial and trade networks, China would appear more centrally located and influential in the import trade network than in the network of portfolio flows, since it still maintains a significant level of capital controls (see Kali and Reyes 2010 and Oatley et al 2013).

For the past 150 years, the international economy has been a relatively hierarchical structure centered upon a single preponderant economic power – the hegemon [8]. The hegemon has exhibited characteristics consistent with Kindleberger's theory; it has been a large, growing, capitalist economy with first-rate innovation and technological superiority. Other countries form the semi-periphery or periphery regions. Countries in the semi-periphery maintain strong ties to the hegemon but slightly weaker ties (on average) to each other and to the periphery. Countries in the periphery may maintain relatively weaker connections to the hegemon, some ties to countries in the semi-periphery, but weak or nonexistent ties to each other.

There are two reasons why a hierarchical structure has predominated for so long: how the system formed, and how it evolved (Oatley et al 2013). One approach to explaining the formation of complex systems, applicable to the international economic system, is fitness preferential attachment (FPA). FPA proposes that ties between nodes form based on nodes' fitness. Nodes (countries) that exhibit advantageous and appealing characteristics (liquidity, good governance and regulatory frameworks) are more likely to attract ties (trade, investment). Overtime, this process is subject to considerable feedback; nodes that have strong ties are more likely to attract additional ties. The system is therefore inherently biased toward a hegemonic structure. Secondly, hegemonic systems exhibit robust yet fragile characteristics. In hierarchically ordered systems, a shock emanating from the hegemon is less probable than a shock generated by a non-hegemon, and a hegemon is uniquely able to absorbs shocks that emanate from peripheral countries, thereby preventing system-wide contagion and collapse. This makes the system robust. On the flip side, the system is remarkably fragile to turbulent events that occur in the hegemon. But while hierarchy is remarkably persistent, the system does not remain entirely static.

Changes to the structure of the network occur when a peripheral country attracts stronger and more numerous trade and investment relations from the hegemon, and from other countries that may constitute the core, jump starting the process of growth and

[8]The period from 1915 to 1945 is the exception. During this period, Britain, Germany, and the United States vied for economic primacy but had similar amounts of economic power

development. Thus, changes in system structure are the result of foreign governments, independent and international financial institutions, and firms ' responses to monetary, exchange rate, fiscal, trade, and investment policies set by governments. Economic development is usually marked by significant growth in the size of the domestic economy, and by the role that foreign investment and trade play in the economy. Foreign direct and portfolio investment will pour in to take advantage of the higher returns on capital. Investment fosters the productive capacity of industry and as it expands, imports will increase to respond to domestic demand for commodities and intermediate goods, followed by an increase in exports (Vernon 1966). In the contemporary era of globalization, development has also been marked by the increased role of national industry in the global value chain hierarchy of international production (Nematy 2005). The increased trade and investment flows necessarily mean a larger role for the country in the foreign exchange market. As countries develop, their positions within the system change. They move from the periphery of the system toward the core. Economic development is therefore an inherently systemic process; it is financed by capital flows from the hegemon (and other core countries) and achieved by exporting to the hegemon.

Significant changes in system structure will be the result of changes across all three dimensions – trade, finance, and monetary. When a country develops and moves away from the periphery and toward the core, the density of the network increases as a higher portion of potential connections between nodes become actual connections. At the same time, the centralization of the network (measured in terms of unweighted or unvalued ties) will decrease. The new ties forged by the developing country (primarily with the hegemon, but with other countries as well) means the system is less organized around a single node. Crisis is more likely to occur as density increases and centralization decreases because there is an increased probability that a country's financial cycle will produce "spillover effects" for close economic partners by pushing the market rate of interest below the natural rate of interest, which increases the demand for financial products and generates a boom in asset prices (Borio and Disyatat 2011). The collapse of the asset bubble results in crisis (Kindleberger 2005; Minsky 1977).

As the volume of trade, investment, and foreign currency exchanges increase between countries, the probability increases that financial cycles spill over from one country to another. When the financial cycle is expanding, credit and debt is expanding, and market liquidity is high. This facilitates investment abroad, particularly if growth is moderate or strong. The increased investment applies downward pressure to the market interest rates of recipient countries, and can push them below the natural rate implied by the productivity of the real of economy, thereby facilitating bubbles that lead to crisis. [9] While a country's monetary policy can influence market rates, and is arguably capable of correcting overly high liquidity and leverage, monetary policy independence is affected by a country's exchange rate regime. Thus, countries with fixed exchanged rates may be hesitant to raise rates because it may make the country more attractive to international investors and make it more difficult to manage its currency value. Furthermore, inflation targeting tends to be the primary focus of monetary policy, and so rates set by a central bank are not always *right*. Lastly, if upswings in the financial cycle provide a boost to real-sector productivity, policy makers may remain willfully ignorant of financial market conditions, since strong levels of growth are desirable.

To further explain how this process works, consider a hypothetical situation. Suppose a country is experiencing an upswing in the financial sector. Credit is expanding, the money supply and asset prices are expanding accordingly, and interest rates are moderate or low. This grants investors the means to invest abroad, and also an eagerness to seek higher rates of return abroad. If the business cycle happens to be also in a period of expansion, investors will likely have even greater means, and will be more optimistic

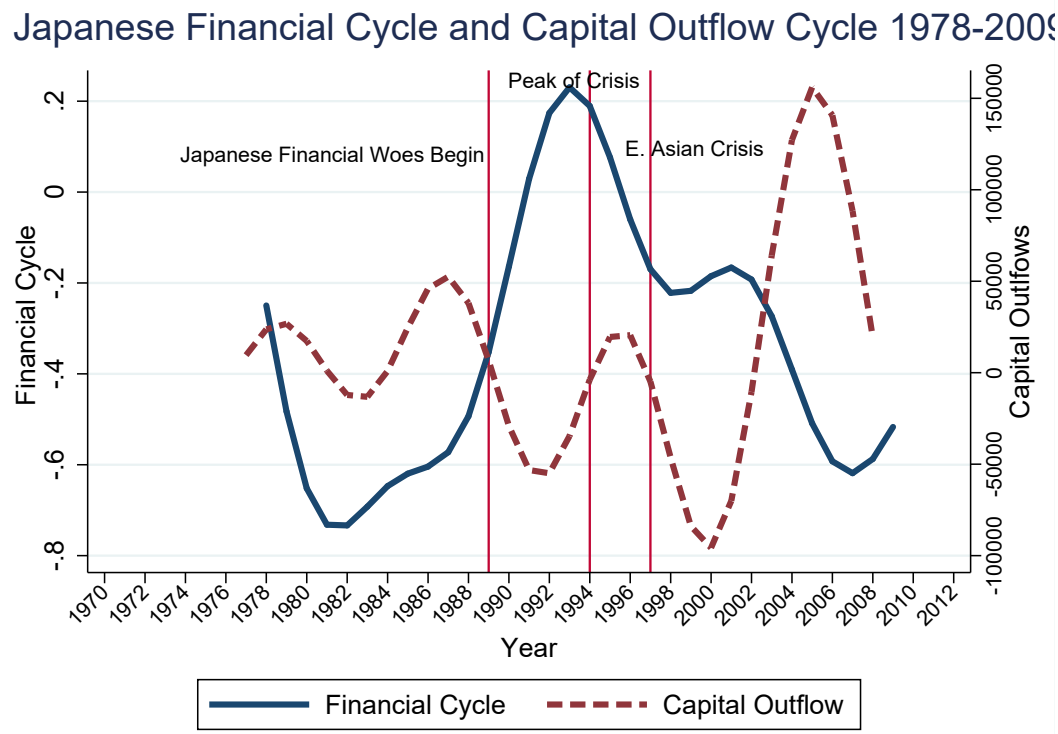
[9]The notion that interest rates can be artificially low, and can diverge from the natural or equilibrium rate of interest, is a departure from mainstream neo-Keynesian economics. In contemporary economic theory, the natural rate of interest is the equilibrium real rate of interest that would result in an economy with fully flexible prices. The earliest conception developed by Knut Wicksell (1898) defined the natural rate slightly differently as the interest rate that prevails when savings equal investment at full employment (return on capital or real profit rate). Either way, the natural rate is a hypothetical rate that would exist if money did not exist. The market rate, in contrast, is the rate that actually prevails (observed nominal rate - expected inflation), which is influenced heavily by actor expectations of market, liquidity risk (as well as the risk preference and tolerance of the actors), and monetary factors (such as credit and the relative availability of assets)(Borio and Disyatat 2010; 2011). In neo-Keynesian economic theory, the two rates are presumed to be the same, as the economy is always in a state of equilibrium. However, in post-Keynesian economic theory, it is possible for these two rates to diverge considerably, resulting in an asset bubble as demand for financial assets increases due to the artificially low rates.

about their financial prospects and more willing to bear the higher risk of investing abroad. Now, consider how an increase in gross flows between this country and another country (with varying exchange rate regimes) might affect the market interest rate in the recipient country. Between a country with a fixed rate and a country with a floating rate, an increase in gross flows of financial assets or goods and services from the latter to the former will require exchange market intervention on the part of the recipient(it will sell its currency), pushing rates lower, regardless of central bank policy on short term rates. While capital controls could mitigate this effect, such policies are always ineffective to some extent and do not completely insulate the country from the effects of other countries' financial conditions. If both countries have floating rates, market interest rates in the country receiving higher gross inflows will still experience downward pressure as the expansion of the supply of money and credit in one country increases the amount of investment available abroad, expanding the supply of capital and pushing down market interest rates.

Two contemporary examples illustrate spillover effects at work. The first is the role of the Japanese financial cycle in producing financial crises that affected many southeast Asian countries beginning in 1997. The second is the United States' financial cycle in the lead up to the 2008 financial crisis that resulted in not only a domestic asset bubble, but asset bubbles throughout the developed and developing world.

The Japanese financial cycle expanded from the early 1980s through to 1992 (see figure 1.2). Notably this aligned with that of the United States, which expanded until the late 1980s. At the same time, beginning in the late 1980s, asset and property prices begin to increase in East Asia. This was most likely spillover from activity in the Japanese and United States' financial sectors. However, following the Japanese financial crisis in 1990, the bank of Japan gradually reduced interest rates nearly to zero by 1996-7 and engaged in quantitative easing. There was initially a contraction in capital outflows at the peak of the financial crisis. Once the bank of Japan's interest rate policies were in full effect, and the money supply increased while corporate investment began to steadily decline(continuing over the decade), investors looked to other markets where growth

Figure 1.2: Japanese Financial and Capital Flow Cycles Since 1975



prospects were better, in hopes of earning higher returns. Japanese (and American) capital poured into the economies of South Korea, Thailand, Malaysia, and Indonesia, quickly exacerbating the bubble which had started to form around the turn of the decade. While Japanese foreign investment in Southeast Asian countries increased in the wake of its crisis, imports from these countries declined, contributing to the current account deficits some of these countries developed over the course of the decade. (Corsetti et al 1999)

However, despite the current account imbalance, growth in these countries remained strong through 1996, which is one reason they were attractive to Japanese investors. Strong growth was complemented by high rates of investment (upward of 20% in all countries), budget surpluses, consistent savings rates, and manageable inflation rates. These strong macroeconomic fundamentals present a puzzle for scholars of financial crises, since many typical signs of distress were absent in these cases. However, four facts remain: foreign investment was high and heavily mediated by the domestic banking sector, foreign liabilities increased for most Southeast Asian countries over the period (even as a ratio

of foreign assets), private debt increased dramatically, and asset prices (both property and stocks) rose sharply. While deregulation, cronyism, and corruption can be identified as contributing to moral hazard, the evidence suggests that a foreign-investment driven asset bubble was ultimately responsible for the crisis. This foreign investment driven bubble began at the tail end of the financial cycle expansions in the United States, and especially Japan, and then was exacerbated when the Japanese crisis erupted. (Corsetti et al 1999)

In the eight years leading up to the financial crisis of 2008, very low interest rates in the US were accompanied by relatively strong economic growth. This implied that the United States' financial cycle and business cycle had aligned – a certain recipe for credit and asset bubbles (Claessens et al 2010; Claessens et al 2012; Kiyotaki and Moore 1997; Adrian and Shin 2010). Moreover, because the upswing in the financial cycle occurred in the most central country in the system, it had spillover effects for many countries throughout the world. From 1992 to 2007, credit, asset prices, housing prices, and the money supply expanded in the United States (Keen 2013b, Keen 2009) as well as in many other developed and middle income countries. For example, the United Kingdom, Spain, Ireland, New Zealand, Sweden, and several East European countries experienced housing bubbles along with the United States. The United Kingdom, Spain, Iceland, and several central and eastern European countries, particularly Baltic states such as Estonia, Latvia, Lithuania, and Bulgaria also experienced substantial growth in private credit (IMF GFS Report 2008; Claessens et al 2010). These simultaneous financial expansions coincided with, and arguably led to, unprecedented levels of both gross inflows and outflows between countries. It was this alignment of financial cycles among many countries during the 2000s that was very likely the cause of the world-wide depression of interest rates that occurred during this period, to which economists have attributed the subsequent international financial crisis (Borio and Disyatat 2011).

The contagion that results from a crisis, or the degree to which the crisis spreads to other countries in the international system, is also affected by the system's density and centralization for the same reasons that financial cycles have spillover effects. Contagion

is simply a spillover effect in the wake of a crisis. More densely connected systems have more ties and more transmission channels through which contagion can spread. Systems that are less centralized, meaning they feature a more equal distribution of the number of ties between countries are more vulnerable because there is no single, disproportionately large economy to absorb the shock. However, contagion is also affected by the relative *size* or *strength* of ties between countries in the system. To say that new ties are forged when a country develops says nothing about the relative strength, or size, of the ties that exist between countries. A hegemon not only maintains the largest number of ties with other countries in the international system, it also maintains the strongest ties. Because ties in the multiplex of the international economy are essentially aggregate economic transactions we can think about tie strength as the dollar value of economic transactions. When a single country maintains disproportionately stronger or larger ties to every other country in the system, this helps to limit the extent of contagion resulting from a crisis in a semi-periphery or periphery country, as the hegemon's economy is large enough to absorb the productivity shock. On the other hand, a crisis that originates in the hegemon will have a strong tendency to spread to many other countries throughout the system.

As an illustration of how the country-of-origin's position in the international economy affects the dynamics of contagion, consider the second half of the case studies presented above. In case of the Asian financial crisis of 1997, the bursting of the Thai property bubble in the mid-1990s precipitated the crisis. The unwinding of the bubble took a couple of years, but its effects on the real sector were felt in early 1997 through the reduction in companies' assets and defaults by major corporations. Speculation on the value of the Thai Baht followed shortly behind. Similar to Thailand, the Malaysian crisis also began with the deflation of a property bubble. However, Korea's crisis was more attributable to an economic slowdown and high levels of corporate debt; The first signs of trouble in South Korea were corporate bankruptcies. Beyond Malaysia and South Korea, the other crises were more clearly the result of contagion from the first three crises. In the Philippines and Indonesia, the currency crisis was the most immediate trigger of the financial crisis. Singapore was most affected by a second round of contagion from the

currency crisis. In short, contagion from the events of Thailand, Malaysia, and South Korea did occur within Southeast Asia, but effects for the broader international economy were quite limited (Oatley et al 2013).

On the other hand, the contagion that resulted from the bursting of the credit and asset bubbles in the US reverberated throughout the developed and developing world. Growth slowed across OECD countries and much of the developing world, especially for close trading partners of the United States such as Mexico, Chile, and Colombia. The Asian tigers experienced a short-lived slowdown at the end of 2008 and first half of 2009, but a slowdown none the less. It may in fact be easier to list the countries that did not take a hit to GDP as a result of the crisis [10]. Housing bubbles in Spain and Ireland popped. The United Kingdom, Iceland, Ireland, France, Germany, and Denmark all implemented bailouts of major financial institutions. Even China's recent troubles can be explained as a second order contagion effect of the US bubble and subsequent financial crisis. [11]

To summarize, in this subsection and the last, I have argued that spillover effects from a country's financial cycle can occur between countries in the system, and that the probability that this occurs is affected by tie strength between countries as well as overall network structure. Furthermore, the overall structure of the international system affects the dynamics of financial crises and contagion. It is no coincidence that financial cycle developments in the second largest economy in the 1990s, Japan, helped fuel the crisis in East Asia in the 1990s, and that the US financial cycle created the conditions for the 2008 financial crisis that rocked the developed world. In both the Asian financial crisis and the 2008 Great Recession, expansions in the financial cycle of a major economy contributed to larger international investment, depression of interest rates, and asset and

[10] Argentina, India, Indonesia, the Philippines, Tunisia, Israel, Jordan, and Poland

[11] During the boom in the US and OECD countries from 2000 to 2009, imports from China skyrocketed and helped create a period of economic exuberance that led to stock market bubble in 2008, and the beginning of the massive housing bubble that popped in 2015. When United States imports from China declined in the wake of the great recession, this contributed to an economic slow down in 2009, and spurred a government stimulus which fueled investment and worsened the housing bubble. Continued slow growth on the part of the US prevented a sustained recovery on China's part and led to reduction in expectations of economic growth.

credit bubbles abroad, which ultimately resulted in crisis. Economic integration is clearly the antecedent of spillover effects and contagion. Ultimately, economic integration is the reason why financial cycles in major developing countries tend to align (Claessens et al 2010, Helene Rey 2015) and have been increasingly coordinated over time. I argue that this phenomenon will occur with greater frequency as the system becomes denser and as the system becomes less centralized around the United State, particularly due to the rise of China. To test the theory I have presented, I offer the following hypotheses linking the structure of the international economy to countries' propensities to experience financial crisis and contagion and estimate several statistical models in the following subsections to test them.

1.3.1 Hypotheses

Hypothesis 1: Countries should be more likely to experience a crisis when the international economy is less centralized around a single, core economy.

Hypothesis 2: Network density should increase the likelihood that any country experiences a crisis.

Hypothesis 3: Countries that are more integrated within the international economy, are more likely to experience a systemic financial crisis. This is due both to spillover effects, and also contagion.

Hypothesis 4: In hegemonic systems, countries that trade more with the hegemon should be more likely to experience contagion from crises that originates in the hegemon.

Hypothesis 5: In hegemonic systems, when crises originate in a country that is not the hegemon, contagion is more likely to affect countries that trade with the country of crisis origin more than with the hegemon, relative to other countries. [12]

[12]To clarify further, consider another way of stating the same proposition: The probability that a non-hegemon experiences contagion from a crisis originating in another non-hegemon correlates positively with the first country's relative trade proximity to the country of origin, where relative trade proximity is the difference between a countries' trade with the country of origin and their trade with the hegemon.

Hypothesis 6: Contagion that originates in the most central economy should be greater in hegemonic systems than in non-hegemonic systems.

Hypothesis 7: Contagion from a crisis that originates in a country that is not the most central country, should be lower in hegemonic systems than in non-hegemonic systems.

For clarity and succinctness, I have also summarized these hypotheses in Tables 1.1 and 1.2. I proceed with empirical analysis as follows. In the next subsection, I introduce the network data I use to model the international economy and I provide an overview of the structure of the international economy from 1870 to 2009 using several network measures that operationalize the relevant concepts. In subsection 5, I test hypotheses 1-3 using a new network model developed by Leifeld and Cranmer (2016) that is an extension of spatial regression models used to estimate models where node characteristics are a function of network structure. In subsection 5, I test hypotheses 4-7 using logistic and linear regression to evaluate the effect of country position and system structure on the dynamics of contagion.

Table 1.1: System Attributes and Effects

	Effect on Contagion in the Wake of a Crisis	**Effect on Financial Cycle Spillovers that Precede Crises**
High Centralization	Contagion is contained by the size of the most central economy	Spillover effects are more likely to be caused by the financial cycle of the most central cycle.
Decentralization	Contagion increases as there is not a single country to absorb the shock, or drive the growth and investment in the international economy while the country is in crisis	As one or more countries approach a similar size and interconnectedness as the most central country, the possibility and probability of spillover effects occurring increases.
Low Density	Contagion should decrease as there are fewer trade and investment channels through which crises can spread.	Spillovers from financial cycles should decrease as there is fewer trade and investment channels through which they can travel.
High Density	Contagion should increase as there are more trade and investment channels through which crises can spread.	More spillovers since there are more trade and investment channels through which financial cycles can transmit effects

Table 1.2: Country-Level Systemic Attributes and Effects

	Effect on Susceptibility to Financial Cycle Spillovers that Precede Crises	**Effect on Susceptibility to Contagion in the Wake of a Crisis in the most central country**	**Effect on Susceptibility to Contagion in the Wake of a Crisis in the a peripheral country**
High Centrality	More likely to experience spillover effects	More likely to catch contagion	Less likely to catch contagion
Low Centrality	Less likely to experience spillover effects	Less likely to catch contagion	More likely to catch contagion
High trade proximity to hegemon	Assuming the source is the most central country, close economic partners are more likely to experience spillover effects	More likely to catch contagion	Less likely to catch contagion
Low trade proximity to hegemon	Assuming the source is the most central country, countries that trade little or not at all with the most central country are less likely to experience spillover effects	Less likely to catch contagion	More likely to catch contagion, if they trade with the country of origin

1.4 Descriptive Networks of the International Economy 1870-2009

Using the tools of network analysis, we can graph economic activities aggregated at the national level, as in Figure 1.3, and calculate statistics to measure concepts such as density and centralization. To construct the graph in Figure 1.3, I used bilateral trade data from the Correlates of War Bilateral Trade data set (Barbieri and Keshk 2009). The size of the node on each graph is scaled according to importance of the corresponding country in the network. More specifically, the node is scaled by the country's degree centrality. Degree centrality is measured differently depending on whether a network is constructed using valued (continuous) or dichotomous data. When a network is constructed using dichotomous data, where a zero represents no tie and a one represents an existing relationship, the *unweighted* degree centrality of a node is simply the number of ties it shares

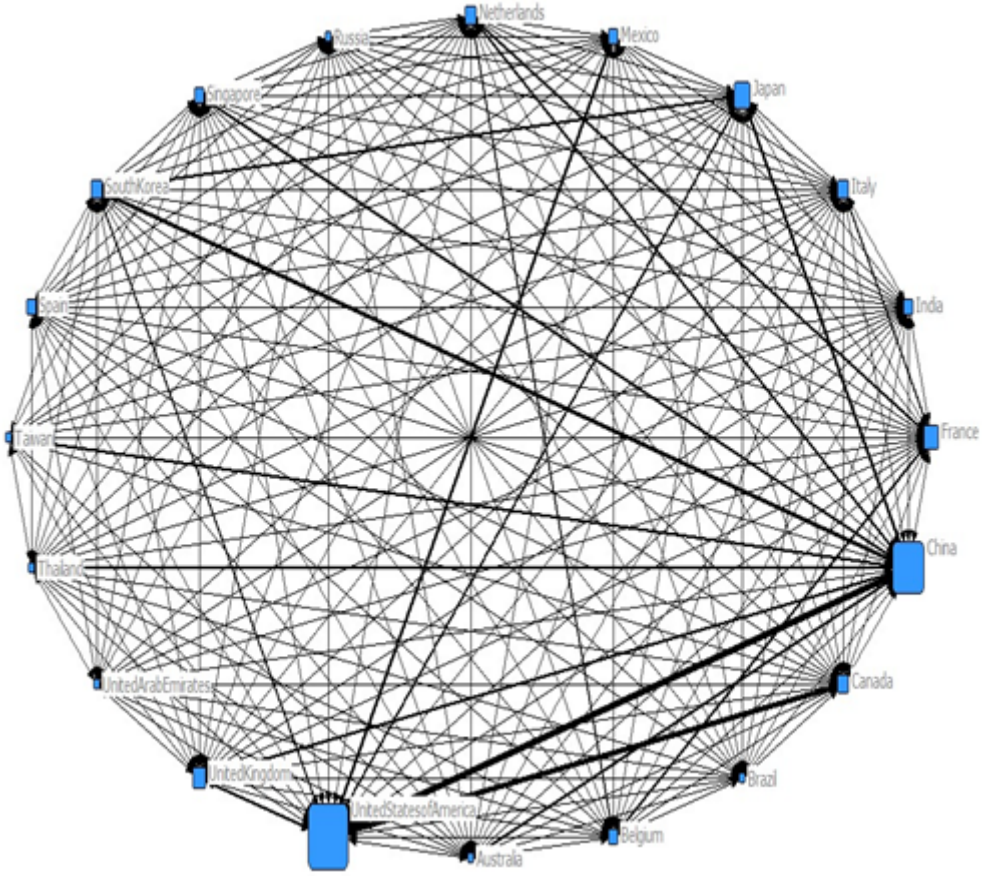


Figure 1.3: 2009 Imports Network

with other nodes. When valued or continuous data is used, *weighted* degree centrality is the sum of the values of the ties it shares with other nodes. Figure 1.3 features weighted degree centrality. As Oatley et al (2013) propose, we can use the topology of such graphs as an indication of the structure of the international economy that emerges from the multitude of exchanges between economic agents in different countries over the course of a year. We can thus conceptualize system structure as a continuous variable measured as the skewness of the distribution of country connectivity in the networks of economic interdependence, or as a measure of network centralization. Constructing these graphs annually, and generating overall network statistics such as centralization, can give us an understanding of how system structure has evolved over time.

Using the Correlates of War Bilateral Trade data (Barbieri and Keshk 2009), I construct annual networks of the bilateral trade network since 1870, and generate several statistics that describe the relationships portrayed by them. First, I generate a measure

of network density that is the proportion of all potential ties that are actualized. Second, I construct three measures of network centralization, which quantify the extent to which a network is centralized around a single node.

As explained above, network density is the percentage of possible ties in a network that actually exist. There are two standard ways of measuring network density, depending on whether a network uses continuous or dichotomous data. When using dichotomous data, this measure is constructed accordingly:

$$\frac{actual\,connections}{potential\,connections} \tag{1.1}$$

where,

$$potential\,connections = \frac{n * (n-1)}{2} \tag{1.2}$$

The weighted version of this measure simply weights the numerator of the above equation by the sum of the value of existing ties. Figure 1.4 shows the evolution of weighted and unweighted network density from 1870 to 2009. Density collapses during the World Wars, but otherwise gradually increases over the period, rising more sharply during the post-war period than in the pre-war period.

There are also two standard ways of measuring network centralization, depending on whether a network uses continuous or dichotomous data. Freeman's original degree centralization measure is simply the sum of the differences between the *unweighted* degree centrality of the most central country and the *unweighted* degree centrality of all other nodes, divided by the maximum potential value of this sum of differences. In essence, this measure is comparing the observed graph to an ideal hub-and-spoke graph, where one node (the hub) is connected to every other node (spokes), but other nodes are connected only to the hub node. This hub-and-spokes graph is the most centralized network structure.

By contrast, the weighted extension of this measure simply measures the sum of the differences between the *weighted* degree centrality of the most central node and the *weighted* degree centrality of all other nodes (Barrat et al, 2004). The *weighted* degree

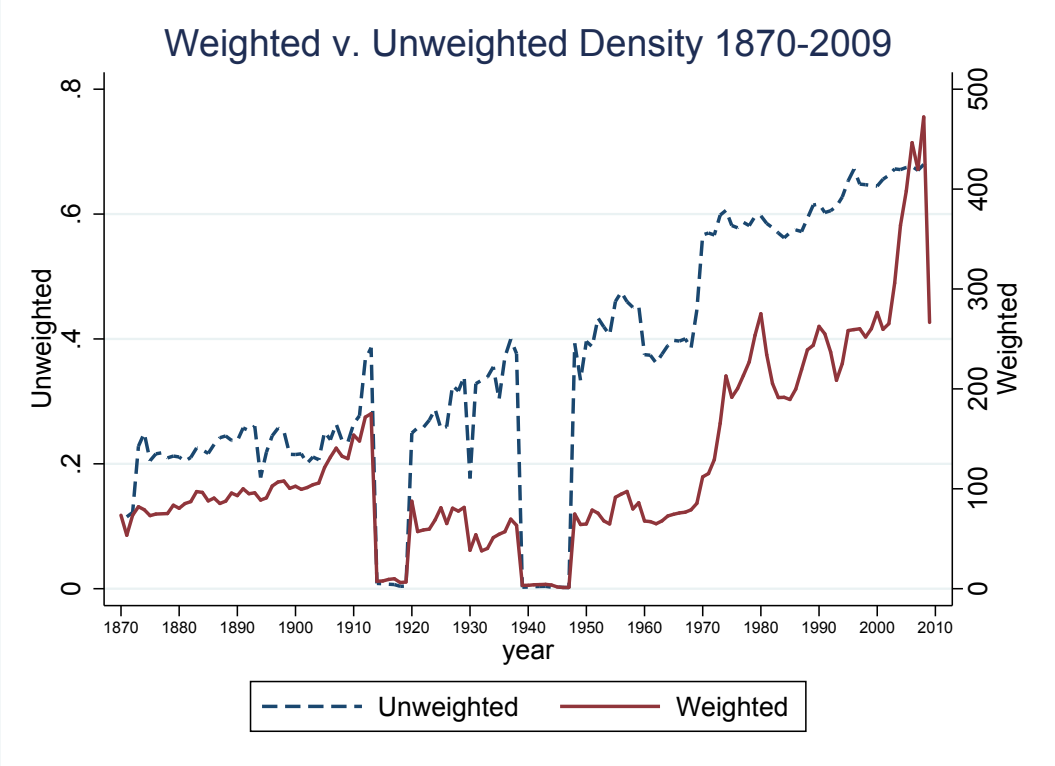


Figure 1.4: System Density 1870 -2009

centrality measure does not have a denominator, and does not therefore compare the observed network to an idealized hub-and-spokes network. Figure 1.5 plots the unweighted and weighted measures of degree centralization from 1870 to 2009. From this figure, we can see that the two measures have vastly different time trends. The unweighted measure of degree centralization decreases steadily, as would be expected from an increase in system density (see Figure 1.6 for a plot of unweighted network density and centralization). Weighted degree centralization increases over time, ticking upward sharply around 1970. The decline in unweighted centralization is attributable to the development of countries that had been in the periphery during the 19th century, in particular the rise of many Asian countries in the last quarter of the 20th century. The upward trend in weighted degree centralization beginning after WWII is attributable to the rise of American hegemony. American hegemony facilitated the reconstruction of Europe, and the industrialization of many Asian countries, but the relative size of the economic transactions the US conducted continued to increase until the end of the period, when the rise of China slowed the differential.

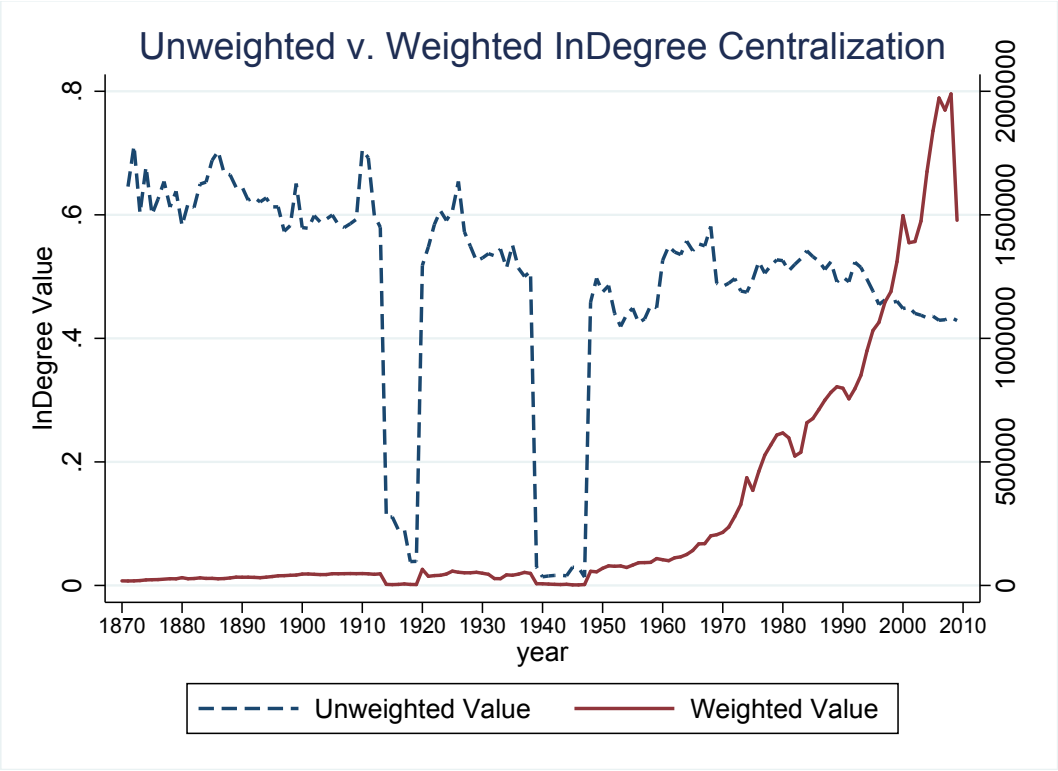


Figure 1.5: Unweighted and Weighted Degree Centralization 1870-2009

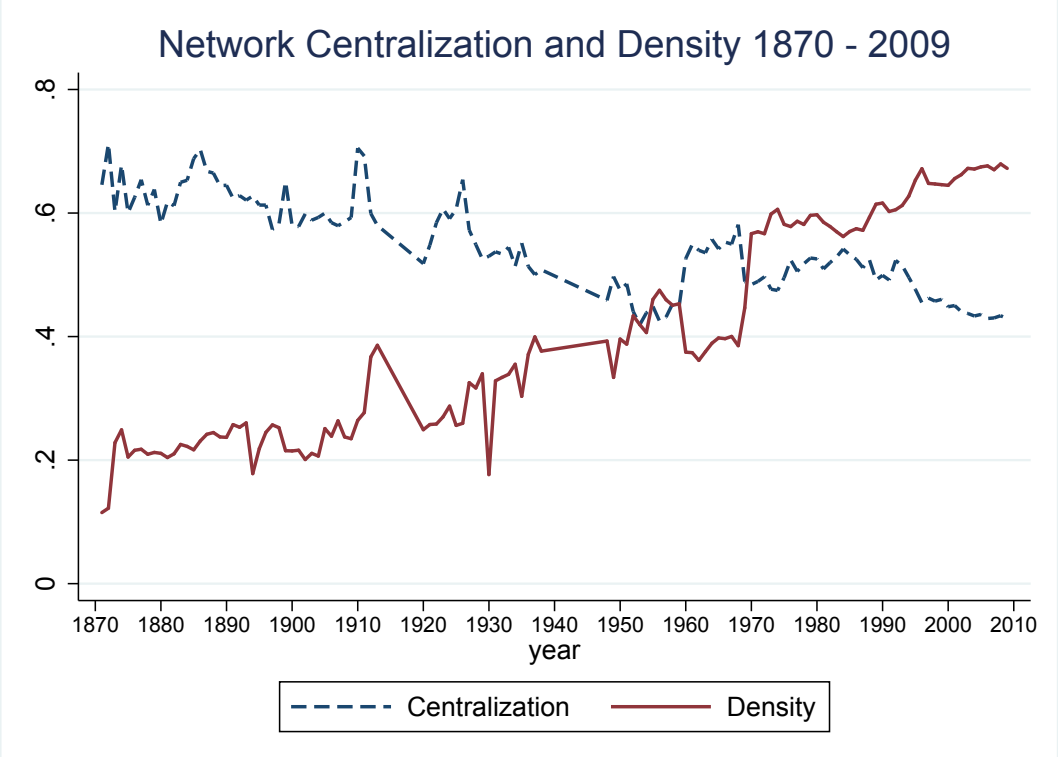


Figure 1.6: Unweighted Centralization and Density 1870-2009

While unweighted and weighted degree centralization are helpful measures for the purposes of describing and categorizing system structure based on trade patterns, they are incomplete on their own. The weighted centralization measure using bilateral trade data measures only the sum of differences between the value of US imports and the value of all other countries' imports. This tells us very little about the structure of the network or patterns of trade. The unweighted centralization measure quantifies the difference between the number of countries the United States imports goods from and the number of countries from which all other countries import goods. This is a better indication of structure, but it is still ignorant of the quantity of goods that pass between countries. Both the number *and* value of each country's ties are important. Therefore, I employ a measure of centrality that combines both the weighted and unweighted measures developed by Opsahl et al (2010) in order to develop a measure of network centralization that accounts for both the value and number of nodes' ties. Opsahl centrality, the basis of my centralization measure, is constructed accordingly:

$$C_i = K_i x (S_i / K_i)^{\alpha} \tag{1.3}$$

Where K is the number of nodes a focal node is connected to (*unweighted* degree centrality), S is the average value of the focal nodes' ties (*weighted* degree centrality divided by *unweighted* degree centrality), and α is a tuning parameter. When the tuning parameter, α, takes on a value of 1, the centrality measure is equivalent to *weighted* degree centrality. When α takes on a value of zero, the result is equivalent to *unweighted* degree centrality. I use a value of .5 for this parameter simply because both variables deserve equal weight; there is not a strong argument to be made as to why the weighted or unweighted measure should matter more than the other.

Based on this measure, I create a measure of network centralization, which I call Opsahl centralization. Opsahl centralization is the sum of differences between the Opsahl centrality value of the most central node and the Opsahl centrality value of all other nodes, divided by the maximum value of the sum of difference if the network were shaped like a hub-and-spoke network, using the maximum and minimum non-zero value from the

observed data. In formula form:

$$OC = \frac{\sum_i^n C_i(max) - C_i}{(n-1) * (S_i(max)/n - 1)^{\alpha} - S_i(min)^{\alpha}} \tag{1.4}$$

Where C is Opsahl centrality, $C_i(max)$ is the maximum value of Opsahl centrality in the network, S is the *weighted* degree centrality, $S_i(max)$ and $S_i(min)$ are the maximum and minimum non-zero values of *weighted* degree centrality, and n is the number of nodes.

Figure 1.7 presents a time series of network density and Opsahl centralization variables. Data for the years during WWI and WWII are unreliable, and so I code these years as missing in this graph, though the series looks continuous. Several features are noteworthy. First, the system exhibits two clear periods of increased centralization. The first occurs during British hegemony in the long 19th century, and the second begins after the conclusion of WWII. We see Britain's decline and American (and German) ascent as centralization decreases from its high of .85 in 1888 to about .76 just before WWI. America consolidates its economic hegemony in the two decades following WWII. Opsahl centralization increases from .74 at the end of WWII to .9 in the year 2000, but then begins to decline slightly due to the rise of China.

Because the Opsahl centralization measure presented in figure 1.7 averages the difference between the centrality of the most central country and all other countries in the network, it glosses over changes that occur at the core of the system. To observe these changes more clearly, I construct a time series of the difference in the Opsahl centrality values of the two most central countries in the network from 1870 to 2009, presented in figure 3.4. The decline of British hegemony is evident here, as the difference between the centrality of Britain and the United States and/or Germany becomes quite small in the first decade of the 20th century. American dominance in the second half of the 20th century is also evident, though the rise of China has meant a decline in the top 2 difference since the mid-2000s.

The conclusion to reach from these network statistics is that over the course of the international economy's evolution from 1870 to 2009, there are two clear periods of hegemony and a single, short lived, period of multi or bipolarity. The first period of hegemony

Figure 1.7: Network Centralization and Density 1870-2009

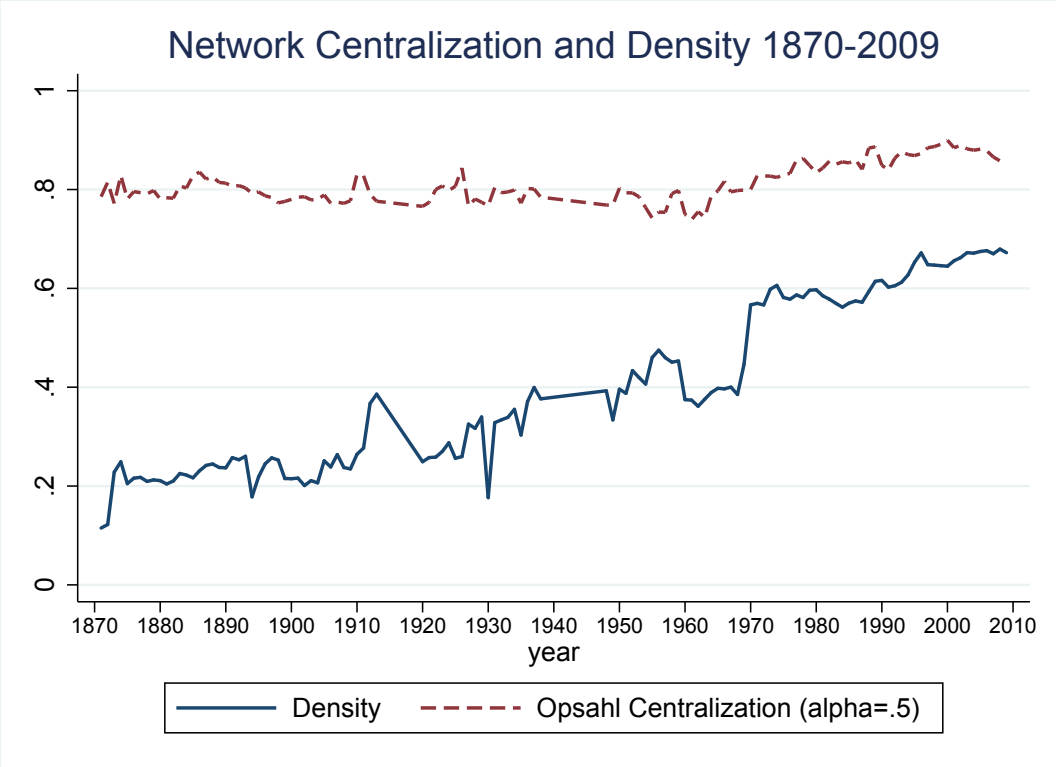
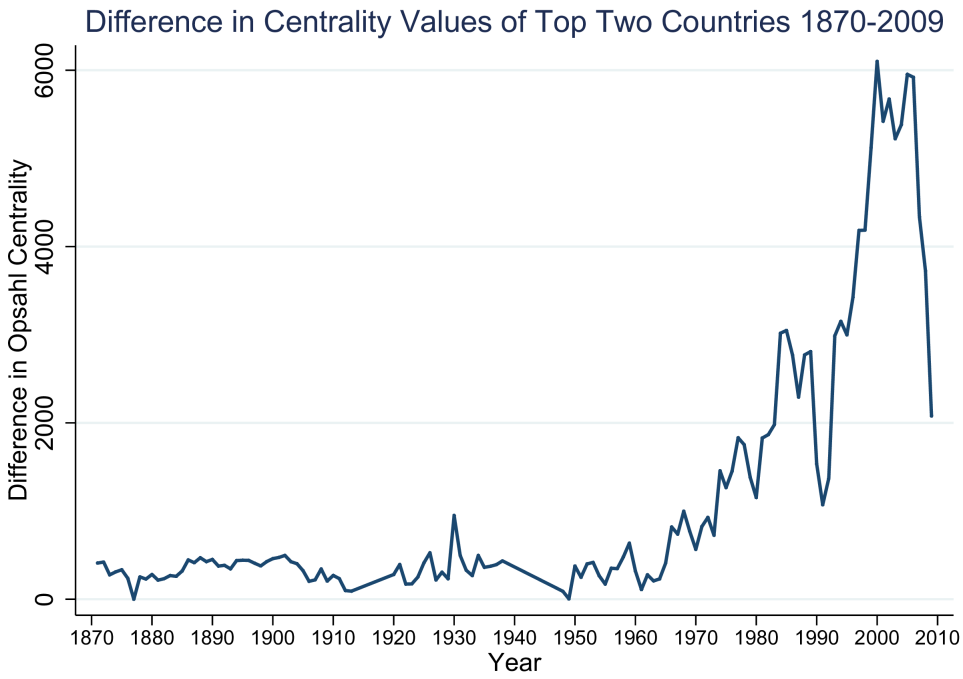


Figure 1.8: Difference in Centrality of Top Two Countries 1870-2009



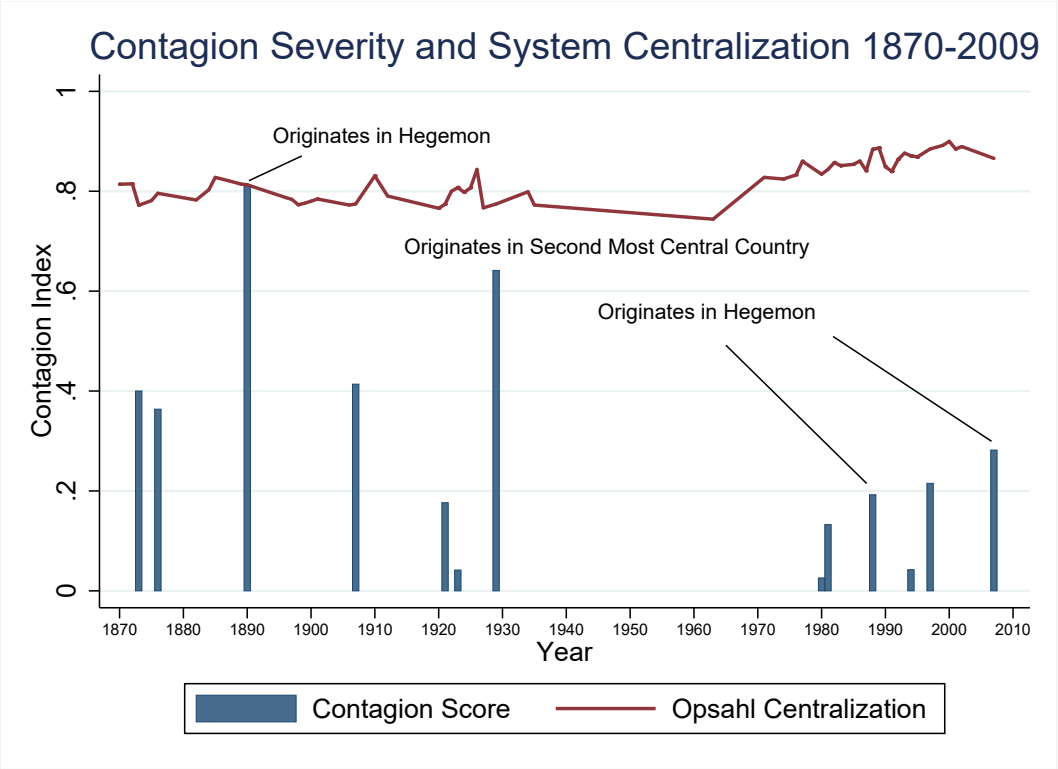
occurred during the long 19th century, and gave way to a brief period of economic multi or bipolarity just prior to and during the World Wars. The second period of hegemony emerged in the middle of the 20th century and persists. Density was lowest during British hegemony and continues to increase. The two periods of hegemony are thus unique in the level of connectedness exhibited by countries. British hegemony was hegemonic both in terms of the number of countries with which it conducted economic relations and in terms of the value of the economic transactions it conducted. However, the difference between the size of its economy and its closest competitors was not as large as the difference between the US and its closest competitors in contemporary times. American hegemony, in contrast, is hegemonic due to the value of its economic transactions only, not in the number of countries with which it conducts exchange. In a sense, we can think about contemporary hegemony as having a large and robust semi-periphery of countries that was largely absent during British hegemony.

Figure 1.10 plots network density and centralization over the period 1870-2009, along with the annual number of financial crises. The theory I have proposed in this paper is that the structure of the international financial system affects the pattern of financial crises observed since 1870. More specifically, my theory implies that the larger number of crises observed in contemporary times is due to a higher level of interconnectedness (density) from economic transactions between countries. The larger number of economic ties means that there are more conduits for spill-over effects to fuel bubbles which cause crises, and also more pathways through which contagion can spread.

While increased density should increase the number of financial crises, network centralization should affect the scale of contagion in the wake of financial crisis, and therefore also affect the number of financial crises that occur. My theory suggests that the preponderant size of British and American economies in the two periods of hegemony should have kept the scale of contagion resulting from financial crises in peripheral countries to a minimum. Evaluating this requires a measure of contagion, which I develop by reviewing historical accounts of financial crises identified by Reinhart and Rogoff(2009). I parse out crises that are unique events or the result of contagion based on these historical accounts.

The details of my contagion index can be found in subsection 6. Ultimately, I identify 115 unique crises, 13 of which prove contagious. I create a measure of contagion by taking the percentage of trading partners who experience contagion multiplied by the average number of years those countries experience contagion. Figure 1.9 presents a time series of contagious crises. First, notice that the scale of contagion has decreased over time, as system centralization increased under American hegemony.[13] Second, the most contagious crises originated in either the most or second most central country in the system. I employ this measure of contagion as a dependent variable in one of my statistical models in the next subsection.

Figure 1.9: Contagion Severity Opsahl Centralization 1870-2009

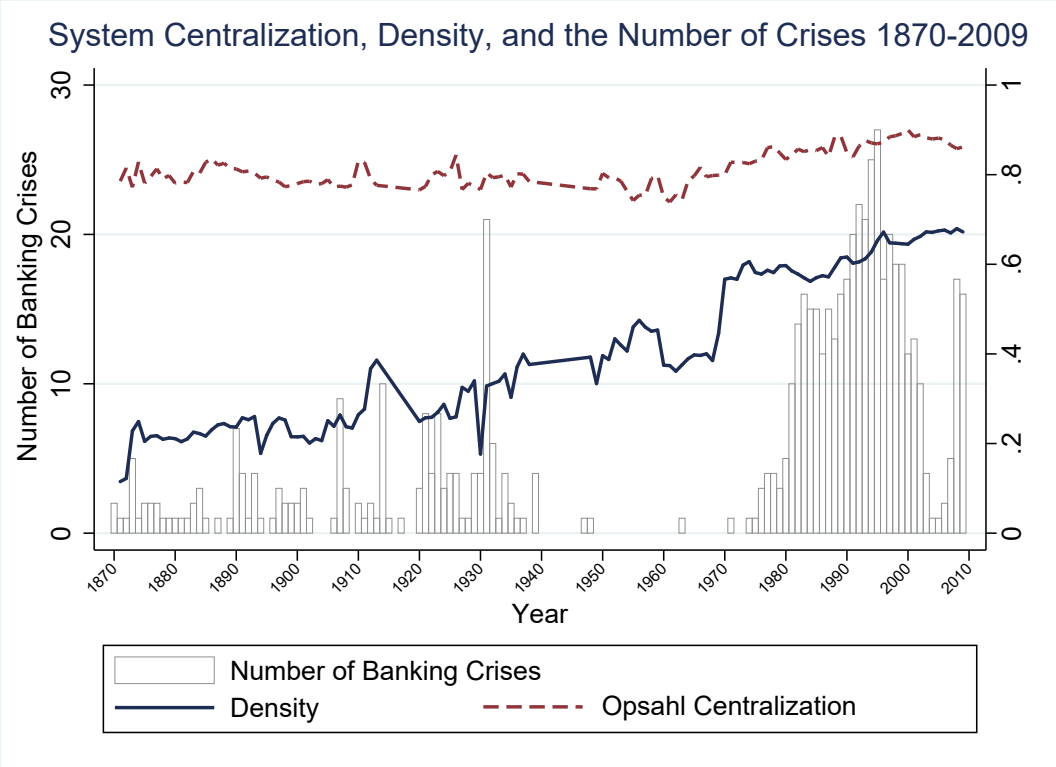


This subsection presents an overview of my network and contagion data that I will employ in my empirical analysis in the next subsection. Before concluding, note that while the analysis presented here is based solely on a single network of bilateral trade data (since it is the only highly available source of bilateral economic data), it is a reasonable representation of the overall structure of the economic multiplex. International

[13]Bordo and Eichengreen(2001) reach a similar conclusion

investment occurs more often and in higher volume between countries who also trade with one another. The two networks are likely to exhibit relatively minor differences. Network statistics of periodic bilateral investment data that do exist confirm this is the case (see Appendix). If bilateral investment data were available for the past century and a half, it would likely confirm the findings outlined herein.

Figure 1.10: Opsahl Network Centralization and Density 1870-2009



1.5 Statistical Models: Economic Integration and Crisis

In this subsection, I present the results of several Temporal Network Autoregressive Models (TNAM) to test hypotheses 1-3, regarding the effect of network structure on the propensity of countries to experience financial crisis. These hypotheses are:

> **Hypothesis 1**: Countries should be more likely to experience a crisis when the international economy is less centralized around a single, core economy.

> **Hypothesis 2**: Network density should increase the likelihood that any country experiences a crisis.

Hypothesis 3: Countries that are more integrated within the international economy, are more likely to experience a systemic financial crisis. This is due both to spillover effects, and also contagion.

The TNAM is a new inferential statistical model for time series network data that accommodates models with nodal attributes as the dependent variable and network and nodal attributes as independent variables (Leifeld and Cranmer 2016). The model is the only one of its kind, and is a huge improvement over standard maximum likelihood regression models because it can account for the dependence between units of observation that are embedded in a network. Accounting for aspects of a data-generating process driven by network structure is essential to proper inference. The TNAM is an extension of spatial autoregressive models, but it is applied to network data. For the purposes of evaluating my theory, the network employed is the international import network. The network statistics I include are generated based on this network, as described in subsection 4. Furthermore, I use this network weighted by the dependent variable to control for the effect of second degree contagion. I include country-year observations for 171-200 countries, depending on the model, from 1976 to 2009. All independent countries in each year, for which data is available, are included in the sample. I employ random effects because some countries never experience a financial crisis in the period for which they exist and because some control variables are time invariant.

1.5.1 Dependent Variables

My main dependent variable is a dichotomous measure of whether or not a country experiences a financial crisis. The data is taken from Laeven and Valencia (2014) who have recorded all systemic banking crises in the international system since 1976.

1.5.2 Independent Variables

While an ideal measure of economic integration would evaluate a country's relative position in trade, investment, and world currency markets, the bilateral data required to construct a network and generate network statistics is only consistently available for trade.

Admittedly, there are downsides to using only trade data. For instance, when comparing networks based on imports and portfolio assets, we see that some countries' positions are quite different in the two networks. Most notably, China is far more prominent in the international trade network than in the international investment network. However, the international trade network is a reasonable proxy. I include the following network statistics generated from the bilateral trade data:

Opsahl Centrality – a measure of how central a node(country) is in the network, based on the following formula:

$$C_i = K_i x (S_i / K_i)^{\alpha} \tag{1.5}$$

where K is the number of nodes a focal node is connected to (*unweighted* degree centrality) and S is the average value of the focal nodes' ties (*weighted* degree centrality divided by *unweighted* degree centrality), and α is a tuning parameter.

Opsahl Centralization – a measure of network centralization based on Opsahl Centrality, constructed according to the following formula

$$OC = \frac{\sum_i^n C_i(max) - C_i}{(n-1) * (S_i(max)/n - 1)^{\alpha} - S_i(min)^{\alpha}} \tag{1.6}$$

where C is Opsahl Centrality, $C_i(max)$ is the maximum value of Opsahl Centrality in the network, S is the *weighted* degree centrality, $S_i(max)$ and $S_i(min)$ are the maximum and minimum non-zero values of *weighted* degree centrality, and n is the number of nodes.

Network Density – an unweighted measure based on the number of possible ties that actually exist in the observed network,

$$\frac{actualconnections}{potentialconnections} \tag{1.7}$$

where,

$$Potentialconnections = \frac{n * (n-1)}{2} \tag{1.8}$$

Based on my theory, I would expect the sign on Opsahl centrality to be positive and statistically significant - as a country becomes more integrated into the financial system, they are more likely to feel the effect of other countries' financial cycles, and also more likely to experience some degree of contagion in the wake of a financial crisis. Opsahl centralization should be negative and statistically significant, although, admittedly, there is not a lot of variation in this variable over the period. Network density should be positive and sta-

tistically significant. As density increases, spillover effects and contagion are more likely.

1.5.3 Control Variables

I include two sets of country level control variables, one set of international macroeconomic controls, and a weighted network lag control variable. I include the country level political and international macroeconomic controls in separate models to maximize the sample size. The first set of controls I include are domestic economic controls. These include GDP growth, exports as a percentage of GDP, inflation, and a dichotomous variable for whether a country is in a period of sovereign default. GDP, export, and inflation data are taken from the World Bank, and the record of sovereign defaults is taken from Laeven and Valencia (2012) who record all periods of sovereign default since 1976. While other measures of a country's fiscal health might be preferable, such as debt service to exports, the country-year coverage on other variables is not as complete. This measure ensures that the worst cases of fiscal health, which may bring about the onset of financial crisis due to the effect of default on domestic creditors, are accounted for.

Secondly, I include a set of domestic political control variables. These variables include regime type and a measure of political risk. Regime type is taken from the Polity IV data set, and political risk is taken from the International Country Risk Guide (ICRG), which publishes data quarterly. To control for overall risk of political violence and upheaval, I use the aggregate political risk index, which is a 100 point scale, with 0 being the most risky and 100 being the least risky. Countries are evaluated on a range of factors, most notably government stability, internal conflict, external conflict, corruption, the role of the military in politics, religious tensions, law and order, ethnic tensions, and bureaucracy quality.

I include several international macroeconomic controls. First, I include Oatley et al (forthcoming) capital account gini (ca gini), which is a gini coefficient of the top ten largest current account deficits. Oatley et al (forthcoming) find this variable to be negatively correlated with the onset of a financial crisis. I also include US interest rates, since prior studies have found US interest rates to be positively associated with financial crisis, and

US GDP growth.

Finally, I include a weighted network lag variable that controls for the effect of contagion from a previously occurring crisis (previous year) in a country's trading partners. This variable is essentially the product of the dependent variable (dichotomous measure of whether a country experiences a crisis in a given year), lagged one period, and multiplied by the weighted international trade network in that same year.

1.5.4 Results

The results from the country-level models are presented in Table 1.3. I find support for my first three hypotheses. Network centralization decreases the probability that a country experiences a financial crisis in all four models. However, it loses statistical significance in the final model with international macroeconomic controls. Density is positively signed and statistically significant across three of the four models. Country-level centrality is positive and statistically significant in all models.

Economic control variables that are significant include GDP growth, inflation, and default. These are each signed as expected – growth decreases the probability of crisis, and inflation and sovereign default increase the likelihood of crisis. Neither of the political control variables are significant. Of the international macroeconomic controls, neither the US federal funds rate nor US GDP growth are significant. Consistent with Oatley et al (forthcoming), the capital account gini is negative and statistically significant. Interestingly, it is the inclusion of all three of these variables - US GDP growth, federal funds rate, and the capital account gini, together - that seems to change the statistical significance of centralization. Removing just one or some combination of two of these variables does not restore statistical significance to centralization. The weighted network lag variable that controls for contagion from crisis in a previous year is not statistically significant.

Substantively, system centralization has the largest effect on the probability of crisis. Increasing the value of *Opsahl centralization* from 8 to its mean of 8.69 (variable ranges from 8-9 during the period of observation) decreases the probability that a country will

experience a crisis by .027. Going from the minimum value of *Opsahl centralization* of .8 to the maximum value of .89 decreases the probability that a country experiences a crisis by .034.[14] *Opsahl centrality* has a slightly smaller substantive effect. The rescaled version of *Opsahl centrality* used in the model ranges from 0-1906, with a mean value of just 123. Increasing this variable from the mean to the top decile of 320, which means moving from an average level of integration in the international system to a very high level of integration, increases the probability that a country experiences a crisis by .000008. Finally, increasing the density of the international economy (the number of countries who are trading with each other) from its minimum value of 20 in 1970 to its maximum value of 473 just before the 2008 financial crisis increases the probability of a crisis by .0003. To compare this to the effect of a country-level predictor, increasing GDP Growth from zero to 1 percent reduces the probability of a crisis by .07, and experiencing sovereign default increases the probability of a crisis by .0004.

Overall, these results offer positive support for my first three hypotheses. The more the international economy was organized around the US economy during the period of observation, the lower the risk that a country experienced a financial crisis. The increased density of the international economy that occurred during this period did increase the likelihood of countries experiencing a financial crisis, and those countries that are more integrated into the international economy are at even greater risk. These results hold even after controlling for country level conditions.

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[14]If different values of the tuning parameter were used to construct the measure of centralization, this would in fact change the coefficient sign, though not the significance. When the tuning parameter, α, takes on a value of 1, the centrality measure is equivalent to *weighted* degree centrality. Weighted degree centralization exhibits a strong upward trend during the post-war period as the United States consolidated its hegemony. The coefficient would thus be larger, but still positive. Alternatively, when α takes on a value of zero, the result is equivalent to *unweighted* degree centrality. Unweighted degree centrality exhibits a strong negative trend as the number of countries which trade with one another increases over the course of the 20th century. The regression coefficient would thus change to negative, but still likely retain its statistical significance. Small decreases in the value of tuning parameter may cause the variable to lose significance, but it is also hard to justify such changes.

Table 1.3: TNAM Model Results

	Model 1	Model 2	Model 3	Model 4
(Intercept)	11.2737 (5.0052)*	9.8032 (5.8499)	14.9514 (7.4209)*	0.5677 (8.7761)
Centrality	0.0009 (0.0003)*	0.0010 (0.0003)*	0.0008 (0.0004)*	0.0011 (0.0003)*
Density	0.0117 (0.0077)	0.0205 (0.0086)*	0.0240 (0.0100)*	0.0391 (0.0136)*
Centralization	−17.7334 (5.8372)*	−16.1250 (6.7932)*	−21.9579 (8.5672)*	−4.3001 (10.2394)
Contagion.lag1	0.0000 (0.0000)	0.0000 (0.0000)	−0.0000 (0.0000)	−0.0000 (0.0000)
GDP Growth‘		−0.0715 (0.0179)*	−0.0819 (0.0229)*	−0.0697 (0.0183)*
Inflation		0.0003 (0.0001)*	0.0002 (0.0001)*	0.0003 (0.0001)*
Sovereign Default‘		2.0353 (0.4204)*	2.4367 (0.5595)*	2.0531 (0.4279)*
Polity			0.0077 (0.0219)	
Political Risk‘			0.0011 (0.0106)	
Capital Account Gini‘				−2.8895 (0.8576)***
Federal Funds Rate‘				−0.0098 (0.0394)
US GDP Growth‘				0.1059 (0.0674)
AIC	1237.4252	917.6060	671.2821	911.6152
BIC	1277.2201	974.5163	735.8371	987.4956
Log Likelihood	-612.7126	-449.8030	-324.6410	-443.8076
Num. obs.	5611	4119	2614	4119
Num. groups: node	200	171	127	171
Var: node (Intercept)	0.0000	0.0000	0.0000	0.0000

*$p < 0.05$

1.6 Statistical Models: System Structure and Contagion

In this subsection, I present the results of several logistic and OLS regression models designed to evaluate hypotheses 4-7 regarding how network structure affects the dynamics of financial contagion. These hypotheses are:

> **Hypothesis 4**: In hegemonic systems, countries that trade more with the hegemon should be more likely to experience contagion that originates in the hegemon.

> **Hypothesis 5**: In hegemonic systems, when crises originate in a country that is not the hegemon, contagion is more likely to affect countries that trade with the country of crisis origin more than with the hegemon, relative to other countries.

> **Hypothesis 6**: Contagion that originates in the most central economy should be greater in hegemonic systems than in non-hegemonic systems.

> **Hypothesis 7**: Contagion that originates from a country that is not the most central country, should be lower in hegemonic systems than in non-hegemonic systems.

In the set of TNAM models presented in subsection 5, I made no real attempt to parse out crises that were caused by contagion from those that were unique events. But my theory holds implications for the way crises spread throughout the system, so identifying

and modeling contagion is a good way to test my theory. Modeling contagion requires identifying and coding the causes of crises, which could be a difficult task in light of the voluminous academic debate within the field of economics as to what exactly constitutes contagion.[15] However, if contagion is defined broadly as resulting from either real or financial linkages with another country experiencing a crisis, this is a surprisingly easy task. When reviewing historical accounts of financial crises, there is often considerable consensus among historians and economists about which crises resulted from the real or financial consequences of other crises, and which were unique in their own right. Below I describe the creation of the dependent, independent, and covariant variables more completely. I use logistic regression and OLS, rather than the TNAM models of the last subsection, because my samples are disrupted time-series, so autocorrelation is not a major concern. Furthermore, I opt for traditional regression models because my dependent variable is essentially an indicator of whether or not a systemic diffusion process occurred, or a measure of severity when it did occur. This is a nuanced distinction, but the TNAM is currently developed to model country level characteristics. I could use it to show that contagion occurs, but not to determine the systemic properties that facilitate it. In the future, the TNAM could facilitate this. In its current state of development, it cannot.

1.6.1 Dependent Variables

I employ three different models with three different dependent variables to test Hypotheses 4-7. The first two dependent variables measure whether a country experiences a financial crisis due to contagion, and whether it caught contagion from the largest, most central economy or elsewhere (used to test hypotheses 4 and 5). A third is a measure of contagion severity (used to assess hypotheses 6 and 7).

To develop the data I use as my dependent variables, I reviewed historical accounts of all crises identified by Reinhart and Rogoff (2009) from the period 1870 to 2009. In the final sample, I include only crises for which there were historical accounts. Some crises

[15]See the edited volume "International Financial Contagion," edited by Claessens and Forbes (2001) for an introduction to the debate

were clearly too small, and were arguably not systemic in nature, and thus had no historical accounts of their causes. Often, when this occurred, there were other comprehensive lists of crises that excluded these events, thus confirming the fact they were likely not systemic banking crises. For those crises which did have some historical accounting, I hand coded the events as either unique events or as precipitated by a prior crisis in an economic partner country. Ultimately, I identified 115 unique crises, 13 of which proved contagious. A time series of contagious crises is presented in subsection 4, figure 1.9. In addition, I coded all crises that resulted from contagion as to whether they were sparked by a crisis that occurred in the largest and most central country (Great Britain from 1817 to 1939 and the United States from 1948 to present) or outside of it. I use this data for Models 1 and 2 in Table 1.4. The samples for these two models are, therefore, country years in which a hegemonic crisis occurred (Model 2 in Table 1.4), and country-years in which a non-hegemonic crisis occurred (Model 1 in Table 1.4).

After coding crises as either unique or part of contagion, I created an index measure of the severity of each contagious crisis. This index serves as my dependent variable in the model in Table 1.5. As described in subsection 4, I created a measure of contagion severity by taking the percentage of trading partners who experienced contagion multiplied by the average number of years those countries experienced contagion. Figure 1.9 presents a time series of the data for crises that were contagious. There are 115 crises in this data set, and 102 have a value of zero.

1.6.2 Independent Variables

My main independent variables for assessing hypotheses 4 and 5 are

> ***Difference in Exports*** This variable is employed in Model 1 in Table 1.4 to test Hypothesis 5. It is the difference between a country's exports to the hegemon and its exports to the country where the crisis originated. The lower this variable, the closer a country is to the crisis point of origin, relative to the hegemon. Large positive values indicate the country is closer to the hegemon, where as negative values indicate the country trades more with the country of crisis origin than with the hegemon. This variable should be negative and statistically significant; as this variable increases, the probability

that a country catches contagion from a crisis originating in a non-hegemonic country should decrease.

Exports to Hegemon This variable is employed in Model 2 in Table 1.4 to test Hypothesis 4. It is simply the amount of a country's exports to the hegemon. The greater this amount, the higher the probability that a country catches contagion from a crisis originating in the hegemon. This variable should thus be positive and statistically significant in Model 2.

The main independent variables for assessing hypotheses 6 and 7 regarding the severity of contagion include the following:

Hegemonic System This is a dummy variable coded 1 for the years when the international economy was hegemonically organized, 1870 to 1918 and 1948 to 2009, and zero for the years during the inter-war period when the international economy constituted a multi- or bipolar system. This variable may not be statistically significant itself, but is included for the purposes of constructing an interaction term.

Opsahl Rank Normalized This measure indicates how integrated into the international economy a country is, relative to other countries. It is constructed by taking the Opsahl Centrality values of each country and ranking them for each year, then normalizing this rank so that the final measure for each country always ranges from 0 to 1, regardless of the number of countries in the system. The country who has a value of 1 is the most central, well-connected country in the international economy.

Hegemonic System*Opsahl Rank Normalized This is the interaction of the *Hegemonic System* variable and the *Opsahl Rank Normalized* variable. Examining the marginal effects of these two variables using this interaction term tests whether crises that originate in countries that are not the most central ($OpsahlRank < 1$) produce a different scale of contagion in non-hegemonic systems than in hegemonic systems, and whether a crisis that originates in the most central country ($OpsahlRank = 1$) produces larger contagion when the system is hegemonically organized than when it is not.

1.6.3 Covariates

The covariates I include in Models 1 and 2 assessing hypotheses 4 and 5 are:

Lagged DV The samples used in the logit model to test hypotheses 6 and 7 included interrupted time series of country-year observations. Auto correlation may or may not be a problem in this context, but I include a lagged

dependent variable to control for the fact that the dependent variable is coded as 1 for the entire duration of a crisis, and not just the onset.

Combination Crisis Crises that are more severe at the point of origin, are more likely to spread. There is no existing measure of crisis severity for all the crises I included in my dataset. However, Reinhart and Rogoff (2009) detail whether financial crises are accompanied by another type of crisis, such as a sovereign default, hyperinflation, or currency crisis. When multiple crises occur simultaneously, it usually indicates a more severe financial crisis. Thus, I included a dummy variable that denotes whether or not the crisis in the country of origin was a combination crisis to control for severity of the event at the point of origin. This variable should be positive and statistically significant.

Opsahl Rank Normalized This measure indicates how integrated into the international economy a country is relative to other countries. It is constructed by taking the Opsahl centrality values of each country and ranking them for each year, then normalizing this rank so that the final measure for each country always ranges from 0 to 1, regardless of the number of countries in the system. In Model 1 in Table 1.4 this variable should be positive and statistically significant; the more integrated a country is in the international economy, the more likely it is to catch contagion.

Origin Country in Crisis This variable is dichotomous and indicates whether the country of origin is still experiencing the crisis at the time the country unit of observation experiences a crisis. This variable should be positive and statistically significant.

The covariates I include in the regression model presented in Table 1.5, modeling the severity of contagion include:

Total Years Crisis Origin As explained previously, there is no existing measure of crisis severity for all the crisis I included in my dataset. Presumably, though, crises that are more severe and last longer are going to result in more contagion. This variable should be positive and statistically significant.

Combination Crisis Crises that are more severe at the point of origin are more likely to spread. There is no existing measure of crisis severity for all the crises I included in my dataset. However, Reinhart and Rogoff (2009) detail whether financial crises are accompanied by another type of crisis, such as a sovereign default, hyperinflation, or currency crisis. When multiple crises occur simultaneously, it usually indicates a more severe financial crisis. Thus, I included a dummy variable that denotes whether or not the crisis in the country of origin was a combination crisis to control for severity of the event at the point of origin. This variable should be positive and statistically significant.

1.6.4 Results

The results of the logistic regression models evaluating hypotheses 4 and 5 are presented in Table 1.4. In the first model, evaluating hypothesis 5 – that crises that originate in a non-hegemon are more likely to spread to countries that trade with the country of origin more than the hegemon, relative to other countries, the main independent variable – *Diff in Exports*, is negative and statistically significant. The larger the difference between the volume of exports to the hegemon and the volume of a country's exports to the country of crisis origin, the less likely that country is to catch contagion. In other words, countries that trade more with the hegemon than with the country of crisis origin are less likely to catch contagion. This finding stands even after controlling for the fact that countries that are more integrated into the international economy are more likely to catch contagion; the coefficient on *Opsahl Rank Normalized* is positive and statistically significant. The coefficient on the other control variable, *Combination Crisis*, is also positive and statistically significant. Countries are more likely to catch contagion from a financial crisis that originates outside the most central economy if it is also accompanied by another type of crisis, such as a monetary crisis, sovereign default, or period of hyper inflation.

Substantively, increasing the value of *Diff in Exports* from its minimum value of -1072, which indicates the country trades more with the country of crisis origin than with the hegemon, to its maximum value of 171026, indicating the country exports substantially more to the hegemon, decreases the probability of experiencing a crisis by .55. To compare this to Opsahl Rank, increasing the value from .5, indicating an average level of integration, to .9 increases the probability of crisis by .004, while experiencing a combination of crises increases the probability of experiencing a crisis by .011.

The second model in Table 1.4 tests hypothesis 4, that countries that trade more with the hegemon should be more likely to experience contagion that originates in the hegemon. Here too, the main independent variable, *Exports to the Hegemon*, is correctly signed and statistically significant. The more a country trades with the hegemon, the more likely it is to catch contagion from a crisis that originates there. Substantively,

increasing this variable from its mean value of 16500 to its maximum value of 348582 (millions of US dollars) increases the probability that a country catches contagion from the hegemon by .008. Moving from zero dollars in exports to the maximum value increases the probability of catching contagion by .01.

Tables 1.5 through 1.7 include the results of the regression model and the marginal effects of the main independent variables of interest. In Table 1.6, the marginal effect of *Opsahl Rank* in non-hegemonic systems is larger than in hegemonic-systems, suggesting that crises that originate closer to the center of the system will produce more contagion, and that the increase in contagion that occurs when the country of origin is more integrated into the international economy is larger in non-hegemonic systems than in hegemonic systems. This lends support to both Hypotheses 6 and 7, but the marginal effects presented in Table 1.7 assess these hypotheses more explicitly.

Table 1.7 presents the marginal effect of the *Hegemonic System* dummy variable at 10 different levels of *Opsahl Rank*. An *Opsahl Rank* value of 1 indicates that a country is the most central and inter-connected economy in the world (this is Britain from 1870 to 1939, and the United States from 1948 to 2009).[16] Examining the marginal effects that attain statistical significance at or close to $\alpha = .05$, which appear in bold, we can see that for values of *Opsahl Rank* less than .9 the effect is larger under non-hegemonic systems than in hegemonic systems. One exception to this is an *Opsahl Rank* value of .7, which appears to be higher in hegemonic systems. Also, examining the difference in the marginal effect of *Hegemonic System* at an *Opsahl Rank* of 1, also provides counter intuitive results. The marginal effect suggests that contagion originating from the most central economy may actually be larger under non-hegemonic systems. However, it is worth noting that in the sample of data, a contagious crisis never originates in the most central economy during a period of non-hegemony (the inter-war period). So it is surprising that the marginal effects at this value attain statistical significance, and this fact might explain this contradictory result. The marginal effects of *Opsahl Rank* values lower than .7 do not attain statistical significance at the $\alpha = .05$, and this is probably because there are

[16]Years during WWI and WWII however are dropped from analysis

no observations in the sample of a contagious crisis originating in a country that is not well integrated into the international economy.

Table 1.4: Logistic Regression Results - Hypotheses 4 & 5

	Model 1 Contagion from Non-Hegemonic Crisis	Model 2 Contagion from Hegemonic Crisis
LaggedDV	4.145 (0.284)***	4.586 (0.275)***
Combination Crisis	1.404 (0.311)***	
Opsahl Rank Normalized	2.083 (0.634)**	
Origin country in Crisis	0.572 (0.306)	−0.223 (0.379)
Diff in Exports	−0.0000259 (0.00000899)**	
Exports to Hegemon		0.00000888 (0.00000257)***
Intercept	−6.737 (0.604)***	−4.282 (0.377)***
N	2682	2813

Standard errors in parentheses
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 1.5: Regression Results - Hypotheses 6 & 7

	Contagion Score
Total years Crisis Origin	0.000896 (0.00568)
Combination Crisis	−0.0146 (0.0256)
Hegemonic System	0.206 (0.166)
Opsahl Rank Normalized	0.419 (0.204)**
Hegemonic System*Opsahl Rank	−0.258 (0.212)
Intercept	−0.277 (0.162)
N	104

Standard errors in parentheses
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 1.6: Marginal Effect of Opsahl Rank - Hypotheses 6 & 7

	dy/dx	Std. Err.	$P > \|t\|$
Non-Hegemonic System	0.4198499	0.2037858	0.042
Hegemonic System	0.1621752	0.0672113	0.018

1.7 Conclusion

This paper attempts to theorize and empirically evaluate the causal connection between the structure of the international economy and its performance. In doing so, it complements our understanding of the domestic political processes that facilitated globalization with an understanding of how the resultant system in turn affects the ability of countries to benefit from their decision to liberalize their economy to international markets. Therefore, this paper also contributes to the burgeoning literature that uses complexity and network sciences to measure and evaluate the structural and financial power of countries (Winecoff 2015; Culpepper 2015).

Table 1.7: Marginal Effect of Hegemonic System - Hypotheses 6 & 7

Opsahl Rank	Hegemonic System	dy/dx	Std. Error	$P > \|t\|$
0	**No**	**-.464945**	**.2586939**	**0.075**
0	Yes	-.1000791	.0772697	0.198
.1	**No**	**-.3957748**	**.2263981**	**0.084**
.1	Yes	-.0773482	.0669221	0.251
.2	No	-.3266046	.1942977	0.096
.2	Yes	-.0546172	.05676	0.338
.3	No	-.2574343	.1625088	0.116
.3	Yes	-.0318863	.0469042	0.498
.4	No	-.1882641	.1312576	0.155
.4	Yes	-.0091553	.0375962	0.808
.5	No	-.1190939	.1010445	0.241
.5	Yes	.0135756	.0293619	0.645
.6	No	-.0499236	.0731668	0.497
.6	Yes	.0363066	.0233653	0.123
.7	No	.0192466	.051563	0.710
.7	**Yes**	**.0590375**	**.0215622**	**0.007**
.8	**No**	**.0884169**	**.0461093**	**0.058**
.8	**Yes**	**.0817685**	**.0248815**	**0.001**
.9	**No**	**.1575871**	**.061281**	**0.012**
.9	**Yes**	**.1044994**	**.0317557**	**0.001**
1	**No**	**.2267573**	**.0868713**	**0.010**
1	**Yes**	**.1272304**	**.0404095**	**0.002**

Susan Strange (1982) defined structural power as "the power to shape and determine the structures of the global political economy... the power to decide how things will be done." In her original work on the subject, Strange outlined four structures in the international system from which structural power is derived: security, production, finance, and knowledge. Of these four, the financial structure and power derived from it has, quite naturally, received the most attention by subsequent IPE scholars. Of the financial structure, Strange wrote:

> The financial structure really has two inseparable aspects. It comprises not just the structures of the political economy through which credit is created but also the monetary system or systems which determine the relative values of the different moneys in which credit is denominated; in the first, the power to create credit is shared by government and banks (and much will depend therefore on the political and regulatory relation of the one to the other). In the second, the exchange rates between the different moneys, or currencies, are determined by the policies of governments and by markets. (1982:90)

Much of the literature developing Strange's notion of structural financial power has focused on the role of the United States as the dominant supplier of international reserve currency. Most notably, Benjamin Cohen (2006; 2015) has highlighted the privileges of supplying the world's reserve currency, namely the ability to delay balance of payments adjustments, which can, in the short term, have politically inconvenient consequences as

certain sectors lose the benefits of the external imbalance they were accustomed to. To Strange, however, credit was of at least equal importance in the creation of structural and financial power. According to Strange:

> The third leg, or facet, of structural power is, admittedly, rather more peculiar to advanced industrialized economies, whether socialist or capitalist, than it is to small communities or less developed economics. But finance – the control of credit – is the facet which has perhaps risen in importance in the last quarter century more rapidly than any other and has come to be of decisive importance in international economic relations and in the competition of corporate enterprises. [...] its power to determine outcomes – in security, in production and in research – is enormous. It is the facet of structural power least well understood by the Marxists and radicals who have written most cogently about structural power over production. Many of them still entertain the old fashioned notion that [...] capitalism somehow depends on the accumulation of capital. What they do not understand is that what is invested in an advanced economy is not money but credit, and that credit can be created. It does not have to be accumulated. Therefore, whoever can gain the confidence of others in their ability to create credit will control a capitalist – or indeed a socialist – economy. (1982: 30)

Most explorations of monetary power include a limited discussion of credit creation, though they do not detract from its importance. Cohen, for example, explores the role investment (financed by credit) plays in creating monetary power: "[...] It is clear that an investment role is essential if a currency is ever to rise to the status of a reserve currency. While a given money can play an investment role even if never used as reserve currency, the reverse is unlikely ever to happen in a market-based currency system. Monetary history suggests that the investment role comes first and then is followed by a reserve role in addition." (2016: 95)

This paper fleshes out the credit dimension of structural financial power, as Strange conceived of it. Countries with large and deep financial sectors, that play a central role in international financial markets by facilitating a disproportionate amount of financial intermediation, have extraordinary influence over and autonomy from international market conditions.[17] As demonstrated by both Britain during the long 19th century and the United States in the post-war era, the ability to create large amounts of financing, and

[17] See Cohen 2015 for a discussion of influence and autonomy as the two dimensions of structural power

provide it to foreign markets, while not being dependent on foreign markets as a source of investment, means a country will disproportionately affect the stability and growth trajectories of foreign powers, while it remains mostly immune to the international market discipline it so readily dolls out. When such a hierarchical distribution of structural power prevails in the international system, countries more entwined with the most central, hegemonic country will receive both a greater benefit of stability when a crisis occurs outside the hegemon, and bear greater losses when the crisis originates within the hegemon. However, when the distribution of financial intermediation changes, and is more equally distributed among economies, as more large and financially developed economies emerge, the influence and autonomy – the structural financial power – of countries also becomes more evenly distributed.

This notion of structural power lies at the heart of international politics. For whether or not the influence on the part hegemonic powers on the stability of the international economy is intentional (to some extent it is and to some extent it is not), it is none-the-less real and impactful. Structural financial power is not immediate obvious, nor is it very tangible, but it is key to answering the fundamental political question: "what is the net result and for whom, in terms of order and stability, wealth and efficiency, justice and freedom; and in terms of all the opposite qualities – insecurity and risk, poverty and waste, inequity and constraint." (Strange 1982) In fact, one could easily argue, the less obvious and more intangible the form of power, the greater our responsibility as political scientists to expose and understand it.

In the broader scientific community, the notion I have asserted here, that a system's structure directly affects its performance, is not novel. In the fields of political economy and international relations, structuralist explanations are passe, debunked by the unexpected end of the cold war. Advances in the field of complexity science warrant a reconsideration of structuralist arguments. In this paper, I have reinterpreted Charles Kindleberger's Hegemonic Stability Theory using the framework of complexity science. Evaluating and testing the theoretical proposition that system structure drives system performance is not an easy undertaking. When the smallest units of the system being

studied are the most biologically complex species on the planet for which universal scientific laws of behavior have yet to be discovered, and the system itself is the highest possible level of aggregation of those units, and is observed empirically for a relatively brief period of time, the magnitude of difficulty is particularly high. Expectations of empirical support must be properly aligned with these realities. Given these realities, I would argue that the results of the statistical models presented herein provide strong support for the hypotheses I outlined. The more integrated a country is into the international system, the more densely organized that system is, and the less centralized it is, the more likely countries are to experience financial crisis.

This paper makes four additional contributions to IPE and the literature on the political economy of financial crisis worth highlighting . First, it offers an empirical measure of hegemony, a concept that pervades the fields of International Political Economy and International Relations. Opsahl centralization can be calculated for two mode networks, meaning it is possible to base the measure of hegemony on more than one dyadic variable, assuming it is available for a series of years. There has been debate among scholars as to whether the 2008 financial crisis marked the decline of the material foundations of American hegemony (Layne 2012, Winecoff 2015). This article lends empirical evidence to the debate. In another five or so years, we will likely be able to evaluate the evolution of American hegemony in the first quarter of the 21st century based not only trade but on investment flows, as the IMF continues to collect and release its Coordinated Portfolio Investment Survey and Coordinated Direct Investment Survey data. This paper also offers other ways of assessing network structure and countries' relative positions within the international system: density and Opsahl centrality.

Second, this paper suggests the need to qualify the advice economists often deliver to developing countries, that integration into the world economy promotes growth, but not stability; As globalization increases, and in particular as the Chinese economy grows to rival that of the United States, volatility will likely become the new normal. Contrary to what proponents of the "great moderation" argued (Benati and Surico, 2009; Bernanke, 2004; Davis and Kahn 2008), countries will not outgrow financial crises.

Finally, this paper employs, for the first time, a statistical model (the TNAM) that can model country-level attributes as a function of both country-level and system-level variables – a major improvement over the use of the standard OLS and MLE regression models. In finding that system structure helps to explain the emergence of financial crises, the study asserts the validity and even necessity of further examining macro-level causal processes. Macrolevel-causality has been a feature of many influential IR and IPE theories, but empirical tools for specifying and testing such theories have not been employed in the field until recently. Macro-level causality has therefore become a somewhat contentious issue in the field of IPE, as a debate over the importance of system level and domestic variables has played out between senior scholars (Oatley 2011; Milner et al 2015). The issue need not be contentious.

All IR and IPE outcomes of interest (all international political and economic epiphenomena) are the result of two or more international actors interacting. Often times, the outcomes are actually the product of a multitude of actors interacting. We can explain how and why these epiphenomena occur by examining other epiphenomena that influence them – other outcomes that occur as a result of the same or other actors' interacting – as well as individual actor behavior. When the relevant actors involved in a particular international political or economic phenomenon are states, which themselves are systems, understanding the internal dynamics of those states is as critical as understanding the dynamics of the broader system in which they are positioned.

Some IR and IPE scholars have in the past treated macro-level phenomena as if they are exogenous forces or variables. This is inaccurate, but is usually done for analytical tractability, which may be justifiable. Domestic and international political and economic phenomena are always endogenous. Therefore, a combination of individual actor behavior, and other epiphenomena produced by other agents interacting in other ways, can be said to cause a particular outcome of interest. This study demonstrates this point. Thus, it is time to conclude, as have scientists in many other fields, that macro-level causality does not "lack microfoundations," rather, it complements our understanding of the micro-level causal processes that occur simultaneously (Henderson 1994).

Chapter 2

The Systemic Causes of Financial Crises in the Long 19th Century

2.1 Introduction

In the wake of the 2008 Financial Crisis, many developing countries experienced strong capital inflows when US interest rates hit historic lows and the US Federal Reserve initiated quantitative easing. When the Federal Reserve began to unwind its quantitative easing in mid-2013, developing countries braced themselves for a sharp reversal in capital flows. Between the policy announcement in May and the end of September, Indonesia's Jakarta Composite Index and Turkey's BIST 100 both lost approximately 20 percent and the cost of a 10-year government bond in Turkey shot up by nearly 370 basis points [1]. The turmoil motivated the Indian Finance Minister to call for renewed cooperation on monetary policy to minimize the impact of Federal Reserve policy on developing economies. In a globalized and hegemonically organized international economy, the financial conditions of the hegemon often have spillover effects for peripheral economies.

In this paper, I build on recent insights regarding the domestic structural and international causes of financial crises, as well as the earliest systemic theory of financial crises, Charles Kindleberger's Hegemonic Stability Theory (HST), to advance a systemic theory of financial crisis. However, while Charles Kindleberger focused on the stability brought about by a hegemonically structured international economy, I emphasize the dynamics of volatility present in this type of system. Hegemonic systems may exhibit stability when a crisis originates in a peripheral country, suggesting hegemonic systems are more stable,

[1] Kawai 2015

as Kindleberger proposed. But hegemonic systems are also especially fragile to a crisis that originate within the hegemon. In fact, hegemonic systems are quite sensitive to financial conditions of the hegemon in general. While hegemonic systems may be resilient to contagion from crises that originate in peripheral countries, the dynamics of the crises that emerge in peripheral countries are driven by the financial conditions of the hegemon.

I argue herein that a hierarchical distribution of economic activity in the international system means that the financial cycle of the most central country influences the financial conditions in peripheral countries that lead to financial crisis. Evidence from financial crises which occurred in the long 19th century supports this theory. During the long 19th century, Great Britain was the largest and most interconnected country in terms of both international trade and investment. Periods of expansion in the financial cycle of Britain, when Bank of England interest rates were relatively low and credit was readily available, coincided with higher levels of foreign investment to peripheral countries and greater demand for raw materials from them. As a result, productivity and credit expanded in these countries, leading to higher asset prices, and increasing the probability of credit and asset bubbles which precede financial crises.

This paper is structured as follows. The first section of this article outlines the core theoretical framework of how globalization and the structure of the international economy in the 19th century influenced the dynamics of financial crises and generates three testable hypotheses. The second section explores the historical evidence for this theory, and the third section uses statistical analysis and data on financial flows and crises in the 19th century to test my hypotheses more formally. The results suggest that even after controlling for domestic "pull factors", system level dynamics affect the probability that a country experiences a surge in capital flows and financial crisis. The last section discusses the implications of these findings for the broader literature on the political economy of financial crises.

2.2 Financial Cycles Culminate in Financial Crises

The Hegemonic Stability Theory [2] was first developed by Charles Kindleberger [3], and spawned one of the foundational research programs in the field of international political economy. Kindleberger argued that the lack of a hegemon contributed to the depth and severity of the Great Depression, and that the stability of the international system requires a single dominant state to dictate the rules of interaction among the most important states in the international system. This argument was and remains unique in the causal role it attributed to the structure of the internatinal economy. In contrast to other theories of the Great Depression which emphasized the failures in a single country's regulation, intervention, or monetary policy [4], Kindleberger proposed a failure in the structure of relations between nation-states:

> [T]he 1929 depression was so wide, so deep and so long because the international economic system was rendered unstable by British inability and United States unwillingness to assume responsibility for stabilizing it [...]. The shocks to the system from the overproduction of certain primary products such as wheat; from the 1927 reduction of interest rates in the United States (if it was one); from the halt of lending to Germany in 1928; or from the stock-market crash of 1929 were not so great. Shocks of similar magnitude had been handled in the stock-market break in the spring of 1920 and the 1927 recession in the United States. The world economic system was unstable unless some country stabilized it.[5]

Kindleberger's theory fell out of favor among most political economists, as scholars questioned the logic of the collective action framework on which Kindleberger's theory

[2] So named by Keohane 1980

[3] Kindleberger 1973

[4] Eichengreen 1992; Friedman and Schwartz 1963; Robbins 2010; Keynes 1936

[5] Kindleberger 1973:292

was built. For instance, Duncan Snidal[6] showed that a hegemon was not a prerequisite for solving collective action problems and providing the counter cyclical policies that Kindleberger linked to international economic stability. However, when removed from the collective action framework, the central hypothesis of Hegemonic Stability Theory does hold merit. Indeed, from the perspective of Complex Systems Theory, it makes good sense.

If the global economy is a system of national economies connected via trade and (perhaps more importantly in the case of crises) investment flows, as some scholars such as Thomas Oatley propose[7] propose, then there is reason to think that hegemonic systems are more stable. Hegemonic systems are hierarchical systems, where a single country is disproportionately well connected to other countries. To use more technical network terminology, a hierarchical system is one where the distribution of degree centrality among the nodes is highly skewed because a single node has a much higher degree centrality than any other node. A network definition of hegemony is quite compatible with traditional definitions of hegemony that emphasized a single nation holding a preponderance of resources and influence within the international system. Degree centrality implies both a preponderance of wealth that results from a high volume of economic exchange as well as a high degree of influence within the network via the countries numerous economic links to other countries.

Within Complex Systems Theory, a well known characteristic of hierarchical systems is remarkable stability. In hierarchical systems, the most central agent is capable of absorbing shocks that originate elsewhere in the system, preventing them from spreading [8]. In the context of financial crises, this means that a hegemonic system should, as Kindleberger argued, be robust to systemic financial crises, provided they occur outside of the hegemon. Complex Systems Theory proposes that the size of the hegemon's economy is sufficiently large to absorb any real or financial shocks that emanate from peripheral

[6]Snidal 1985

[7]Oatley et al. 2013

[8]Wang and Chen 2002

countries, preventing crises that originate in the periphery from spreading to the rest of the world economy [9].[10]

However, hegemonic systems are also fragile to crises that originate within the hegemon, as the hegemon maintains the largest and most numerous economic ties through which crises are transmitted to other countries. Whether the transmission mechanism of financial crises is real economic disruption (illiquidity) or semi-rational investor expectations [11], contagion cannot exist in the absence of an economic relationship. [12] This is the flip-side of Kindleberger's argument; Hegemonic systems are robust *yet fragile*.

The core logic of the "robust yet fragile" property of hierarchical systems, and of network theory more generally, is that the influence of a node in a network is determined by its position relative to another nodes, as well as the overall structure of the network. Thus, another way of characterizing the robust-yet-fragile property of hierarchical systems is to say that the most central actor holds significant influence over other actors in the network and thus plays a special role in driving the dynamics of the system overall. This property is important not only to understanding contagion, in the wake of a financial crisis, but to understanding the emergence of crises as well. This property implies that financial conditions of the hegemon influence these same conditions in other national economies and by extension, financial conditions in the hegemon are likely to influence or drive the crises that result from developments in these conditions in other countries in the system.

The hegemon drives crises throughout the rest of the system because its numerous trade and investment links act as conduits of "spillover" effects from its financial cycles. Scholars who study financial cycles define them similarly to business cycles – the pattern of expansion, peaks, contractions, and troughs that occur in an economy's as-

[9]Haldane 2009

[10]See Oatley et al 2013 for an explanation of how the hegemony prevents the spread of economic contagion, whether or not the hegemon actively chooses to implement counter cyclical policies.

[11]Dornbusch et al. 2000

[12]As Forbes and Rigobon (2002) have argued, this is because contagion is actually just interdependence.

set(with an emphasis on property) and credit prices[13]. These cycles are the result of "self-reinforcing interactions between perceptions of value and risk(property prices), [and] attitudes towards risk and financing constraints(credit), which translate into booms followed by busts." [14] They are, in essence, a property of market systems, like business cycles. [15] The financial cycle is, however, distinct from the business cycle, in that it is much longer – 16-20 years verses 8 for the average business cycle – but it sometimes coincides or aligns with the business cycle, because financial and real sectors are inextricably linked. The period from 2000-2008 in the United States is an example of an alignment of the two cycles. As was also the case in 2008, the peak of financial cycles are usually associated with a period of financial distress.

As the volume of trade and investment increases between countries, the probability increases that financial cycles "spill over" from one country to another, in particular from a disproportionately large economy to smaller economies. When a country's financial cycle is expanding, credit and debt is expanding, and market liquidity is high. This facilitates investment abroad, particularly if growth is moderate or strong. The increased investment applies downward pressure to the market interest rates of recipient countries, and can push them below the natural rate implied by the productivity of the real of

[13]Drehmann et al., 2012

[14]Borio 2014

[15]They are a property of market systems because markets are themselves complex *systems* consisting of a variety of human actors interacting and reacting to one another by buying and selling both real goods and financial assets (the prices of which are jointly determined). The fact that system components (market actors) are interacting with and reacting to one another, implies that the human market system contains feedback. All complex systems that feature a feedback component exhibit cycles. Being that humans frequently utilitize heuristic short cuts for decision making (see the life-long work of Daniel and Kahneman and Amos Tverksy) and have a very limited ability to predict the future, they are prone to imitate one another and to assume that current conditions will continue in to the future. This implies that the cycles, or the feedback process, can and likely will be quite large and long in duration since this behaviour on the part of market actors is persistent and can drive prices far from fundamental market value before market actors realize that the prices have inflated so dramatically. The complex systems narrative is very consistent with the narrative Hyman Minsky's created in his financial instability hypothesis (1977) and with that of Kindleberger in his work on manias and panics (2005). For additional literature on financial markets as complex systems see Markose (2005), Foster (2005), and Sornette (2009). For literature on the problems of incorporating finance into macroeconomic models with in the New Neoclassical Synthesis framework see Bhattacharjee and Thoenissen(2007). For macroeconomic models that successfully incorporate finance, outside of the NNS framework, see Keen (2008, 2009, 2010, 2011, 2013a, 2013b)

economy. [16] When a country's market interest rates are lower than the natural rate warranted by real sector productivity, credit and asset bubbles are sure to follow since the divergence will stimulate demand for credit and assets [17]. As Charles Kindleberger[18] and Hyman Minsky[19] have theorized, and as other economists have demonstrated with empirical evidence [20], asset and credit bubbles frequently precede financial crises because the financial sector amplifies real sector activity. [21]

The ability of a hegemon's financial cycle to create spill-over effects for the financial sectors of other, smaller economies has been highlighted in the contemporary period by economist Helene Rey. Rey documents the existence of what she calls the "global financial cycle.":

> There is a global financial cycle in capital flows, asset prices and in credit growth. This cycle co-moves with the VIX, a measure of uncertainty and risk aversion of the markets.[...]The global financial cycle is not aligned with countries' specific macroeconomic conditions. Symptoms can go from benign to large asset price bubbles and excess credit creation, which are among the best predictors of financial crises. [...] One of the determinants of the global financial cycle is monetary policy in the centre country, which affects leverage

[16]The notion that interest rates can be artificially low, and can diverge from the natural or equilibrium rate of interest, is a departure from mainstream New Neoclassical Synthesis (NNS) economics. In contemporary economic theory, the natural rate of interest is the equilibrium real rate of interest that would result in an economy with fully flexible prices. The earliest conception developed by Knut Wicksell (1898) defined the natural rate slightly differently as the interest rate that prevails when savings equal investment at full employment (return on capital or real profit rate). Either way, the natural rate is a hypothetical rate that would exist if money did not exist. The market rate, in contrast, is the the rate that actually prevails (observed nominal rate - expected inflation), which is influenced heavily by actor expectations of market, liquidity risk (as well as the risk preference and tolerance of the actors), and monetary factors (such as credit and the relative availability of assets)(Borio and Disyatat 2010; 2011). In new-Keynesian economic theory, the two rates are presumed to be the same, as the economy is always in a state of equilibrium. However, in post-Keynesian economic theory, it is possible for these two rates to diverge considerably, resulting in an asset bubble as demand for financial assets increases due to the artificially low rates.

[17]Borio and Lowe 2002

[18]Kindleberger 2005

[19]1977

[20]Reinhart and Rogoff 2009; Claessens 2012

[21]In new neoclassical synthesis economics, this occurs via the financial accelerator effect (Bernanke and Blinder 1998; Keen 2013; Schumpeter 1934:72). In post-Keynesian economics this is because the financial sector is is endogenous component of the macroeconomy as banks create money (Keen 2013).

> of global banks, capital flows and credit growth in the international financial system. Whenever capital is freely mobile, the global financial cycle constrains national monetary policies regardless of the exchange rate regime. [22]

In other words, the global financial cycle is the tendency for the financial cycle of the most central country in the international economic system to influence or spillover to the financial sectors in other countries.[23] I propose that a very similar phenomenon occurred during British Hegemony in the long 19th century.

If this logic is correct and system structure and the economic fundamentals of the hegemon drive financial crises, then a correlation should exist between the state of the financial cycle in the hegemon and international financial crises in the periphery. The first era of globalization in the long 19th century presents an ideal case with which to examine this relationship. In the 19th century, the international economy was hierarchically structured with Britain as the hegemon, or most central and connected economy. Britain dominated international trade and was the preeminant source of international investment. Furthermore, because the gold standard was in place and capital was highly mobile, interest rates in peripheral countries were heavily influenced by interest rates in Britain. In the next two sections, I examine historical qualitative and quantitative evidence in support of this correlation. Specifically, I will examine evidence for the following testable hypotheses based on the theory I have outlined.

> *Hypothesis 1*: When the British financial cycle was expanding, the probability that peripheral countries experienced a surge of capital from the hegemon increased.
>
> *Hypothesis 2*: When the British financial cycle contracted, and credit shrank, the probability that peripheral countries experienced a financial crisis increased.

---

[22] Rey 2015

[23] This assertion that the hegemon's economic fundamentals affect financial conditions across the rest of the system finds empirical other empirical support as well. See Calvo, Leiderman, and Reinhart (1996), which found that "global factors affecting foreign direct investment tend to have an important cyclical component, which has given rise to repeated booms and busts in capital inflows." Research from Renaud (1995; 1997), suggests the dynamic probably precedes the period covered by Rey. He documents the existence of a global real estate cycle from 1985 to 1994, peaking in 1990, that simultaneously inflated real estate prices across most OECD countries.

Hypothesis 3: Experiencing a surge in capital flows from the hegemon increased the probability that a periphery country experienced a financial crisis.

2.3 The Global Financial Cycle and Crises in the 19th Century

The international economy in the 19th century revolved around Great Britain due to its industrial and technological leadership. Britain emerged victorious from the Napoleonic Wars in 1815 and with the onset of the second industrial revolution, became the world's leading economic power. With regard to trade, Britain imported primary commodities, mostly from North America, Argentina, Brazil, and Uruguay, and exported finished manufactured goods to former and current colonies. With regard to international investment, London's capital market was twice as large as its rivals' combined by 1870. Britain was the largest exporter of capital to its current and former colonies in Africa and the Americas. On average, between 1870 and 1913, it invested 5 percent of its GDP overseas, but this amount peaked at nearly 10 percent just before WWI.[24] The United States, Canada, Australia, Argentina, Brazil, and Uruguay attracted the largest share of this investment. Britain's position in trade and investment markets was of course linked to the gold standard and Sterling's role as the dominant reserve currency. Britain formally established the Gold Standard in 1819 and most countries adopted a similar arrangement in the 1870s, making it the linchpin of the international economy in the 19th century. The adoption of the Gold Standard and participation in the monetary union or currency band led to increased trade.[25]

The centrality of Britain in all three dimensions of the international economy – monetary, financial, and trade – amounted to nothing short of economic hegemony. This hierarchical structure determined patterns of crisis in the periphery, as the financial cycles in Britain disproportionately influenced the financial conditions abroad. A more elaborate exposition of the British financial system and British monetary policy in the 19th century will illuminate these dynamics.

[24]Fishlow 1985

[25]Flandreau and Maurel 2001

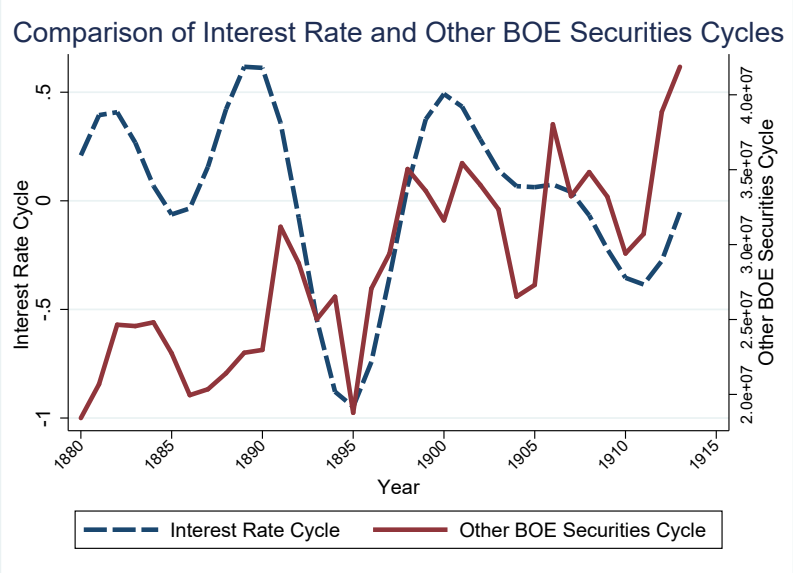
In the 19th century, the British financial system revolved around the Bank of England (BOE). By today's standards, the Bank of England was a quasi-central bank during the period, and exercised less control over monetary policy than it does now. It was the largest financial institution in the country and held significant influence within financial markets, but it did not set interest rates for the purpose of maintaining price or employment levels, as do contemporary central banks. Instead, as the first and only joint-stock bank allowed to operate with limited liability until 1826, the Bank of England was a private bank accountable to its shareholders. Very few firms borrowed from the Bank of England. Its primary activity was to rediscount bills for discount houses in London, who in turn lent to banks, who in turn lent to firms. As rediscounting was the primary function of the BOE, the Bank naturally provided lender of last resort services in times of crisis, but was free to deny credit to any institution deemed unprofitable.

It was through these two functions, rediscounting and lender of last resort, that the bank influenced (but did not solely determine) monetary policy and short term interest rates. In fact, between 1857 - 1890, when the Bank of England stopped rediscounting for London discount houses, it actually chased the market rate set by the London discount houses rather than leading them.[26] For most of the 19th century, the Bank of England rates were largely a reflection of two factors: the amount of gold reserves and the demand for rediscounting by other discount houses in London. The Bank of England lowered rates when demand for rediscounting was low, and its reserves were plentiful, and it raised rates when demand for rediscounting was high, and its levels of reserves tended to be lower. Figure 2.1 plots the bandpass filtered cycles of Bank of England interest rates against "other securities" on the Bank of England's balance sheet. These "other securities" were rediscounted bills. The cycles apparently follow very similar trends.

While the BOE served as a lender of last resort, its role in the economy was mostly pro-cyclical. When Bank of England rates were low and stable, this was an indication that credit was easy to obtain, that economic fundamentals were strong, and that the money supply was expanding. When rates were high and volatile, demand for re-discounting

[26]Collins 2012: 186

Figure 2.1: Cyclical Component of UK Interest Rate and Other BOE Securities



from the Bank of England was high, and the money supply was shrinking. Higher rates could also be an indication of trouble within the banking system or that the economy was experiencing a contraction. [27]

Perhaps more importantly, the BOE influenced but did not completely control the national money supply. The Bank began to issue banknotes soon after its creation in 1694. However, the Banking Charter Act of 1844 was the first major attempt to regulate the institution's credit and banknote operations, giving the Bank sole power to create banknotes. But even this special role conferred relatively little influence over the nation's money supply. The act was a response to the Bank Panic of 1825, which the public blamed on the oversupply of banknotes, and sought to prevent banking crises due to the expansion of the money supply. The Act had notable flaws and did not accomplish this objective. The Act restricted the creation of banknotes to the Bank of the England and fixed a quota of $14,000,000 on the number of notes the Bank could issue, above which any additional printing of notes by the Issue Department had to be 100 percent backed by gold. However, the Act did not, in practice, ensure that the value of banknotes in circulation varied with level of gold reserves. This was partly because the BOE was divided into two sections - the issue department and the banking department. The issue

[27] Homer and Sylvia 1996: 182-185

department issued bank notes in exchange for gold. The banking department handled rediscounting. As Collins explains:

> The Issue Department issued notes directly only to the Bank's own Banking Department, with these notes, in turn, entering into general circulation as customers drew on their accounts and borrowed from, or sold securities to, the bank. At any one time the Banking Department retained a reserve of notes and the extent to which they were passed to customers would depend on many factors such as rates of interest and the public demand for legal tender. The 1844 Act did not fix the ratio of the Banking Department's reserve to its note liabilities. Thus, it was possible for the Banking Department to pay out notes to the public – or take them in – with some degree of independence from the size of the regulated reserve in the Issue Department. In other words, the purity of the direct link that the Currency School had sought to establish between the gold reserve and the note circulation was never attained.[28]

The legislation also failed to limit the creation of other types of money, most notably book money – that is credit or deposits that existed on the books. Given the growing prevalence of checks and banker's drafts during this period, book money was an important component of the money supply and did not vary with the level of gold reserves. [29] Thus, while the supply of money in the form of banknotes was technically limited, the British money supply largely expanded and contracted with the real sector's demand for credit. In other words, the money supply was minimally constrained by the gold reserves at the Issue Department of the Bank of England.

Lying at the center of the international economy, the British financial sector conditions heavily influenced real and financial sector developments in other countries. When the financial cycle was in a period of expansion, and credit was expanding, capital flowed to other countries fluidly as well. Indeed, most international loans were channeled through the London discount houses, which had the most direct relationship with the Bank of England. When credit was bountiful (and rates were relatively low), capital flowed out of the country looking for higher returns abroad. This, in turn, pushed rates down abroad. Quantitative evidence tells us that short term interest rates and price movements

[28] Collins 2012:175

[29] Collins 2012: 176-177

were tightly integrated across major economies on the gold standard. [30] In countries with a central bank, the institution usually adjusted their bank rates in response to Britain's. When Britain raised or lowered rates, peripheral countries made corresponding changes within several months.[31] In economies without a centralized banking system, rates were affected via the gold standard. The availability of British capital during periods of low rates helped fuel economic expansion in recipient countries by raising incomes and spurring demand, which in turn also boosted domestic investor confidence, created demand for assets, and fostered speculation in asset markets.[32]

Data from the 19th century confirms the plausibility of this account. Figure 2.3 presents the bandpass filtered credit/GDP cycle of the UK along with the number of surges in UK capital outflows to peripheral countries. The logic for using surges in capital flows rather than simply a continuous measure of all capital flows is that large influxes of capital flows can have different effects on a countries' economy than smaller, gradual increases. Large influxes can cause asset prices to appreciate more rapidly, and interest rates to fall [33] [34] To construct this figure, I first calculated the annual change in gross capital flows from Britain to each country for the period 1880 - 1913 using data from Irving Stone's estimates of gross annual capital flows from Britain to 25 countries.[35] I then constructed the average and standard deviation for the previous five years. [36] I define a

[30]Bloomfield 1959; Triffin 1964

[31]Eichengreen 1987a

[32]AG Ford 1958

[33]Kim and Yang 2009; Ghosh et al. 2014; Caballero 2014

[34]The approach to identifying capital flow surges is similar to the one adopted by Forbes and Warnock (2012).

[35]Stone 1999

[36]Using the following equations

$$Mean(\Delta Kflows)_t = \sum Kflows_{t-1:t-5}/5 \tag{2.1}$$

$$SD(\Delta Kflows)_t = \sqrt{(\sum (Kflows_{t-1:t-5} - Mean\Delta Kflows_t)^2)/4} \tag{2.2}$$

surge as a change in capital flows that is greater than one standard deviation above the average change of capital flows. The bars denote the number of capital flows surges in a given year. In this figure, it is evident that capital flow surges tend to follow a similar trend to the UK credit/GDP cycle. Figure 2.4 similarly plots the credit/GDP cycle of the UK against the number of financial crises occurring in other countries. Clustering of taller bars is evident around recessions and troughs in Britain's financial cycle.

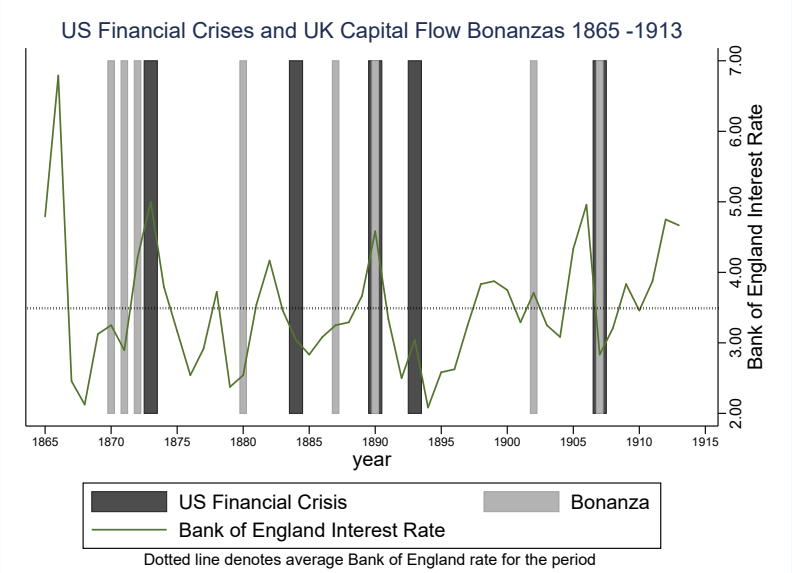
The dynamics illustrated by these charts are well illustrated by the economic history of the United States, which experienced several significant banking crises in the long 19th century. As the US developed and its financial sector expanded, it experienced a series of banking crises that grew in size and significance. [37] The three largest crises, in 1873, 1890 and 1907 were preceded by large surges in capital flows from the UK (see Figure 2.2), and coincided with contractions in the British financial cycle.

The most substantial financial crisis prior to the Great Depression, the Panic of 1907, presents a good case study of these dynamics. The crisis was the byproduct of international market conditions, heavily influenced by British economic fundamentals and financial conditions. In 1895, when the British financial cycle began to expand, and interest rates bottomed out during the recovery from the Barings Crisis, UK capital flows to the US surged and the US experienced an economic boom. The expansion in the US peaked in 1900-1, when the recession in Britain took a toll on the US economy, and again in 1905-6, when the financial cycle in the UK expanded (1904-1905). The years 1905-1906 featured particularly high GDP growth for the US at 7.34 percent (nearly twice the average of the previous five years). This period of expansion was accompanied by 10.5 percent increase in exports, a 12 percent increase in imports, a credit boom, and an asset boom. Bonds, in particular, were a favorite form of asset. In the two years, $872,000,000 in new bonds were listed on the New York Stock Exchange. To compare this to the prior period with hot growth in 1900-1, the total was only $367,000,000 (GDP growth in 1901 was over 9 percent).

Economic conditions during the first few years of the 20th century were nearly as

[37] see Reinhart and Rogoff 2009, who cite Conant 1915, Jalil 2009

Figure 2.2: UK Capital Flow Surges and US Crises 1865-1913



prosperous for other countries as for the US. Britain, Russia, France, Belgium, and Italy all experienced significant increases in trade as a share of GDP. The demand for credit to facilitate this trade was not restricted to the US, but occurred in other industrializing countries as well. Warning of impending market correction, M. Leroy Beaulieu, a prominent french economist of the era, noted in the Economiste Francaise in 1907:

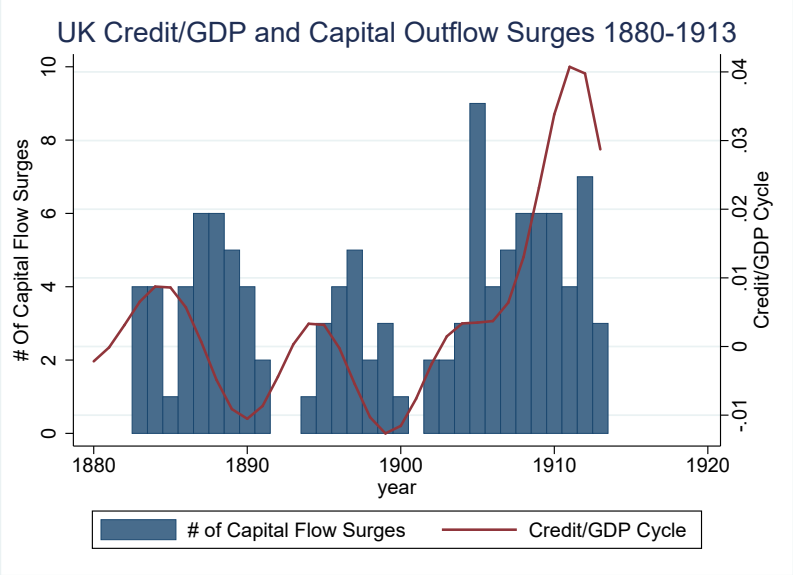
> The growing industrial states, particularly the new countries, are at this moment demanding more capital than the whole world has accumulated recently, or is accumulating to-day. From this fact follow two consequences: first, that the users of this capital have to pay more for it in the shape of a higher interest rate; second, that they will be compelled to postpone, or extend for several years, many of the enterprises on which they had decided and for which they had already made preparations. [38]

The demand for credit was also reflected in higher international commodity prices. The Economist's commodity price index rose from 1,885 in 1897 to 2,136 at the end of 1904, to 2,601 in June, 1907. In short, this period marked a major upswing in the global financial cycle that was driven by a period of economic and financial expansion in the UK.

It was the tug of war for gold between the UK and the US, arguably brought on by the world-wide economic boom, that forced the bank of England to bump up rates in 1906.

[38] De Noyes 1909: 198

Figure 2.3: UK Credit/GDP and Capital Flow Surges to the US 1880-1913



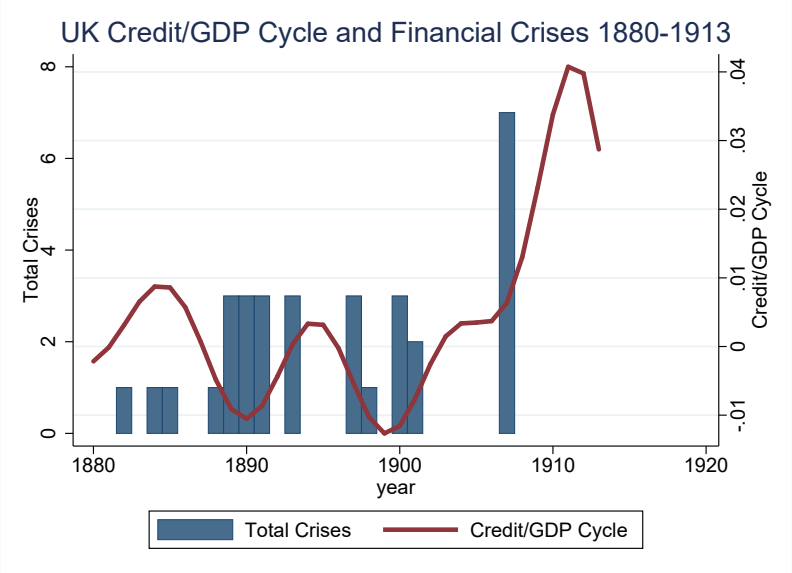
In 1906, the US treasury devised a strategy to increase gold flows using financing bills. Gold poured in – $50 million in just over a month. In response, Britain raised interest rates in late 1906 to defend against a banking crisis.[39] Rates followed in other major economies. When the finance bills matured, and the UK suspended any new issues, the US exported nearly $30 million in gold back to the UK for repayment during the summer of 1907. Soon after, in the Fall of 1907, the stock market crashed and a banking panic struck. In the wake, rates spiked further across all major economies. [40]

To summarize, the British financial and business cycles impacted financial and real sector conditions in other countries due to its central location in the world economy. As the financial cycle expanded in the UK, capital flowed abroad from Britain looking for higher returns, fueling growth, facilitating investment, and fostering speculation that led to bubbles and crises. The Panic of 1907 in the United States was a product of these exact dynamics. A nearly decade-long period of low interest rates and economic expansion in

[39]Some recent economic literature suggests that an increase in the hegemon's interest rates could bring about a financial condition as capital flows contract and are brought back to the hegemon. While this could be case, this, on its own, is not a sufficient cause of financial crises. My argument is that unless this is preceded by a surge in capital flows that foster asset and/or credit bubbles, rate contractions are not going to cause crises. Furthermore, the fact that increased rates in the hegemon may be associated with the onset of financial crises, does not negate the argument I am making herein.

[40]De Noyes 1909

Figure 2.4: UK Credit/GDP and US Crises 1880-1913



Britain facilitated large amounts of British foreign investment in the US. Rates in the US also dipped during this period and this created the conditions for credit and asset bubbles, which eventually burst and caused a crisis.

2.4 Statistical Analysis

Statistical analysis offers more systematic evidence of British influence on conditions in peripheral countries. I test the three hypotheses presented at the end of the first section by using logistic time series analysis and lagged dependent variable models with panel data for banking crises and British capital flows ranging from 1880 to 1913. I first examine whether the British financial cycle affected the global incidence of capital flow surges, and check the robustness of this model with a measure of aggregate capital flows from Britain. I then test whether capital flow surges and the financial cycle predicted crises when controlling for a range of domestic variables that other studies suggest are important causes of financial crises. I estimate the models with random effects because some of the control variables in the data change very little or not at all from year to year, and because some countries in the sample never experience a crisis.

2.4.1 Surge Model Description

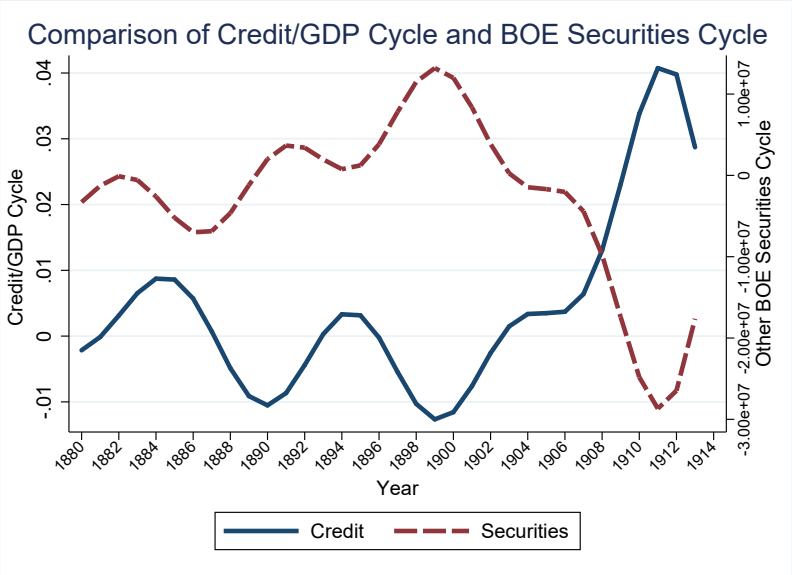
The main dependent variable for the first set of models to test my first hypothesis is a dichotomous measure of whether a country experienced a surge in capital flows from Great Britain. I define a surge as a change in capital flows greater than one standard deviation above the the average change of capital flows. Of the 614 country years included in the data set, 58, or approximately 9 percent experienced a surge in capital from Great Britain. For robustness, I also estimate the models using the volume of capital flows from the UK to each country. The data on UK capital flows is taken from Irving Stone's "The Global Export of Capital From Great Britain 1865-1914."[41]

Operationalizing the conditions that I propose drive these surges is a slightly more difficult task. Contemporary measures of a country's financial cycle usually combine measures of credit and housing or asset prices. Data availability is more limited in the 19th century. However, the Jorda-Schularik-Taylor Macro History database does contain data on credit from 1880 onward. I use credit/GDP from this database as one measure of the British financial cycle. As an additional measure of the British Financial cycle, I use an item from the annual Bank of England balance sheet for the period called "Other Securities." As I explained in my case study of the British financial system in the 19th century, the Bank of England served a lender of last resort function, which meant that it lent to other banks throughout England when they were experiencing liquidity problems. These loans showed up the Bank of England balance sheet as "other securities." Thus, these assets would have been higher during periods of financial stress (when the financial cycle contracted), and lower during expansionary periods in the cycle. These two variable should be mirror images of one another. And indeed, when I bandpass filter each to remove the trend, and compare the remaining cyclical components of the two variables, the cycles move in continuous counterpoint (see figure 2.5). Using these variables as two measures of the financial cycle in the UK, I therefore expect a positive correlation between credit/GDP and capital flow surges, and a negative correlation between "other

[41] Stone 1999

securities" and capital flow surges.

Figure 2.5: Cyclical Component of Credit/GDP and Other BOE Securities



Data on appropriate control variables is limited from this period, so I include minimal control variables to proxy for institutional, political, and economic "pull factors" highlighted in the existing literature on capital flow surges. In existing literature, these controls include measures of economic health and or need for capital, measures of political stability, and measures of institutional quality. The variables I include to measure institutional quality include regime type and a dichotomous measure for whether a country has a central bank or not. Data on regime type comes from the Polity Project. Polity scores ranges from -10 to 10, with a higher score indicating a higher level of democracy. Polity is the best available indicator for assessing the effect of domestic political institutions. Financial repression should be reduced, economic transparency should be higher, and the price system less distorted in more democratic and liberal regimes, which may act as "pull factors," attracting international investment.[42] Data on the year central banks were created was gathered from individual central bank websites. The presence of a central bank may or may not attract international investment. On the one hand, if the central bank acts as a lender of last resort, investors may feel more secure investing in the country. Alternatively, if the central bank can affect interests rates, and is therefore able to close

[42]Ghosh et al 2014

the difference between UK and domestic rates more quickly than in economies without a central bank, such countries may be less likely to experience a surge in investment. To control for economic conditions, I include measures of inflation and real GDP growth. Higher inflation and lower growth should deter investors, making a surge less likely. I include measures of a country's budget deficit and public debt to account for economic need, which could result in a sudden influx of capital. Data for these variables is taken from from Flandreau and Zumer's economic history database. [43] However, because each of these variables contain missingness across different observations, I include each of these controls separately in different models so as to keep the number of observations as high as possible[44] Including all the controls in a single model reduces the amount of observations by half.

2.4.2 Surge Model Results

The results are summarized in tables 2.1 through 2.4. In both the lagged dependent variable models using the bilateral UK capital flow exports, and the logit models using capital flow surges, both independent variables perform as expected and are statistically significant. A one point expansion in the credit/GDP ratio (from zero to .1) increases the volume of exports by anywhere from 36,000 to 60,000 British pounds, depending on the control variables included. For every additional one million pounds the BOE lent to British banks as the lender of last resort, British capital exports decreased by anywhere from 500 to 900 GBB. Interpreting the results of the logistic regression models, a one million GBB increase in the value of "other securities" on the BOE balance sheet decreases the probability that a country experiences a capital flow surge by .004-.005 (depending on which control variables are employed). A .01 increase in the credit/GDP ratio increases the probability of a capital flow surge by about .02-.04 (depending on which control variables are employed). The only control variable that returns statistical

[43]Flandreau and Zumer 2004

[44]Multiple imputation techniques produces very wonky estimated values and coefficient estimates for these variables in the regression models. Thus the imputed values were not used.

significance is the presence of a central bank, and only in the lagged dependent variable models using the volume of capital flows. The existence of a central banks reduces the volume of capital flows, by about 1018 GGB, on average. This may be because the existence of a central bank minimized interest rate differentials between countries. The variable is not significant in the surge models, suggesting the existence of a central bank did not mediate the tendency for a country to experience large surges in capital inflows from the UK.

Table 2.1: Lagged DV Models with Capital Flows & BOE Securities

	(1) kflows	(2) kflows	(3) kflows	(4) kflows	(5) kflows	(6) kflows	(7) kflows
L.kflows	0.693*	0.867*	0.883*	0.878*	0.884*	0.853*	0.891*
	(0.0415)	(0.0317)	(0.0320)	(0.0333)	(0.0333)	(0.0344)	(0.0300)
Other BOE Securities	-0.0000924*	-0.0000644*	-0.0000637*	-0.0000642*	-0.0000683*	-0.0000540*	-0.0000592*
	(0.0000217)	(0.0000220)	(0.0000241)	(0.0000242)	(0.0000260)	(0.0000241)	(0.0000222)
Central Bank		-1018.2*					
		(465.5)					
Real GDP Growth			31.49				
			(41.04)				
Polity				84.95			
				(51.20)			
Inflation					3.878		
					(30.36)		
Exports						-0.233	
						(0.179)	
Low Rate							44.60
							(443.1)
_cons	1383.7*	1151.9*	586.9	354.3	709.9*	971.9*	585.1
	(271.3)	(352.1)	(308.5)	(320.9)	(307.6)	(353.9)	(361.0)
N	429	428	386	376	359	346	429

Standard errors in parentheses
* $p < 0.05$)

2.4.3 Crisis Model Description

To test my second and third hypotheses regarding the effect of the British financial cycle and capital flow surges from Britain on the incidence of financial crisis in the international system, I re-estimate the logit models above using crisis as my dependent variable, rather than capital flow surges. The main independent variables are thus credit/GDP, other securities, and a dummy variable denoting whether a country experienced a surge in

Table 2.2: Lagged DV Models with Capital Flows & Credit/GDP

	(1) kflows	(2) kflows	(3) kflows	(4) kflows	(5) kflows	(6) kflows	(7) kflows
L.kflows	0.705*	0.870*	0.887*	0.883*	0.887*	0.858*	0.894*
	(0.0413)	(0.0316)	(0.0319)	(0.0331)	(0.0332)	(0.0341)	(0.0298)
Credit/GDP	60255.7*	43367.1*	42215.3*	41148.9*	45847.2*	36124.1*	39900.2*
	(15831.0)	(16109.2)	(17592.8)	(17690.7)	(18988.4)	(17642.6)	(16413.1)
Central Bank		-1018.7*					
		(466.8)					
Real GDP Growth			32.51				
			(41.10)				
Polity				82.50			
				(51.30)			
Inflation					5.711		
					(30.44)		
Exports						-0.230	
						(0.179)	
Low Rate							115.0
							(449.8)
_cons	1312.1*	1115.6*	549.7	332.1	668.8*	930.7*	511.3
	(273.0)	(352.9)	(310.7)	(323.6)	(310.7)	(355.5)	(369.8)
N	429	428	386	376	359	346	429

Standard errors in parentheses
* $p < 0.05$

capital flows from Britain in the previous two years. I choose two years because the unit of observation is country-year and because the formation of a bubble can take time. The process usually occurs over several years, not within the span of single 12 month period. The data on financial crises come from Reinhart and Rogoff's database.[45] In these models, I would expect a negative correlation between credit/GDP in the UK and the incidence of financial crises in the international system, since a contraction of British credit implies less credit to offer abroad. The "other securities" variable should be positively correlated with the incidence of financial. The occurrence of a capital surge from Britain in the previous two years should also increase the likelihood that a country experiences a crisis.

2.4.4 Crisis Model Results

Results are presented in tables 2.5 and 2.6. In these tables, both the credit/GDP and "other securities" variables perform as expected. A one million GGB increase in the

[45]Reinhart and Rogoff 2010

Table 2.3: Logit Models with Capital Flow Surge and BOE Securities

	(1) KSurge	(2) KSurge	(3) KSurge	(4) KSurge	(5) KSurge	(6) KSurge	(7) KSurge
Other BOE Securities	-4.13e-08***	-4.19e-08*	-4.06e-08*	-4.39e-08*	-3.56e-08*	-4.06e-08*	-4.77e-08*
	(1.06e-08)	(1.07e-08)	(1.11e-08)	(1.13e-08)	(1.16e-08)	(1.16e-08)	(1.14e-08)
Central Bank		-0.0642					
		(0.601)					
Real GDP Growth			0.0294				
			(0.0210)				
Polity				0.0387			
				(0.0473)			
Inflation					-0.00656		
					(0.0144)		
Exports						0.0000526	
						(0.000119)	
Low Rate							0.448
							(0.248)
_cons		-2.028*	-2.620*	-2.805*	-2.865*	-2.590*	-2.929*
		(0.548)	(0.524)	(0.567)	(0.590)	(0.536)	(0.542)
lnsig2u							
_cons		0.684	1.244*	1.331*	1.432*	1.191*	1.310*
		(0.623)	(0.553)	(0.545)	(0.573)	(0.560)	(0.527)
N	416	575	600	621	604	534	672

Standard errors in parentheses
* $p < 0.05$

"other securities" on the BOE balance sheet increases the probability that a country experiences a crisis by .002-.003. Alternatively, an increase of .01 in the credit/GDP ratio decreases the probability of a crisis by .014. As well, the coefficient on the capital flow surge variable is positive and statistically significant in all models except model 5. While this could imply that inflation is a confounding variable, the coefficient on the inflation variable is not significant, so the change in significance is probably attributable to a reduction in sample size. Interpreting the coefficient on the capital flow surge variable implies that when a country experiences a capital flow surge from Great Britain, the probability that it experiences a crisis within two years increases by .05.

Taken together, these results lend strong empirical support to the three hypotheses presented above. They suggest that years in which the financial cycle in Britain was expanding, capital flows to peripheral countries surged, and that countries which experienced an especially large increase in capital flows from Britain were more likely to experience a financial crisis shortly thereafter, particularly when the British financial

Table 2.4: Logit Models with Capital Flow Surges & Credit/GDP

	(1) KSurge	(2) KSurge	(3) KSurge	(4) KSurge	(5) KSurge	(6) KSurge	(7) KSurge
Credit/GDP	23.06*	23.40*	22.61*	23.53*	20.01*	24.09*	28.53*
	(7.629)	(7.746)	(7.983)	(8.138)	(8.422)	(8.438)	(8.331)
Central Bank		-0.0698					
		(0.599)					
Real GDP Growth			0.0312				
			(0.0208)				
Polity				0.0407			
				(0.0511)			
Inflation					-0.00554		
					(0.0143)		
exports						0.0000526	
						(0.000119)	
Low Rate							0.460
							(0.250)
_cons		-1.989*	-2.587*	-2.764*	-2.834*	-2.570*	-2.901*
		(0.540)	(0.518)	(0.567)	(0.586)	(0.531)	(0.538)
lnsig2u							
_cons		0.649	1.219*	1.309*	1.415*	1.172*	1.285*
		(0.624)	(0.555)	(0.546)	(0.574)	(0.561)	(0.529)
N	416	575	600	621	604	534	672

Standard errors in parentheses
* $p < 0.05$

cycle was contracting.

2.5 Conclusion

The structure of the international economy and the pattern of economic integration play a crucial role in the timing and prevalence of financial crises. The structure of the international economy determines which countries exert the most financial influence on other countries in the system, and by extension which country has the greatest ability to create the conditions for financial crisis. Developments in the financial cycles of the most central economy can spillover to many other peripheral economies. The long 19th century presents an opportunity to test this theory about the systemic determinants of financial crises. Scholars have identified the 19th century, particularly 1860-1913, as the first wave of economic globalization, unmatched in terms of the volume of capital flows (as a percentage of GDP). Also during this period, the economy was hegemonically organized. Britain served as the world's largest importer, and was the largest source of

Table 2.5: Logit Models with Crises & BOE Securities

	(1) Crisis	(2) Crisis	(3) Crisis	(4) Crisis	(5) Crisis	(6) Crisis	(7) Crisis
Other BOE Securities	6.74e-08*	6.70e-08*	6.37e-08*	7.04e-08*	6.18e-08*	6.45e-08*	6.47e-08*
	(2.44e-08)	(2.59e-08)	(2.38e-08)	(2.52e-08)	(2.48e-08)	(2.58e-08)	(2.38e-08)
Central Bank		0.313					
		(0.510)					
Real GDP Growth			0.00437				
			(0.0297)				
Polity				-0.0197			
				(0.0102)			
Inflation					0.0517		
					(0.0276)		
Exports						-0.0000171	
						(0.000171)	
Low Rate							-0.257
							(0.371)
_cons		-3.382*	-2.968*	-3.209*	-3.170*	-3.005*	-3.029*
		(0.433)	(0.255)	(0.298)	(0.269)	(0.313)	(0.326)
lnsig2u							
_cons		-0.786	-1.798	-0.907	-1.559	-1.486	-1.178
		(1.032)	(1.692)	(1.054)	(1.541)	(1.522)	(1.146)
N	507	608	615	656	619	563	711

Standard errors in parentheses
* $p < 0.05$

foreign investment for many other developed and developing countries in the international system. The evidence cited within suggests that this hegemonic structure of trade and financial relations meant that during the long 19th century the financial conditions of Great Britain heavily influenced financial (and to some extent real sector conditions) in peripheral countries, which fostered bubbles and the subsequent financial crises.

While this paper focuses on the dynamics at work in the long 19th century, the theory proposed herein is applicable to the contemporary era. The same dynamics at work in the international economy in the long 19th century are also at work in contemporary times. Both trade and investment have been centralized in the US throughout much of the post-WWII period. Though the dynamics are slightly more complex and nuanced given the variety of exchange rates regimes that have prevailed, the economy of the US has undoubtedly played a role in setting the financial and real sector conditions conducive to crisis in peripheral countries.

Therefore, this study has implications for the politics of international cooperation on

Table 2.6: Logit Models with Crises, Credit/GDP & Capital Surge

	(1) Crisis	(2) Crisis	(3) Crisis	(4) Crisis	(5) Crisis	(6) Crisis	(7) Crisis
Credit/GDP	-70.54*	-67.74*	-70.16*	-76.82*	-64.79*	-74.82*	-68.12*
	(22.36)	(23.15)	(22.07)	(23.38)	(22.68)	(24.55)	(21.26)
Capital Surge	0.988*	1.092*	0.921*	1.210*	0.768	1.261*	1.033*
	(0.386)	(0.427)	(0.379)	(0.419)	(0.412)	(0.414)	(0.390)
Central Bank		0.458					
		(0.473)					
GDP Growth			-0.000191				
			(0.0295)				
Polity				-0.0267*			
				(0.00998)			
Inflation					0.0367		
					(0.0272)		
Exports						0.0000328	
						(0.000153)	
Low Rate							-0.421
							(0.376)
_cons	-3.531*	-3.900*	-3.296*	-3.619*	-3.398*	-3.585*	-3.318*
	(0.314)	(0.474)	(0.301)	(0.338)	(0.311)	(0.381)	(0.359)
lnsig2u							
_cons	-1.687	-1.374	-2.956	-1.797	-1.980	-2.468	-1.629
	(1.597)	(1.470)	(4.344)	(1.898)	(2.088)	(3.091)	(1.535)
N	711	608	615	656	619	563	711

Standard errors in parentheses
* $p < 0.05$

financial regulation, monetary policy, and crisis management. It suggests that regulation may matter at the margin, and that countries' macroeconomic policy, and in particular monetary policy, are of greater import for fostering international financial stability. Thus, monetary policy cooperation may indeed be a critical addition to recent efforts to generate a framework for macroprudential regulation. However, this study also implies that achieving greater stability in the international financial system might actually require the imposition of constraints on the largest and most interconnected economies, who, as a result of their position and the privileges the position provides, have little or no incentive to bind themselves.

Furthermore, the dynamics of interdependence highlighted in this paper have critical implications for power in the contemporary international financial system. If the conditions of crisis in a hierarchical or hegemonic system are disproportionately determined by a single or a handful of major economies, as are the economic conditions for recovery and the conditionality of lending assistance, the costs of international economic integra-

tion may be far higher for developing and underdeveloped countries than conventionally recognized, and the extent of U.S. and G-7 financial power far greater than is currently acknowledged. Thus, many financial crises may actually serve to reinforce the existing international structure and distribution of power, rather than redefine it. [46]

Lastly, this study implies that a return to the international level of analysis and macro-level causality is warranted and long overdue in the field of political economy. Financial interdependence means that the economic and credit conditions that affect bubbles and crises cannot be isolated at the national level. The causes of financial crises are in fact jointly determined by system and domestic-level factors. As Oatley argues, "a defining characteristic of financial interdependence is the inability to separate the system into independent national units or distinct levels of analysis." [47] Instead, we need to think of the international financial system as one unified system, whose dynamics are likely to be disproportionately affected by the largest and most interconnected economies.

[46] Layne 2012; Winecoff 2015; Saull 2012; Starrs 2013

[47] Oatley et al 2013

Chapter 3

The Underbelly of American Hegemony

3.1 Introduction

The U.S. housing bubble and the related mortgage backed securities are two of the most commonly cited causes of the 2008 Financial Crisis (Taylor 2009). The fact that U.S. mortgage-backed securities were bought and sold around the world is one frequently cited reason for the scale of the contagion resulting from the event, especially for its effect on European countries where the bulk of the mortgage backed securities were held (Milesi-Ferretti 2009; Baba et al. 2008, 2009, Baba and Packer 2009). What is less discussed, however, is that many of these countries (i.e. the United Kingdom, Spain, France, Ireland) also experienced their own asset and credit bubbles (Obstfeld and Rogoff 2009; Mayer 2011:561-563) as a result of a long downward trend in both short term policy rates and long term rates across the developed world (Borio and Disyatat 2011:22-23). In the years leading up to the financial crisis, low U.S. interest rates coincided with periods of low rates across the developed world, and the development of credit and asset bubbles in these countries were also similarly timed. This phenomenon is not unique in kind, though it may be so in size and scale. Other scholars have identified previous occasions since 1970 when a wave of housing and credit bubbles swept across developed countries (Renaud 1995, 1997), just on a smaller scale. Recent economic research suggests this may be the bi-product of synchronization among countries' financial cycles. This paper builds on this recent research and argues that the application of complexity and network sciences, as a conceptual framework, to the field of political economy can further illuminate this synchronization process. Furthermore, because many financial crises are the bi-product of the the financial cycle, applying complexity and network sciences to the study of the

international economy can help elucidate the international structural determinants of financial crises since 1970. Specifically, the hierarchical organization of the international economy around the US, which has prevailed since at least the 1970s, implies that the financial cycle of the US has disproportionately influenced financial conditions in other countries, fueling asset and credit bubbles during periods of expansion, and increasing the likelihood of capital flow "stops" and financial crises during contractions.

The implications of this analysis for the field of international political economy are several. First, this analysis provides a concrete example of the financial dimension of the United States's structural power, as originally conceived by Susan Strange (1988). Strange argued in *States and Markets* that whoever earns the confidence to create credit controls the economy. The dynamics described in this paper attest to the validity of Strange's assertion. Even more of note, this paper explores the *passive* dimension of structural financial power in the international system stemming from the US' influence and autonomy in global financial markets(Cohen 2015). This paper explains how the US determines access to financing for other countries in the international system to such an extent that it shapes the timing of financial crises experienced by them. Yet as the years since the 2008 financial crisis has demonstrated, the US itself remains largely unconstrained by the financial conditions of other countries. Though not intentional, the US' influence within international credit markets is one manifestation of its structural and financial power, which benefits its economic performance and preserves its economic and military superiority.

Second, this theory reconceptualizes one of the foundational research programs in IPE, the Hegemonic Stability Theory. In his original version of the theory, Charles Kindleberger argued that the structure of the international system (the lack of a hegemonic power) directly affected the scale and duration of the Great Depression. When removed from its collective action framework, and re-framed in terms of the complexity and network science, the core assertion of Kindleberger's theory retains validity.

This paper is organized as follows. The first section reviews recent economic literature on the financial cycle and the structural attributes of markets that give rise to financial

crises. The second section explains how the application of complexity and network science to the study of the international political economy can help elucidate the dynamics of interdependence that lead to the synchronization between individual countries' financial cycles. The second section concludes with three specific hypotheses about how the structure of the international economy since 1970 has affected countries' financial cycles and the evolution of financial crises. The following section tests these hypotheses using cross sectional panel data and time series analysis on quarterly and annual data. The final section concludes by outlining the theoretical contribution of this article to our understanding of early structural theories of IPE, and of structural and financial power, as well as other methodological and policy implications of this analysis.

3.2 Financial Cycles and Crisis

Since the 2008 financial crisis, research on the causes of financial crises has experienced a renaissance. In particular, scholars have advanced our understanding of the *international* determinants of financial crises, exploring the role of global capital flows and global imbalances in fomenting crisis. Much of this literature, whether in the field of political economy or macroeconomics is positioned squarely within the orthodox neoclassical synthesis economic paradigm. Explanations therefore identify the sources of "exogenous" shocks that may throw the economy out of equilibrium.

Alternatively, building on Hyman Minsky(1977) and Charles Kindleberger's(1978) early proposition that financial crises are an inherent feature of the human system we call the market economy, scholars associated with the heterodox school of economics known as post-keynesianism have developed an alternative economic theory of financial crisis that emphasizes the cyclical behavior of financial market economies. Along with business cycles, proponents of these alternative theories identify the presence of financial cycles within market economies, the peaks of which coincide with incidence of financial sector stress and crisis.

In complex systems theory, cycles, or oscillations, are the bi-product of both positive and negative feedback loops operating among units in goal seeking agent-based complex

systems. Within the context of financial markets, the agents are just individuals and firms, who buy and sell with the goal of earning a profit. Positive feedback loops in markets are the result of human's tendency to herd, or imitate each other (Sornette 2009; Sornette and Harras 2011). For example, the purchase of a particular type of asset motivates others to buy the same type of asset. In contrast, negative feedback loops are usually the result of a constraining mechanism within the system. In the context of an economy, this is probably real sector growth and productivity. Investors can speculate about the future value of a particular class of assets for only so long before they must confront the asset's actual performance. Alternatively, the negative feedback could simply be investor's tolerance for risk – a certain level of speculation is tolerable to most investors, but at some point the speculation inspires investors to sell or otherwise bet against the market.

The central insight of post-Keynesian economics is that economies regularly experience financial cycles and that these financial cycles are ultimately what cause financial crises. Contemporary scholars who study financial cycles define them similarly to business cycles: the pattern of expansion, peaks, contractions, and troughs that occur in an economy's asset prices(with an emphasis on property prices) and credit prices(Drehmann et al., 2012). These cycles are the result of "self-reinforcing interactions between perceptions of value and risk(property prices), [and] attitudes towards risk and financing constraints(credit), which translate into booms followed by busts." (Borio 2014) The financial cycle is distinct from the business cycle in that it is much longer, 16 to 20 years verses 8 for the average business cycle, but it sometimes coincides or aligns with the business cycle because financial and real sectors are inextricably linked. [1]. The period from 2000-2007 in the United States is an example of an alignment of the two cycles. As was also the case in 2008, the peak of financial cycles are usually associated with a period of financial distress, and often with full on financial crisis.

[1]In standard neo-Keynesian economics the mechanism for this is Bernanke's Financial Accelerator, in Post-Keynesian economics this is explained through the process of endogenous money creation. For formal models using both the logic of NNS financial accelerator theory, but non-linear modeling see Corsi and Sornette 2014

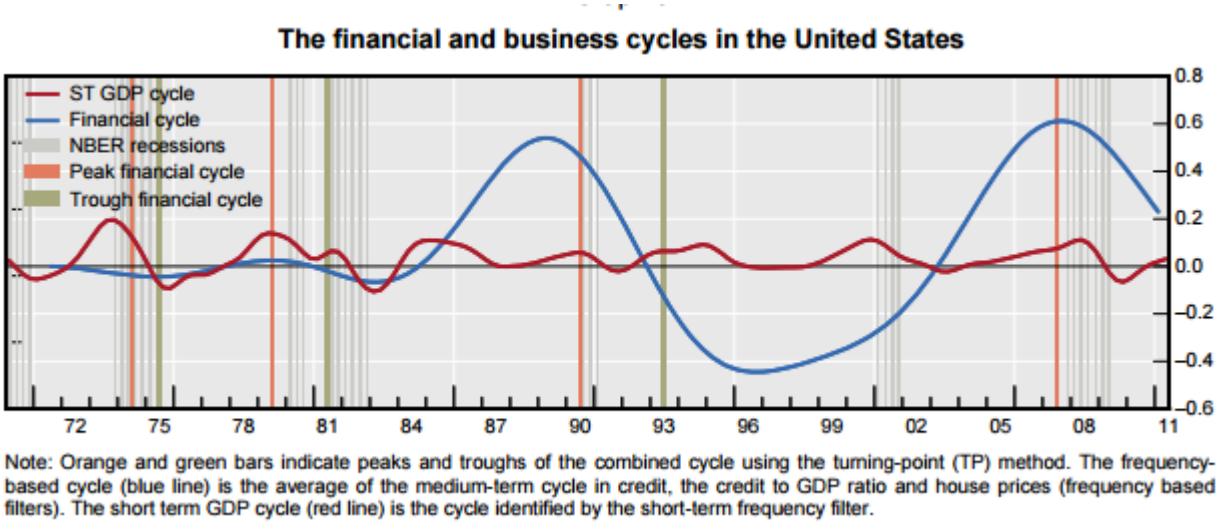


Figure 3.1: US Financial Cycle 1970 - 2011
Source: Drehmann, Borio, and Tsatsaronis(2012)

Figure 3.1 is an attempt by Drehmann, Borio and Tsatsaronis (2012) to plot the the US financial cycle from 1970 - 2011. They utilize turning-point analysis and frequency-based filters applied to data on credit, the credit-to-GDP ratio, property prices, equity prices and an aggregate asset price index which combines property and equity prices to construct the time series.

These advances in our understanding of the sources of financial crisis, as structural features of capitalist markets, now give us the micro and macro foundations on which to layer an understanding of how globalization and the structure of *international markets* can shape these events. Applying complexity and network sciences to study the structure of the international economy can help to illuminate the pattern of economic globalization, and elucidate the process of synchronization that occurs among interdependent national economies. Understanding how the financial cycles of national economies interact, such that economic and financial developments in some economies can affect these same conditions in other countries, will also shed light on how the structure of economic and financial globalization affects financial instability. Specifically, when the international economy is hierarchically organized around a single country, as it has been for the past fifty or more years, the financial cycle of most central country is likely to disproportionately influence the financial conditions of other countries, fueling credit and asset bubbles that culminate in crisis.

3.3 The International Structural Determinants of Crises

The international economy is a complex system of economic agents conducting exchanges, such as trade and investment, across borders (Oatley et al 2013). Using the tools of network analysis, we can graph these activities aggregated at the national level and use the topology of these graphs as an indication of the structure of the international economy that emerges from the multitude of exchanges between economic agents in different countries over the course of a year. System structure can thus be conceptualized as a continuous variable measuring the distribution of connectivity among countries, or the level of *network centralization*, which is the extent to which the network is centralized around a single country.

The Correlates of War Bilateral Trade data set (Barbieri and Keshk 2009), provides ample data with which to calculate overall network statistics to measure the centralization of the international trade network since 1870. While this data is for trade only, the trade network is a good proxy for the international financial network, for which annual data before 2000 is not readily available.[2] There are two standard ways of measuring network centralization, depending on whether a network uses continuous or dichotomous data. Freeman's original degree centralization measure is simply the sum of the differences between the *unweighted* degree centrality of the most central country and the *unweighted* degree centrality of all other nodes, divided by the maximum potential value of this sum of differences. In essence, what this measure is doing is comparing the observed graph to an ideal hub-and-spoke graph, where one node (the hub) is connected to every other node (spokes), but other nodes are connected only to the hub node. This hub-and-spokes graph is the most centralized network structure.

In contrast, the weighted extension of this measure simply measures the sum of the differences between the *weighted* degree centrality of the most central node and the *weighted* degree centrality of all other nodes (Barrat et al, 2004). The *weighted* degree centrality measure does not have a denominator, and does not therefore compare the observed

[2]See figure 2 in the appendix for a comparison of degree centralization for the trade and financial networks in contemporary times

network to an idealized hub-and-spokes network. Figure 3.2 plots the unweighted and weighted measures of degree centralization from 1870-2009. In this figure, the two measures exhibit vastly different time trends. The unweighted measures of degree centralization decreases steadily. Weighted degree centralization increases over time, ticking upward sharply around 1970. The decline in unweighted centralization is attributable to the development of countries that laid in the periphery during the 19th century, in particular the rise of many Asian countries in the last quarter of the 20th century. The upward trend in weighted degree centralization beginning after WWII is attributable to the rise of American hegemony. American hegemony facilitated the reconstruction of Europe, and the industrialization of many Asian countries, but the relative size of the economic transactions it conducted continued to increases until the end of the period, when the rise of China slows the differential.

While unweighted and weighted degree centralization are helpful measures for the purposes of describing and categorizing system structure based on trade patterns, they are incomplete on their own. The weighted centralization measure using bilateral trade data measures only the sum of differences between the value of US imports and the value of all other countries imports. This provides relatively little information about the structure of the network, and patterns of trade. The unweighted centralization measure quantifies the difference between the number of countries the US imports goods from and the number of countries from which all other countries imports goods. This is a better indication of structure, but ignorant of the quantity of goods that pass between countries. Both the number *and* value of each country's ties are important. Alternatively, a measure of centrality that combines both the weighted and unweighted measures, developed by Opsahl et al (2010), can account for both the value and number of nodes' ties. Opsahl centrality, can be transformed into a centralization measure, that also accomplishes these objectives, accordingly:

$$C_i = K_i x (S_i/K_i)^{\alpha} \tag{3.1}$$

Where K is the number of nodes a focal node is connected to (*unweighted* degree

centrality) and S is the average value of the focal nodes' ties (*weighted* degree centrality divided by *unweighted* degree centrality), and α is a tuning parameter. When the tuning parameter, α, takes on a value of 1, the centrality measure is equivalent to *weighted* degree centrality. When α takes on a value of zero, the result is equivalent to *unweighted* degree centrality. In this analysis, the tuning parameter is set to .5 because both dimensions of centralization matter equally, and it is difficult to make a strong argument as to why this value should be adjusted to favor either measure.

Based on this measure, Opsahl centralization is the sum of differences between the Opsahl centrality value of the most central node and the Opsahl centrality value of all other nodes, divided by the maximum value this sum of difference could take on if the network were shaped like a hub-and-spoke network, using the maximum and minimum non-zero value from the observed data. In formula form:

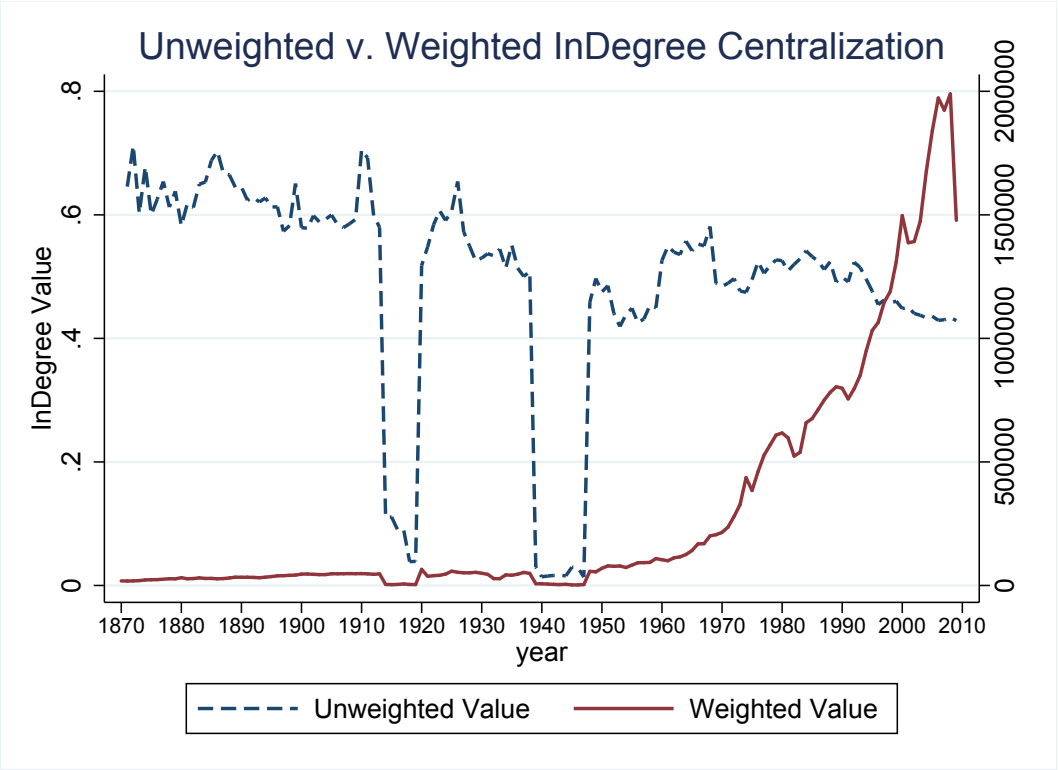
$$OC = \frac{\sum_i^n C_i(max) - C_i}{(n-1) * (S_i(max)/n - 1)^\alpha - S_i(min)^\alpha} \tag{3.2}$$

Where C is Opsahl Centrality, $C_i(max)$ is the maximum value of Opsahl Centrality in the network, S is the *weighted* degree centrality, $S_i(max)$ and $S_i(min)$ are the maximum and minimum non-zero values of *weighted* degree centrality, and n is the number of nodes.

Figure 3.3 presents a time series of the Opsahl centralization variable. Data for the years during WWI and WWII are unreliable, and so is coded as missing during these years in this graph, though the series looks continuous. Several features are noteworthy. First, the system exhibits two clear periods of increased centralization, the first during British hegemony in the long 19th century, and the second begins after the conclusion of WWII. We see Britain's decline and American (and German) ascent as centralization decreases from its high of .85 in 1888 to about .76 just before WWI. As America consolidates its economic hegemony in the two decades following WWII, the Opsahl centralization measure increases from .74 at the end of WWII to .9 in the year 2000, but then begins to decline slightly due to the rise of China.

Because the Opsahl centralization measure presented in Figure 3.3 averages over the difference between the centrality of the most central country and all other countries in

Figure 3.2: Unweighted and Weighted Degree Centralization 1870-2009



the network, it glosses over changes that occur at the core of the system. To observe these changes more clearly, figure 3.4 presents a time series of the difference in Opsahl centrality values of the two most central countries in the network from 1870-2009. American dominance in the second half of the 20th century is even more evident in this graph, though the rise of China has meant a decline in the top two difference since the mid-2000s.

These network statistics support the proposition that the international economy is hierarchically (and hegemonically), organized in that trade and investment activities are unevenly distributed across countries, and disproportionately centralized around a single country, the US, since at least 1970. This is, admittedly, not a new or contentious claim to make as far as contemporary political economy is concerned. However, when we conceptualize the international system using this framework, and define system structure based on network topology, the structural determinants of the financial crisis become clearer; Therein lies its contribution.

Figure 3.3: Network Centralization 1870-2009

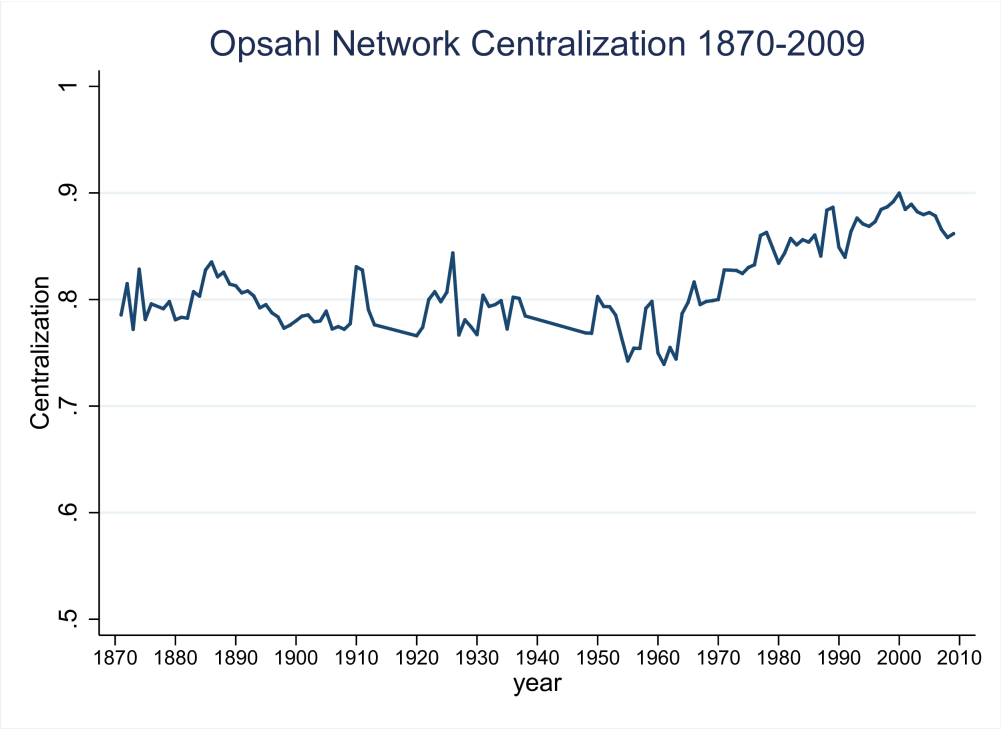
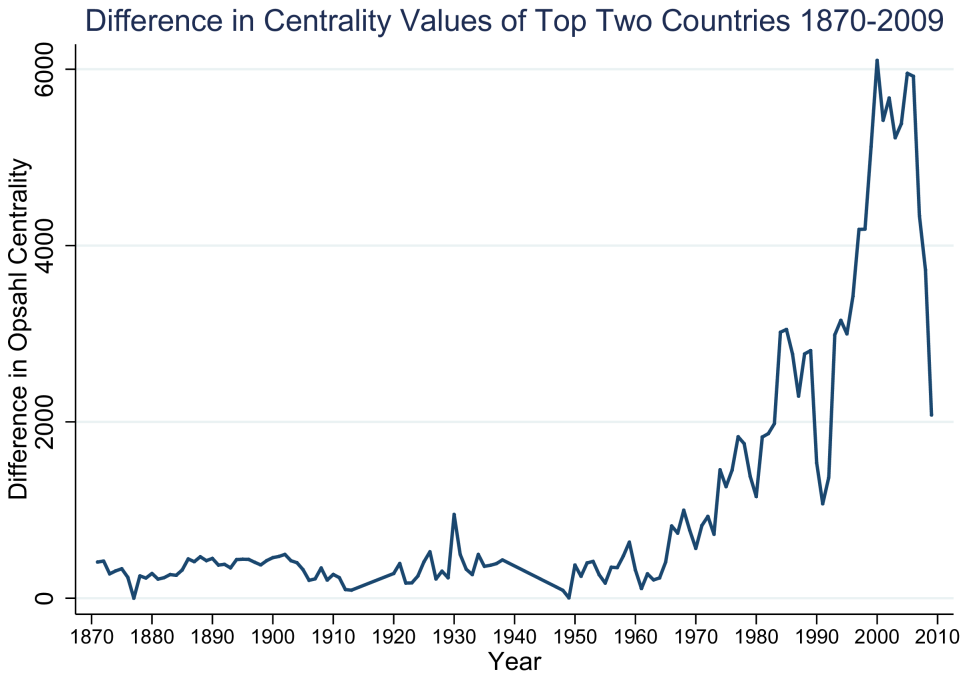


Figure 3.4: Top 2 Centralization 1870-2009



3.3.1 Structure Determines Stability and Volatility

Within complex systems theory, a well known property of hierarchical systems is their "robust yet fragile" nature. This means that in hierarchical systems, the most central agent is capable of absorbing shocks that originate elsewhere in the system, preventing them from spreading (Wang and Chen 2002). In the context of financial crises, this property implies that a hierarchical system should be robust to systemic financial crises that originate outside of the most central country, as the size of the hegemon's economy is sufficiently large to absorb any real or financial shocks that emanate from peripheral countries, preventing crises that originate in the periphery from spreading to the rest of the world economy (Haldane 2009). On the other hand, hierarchical systems are especially fragile to turbulence originating from within the most central node. Thus, financial crises that originate from within the most central country (the hegemon) should be more likely to spread far throughout the system. In fact, this is what has occurred. The Asian financial crisis of 1997 had minimal consequences for countries outsides of Asia, mainly because their economies were so small relative to the US economy (Oatley et al 2013). Strong growth and low interest rates in the US kept demand strong, and the flow of international investment fluid, thereby keeping the international economy afloat and preventing widespread economic fallout. The effects of the 2008 financial crisis have, however, reverberated through developed and developing countries alike. The underlying logic of the robust yet fragile property of hierarchical systems is that the centrality of the node determines its influence on other nodes in the systems. The more central a node, the greater its influence. This logic holds not just for explaining the pattern of contagion in the wake of a crisis, which is the most intuitive application of the principle, but also for understanding how the conditions that foster crisis emerge to begin with. Contagion spreads through existing trade and investment channels (Chinn and Forbes 2004), but so do the conditions that cause crises initially. Crises that originate in the hegemon are more likely to spread throughout the system than are crises that originate in peripheral countries because peripheral countries maintain few economic connections to other countries in the system apart from the hegemon. This same pattern of connectivity

also means that the financial conditions in the hegemon are more likely to have a large impact on peripheral countries' financial conditions. When the financial cycle in the US is expanding, investment and capital flows are likely to surge to peripheral countries, credit and asset bubbles are more likely to emerge, and financial crisis is likely to follow.

Because the United States' is the largest and most interconnected economy, its financial cycle can produce "spillover effects" by pushing down the natural rate of interest in other countries. When the financial cycle is expanding in the US, credit and debt is expanding, and market liquidity is relatively high. This facilitates investment abroad, particularly if growth is moderate or strong. The increased investment applies downward pressure to the market interest rates of recipient countries, and can push them below the natural rate implied by the productivity of the real of economy, this increases the demand for financial products and generates a boom in asset prices, thereby facilitating bubbles that lead to crisis. (Borio and Disyatat 2011).[3] The easing of credit conditions may itself spur growth, but given that international investment tends to flow to countries that already have strong economic fundamentals, where demand for international investment is therefore strong, the increased supply of investment may simply accelerate the expansion of the business cycle. The expansion of the business cycle will feedback into the financial cycle as producers realize their profits, payback their investors, and demand further investment, thereby improving investors' expectations for future returns. The conditions for an asset price or credit bubble are therefore set.

Its worth noting that the effect on increased international investment on the business cycle of recipient countries may be compounded when when real sector output is strong

[3]The notion that interest rates can be artificially low, and can diverge from the natural or equilibrium rate of interest, is a departure from mainstream new-Keynesian economics. In contemporary economic theory, the natural rate of interest is the equilibrium real rate of interest that would result in an economy with fully flexible prices. The earliest conception developed by Knut Wicksell (1898) defined the natural rate slightly differently as the interest rate that prevails when savings equal investment at full employment (return on capital or real profit rate). Either way, the natural rate is a hypothetical rate that would exist if money did not exist. The market rate, in contrast, is the the rate that actually prevails (observed nominal rate - expected inflation), which is influenced heavily by actor expectations of market, liquidity risk (as well as the risk preference and tolerance of the actors), and monetary factors (such as credit and the relative availability of assets)(Borio and Disyatat 2010; 2011). In neo-Keynesian economic theory, the two rates are presumed to be the same, as the economy is always in a state of equilibrium. However, in post-Keynesian economic theory, it is possible for these two rates to diverge considerably, resulting in an asset bubble as demand for financial assets increases due to the artificially low rates.

in the United States. Strong growth entails higher consumption and higher production utilizing intermediary inputs, which in turn boosts imports. Higher demand for imports can boost real sector productivity in the exporting countries. If an expansion in the business cycle in the US coincides with an expansion in the financial cycle, investor confidence will be stronger, and creditors and investors will be eager to lend and more likely to look abroad for profitable opportunities; Risk appetites are higher and this is reflected in larger investment flows abroad. This makes the coincidence of business and financial cycles, as occurred in the lead up to the 2008 financial crisis, particularly dangerous.

The collapse of inflated asset and credit prices is a common cause of financial crisis (Kindleberger and Aliber 2005; Minsky 1986). The most proximate and precise cause of the deflation and de-leveraging that marks the contraction of the financial cycle varies. Sometimes it is the failure of a large firm, or bank, embedded centrally in a nation's economy. Other times, it may be the simultaneous but dispersed failure of a multitude of less central actors, for example households or small-scale property investors that can no longer afford their sub-prime mortgages. No matter the spark, the wildfire that results is the same. Loan failures spike, credit supplies shrinks, asset prices collapse, balance sheets shift toward the red, and market actor expectations quickly grow dim; The failure of a single, well connected market actor, or several less well connected market actors cascades through the systems, spreading from sector to sector. The contraction of the financial cycle in a national economy should yield contagious effects dependent on its own relative position in the international economy. When the largest, most centrally located economy experiences a contraction in the financial cycle, foreign investors holding assets in the US may experiences losses directly as the value of their assets decline. Alternatively, other countries may feel the indirect effect via a contraction in the level of investment American investors are making abroad because the overall value of their portfolios shrink with the contraction (assuming the hold some portion of their assets domestically).

While most research on financial cycles has focused on cycles at the nation level, some recent research has examined them at the international level as well. The conclusions of

this research are consistent with this theory. For example, Helene Rey (2015), who has received international attention of her theory of a *global* financial cycle concludes that the VIX, an index that measures the volatility of the US stock market, and US interest rates are two key determinants of the global financial cycle:

> Risky asset prices around the globe, from stocks to corporate bonds, have a strong common component. So do capital flows. Credit flows are particularly procyclical and volatile. As credit cycles and capital flows obey global factors, they may be inappropriate for the cyclical conditions of many economies. For some countries, the global cycle can lead to excessive credit growth in boom times and excessive retrenchment in bad times. As the recent literature has confirmed, excessive credit growth is one of the best predictors of crisis (Gourinchas and Obstfeld (2012), Schularick and Taylor (2012)). Global financial cycles are associated with surges and retrenchments in capital flows, booms and busts in asset prices and crises. The picture emerging is that of a world with powerful global financial cycles characterised by large common movements in asset prices, gross flows and leverage. It is also a world with massive deviations from uncovered interest parity. There are interrelations with the monetary conditions of the centre country (the US), capital flows and the leverage of the financial sector in many parts of the international financial system. The global financial cycle can be related to monetary conditions in the centre country and to changes in risk aversion and uncertainty (Bekaert et al. (2012), Miranda Agrippino and Rey (2012), Bruno and Shin (2013b)).

Ghosh et al (2014) ask a slightly different question, regarding the determinants of capital flows to developing countries, but ultimately reach a similar conclusion to Rey. They find that over two-thirds of capital surges in developing countries in net flows are liability related (foreigners lending money), as opposed to asset driven(domestic residents repatriating profits from assets), and that these surges are significantly determined by US interest rates and US stock market performance. These two studies suggest that US financial conditions are the primary determinant of large swings in capital flows.

While research on global and international financial cycles is in the early stages, other research examining a similar phenomena among countries' business cycles (and, to a lesser extent, consumption and investment) highlight synchronization dynamics very consistent with the theory proposed herein. Economists have shown that both trade and financial integration increase synchronization between countries' GDP (Frankel and Rose 1998; Imbs 2004). To date, this literature has reached varying conclusions about the extent to

which trade and financial integration affect GDP correlations(Stock and Watson 2005), among which countries this effect is robust and consistently observed (Kose, Prasad, and Terrones 2003; Kose Otrok, and Prasad 2008), and the reasons why this may occur (Baxter and Kouparitsas 2005). None-the-less, it is a generally accepted phenomenon, though one that is still treated as a puzzle by economists who study it due to the fact that this empirical observations contradicts heterodox dynamic general equilibrium theory predictions(Backus, Kehoe, and Kydland 1993).[4]

Within the framework of complexity systems theory, the existence of a global financial cycle, or a synchronization of national financial cycles, makes complete sense (as does synchronization of business cycles). As countries integrate economically to form a single, global economy, production, consumption, and investment all occur across borders, as firms, households, and governments interact or even exist trans-nationally. This means that the system of individual market actors whose interactions and transactions in aggregate constitute production, consumption, and investment are not geographically isolated, and instead form a single global system in which developments or changes amongst actors in one part of the system can quickly spillover to actors in other parts of the system through both real and financial linkages. In this context, synchronization between the behaviour of nationally aggregated sets of actors who interact frequently with each other seems logical and obvious; it is the result of many, individual, formerly rather isolated human systems, becoming one. The early evidence pointing to the disproportionate influence of the U.S. economy on the global financial cycle also makes complete sense, given the US' disproportionate influence with in the international economic network.[5]

[4]Dynamic general equilibrium theory predicts that because capital flows follow interest rate differentials, this should result in negative output correlations. Since investment drives productivity, this should mean more steady, consistent, and highly correlated consumption.

[5]This assertion that the US's financial conditions affect financial conditions across the rest of the system stands in contrast to extant literature on capital flow surges and financial crisis which focuses on either domestic political and institutional quality variables, or on global macro-economic conditions (i.e. global risk, global liquidity, global growth, and global interest rates). Forbes and Warnock (2012) for instance find that while world GDP and global risk (which is actually a measure of US stock market volatility) do correlate with capital flow surges, the world interest rate is not a consistently a good predictor. Albuquerque et al (2005) also focus attention on world interest rates and world growth, but find that both variables predict levels of foreign direct investment in both developed and developing countries. The focus on these *global* factors glosses over important dynamics that occur between the US,

To summarize, the theory presented in this section argues that the structure of the international system influences patterns of stability and volatility within it. More specifically, in hierarchically organized systems, like our contemporary international economic system, the financial conditions of the largest and most centrally located economy spillover to the economies of smaller countries, resulting in capital surges, asset and credit bubbles, and ultimately financial crisis. This theory implies the following testable hypotheses:

> *Hypothesis 1:* During the period 1970-2011, the expansion of the US financial cycle increased the probability that other countries experienced surges in gross capital inflows.
>
> *Hypothesis 2:* During the period 1970-2011, the contraction of the US financial increased the probability that other countries experienced a "sudden stop" in capital flows.
>
> *Hypothesis 3:* During the period 1970-2011, gross capital flow surges and stops increased the probability that other countries experienced a financial crisis.

The next section presents cross sectional time series models to test these hypotheses.

3.4 Empirical Analysis: Surges and Stops

I test the first two hypotheses outlined above using cross sectional time series analysis with quarterly panel data for 54 countries from 1980-2009 and annual data for 104 countries from 1970 - 2011. More specifically, I examine the correlation between a measure of the US financial cycle and the probability that other countries experience either a capital flow surge or a capital flow stop.

3.4.1 Dependent Variables

The dependent variable for the first set of models is a dichotomous variable *surge*, for whether a country experiences a surge in *gross* capital flows in a particular quarter or year. The quarterly data is taken from Forbes and Warnock (2012). Their measures are constructed using data on gross capital inflows. As Forbes and Warnock (2012)

as global hegemon, and most other countries in the international system.

explain, the distinction between gross and net flows is important. Gross capital flows are net foreign purchases of domestic assets, while net capital flows are foreign purchases of domestic assets minus net domestic purchases of foreign assets. The distinction is important because the activity of one type does not always mirror that of the other. For instance, Broner et al (2013) find that while gross flows always collapse in the year of a crisis, net flows may not because domestic investors tend to reduce purchases of foreign assets more than foreign investors reduce their purchases. Also, gross capital flows are usually pro-cyclical, while net flows do not always follow this trend.

Ultimately, net and gross capital flows measure different concepts. Net flows measures the amount of credit extended by foreigners to cover an imbalance of payments generated by a current account deficit. Thus, surge measures constructed using net flows can only occur when a country is experiencing a current account deficit, but there are numerous examples of countries with current account surpluses, or negative net flows experiencing a banking crisis.[6] Gross flows measure the total amount of credit extended to a country by foreign investors. Gross flow surges can occur even when a country is experiencing a current account surplus. I use this measure rather than the abundance of measures using net flows because gross flows better capture the volume of credit extended by foreigners to a particular country and as such is more indicative of trends in domestic leverage and asset prices. [7]

Briefly, Forbes and Warnock (2012) create their measure of capital flow surges by calculating changes in year-over-year gross capital inflows and outflows and define episodes as starting when the year-over-year change is greater than one standard deviation above the five year historic average change. The episode ends in the quarter in which the year-over-year change falls one standard deviation below average. Additionally, a two standard deviation change must occur during at least one quarter of the episode in order for it to be counted. Episodes that last for only one quarter are excluded. A "stop" episode be-

[6]Brazil 1990; Argentina 1989; China 1998; Germany, Denmark and France in 2008; Norway in 1991; and Japan in 1997 to name a few

[7]for a more detailed rationale see Borio and Disyatat 2011

gins when a decrease in capital flows is greater than or equal to a one standard deviation above the five year historic average change. The episode ends in the quarter in which the year-over-year change no longer falls within this range. Similar to the definition of surge, the year-over-year decline must be greater than or equal to two standard deviations above the mean for at least one quarter in order for an episode to be counted.

Because the sample of countries for which quarterly data is available is limited, I also replicate Forbes and Warnock's surge method using annual gross flows for a 104 middle and high income countries for the years 1970 - 2011. To simplify the task, and because I am using annual instead of quarterly data, I define a surge or a stop as an increase or decrease in gross capital inflows that is greater than or equal to two standard deviations above the five year historic average change. I run the models using this annual data for robustness.

3.4.2 Independent Variables

The main independent variable for the models explaining capital flow surges and stops is the change in the US financial cycle. The data on the US financial cycle is produced by Drehmann, Borio and Tsatsaronis (2012), who construct a measure of the US financial cycle from 1970 - 2012 using turning-point analysis and frequency-based filters applied to quarterly data on credit, the credit-to-GDP ratio, property prices, equity prices and an aggregate asset price index which combines property and equity prices to construct the time-series. I use the first difference of their variable to measure whether the financial cycle is expanding or contracting. This measure should be positive and statistically significant in the surge model, and negative and statistically significant in the stop model.

3.4.3 Control Variables

The control variables in both the annual and quarterly surge models include a variety of economic and political "pull factors," identified in extant literature. Investors undoubtedly respond to domestic need, positive domestic economic conditions, a transparent business environment, and political stability. Economic control variables include annual

GDP growth, exports-to-GDP, and inflation. These data come from the World Bank. While inflation should clearly be negatively correlated and GDP positively correlated with capital flows, the expected direction the coefficient on exports-to-GDP is less clear. On the one hand, high levels of exports-to-GDP and low debt service-to-exports could be signs of economic health, and therefore attract investment. Alternatively, a low exports-to-GDP ratio and high debt service-to-exports ratio could indicate a sudden need for loans, which investors may be eager to meet. Data for these variables is taken from the World Bank. I also include Aizenman, Chinn and Ito's (2012) measures of exchange rate stability and monetary independence. Greater monetary independence should allow countries to dampen volatility, which might be considered a pull factor, alternatively it may also correlate with less volatility of capital inflows as well, so may reduce the likelihood of a capital inflow surge. Exchange rate stability should attract investment, by reducing the need to hedge against currency devaluations. Chinn and Ito's KAOPEN measure of capital account controls should be positively correlated with capital surges.

Finally, I include a gini coefficient which measures the equality of of the top 10 largest current account deficits. It is primarily a measure of the US current account deficit, and hence US borrowing. The CA gini is low when the US capital account is low (because its size is similar to that of other deficits), while it approaches a value of 1 when the US current account deficit is high. This variable is taken from Oatley, Winecoff, and Bauerle (2017, forthcoming), who hypothesize that US borrowing drives net capital flow surges which affect the onset of crises. They find that this variable is negatively correlated with net capital flow surges (lower gini, more bonanzas), and positively correlated with the onset of financial crisis (high gini, more crises). Their argument is logical and finds empirical support since the capital account gini is a measure of how evenly distributed net capital flows are across the top ten countries with current account deficits, which would naturally be negatively correlated with the number of large influxes in net capital flows because both variables are derived from net flows data. The correlation between the Capital Account Gini and financial crises is probably explained by the fact that the US the size of the US current account most grows over the period of 1970-2009, at the

same time the number of financial crises increases. The theoretical explanation they offer for this correlations is that the CA gini proxies for the amount of capital in the system the US is using to finance its deficit. When the US is borrowing more of the available capital, other countries are deprived and are more likely to experience financial crisis. However, current imbalances are an inadequate measure of global liquidity. Only when one collapses the notions of savings with financing, does this logic makes sense. Since gross flows, a better indicator of global liquidity, and net flows often have different trends, and sometimes move in opposite directions, the effect of the CA gini in my models is uncertain.

Political control variables are included to capture investment risk stemming from political conditions that may incentivize or deter investors. I include Polity IV as a measure of regime type. More democratic and liberal regimes are also more likely to maintain freer markets and experience less political violence because they have institutional mechanisms in place to facilitate peaceful transitions of power. They may therefore be more likely to attract investment. Admittedly, this variable may be too broad and vague, and so I also include several more specific measures of bureaucratic and institutional quality as well as a measure of risk for political turmoil. These variables are taken from the International Country Risk Guide (ICRG), which publishes data quarterly. To control for overall risk of political violence and upheaval, I use the aggregate political risk index, which is a 100 point scale, with 0 being the most risky and 100 being the least risky. Countries are evaluated on a range of factors, most notably government stability, internal conflict, external conflict, corruption, the role of the military in politics, religious tensions, law and order, ethnic tensions, and bureaucracy quality. I also include two sub-component measures of the index, bureaucratic quality and corruption because past literature has identified these two variables as strong pull-factors. The corruption measure is particularly concerned with excessive patronage, nepotism, job reservations, clandestine party funding, and suspiciously close ties between politics and business. The bureaucracy measure is intended to assess how insulated government bureaucracy is from changes in political structures. Bureaucracy that cannot fulfill its role of implementing policy because political turmoil

leads to bureaucratic turnover and disruption means that businesses likely cannot function well and will have less certainty about the conditions under which the operate. Both of these variables should strongly deter investment.

3.4.4 Estimation

To estimate the quarterly surge and stop models, I run logistic time series models with a single lag, since the variable takes on a value of one for every quarter a country is experiencing a surge or a stop and these episodes can last for more than one quarter. I use contemporaneous independent variables since I expect the time delay in causation to be minimal. In the annual data, episodes do not last for more than one period, so I do not lag the independent variable. The models employ random effects because some countries never experience a surge in capital flows in the period for which they exist and because some control variables are time invariant.

3.4.5 Results

The results of the quarterly surge and stop models are presented in table 3.1. The US financial cycle is correctly signed and statistically significant for both the surge and stops models using quarterly data. When the US financial cycle experiences an average level expansion ($\mu = .1$), this increases the probability that a country experiences a financial crisis by .06. When the US financial cycle expands at its maximum observed rate of .18, the probability that a country experiences a surge increases by .10. Alternatively, when the US financial cycle experiences an average level expansion ($\mu = .1$) the probability that a country experiences a stop in gross capital inflows decreases by .0079. When the US financial cycle expands at its maximum observed rate of .18, the probability that a country experiences a stop decreases by .0084. 3.2.

The results vary for the control variables included in the quarterly model. GDP growth is signed as expected (positive for surges and negative for stops) and statistically significant in both models. As a comparison with the substantive effect of the US financial cycle, a one point increase in GDP growth (i.e. from 0 percent to 1 percent growth),

increases the probability that a country experiences a gross capital surge by .002, and decreases the probability of a stop by .001. Corruption appears to decrease the probability of a stop, which is counter intuitive. Inflation is positive and statistically significant in the surge model, which may be because inflation is caused by the surge.

The results from the models using annual data are quite similar to the models using quarterly data. Using the annual data, the coefficient on the US financial cycle variable is correctly signed and statistically significant across three of the four models. Based on the estimates from the surge model with controls, when the US financial cycle experiences an average level expansion ($\mu = .1$), this increases the probability that a country experiences a financial crisis by .012, while an expansion at the maximum level of .18 increases the probability of surge by .023. The coefficient on US financial cycle loses statistical significance in the stop model when controls are introduced. It appears to be especially sensitive to the capital account gini variable, and it does achieve significance when the capital account gini variable is excluded. The capital account gini would, therefore, appear to be a confounding variable except that it is not signed as Oatley et al (forthcoming) expect. They anticipate that as net capital flows are more unevenly distributed throughout the international economy (as the gini coefficient increases toward a value of one), sudden stops, and therefore crises, should increase. The results of my model suggest that the gini coefficient decreases both the probability that countries experience a surge, and the probability that countries experience a stop in gross flows. GDP growth again performs as expected in the models using annual data. Corruption also proves to be anomalous in the stop model with control variables. Exchange rate stability appears to decrease the likelihood that a country experiences a sudden stop in capital flows, but has no effect on probability that a country experiences a surge.

Table 3.1: Surge and Stop Model Results Using Quarterly Data

	(1) Surge	(2) Surge	(3) Stop	(4) Stop
Lagged DV	4.416*	4.271*	3.889*	3.802*
	(0.121)	(0.130)	(0.108)	(0.131)
US Financial Cycle	7.671*	11.48*	-9.834*	-27.52*
	(2.100)	(5.112)	(1.832)	(4.874)
Capital Account Openness		0.213		0.135
		(0.260)		(0.258)
Exchange Rate Stability		0.238		-0.221
		(0.278)		(0.263)
Monetary Independence		0.536		-0.00386
		(0.393)		(0.383)
Capital Account Gini		-1.072		2.926*
		(1.060)		(0.922)
Corruption		0.0289		-0.228*
		(0.0725)		(0.0701)
Political Risk		-0.00143		0.0113
		(0.00883)		(0.00867)
Bureaucracy		0.102		0.135
		(0.108)		(0.112)
Gdp Growth		0.0846*		-0.127*
		(0.0219)		(0.0216)
Inflation		0.000818*		0.00000689
		(0.000295)		(0.000279)
Exports to GDP		-0.00151		0.00449
		(0.00265)		(0.00254)
_cons	-3.235*	-3.540*	-2.809*	-4.763*
	(0.0842)	(0.857)	(0.0713)	(0.771)
lnsig2u				
_cons	-14.77	-14.25	-15.26	-14.71
	(24.56)	(29.21)	(24.56)	(25.25)
N	4689	3847	4691	3849

Standard errors in parentheses
* $p < 0.05$

In summary, the results of the first set of time series analyses suggest that when the US financial cycle is expanding, gross capital flows abroad increase, as do the prevalence of unusually large increases, or surges in capital flows. When the cycle contracts, this increases the probability that other countries experience a sudden stop in capital flows, as credit and liquidity tighten. In the next section, I test my final hypothesis that sudden stops gross capital flows increase the likelihood that a country experiences a financial crisis.

Table 3.2: Surge and Stop Model Results Using Annual Data

	(1) Surge	(2) Surge	(3) Stop	(4) Stop
US Financial Cycle	1.049*	2.600*	-2.509*	-0.170
	(0.52)	(1.294)	(0.545)	(1.368)
Capital Account Gini		-1.988*		-2.382*
		(0.941)		(0.947)
Capital Account Openness		-0.201		0.245
		(0.236)		(0.281)
Exchange Rate Stability		0.270		-0.606*
		(0.258)		(0.298)
Monetary Independence		-0.429		-0.661
		(0.407)		(0.472)
Corruption		-0.100		-0.193*
		(0.0783)		(0.0901)
Political Risk		0.0140		0.0160
		(0.00929)		(0.0112)
Bureaucracy		0.0174		0.0824
		(0.109)		(0.127)
Polity2		0.00627		0.00480
		(0.0133)		(0.0164)
GDP Growth		7.514*		-6.944*
		(1.927)		(2.071)
_cons	-1.919*	-1.515	-2.062*	-0.647
	(0.0625)	(0.776)	(0.0648)	(0.827)
lnsig2u				
_cons	-12.98	-13.05	-15.09	-13.09
	(18.17)	(19.55)	(18.33)	(23.66)
N	2451	1759	2451	1759

Standard errors in parentheses
* $p < 0.05$

3.5 Empirical Analysis: Predicting Crises

In this section, I present the results of a set of models used to test my third hypothesis. Once again, I run cross-sectional logistic time series analysis on both quarterly and annual data to examine the correlation between gross capital flow stops, the US financial cycle, and financial crises.

3.5.1 Variables

My main dependent variable for the second set of models is a dichotomous variable measuring the *onset* of financial crisis. This variable is taken from Laeven and Valencia (2014), who record all systemic banking crises in the international system since 1976. I

also code the quarterly state date of these crisis in order to run these same models using the quarterly data from Forbes and Warnock (2012).

The main independent variables for the second set of models is a dichotomous variable of whether a country has recently experienced a stop in gross capital flows. The source and construction of this variable is the same as I explained in the previous section. I lag this variable by one period in all models. The second independent variable is the state of the US financial cycle, measured the same as in prior models.

Control variables included in the second set of models predicting financial crises are similar to the controls from the earlier models predicting gross flow surges. Domestic economic controls include national GDP growth, inflation, capital account openness, monetary independence, and exchange rate stability. GDP growth should be negatively correlated with crises, as should monetary and exchange rate stability. Greater monetary independence and exchange rate stability should allow countries to dampen economic volatility. Capital account openness has the opposite effect, by increasing the ease of short term capital movements. High inflation has the potential to affect productivity, which could in turn affect the probability of a banking crisis. I also include a dummy variable for whether a country is experiencing a debt crisis, which Reinhart and Rogoff (2009) found to increase the probability of a banking crisis. Domestic political controls include regime type, and the ICRG measure for political risk to capture the effect of an uncertain political climate, particularly related to impending conflict, which often triggers banking crises.

International level control variables include a regional contagion variable constructed in the same manner as the capital flow contagion variable, US interest rates, which are often positively correlated with the onset of financial crises, and a dummy variable for whether the United States is in a period of crisis. I also include the Oatley et al.(forthcoming) Capital Account Gini, which they found to be negatively correlated with the onset of a financial crisis. Due to data missingness, the only variables presented in the final model are those that either have little to no missingness OR are statistically significant. If a variable is not statistically significant and reduces the sample size substantially,

I drop it from the final model.

3.5.2 Estimation

I run time series models with random effects since some of the variables are time invariant and such variables cannot be included in fixed effects models. I do not lag the dependent variable because the dependent variable is the *onset* of financial crisis, and this does not occur for multiple successive periods. I lag the independent variable in the quarterly model, but I do not do so in the annual model because it more likely that a country experiences a capital stop and a financial crisis in short succession, within the period of single year. All other independent variables are not lagged.

3.5.3 Results

Table 3.3 displays the banking crisis model results. The results are largely as I anticipated. In both the quarterly and annual models, experiencing a stop of gross capital inflows increase the probability that a country experiences a financial crisis. However, the substantive effect is significantly larger using the annual data. In the annual model, experiencing a stop of gross capital inflows increases the probability of experiencing a financial crisis by .09, but in the quarterly data, the increase is only .000001 – quite small. Additionally, episodes of financial crisis are less likely to occur during expansions in the US the financial cycle, but again the effect is more substantial in the annual model. In the annual model, an average level expansion in the US financial cycle decreases the probability that a country experiences a financial crisis by .004, but this is just .0000008 in the quarterly model. Political instability appears to increase the probability that a country experiences a financial crisis by .001 for every one point increase in the ICRG index, based on the annual data (.0000001 for quarterly). If a regional neighbor is experiencing a crisis, this also increases the probability that a country experiences a crisis by .05 in the annual model, and .00003 in the quarterly data. Regional contagion thus seems to have the strongest substantive effect. The coefficient on the capital account gini attains significance in the quarterly models with controls, but it is, once again, incorrectly

signed.

Table 3.3: Banking Crisis Model Results

	(1) Quarterly	(2) Quarterly	(3) Annual	(4) Annual
Capital Flow Stop	1.042*	0.897*	1.766*	1.786*
	(.345)	(0.389)	(.246)	(.323)
US Financial Cycle	-19.725*	-69.04*	-4.268*	-2.367
	(5.821)	(15.65)	(1.043)	(2.639)
US Federal Funds Rate		0.00129		.017
		(0.0976)		(.015)
Capital Account Openness		-1.084		-.817
		(0.757)		(.552)
Exchange Rate Stability		-0.133		.174
		(0.690)		(.523)
Monetary Independence		-0.765		-.773
		(1.115)		(.897)
Capital Account Gini		6.703*		-1.729
		(2.778)		(1.643)
Corruption		-0.434		-.139
		(0.236)		(.178)
Political Risk		0.132*		.048*
		(0.0345)		(.022)
Bureaucracy		-0.713*		-.454
		(0.340)		(.241)
GDP Growth		-0.177*		-15.23
		(0.0519)		(3.443)
Debt Crisis				.916
				(.675)
Inflation Crisis				.000
				(.000)
Regional Crisis		3.320*		(1.23)*
		(.419)		(.333)
_cons	-5.254 *	-14.06*	-3.807	-3.917*
	(.230)	(2.917)	(.155)	(1.636)
lnsig2u				
_cons	-14.085	-14.61	-13.989	-14.26827
	(-14.084)	(25.23)	(268.196)	(33.916)
N	4681	3842	2307	1586

Standard errors in parentheses
* $p < 0.05$

In summary, the results of the second set of time series models suggests that experiencing a sudden stop of capital flows increase the probability of experiencing a financial crisis. Regional contagion also seems to be a very influential factor, but this says nothing about what the underlying cause of the financial crisis in those neighboring countries is, and this too may have been influenced by the financial conditions in the US. In light of

this evidence, the causal story outlined in this paper seems plausible. The US influences financial conditions in the international economy. When conditions are lax, this increases the likelihood that other economies in the international system experience bubbles as real interest rates are reduced and easy access to credit pushes up asset prices. When the US financial cycles contracts, credit and liquidity conditions tighten, gross capital flows seize up, and banking crises result.

3.6 Implications and Conclusion

As IR and IPE scholars we are concerned with explaining, and hopefully predicting to some extent, aggregate social phenomena with implications for the distribution of resources at the broadest (international) level. As political scientists, we believe that explaining and predicting such social and economic phenomena requires an understanding of the distribution of power within a given social unit. Power is of course an inherently relational concept that has traditionally been defined in IR and IPE according to the material means actors use to exploit relationships for their own advantage. However, an alternative notion of power found in the IPE tradition relies instead on the power actors' derive from their social positions and their ability to use this status not just to compel or deter another actor but to set the rules of interaction between all actors. Susan Strange (1988) labeled this far more implicit notion structural power, which she defined as "the power to shape and determine the structures of the global political economy... the power to decide how things will be done." Structural power is similar to agenda-setting power – the ability to determine the choice sets other actors face by constructing or constraining the environment in which they operate.

In her original work on the subject, Strange outlined four structures in the international system from which structural power is derived: security, production, finance, and knowledge. Of these four, financial power has, quite naturally, received the most attention by subsequent IPE scholars. Of financial power, Strange wrote:

> The financial structure really has two inseparable aspects. It comprises not just the structures of the political economy through which credit is created

> but also the monetary system or systems which determine the relative values of the different moneys in which credit is denominated; in the first, the power to create credit is shared by government and banks (and much will depend therefore on the political and regulatory relation of the one to the other). In the second, the exchange rates between the different moneys, or currencies, are determined by the policies of governments and by markets. (1988:90)

Much of the literature developing Strange's notion of structural financial power has focused on the role of the US as the dominant supplier of international reserve currency. Most notably, Benjamin Cohen (2005; 2015) has highlighted the privileges of supplying the world's reserve currency, namely the ability to delay balance of payments adjustments, which can, in the short term, have politically inconvenient consequences as certain sectors lose the benefits of the external imbalance they were accustomed to. To Strange, however, credit was of at least equal importance in the creation of structural and financial power. According to Strange:

> The third leg, or facet, of structural power is, admittedly, rather more peculiar to advanced industrialized economies, whether socialist or capitalist, than it is to small communities or less developed economies. But finance – the control of credit – is the facet which has perhaps risen in importance in the last quarter century more rapidly than any other and has come to be of decisive importance in international economic relations and in the competition of corporate enterprises. [...] its power to determine outcomes – in security, in production and in research – is enormous. It is the facet of structural power least well understood by the Marxists and radicals who have written most cogently about structural power over production. Many of them still entertain the old fashioned notion that [...] capitalism somehow depends on the accumulation of capital. What they do not understand is that what is invested in an advanced economy is not money but credit, and that credit can be created. It does not have to be accumulated. Therefore, whoever can gain the confidence of others in their ability to create credit will control a capitalist – or indeed a socialist – economy. (1988: 30)

Most explorations of monetary power include a limited discussion of credit creation, though they do not detract from its importance. Cohen, for example, explores the role investment (financed by credit) plays in creating monetary power: "[...] It is clear that an investment role is essential if a currency is ever to rise to the status of a reserve currency. While a given money can play an investment role even if never is used as reserve currency, the reverse is unlikely ever to happen in a market-based currency system. Monetary

history suggests that the investment role comes first and then is followed by a reserve role in addition."(2015: 95) In other words, until a country supplies a large amount of financing, it will likely not provide a large amount of international reserves. Credit creation thus affords countries at least a similar level of autonomy and influence [8] as does supplying the international reserve currency.

The theory presented in this paper applies the framework of complexity science to the study of international political economy to expose the extent of the US' power within global credit markets. The size, scale, and level of international integration of the US financial sector provides it a breadth and depth of influence and autonomy in international financial markets that is unrivaled. The events leading up to and following the 2008 financial crisis epitomize this reality, but the crisis is really just the pinnacle of the dynamics that have been evolving in the international system since capital account liberalization took hold in the 1970s.

US influence in international credit markets comes primarily from its ability to create credit, and then repackage and re-sell the assets. The scale and depth of the financial sector in the US means credit can be easily created at the will of bankers, corporations, and the average American consumer. Notably, the Federal Reserve has no mandate to curb or affect the creation of credit, instead it prioritizes growth and employment. The US government's efforts to promote capital account liberalization since the 1970s, along with the US' strong economic track record and reputation, has additionally given the US financial sector the ability to repackage and resell asset-backed securities derived from this debt. The international market for U.S. public and private debt is broad and deep. For example, from 1990 - 2007, outstanding US-issued asset backed securities increased from 66 billion to 1.9 trillion dollars (SIFMA). A 2008 report by the Federal Reserve Board of Governor's estimated net foreign exposure to US-issued asset backed securities to be .8 trillion, in mid-2007 (Beltran, Pounder, and Thomas 2008). Nearly three quarters of these asset backed securities were mortgage-backed. Eight years after the crisis, at the end of 2016, SIFMA reported outstanding asset backed securities to be nearly 1.4 trillion, with

[8] Cohen's (2015) dual dimensions of structural power

mortgaged-backed securities constituting a little less than half of the total. The Federal Reserve estimates foreign holding of US-issued asset backed securities is about .4 trillion, half of which are mortgage backed.

US influence within credit markets is then extended when the creation of large amounts of credit, during the expansion phase of the financial cycle, spills over to other countries primarily via portfolio (and probably to a lesser extent foreign direct) investment, thereby enhancing the ability of market actors and governments in other countries to finance investment. At the extreme end of the scale, this influence can foster credit and asset bubbles that lead to financial crises, meaning that the United States' affects the financial stability and volatility other countries experience. Less extreme, but none the less important, the influence of the US within global credit markets also implies the constraint of choice sets faced by governments and non-state actors on a host of distributional issues, from the ability to finance deficit spending or investment in public infrastructure, to firms' ability to expand production, to politicians' ability to win reelection (which we know is dependent on macroeconomic conditions), to governments' choice of economic development models.

US autonomy within global credit markets is manifest in the US's limited sensitivity to the financial conditions of other countries, and virtual immunity from market discipline. As the fallout of the 2008 financial crisis cascaded through the system in the wake of the crisis, rocking the foundations of nearly every major economy and sparking the euro-zone crisis, foreign investors simply clambered for more US debt; The interest rates on both 10 year and 3 month treasury bonds dropped by about 2 points, and AAA rated corporate bonds fell by a little over a point. The demand for US debt enabled the US to finance a substantial number of counter-cyclical economic policies, and, most notably, to provide a tourniquet for the hemorrhaging financial sector through the Troubled Asset Relief Plan implemented by the US Treasury and the Federal Reserve's Term Asset-Backed Securities Loan Facility. The demand also facilitated the continued extension of credit to average Americans in the form of auto loans (an increased number of which are sub-prime and encountering high default rates), and school loans, both of which now constitute a very

large portion of asset-backed securities.

Structural power is arguably the purest and greatest form of power due to its recondite nature, though this quality also makes the concept particularly hard to measure and it has thus been underutilized in positivist IPE scholarship (Milner and Snyder 1988). The notion of structural power has been developed more fully since Strange's original writing on the subject. While Strange's contribution moved power analysis in the field of IPE away from notions of explicit relational power, toward a more inclusive understanding of power as also derived implicitly from context and the structure of relationships, Strange still imagined that this power would be expressed intentionally. Yet, as Cohen(2016) highlights in his discussion of power analysis, political scientists have acknowledged that power can also be expressed unintentionally, and is no less impactful or important. The contribution this paper makes to our understanding of structural financial power differs from Strange's original conception in this way: the autonomy and influence of the US in the international financial system is as much unintentional as it is intentional. While Strange focused on the latter, I complement her contribution with an exposition of the former. The United States surely never intended to cause financial crises in other countries. Past politicians and policy makers intended instead to re-forge a globalized economy that would both lay the foundations for international peace and stability, while also advancing American economic interests. But achieving the latter paved the way for the former, and both the US' unintentional and intentional expressions of structural power equally constrain the extent to which countries can benefit from the global economy and attain their own interests. Both also impact the timing and pace of shifts within the global distribution of power, and both must therefore be laid bare.

There are three other additional implications of this study for the fields of IR and IPE. The first pertains to early IPE research more generally. Much of Susan Strange's work was developed in reaction to American scholars' predictions of hegemonic decline, predictions that were part of a preoccupation in early IPE scholarship with the structure of the international system and the balance of power within it. Until Strange, this early IPE literature had a very narrow and inadequate definition of both power and struc-

ture. Strange won the hegemonic decline argument, and her insight regarding the role structural power in ensuring America's position was spot on, but her notions of structural power, and of structure especially, lacked empirical concreteness. The application of complexity science and network science, both conceptually and empirically, can resolve these shortcomings and may help to revive the important, but mostly abandoned research agenda of early IPE scholarship.

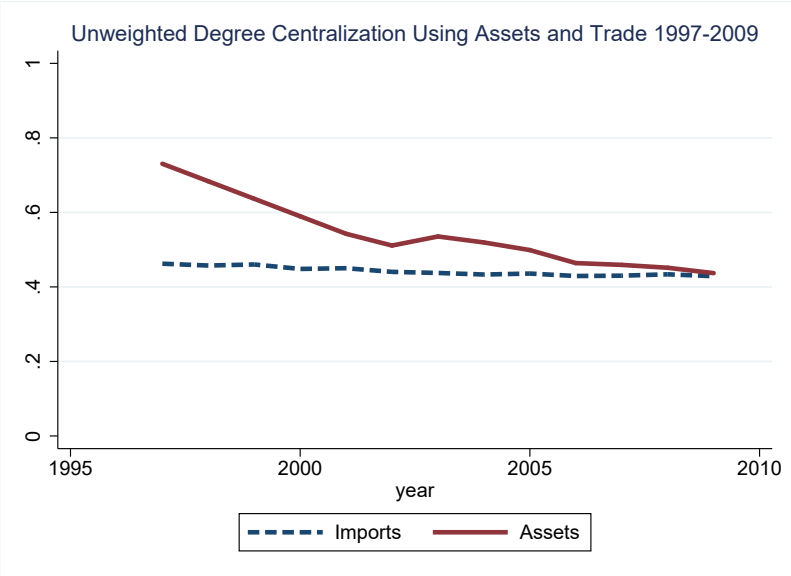
The theory theory presented in this paper, for example, makes an argument not very different from Charles Kindleberger's original Hegemonic Stability Theory - the foundational research program in the field of IPE. Kindleberger argued that the structure of the international economy, conceptualized as the distribution of power, directly affected the severity and duration of the Great Depression; Without the existence of a single dominant power to solve the collective action problems of trade promotion and the provision of countercyclical financing, a market crash in single country would reverberate throughout the world and snowball into the largest financial crisis the world had yet seen. When removed from the logic of collective action (which has since been debunked by several scholars), and instead viewed through the lens of complex systems theory, the theory takes on new relevance – hierarchically organized (hegemonic) systems are more robust (stable). Kindleberger was more right than he knew! Examining the dynamics of the international economy through the lens of complexity science, introduces a whole new range of possibilities for empirically evaluating the distributional and political questions which birthed the subfield of political economy.

The second implication of this paper regards policy. By highlighting the influence of the US the financial cycle on international system stability, this study implies that international cooperation on financial regulation may matter at the margin, and that countries' macroeconomic policy, and in particular monetary policy, are of greater import for fostering international financial stability. Thus, monetary policy cooperation may indeed be a critical addition to recent efforts to generate a framework for macroprudential regulation.

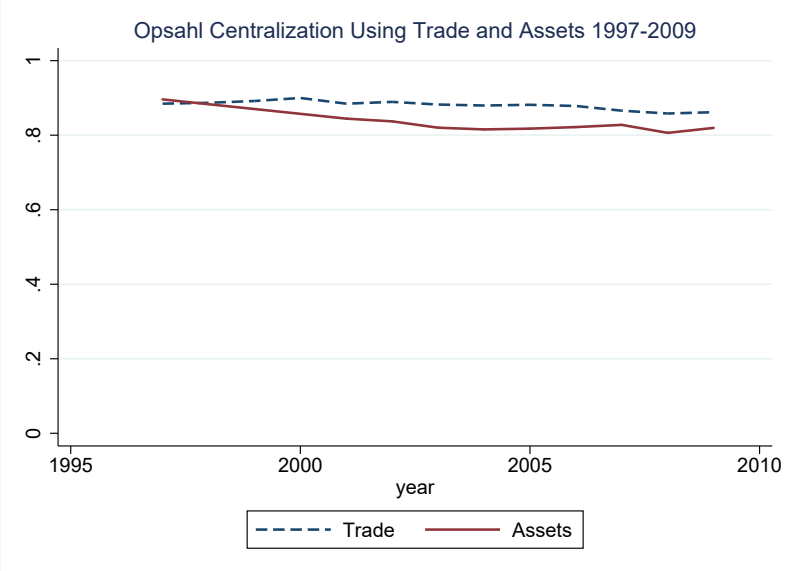
The final implication of this paper for the field of IPE is methodological. In finding

that system structure helps to explain the emergence of financial crises, the study asserts the validity and even necessity of further examining macro-level causal processes. Macrolevel-causality has been a feature of many influential IR and IPE theories, but empirical tools for specifying and testing such theories have not been employed in the field until recently. Macro-level causality has therefore become a somewhat contentious issue in the field of IPE recently, as a debate over the importance of system level and domestic variables has played out between senior scholars (Oatley 2011; Milner et al 2015). The issue need not be contentious. All IR and IPE outcomes of interest (all international political and economic epiphenomena) are the result of two or more international actors interacting. Often times, the outcomes are actually the product of a multitude of actors interacting. We can explain how and why these epiphenomena occur by examining other epiphenomena that influence it – other outcomes that occur as a result of the same or other actors' interacting – as well as individual actor behavior. When the relevant actors involved in a particular international political or economic phenomena are states, which themselves are systems, it goes without saying that understanding the internal dynamics of states is as critical as understanding the dynamics of the broader system in which they are positioned. Some IR and IPE researchers have in the past treated macro-level phenomena as if they are exogenous forces or variables. This is inaccurate but is usually done for analytical tractability, which may be justifiable; Domestic and international political and economic phenomena are always endogenous. Therefore, a combination of individual actor behavior, and other epiphenomena produced by other agents interacting in other ways, can be said to cause a particular outcome of interest. This study demonstrates this point precisely. Explaining why financial crises occur requires an understanding of individual country attributes and two other epiphenomena - patterns of international trade and investment. Thus, it is time to conclude, as have scientists in many other fields, that macro-level causality does not "lack microfoundations," it complements our understanding of the micro-level causal processes that occur simultaneously (Henderson 1994).

APPENDIX



Appendix Figure 1: Unweighted Degree Centralization of Assets and Trade Networks 1997-2009



Appendix Figure 2: Opshal Centralization of Assets and Trade Networks 1997-2009

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