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Credit Default Swaps Regulation and the Use of Collateralized Mortgage Obligations in U.S. Financial Institutions

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2014

Abstract

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MPA, Northern Kentucky University, 1996

BSBA, University of Florida, 1984

Dissertation Submitted in Partial Fulfillment

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Abstract

The fast and easy global movement of capital throughout the financial system, from lenders to borrowers and through intermediaries and financial market participants, has been recognized as a source of instability associated with illiquidity and financial crises. The purpose of this research was to better understand how regulation either enables or constrains capital movement. The theoretical framework comprised 2 contrasting public policymaking models, Arrow's rational-comprehensive model and Kingdon's garbage can model, which were used to derive opposing hypotheses. The research question addressed the nature of the relationship between Credit Default Swaps (CDSs) regulations and the flow of capital into Collateralized Mortgage Obligations (CMOs) when lenders share their borrower-related loan risks through intermediaries with other market participants. This quantitative study was a quasiexperimental time series design incorporating an autoregressive integrated moving average (ARIMA) model using secondary data published by the U.S. government. The 2 independent variables were regulatory periods involving 2 CDSs regulations and the dependent variable was capital in the U.S. financial system that is deployed to CMOs. The Commodity Futures Modernization Act of 2000's ARIMA model (1,2,1) was significant at $p < .05$ and was negatively correlated to the Emergency Economic Stabilization Act of 2008's ARIMA model (1,1,0), $r = -.91$, $n = 18$, $p < .001$. These results suggest that regulations cannot be relaxed and then reinstated with predictable results. The potential for positive social change is from stable financial institutions that mutually benefit depositors and borrowers.

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Dedication

This dissertation is dedicated to the memory of my late cousin, Mrs. Frances G. Board Keightley-Moseley of Harrodsburg, Kentucky.

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Chapter 1: Introduction to the Study

Introduction

The Great Recession was a calamity to financial institutions and individuals alike featuring the enduring issue of the complicated relationship between government and commerce. The topic of this quantitative research study is the public policy of the U.S. federal government as it is related to the control and regulation of privately held U.S. financial institutions. This quantitative study was conducted in order to better understand financial institutions' deployment of capital to Collateralized Mortgage Obligations (CMOs) and to determine whether regulatory decisions on Credit Default Swaps (CDSs) were statistically significantly related to changes in CMOs during the period 1989 to 2013 through a quasiexperimental time series design incorporating an autoregressive integrated moving average (ARIMA) model. The terms CMOs and CDSs are defined in the Definitions section16. There is the potential for positive social change from financial institutions that are stable and in which depositors and borrowers mutually benefit from banking transactions.

In Chapter 1 I present the background to the 2008 financial crisis and then introduce the problem statement addressed by this quantitative study. I then briefly state the purpose of the study that is followed by the quantitative research question and a null and two alternate hypotheses. The hypotheses were analyzed within the context of the combined theoretical framework of rational actor and garbage can policy models, which are defined in the Definitions section. I then present the nature of the quantitative study with sections devoted to definitions, assumptions, scope and delimitations, and limitations. Finally, I review the significance of the study for its implications to positive social change and summarize the chapter highlights.

Background

The U.S. financial system experienced a crisis in 2008 that led to economic contraction, causing hardships for people worldwide (Cable, 2009; Deaton, 2011). Significant public policy actions in the U.S. financial system preceded the crisis, including the global banking capital agreements under the Basel Accords that began in 1988 and the Gramm-Leach-Bliley Act of 1999 (GLBA; 15 U.S.C. § 6801-6809) deregulation of financial institutions (Bordo, 2008; De Grauwe, 2008a). Under the GLBA, financial institution activities associated with commercial banking, investment banking, and insurance that had been segregated under Glass-Steagall Act (GSA) restrictions enacted by President Franklin Roosevelt in 1933 were permitted to combine (Cornford, 2009). Such regulatory changes and financial innovations had historically been precursors to financial crises (Ferguson, 2008; Kindleberger & Aliber, 2005) that were in turn interwoven with business cycles which are patterns of economic growth and contraction (National Bureau of Economic Research [NBER], 2010).

Economic cycles are part of the broader movements of population growth and human development (Fischer, 1996, p. 239). These cycles can appear coherent when the focus on an occurrence zooms out toward vantages of years where random variation fades (Reinhart & Rogoff, 2008a). Perceiving the coherence in such cyclical patterns and movements requires various vantage points for the examination of their causes across time while simultaneously being able to zoom in on quarterly results to understand these causes in detail. The financial crises associated with these cycles have always erupted in problems never before experienced (Caprio & Honohan, 2005; Eichengreen, 2002) and as predictable surprises that some had actually predicted (Posner, 2009, pp. 252-254; Watkins & Bazerman, 2003).

Predicting the onset and ending of a financial crisis is daunting because of the complexities of these situations and competing vantage points. Centuries of financial cycles show that asset bubbles and associated banking crises have been an enduring and recurring feature of the economy (Ferguson, 2008; Reinhart & Rogoff, 2009). In contrast, the notion of the *black swan*, a rare and unexpected event, holds that unique circumstances with a minuscule probability of occurring determine the direction of human history (Taleb, 2007, p. 18). The point of no return occurs when the crucial problem emerges, separating the condition from its presentation (Gladwell, 2000). Just 2 years before the financial crisis of 2008, Nobel Laureate economist Stiglitz warned that the financial system was not working well (2006, p. 245). The tipping point came when approximately 3 million U.S. homeowners could no longer afford to make mortgage payments (Blomquist, 2013; Levy, 2010), triggering the 2008 Global Financial Crisis (GFC; Felsenheimer & Gisdakis, 2008, pp. 47, 197, 199; Immergluck, 2009, p. 128).

Public administrators and key policymakers are responsible for the governance and stability of the U.S. financial system (Peretz & Schroedel, 2009). Yet the idea of the financial system stability as a public good, measured by the resources a government is willing to commit for intervention in supporting financial institutions, was generally accepted only in the approximately five years preceding the GFC (Quintyn & Taylor, 2002). Even key policymakers in this era (Gergen, 2000; Greenspan, 2007; Paulson, 2010; Rubin & Weisberg, 2003; Woodward, 2000) failed to recognize that the ominous events they were experiencing were consistent with the development of financial crises (Fischer, 1997; Kindleberger & Aliber, 2005; Qian, Reinhart, & Rogoff, 2010). Confusion and dismay accompanied the GFC events (Augar, 2009), causing one practitioner to call regulatory management of the financial system "incomprehensible" (Grant, 2009, p. 20). A skeptic imputed the crisis to "fear and greed" (Grumet, 2008, p. 7), while a cynic said the GFC was "insanity" (Lewis, 2009, p. 1).

The deregulatory era for the financial system that had begun in 1980 and lasted for a generation ended with the GFC (Cassell & Hoffman, 2009). This ending was epitomized by the U.S. government action in 2008 taking direct control of the housing finance enterprises: the Federal Home Loan Mortgage Corporation (FHLMC, a.k.a. *Freddie Mac*) and the Federal National Mortgage Association (FNMA, a.k.a. *Fannie Mae*), under the Housing and Economic Recovery Act (HERA; Cassell & Hoffman, 2009; Jaffee, 2009). From the body of published research on financial regulation, the discipline of public policy and administration appeared to have been passive prior to the GFC in 2008 and the discipline of economics was unsuccessful at predicting the GFC (Caballero, 2010). Robust efforts by researchers across disciplines ensued to understand the financial system relationships associated with the events of the GFC, which was reflected in the existing research literature. Adding to this body of theoretical and empirical research, this quantitative research study was needed to fill an existing gap in the literature and to demonstrate the nature of the relationship between the independent variables—2000's the Commodity Futures Modernization Act (CFMA) and 2008's the Emergency Economic Stabilization Act (EESA)—and the dependent variable—capital deployed to CMOs in U.S. financial institutions and measured by millions of U.S. dollars in quarterly intervals which were involved in the triggers of the GFC. These regulations include responses to the GFC, such as the Troubled Asset Relief Program (TARP, 2008) contained in the EESA.

Problem Statement

The fast and easy global movement of capital throughout the financial system, from lenders to borrowers and through intermediaries and financial market participants, has been recognized as a source of financial instability associated with illiquidity and financial crises in general (Ashcraft & Schuermann, 2008; Begg, 2009; Billio, Getmansky, Lo, & Pelizzon, 2010; Booth, 2008; Brown et al., 2009; Kirabaeva & Razin, 2009; Reinhart & Rogoff, 2008a, 2008b, 2009; Rossi, 2010). Yet little is currently known about how regulation either enables or constrains capital movement globally (Lee, 2012). Understanding the effect of regulation on financial stability is important for the regulatory response to the GFC, and scientifically based quantitative research (such as this study) from the public policy discipline was needed (Warren, 2008; Wehinger, 2008). Traditional economic research lacked a valid or reliable method to predict financial crises based upon capital movement (Caballero, 2010; Friedman, 1986), and there is a gap in the quantitative research literature demonstrating how capital in the financial system moves in response to regulation (Aizenman & Pasricha, 2009; Barth, Caprio, & Levine, 2008; Eichengreen, Mody, Nedeljkovic, & Sarno, 2009; Ford, 2010; Marquis & Huang, 2009).

Purpose of the Study

The purpose of this quantitative study was to better understand how the movement of capital in the system of privately owned financial institutions is related to regulatory actions. Regulations are legislated by Congress and then enforced primarily by the U.S. Department of the Treasury's (DOT) Office of the Comptroller of the Currency (OCC) and the Federal Reserve System (FRS). The approach to this quantitative study was to identify regulatory actions that might have been related to the financial system stability by involvement in the GFC triggers (Birdsall, Caicedo, & de la Torre, 2010). Knowledge of the relationship between regulations and financial system results may help to identify public policy correlates of financial instability (Blundell-Wignall, Atkinson, & Lee, 2008; Cherny & Craig, 2009; Haubrich & Lucas, 2007; Naceur & Omran, 2011). Understanding the mechanisms of financial instability is necessary in order to avoid future financial crises, which may both precede and follow this current GFC instability (Bordo, 2008). The archetype response to a financial crisis is tightening monetary policy and limiting available credit that in turn may result in stock market crashes and real estate busts (Bordo & Haubrich, 2009; Mian, Sufi, & Trebbi, 2011).

This quantitative research study used a quantitative research design with a quarterly time series analysis from September 1989 (3Q) to March 2013 (1Q) and incorporated the autoregressive integrated moving average (ARIMA) model (de Smith, 2011; Glass, Gottman, & Willson, 2008; National Institute of Standards and Technology [NIST], 2012). ARIMA models are used for forecasting time series and are a refined version of random-walk models (Glass et al., 2008). The data in ARIMA models are made stationary by transforming them into nonseasonal differences and with variance-stabilizing logs (de Smith, 2011; Glass et al., 2008; NIST, 2012; Parsad, Bhar, Bhatia, & Gupta, 2012). The nonseasonal ARIMA model is a (p,d,q) model in which p is the number of autoregressive terms, q is the number of moving average terms, and d is the number of differences in the series after seasonality has been removed, which if present with a value greater than one indicates the time series can be made stationary only by integrating these differences (Glass et al., 2008). If the first difference of the series is predicted in the model to be constant, then a *random walk* is present and is *drifting* when there is an average upward or downward trend (Glass et al., 2008). The random walk is refined in the ARIMA model's forecasting equation by adding lags of the differenced series (the number of autoregressive terms p) and lags of the forecast errors (the number of moving average terms q) that together remove the correlation of the historical values in the differenced series (Glass et al., 2008; NIST, 2012; Parsad et al., 2012). I provide details on the time series regression analysis and further statistical refinements related to the ARIMA model in Chapter 2. Further, I detail the application of the ARIMA model to the modeling parameters in this quantitative study in Chapter 3.

The intent of this quantitative study was to identify perturbations in the financial system related to the performance of CMOs, which in turn are related to CDS regulatory decisions. The independent variables were (a) 2000's the CFMA and (b) 2008's the EESA, and the dependent variable was capital deployed to CMOs in U.S. financial institutions and measured by millions of U.S. dollars in quarterly intervals which were involved in the triggers of the GFC. A variable was needed to control for the effects of history in ARIMA models that was independent of the hypothesized regulatory interventions (Glass et al., 2008). The selected control variable was the labor participation rate (LPR; expressed as a percent) which is the employment to working age population ratio and based on the existing literature should have little relationship to CDSs or the capital flows into CMOs. As an example this LPR was 67% in 2000 and 66% in 2008 (DOL, BLS, 2013).

Research Question and Hypotheses

This study was based on the following quantitative research question: What is the nature of the relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants?

The null (H_0) and alternate (H_A1 and H_A2) hypotheses were based upon the theoretical framework in which two contrasting public policymaking models are considered (the rational-comprehensive model and the garbage can model) for two CDS regulations (the CFMA and the EESA).

Null hypothesis (H_0): There is no statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

The first alternate hypothesis (H_A1) was derived from the garbage can policy model in which a *reactive* policy was implemented, with a *negative* relationship. The garbage can model is associated with reactive policymaking and is defined in detail in the Definitions section. A negative relationship is a policy result in which the presence of the regulation is associated with the measure of an unfavorable result.

Alternate research hypothesis A1 (H_A1): There is a negative and statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

The second alternate hypothesis (H_A2) was derived from the rational-comprehensive policy model in which a *proactive* policy was implemented, with a *positive* relationship between CDS policy and increasing CMO capital flows. The rational-comprehensive policy model is associated with proactive policymaking and is defined in detail in the Definitions section. A positive relationship is a policy result in which the presence of the regulation is associated with the measure of a favorable result.

Alternate research hypothesis A2 (H_A2): There is a positive and statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

An ARIMA model was used for analysis of time series data. ARIMA model policy periods are formulated and then analyzed for significance using a one-way analysis of variance (ANOVA) *F*-test and *t*-test statistics, with alpha (α) set at .05 (I am 95% confident that the results did not occur by chance). Adjustments were made to the data in the policy periods using the ARIMA model in order to detect discrete episodes of nonseasonal differences in the time series data. The null hypothesis is treated as *no association* between the independent and dependent variables. Direction is quantified by best fit ARIMA parameters which are the time series regression analysis and statistical tests that are detailed in Chapter 2. The data sources were financial statistics published by the U.S. government that are aggregated financial system results.

Theoretical Framework of the Study

The theoretical framework for this quantitative research study is public policymaking through contrasting models of the rational-comprehensive approach (Arrow, 1987) and the garbage can approach (Kingdon, 2003). The rational-comprehensive approach is a model of public policymaking focused on analysis and the examination of alternatives in order to select the optimal alternative (Arrow, 1987; Simon, 1957). The garbage can approach, by contrast, is a model of public policymaking that is loosely structured and strongly influenced by political motivations and shifting coalitions. Policymaking for banking activity involves the application of the federal government's power under the U.S. Constitution granting the power to regulate commerce (Hamilton, Jay, & Madison, 1788/2006; U.S. Const. art. I, § 8, cl. 3). Theories that are based on an assumption of rationality have become the dominant way of analyzing behavior, including certain commercial behaviors that are regulated in public policymaking, as opposed to political motivation (Anderson, 2006).

The Rational-Comprehensive Policy Model

The rational-comprehensive policy model is closely associated with the general outlook of economists and holds that objectives can be maximized through a specific process for making decisions rationally (Arrow, 1987; Simon, 1957). The rational-comprehensive policy model assumes a decision maker is equipped with guiding goals, values, or objectives and that there is a problem in which alternatives can be clearly identified. These alternatives are then examined by the decision maker so that the related consequences, both favorable and unfavorable, are determined through cost-benefit and other analyses. This analysis is complete when the decision maker selects the optimal alternative that maximizes the goals, values, or objectives (Arrow, 1987; Simon, 1957). Elements of the rational-comprehensive model are in the public administration discipline, in theory and in practice (National Performance Review, 1993; Pious, 2004; Wilson, 1989).

The Garbage Can Policy Model

The garbage can policy model posits a decision-making situation in which there is a collection of existing policy preferences that partisans seek to apply to various problems as the opportunities arise (Kingdon, 2003; Tomlin, 2007). Although the organized chaos of public organizations was the inspiration of the original garbage can model (Cohen, March, & Olsen, 1972), Kingdon's (2003) revision placed more emphasis on being organized than being chaotic, and included refined assumptions of the activities. There are process streams of roughly sequential activities occurring and involving the fluid participation of actors, starting with a problem being recognized, and with policy proposals being formed and then refined by technical specialists (Kingdon, 2003), and politics was added into the mix as the force behind the decision making. In some instances, a policy window would emerge from circumstances in which there was a critical moment with the opportunity for the coupling of a recognized problem and an available solution, producing new policy. The garbage can policy model is based in experience from policy case studies (Kingdon, 2003; Tomlin, 2007), and requires a perspective that metaphorically recognizes the structures and patterns of policymaking to be in the form of clouds and not as clocks (Kingdon, 2003, p. 223), meaning policy is a result of timing and transient political forces and not mechanically produced through logical evaluation by expert decision makers.

Comparison of Rational-Comprehensive and Garbage Can Models

The rational-comprehensive and garbage can models of policymaking are both limited by the presence of constraints resulting from the failures of existing regulatory policy (Cooper, 2006, p. 16; Sparrow, 2000, 2008). The divergence of these two models is with the policymaking process. Policy actions resulting from circumstances in which a policy window is opened (Kingdon, 2003) can differ from situations in which alternatives are objectively formulated and considered (Arrow, 1987; Simon, 1957). Both policymaking models applied to a degree in the process that resulted in the CFMA (Born, 2009; U.S. Senate Committee on Banking [SCB], 2005). The most important proclamation of the CFMA was the exclusion from regulation of transactions between financial institutions and their eligible counterparties in over-the-counter derivatives and foreign currency (SCB, 2005). Likewise, 2008's TARP and eventual regulation of CDSs under the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA, a.k.a. *Dodd-Frank*) Title VII had indicators of policy windows and rationality (Arrow, 1987; Jickling, 2010; Kingdon, 2003; Miller & Ruane, 2012; Nanto, 2009; Simon, 1957).

The rational-comprehensive and garbage can policy models provide for contrasting explanations for the same observed phenomenon (Keeney, 2012; Khademian, 2009; Lauckner, 2012). Policy produced by rational actors is intentional (Green, 2002; Lovett, 2006), and so the actual outcomes can be compared to the intended outcomes in order to minimize unintended consequences. As applied to CDS regulation, if this policy resulted from a rational-comprehensive process, it is expected that CDSs and CMOs would not be affected by unintended consequences, because consequences in this model are purposeful. In this rational-comprehensive model, preferences were attached to alternatives by legislators with clear goals, objectives, and values and bankers pursuing their own self-interest (Lovett, 2006). Regulators agreed with bankers on the value of diversifying risk from using CDSs and with intrusive CFMA rules could have harmed the financial system (SCB, 2005). Furthermore, regulating CDSs would have been contrary to the financial deregulation in GLBA (Kalinowski, 2011). During the GFC, there was similar agreement between congresspersons on the need to take pragmatic actions in TARP to prevent illiquidity from damaging the financial system and the economy (Ferguson & Johnson, 2009). The exchange required by Dodd-Frank for CDSs and other derivatives was a government-mandated market mechanism not sought by financial institutions (Ferguson & Johnson, 2009; Klieber, 2012).

The garbage can model, in contrast to the rational-comprehensive model, is inclusive of outcomes that could include unintended consequences and disruption to the use of CDSs and CMOs (Kingdon, 2003; Klieber, 2012). In the garbage can model, the GFC had caused a policy window to open in which the proregulatory political faction in Congress was able to build a coalition to pass both TARP in 2008 and Dodd-Frank in

2010 (Jickling, 2010; Kingdon, 2003; Miller & Ruane, 2012; Nanto, 2009). This faction had opposed the deregulatory reforms of the GLBA and the CFMA and was ready to apply regulatory solutions to the problems identified in the GFC (Born, 2009; Ferguson & Johnson, 2009). In return for political support to aid the financial system, this faction introduced new financial institution regulations in the EESA's TARP in 2008 and Dodd-Frank in 2010 that were intended to restrict CDSs activities (Ferguson & Johnson, 2009). This process reflected a nonlinear, at times chaotic, policymaking process with no particular start or end (Depository Trust and Clearing Corporation [DTCC], 2012; U.S. Securities and Exchange Commission, Division of Risk, Strategy, and Financial Innovation [SEC], 2012).

Nature of the Study

This quantitative study used a time series design incorporating an ARIMA model as this approach aligned well with the quantitative research question of determining the relationship between regulations and associated financial system results. The ARIMA model was a lagged moving average regression as defined in detail in the Purpose of the Study section in Chapter 1 and in Chapter 3. The variables include the independent variables of regulatory decisions involving CDSs which are defined as the CFMA and the EESA. The dependent variable is capital in the financial system that is deployed to CMOs, which is measured in millions of dollars each quarter. The strongest policy model explaining CMOs is tested against the control variable of the employment to working age population ratio that is used in the labor participation rate. A control variable is used in

ARIMA models to control for the effects of history (LPR). Financial statistics data published by the U.S. government were used in the analysis (as detailed in Appendices A and B).

Definitions

Key terms used in this study have specific meanings that are essential to the quantitative research topic and combine elements of public policy and economics from their use in academic and professional settings. The dependent and independent variables are defined in their operational definitions in Chapter 3.

Asset Backed Security (ABS): A security owning cash flows that are associated with assets in an underlying loan pool, excluding mortgage securities guaranteed by the U.S. government. A financial institution is the seller of a loan pool to a security, in which the cash flows are structured into bonds for sale to investors based on market preferences of risk including for credit rating, maturity, and interest rate (Ashcraft & Schuermann, 2008; Jarrow, 2011; Securities Industry and Financial Markets Association [SIFMA], 2010).

CAMELS: Acronym for the Federal Reserve Bank supervisory framework used to assess financial institution quality, based on scoring six factors: Capital adequacy, Asset quality, Management and administration quality, Earnings, Liquidity, and Sensitivity to market risk (Board of Governors, 2005).

Capital arbitrage: Capital movement from one regulatory structure to another more favorable for profits while holding the amount of capital constant (De Grauwe, 2008a; Frachot, 2010; Khademian, 2009).

Capital flow: Passing of capital in the globalized financial system involving transactions between lenders and borrowers through market entities and including intermediary agents (Ashcraft & Schuermann, 2008; Begg, 2009; Chandrasekhar, in press; Tollefsen, 2010).

Capital mobility: Capital movement across the boundaries of national borders and regulatory structures, which has the potential to destabilize the financial system (Bordo & Helbling, 2010; Reinhart & Rogoff, 2008a).

Capital stability: Preferred state of capital in the financial system, favoring inertia and then moving in accordance to the policymaking of the central banker or from regulatory changes (Barth et al., 2008; Geyfman & Yeager, 2009; Skidelsky, 2009).

Central bank: Publicly controlled banking and financial authority that manages a nation's money and credit supply. The FRS is the U.S. central bank that maintains liquidity in the financial system by increasing or decreasing bank reserves requirements and by market intervention (Board of Governors of the Federal Reserve System [Board of Governors], 2005; Kilian & Manganelli, 2008; Obstfeld, Shambaugh, & Taylor, 2009).

Collateralized: Feature of a security that has loans, or pools of already-securitized loans, as the underlying source of cash flow (Jarrow, 2011; SIFMA, 2010).

Collateralized Debt Obligation (CDO): Investment instrument owning cash flows of principal or income, or both, from aggregated asset-backed securities that had been issued by financial institutions and other parties, from which its value derives. Asset classes of asset-backed securities include residential and commercial mortgages, automobile loans, credit cards, student loans, and various business-related loans and leases (Bond Market Association, 2003; Jarrow, 2011; SIFMA, 2010).

Collateralized Mortgage Obligation (CMO): Investment instrument owning cash flows of principal or income, or both, from aggregated mortgage securities that had been issued by financial institutions and other parties, from which its value derives. CMOs are those CDOs in which all the underlying debts are residential or commercial mortgages (Bond Market Association, 2003; Estrella & Silver, 1984; Jarrow, 2011; SIFMA, 2010).

Commercial bank: Privately owned, chartered depository institution and lender engaged in activities of commerce. The Federal Deposit Insurance Corporation (FDIC) regulates its cash reserves for liquidity and capital for lending risks (Bordo, 2008; Geyfman & Yeager, 2009; Walter, 2009).

Credit Default Swap (CDS): Contract between counterparties (in which one or both of the parties are a financial institution) that insures securities and debt instruments, including CMOs, against adverse credit events and boosts financial system liquidity by providing a market value of the insured instrument without requiring a trade (Cherny & Craig, 2009; Jarrow, 2011; Mengle, 2007).

Derivative: Contract between two or more parties in which the value of one asset is determined by fluctuations in another asset (Jarrow, 2011; Mengle, 2007).

Excess risk: Financial institution having an excess supply of funds coupled with excess borrower demand in a way that results in loans with latent credit losses for which there is insufficient financial institution capital (Felsenheimer & Gisdakis, 2008, p. 19; Jarrow, 2011).

Federal funds rate: Key interest rate affected by the FRS monetary policy and that member financial institutions use to lend to each other overnight (Angeriz, 2009; Board of Governors, 2005).

Financial crisis: Events conjointly impacting the real economy and the financial system associated with economic contraction and government intervention to support liquidity (Dungan, 2008; Kindleberger & Aliber, 2005; Mian et al., 2011).

Financial institution: A commercial bank, investment bank, universal bank, savings and loan, credit union, insurance company, or a nonbank commercial company that is predominantly engaged in financial activities like a mortgage company issuing ABSs (Board of Governors, 2013a; EESA § 3, cl. 5; Federal Financial Institutions Examination Council [FFIEC], 2013; Jarrow, 2011).

Financial institution regulatory structure: The collection of rules and regulations governing the operation and supervision of financial institution capital and risk (Jarrow, 2011; Kilian & Manganelli, 2008; Kose, Prasad, & Taylor, 2009).

Financial system: Comprehensive collection of private and publicly supported U.S. financial institutions participating under various regulatory arrangements in banking and related activities in which the institutions are dependent on their collective liquidity (Board of Governors, 2005; Fisher, 2008).

Garbage can model: Public policymaking model based on the garbage can theory in which policy emerges reactively from circumstances when there is a window of opportunity for policy action amid loosely formed decision-making processes in an organization that is strongly influenced by politics and shifting coalitions (Cohen, March, & Olsen, 1972; Kingdon, 2003).

Global Financial Crisis (GFC): Instability in the U.S. financial system related to the housing market that emerged in 2008 and spread to other countries, leading to economic contraction (Aizenman & Pasricha, 2009; Bordo & Haubrich, 2009; Deaton, 2011; Nanto, 2009).

Investment bank: Privately owned financial services institution engaged in securities activities involving issuing, managing, and trading stocks, bonds, notes, securities, and debentures. Its underwriting, sale, and securities distribution activities are regulated under GLBA (Bordo, 2008; Geyfman & Yeager, 2009).

Liquidity: Availability of cash assets sufficient to settle banking transactions at the end of the business day (Board of Governors, 2005; Diamond & Rajan, 2009; Fujiwara, Nakajima, Suda, & Teranishi, 2011; Scott, 2010).

Macroeconomics: Aggregated economic behavior and results associated with the total goods and services produced in the real economy in conjunction with the financial system (Ashraf, Gershman, & Howitt, 2011; Gerding, 2011; Kilian & Manganelli, 2008).

Macroprudential: The FRS policymaking objectives of financial stability and macroeconomic performance that require prudent control of large-scale economic relationships (Aizenman, 2009; Board of Governors, 2005; Negrilă, 2009; Schinasi, 2003).

Mortgage Backed Security (MBS): A security owning cash flows that are associated with assets in an underlying loan pool of mortgage loans, including mortgage securities guaranteed by the U.S. government. A financial institution is the seller of a mortgage loan pool to a security, in which the cash flows are structured into bonds for sale to investors based on market preferences of risk including for credit rating, maturity, and interest rate. MBSs directly own mortgage loans, unlike CMOs that can own MBSs, ABSs, and/or CDSs (Jarrow, 2011; SIFMA, 2010).

Mortgage Derivative Instrument: Instrument in which the value of an asset is determined by the underlying mortgage loan performance of another asset, primarily as a result of the timing of principal repayments, instances of borrower default, and the housing market values. Such instruments consist of ABSs, CDSs, and CMOs (Cherny & Craig, 2009; Jarrow, 2011; Mengle, 2007; Shiller, 2012).

Mortgage Derivative Risk: Exposure of the financial system's capital and liquidity to mortgage derivative instruments owned by financial institutions (Cherny & Craig, 2009; Jarrow, 2011; Mengle, 2007).

Parameters: Factors that are hypothesized to set the conditions of operations for the ARIMA model involving CDSs and CMOs (Glass et al., 2008; NIST, 2012).

Rational-comprehensive model: Public policymaking model based on the rational-comprehensive theory in which policy is a proactive process of deliberative, analytical decision making that is guided by clear goals, values, or objectives in order to select the optimal alternative for implementation (Arrow, 1987; Simon, 1957).

Regulation: Statutes and administrative rules governing the conduct and supervision of banking activity (Anderson, 2006, pp. 11-13; SCB, 2011).

Securitization: Method of financing that enables lenders to access capital in the marketplace and that enhances liquidity. Loans that had been originated by a lender are pooled into a legal entity, which is then sold to investors as bonds based on the expected cash flow of the underlying loans (Ashcraft & Schuermann, 2008; Begg, 2008; Jarrow, 2011; SIFMA, 2010).

Subprime Mortgage Loan: Mortgage loan in which the underlying borrower has heightened default risk as indicated by a credit score of 650 (or less) or debt-to-income ratio of 40% (or more; Ashcraft & Schuermann, 2008; Jarrow, 2011; SIFMA, 2010).

Universal bank: Privately owned, chartered depository institution and lender engaged both in activities of commerce and securities. Its liquidity and capital are regulated by the FDIC and its investment banking activities are regulated under GLBA (Bordo, 2008; Geyfman & Yeager, 2009; Walter, 2009).

Assumptions, Scope and Delimitations, and Limitations

The scope of this quantitative research study is defined in this section together with assumptions used in the quantitative research design, the delimitations of research, and limitations related to the quantitative design that threaten its validity.

Assumptions

The secondary data used in this quantitative research study were published by the U.S. government, including the FRS and the U.S. DOL, Bureau of Labor Statistics (BLS, 2013). These data were assumed to be current, accurate, and complete when reported, but were analyzed for outliers as part of the ARIMA modeling process (IBM, 2012; NIST, 2012). Although these are government data, there is the risk that the financial institutions either submitted incorrect information or that true data were incorrectly tabulated and reported. Discontinuity in data collected by the FRS can arise from changes in definitions or valuations and from breaks in receiving data, though the value of discontinuity is reported to be zero for most periods and data series (Board of Governors, 2013a), which means that data from this source are in general highly accurate and near complete. The assumption that FRS data are correct is necessary because I lacked the independent means to verify the data. It is also assumed that the U.S. financial system regulations and banking supervision are lawful, despite concerns by some economists and legal scholars (Higgs, 2010; Lawson, 2010; Miron, 2010) that certain actions taken by the U.S.

government during the GFC were unconstitutional. This assumption is necessary because of the potential delay associated with the confirmation of legality through judicial review that could involve a multiyear legal process.

Scope and Delimitations

The scope of this quantitative research study was U.S. financial institutions during the recent GFC. The population corresponding to U.S. financial institutions was the basis for data sampling, and research results are generalized to this scope (Creswell, 2009). The focus of this quantitative study was on financial institution regulations because these were enacted at a point in time and can be operationalized to measure related results in the financial system (Eichengreen et al., 2009; He, 2010; Jordà, Schularick, & Taylor, 2012). Financial institutions of countries other than the U.S. were excluded from the scope of this quantitative research study. Although the U.S. participates in the global financial system, there lacks a standardized regulatory structure among the national central banks (Kose et al., 2009) and there was no associated global regulatory supervision ("Global Regulation," 2009).

The scope of the research study excluded the U.S. monetary policy of the FRS in which macroeconomics principles were applied to manage economic performance, which also impacted financial institution results (Board of Governors, 2005). Despite delimitation, macroeconomics remained influential in public policy because economic performance was the context for applying many regulatory decisions. Lower interest rates (ranging from a FRS Discount Rate of 0.5% to 6.75%) since 2001 meant monetary policy had remained constant and loose (Angeriz, 2009; Federal Reserve Bank of New York, 2013c; Kalinowski, 2011) and therefore the quantitative research design must have a control variable that was *not* a macroeconomics measure targeting monetary policy (targets include gross domestic product [GDP], the unemployment rate, price indices; Board of Governors, 2005).

Limitations

Quantitative methodology limits the universe of independent variables that could be used to explain the U.S. capital flow aspect of the dependent variable CMO because these variables must be a coherent grouping based in academic literature (Creswell, 2009). The quasiexperimental design in this quantitative research study included inherent weaknesses associated with using time series methods. Some of these inherent weaknesses were the lack of a control group and the inability to control for concurrent historical events (Glass et al., 2008). As a result, a control variable of LPR was included in the ARIMA. Additionally, there was the risk of extrapolation of results beyond the time frame and data setting of the quantitative study. There are loose controls in that quasiexperimental samples are drawn purposefully for an experimental group and consequently lack random sampling and a control group (Glass et al., 2008). Data analysis is used as a substitute for controls, including ARIMA modeling, regression analysis, and statistical procedures to address time series data issues (Glass et al., 2008). Definitions like CDS and CMO emerged during the time frame of the study while other definitions, like capital, were defined or measured differently over time. I address validity concerns regarding the operationalization of variables in Chapter 3 (Creswell, 2009).

Significance of the Study

Financial institutions are essential to the performance of the economy (Das, Chenard, & Quintyn, 2004) and identifying instances of regulatory policy that are related to adverse results will help to improve the stability of the financial system (Cherny & Craig, 2009; Haubrich & Lucas, 2007). Essential human needs are met through economic relationships that depend upon these institutions (Fisher, 2008), which becomes more apparent in times of financial system dysfunction when job loss, homelessness, and hardship in the economy are amplified (Lusardi, 2011). Enhancing the stability of financial institutions benefits the public good (Quintyn & Taylor, 2002), especially as financial problems easily spread in the increasingly globalized economy (Eichengreen et al., 2009; Lin & Martin, 2010; Vicente & Araújo, 2010).

Professionals involved in the ongoing U.S. response to the GFC as either the regulator or the regulated would benefit from the findings of this quantitative research study. It is important for academia and practitioners to recognize the relationships between regulations and financial system results because policy actions must be neither overapplied nor underapplied, so that unintended policy consequences are not generated (Aizenman, 2009; Goulder, Jacobsen, & Van Benthem, 2009). Furthermore, professionals in specialized institutions, such as the FRS, are responsible to protect the public interest against negative spillover from private markets, which threatens the social welfare (McCarty, 2001).

Social change is needed in order to address the borrower and lender relationship that was complicated by the rise of financial intermediaries and left weakened at the end of the Great Recession (Warren, 2008). Access to credit for prime and subprime borrowers to purchase a new home, refinance a mortgage loan, or purchase goods and services is the social purpose of liquidity (Akerlof & Shiller, 2009). Yet, while liquidity is a social construct based upon a depositor willing put a dollar in the bank for lending to a borrower, the relief from illiquidity was only provided to those U.S. financial institutions that created the credit problem (Walter, 2009). Borrowers instead experienced record levels of foreclosed homes (Mian et al., 2011) while individual mortgage holders who were foreclosed upon (thus losing all their existing equity even at then current market prices) and society collectively bore the financial institutions' losses as a result of government actions during the GFC that socialized this risk (Khademian, 2009). The trust that is essential to the borrower and lender relationship was breached and so ongoing liquidity depends on its restoration, whether through actions by U.S. financial institutions or U.S. regulators as their proxy (Statman, 2009).

Summary

This quantitative scientifically based research study was a public policy and administration inquiry into the problem of capital movement and financial system instability related to the GFC of 2008. The quantitative research question is the following: What is the nature of the relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants?

The quasiexperimental design that was used to answer this question was an ARIMA lagged time series used for public policy analysis. By probing this problem as a public policy concern, the principles and processes of public policymaking and evaluation were considered, contributing to the ongoing policy dialogue of financial stability and liquidity.

In Chapter 1, I presented the overview of the quantitative research study. I explore the quantitative research question in Chapter 2 (the literature review), which is evaluated on the theoretical basis of governance by the FRS and includes current research on financial stability, regulations, and proposed quantitative research design. The themes and trends from the existing research literature are developed and applied to the quantitative research methodology, which I discuss in Chapter 3. I present the results from the quantitative research in Chapter 4 and discuss these results and their implications in Chapter 5.

Chapter 2: Literature Review

Introduction

The U.S. financial system succumbed to a GFC in 2008 despite a robust economy and decades of national and global efforts to build safe and sound financial institutions. In the aftermath of the GFC, there was a flurry of quantitative and qualitative scholarly research (2008 to 2013) to attempt to understand the crisis and its precursors and components. The output of this research literature followed five different themes based upon the perspective and data of the researcher: capital movement, regulatory structure, financial innovation, mortgage derivative instruments, methods and designs used in past analyses. A common point in these themes was that the GFC was preceded by excess risk in the U.S. financial system. This quantitative research study was undertaken to determine how the dependent variable—capital deployed to CMOs—is related to the independent variables—U.S. regulatory decisions CDSs (the CFMA and the EESA).

In Chapter 2 I provide a synthesis of the literature reviewed and begin with an overview of the search method. I provide a brief history of the theoretical basis of the U.S. financial system stability and follow that with a summary of current research on the theoretical foundation approaches of garbage can model and rational-comprehensive model. I summarize the GFC triggers and review the literature in the context of the crisis and the associated mortgage derivative risk in the U.S. financial system. At the end of Chapter 2 I make some relevant observations and conclusions from the reviewed empirical and theoretical literature so that they can be applied in Chapter 3 (Research Methodology).

Search Method

The Internet was the predominant search method, using online libraries, academic article databases, and government-published gray literature (written material not typically published in peer-reviewed journals; American Psychological Association (APA), 2010; Borum, 2004, pp. 6-9). I searched these databases using an iterative process based upon keywords in order to identify the relevant public policy and economic literature. I took a multidisciplinary database approach because the quantitative research topic spanned public policy, business, economic, political, and social science research literature. I also searched for literature in the Elton B. Stephens Company (EBSCO) EBSCOhost multidisciplinary collection: Academic Search Complete, Business Source Complete, Military and Government Collection, Political Science, and SocINDEX with Full Text. I also searched databases for articles and gray literature from the FRS, NBER, the World Bank (WB), and the International Monetary Fund (IMF). Because the 2008 financial crisis was global, I took an expansive perspective by researching authors and articles from outside the United States, including the United Kingdom, Europe and the European Union, Asia, Australia, South America, and Canada, in English only.

I generated search terms used in the database research from a keyword analysis of 365 working papers issued between December 2008 and October 2010 by NBER, the publisher of economic data on behalf of the U.S. government that also declares the official U.S. business cycles (Moore & Zarnowitz, 1986; NBER, 2010). The three primary search terms identified were *financial* (in 134 working papers), *risk* (in 120 working papers), and *regulation* (in 43 working papers). Through this process, I identified some additional search terms including *crisis*, *systemic*, *control*, *stability*, and *consequences*. I supplemented these search terms with keywords associated with GFC financial instruments: *derivative*, *credit default swap*, *collateralized*, and *securitization*. Keywords were used singularly and in Boolean combinations by searching both title and abstract fields for articles published between 2007 and 2013. There were 346 references cited in the text.

Theoretical Basis

The theoretical basis of this quantitative research study was the stability of the U.S. financial system, which was examined within the public policymaking context of the rational-comprehensive theory and the garbage can theory as contrasting frameworks for policymaking models. The Board of Governors of the FRS is a federal government agency responsible for economic performance and financial stability (Board of Governors, 2005). The board's chairperson, vice chairperson, and seven board members are appointed by the President of the United States and confirmed by the U.S. Senate (Board of Governors, 2005). The chairperson of the board of governors during the GFC was Bernanke, whose position bore the macroprudential responsibility and operational control for the monetary policy (Raines, Leathers, & Richardson, 2009; Schinasi, 2003; Wessel, 2009). Other studies of economic issues involving macroprudential matters share this theoretical basis, particularly those studies relating to monetary policy (Angeriz, 2009; Aspachs, Goodhart, Tsomocos, & Zicchino, 2007; Geyfman & Yeager, 2009; Mikesell, 2007; Negrilă, 2009).

The primary role of the FRS in the U.S. economic system is to conduct the monetary policy through the Federal Open Market Committee (FOMC) by influencing monetary and credit conditions in pursuit of optimal economic development, largely through manipulation of the Federal funds rate (Board of Governors, 2005). Monetary policy is intended to produce maximum employment, stable prices, and moderate long-term interest rates (Angeriz, 2009; Goodhart & Tsomocos, 2007). The most significant of the FRS's monetary policy tools is the open market operations conducted by the FOMC, in which the U.S. Treasury bonds are bought or sold to increase or decrease liquidity and thus impact the cost of bank lending. The FRS also implements monetary policy through the federal funds rate which is the rate that member depository institutions trade balances (Angeriz, 2009; Board of Governors, 2005).

The duty of the FRS related to financial stability is to contain systemic risks that may arise in financial markets (Board of Governors, 2005). The safety and soundness of the banking and financial system is ensured through the supervision and regulation of financial institutions (Acharya, Pedersen, Philippon, & Richardson, 2009; Board of Governors, 2005; Federal Reserve Bank of New York, 2013a; de la Torre & Ize, 2009). The framework for this supervision is the components of the rating systems: Capital adequacy, Asset quality, Management quality, Earnings, Liquidity, and Sensitivity to market risk (CAMELS; Board of Governors, 2005), which was an approach for assessing the presence of potential instability in regulated financial institutions. The body of existing research literature related to the GFC confirmed the presence of failure in each of the six CAMELS components.

The operational capabilities of the FRS include banking supervision and the intervention authority to control liquidity in the banking system as warranted by events (Board of Governors, 2005; Wagner, 2010). After the GFC, intervention powers were expanded with the Financial Stability Oversight Council (FSOC) that was established under Dodd-Frank in 2010. The purpose of the FSOC is to provide comprehensive monitoring of the U.S. financial system, identify risks to its stability and to respond to emerging risks such as those experienced during the GFC (DOT, 2013). Yet, a key operating constraint of the FRS is the need to coordinate monetary policy with the U.S. fiscal policymaking of taxation and government spending (Super, 2005).

The contrasting theoretical frameworks of the rational-comprehensive theory (Arrow, 1987; Simon, 1957) and the garbage can theory (Kingdon, 2003) were used in the currently reviewed research on public policymaking, including separately (Lauckner, 2012; Lee, 2012) and in combination (Keeney, 2012). These two frameworks, which I reviewed in Chapter 1, were unreconciled as public policymaking models because of the chaotic processes aligned with the garbage can approach and the logical consequences aligned with the rational-comprehensive approach (Keeney, 2012). Regulatory policy in the financial system had been examined in a rational-comprehensive approach (Lee, 2012), while other federal policymaking had been examined using the garbage can model with comparably sound methodology (Lauckner, 2012). Rather than introducing potential researcher bias by favoring a worldview that was alternately chaotic or logical, these contrasting frameworks were incorporated into this ARIMA model research design and structured as opposing alternate hypotheses for testing so that the outcome determined the policymaking type.

Research Design

Quantitative research designs among the literature reviewed demonstrated the relationships of economic and regulatory variables to the 2008 GFC (Billio et al., 2010; Fahlenbrach, Prilmeier, & Stulz, 2011). Time series analyses added to this body of knowledge by identifying financial system changes over extended periods of years and decades (Das et al., 2004; Fahlenbrach et al., 2011; Hinich, Foster, & Wild, 2006). The time series research methodology used in GFC research was a type of regression analysis consistent with quantitative theory (Creswell, 2009; Glass et al., 2008) and with economic measurement (DeLong & Summers, 1986; Friedman, 1986; Gorton, 1994).

Times Series Regression and ARIMA Analysis

The results from time series regression analyses provided a precedent for research design methodology and for time frames to further study and analyze (Richey, 2008; Shahbaz, Shamin, & Aamir, 2010; Wang, Zhou, & Zhou, 2011). Regression analyses generated empirical evidence of relationships between variables, though the details varied according to research objectives and statistical refinements were applied based upon the problem inherent in the data.

The Breusch-Pagan test was used to test data for heteroskedasticity of variable residuals, which showed whether the values of the independent variable resulted in differing levels of variances (Richey, 2008). The application of this test statistic was to transform raw data into a form that could be analyzed further in a bell curve with regression statistics (NIST, 2012). The data transformation in Breusch-Pagan was a curve-fitting method incorporating estimated Feasible GLS to value the variable residuals so that test statistics could be compared to variances, rather than using an assumed GLS (NIST, 2012; Parsad et al., 2012; Richey, 2008). The importance of GLS was in refining the technique for estimating unknown parameters based upon the specific data set being analyzed. The generalized least squares (GLS) model was used when the time series data had state-level subsets (Richey, 2008). A traditional macroeconomic analysis had fully modified ordinary least squares (OLS) for long-term association and for short-term error correction (Shahbaz et al., 2010).

The Ng-Perron test was used to determine the integrating order of variables based on the β coefficient and the associated p-value (Shahbaz et al., 2010; NIST, 2012). The common application of this test statistic was to analyze pairs of asset prices to determine whether the pairing was random or not (Ng & Perron, 2000). A key data problem with times series analysis was addressed by the Ng-Perron test, which was developed for the selection of time series lags with good size and power (> .80) even when the sample size was limited (Ng & Perron, 2000; Shahbaz et al., 2010).

The Granger causality test was used to demonstrate cause and effect to known covariation relationships (Wang et al., 2011). The value of this test statistic is in facilitating development path analyses and causal models (Billio et al., 2010; Parsad et al., 2012). The logic underlying the procedure was that a cause appears before an effect and this should be identifiable in the data such that X_1 Granger-causes X_2 to the extent that past values of X_1 predicts a value of X_2 more than do the past value of X_2 alone (NIST, 2012; Parsad et al., 2012; Seth, 2007; StatSoft, 2012b).

ARIMA modeling was used to identify parameter differences from a nonstationary time series (Adams, Akano, & Asemota, 2011). The preliminary transformation involved the process of *differencing* in which the data were divided into series that had stationary autocorrelations (Adams et al., 2011; NIST, 2012). Autocorrelation referred to the correlation of a time series with its own past and future values (NIST, 2012). The stationary series were analyzed for autocorrelation and partial autocorrelation features in order to estimate the AR (autoregressive) and MA (moving average) parts of the ARIMA parameters, including the examination of plotted data and "subjective" interpretation (Adams et al., 2011, p. 31). Partial autocorrelation refers to the correlation of a time series with itself and with the contributions of previous lags being removed. Partial autocorrelations cut off when the desired autocorrelation term is reached (NIST, 2012; Parsad et al., 2012).

The adequacy of the ARIMA model parameters were diagnosed for statistical significance with *p*-values and for goodness of fit using stationary R^2, Bayesian information criteria (BIC), standard error of the estimate, and *Q*-statistic (Adams et al., 2011), which are each explained in this section. The *p*-value was the probability of obtaining a time series test statistic at least as extreme as the result that was observed, assuming the null hypothesis was true (NIST, 2012; Parsad et al., 2012). The *p*-values were compared to the 1% and 10% levels (Adams et al., 2011), with the lower the *p*-value, the more strongly the time series test statistic rejected the null hypothesis (NIST, 2012; Parsad et al., 2012). The stationary R^2 was the fraction of variance explained by the stationary times series model (Adams et al., 2011; Green & Salkind, 2008; IBM, 2012). The BIC was used for considering the adequacy of an ARIMA model in comparison to its alternatives (Adams et al., 2011). The BIC was a fitting of two models to the data in order to determine the version with the smaller differences between observed and expected values by using the likelihood ratio test (Adams et al., 2011; Bollen, Harden, Ray, & Zavisca, in press; NIST, 2012). The standard error of the estimate was the measure of the accuracy of AR (autoregressive) and MA (moving average) parts of the ARIMA model in predicting the observed values (Adams et al., 2011; NIST, 2012). The *Q*-statistic was expected to be statistically insignificant in order to demonstrate a well-fitted ARIMA model, based on the Ljung-Box test for randomness of autocorrelations in the time series (Adams et al., 2011; NIST, 2012).

Variables and Date Ranges

The number of independent variables in the quantitative studies reviewed mostly ranged from 2 to 8 (Billio et al., 2010; Bordo & Haubrich, 2009; Das et al., 2004), with up to 8 used when there was a less obvious structure to the research design (Das et al., 2004; He, 2010). These independent variables were determined through qualitative methods, mixed methods, and quantitative methods. Causal analysis that was a topic of qualitative research during the GFC (Poole, 2010) was refined in the crisis aftermath (Jickling, 2010; Nanto, 2009). The qualitative causal analyses generated led to the identification of independent variables used in later quantitative designs, such as the classification of financial institutions by regulatory structure (Billio et al., 2010). Mixed methods research resulted in analytical frameworks like capital mobility and financial institution risk (Bordo, 2008; Reinhart & Rogoff, 2008a).

Date ranges of studies incorporating the GFC began with various events in order to coordinate with the research purpose. The most common demarcation for those purposes involving long-term globalization and financial system deregulation and innovation was 1980 (in order to isolate a uniform regulatory environment; Aizenman, 2009; Phillips, 2008; Reinhart & Rogoff, 2008a). Studies involving U.S. financial institutions often had a date range beginning after the resolution of the 1988 savings and loan crisis (in order to isolate a uniform marketplace; Cassell & Hoffman, 2009), particularly when the research topic focused on mortgages (Rossi, 2010; Yezer, 2010).

Current Research on the Financial Crisis

The scholarly and incremental dialogue on financial system stability was disrupted swiftly in 2008 at the time of the GFC. Unfolding events of the emergent GFC were seldom forewarned in the literature and these events, involving the theme of capital movement, defied simple explanations. Suddenly, seasoned policymakers and researchers were confounded with the presence of instability and crisis in the rapidly globalizing financial system (Statman, 2009). This globalizing financial system was supposed to have been made more stable in the 1990s as a result of major regulatory overhauls of the U.S. financial system, which was a key theme in the literature (Bucur, 2009; Dobson, 2008; Drew, 2010; Mussa, 2009; Statman, 2009).

The resulting shift in the research literature broadened the academic discussion beyond the largely quantitative output of the economics discipline. Simultaneously, the tone in some publications gained in expressions of urgency and conviction as the GFC became a matter of public policy (Breen, 2010; De Grauwe, 2008a; Issa, 2010; Paul, 2010; Weissman & Donohue, 2009). The U.S. model of capitalism, closely tied to its political values, faced an existential threat from the GFC (Whitley, 2009) that was being defended even while financial institution failures spread among nations (Gamble, 2009; Marks, 2009; Milne & Wood, 2009). Some authors added anchored their arguments in Constitutional viewpoints thereby adding public policy depth to the topic of banking regulation by examining the legal bounds of public policymaking associated with financial crisis (Arkes, 2010; Higgs, 2010; Lawson, 2010; Paul, 2010).

The increasingly prolific output of research was generated from multidisciplinary authors of varying perspectives, with much of the research including an aspect of theme of subprime mortgage securitization and mortgage derivative instruments. NBER supported U.S. government policymakers with economic analyses (Aizenman, 2009; Moore & Zarnowitz, 1986). Respected research journal authors went to press in book form (Immergluck, 2009; Reinhart & Rogoff, 2009), and well-established authors published books that added accurate and factual historical context to the crisis (Ferguson, 2008; Phillips, 2008). Useful articles included analyses of the GFC (Acharya, Philippon, Richardson, & Roubini, 2009), an element of the GFC (Lea, 2010), or an important detail like the process of subprime mortgage securitization (Ashcraft & Schuermann, 2008). Conversely, among the articles reviewed there were instances of subtle bias favoring free-market economic theory (Barth et al., 2008), overt bias related to the economic role of the United States ("Global Regulation," 2009), and factual error in ascribing responsibility for the GFC (Gökay, 2009). To provide for quality and diversity in research sources, the various authors, or their journals, were sampled and compared to a benchmark journal for commonality in citations of authors and journals. Volume 31 of the *Journal of Post-Keynesian Economics* that was published in 2009 was used as the benchmark journal.

Articles written before the GFC were particularly useful in assessing the literature without the bias of hindsight (Aspachs et al., 2007). Yet, hindsight hardly seemed necessary because the GFC followed so closely the crisis pathology already defined

(Ferguson, 2008; Fox, 2009; Kindleberger & Aliber, 2005). The pre-GFC literature provided for methodological insight (DeLong & Summers, 1986) and for the identification of public policy independent and dependent variables aligning with the GFC literature (Caprio & Honohan, 2005; Eichengreen, 2002; Haubrich & Lucas, 2007; Neill, 2010).

As promised in Chapter 1, I have included a critical assessment of research regarding the GFC in U.S. financial institutions and have paid attention to its crucial details in the literature review. I begin the literature review with the background to the trigger events of the GFC, which is a synthesis of empirical data from research journals and key books (Felsenheimer & Gisdakis, 2008; Immergluck, 2009; Phillips, 2008). Next, I cover the macro-oriented topics of capital movement and financial institution regulatory structures as well as the narrower topics of financial instrument innovation and mortgage derivative instruments.

Financial Instruments and the Global Financial Crisis Triggers

The GFC triggers that set markets into motion represented a linkage of the research themes of the financial crisis to the details of financial instruments (Booth, 2008). The consideration of regulatory issues associated with the GFC must account for regulatory changes that long-preceded the crisis and the market events that defined the crisis (Rossi, 2010). The relevance of the GFC triggers was guided by research of earlier financial crises that had triggers that were similarly a relatively small part of the economy (DeLong & Summers, 1986, p. 689). The description of the GFC's trigger was made in an empirical and approximated manner, in order to generate comparisons over time (Geyfman & Yeager, 2009).

The GFC trigger events dated to the fourth quarter of 2007 with the collapse of the U.S. asset securitization market and its financial instruments mechanisms (Acharya, Philippon, et al., 2009; Felsenheimer & Gisdakis, 2008, pp. 32, 175, 200). Asset securitization was an innovation in credit and debt instruments whereby financial institutions made loans that were sold into a security, and then the institution issued bonds to investors based on these aggregated loan assets (Phillips, 2008, p. 71; Rossi, 2010). U.S. originated securities were sold throughout the world's financial markets to investors (Jarrow, 2011) and were later repackaged by intermediaries into derivative securities, or CDOs including CMOs. Multiple asset classes were securitized, but the practice started with and centered upon subprime mortgage loans to homeowners with impaired or falsified (mortgage originator tweaked) borrower qualifications (Ashcraft & Schuermann, 2008; Felsenheimer & Gisdakis, 2008, pp. 118-122; Frame, Lehnert, & Jarrow, 2011; Friedland, 2009; Prescott, 2008).

The valuation of the GFC's trigger was the amount of securitized assets including subprime loans and was estimated at $3 trillion U.S. dollars (Ferguson, 2008, p. 4). In an annual global economy of $47 trillion U.S. dollars of goods and services, these trigger securities represented a moderate 6.4% of U.S. annual economic output (Ferguson, 2008, p. 4). When considered as assets, these securities compared to 5.9% of the valuation of global stock markets, and as debt, these securities compared to 4.4% of the valuation of the global bond market (Ferguson, 2008, p. 4). As a component of global capital markets valued at $175 trillion U.S. dollars (Sinclair, 2009, p. 452), the $3 trillion U.S. dollars of securitized assets were merely 1.7%, which indicated a modest global risk. The trigger valuation diminished by two thirds to less than $1 trillion U.S. dollars when considering just the losses on the then current value of the underlying assets of foreclosed homes (Felsenheimer & Gisdakis, 2008, p. 121). Conversely, the trigger valuation was magnified by derivative transactions like CDOs and its CMOs subset together with credit default and interest rate swaps (often exchanging a fixed for a floating payment) derived from contracts underlying loans and securities (Eichengreen et al., 2009; ISDA, 2012b). These swaps grew from $473 trillion to $680 trillion U.S. dollars between 2006 and 2009 while remaining tenfold the annual global economy (Born, 2009; Ferguson, 2008, p. 4). The CDSs of $60 trillion U.S. dollars at the onset of the GFC was greater than the annual output of the global economy (Huian, 2010), which clearly indicated a significant global risk. Furthermore, these CDSs equated to nearly one third of the global capital markets' valuation (Sinclair, 2009, p. 452).

Key long-term market trends that preceded the GFC were related to the trigger and dated to the 1980s (Reinhart & Rogoff, 2008a). In the 1980s, debt levels that had been stable since the end of World War II began to grow at a pace not experienced before (Phillips, 2008, p. 7), and as demonstrated by debt levels of U.S. businesses and consumers. Domestic U.S. debt for financing businesses progressively doubled during the 1990s until it equaled the U.S. gross domestic product (GDP; Phillips, 2008, p. 45). In the following decade, the 2000s had home mortgage debt double between 2001 and 2007 driven by consumer consumption (Phillips, 2008, p. 51), lax lending standards, and abusive banking practices (Friedland, 2009; Warren, 2008). Concurrently, increasing home prices (and the related growing intangible equity) replaced the stock market as the main asset for U.S. residents (Phillips, 2008, p. 13).

Financial institutions participated in long-term market trends by shifting capital into home mortgages and doubled their capital allocation for home mortgages from 30% to 60% of capital (Phillips, 2008, p. 32). In order to keep generating fees from new loans, lenders freed capital by selling their loans to the Government Sponsored Enterprises (GSEs) supporting the secondary market for home mortgages (Cassell & Hoffman, 2009). Operating with an implied guarantee of the U.S. government, GSE financial commitments spiked between 2001 and 2007 (Felsenheimer & Gisdakis, 2008, pp. 111, 132). By 2010, home mortgages owned by GSEs were a government-backed obligation of $6.7 trillion U.S. dollars (Federal Housing Finance Agency, 2011), representing 40% of the size of the U.S. economy (Ferguson & Johnson, 2009).

The home mortgage debt spike from 2001 to 2007 was significant for its size, the coupling of risk with the U.S. government, and the increasing loan risk (Rossi, 2010). At its peak over half of all new home loans originated from mortgage banking companies, which were growing outside the regulatory controls imposed on commercial banks (Immergluck, 2009, p. 65). Meanwhile, subprime loans grew 330% from under $180 billion U.S. dollars produced in 2001 to about $600 billion during 2006 and again in 2007

(Felsenheimer & Gisdakis, 2008, p. 118). The quality of subprime loans was lower in 2007 than it had been in 2001 (Rossi, 2010), based on consumer debt levels and loans with fully documented income. During this period consumer debt levels rose to 42% (in 2007) from 40% (in 2001) of monthly debt payments compared to income (Immergluck, 2009, pp. 86, 130). Concurrently, loans with income from employment and investments fully documented fell to 50% (in 2007) of new loans from 72% (in 2001), and homeowners had less equity despite the increasing house values (Immergluck, 2009, pp. 86, 130; Rossi, 2010). These and various borrower quality attributes were combined in individual loans that layered risk upon risk (Rossi, 2010).

As trigger events neared, interest rates were raised by the FOMC beginning in 2004 over concerns with an inflationary economic growth rate (Felsenheimer & Gisdakis, 2008, p. 36; Schinasi, 2003). First-time and existing homeowners responded by changing to adjustable rate mortgages (ARMs) that had a lower starting interest rate than fixed rate mortgages (FRMs; Woods, 2009, p. 21), but that were subject to large increases based upon the Prime Rate and/or included balloon payments (and sometimes the homeowner was unaware of this fact). During 2007 alone, there were $500 billion U.S. dollars of ARM loans outstanding set to adjust into higher interest rates to the borrowers (Phillips, 2008, p. 11). Although the risk was up, the cost of money remained cheap for borrowers (De Grauwe, Lannoo, & Mayer, 2008). Ongoing asset securitization reinforced cheap money because the most favorable Standard and Poor's bond rating of AAA covered 80% of the subprime loan amounts (De Grauwe et al., 2008; Immergluck, 2009, p. 39).

The trend of cheap, risky money conjoined with a slowing economy where homeowners financially had less ability and less motivation to make monthly mortgage payments (Rossi, 2010).

A mortgage banking company, New Century Mortgage (NCM), might have been the weakest point in this weakened financial system (Rossi, 2010), and its failure in 2007 was a trigger of the GFC (Felsenheimer & Gisdakis, 2008, p. 26; Marks, 2009). Delinquency in monthly mortgage payments rose to such a level that not enough cash was leaving NCM securitizations to fund its ongoing operations, resulting in bond rating downgrades to subprime securities market-wide (Felsenheimer & Gisdakis, 2008, pp. 47, 197, 199; Immergluck, 2009, p. 128). As NCM was failing with expected credit losses on subprime mortgages, there was widespread concern that accounting rules on fair value would be required to be immediately recognized (Barua & Gujarathi, 2009; Felsenheimer & Gisdakis, 2008, p. 121; Wallace, 2009). The contagion spread quickly from mortgage banking companies into those banks involved in subprime mortgage such that a chain of bank failures ended only with U.S. government rescue (Eichengreen et al., 2009; Felsenheimer & Gisdakis, 2008, pp. 124-125). Lending standards quickly tightened after the GFC onset, but not enough to prevent the failure and nationalization of the GSEs or the failure of most mortgage companies (Cassell & Hoffman, 2009; Felsenheimer & Gisdakis, 2008, pp. 39, 49, 131; Marks, 2009).

The culmination of long- and short-term trends was that total U.S. household debt had grown to equal the U.S. GDP and no longer could be adequately serviced by borrowers (Phillips, 2008, p. 43). Housing values fell steadily during the GFC, entwining the negative trends in the financial system and the real economy (Felsenheimer & Gisdakis, 2008, p. 22; Rossi, 2010). By February 2009, the median U.S. house value stood at $175,000 compared to the May 2006 peak of $225,000 (Ferguson, 2008, p. 263; Hull, 2008). The bubble pattern of the 1990s technology-driven stock market repeated itself with remarkable similarity in the bursting housing bubble of 2008 (Fleckenstein & Sheehan, 2008, p. 12; Guttmann, 2009; Phillips, 2008, p. 188; Rossi, 2010).

Capital Movement: Stability, Mobility, and Arbitrage

Capital movement was described in the research literature in terms of its stability (Barth et al., 2008; Schinasi, 2003), mobility (Reinhart & Rogoff, 2008a), and arbitrage (De Grauwe, 2008a; Frachot, 2010; Lumpkin, 2010; Rossi, 2010). Stability, mobility, and arbitrage were related constructs that at times overlapped when used to describe capital movement in a multifaceted, interconnected financial system (Bair, 2008; Billio et al., 2010; Wagner, 2010). Together, these constructs formed a structure to demonstrate how capital moved in a way that was related to the crisis in the U.S. financial system. Because one phenomenon like the GFC cannot be explained with another phenomenon like capital movement, these constructs are linked to actions in financial institutions and synthesized in this literature review.

Capital *stability* means that capital favors inertia and then moves in accordance to the policymaking of the central banker or from regulatory changes (Geyfman & Yeager, 2009). Stability is the preferred state of the financial system when in balance, like when supply equals demand (Skidelsky, 2009). The movement of capital represents instability, which worsens qualitatively by the redeployment of capital into a higher-risk use. Instability emerges either from a poor macroeconomic environment or from the deterioration of a component of the financial system (Barth et al., 2008; Fetisov, 2009). The practical problem is the central bankers managing macroeconomic policy are simultaneously managing stability (Geyfman & Yeager, 2009). When instability emerges in the midst of robust economic performance as in 2007, these policies were especially difficult to manage because instability cannot be readily fixed by loosening monetary policy (Booth, 2008; Kindleberger & Aliber, 2005, p. 239).

Capital *mobility* means the ease of movement across the boundaries of national borders and regulatory structures, which could destabilize the financial system (Bordo & Helbling, 2010; Reinhart & Rogoff, 2008a). The global nature of the GFC is consistent with the presence of capital mobility, and research had shown the multinational aspect of such crises to be a normative feature (Kindleberger & Aliber, 2005, p. 106). Although capital mobility is associated with instability in a mutually reinforcing way, its *negative* implications are less apparent in the short-term than the long-term. Clear evidence of the ongoing global economic cycles and financial crises related to capital mobility is derived from analysis of an 800-year time horizon (Reinhart & Rogoff, 2008a).

Capital *arbitrage* means that capital moved from one regulatory structure to another more favorable for profits while holding the amount of capital constant and assuming the cost of the transfer was outweighed by the gain in profits (De Grauwe, 2008a; Frachot, 2010; Khademian, 2009). Yet, the time frame for arbitrage is problematic when the setting changes from economics to public policy. Arbitrage implies a simultaneous transaction of buying and selling to profit from inefficient market structures while it might take years for capital to move in response to regulatory structures (Frachot, 2010). In economics, harm from capital arbitrage is the public's exposure to irrationality during the period for the market to self-correct (Ambachtsheer, 2008). From a public policy perspective, temporarily irrational markets created consequences that the government and its citizens might have been unwilling to endure (Fox, 2009).

The conceptual synthesis is of capital moving quickly and easily around the global financial system while leaving a mark on the real economy. The inertia related to financial system stability could be disrupted by regulatory and monetary policy changes, with instability as a byproduct (He, 2010). The alignment of forces like capital mobility, regulatory arbitrage, and systemic instability favored the conditions associated with the onset of the financial crisis in the United States that led to the GFC.

Banking Regulatory Framework and Financial Stability

A change of banking regulatory frameworks was rare in U.S. history and profoundly impacted the financial system and the real economy when it was changed (Peretz & Schroedel, 2009). In the 1990s, legislation changed this framework while concurrently changing commercial bank capital rules by adopting the global capital standards in the Basel Accords (Berger, DeYoung, Flannery, Lee, & Öztekin, 2008; Kose et al., 2009). Dismantling the barriers from the Great Depression, the United States shifted its financial strategy and deregulated its financial markets with the GLBA of 1999 (Cornford, 2009). This regulatory framework exchange was inherently destabilizing to the United States financial system (Wagner, 2010).

Regulatory framework. Banking serves a vital role in capitalism both as a component of the economy and as a provider of business investment (De Grauwe, 2008a). The basic activity of commercial banking is to make loans to individuals and businesses in order to earn a profit from interest on loan balances (Benmelech & Moskowitz, 2010). The money that a bank lends comes from the investment of capital into the bank and from customers' cash deposited into the bank. This relationship is termed leverage because a single dollar of capital can be leveraged by using the bank's liabilities in the form of customer deposits (Jordà et al., 2012). In a basic example, for one dollar of bank capital there are nine dollars of cash deposits coupled with the capital in order to support 10 dollars of bank assets like mortgage loans. In a good economy, bank capital should grow from its earnings, but during a bad economy there must be enough bank capital to cover its loan losses (Geyfman & Yeager, 2009).

The control of bank capital is the main purpose of the banking regulatory framework and its associated rules and structures (Ellul & Yerramilli, 2010; Kilian & Manganelli, 2008). Frameworks are determined through the political process, making political philosophy and economic theory as influential to the structure as the practical operating requirements (Brady, 2008). Regulations were incorporated continually into the framework to address market developments and were determined by the balancing of the use of capital to risk. Regulation became an important tool of democratic accountability as a proxy for the trust that was previously formed based upon personal knowledge of the individual and institutional reputation of the bank (Statman, 2009). Banks required ongoing supervision to assure that the financial system remained liquid and financial institutions remained solvent (Fujiwara et al., 2011). Control of bank capital had to be accomplished in an efficacious way yet consistent with democratic governance so that nonelected officials lacked excessive authority that could potentially stifle the free markets (Barth et al., 2008; Hafeez, 2003; Statman, 2009).

The governance of bank capital is the responsibility of the FRS the U.S. central bank. The FRS operates quasi-independently in the regulatory framework that was legislated by Congress with the concurrence of the President of the United States (Peretz & Schroedel, 2009). Central bank duties and responsibilities were established about 400 years ago in England, providing tradition and precedence in the creation of the U.S. FRS during the early twentieth century (Aspachs et al., 2007; Geyfman & Yeager, 2009). The functioning of the U.S. financial markets, including the commercial banking system, became the responsibility of the central bank (Arner, 2007, p. 136; Board of Governors, 2005). When a crisis emerged the U.S. central bankers, led by the chairperson of the FRS board of governors, were expected to restore financial stability and minimize spillover damage to the real economy (Geyfman & Yeager, 2009; Tambovtsev, 2009).

Financial stability and macroeconomic performance are the dual policymaking objectives of the FRS (Schinasi, 2003) and together termed macroprudential responsibilities because these required prudent control of large-scale economic relationships (Aizenman, 2009; Negrilă, 2009). The problem was that financial stability was often treated as a byproduct of monetary policy, rather than as a separate process of regulation and supervision (Arner, 2007, p. 34; Aspachs et al., 2007). The consistent result was that financial stability did not directly follow from effective management of the economy through the FRS (Aspachs et al., 2007; Geyfman & Yeager, 2009).

The 1999 GLBA regulatory framework was designed to allow for discretion in the treatment of specific issues that could arise over time (Cornford, 2009), yet with problem solving and policymaking within the legal confines of the framework (Anderson, 2006, pp. 122-136). Decisions made within the regulatory framework were subjected to ongoing political processes and influences, bringing in factors other than rationality (Kingdon, 2003, pp. 77-82). The point is that the financial system, at the GFC onset, was not the predetermined result of the GLBA. Rather, alternatives forgone and policy options subsequently selected had produced the end state of the financial system that had the potential for crisis.

Although the GLBA could be described as the national regulatory framework, Basel was the global regulatory architecture (Elson, 2010; Peretz & Schroedel, 2009; Wagner, 2010). The framework had to function within the architecture yet was not determined by it. Completion of the financial system details within the framework also satisfied the architectural requirements. The Basel Accords addressed banking capital yet did not require specific financial frameworks, like the U.S. framework move to the

GLBA from the 1933 GSA, which preceded Basel (Mussa, 2009; Wagner, 2009). The accords allowed for financial supervision through either unified or multiple national regulators (Mussa, 2009; Wagner, 2010).

Basel and the GLBA were never formally linked, but the development of the GLBA in the 1990s took place within the context of rapid financial globalization that was perceived by some to be a rational U.S. response that was consistent with the Basel architecture (Barth et al., 2008; Geyfman & Yeager, 2009; Grant, 2010). Competitive pressure mounted from European banks already operating in the United States as universal banks (De Grauwe, 2008b; Garcia, 2009; Rajan, 2003, p. 247). Even as the U.S. commercial banks under the GLBA developed into the universal banks already used in Europe, the European authorities were allowing bank mergers across national borders that accelerated the market consolidation of banks (Garcia, 2009). Thus, banking development associated with the Basel architecture was dynamic during the period that the U.S. financial framework was shifting from the GSA to the GLBA (Barth et al., 2008).

Financial stability and risk mitigation strategy. The purpose of the GLBA, or the Financial Services Modernization Act of 1999, was deregulation of the financial system, including commercial and investment banks (Statman, 2009). It was a bipartisan political effort between the Democratic administration of President Clinton and the Republican-led Congress (Grumet, 2008). The GLBA authorized mergers between banks and insurance companies, and the expansion of commercial banks into riskier activities that had previously been restricted to investment banks (Billio et al., 2010; Papaioannou, 2009). In so doing, Congress removed barriers that had been established by the GSA (Papaioannou, 2009).

The GLBA and the GSA represented different risk mitigation strategies to achieve stability, safety, and soundness in the financial system (Statman, 2009). Risk mitigated through the monoline regulatory principle was accomplished by isolating and containing a type of risk within a single business line (Jaffee, 2009). The GSA exhibited traits of the monoline principle by isolating revenues from commercial banking and insurance from the more risky investment banking. When isolated, investment banks were shown empirically to be the riskier component of universal banking, consistent with the experience of their failure during the GFC (Bordo, 2008). Alternatively, risk was mitigated in the financial system through the diversification of mixing revenues, which was the approach in the GLBA (Jaffee, 2009; Neale, Clark, & Drake, 2010).

The risk mitigation conflict between monoline businesses and diversification strategies reflected underlying political philosophy and economic theory about markets in industrialized nations (Boyd & De Nicoló, 2005; Brück, 2009; Jaffee, 2009). Diversification strategy was consistent with the free-market orientation in which personal choices, made freely, moved markets rationally and regulated markets naturally (Neale et al., 2010; Statman, 2009). The monoline strategy was consistent with the regulated-market orientation in which the government took responsibility for decisions that directed markets, consistent with the interventionist approach (Statman, 2009). Regulators generally aligned with intervention because many of them shared an understanding of the financial crisis as endogenous to financial markets (Sinclair, 2009). That is, crisis came from within financial markets and thereby justified the inclination for supervisory processes that prevent risks. For those with an exogenous understanding, the financial markets cannot be wrong (like with housing values), and so crisis must come from external causes (Sinclair, 2009). The policy conflict concerned government action. If viewed as endogenous, government actions fixed flaws in the financial markets; if viewed as exogenous, government actions caused flaws (Sinclair, 2009). This fundamental difference, explained by one's orientation, hardened into a dividing line such that regulatory sensibilities paralleled beliefs in economics and politics (Gregg, 2010).

Amid the irreconcilable differences between free-market and regulated-market orientations, operating risks remained and so ongoing rules and regulations were still needed to address unexpected events (Tambovtsev, 2009). When losses occurred in the financial system, the public debt guarantee and the spontaneous actions by the government determined whether a loss was contained, shared, or socialized (including through debt forgiveness; Khademian, 2009; Walter, 2009). Losses contained to a firm that caused it might result in that firm's failure (Eichengreen et al., 2009; Stulz, 2010). Losses incurred through systemically acceptable risk was partially shared by systemically important firms that created the burden, which was done indirectly through regulatory mechanisms like the FDIC assessing fees on depository institutions (Walter, 2009).

Systemically acceptable risk shared by society originated with government debt guarantees like the one for Fannie Mae, a Great Depression-era housing program begun in 1938 (Federal Housing Finance Agency, Office of Inspector General, 2013; Shlaes, 2008).

The trade-off, in theory, was the firm's acceptance of regulation in exchange for protection in the event of the financial system's instability. Beyond a trade-off was the concept that an industry created a demand for regulation for its own benefit, which was then provided by government (Kingdon, 2003). Rather than being viewed as a burden, regulation in this concept became desirable because of the failure of contract disputes to be settled fairly, impartially, and in a timely manner by the courts (Shleifer, 2010). An example of the practical desire for regulation was the benefits for firms covered by the too big to fail doctrine that gave these firms preferential treatment during the response to the GFC (SCB, 2011; Walter, 2009).

The GLBA and financial stability. There was a consensus in the aftermath of the GFC that an important factor in the crisis was the repeal of the GSA and the passage of the GLBA and associated deregulation (Ferguson & Johnson, 2009; Grant, 2010; Grumet, 2008; Peretz & Schroedel, 2009; Raines et al., 2009; Statman, 2009). Opinions diverged on whether or not the GSA should have been reinstated, and some actively advocated the investment banking restrictions found in the GSA (De Grauwe, 2008b; Kranacher, 2009). Some WB economists counterclaimed that restricting bank activities made banks weaker and more prone to crisis (Barth et al., 2008), supporting the appropriateness of the GLBA.

The prevailing argument for the GLBA risk mitigation model was that universal banking was simply a return to the banking system used in the United States before economic interventionists like President Franklin Roosevelt (Bordo, 2008). The GLBA was consistent with the economic ideas of the 1980s that favored lessened regulation, lower taxes, and freer trade (Duina & Buxbaum, 2008). This GLBA regulatory framework was similar to that of some European countries, whose banks were considered to have had a regulatory advantage by competing as universal banks against the U.S. financial institutions (Avgouleas, 2009; Garcia, 2009). The evidence in support of the universal bank was the extensive history in Europe of this regulatory structure producing stability and efficiency in banking (Grant, 2010). The contrary argument was that the GLBA "deregulatory process has sown seeds of instability into the banking system" (De Grauwe, 2008a, para. 5), that was manifested in the GFC.

The GLBA might have been theoretically flawed (De Grauwe, 2008a), or it might have had merely practical flaws conjoined with bad timing (Statman, 2009) and a lack of efficacious supervision (Bergsten, 2009). Not all claims made in the published debate were supported by evidence, particularly while the crisis was still emerging. The conclusion that the financial system was destroyed in 1999 by the repeal of the GSA was unsupported by evidence (Weissman & Donohue, 2009). Additionally, some expert insights into the complexities of financial situations had logical assertions but lacked an objective method to assess the claims (Bergsten, 2009). Empirical evidence showed that 8 years after the passage of the GLBA the economy produced the sole U.S. business cycle since the Great Depression to include a real estate bust along with a credit crunch (Bordo & Haubrich, 2009).

The change of the regulatory framework to the GLBA was inherently destabilizing to the financial system as banking capital moved in its entirety from one regulatory framework to another (Wagner, 2010). Empirical evidence from non-U.S. national banking systems demonstrated that deregulation like the GLBA increased the probability of banking crises when combined with weak regulatory supervision (Angkinand, Sawangngoenyuang, & Wihlborg, 2010). The adverse effects of these non-U.S. banking crises reversed as supervision became stronger, demonstrating the limitations of the regulatory framework as a *destabilizing* factor and the importance of subsequent regulatory actions (Angkinand et al., 2010). Consistent with non-U.S. experience, the mere presence of instability from the GLBA was not claimed to be the mechanism of the GFC rather it was this instability in combination with other conditions and factors (De Grauwe, 2008a). The condition of high capital mobility was associated with the condition of instability in a mutually reinforcing relationship (Reinhart & Rogoff, 2008a) such that greater capital mobility brought instability, and greater instability brought capital mobility.

Innovation in Financial Institutions and Capital Mobility

Innovations that linked the real economy and the financial system were also related to increases in capital mobility (Bordo, 2008; Peretz & Schroedel, 2009). During the 1980s, innovation in the real economy accelerated so quickly that core business earnings were equaled by earnings from new business activities for many successful companies within a 7-year cycle (Senge, 1990). Coupled with this innovation in the real economy were regulatory changes to the financial system in the 1990s and its attendant financial instrument innovation (Bordo, 2008). By the 2000s, the economy was robust yet with credit risk increasing in the U.S. financial system (Bordo, 2008) and being shared globally during a period of high capital mobility (Beck, Demirgüç-Kunt, & Levine, 2009; Reinhart & Rogoff, 2008a). The three long-term cycles of riskier commercial bank lending, high capital mobility, and U.S. economic growth all ceased abruptly in 2007 (Bordo & Haubrich, 2009).

Risks in financial instrument innovation. Long-term trends and risks that attended innovation coalesced into financial system instability. The nexus of financial innovation during the period between the 1980s and the GFC was the U.S. housing market and its related financial instruments (Bordo, 2008; De Grauwe, 2008a, 2008b; De Grauwe et al., 2008). U.S. housing provided favorable market conditions for innovation because of its established performance of low risk without asset price bubbles (Favilukis, Kohn, Ludvigson, & Van Nieuwerburgh, 2012; Ferguson, 2008, pp. 261-269). Although innovations associated with specific financial instruments were linked to increases in lending risk and capital mobility (Bordo & Haubrich, 2009; Statman, 2009), these effects were indirect because the use of such instruments in the marketplace was discretionary and random (Sánchez, 2010).

In contrast to uncertainties that are incalculable, risk is the variation in loss that can be defined and measured (Adler, Mansilla, & Wezel, 2009; Bordo & Haubrich, 2009; Ojo, 2010). Loss is the difference between the loan balance and the recovery of the nonperforming loan balance through the repossession and sale of the underlying loan collateral like a house (Adler et al., 2009). The magnitude, or extent, of loss differs from its amplitude, or the range of movement from an equilibrium performance point (Bordo & Haubrich, 2009). Loss contains these elements and their interactions that must be associated with practices and events in order to ascertain risk (Adler et al., 2009). Furthermore, bank assets like loans require capital sufficient for this risk. Yet there remains a serious flaw. If risk is defined by loss, then the required capital is ultimately determined by the past performance of the assets. Financial institutions are exposed to the gap that is created when asset performance deteriorates beyond historical precedence, and its supporting capital is found to be inadequate for the losses (Kindleberger & Aliber, 2005). Consequently, this risk gap is widened by innovation.

The risks associated with GFC-related innovation revolved around homeowners' credit risk (Diamond & Rajan, 2009). These risks included the level of credit risk in the financial system, changes to the patterns of credit loss, and capital mobility (Diamond & Rajan, 2009). Capital mobility was a risk because financial instruments attracted capital and could cause asset price bubbles (Diamond & Rajan, 2009; Reinhart & Rogoff, 2008a). Regular cycles of the level of credit risk in the commercial banking system that had been long-established under GSA were disrupted by the GLBA and then sustained by lending and innovative financial instruments (Diamond & Rajan, 2009; Geyfman & Yeager, 2009). Universal banks created in the GLBA changed the pattern of credit losses by combining investment banking risks with commercial banking risks (De Grauwe, 2008a, 2008b). Financial instrument innovations involving securitization (such as CDOs, CMOs, and CDSs) theoretically improved risk management by spreading risk among more financial institutions and investors (Bordo, 2008; Geyfman & Yeager, 2009) but also exposing more institutions and investors to higher risk. Yet this innovation masked negative trends in the risk of the underlying assets and placed more institutions and investors at risk of loss (Dungan, 2008; Felsenheimer & Gisdakis, 2008, p. 254; Kramer, 2008; Yezer, 2010).

Bank risk cycle. The long-dormant commercial bank lending cycle emerged from dormancy during the GFC. Empirical evidence of overall riskier commercial bank credit was identified in the aftermath of the GFC, rather than by the practice of regularly tracking key risk indicators that have acceptable tolerances (Bordo, 2008). This measurement of credit risk used interest rates for the pricing of corporate loans to represent the *market interest rate* by using the corporate bond rating of Baa as a benchmark (Jarrow, 2011). With this measurement, risk was quantified to be the difference between the market interest rate and the *risk-free interest rate* by using the

DOT 10-year Constant Maturity Treasury (CMT) bond rate (Bordo, 2008). This credit risk indicator was at equilibrium when the interest rate difference between the market and risk-free rates was at 2% and indicated an impending financial crisis at 3%. By 2008, the difference that had been widening for years was over 3%, and the GFC was already underway (Bordo, 2008).

Capital mobility cycle. Risk within the financial system grew at the same time that capital moved largely without regulatory restriction and across global markets (Arner, 2007, pp. 64-65; Bordo & Helbling, 2010; Reinhart & Rogoff, 2008a). The capital mobility cycle described a global phenomenon (Reinhart & Rogoff, 2008a) that was part of the cycles of global history and human development (Fischer, 1996; Friedman, 2006). Identifying this phenomenon was a significant contribution from contemporaneous research about the 2008 U.S. financial crisis because it included an analytical framework explaining the historical relationship between the global capital movement and economic crises (Reinhart & Rogoff, 2008a, 2008b). With data that extended 800 years deep into recorded history, it was demonstrated that periods of high international capital mobility preceded international banking crises (Beck et al., 2009; Reinhart & Rogoff, 2008a). The period from1980 to 2007 was categorized as high capital mobility (Reinhart & Rogoff, 2008a), and its endpoint was the GFC (Bordo, 2008).

The analytical framework of historical capital cycles was capital mobility according to the period categories of low, low-to-moderate, moderate, and high capital mobility to explain financial crises (Reinhart & Rogoff, 2008a). The data set included economic results that dated to the fourteenth century and that spanned 66 countries across all the inhabited continents. Seven distinct capital mobility periods were identified during the period 1800 to 2007, which were classified according to the four capital mobility categories. The two periods of low capital mobility (1915 - 1919; 1930 - 1969) coincided historically with World War I combat in Europe (1915 - 1919) and with post-World War II financial stability (1930 - 1969). Between periods of high capital mobility and low capital mobility were the moderate and low-to-moderate periods. The decade of the 1920s was a period of moderate capital mobility (1920 - 1929), although it ended with a stock market crash and the onset of the Great Depression. The two periods of the low-to-moderate capital mobility (1800 - 1879; 1970 - 1979) ended with the onset of high capital mobility. In addition to the business cycle that ended in 2007, one other period of high capital mobility had ended in 1914, marking the endpoint of U.S. industrialization (Reinhart & Rogoff, 2008a).

Evidence of risk associated with high capital mobility was found in the global flows of capital that existed before the GFC (Kirabaeva & Razin, 2009). A significant capital imbalance was created by inflows of non-U.S. capital into the U.S. financial system from Europe, Asia, and South America (Bergsten, 2009). This capital influx caused excessive liquidity in the U.S. financial system, which had the effect of encouraging financial institutions to deploy capital into incrementally riskier assets such as subprime mortgages (Bordo, 2008; Diamond & Rajan, 2009; Guttmann, 2009). Paralleling the U.S. capital influx, the FRS's monetary policies of low interest rates and high money supplies had the effect of encouraging borrowing (Bordo, 2008; Diamond & Rajan, 2009; Guttmann, 2009).

Business cycle. The onset of the economic recession in December 2007 was the end point of the U.S. business cycle that began in 2001, and it was the fifth economic contraction since 1980 (Bordo & Haubrich, 2009; Peretz & Schroedel, 2009). Growth and contraction is such a regular feature of the economy that each U.S. business cycle is delineated and officially declared by NBER (2010). Despite advances in understanding U.S. business cycles, there was no successful method for predicting future business cycles (Friedman, 1986; Gregg, 2010). Furthermore, because these official cycles were confined to the U.S. economy there lacked explanatory power for economic movement on the global scale (Bordo, 2008; NBER, 2010). U.S. business cycles were identified by the various factors of banking crises, real estate busts, stock market crashes, tight monetary policy, and credit crunches (Bordo & Haubrich, 2009). Irregular events from within the financial system also combined to worsen the severity of economic downturns, which occurred during the GFC (Bordo & Haubrich, 2009).

The commercial bank credit risk cycle, the U.S. business cycle, and the international capital mobility cycle were positively related to one another in cycles that ended in 2007. These relationships are important because of their confluence, despite the lack of established causation among the three cycles. That is, in the mid-1990s, innovative financial instruments used for real estate lending were introduced into an instable financial system and conjoined with increasing credit risk and readily available capital supplied from throughout the world, which also reinforced U.S. economic growth. The lynchpin of these relationships was innovative financial instruments using global capital for real estate lending by U.S. financial institutions, and its removal triggered the GFC.

Mortgage Securitization Derivatives and Regulatory Arbitrage

The key financial innovation of the GLBA era was mortgage securitization and its associated derivative transactions (Bordo, 2008; Eichengreen et al., 2009) that eventually threatened the stability of the financial system (Cherny & Craig, 2009) and was prominent in events of the GFC (Acharya, Philippon, et al., 2009; Booth, 2008; Felsenheimer & Gisdakis, 2008, pp. 32, 175, 200). Although innovation presented systemic risk (Hellwig, 2009), there was little attention to this risk as public policy matters (Haubrich & Lucas, 2007; Hlinka, 2008). Perhaps this inattention was due to the political values of deregulation under the GLBA (Weissman & Donohue, 2009), or due to the lack of transparency within the banking system that impaired supervision (Bordo, Redish, & Rockoff, 2012; Dincer & Eichengreen, 2009). With little public policy attention or restraining regulation, competition under the GLBA reinforced innovation as firms sought to maintain parity with the financial performance of their peers (Boyd & Nicoló, 2005; Langenohl, 2008). The significance of securitization in the market was probably not exaggerated that each securitization created a void to be filled by new lending, creating credit inflation and becoming a credit multiplier (De Grauwe, 2008a).

The foundation of mortgage securitization practices was the issuance of ABSs composed of subprime mortgage loans and other mortgage loans that did not conform to the lending rules of the GSEs (Ashcraft & Schuermann, 2008; Ding, Li, Quercia, & Ratcliffe, 2010; Jarrow, 2011). In the ABS practice, the bank sold their loans as a single pool into the ABS, with each ABS being a unique security that issued bonds (Hu, 2001). The bank recognized income from the sale of the mortgage loans, which was based upon the estimated future cash flows from the loans in the security. In return for the mortgages, the bank got back through the proceeds of the bonds the capital originally lent and then used this capital to repeat the process the following quarter (Hu, 2001). Other asset classes such as car loans, student loans, leases, credit cards, and other instruments with an underlying cash flow came to be securitized using the ABS structure (Jarrow, 2011). The ABS instrument was modeled after the MBSs that were composed of mortgage loans conforming to the lending rules of the GSEs (Rossi, 2010).

The rising borrower risk and housing values that were evident after 1980 became encased in mortgage securitization practices and culminated in an asset valuation bubble of inflated housing prices between 2002 and 2007 (Felsenheimer & Gisdakis, 2008, p. 22; Mian et al., 2011; Phillips, 2008, pp. 86, 114; Rossi, 2010; Shiller, 2012). In 1980, there was an annual foreclosure rate of 0.5% associated with a housing market index (HMI) value of 43.63 (Hlinka, 2008; Shiller, 2012). The HMI measured U.S. residential real estate prices and had a value after World War II of 7.50, compared to the 1890 index base value of 3.66 (Hlinka, 2008; Shiller, 2012). By 1980, steady inflation of the U.S. housing stock had been evident for nearly a century (Shiller, 2012). After having only doubled in the 50 years before World War II, values then more than quintupled in the 35 years following World War II (Shiller, 2012). At the point of the GLBA deregulation in 1999, there was evidence of rising borrower risk along with rising house values. Both of these measurements had doubled during the 19 years between 1980 and 1999, such that the annual foreclosure rate of 1.1% was associated with the housing market index value of 92.08 (Shiller, 2012). Just before the GFC, there was another doubling in the U.S. housing market index value to its peak of 189.93 that took place in the mere 7 years between 1999 and 2006 (Shiller, 2012), at which point the annual foreclosure rate had been stabilized around 1%.

ABS and subprime mortgage securitization. Subprime mortgage securitization began mechanically with the sale of mortgage loans by a financial institution to an ABS (Barnett-Hart, 2009; Hu, 2011). The collateral used to secure the bonds were peoples' homes, which were the houses that backed the separate mortgage loans in the aggregated pool of loans (Ashcraft & Schuermann, 2008). Bonds issued through this securitization process paid higher interest rates than U.S. government treasury bonds but were exposed to risk associated with shifting values in the housing market (Bordo, 2008; Felsenheimer & Gisdakis, 2008, pp. 22, 36, 213; Phillips, 2008, pp. 86, 114). U.S. government and ABS bonds were investment grade and carried the highest rating of AAA issued independently by the credit rating agencies (Jarrow, 2011). In order to account for the difference in risk compared to U.S. government bonds, just 80% of an ABS security was sold to investors as AAA bonds (De Grauwe et al., 2008). This 80% of the ABS was insured by an independent bond guarantor, while the remainder was uninsured (De Grauwe et al., 2008).

Every ABS bondholder had an ownership interest in every mortgage loan because securitization bonds were sold based upon the aggregated cash flows from the underlying loans, with classes of bonds in the ABS termed *tranches* associated with specified cash flows (Geyfman & Yeager, 2009; Hellwig, 2009; Rossi, 2010; SIFMA, 2010). As a consequence, a single securitized mortgage loan was owned by the specific security in which it was put, creating contractual requirements and ownership interests that were unique to each security (Ashcraft & Schuermann, 2008). The ownership structure for a loan was further complicated by subsequent transactions involving the security. Contracts derived from the security were created to share both the interest rate risk and the credit default risk among counterparties (Mousavi & Shefrin, 2010). Contracts involving shared risks could then be privately traded within the GLBA-defined financial system or outside of it (Haubrich & Lucas, 2007).

Mortgage financing practices that developed under securitization separated the lender from the borrower in convoluted relationships involving intermediaries and various financial market participants (Pearson & Pearson, 2007; Sinclair, 2009). Financial institutions that regularly participated in the mortgage process were specialized and represented a variety of the legal structures that existed under GLBA. Investment bankers arranged mortgage securities using loans originated from mortgage banking companies, commercial banks, investment banks, universal banks, and insurance companies (Geyfman & Yeager, 2009). In the 90 days before a quarterly securitization issuance, a single mortgage loan could pass through multiple legal structures, each with different regulations and supervision (Friedland, 2009; Hellwig, 2009; Jarrow, 2011). At origination, a loan could be arranged by a third party mortgage broker for funding through a mortgage bank. In the secondary market phase, a correspondent mortgage bank could have bought the loan and sold it at a profit to a commercial bank. To prepare for securitization, commercial banks sometimes used a Special Purpose Vehicle (SPV) to pool (or, *warehouse*) the loan temporarily (Jarrow, 2011). Additionally, another SPV could be used to fund a new securitization with the loan in it, which was then finally sold to the ABS (Friedland, 2009; Hellwig, 2009; Jarrow, 2011). Yet, mortgage financing was made complicated not just because of securitization rather from the subsequent CDSs and CMOs derivative transactions.

Mortgage securitization derivative transactions. The development of derivative transactions conjoined with the innovation in mortgage financing (Eichengreen et al., 2009; Rossi, 2010) and represented a new intellectual hazard to the financial system (Miller & Rosenfeld, 2010). The ABS security type was divided into specific types of cash flows by having senior, mezzanine, and junior tranches (Jarrow, 2011). The 80% senior tranche was AAA-rated and the other tranches were a mix of investment grade and speculative grade (or junk; Jarrow, 2011). Additionally, these securities required payments for the loans to be serviced by a mortgage loan servicer (Vickery & Wright, 2010), which was another cash flow associated with the security that could be sold by its owner. Cash flowed into tranches for payments to bondholders according to the *cash waterfall*, which defined the cash prioritization (Jarrow, 2011). Once the ABS bonds were sold to investors worldwide, investors were able to resell the bonds based upon valuations of their worth. CMO derivative securities were ownership vehicles to buy and resell ABS bonds, and were based upon the ABS tranche model. To offset the risk of credit loss associated with the ABS cash flows, CDS contracts were used to cap the potential losses through an agreement with a counterparty willing to give this insurance (Cherny & Craig, 2009; Eichengreen et al., 2009).

CMO derivative transactions. CMOs were investment instruments used to own certain cash flows from the tranches of other mortgage securities, which made these derivative transactions in that their value derived from a separate investment instrument's value (Bond Market Association [BMA], 2003; Estrella & Silver, 1984; Haubrich & Lucas, 2007; SIFMA, 2010). CMOs could own any combination of original bonds issued from ABSs and MBSs, derivative bonds from other CMOs, or CDSs (Haubrich & Lucas, 2007; Jarrow, 2011). Although some banks retained portions of the mortgage securities they issued, these too were assets that could be sold, securitized in a new CMO, or merged into other banks (Rossi, 2010; SIFMA, 2010).

CMOs were first issued in June 1983 during a period of high inflation and high interest rates that made it difficult for financial institutions to predict principal repayments associated with MBSs (Estrella & Silver, 1984). One way for a bondholder to mitigate this risk and make the return of principal more predictable was to own a wider range of maturity dates, which was made possible through the CMO structure (Estrella & Silver, 1984). Instead of owning a single tranche with similar loan characteristics, the investor could diversify with a CMO purchase and own a smaller portion of multiple tranches (BMA, 2003; Estrella & Silver, 1984; Haubrich & Lucas, 2007; SIFMA, 2010).

CMOs made financial planning more effective for financial institutions (Nicolò & Pelizzon, 2006). Institutions could buy a CMO bond with the expected return of the principal over 18 months, for example, rather than directly buying two MBSs with expected returns of principal over just 6 and 24 months. The CMO structure became a risk mitigation tool for any type of loan characteristic that an investor wanted to diversify (Nicolò & Pelizzon, 2006; SIFMA, 2010). Institutions that had mortgage portfolios with geographic concentration could protect against regional variation in loan performance (Nicolò & Pelizzon, 2006; SIFMA, 2010). A CMO could be used in selling the portfolio in order to buy a CMO bond that comprised loans originated nationally. Furthermore, commercial banks still had access to borrow funds from the Federal Reserve Bank discount window, whether pledging assets that were mortgage portfolios or market-purchased CMOs (Federal Reserve Bank of New York, 2013a).

CDS derivative transactions. The purpose of CDSs for financial institutions was to reduce bank risk from the unpredictability of credit loss (Cherny & Craig, 2009; Jarrow, 2011). Credit loss was determined by the incidents of borrower default together with the market value of the houses securing mortgage loans (Cherny & Craig, 2009).

The spirit of deregulation found in GLBA during 1999 was reflected in the nonregulation of CDSs and other financial derivatives like interest rate swaps during 2000 in the aftermath of the GLBA (Kalinowski, 2011; Sánchez, 2010). These emergent financial risks were explicitly rejected as a topic of regulation in the CFMA of 2000, which was consistent with the trend of economic deregulation (Kalinowski, 2011; Kingdon, 2003).

The CFMA proclamations were reaffirmed in the 2005 renewal of the Commodity Futures Trading Commission (CFTC), which was required every 5 years, before having restrictions introduced as part of the Dodd-Frank financial regulation in 2010 (Jickling, 2005; Klieber, 2012; SCB, 2005). There was no requirement in CDS transactions to hold capital in reserve in order to protect against the potential impact in the event of counterparty failure. The lessened perceived risk exposure from using CDSs led some banks to reduce their capital buffer accordingly (Karras, 2009). The self-regulation of derivatives that was affirmed for CDSs kept those transactions private, unrecorded, and outside the control of central clearing exchanges (Acharya, Engle, Figlewski, Lynch, & Subrahmanyam, 2009).

CDSs were first issued in February 1994 in order to share the credit risk associated with a large commercial bank loan (Duhon, 2012; Noeth & Sengupta, 2012). The demand for credit derivatives increased as commercial banks applied this risk mitigation tool to diversify credit risk similar to the practices used for interest rate risk and currency risk (Mengle, 2007). In 1985, about the time CMOs were expanding, over-the-counter markets for derivatives and swaps contracts were formalizing through an independent, global trade association that was formed to make transactions safe and efficient (International Swaps and Derivatives Association [ISDA], 2012a). Along with the growth in size and scope of the derivatives market came increasing standardization in the contracts and sophistication, such as indices of CDS valuations (Born, 2009; ISDA, 2012a, 2012b, 2012c; Noeth & Sengupta, 2012).

CDSs had fundamental differences in comparison to traditional insurance features (Noeth & Sengupta, 2012), which during the GFC were related to the acceleration of default events. CDS contract buyers did not have to own the underlying asset like a CMO or ABS, referred to as the *reference entity* (Mengle, 2007), thereby enabling its use as a speculation tool for housing market values (Jarrow, 2011; Nesvetailova, 2007; Noeth & Sengupta, 2012). The CDS contracts could be made quickly and easily, facilitated by a simple approach to calculating the seller's price and buyer's value (Noeth & Sengupta, 2012). The value of a CDS was equal to the expected loss rate times the face value of the instrument being insured (Noeth & Sengupta, 2012).

Another key CDS feature was that the buyer paid a periodic fee to the counterparty for protection against a specifically defined *credit event* involving the reference entity (Mengle, 2007). Starting in 2007, the accumulated impact from rising loan delinquencies, home foreclosures, and falling housing values led to widespread credit events (Hlinka, 2008; Shiller, 2012) invoking the protection seller's obligation to compensate the buyer (Mengle, 2007). The impact of those credit events to the protection's seller was made worse to the extent the *recovery rate* was overestimated when considering declining borrower credit quality (Bordo, 2008; Immergluck, 2009; Jarrow, 2011; Rossi, 2010) and housing values (Mengle, 2007; Noeth & Sengupta, 2012).

CDS and financial institution liquidity. The daily operating liquidity of the financial system was maintained during the GFC despite a significant threat of illiquidity linking key financial institutions (Diamond & Rajan, 2009; Eichengreen et al., 2009; Milne & Wood, 2009; Scott, 2010). Operating liquidity is a risk to financial institutions because a banking system is illiquid by nature (Akerlof & Shiller, 2009). The fundamental relationship in banking is that savings is short-term in duration and lending is long-term in duration; by design, there simply would not be enough capital liquid to settle the demand for simultaneous withdrawal of savings (Fujiwara et al., 2011). In other words, operating liquidity may be sustained, but systemic liquidity does not exist. CDS derivatives complicated the operating liquidity of financial institutions because these could be ABS or MBS derivatives, or derivatives of CMO derivatives. The shift of derivative structures from being tools of risk mitigation to being tools of market speculation was perfected with the *synthetic CMO,* composed of CDSs (Jarrow, 2011). The synthetic CMO became the structure preferred by high-risk-taking speculators (Jarrow, 2011).

During the financial crisis, CDSs were the mechanism of illiquidity between Lehman Brothers and the American Insurance Group, Inc. (AIG) that accelerated the crisis throughout the financial system (Born, 2009; Fisher, 2008; McDonald & Robinson, 2009; Stulz, 2010). When Lehman Brothers filed for bankruptcy protection, AIG lost

Lehman Brothers as an insuring counterparty to their CDS transactions. This bankruptcy left AIG responsible for losses that Lehman Brothers had insured it against and, in turn, as an illiquid counterparty to AIG's CDS transactions in which it insured others (Born, 2009; Stulz, 2010). Concerns over the enforcement of bankruptcy claims only accelerated the system-wide crisis because bankruptcy protection gave preferential treatment to CDS contracts, benefitting Lehman Brothers in this instance (Peristiani & Savino, 2011; Roe, 2011). The FRS intervened during the GFC and aggressively accepted collateral for loans to their member banks in order to support liquidity (Blankart & Fasten, 2009). This intervention was consistent with the FRS's central banker role as the *lender of last resort* (Board of Governors, 2005) in stopping the downward-spiraling illiquidity of the financial system (Blankart & Fasten, 2009; International Monetary Fund, 2009; Obstfeld et al., 2009).

The threat of illiquidity that almost felled the financial system originated with a CDS counterparty relationship *outside* of commercial banking (Eichengreen et al., 2009; Stulz, 2010). AIG was regulated like a GSA insurance company and Lehman Brothers like a GSA investment bank (Bordo, 2008) although once the crisis started there was a "perception that banks' fortunes were linked" (Eichengreen et al., 2009, p. 4). This perception that the banking system was at risk of collapse from illiquidity was reflected in the comparison of risk factors in common to banks as a class relative to U.S. high-yield bond spreads (the gap between bid and ask prices). Risk factors associated with banks in general, in contrast to risk factors present only in specific banks, grew from 62%

correlation to bond spreads in July 2007 before the crisis to 77% in September 2008 during the crisis (Eichengreen et al., 2009). This correlation indicated the higher perceived risk of banks as a class, or system (Eichengreen et al., 2009). The change in perceived risk reflected the interdependency of banks from increased counterparty risk and increased funding-related liquidity risk that followed the failure of Lehman Brothers (Eichengreen et al., 2009).

The burst of mortgage financing innovation and the accompanying higher-risk assets (Jarrow, 2011) entered into the financial system with fragmented governance and accountability among multiple regulators (Bevir, 2009; Pitti, 2009). Federal supervision and monitoring for securitization-related activity in the GLBA framework was "a complex muddle, involving problems of co-ordination and inter-agency rivalry" (Goodhart & Tsomocos, 2007, p. 8). The potential for harm was raised by the presence of perverse incentives for bankers' gain by doing wrong (Jackson, 2010; Jarrow, 2011; Kling, 2010). Practices developed informally to address securitization and other related details left untreated by federal supervision (Bordo et al., 2012; Geyfman & Yeager, 2009). Transparency in the financial system became limited from the inability by banks, regulators, and rating agencies to assess the risks related to mortgage assets (Papaioannou, 2009; Pitti, 2009). CDS transactions worsened this risk assessment capability because banks were allowed to report their CDS position net of all buyer and seller transactions (Haubrich & Lucas, 2007). As a result, counterparties with CDSs had undisclosed risk exposure to their capital positions (Aizenman & Pasricha, 2009; Avgouleas, 2009; Cherny & Craig, 2009).

Regulation and arbitrage. In public policymaking, the object of banking regulation and supervision is the relationship between capital and risk (Adler et al., 2009; Bordo et al., 2012). Public law involving financial institutions was justified by the Commerce Clause of the United States Constitution (U.S. Const. art. I, § 8, cl. 3) and spanned the government from the executive, legislative, and quasi-independent entities and included judicial review (Arkes, 2010). Although public policy governance of capital and risk was deliberate, specific policy decisions created consequences both intended and unintended that impacted financial institutions (Acharya, Pedersen, et al., 2009; Allen, Babus, & Carletti, 2010; de la Torre & Ize, 2009; Goulder et al., 2009; Pacces, 2010). The deployment of capital was made by financial institutions to maximize the return on capital (Frachot, 2010). Regulation influenced this capital deployment so that over time the economic use of capital conformed to its regulation (Frachot, 2010).

Financial institution regulation and mortgage origination. U.S. supervisory and monitoring authority over financial institutions started with the Office of the Comptroller of the Currency (OCC), part of the U.S. Department of the Treasury (Board of Governors, 2005). The OCC was created in the National Banking Act of 1864 that established the commercial banking regulatory framework. The Federal Reserve Act of 1913 added the FRS to the framework, followed by the FDIC in 1933 as part of the GSA, with each given supervisory and monitoring power (Board of Governors, 2005). The first significant structural complexity came with the Bank Holding Company Act (BHCA) of 1956 (Aspachs et al., 2007; Board of Governors, 2005). The BHCA allowed for nonbank subsidiaries and was later amended, in 1970, to permit one-bank holding companies in such a way that encouraged financial system development (Aspachs et al., 2007; Board of Governors, 2005).

About the time of the BHCA, in 1970, residential mortgage loan origination began to shift steadily away from savings and loan firms to mortgage banking companies that did not take deposits (Marks, 2009). As a result of the interaction between long-term market and regulatory changes, market share reversed (Friedland, 2009; Hellwig, 2009; Rossi, 2010). Mortgages from savings and loans shrank from 50% to 10% of the market while mortgage banking companies grew to be 50% of the market (Immergluck, 2009, p. 65). Although mortgage loans were subject to federal lending laws, the capital used for loans by mortgage banking companies was unregulated while loans made by savings and loan companies remained regulated (Marks, 2009).

Unregulated mortgage banking companies grew further after 1980 when the Depository Institutions Deregulation and Monetary Control Act (DIDMCA) eliminated interest rate limits (He, 2010; Marks, 2009). With little regulatory restriction, home equity requirements were lowered by lenders that created higher interest rates, higher risk, and higher credit demand (Campbell & Hercowitz, 2010). After the savings and loan crisis of 1988, the mortgage market was reconfigured through the Financial Institutions Reform, Recovery, and Enforcement Act (FIRREA) of 1989 (Cassell & Hoffman, 2009).

FIRREA supported mortgage lending through GSEs and secondary markets rather than by savings and loan companies (Cassell & Hoffman, 2009).

In 1996, the central bankers of the Basel agreement from the Bank for International Settlements (BIS) in Switzerland standardized the classification of capital (Basel Committee on International Supervision, 2005; Cornford, 2009; Moosa, 2010). In doing so, capital level requirements were implemented among the central banks of the world, a primary objective of the Basel Concordant of 1975 (Basel Committee on International Supervision, 2005; Cornford, 2009; Moosa, 2010). The Basel Capital Accord, or Basel I, of 1988 was enacted by the U.S. in 1989 and significantly amended in 1996 (Board of Governors, 2005), with an effect of increasing the flow of capital across national borders. This global standardization process was ever-present in the U.S. commercial banking and the financial system from 1975 through 2010, including with Basel II of 2004 and Basel III of 2010 (Basel Committee on Banking Supervision, 2011; Basel Committee on International Supervision, 2005; Cornford, 2009; Moosa, 2010). The most significant of the capital changes were decreased requirements in Basel I in January 1996 and increased requirements in Basel III in December 2010 (Basel Committee on Banking Supervision, 2011; Moosa, 2010). Despite the United States' adherence to these global capital standards from Basel, the government had no higher authority than the Constitution and so these standards were restricted to voluntary acceptance by U.S. policymakers (Stiglitz, 2010).

The United States followed the Basel I amendment in 1996 with the GLBA in 1999 and the accompanying deregulation of Great Depression-era barriers to capital movement (Barth et al., 2008; Moosa, 2010), in part to align with Basel (Acharya, Wachtel, & Walter, 2009). Significant deregulation and nonregulation in housing financing accompanied the GLBA. In 1999, the secondary market change from 1992 standardizing GSE operating charters to make Freddie Mac into a publicly traded company directly competing with Fannie Mae (Cassell & Hoffman, 2009) was enhanced to allow for GSE participation in subprime securitization (Jaffee, 2009). In 2000, the CFMA was an affirmation of the nonregulation of derivatives used to hedge mortgage securitization risks (Kalinowski, 2011; Sánchez, 2010). Taken together, Basel and the GLBA restructured banking relationships in the 1990s that had been firmly established across the world for decades (Peretz & Schroedel, 2009; Stiglitz, 2006, 2010).

The GLBA and mortgage securitization. The GLBA and its capital rules for investment banking coincided with the growing market opportunity in subprime mortgage securitization and derivative transactions activities (Bordo, 2008). Between the GLBA passage in 1999 and the GFC in 2008, investment banks became the commercial banks' Wall Street outlet for mortgage securitization and derivative transactions activities (Geyfman & Yeager, 2009). Yet, the claim that capital was moved and thereby impaired the financial system from "new instruments often devised to avoid regulation" (Bordo, 2008, pp. 6-7) was only technically correct. Rather than new practices like securitization being designed to avoid regulation, a better explanation was that capital was deployed most efficiently within the developing regulatory framework, consistent with the earlier U.S. experiences and capitalist tenets (Lumpkin, 2010; Rajan, 2003).

Investment bankers and their financial networks on Wall Street were well-suited for the activities required to issue a subprime securitization (Geyfman & Yeager, 2009). Many investment bank firms entered the securitization market from traditional GSA activities including bond underwriting and operations, and evolved to become participants in the securitization market (Hellwig, 2009; Papaioannou, 2009). After years of incremental increases in their participation, investment banks eventually used their capital to issue and own subprime securities. Subprime mortgage loans started as a specialty finance product yet became acceptable assets to commercial banks through this securitization process (Blundell-Wignall et al., 2008; Booth, 2008; Raines et al., 2009). Even after the GFC, securitization remained an essential feature of U.S. mortgage financing (Vickery & Wright, 2010).

Mortgage securitizations and the associated derivative transactions in the GLBA regulatory regime also depended on favorable accounting treatment in order to recognize the benefits of these practices (Gerding, 2011). Accounting and auditing transformed from the mundane to the exotic and essential through the accounting treatment of subprime mortgage securitization (Al Janabi, 2008; Huian, 2010). This accounting was attractive because *off balance sheet accounting* meant the full amount of the debt associated with a subprime security was not included in financial statements (Kirzner, 2008), favorably affecting operating leverage (Gerding, 2011). Favorable accounting treatment was applied to recognize income for commercial banks' *gain on sale* of mortgage loans into securities (Geyfman & Yeager, 2009), which was based on models of future loan performance.

These accounting changes extended into the home foreclosure process, with *fair value accounting* of foreclosed properties using market-based prices (Wallace, 2009). Although intended to be a favorable accounting practice for securitization, the fair value worked procyclically and exacerbated the decline and slow recovery of the housing market (Goyal, 2009; Wallace, 2009). The complicated securitization accounting worsened the problem of transparency in commercial banks and in financial institutions in general (Bazerman, Loewenstein, & Moore, 2002; Levitt & Breeden, 2009; Wagner, 2010).

The GLBA regulatory framework resulted in preferential treatment of subprime mortgage securitization and derivative transactions activity (Bordo, 2008). This treatment was especially beneficial for investment banks operating with less regulation and lower capital requirements than commercial bank counterparts and with corresponding higher risk and higher leverage (Bordo, 2008; Geyfman & Yeager, 2009; Phillips, 2008, p. 35; Papaioannou, 2009). Capital moved easily between commercial bank and investment bank structures (Geyfman & Yeager, 2009). Yet the GLBA regulatory supervision was determined by financial institution type such that investment banking activity became regulated by the FRS only if it occurred in a universal bank (Bordo, 2008; Raines et al., 2009). As a result, the FRS exercised indirect regulation and limited oversight of investment banks (Raines et al., 2009). Investment banking was not changed by the GLBA, but the nature of investment banking changed under the GLBA because of subprime mortgage securitization and derivative transactions (Geyfman & Yeager, 2009).

Within the Basel architecture, regulatory arbitrage of mortgage securitization related financing activity became commonplace (Lumpkin, 2010). The GLBA commercial banks competed globally against each other and against non-U.S. banks while lending each other money and together participating in securitization transactions (Goyal, 2009; Reinhart & Rogoff, 2008a, 2008b; Wehinger, 2008). This interbank lending was encouraged by Basel capital rules that had loans from banks to other banks rated as low risk, with a corresponding low capital requirement (Wagner, 2010; Wehinger, 2008). Over the long term, the financial system liquidity became overstated, and credit risk understated, by lending banks reporting loans to other banks as low risk while the borrowing banks used these funds for the financing of risky assets like mortgage securitization-related activity (Garcia, 2009). Depending on ownership percentages and the legal structure in SPV transactions, borrowing banks could participate in SPV financing transactions yet not disclose this financial exposure in regulatory reporting (Jarrow, 2011; Wagner, 2010; Wehinger, 2008).

Derivatives regulation. CDS was similar to interbank lending in that counterparties included the GLBA-regulated financial institutions adding to the unreported, systemic risk (Gerding, 2011). The use of CDSs expanded rapidly outside the confines of its commercial banking origins. By the late 1990s, CDSs had become a large, dynamic, and growing market according to Born (2009), the Chairperson of the CFTC. Policy positions as to the proper regulation for derivatives and swaps were articulated in 2000 during the legislating of CFMA regulation. Consistent with the GLBA factions already established, Born (2009) and others advocated regulation and the prevailing faction led by the FRS opposed regulation (SCB, 2005). The prevailing viewpoint was that interest rate swaps had been successfully implemented and the capabilities of market participants made additional regulation for CDSs unnecessary (SCB, 2005).

The stated purpose of the CFMA was “to promote legal certainty, enhance competition, and reduce systemic risk in markets for futures and over-the-counter derivatives” (2000, §2). In this legislation, the reduction of systemic risk from over-the-counter derivatives was interpreted to leave CDSs unregulated as supported by the FRS (SCB, 2005). The CFMA of 2000 was an amendment to the Commodity Exchange Act of 1936, which had been amended with multiple public laws before and after the 2000 act. Although Born (2009) had identified the growth in credit derivatives to support the position for its regulation, this growth had been relatively recent, and financial modernization was an ongoing process.

Post-financial crisis regulation. Themes developed regarding credit derivatives regulation during the period between the CFMA in 2000 and the financial crisis in 2008. These themes were revisited in the EESA’s TARP legislation in 2008 and again with Dodd-Frank legislation in 2010 (Ferguson & Johnson, 2009; Klieber, 2012). The predominant viewpoint had been that derivatives did not require additional regulation and a government-mandated trading exchange was unnecessary (SCB, 2005). According to Congressional testimony given in 2005, "the Federal Reserve Board believes that the CFMA has unquestionably been a successful piece of legislation" (SCB, 2005, para. 2). In the capital marketplace, the assessment from FRS was not shared by an influential participant, Buffett who wrote that "derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal" (Berkshire Hathaway, Inc., 2002, p. 15). Just months before the GFC onset, the Federal Reserve Bank of Cleveland economist, Haubrich, and a Northwestern University professor, Lucas (2007), forewarned of CMOs. There was not enough information related to the risky uses of CMOs that was publicly available to assess the risk to the financial system (Haubrich & Lucas, 2007).

The predominant viewpoint regarding CDS regulation shifted in dramatic fashion after the U.S. government responded to the financial crisis with TARP on October 3, 2008 (Ferguson & Johnson, 2009; Klieber, 2012). This legislation was passed at the height of the crisis and was intended to increase capital in financial institutions in order to stabilize the financial system (Black & Hazelwood, 2012; Lawson, 2010). The long-standing position at the FRS against regulation was left undefended. Business media reported that for CDSs, "pressure is rising on policy makers to regulate a market that's moved beyond its origins protecting banks from loan losses" (Moses & Harrington, 2008, para. 3). Nobel Laureate economist and financial journalist Krugman (2009) blamed the CFMA for exacerbating the financial crisis. Concurrently, former SEC Chairperson Pitt, incumbent Securities and Exchange Commission Chairperson Cox, and Commodity Futures Trading Commissioner Chilton expressed strong messages of support to regulate CDSs (Moses & Harrington, 2008).

TARP contained emergency credit programs as part of the EESA (Board of Governors, 2012a; Federal Reserve Bank of New York, 2013a) that indicated a shift toward the position of CDS regulation requiring a government mandated exchange. The EESA Section 105(c) called for the Secretary of the Treasury to review the effectiveness of oversight given the state of the financial markets. The EESA also required the Secretary to issue a Regulatory Modernization Report to include a recommendation for the regulation of over-the-counter swaps markets. More specifically, the recommendation of the Secretary contained in the legislation was to include "enhancement of the clearing and settlement of over-the-counter swaps" (§105(c)(1)(B)). Congressional research reports that followed the EESA in 2009 and 2010 included credit derivatives exchanges when highlighting the important issues of the financial crisis (Jickling, 2010; Nanto, 2009). The emergency credit programs contained in TARP also effectively socialized financial institution risk through the spontaneous government action of directly injecting public funds into private financial institutions (Khademian, 2009; Walter, 2009).

Dodd-Frank passed in July 2010, and its Title VII mandated that most derivatives instruments be traded on centralized exchanges. CDSs were of particular concern due to their role during the financial crisis related to illiquidity and TARP (Peristiani & Savino, 2011; Song & Uzmanoglu, 2012; Stulz, 2010). Title VII of Dodd-Frank required significant involvement from regulators in the U.S. financial system to implement an over-the-counter derivatives exchange. The FRS's role included coordination with other domestic and international authorities, strengthening the infrastructure of the derivatives market, and supervising derivatives market participants (SBC, 2011). The Financial Stability Oversight Council was created by the DOT (2013) and included derivatives in its scope of oversight. The SEC (2012) was responsible for implementing the derivatives and swaps exchange that began in October 2012, over two years after Dodd-Frank passed (DTCC, 2012).

Financial institutions dynamically deployed capital into new legal structures according to the banking activity at hand rather than confining activity to that allowable in existing entities (Gerding, 2011; Wagner, 2010). An effect from years of this regulatory arbitrage was undercapitalization for the mortgage-related risks in the financial system (Gerding, 2011; Wagner, 2010). Simultaneously, banking capital and risk collectively shifted from being narrow and categorical under GSA to being systemic under GLBA (Hellwig, 2009; Neale et al., 2010) while not being regulated systemically (Negrilă, 2009). Preceding the GFC these accumulated regulatory and market changes made financial institutions less transparent, thereby impairing the supervision of banking activities (Bordo et al., 2012; De Grauwe, 2008a). As a result of all this, in financial transactions the borrowers became further separated from the lenders.

Methodology and Analysis of Financial Institution Risk

Empirical studies on the regulatory framework conducted before the financial crisis employed a variety of methods to analyze banking risk, including practitioner based models of synthetic banks and stress testing (Khademian, 2009). Additionally, monetary policy models were incorporated into the synthetic banks and stress testing models (Aspachs et al., 2007; Kilian & Manganelli, 2008; Moosa, 2010). Yet on the eve of the GFC, economists were still struggling to identify the theoretical framework for financial system stability and a methodology to analyze it beyond money supplies and interest rates (Aspachs et al., 2007; Caballero, 2010; Repullo, 2005). In 2007, the advancements in methods that had been made in identifying relationships in the financial system like regulation and financial results were "only just beginning to be addressed empirically" (Arner, 2007, p. 87).

The *synthetic bank method* was used to model the stability of the financial system, but failed to demonstrate its intended predictive value (Geyfman & Yeager, 2009; Hermsen, 2010). A *synthetic bank* is a hypothetical bank using actual financial system data to simulate economic scenarios and financial system results (Geyfman & Yeager, 2009; Weber, 2010). The purpose of the synthetic bank method was to potentially identify disruptions to the banking system that could threaten financial stability and to quantify the probability of default for the whole system (Hermsen, 2010; Weber, 2010). This analysis was similar to the economic models of Keynes using variables within a closed system, such that changing one variable necessarily impacts other variables

(Skidelsky, 2009). The benefit of synthetic bank analysis was to demonstrate the impact of changes made in the banking system because the United States lacked historical precedent for the performance of a universal bank system (Geyfman & Yeager, 2009). The obvious flaw with the method was the output was simply a function of the input assumptions (Geyfman & Yeager, 2009).

A similar empirical method, *stress testing*, is the reverse of the synthetic bank analysis in that an actual bank was tested for hypothetical results. The purpose of the stress testing method was to determine the performance point where a commercial bank would fail (Aspachs et al., 2007; Marcelo, Rodríguez, & Trucharte, 2008). The results were useful to banks for their risk mitigation analysis and could be combined with other financial institutions for system-wide and central bank risk analysis (Aspachs et al., 2007). When results were aggregated the stress test model was similar to the synthetic model because it was a representation of the financial system. The key assumption in these models was that knowing the probability of default was necessary to produce the appropriate regulatory controls for financial stability (Aspachs et al., 2007; Geyfman & Yeager, 2009; Marcelo et al., 2008; Negrilă, 2009). Although the quality of analysis improved with empirical modeling, there lacked evidence that these models could be either predictive of instability or useful for structuring regulations (Aspachs et al., 2007; Geyfman & Yeager, 2009; Naceur & Omran, 2011).

The studies of empirical modeling efforts were insightful because synthetic bank and stress testing research was conducted just before the financial crisis, with its value limited to explaining past events and testing hypothetical situations (Aspachs et al., 2007; Gray, Bodie, & Merton, 2007). These models failed to predict the impending crisis, which might have been due either to undetected instability in the financial system or limitations of assumptions in the method like systemic liquidity (Geyfman & Yeager, 2009). The evidence of predictive ability was limited to predicting regulatory changes once a financial crisis has started (Mousavi & Shefrin, 2010). Indeed, the failures of empirical modeling related to the GFC reflected long standing doubts in macroeconomics modeling to be a predictive discipline (DeLong & Summers, 1986; Friedman, 1986; Gregg, 2010).

Empirical studies successfully defined key relationships between phenomena in the economy and the financial system, in the context of the GFC (Bordo, 2008; Eichengreen et al., 2009; Reinhart & Rogoff, 2008a). Most notably, the understanding of capital movement throughout the world was advanced by defining the relationship between the levels of capital mobility and global economic phases (Bair, 2008; Beck et al., 2009; Reinhart & Rogoff, 2008a). Factors that were related to the U.S. business cycles were identified, which in certain combinations also identified the severity of the cycle (Bordo & Haubrich, 2009). Other empirical studies yielded the housing value index (Shiller, 2005, 2012) and evidence of relationships between regulations and financial results involving various components of the financial system (Avery, Bostic, & Canner, 2000; Billio et al., 2010; Dincer & Eichengreen, 2009; Eichengreen et al., 2009; He, 2010; Hellwig, 2009; Jaffee, 2009; Jordà et al., 2012). These studies also advanced methodology for the original analysis of financial statistical data involving the time frame of multiple years.

Conclusion

Public policies regarding U.S. financial system stability addressed complex economic matters while entangled with political values and tenets of capitalism (Gregg, 2010; Key, 2012). In the United States, the FRS was entrusted to exercise prudence over the economy and the financial system (Board of Governors, 2005). Yet the regulations governing this complicated system emerged from rational actions and policy garbage cans alike, with the distinction not always clear (Keeney, 2012, Lauckner, 2012; Lee, 2012). The regulatory framework shift to the GLBA from the GSA, regardless of its merit, was destabilizing to U.S. financial institutions and entwined with other historic changes (Cornford, 2009; Ferguson, 2008). The Basel Accords had enhanced capital mobility so that capital flowed easier among market participants worldwide (Peretz & Schroedel, 2009; Reinhart & Rogoff, 2008a). Innovations such as CMOs and CDSs brought new financial instruments and intermediaries into the financial system, with uncertain risks to lenders and borrowers (Gerding, 2011).

A grave financial crisis, rather than financial system stability, resulted from market changes coupled with regulatory policies. Although the GFC had no sole cause, illiquidity was triggered by falling house values conjoined with mortgage securitization derivative instruments like CMOs and CDSs (Dincer & Eichengreen, 2009; Felsenheimer & Gisdakis, 2008). As with many phenomena in the financial system, there was little empirical evidence of the relationship between CDS regulations and CMOs and their associated risks. The research response to the GFC included the development of causal and pathway models incorporating empirical evidence in order to better understand financial system relationships and risks (Adams et al., 2011; Billio et al., 2010; Bordo, 2008; Bordo & Haubrich, 2009; Wang et al., 2011). In Chapter 3, I apply the findings from the literature review to the quantitative research design, in terms of the regulations and relationships to be analyzed and the selected quantitative methodology.

Chapter 3: Research Method

Introduction

In Chapter 3 I describe the quantitative research design used to evaluate the problem of CDS regulation and the corresponding results in the financial system. First I present the quantitative research question and hypotheses followed by an overview of the quantitative research design and the range of methodology options available. Then I include the quantitative research setting, descriptions of the population and the sampling frame from which the data are drawn. Further I describe the instrumentation, the ARIMA parameters and periods, and the operationalization of variables, and then I discuss the ARIMA method. I then present the data collection processes along with the statistical techniques associated with ARIMA modeling and considerations of validity and reliability. I summarize the quantitative research design with an overview of and discussion of results.

Research Question and Hypotheses

This study is based on the following quantitative research question: What is the nature of the relationship between the independent variables—CDSs regulations (the CFMA and the EESA)—and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants?

The null (H_0) and alternate (H_A1 and H_A2) hypotheses were based upon the theoretical framework in which two contrasting public policymaking models are considered (the garbage can model and the rational-comprehensive model) for two CDS regulations (the CFMA and the EESA).

Null hypothesis (H_0): There is no statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

The first alternate hypothesis (H_A1) was derived from the garbage can policy model in which a *reactive* policy was implemented, with a *negative* relationship between CDS policy and CMO capital flows. The garbage can model is associated with reactive policymaking and is defined in detail in the Definitions section . A negative relationship is a policy result in which the presence of the regulation is associated with the measure of an unfavorable result.

Alternate research hypothesis A1 (H_A1): There is a negative and statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

The second alternate hypothesis (H_A2) was derived from the rational-comprehensive policy model in which a *proactive* policy was implemented, with a *positive* relationship between CDS policy and increasing CMO capital flows. The rational-comprehensive policy model is associated with proactive policymaking and is defined in detail in the Definitions section. A positive relationship is a policy result in which the presence of the regulation is associated with the measure of a favorable result.

> *Alternate research hypothesis* A2 (H_A2): There is a positive and statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

The quantitative alternate research hypotheses (H_A1 and H_A2) that are set in opposition are derived from the CFMA of 2000. CFMA is the CDS regulation that allowed for the policy of unrestricted use of CDSs by U.S. financial institutions, which was favorable to CDSs. The existing empirical literature pointed to CFMA being derived from the rational-comprehensive model (H_A2) of public policymaking (Barth et al., 2008; Billio et al., 2010), rather than from the garbage can model (H_A1) of public policymaking. The ARIMA modeling period demarcating this regulation is January 2001 through September 2008.

Research Design and Approach

Knowledge and theories are built inductively through the qualitative and tested deductively through the quantitative methods of inquiry within the context of a theoretical or conceptual framework (Creswell, 2009; Reynolds, 2010). The research design uses contrasting theoretical frameworks of public policymaking incorporating the rational-comprehensive model and the garbage can model. Possible approaches to research design from the literature review included quantitative studies of regulatory policy, macroeconomic policy, and capital flow (Kirabaeva & Razin, 2009; Lee, 2012; Song & Uzmanoglu, 2012; Taylor, 2009) and studies that focused on specific topics like CDSs, CMOs and CDOs, and TARP (Barnett-Hart, 2009; Black & Hazelwood, 2012; Peristiani & Savino, 2011). Qualitative studies involved regulatory policy (Higgs, 2010; Pacces, 2010), ethical evaluation, and legal case study approaches (Arkes, 2010; Breen, 2010; Jackson, 2010; Kling, 2010; Lawson, 2010). Few of the reviewed designs were mixed methods (Newman, DeMarco, Newman, & Ridenour, 2003) involving case study and empirical evidence (Mussa, 2010). Based on the research question, the quantitative research design is the best fit for analyzing CDSs and CMOs by deductively testing for a relationship between these two constructs.

The quantitative research design selected is a quantitative inquiry involving lagged time series analysis, which is used to explain the empirical relationship between public policy and financial system results (Inter-American Development Bank [IADB], 2004). Time series is a classical, quasiexperimental structure incorporating regression analysis (Glass et al., 2008). The two independent variables are CDS regulations (the CFMA and the EESA) and the dependent variable is CMO assets in U.S. financial institutions, measured in millions of U.S. dollars each quarter (Jarrow, 2011). The relationship of the independent and dependent variables is modeled and the U.S. LPR ratio was used as a control variable. The time series methodology requires a control variable for the effects of history and this particular control was selected because it is independent of the regulatory intervention (Glass et al., 2008). The ARIMA method was chosen in order to evaluate the change over time of the dependent variable.

The date range for the quantitative research study starts with the enactment of FIRREA in August 1989, which was the terminal legislation of the 1980s Savings & Loan Crisis (Cassell & Hoffman, 2009). The end point of the date range is March 2013, after the implementation of CDS regulation under Dodd-Frank, the terminal legislation of the GFC (Miller & Ruane, 2012). Although Dodd-Frank was enacted in July 2010, key CDS provisions in the act were proposed in TARP during 2008 yet not fully implemented until October 2012 (DTCC, 2012; Nanto, 2009).

Setting and Sample

In this section of Chapter 3 I include an overview of the setting and the associated data that were used in the quantitative study, including descriptions of the population, sampling strategy, sample size, and the sample population to which the results should be generalizable (Trochim, 2006). The operationalization of variables and the corresponding analytical model are defined in the section that follows on instrumentation and materials.

The setting is the U.S. financial system in which lenders and borrowers interact through intermediaries and capital flows among firms participating in the market. The financial system has multiple types of privately owned financial institutions and it is a subset of the global financial system that consists of the central banks with their associated national banking systems and macroeconomic policies (Barth et al., 2008).

The data are financial statistics of the U.S. financial system published by the FRS from the defined sampling frame. Samples are drawn from the population of financial institutions that is consistent with the operationalized variables and the ARIMA modeling specifications which are CDS regulations and their corresponding time frames that are detailed in Table 1.

Population and Sampling Frame

The population is all privately held U.S. financial institutions, which includes depositories and nondepositories. Large commercial bank depositories are the 1,734 members of the FRS with assets greater than $300 million U.S. dollars that represent approximately 90% of the assets of member commercial banks (Board of Governors, 2013d) and approximately 80% of the $13 trillion U.S. dollars in bank and thrift deposits insured by the FDIC (2013). Of the nondepository financial institutions with independent financial ratings in the United States, there are 275 life insurance companies, 677 property and casualty insurance companies, 43 securities broker dealers participating in investment banking activities, and 168 finance companies (Standard and Poor’s Rating Services, 2013). Additionally, issuers of ABSs include financial institutions that issued some of 1,375 ABSs that have independent financial ratings (Standard and Poor’s Rating Services, 2013).

A population member is a privately held financial institution. Those population members that are depositories include commercial banks operating in the United States and affiliated territories, non-U.S. banks operating in the U.S., and credit unions (Board of Governors, 2013a, 2013b, 2013c, 2013e). Those population members that are nondepositories include insurance companies, securities broker dealers, and finance companies and other issuers of ABSs (Board of Governors, 2013a, 2013b, 2013c; Independent Directors Council, 2010; REIT Wrecks, 2008; Thiruvengadam, 2010; DOT, 2001; U.S. Government Accountability Office [GAO], 2008, 2009a, 2009b, 2010, 2011, 2012a, 2012b; U.S. Senate, Joint Economic Committee, 2012). The FRS does not explicitly report on the financial institutions associated with its results, though limited information regarding financial institutions is publicly available (FFIEC, 2013).

The sampling frame is financial institutions that are required to report financial results to the FRS (Board of Governors, 2005). This limitation excludes savings and loan companies and, in general, small financial institutions that have less than approximately $1.2 billion in assets (Board of Governors, FDIC, & OCC, 2012). Not all financial institutions are required to be members of the FRS, so membership is elective particularly for those in asset range of $300 million to $1.2 billion (Board of Governors, 2005, 2013d). Financial results are aggregated by the FRS for publishing financial statistics (Board of Governors, 2013a).

Sampling Strategy

The sampling strategy was to purposefully draw data from U.S. government reports published electronically by the FRS that contain financial statistics based upon financial institutions' aggregated results by accounts that are unobservable by institution in this source (Board of Governors, 2012b). These data were published at quarterly intervals, which is consistent with the periodic valuations that financial institutions perform for assets that have market-based values such as CMOs. The FRS data are levels of outstanding assets and liabilities observed at the end of period and that are neither seasonally nor inflation adjusted (Board of Governors, 2012b, 2012c, 2013b, 2013c; Federal Reserve Bank of New York, 2013b). All data were thus observed uniformly and in a way that was consistent with time series analysis (Glass et al., 2008). The unit of analysis is aggregated data from the entire sampling frame. A unit of data is a quarterly financial statistic from a financial time series each quarter. Each datum within the sampling frame is included so that no available data are skipped in the quarterly observations of units of data. The data collected in this sampling are stated as millions of U.S. dollars.

Sample Size

The ARIMA process involves the values associated with a single panel of time series data and the corresponding sample size is simply all the quarterly values within the window of the study, which is from the fourth quarter of 1989 through the first quarter of 2013 and results in 95 unique data points. There is no required sample size with ARIMA modeling rather achieving statistically significant results is a function of the specific data being analyzed and the goodness of fit to the model (NIST, 2012; StatSoft, Inc., 2013).

Sample of the Population

These financial statistics are drawn according to the quantitative research design and the specifications of the dependent variable defined in the instrumentation and materials section. The FRS is an exclusive and authoritative source of this data, and the reporting process is an important part of their governance of the financial system (Board of Governors, 2005). These U.S. government official statistics were typical of secondary data used in independent empirical analyses (Howell, 2008; Kiecolt & Nathan, 1985; United Nations Statistical Institute for Asia and the Pacific, *n.d.*). The use of secondary data in general is appropriate when there is a strong relationship between the quantitative research question and the data used for testing hypotheses (Thomas, Bauer, & Heck, 2005).

Instrumentation and Materials

In this section I include ARIMA modeling parameters, the definition and operationalization of variables, and an overview of the ARIMA modeling process. The instrumentation and data collection in this quantitative research methodology were designed to be sufficient for answering the quantitative research question through the testing of the null and alternate hypotheses (Creswell, 2009; Reynolds, 2010). The materials used in the instrument were researcher developed and based upon the literature review (Barnett-Hart, 2009; Black & Hazelwood, 2012; Peristiani & Savino, 2011), the selected theoretical framework (Arrow, 1987; Kingdon, 2003; Simon, 1957), and choices for ARIMA modeling in the quantitative research design and during the research project (Glass et al., 2008).

ARIMA Parameters for Modeling Periods

Time series analysis is a fixed-effect model, in which it is assumed that successive values of data represent consecutive and equally spaced measurements over time (NIST, 2012; Parsad et al., 2012; Yaffee, 2003). The phenomenon being studied was represented by quarterly data from which the nature of the phenomenon can be understood, but contingent on the appropriate selection of variables (Yaffee, 2003). The ARIMA method was used to identify patterns over time in data by indicating differences that are used to divide a nonstationary time series into stationary periods for further analysis using ARIMA modeling steps (Glass et al., 2008).

The ARIMA modeling parameters were measurable factors that are hypothesized to set the conditions of operations for its subject (Glass et al., 2008). These parameters were used to develop the initial periods. The ARIMA modeling periods were subsequently determined by testing the initial periods using ANOVA *F*-tests and *t* tests for correlated samples (Glass et al., 2008; NIST, 2012). The modeling parameters are presented in Table 1. The associated variables are operationalized in the section that follows ARIMA periods.

Table 1

ARIMA Modeling Parameters for CMOs, CDSs, and Associated Indications

Modeling parameters	Started	Indication
The Financial Institutions Reform, Recovery and Enforcement Act of 1989 (FIRREA)	Aug. 1989	Start of regulatory era after the savings and loan crisis
The Commodity Futures Modernization Act of 2000 (CFMA)	Jan. 2001	Favorable CDS legislation
The Emergency Economic Stabilization Act of 2008 (EESA) / Troubled Asset Relief Program (TARP)	Oct. 2008	Unfavorable CDS legislation

For the dependent variable CMO, the modeling parameters are demarcated by the independent variables' (the CFMA and the EESA) CDS policy changes. These CMO parameters might have shifted from a baseline after the passage on December 21, 2000 of the CFMA legislation that was consistent with the GLBA deregulation and favorable to CDSs. A second shift in CMOs might have occurred with legislation unfavorable to CDSs in 2008. Three different CMO periods result from these two CDS-related interventions that are analyzed beginning with ANOVA *F*-tests and *t* tests: August 1989 to December 2000, January 2001 to September 2008, October 2008 to March 2013.

For a model control, parameters for the LPR were used in order to control for the effect of history, which is essential to time series design considerations (Glass et al., 2008). This parameter shifted after 1999, based upon a visual assessment of the graphed data, after which point the LPR appears to have steadily declined (DOL, BLS, 2013). The rationale for selecting this control variable was that the LPR is a macroeconomic measurement is independent of the intervention of CDS regulation, which is consistent with the selection criterion in the time series methodology (Glass et al., 2008). By comparison, GDP is a macroeconomic measurement that may not be independent of the intervention of CDS regulation and thus is not used.

ARIMA Periods Using a One-Way Analysis of Variance (ANOVA) *F*-Tests and *t* Tests

ANOVA *F*-tests and *t* tests were performed to determine whether the time series of the dependent variable is a uniform set of data or comprised two or more different periods associated with the two independent variables (Glass et al., 2008; NIST, 2012). ANOVA *F*-tests were used to compare the difference between two means in relation to the variation in the data, with the mean portraying the first moment and variance the second moment. If statistically significant periods are found, *t* tests for period comparisons were used. This tested whether or not each pair of periods has a mean difference to the dependent variable in order to identify the model that best fits the sampled data (Glass et al., 2008; NIST, 2012).

Operationalization of Variables

The theoretical basis of examining the nature of the relationship between CDSs and CMOs is two contrasting public policymaking models (the independent variables), which are the rational-comprehensive model and the garbage can model (Arrow, 1987; Kingdon, 2003; Simon, 1957). The dependent variable was CMO assets that are created when capital is deployed to these assets in the U.S. financial system (Estrella & Silver, 1984; Haubrich & Lucas, 2007). The independent variables were CDS regulation periods that were identified in the research literature (Aizenman & Pasricha, 2009; Eichengreen et al., 2009; Roe, 2011) and determined by reviewing the primary source data of the acts of Congress.

The variables used in the quantitative research study were operationalized for use in the ARIMA modeling. The dependent variable is CMO that was operationalized by the sum of the CMO asset categories reported by the FRS (Board of Governors, 2012b, 2012c, 2013b) and is discussed in further detail in the data collection section. CDS regulations are independent variables operationalized by the enactments of the CFMA of 2000 and the EESA of 2008 (that includes TARP). The control variable was operationalized by the LPR which was the employment to working age population ratio published by the U.S. government (DOL, BLS, 2013).

ARIMA Method (*p,d,q*)

The ARIMA method is an integration of autoregressive (AR) and moving average (MA) models in which the time series values may be differenced according to factors that are identified from the modeling process (Glass et al., 2008; Nau, 2014; NIST, 2012; StatSoft, Inc., 2013). The output from ARIMA models are shown in the form (*p,d,q*). In this form, the time-lagged intervals used from the AR part of the model is *p*, the number of differenced periods integrated in the time series is d, and the time-lagged intervals used from the MA part of the model is q (NIST, 2012). The ARIMA model output of (0,1,0) may also be stated as $I(1)$ and indicates the presence of a random walk in which the future expected value is equal to the current value plus a constant. If the constant is zero, then a random walk without drift is indicated (NIST, 2012).

The ARIMA method is commonly used with stochastic data when there is no clear indication of simple cause and effect mechanisms and the underlying process may be haphazard though associated with a data pattern. A good example is financial related data that vary on a monthly basis, perhaps resulting from a haphazard process that can be analyzed with ARIMA techniques (New England Actuarial Seminars [NEAS], 2008). The ARIMA process is used to model fluctuations so that components of trends and seasonal influences can be removed in order to identify a residual, which is then analyzed for randomness and for significance related to the different periods of the data (NEAS, 2008; NIST, 2012; StatSoft, Inc., 2013). Trends in the CMO ARIMA model may be present that are related to housing values (Shiller, 2005, 2012) and to seasonal mortgage borrowing (Rossi, 2010; Yezer, 2010).

The ARIMA modeling parameters in Table 1 based on CDS regulations resulted in three periods and each of these periods is analyzed for (p,d,q) for CMO and the control, which results in 6 (p,d,q) potential findings. The findings depend on the presence, or absence, in the data of autocorrelation and random-shock-related moving averages for each period (Glass et al., 2008; Nau, 2014). In the event that autocorrelation is present in a (*p,d,q*) model of (1,0,0), then the data are analyzed for partial autocorrelation of the residuals in a model of (1,0,1), including the examination of the data plot of the partial autocorrelation function (Adams et al., 2011; Dębowski, 2011; Glass et al., 2008; Inoue, 2008). If the partial autocorrelation cuts off after the lag *p* then the model is (1,0,0), whereas partial autocorrelation that dies out slowly indicates that the model is (1,0,1), based on the effects of a random shock *q* (Adams et al., 2011; Glass et al., 2008). The findings from the three modeled ARIMA periods in Table 1 are shown in the following form, for further statistical analysis:

	Period 1 Model	Period 2 Model	Period 3 Model
CMO	(*p,d,q*)	(*p,d,q*)	(*p,d,q*)
control	(*p,d,q*)	(*p,d,q*)	(*p,d,q*)

Data Collection and Analysis

The data collection and analysis processes are defined in this section. The corresponding details are given for the data collection procedure in Appendix A and the data in Appendix B. After the discussion of the treatment of data related to ARIMA and time series data issues, the quantitative research design was reviewed for concerns involving validity and reliability.

Data Collection

The dependent variable CMO is operationalized with data representing CMO assets in U.S. financial institutions and summarized in Table 2. CMO data are obtained from the FRS report *Z.1 Flow of Funds Accounts of the United States* (Board of Governors, 2012b, 2012c, 2013a, 2013b).

Microsoft Excel 2010 spreadsheets were used for storing the collected data that was consolidated and imported into statistical software for analysis. The Statistical Package for Social Sciences by IBM (SPSS Statistics Premium Grad Pack Version 21.0) included basic and advanced procedures for time series analysis (Green & Salkind, 2008; IBM, 2012). The functionality of this software was limited by its inclusion of statistical procedures and SPSS cannot replace the human intuition and judgment that is necessary for estimations used in ARIMA modeling (Glass et al., 2008).

Table 2

CMOs in Federal Reserve Z.1 Flow of Funds Accounts

Account	Account description	Data series
Depository Institutions		
30616	Residential CMOs and other structured MBS	L.110 U.S.-Chartered Depository Institutions, Excluding Credit Unions
30636	Private residential CMOs and other structured MBS	L.110 U.S.-Chartered Depository Institutions, Excluding Credit Unions
Nondepository Institutions		
30617	Agency- and GSE-backed mortgage pool securities backing backing privately issued CMOs	L.124 Issuers of Asset-Backed Securities CMOs
30651	Home mortgages backing privately issued pool securities and privately issued CMOs	L.124 Issuers of Asset-Backed Securities CMOs
30654	Multifamily mortgages backing privately issued pool securities and privately issued CMOs	L.124 Issuers of Asset-Backed Securities CMOs

ARIMA Modeling Statistical Procedure

The procedure used was based on Box-Jenkins which is a multistep and iterative process used to fit an ARIMA model to the data (Glass et al., 2008; Key, 2012; Lopes, 2011; NIST, 2012; Parsad et al., 2012). The steps included iteratively modeling a time series until it had stationary mean and variance (the basis of standard deviation), without trends and seasonality, by identifying differenced and distinct periods of nonrandom, univariate data. The data analysis was expected to take multiple iterations and included the portrayal and interpretation of visual data because the data were not expected to fit any one ARIMA model exactly. This is a process of parsimony that requires intuitive analysis to identify the model that requires the least change to explain the observed data (NEAS, 2008; StatSoft, Inc., 2013).

Box-Jenkins. Problematic data issues in ARIMA can be addressed with Box-Jenkins techniques (NIST, 2012; Parsad et al., 2012; StatSoft, Inc., 2013). The first step was to identify *d,* the integrated stationary periods (I) in the ARIMA model, by using ANOVA *F*-tests and *t* tests and that demonstrate statistically significant periods (Glass et al., 2008; NIST, 2012). Assuming there are two or more stationary periods *d* in the time series, the second step *p* was to determine the autoregressive (AR) portion of the ARIMA model used to identify the autocorrelation of all pairs of values according to the potential time interval lags. This technique is the process of comparing the variation among observations in order to identify its components of autocorrelation, randomness, and residual variation in the differenced time series. When autocorrelation is present, further analysis is necessary to analyze these variances (NIST, 2012; Parsad et al., 2012; StatSoft, Inc., 2013), including Granger-caused implied and expected variances (Wang et al., 2011). The third step *q* was the moving average (MA) part of the ARIMA model the weighted average of current and immediate past values at a defined time interval lag, which is a pragmatic smoothing mechanism not directly linked to a statistical model and that is determined through a comparison of the graphic portrayal of the moving average to NIST logic tables (Glass et al., 2008; NIST, 2012).

Validity and Reliability

The quantitative research design included considerations of whether the test measures what it was intended to measure, which were related to the concerns of internal and external validity. Reliability in test measurement is reviewed as it is a precondition to achieving validity in the quantitative design. Additionally, in order to draw conclusions the overall structure of the quantitative research design must be unbiased and the data trustworthy, which is also given consideration in this section (Creswell, 2009).

Internal validity. Construct validity is established in the quantitative research design by the use of the theoretical framework of public policymaking in order to develop the measuring instrument (Creswell, 2009), which is based upon regulatory policy type leading to CMO changes. Empirical validity is a concern because many factors could invalidate a cause and effect relationship between CDS policy periods and CMOs, so the instrument is limited to identifying patterns rather than the causes of patterns with claims of statistical certitude. Accordingly, the empirical methodology selected is ARIMA modeling rather than linear regression analysis that has an assumption there is enough evidence to test for cause-and-effect relationships (Creswell, 2009; NIST, 2012). Despite the limited claims from ARIMA methods, results could yet be explained by history that remains a threat to the internal validity due to other, undefined events that were concurrent to the periods defined in ARIMA models. History is controlled for in this quantitative design by the use of a macroeconomic control variable, the LPR.

Reliability is the internal consistency in test measurement and is a necessary condition of validity, but does not fully satisfy the requirements of validity (Creswell, 2009). This consistency is internal to the quasiexperiment and is operationalized by clearly defining the variables and the data that are collected and by documenting detailed procedures used in the testing process in order that others may produce the same results in replication (Creswell, 2009). Reliability for the ARIMA model is accomplished by the (p,d,q) determining methodology (Glass et al., 2008). Differencing of CMO data is determined based on the 3 CDS regulatory policy analytical periods in order to define the periods d in which the mean and variance are stationary. The CMO data and control data for these periods were further analyzed for the p autocorrelation function to determine whether observations are a function of a time difference with prior observations. Similarly, q was derived from the NIST (2012) logic table based on the graphical portrayal of moving average data for the CMO data and the control data, resulting in 6 (p,d,q) models.

Threats to validity were mitigated by including research literature-based variables and by designing a representative sample with valid data and sufficient sample sizes for ARIMA modeling (Yaffee, 2003; Yezer, 2010). Rigorous methodology and analyses in the quantitative research design was necessary to attain impartiality (Creswell, 2009), although this alone did not ensure the quantitative study was free from bias because public policy is developed inside a political system with exposure to political preferences and economic philosophies (Anderson, 2006, p. 2; Yezer, 2010). The most trustworthy source of financial system statistical data was the FRS data used in this quantitative design, although its trustworthiness is not definitive in either theory or practice (Creswell, 2009; Ivry, Keoun, & Kuntz, 2011).

External validity. The primary threat to content validity in the quantitative research design was the relevance of the instrument to the variable it was meant to measure. This is a concern of face validity that was present due to the dependent variable CMO being a derivative because its value is derived from another source. The independent variable CDS was stated in regulatory periods, so the instrument was designed with consideration of this limitation. The research literature reviewed in Chapter 2 supported the content validity of this quantitative design involving CDS regulatory periods and CMOs as financial assets. Sampling issues related to external validity were adequately addressed in the design in that the quantitative research setting was the same as the environment to which results are generalized, and the sample was representative of the population (Creswell, 2009). Overall, the external validity of the quasiexperiment is weak due to the United States only population, set time period, and dependence on U.S. laws (Creswell, 2009).

Ethical Procedures

The safety, welfare, and rights of research participants were considered in this quantitative research study in order to protect the privacy of persons. Data in this study were used to interpret patterns in the U.S. financial system to benefit public policymakers constructing financial regulations. Financial results were aggregated from financial institutions and this analysis does not require their identification. The data for the quantitative research study were publicly available and may be collected from Internet sites; there is no identification of persons, or firms, in the data being used. The data observations used in the analysis have been recorded in Appendix B and are openly available to other scholars or researchers in electronic format for 7 years by request to me. The collected data are archived on a personal computer and are not publicly accessible. There are no human subjects involved in this quantitative research design. The Institutional Review Board (IRB) approval number for this research project is 10-18-13-0154510.

Summary

This quantitative research study was designed to demonstrate empirically whether there are patterns in the association between CDS regulations and CMO assets in U.S. financial institutions. The quantitative research question is:

What is the nature of the relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants?

The quantitative study answers this question based in a theoretical framework of public policymaking comparing the rational-comprehensive model and the garbage can model. The quantitative design was formulated from the research literature for the identification of variables and the quantitative methodology used. The ARIMA model fits the stochastic phenomenon that was being studied, which involved quarterly intervals of secondary data from U.S. government financial statistics. The ARIMA modeling parameters provided for a framework stated in CDS regulatory periods that could be analyzed for differences in CMO time series. Understanding the patterns of data over time involving CDSs and CMOs may shed light on the relationship between these two phenomena and aid in public policymaking to identify and contain systemic risks. The results of the ARIMA modeling and testing will be presented in Chapter 4 including tables, charts, and data output along with the analytical procedures performed. In Chapter 5, I interpret the results of the research study.

Chapter 4: Results

Introduction

The purpose of this chapter is to present the results of the quantitative research study. This study was based on the following quantitative research question: What is the nature of the relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants?

The null (H_0) and alternate (H_A1 and H_A2) hypotheses were based upon the theoretical framework in which two contrasting public policymaking models are considered (the garbage can model and the rational-comprehensive model) for two CDS regulations (the CFMA and the EESA).

> *Null hypothesis* (H_0): There is no statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

The first alternate hypothesis (H_A1) was derived from the garbage can policy model in which a *reactive* policy was implemented, with a *negative* relationship between CDS policy and CMO capital flows. The garbage can model is associated with reactive policymaking and is defined in detail in the Definitions section. A negative relationship is a policy result in which the presence of the regulation is associated with the measure of an unfavorable result.

> *Alternate research hypothesis* A1 (H_A1): There is a negative and statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

The second alternate hypothesis (H_A2) was derived from the rational-comprehensive policy model in which a *proactive* policy was implemented, with a *positive* relationship between CDS policy and increasing CMO capital flows. The rational-comprehensive policy model is associated with proactive policymaking and is defined in detail in the Definitions section. A positive relationship is a policy result in which the presence of the regulation is associated with the measure of a favorable result.

> *Alternate research hypothesis* A2 (H_A2): There is a positive and statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

Chapter 4 consists of data collection highlights, the results, and a summary of the findings of the ARIMA modeling.

Data Collection

The data were collected and analyzed with ARIMA modeling according to the plan I presented in Chapter 3. The dependent variable COLLMO is Collateralized Mortgage Obligations (CMOs; measured in millions of U.S. dollars once per quarter) and consisted of 95 data points. These data are summarized in Table 3 and presented graphically in Figure 1.

Table 3

Data Characteristics of the Sample and Three ARIMA Modeling Periods for the Dependent and Control Variables

Data characteristic	Sample	Period 1 1989 - 2000 Unregulated	Period 2 2001 – 2008 Favorable	Period 3 2008 - 2013 Unfavorable
Starting Quarter (Q)	3Q 1989	3Q 1989	1Q 2001	4Q 2008
Ending Quarter (Q)	1Q 2013	4Q 2000	3Q 2008	1Q 2013
Number of observations	95	46	31	18
<u>CMOs in millions of dollars</u>				
Minimum dollar value	143,378	143,378	808,450	1,485,216
Maximum dollar value	3,215,406	776,275	3,215,406	2,815,334
Mean	1,242,171	448,737	1,978,773	2,001,241
Median	830,830	444,289	1,814,582	1,910,515
<u>LPR</u>				
Minimum ratio value	63.3	66.0	65.8	63.3
Maximum ratio value	67.3	67.3	67.2	65.8
Mean	66.1	66.7	66.2	64.4
Median	66.4	66.7	66.1	64.3

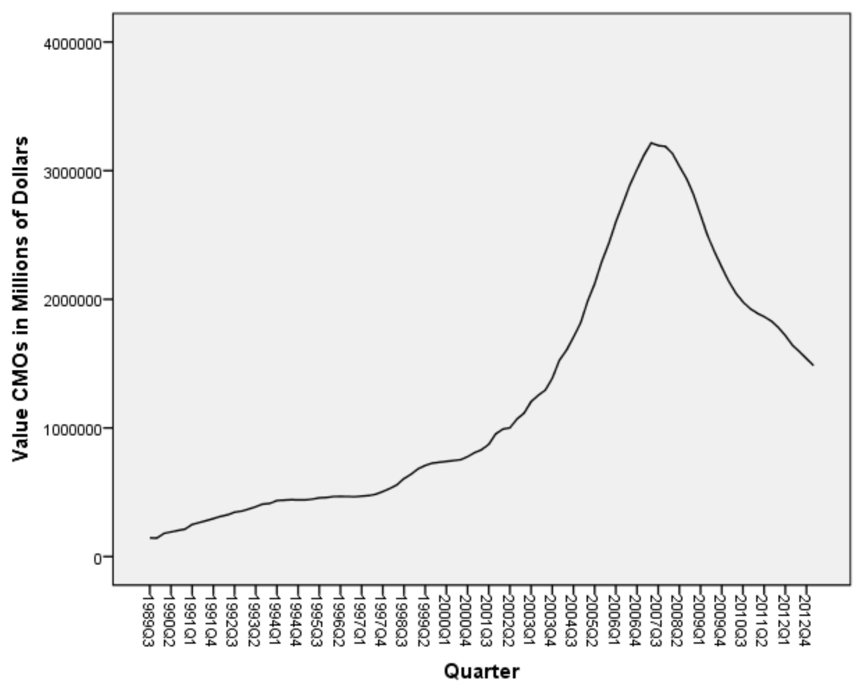

Figure 1. The value of CMOs in millions of dollars measured over the period of 95 quarters 1989 to 2013. CMOs increased consistently when unregulated, grew and then declined under favorable regulation, and continued to decline under unfavorable regulation.

The control variable LABORP is the LPR which is the employment-to-population ratio. These data are presented graphically in Figure 2 and summarized in Table 3. The collected data are assumed to be current, accurate, and complete when reported by the FRS. The sample is representative of the population of CMOs and labor participation rate during the time frame studied.

Figure 2. The value of the labor participation rate measured over the period of 95 quarters (1989 to 2013). The employment-to-population ratio fluctuated while declining over the long-term through periods of no CDS regulation, favorable CDS regulation, and unfavorable CDS regulation.

Results of the Study

I present the results of this quantitative study in this section, beginning with the data characteristics of the sample. The results of ANOVA *F*-tests and *t* tests were the time series was not a uniform or randomly distributed data set, so additional testing proceeded. Data transformation procedures consisted of analysis and correction for outliers, heteroskedasticity, and seasonality. The time series had no outliers, although these were present in some of the ARIMA model parameters. The Breusch-Pagan test resulted in the finding of homoskedasticity of variable residuals, so that no correction to the data was necessary. Seasonality was present in the CMO data and was corrected by data transformation. The spectral analysis procedure was used to confirm that no significant periodicities were present in the time series other than seasonality.

Initial ARIMA modeling resulted in three distinct stationary periods of the dependent variable, CMOs. These stationary periods corresponded to the two CDS regulatory events (the independent variables) after making appropriate adjustments to the starting and ending quarters. The six ARIMA (*p,d,q*,) models evaluated consisted of three stationary periods with two variables, the dependent variable CMOs and the control variable. Statistically significant parameters were identified in the AR (autoregressive) and MA (moving average) components of the ARIMA (*p,d,q*,) models as a result of testing multiple configurations. ARIMA (*p,d,q*,) models were refined based on the autocorrelation and the partial autocorrelation present in these models. Statistical testing of these ARIMA (*p,d,q*,) models was performed and statistically significant covariation with $p \leq .05$ was found in 1 of the 6 models. The null and alternative hypotheses were evaluated based on these statistical findings.

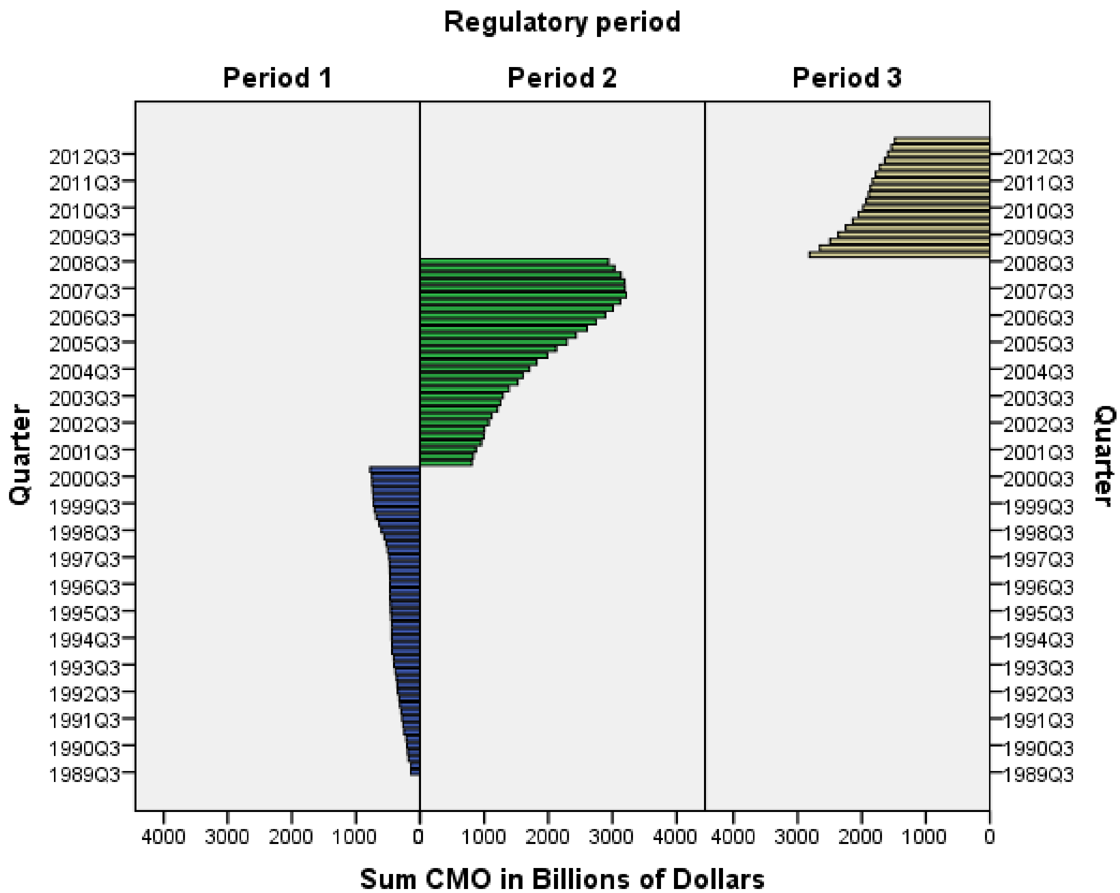

Figure 3. The value of CMOs in billions of dollars measured over the 3 periods created by the CFMA and EESA regulations (1989 to 2013). Period 1 was prior to CDS regulation. Period 2 was after the CFMA and contained the housing peak and the onset of the global financial crisis. Period 3 was after the EESA.

ANOVA *F*-Tests Results

ANOVA *F*-tests were performed and it was determined that the time series of the dependent variable comprised two or more different periods, rather than being a uniform set of data. These results mean the data are not random and that the ARIMA model is not *I*(1). An ANOVA was conducted to evaluate the relationship between CDS regulatory periods and CMOs (measured in millions of dollars). The factors tested consisted of two CDS regulations resulting in three CDS regulatory periods. The dependent variable was CMOs in U.S. financial institutions (measured in millions of dollars each quarter). The ANOVA was statistically significant, $F_{(2, 92)} = 95.32$, $p \leq .00$. The strength of the relationship between the CDS regulatory periods and CMOs (measured in millions of dollars each quarter), as assessed by η^2, was strong, with the CDS regulatory periods accounting for 67% of the variance of the dependent variable.

Follow-up tests were conducted to evaluate differences among the means. Because the variances of CMOs (measured in millions of dollars) among the three periods ranged from 3.051×10^{10} to 7.737×10^{11}, I chose not to assume the variances were homogenous and conducted post hoc comparisons with the use of Dunnett's *C* test, a test that does not assume equal variances among the three CDS regulatory periods. There was a statistically significant difference in the means between the period in which there was favorable CDS (period 2) regulation with the CFMA and the period in which there was no regulation (period 1), but no significant differences between the periods of favorable CDS regulation (period 2) with the CFMA and unfavorable CDS regulation with the EESA (period 3). The period that had unfavorable CDS regulation with the EESA (period 3) showed a greater amount of CMOs (measured in millions of dollars each quarter) in comparison to the period in which there was no regulation (period 1). The 95% confidence intervals for the pairwise comparisons of the means, as well as the means and standard deviation for the three CDS regulatory periods, are shown in Table 4.

Table 4

Ninety-five Percent (95%) Confidence Internals of Pairwise Comparisons in Mean Changes in CMOs in Millions of Dollars

Regulatory period	$\bar{x}$	*sd*	Unregulated	Favorable regulation
Pair 1– Period 1 Unreg	$354,072	$108,960		
Pair 1– Period 2 CFMA	$1,978,773	$879,602	-$1,910,251 to -$1,339,151*	
Pair 2– Period 1 Unreg	$282,229	$88,314		
Pairs 2, 3– Period 3 EESA	$2,001,241	$384,497	-$1,906,284 to -$1,531,739*	-$914,665 to -$472,576*
Pair 3– Period 2 CFMA	$1,307,620	$403,670		

Note. An asterisk indicates that the 95% confidence interval does not contain zero, and therefore the difference in means is statistically significant at the .05 significance using Dunnett's *C* procedure.

t-Tests Results

Since statistically significant periods were found using ANOVA, *t* tests were performed on the data. Paired-samples *t* tests were conducted to evaluate whether CMOs (measured in millions of dollars each quarter) were different between the CDS regulatory periods as a check to proceed with modeling. The results for the first of three paired comparisons indicated that the mean for the unregulated CDS period ($\bar{x}$ = 354071.84, *sd* = 108959.96) was significantly different than the mean for the favorable CDS regulation period with the CFMA ($\bar{x}$ = 1978773.00, *sd* = 879601.61), $t_{(30)} = -11.62$, $p \leq .00$. The standardized effect size index, *d*, was 2.09, indicating a large effect, with no overlap in the distributions of CMOs measured in millions of dollars in quarterly intervals as shown in Figure 4. The 95% confidence interval for the mean difference between these 2 periods was −1910250.87 to −1339151.45. For the second paired comparison, the mean for the unregulated CDS period ($\bar{x}$ = 282229.06, *sd* = 88313.84) was significantly different than the mean for the unfavorable CDS regulation period with the EESA ($\bar{x}$ = 2001240.61, *sd* = 384497.02), $t_{(17)} = -19.37$, $p \leq .00$. The standardized effect size index, *d*, was 4.57, indicating a large effect, with no overlap in the distributions of CMOs measured in millions of dollars by quarter. The 95% confidence interval for the mean difference between these 2 periods was −1906283.63 to −1531739.48. For the third paired comparison, the mean for the favorable CDS regulation period with the CFMA ($\bar{x}$ = 1307620.33, *sd* = 403670.12) was different than the mean for the unfavorable CDS regulation period with the EESA ($\bar{x}$ = 2001240.61, *sd* = 384497.02), $t_{(17)} = -6.62$, $p \leq .00$, but not significantly. The standardized effect size index, *d*, was 1.56, indicating a large effect, with considerable overlap in the distributions of CMOs measured in millions of dollars by quarter. The 95% confidence interval for the mean difference between periods 2 and 3 was −914664.73 to −472575.82. Although the difference between periods 2 and 3 was not statistically different based on the *t* test, there was statistically significant negative correlation between these periods, $r = -.91$, $n = 18$, $p \leq .000$, warranting further investigation and modeling.

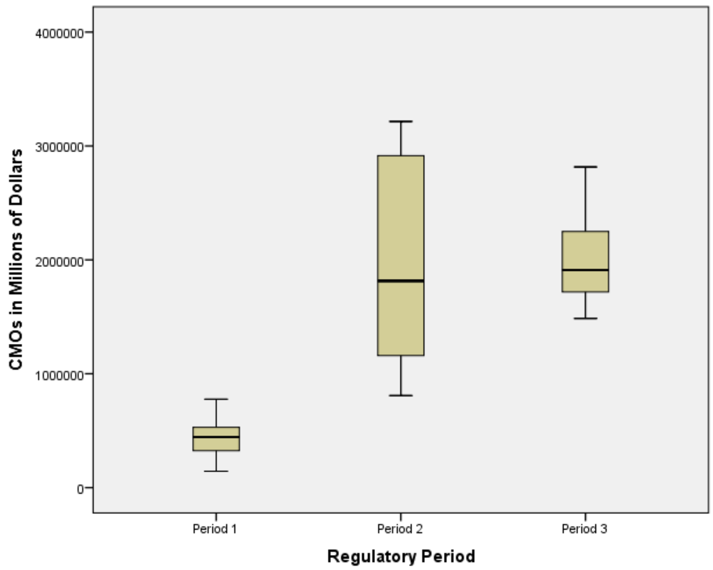

Figure 4. The distributions of CMOs (measured in millions of dollars) had no overlap between period 1 and periods 2 and 3, although period 3 fully overlapped with period 2.

Data Transformation

Data transformation preceded the ARIMA modeling, consisting of procedures for outliers, heteroskedasticity, and seasonality, including spectral analysis. This transformation was performed for the CMO time series data. The control variable was already stated on a nonseasonal basis.

Outliers. The data was analyzed for outliers in the univariate time series, distinctly from the outlier analysis conducted in the ARIMA modeling. The data was normalized into *z*-scores, or standard scores, which is the number of standard deviations an observation is above the mean. The *z*-score threshold was set at plus or minus 3.0 because the sample exceeded 80 observations. The lowest *z*-score value was -1.16760 and the highest was 2.09681. No outliers were identified either at the stated threshold of plus or minus 3.0 or at the lower threshold of plus or minus 2.5, which is common for small samples like those not exceeding 80 observations. Accordingly, no changes were made to the data.

Heteroskedasticity. The Breusch-Pagan test was used to test for heteroskedasticity in the raw data by testing whether the estimated variance of the residuals from a regression was dependent on the values of the independent variables. In R, this test was performed by the function ncvTest in the Companion to Applied Regression (CAR) package. The null hypothesis that the variance was constant, indicating that the model error is homoskedastic, was accepted. For the 3 CDS regulatory periods the Chi-square (χ^2) was small and there was no associated statistical significance measured at the .05 significance. Accordingly, no changes were made to the data. The Breusch-Pagan test results and findings are shown in Table 5.

Table 5

Breusch-Pagan Test Results for Heteroskedasticity

Regulatory period	Chi-squared	Significance*	Result	Finding
Period 1 No regulation	.190	.663	Accept Null	Homoskedasticity
Period 2 CFMA	2.958	.085	Accept Null	Homoskedasticity
Period 3 EESA	.660	.417	Accept Null	Homoskedasticity

Note. An asterisk indicates that the test is significant at $p \leq .05$.

Seasonality. The CMO quarterly time series was transformed into a seasonally adjusted series through seasonal decomposition. The data indicated mild seasonal influences, with seasonal adjustment factors by quarterly periods of 99.9, 99.5, 100.7, and 99.9, respectively. Expectations about seasonality were confirmed with spectral plots and through this spectral analysis procedure it was verified that no other significant periodicities were present in the time series.

Spectral analysis. Peaks in the periodogram around .025 and .05 indicated the lower frequency to be dominant, which was consistent with a smooth times series of nonrandom data. The periodogram is shown in Figure 5. The spectral density plot excluded background noise from fluctuations caused by the nonperiodic component of the data and was a smoothed version of Figure 5. This plot confirmed the existence of a trend or underlying cycle in this time series of CMO data. The trend identified in the periodogram was confirmed from the autocorrelation function (ACF) of the series. In both the raw data and seasonally adjusted series, autocorrelation was present in 5 lags at the first differencing and residual autocorrelation was present in 2 lags at zero differencing.

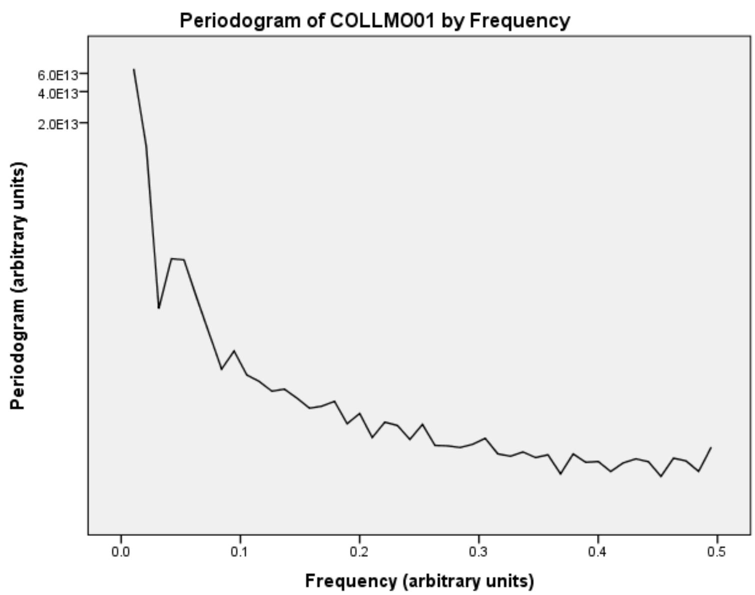

Figure 5. The plot of the periodogram shows dominant signals of frequency at the lower frequencies and some periodicity.

ARIMA Modeling

The ARIMA modeling was a multistep, iterative process that consisted of evaluating the data for stationarity, determining ARIMA (*p,d,q*,) models for evaluation, and analyzing the statistical results. This section includes the results of each step of the ARIMA modeling and the associated statistical results. The hypotheses are tested in the section that follows, with this testing based on the ARIMA model findings.

Stationarity. The seasonally adjusted series of CMO data was not stationary as a whole due to the presence of multiple periods and trends. As shown in Figure 6, the first CDS regulatory period straddles the mean, the second regulatory period is mostly above the mean, and the third regulatory period is below the mean. In addition to first order linear trends and second order quadratic trends throughout the time series, a third order trend was present in the initial 6 quarters of CMO data, as shown in Figure 7.

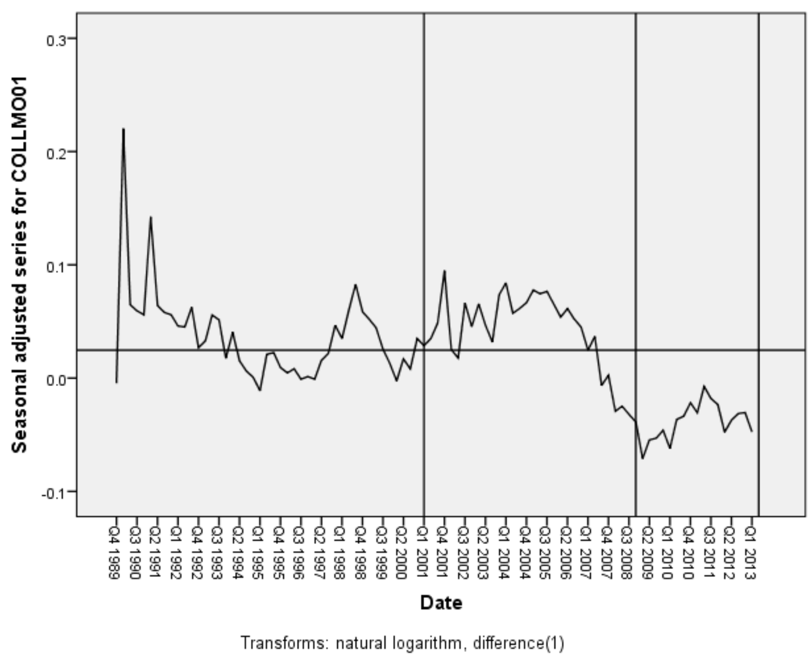

Figure 6. The seasonally adjusted series for CMO data from 1989 to 2013 is not stationary after removing first order linear trends, as shown in this line chart. The horizontal line represents the mean of the series and the vertical lines represent the modeled CDS regulatory periods.

The data was transformed using natural logarithms due to measurements of trillions of dollars with a wide range of values. This transformed data aided modeling by restoring symmetry to the mean and median distributions. Seasonally adjusted data at lag 4 was used, reflecting a linkage of quarterly values.

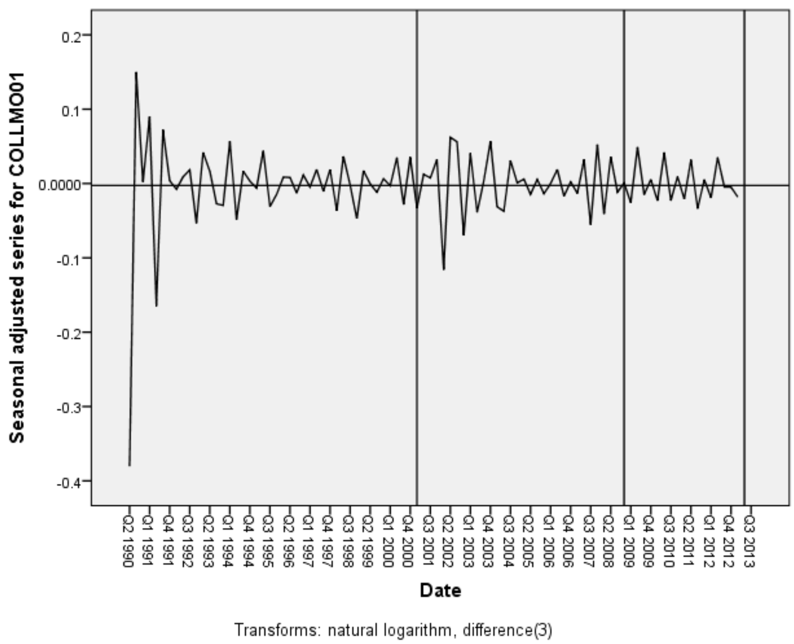

Figure 7. In addition to first order linear trends and second order quadratic trends, a third order trend was present in the start of the seasonally adjusted series for the CMO data transformed into natural logarithm, which is plainly seen in the far left of the chart.

The CMOs time series was divided into 3 CDS regulatory periods for ARIMA modeling and these periods were all diagnosed to be stationary, as shown in Table 6. This table shows the CDS regulatory periods, stationarity, differencing, and the adjustments required that correspond to the revised start and end quarters. The differencing is the *d* value for ARIMA modeling. The supporting evidence for Table 6 is in Appendix C, Tables C1 through C5.

Table 6

CDS Regulatory Periods and Findings for ARIMA Modeling Differencing

Period	Finding	Differencing (*d*)	Adjusted start	Adjusted end	Revised start	Revised end
1	Stationary	1	- 6	0	1Q 1991	4Q 2000
2	Stationary	2	0	- 1	1Q 2001	2Q 2008
3	Stationary	1	- 1	- 1	1Q 2009	4Q 2012

The first CDS regulatory period was stationary at the first order differencing after the initial 6 quarters were eliminated, as shown in Figure 8. This was the most significant adjustment made to the CDS regulatory periods. The twofold rationale to the adjustment was the presence of a third order trend in the initial observations of the time series and the 40 subsequent observations that were stationary in the first CDS regulatory period.

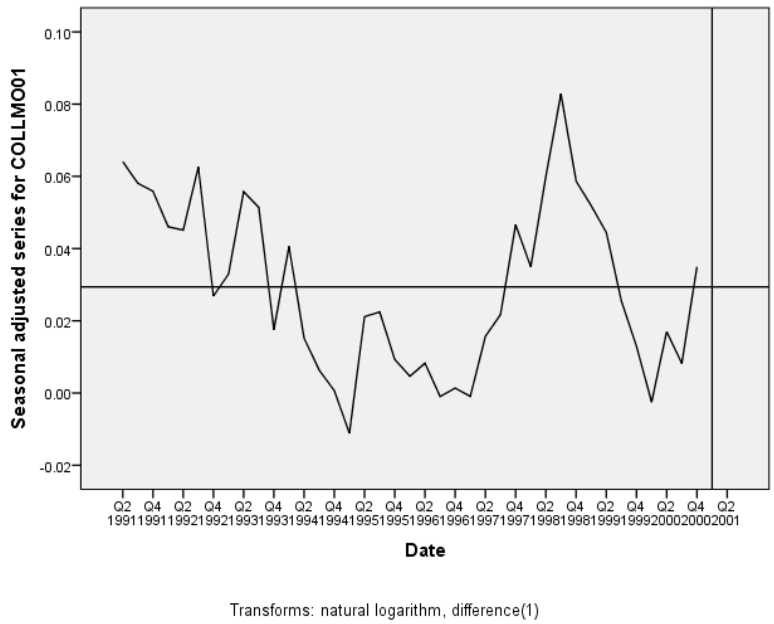

Figure 8. The first modeled CDS regulatory period was made stationary by removing the third order trend contained in the first 6 quarters of the 46-quarter CMO time series. Conversely, the stationarity was not impacted by extending or contracting the end of this first period up to 3 quarters. Moderate spikes remained in this period extending .06 from the mean that intercepted the y-axis at .03.

The second CDS regulatory period had a linear trend, shown in Figure 9, that made this period nonstationary in the first order differencing. After removing the last quarter in the modeled period, this CDS regulatory period was diagnosed to be stationary in the second order differencing, which is shown in Figure 10. The third CDS regulatory period was diagnosed to be stationary in first order differencing after removing the first and last quarters, as shown in Figure 11.

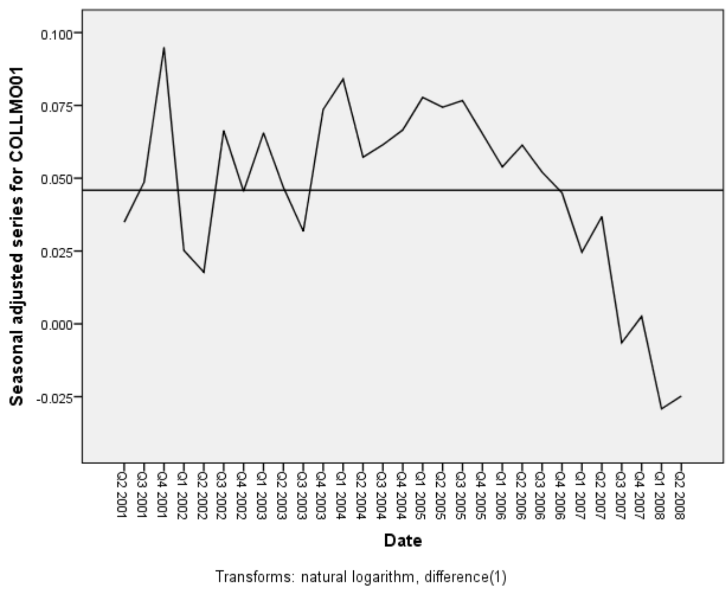

Figure 9. The second modeled CDS regulatory period was not stationary in the first differencing due to a consistent downward trend in the final third of the data series.

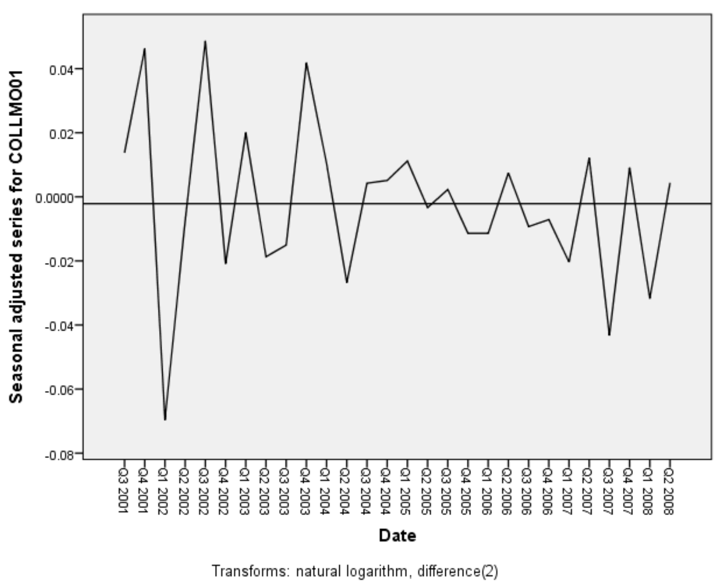

Figure 10. The second modeled CDS regulatory period was stationary in the second differencing when contracted by 1 quarter at the end of this time series (2001 to 2008). Moderate spikes remained in this period extending .07 from the mean that intercepted the y-axis at .00.

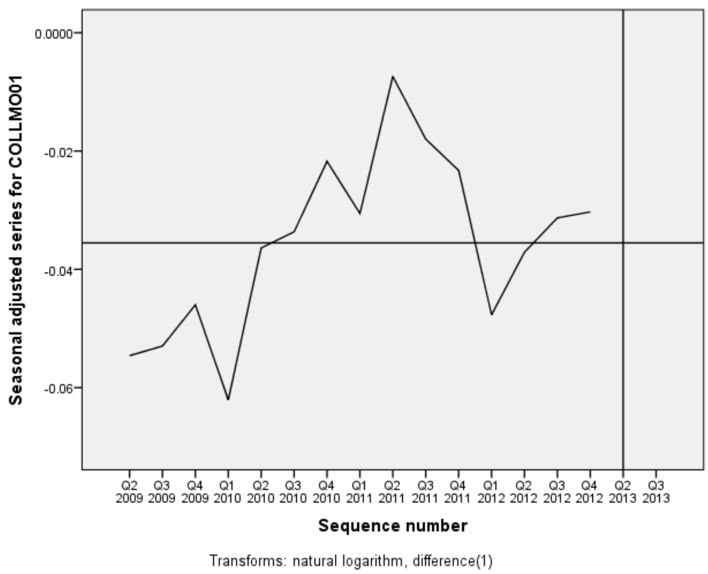

Figure 11. The third modeled CDS regulatory period was stationary in the first differencing when contracted by a quarter at the start and end of this time series (2009 to 2012). Moderate spikes remained in this period extending .03 from the mean that intercepted the y-axis at −.04.

The control variable contained linear trends, as shown in the labor participation rate in Figure 2. This variable was confirmed to have been seasonally adjusted and diagnosed to be stationary in the first order differencing, which is shown in Figure 12. There was no trend pattern identified in the labor participation rate by CDS regulatory period.

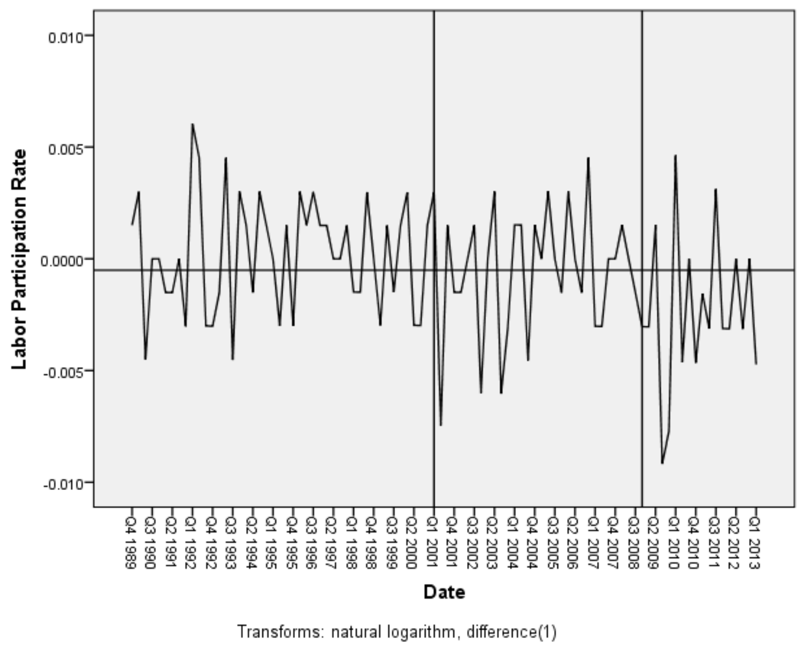

Figure 12. The labor participation rate data was stationary in the first differencing. Mild spikes remained in this period extending .01 from the mean that intercepted the y-axis at .00.

Best Fit Models

Statistically significant versions of the stationary CMO and control variable (*p,d,q*) models were diagnosed for the best fit. The supporting evidence for the statistically significant parameters is in Appendix C, Tables C6 through C8. Choice of the best (*p,d,q*) models was based on *t* scores, residual autocorrelation (ACF), residual partial autocorrelation (PACF), and mean absolute percentage error (MAPE). The supporting evidence and associated discussion for these best fit models is in Appendix C, Tables C9 through C15. The best fit (*p,d,q*) models by regulatory period from the statistically significant alternatives are denoted with an asterisk.

	Period 1 Model	Period 2 Model	Period 3 Model
CMO	(0,1,0)	(0,2,2)	(0,1,0)
	(0,1,1)	(1,2,0)	(1,1,0)*
	(0,1,2)	(1,2,1)*	(1,1,1)
	(1,1,0)	(2,2,0)	(1,1,2)
	(1,1,1)*	(2,2,1)	(2,1,0)
	(1,1,2)		(2,1,1)
	(2,1,0)		(2,1,2)
	(2,1,2)		
control	(1,2,0)	(0,1,2)	(1,1,1)
	(1,2,2)	(1,1,2)	(1,1,2)*
	(2,2,0)	(2,1,1)	(2,1,2)
	(1,3,0)	(2,1,2)*	(0,2,2)
	(1,3,1)	(0,2,1)	(1,2,0)
	(1,3,2)	(0,2,2)	(1,2,1)
	(2,3,0)*	(1,2,0)	(2,2,0)
	(2,3,1)	(1,2,1)	(2,2,1)
	(2,3,2)	(1,2,2)	
		(2,2,0)	
		(2,2,1)	
		(2,2,2)	

The best fit ARIMA (*p,d,q*) models for seasonally adjusted CMO were (1,1,1) in period 1, (1,2,1) in period 2, and (1,1,0) in period 3. CMO period 1 had a better fitting model without the seasonal adjustment, as measured by *t* score and shown in Table 7. The best fit ARIMA (*p,d,q*) models for the control variable were (2,3,0) in period 1, (2,1,2) in period 2, and (1,1,2) in period 3.

The residual autocorrelation (ACF) and residual partial autocorrelation (PACF) charts that corresponded to the best (*p,d,q*) models for CMO and the control variable are shown in Figures 13 through 18. The residual ACF portion of the plots were within ARIMA tolerances and demonstrated that the lingering effects of preceding values impacting *p* did not necessitate an additional parameter to the model. The residual PACF portion of the plots were within ARIMA tolerances and demonstrated that the lingering effects of preceding random shocks impacting *q* did not necessitate an additional parameter to the model.

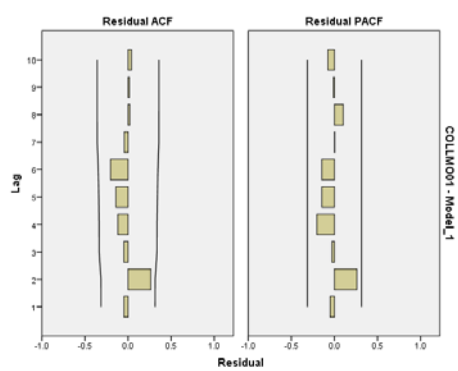

Figure 13. Period 1 CMO (1,1,1) (1989 to 2000)

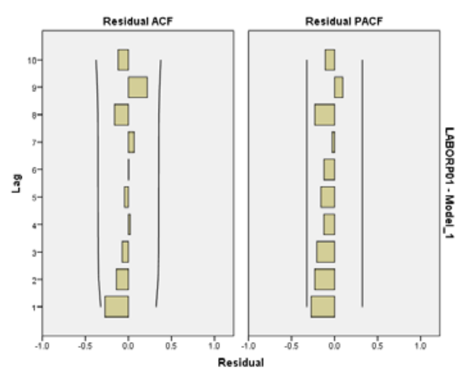

Figure 14. Period 1 Control (2,3,0) (1989 to 2000)

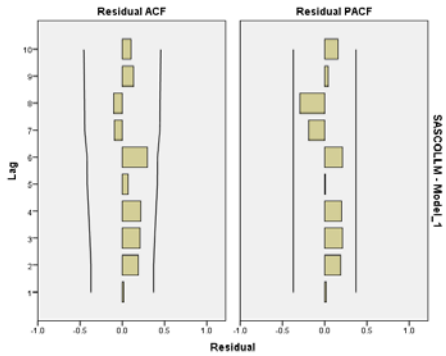

Figure 15. Period 2 CMO (1,2,1) (2001 to 2008)

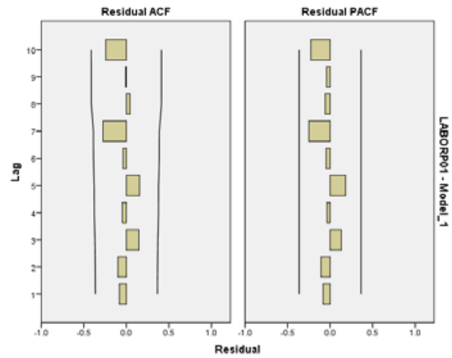

Figure 16. Period 2 Control (2,1,2) (2001 to 2008)

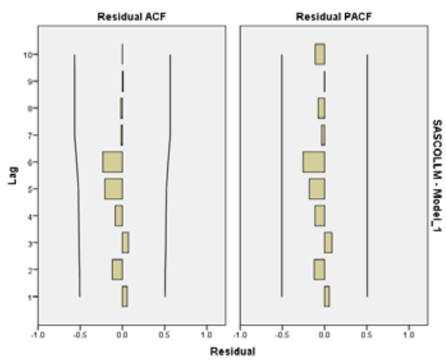

Figure 17. Period 3 CMO (1,1,0) (2009 to 2012)

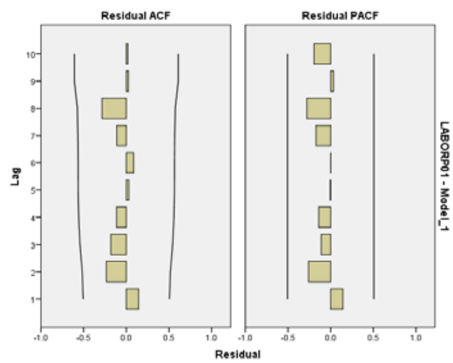

Figure 18. Period 3 Control (1,1,2) (2009 to 2012)

CMO models. The period 1 CMO ARIMA model was (1,1,1), as shown in Figure 13 and in Table 7, and contained 40 observations from 1Q 1991 to 4Q 2000. This ARIMA model is a differenced first-order, mixed model with autoregressive and moving average components, with details in Table C9. The nonseasonal version of this model had a higher *t* score and was a better fit than the seasonally adjusted version, as shown in Table C15. The model had a statistically significant autoregressive parameter of .949 with $t = 19.407$, $p \leq .00$ and moving average parameter of .189 with $t = 1.041$, $p = .305$.

The *Q*-statistic of 12.316 with insignificance of .722 indicated overall goodness of fit based on the randomness of the autocorrelation. The time series Granger-cause CMO values, as shown in Table C16.

Table 7

Best Fit (p,d,q) ARIMA Models and Seasonality

Period	Variable	*d*	(*p*,*q*)	Seasonality	*p*-Value
1	CMO	1	(1,1)	Not Seasonally Adjusted	.000*
2	CMO	2	(1,1)	Seasonally Adjusted	.000*
3	CMO	1	(1,0)	Seasonally Adjusted	.000*
1	Control	3	(2,0)	NA	.000*
2	Control	1	(2,2)	NA	.000*
3	Control	1	(1,2)	NA	.000*

Note. The control variable data are already seasonally adjusted. The best *p*-value is given in instances of multiple parameters.
* $p < .05$.

The period 2 CMO ARIMA model was (1,2,1), as shown in Figure 15 and Table 7, and contained 30 observations from 1Q 2001 to 2Q 2008. This ARIMA model is a differenced second-order, mixed model with autoregressive and moving average components, with details in Table C11. The seasonally adjusted version of this model had a higher *t* score and was a better fit than the nonseasonal version, as shown in Table C15. The model had a statistically significant autoregressive parameter of −.934 with $t = -9.492$, $p \leq .00$, and a statistically significant moving average parameter of −.55 with $t =$

-2.228, $p = .036$. The Q-statistic of 18.312 with insignificance of .306 indicated overall goodness of fit based on the randomness of the autocorrelation. The time series Granger-cause CMO values, as shown in Table C16.

The period 3 CMO ARIMA model was (1,1,0), as shown in Figure 17 and Table 7, and contained 16 observations from 1Q 2009 to 4Q 2012. This ARIMA model is a differenced first-order, autoregressive model, with details in Table C13. The seasonally adjusted version of this model had a higher t score and was a better fit than the nonseasonal version, as shown in Table C15. The model had a statistically significant autoregressive parameter of .98 with $t = 32.556$, $p \leq .00$. The Q-statistic was undetermined in this period. The time series Granger-cause CMO values, as shown in Table C16.

Control models. The period 1 control ARIMA model was (2,3,0), as shown in Figure 14 and Table 7. This ARIMA model is a differenced third-order, autoregressive model, with details in Table C10. The model had statistically significant autoregressive parameters of -1.243 with $\mathrm{t} = -9.71$, $p \leq .00$ and $-.725$ with $\mathrm{t} = -5.693$, $p \leq .00$. The Q-statistic of 13.692 with insignificance of .622 indicated overall goodness of fit based on the randomness of the autocorrelation. The time series Granger-cause labor participation rate values, as shown in Table C16.

The period 2 control ARIMA model was (2,1,2), as shown in Figure 16 and Table 7. This ARIMA model is a differenced first-order, mixed model with autoregressive and moving average components, with details in Table C12. The model had statistically significant autoregressive parameters of −.276 with $t = -3.021$, $p = .006$ and −.93 with $t = -11.76$, $p \leq .00$. The moving average parameters were −1 with $t = -5.652$, $p \leq .00$ and −.096 with $t = -.535$, $p = .597$. The *Q*-statistic of 14.012 with insignificance of .449 indicated overall goodness of fit based on the randomness of the autocorrelation. The time series Granger-cause labor participation rate values, as shown in Table C16.

The period 3 control ARIMA model was (1,1,2), as shown in Figure 18 and Table 7. This ARIMA model is a first-order differenced, mixed model with autoregressive and moving average parameters, with details in Table C14. The model had a statistically significant autoregressive parameter of .968 with $t = 18.492$, $p \leq .00$. The moving average parameters were 1.488 with $t = 4.254$, $p = .001$ and −.704 with $t = -1.986$, $p = .07$. The *Q*-statistic was undetermined in this period. The time series Granger-cause labor participation rate values, as shown in Appendix C, Table C16.

The modeled labor participation rate was the control variable, which did not have significant changes during the regulatory periods. The best fit ARIMA control models varied across these periods, with first-order and third-order trends and varying lags of autocorrelation and partial autocorrelation. The control model suggested that the labor participation rate was heavily influenced by outside variables.

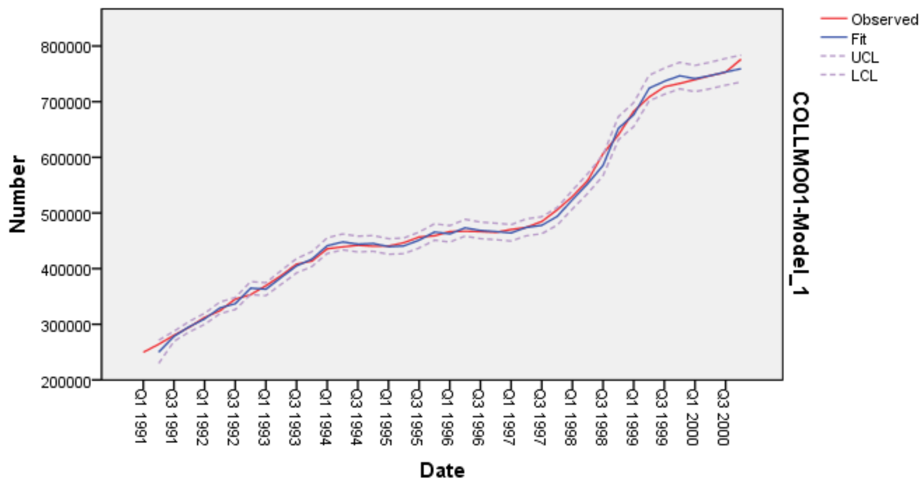

Figure 19. Period 1 CMO is an ARIMA model of (1,1,1) (1989 to 2000) with an AR parameter of .949 and some MA smoothing. This linear trend of CMO before CDSs regulation grows and then flattens at varying rates.

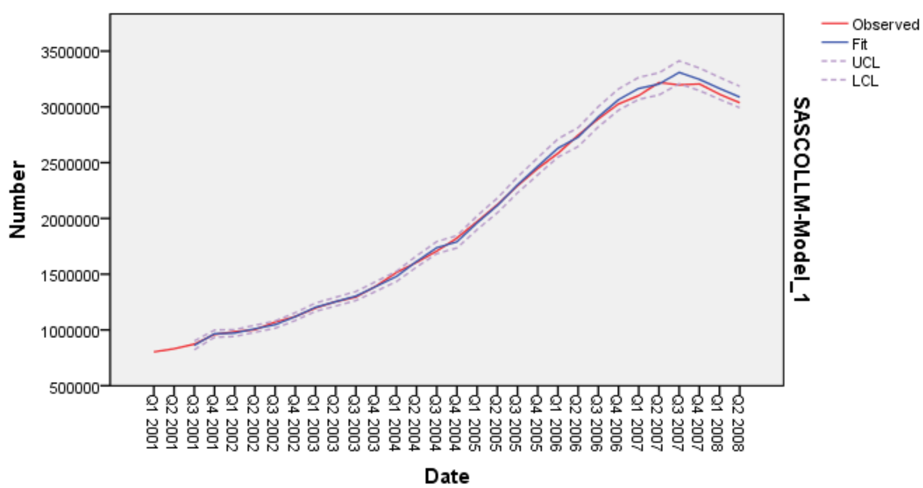

Figure 20. Period 2 CMO is an ARIMA model of (1,2,1) (2001 to 2008) with an AR parameter of −.934 and some MA smoothing. The AR parameter is negative, indicating a turn in the CMO series, and this second-order change under CDSs deregulation (the CFMA) is parabolic.

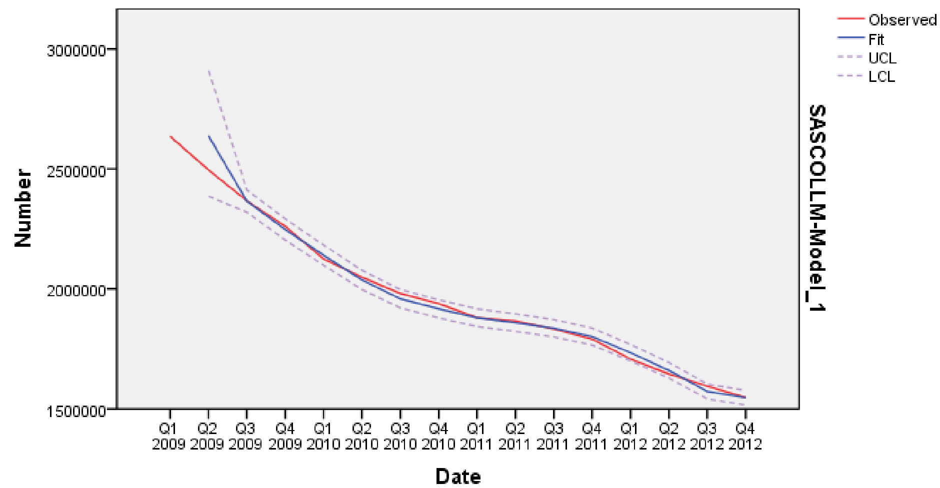

Figure 21. Period 3 CMO is an ARIMA model of (1,1,0) (2009 to 2012) with an AR parameter of .98. This linear trend of CMO under CDSs regulation (the EESA) declines regularly at the rate of 1 lag from the preceding value, together with MA noise.

Hypotheses

The null (H_0) and alternate (H_A1 and H_A2) hypotheses were based upon the theoretical framework in which two contrasting public policymaking models were considered (the garbage can model and the rational-comprehensive model) for two CDS regulations (the CFMA and the EESA). These hypotheses are presented and tested based on the statistical results of the ARIMA modeling. ARIMA modeling period 2 corresponds to the first set of hypotheses with the CFMA, and ARIMA modeling period 3 corresponds to the second set of hypotheses with the EESA.

Null hypothesis 1 (H_01): There is no statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S.

dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

Alternate research hypothesis 1 (H_A1): There is a negative and statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

Alternate research hypothesis 2 (H_A2): There is a positive and statistically significant relationship between the independent variables—CDSs regulations (the CFMA and the EESA) and the dependent variable—flow of capital into CMOs (as measured by millions of U.S. dollars each quarter) when lenders share their borrower-related loan risks through intermediaries with other market participants.

Test ($H_{\mathbf{A}}1$): Reject the null hypothesis. Accept the alternate research hypothesis A2.

Null hypothesis 2 (H_02): There is no statistically significant relationship between CDS regulation under the EESA and the flow of capital into CMOs (as measured by millions of U.S. dollars) when lenders share their borrower-related loan risks through intermediaries with other market participants.

Alternate research hypothesis 3 (H_A3): There is a negative and statistically significant relationship between CDS regulation under the EESA and the flow of capital into CMOs (as measured by millions of U.S. dollars) when lenders share their borrower-related loan risks through intermediaries with other market participants.

Alternate research hypothesis 4 (H_A4): There is a positive and statistically significant relationship between CDS regulation under the EESA and the flow of capital into CMOs (as measured by millions of U.S. dollars) when lenders share their borrower-related loan risks through intermediaries with other market participants.

Test (H_A4): Accept the null hypothesis.

Summary

The research study results showed mixed results for the relationship between CDS regulations and CMOs as measured by millions of U.S. dollars. Under the CFMA regulation between 1Q 2001 and 2Q 2008, there was a statistically significant and positive relationship between CDS regulation and CMOs when lenders shared their borrower-related loan risks through intermediaries with other market participants. Yet, for the period between 1Q 2009 and 4Q 2012, under the EESA regulation, there was no statistically significant relationship between CDS regulation and CMOs. The results under the EESA regulation were similar to the period between 1Q 1991 and 4Q 2000 when there was no regulation concerning CDSs. Throughout the three periods analyzed, the labor participation rate as a control variable was not statistically significant. In Chapter 5 I present and interpret the research findings and limitations along with recommendations for further study and implications for positive social change.

Chapter 5: Conclusion

Introduction

The purpose of this quantitative study was to better understand how the movement of capital in the system of privately owned financial institutions is related to regulatory actions. This quantitative study used a time series design incorporating an ARIMA model for determining the relationship between regulations and associated financial system results. The study was conducted to determine whether the independent variables of regulatory decisions involving CDSs, which are defined as the CFMA and the EESA, were related to the dependent variable of capital in the U.S. financial system that is deployed to CMOs, as measured in millions of dollars each quarter. The key findings are the presence of a statistically significant relationship between CDS regulation and CMOs results at $p < .05$ under the CFMA and a negative correlation between the CFMA and the EESA periods, with $r = -.91$, $n = 18$, $p < .001$. In Chapter 5 I provide an interpretation of the research findings. Further, I consider the implications of the research for positive social change and make recommendations for action and for further research.

Interpretation of Findings

The findings of the quantitative research project extended knowledge in the discipline of financial system regulation by demonstrating a relationship between CDS regulation under the CFMA and CMOs results in the financial system. This relationship was evidence of capital movement involving CMOs that was related to financial system regulation though without an assertion that the capital movement was caused by regulation. There might have been multiple factors or causes of CMOs results that were not related to the CDS regulations examined in this research project. Furthermore, there was no evidence of such a relationship between the EESA and CMOs results, which supported the interpretation that CDS regulation is one factor related to CMOs results rather than either a universal or causal explanation. Despite the limitations surrounding the findings of this research project, this empirical evidence contributes to the ongoing development of pathway models and causal analysis involving the impact of CDS regulation.

As I discussed in the Chapter 2 literature review, capital movement is inherently destabilizing to the financial system. Capital stability was identified as a type of capital movement that included changes to the regulatory framework that cause instability. The CFMA was a change to the regulatory framework to the extent it was legislation that encouraged the use of CDS by financial institutions, even though this legislation was technically a matter of *not* regulating CDS. The quantitative research project demonstrated that a change in the CDS regulatory framework was related to a change in CMOs results. This relationship is important because it is an instance in which a change in the regulatory framework is linked to a U.S. financial system result that was only an indirect object of the regulation. Such relationships raise concerns of unintended consequences of CDS regulation.

The types of capital movement discussed in Chapter 2 also included capital mobility and capital arbitrage. CDSs were a key financial instrument innovation preceding the CFMA period of 1Q 2001 to 2Q 2008 and such financial instrument innovation was associated with capital mobility. In addition to capital movement related to change in the regulatory framework and to financial instrument innovation, during this period there was capital arbitrage related to mortgage securities derivatives transactions, particularly CMOs and CDSs. Accordingly, the capital movement associated with the change in CMOs during the CFMA period cannot be attributed to any one type of capital movement.

The EESA period of 1Q 2009 to 4Q 2012 shared attributes of capital movement with the CFMA period while diverging in important ways. The EESA was related to change in the regulatory framework like the CFMA, but it did not share the other capital movement attributes. During this period, there was no innovation associated with the EESA to impact capital mobility. Mortgage securities derivatives transactions, including CDSs and CMOs, remained the same as in the CFMA period and so did not change capital arbitrage. Unlike the CFMA, the EESA showed no statistically significant relationship with CMOs in the research results and had noisy data in the (1,1,0) ARIMA result.

One interpretation of the combined CFMA and EESA results is these do not conflict, rather they are explained by capital movement related to innovation. The comparison that follows shows the differences between the CFMA and the EESA are the lack of innovation during or preceding the EESA period and a corresponding lack of a statistically significant relationship. Alternately, another interpretation is the analysis performed on the CFMA period had a definitive start and end quarter, whereas the EESA remains midperiod with no definitive end date yet associated with a transition to a new regulation. Support for this alternate interpretation is in the first period analyzed, between 1Q 1991 and 4Q 2000, that the (1,1,1) ARIMA result showed was stable for a time before regulation was relaxed.

	CFMA	EESA
Relationship between CDS regulation and CMOs	Yes	No
Comparisons:		
Regulatory change preceding the period	Yes	Yes
Innovation during or preceding the period	Yes	No
Mortgage securities derivatives transactions during period	Yes	Yes

The labor participation rate used as the control variable was not statistically significant for the three periods in which it was aligned to control for CDS regulation. Although the labor participation rate is an important macroeconomic metric, the evidence inferred that its explanatory power for CMOs results is limited. Despite the insignificance in this ARIMA model, the labor participation rate was found to contain linear and third-order trends that may be important in other ways.

The theoretical basis of this quantitative research study is the stability of the U.S. financial system, which was examined within the public policymaking context of the rational-comprehensive theory and the garbage can theory as contrasting frameworks for policymaking models. The statistically significant relationship between the CFMA and CMOs aligned with the theoretical framework of the rational-comprehensive model. The rational-comprehensive model was consistent with the hypothesized relationship in which a proactive policy was implemented, with a positive relationship between CDS policy and increasing CMO capital flows. This relationship was an important finding because of the linkage between policymaking theory and financial results in the U.S. financial system. Yet, the negative turn and parabolic change in ARIMA (1,2,1) with the CFMA at the end of the second period suggested that capital flows can get out of control. The lack of a statistically significant relationship between the EESA and CMOs inferred that regulation *alone* was not the driver behind such relationships and perhaps the difference between the EESA and the CFMA was that the CFMA gave innovation related to CDSs and CMOs the force of law. The noisy results in ARIMA (1,1,0) with the EESA during the third period suggested that the tightened controls in the 2008 law was less of a rational act and more of a panic that took place during a policy window. Yet, the (1,1,0) model was significant and may be antifragile (Taleb, 2012) because the noise could be enough to perturb the system so that it learns and strengthens from having endured disorder. The CDSs exchange included in the EESA and implemented in 4Q 2012 under the DFA represents a potential antifragile outcome that is measurable.

Limitations of the Study

The limitations of the study that arose during the execution of the study were consistent with quasiexperimental and ARIMA modeling concerns I discussed in Chapter

1. History was controlled for in this ARIMA design by the use of a macroeconomic control variable, the LPR, though the selection of a different control variable could lead to other findings. This quantitative model was accordingly limited by the ability to comprehensively control for concurrent historical events. Data analysis was used as a substitute for experimental controls of random sampling and a control group, which can provide for reliability but not necessarily empirical validity.

Recommendations for Further Study

The research discussed in this project is narrowly focused on the capital movement associated with one regulatory topic (CDSs) and one type of capital deployment in the U.S. financial system (CMOs). Potential research questions involving different parameters are left unanswered, such as whether regulations like the Basel Accords and the GLBA of 1999 impacted CMOs capital results and what other capital results were impacted by CDS regulations. New data and differing levels of data detail from the globalized financial system are opportunities for further in-depth study of CMOs and CDSs. Research of the factors influencing capital movement would be beneficial from both an academic and regulatory policy viewpoint. Several resulting recommendations for further study are considered here.

There is a need to better understand capital movement in the U.S. financial system in terms of stability, mobility, and arbitrage. Stability of capital might be able to be detected through the systematic use of the ARIMA methodology to detect time series breaks in the comprehensive data published by the FRS. The research literature showed recent progress since the GFC in understanding the mobility of capital, but there remains the need to understand mobility and its relationship to regulations. Arbitrage analysis would involve structural changes in financial institutions' capital that are the cumulative result of purposeful financial transactions. Capital movement could be identified from shifts in time series data at the financial institution level of analysis when paired with their regulatory options and choices. ARIMA modeling and forecasting could perhaps then be used to detect the affinity of capital with various regulatory structures, and conversely, the dissociation of capital from regulatory structures.

There is no reason to assume that the widespread changes undergone since the GFC by U.S. financial institutions will cease, so consequently the further study of financial innovation is desirable. This quantitative research study's subjects of CMOs and CDSs were mortgage derivative instruments that are exemplars of financial innovation, although financial innovation is therefore only indirectly considered. Greater understanding of financial innovation and its linkage to capital stability, mobility, and arbitrage could perhaps lead to improved management of the U.S. financial system. For example, a quantitative research study on the sales of ABSs residual values in the secondary market might reveal indicators of a market that was in distress before it was plainly evident during the GFC.

Liquidity is the little-understood phenomenon that pervades the operation and the study of the U.S. financial system. Furthermore, the research literature treated liquidity from as far-ranging perspectives as quantitative exercises in capital management to psychologically based reactions. This quantitative research study on mortgage derivatives instruments could alternately have been developed into a CDS liquidity related analysis, rather than CMO capital movement related. Illiquidity needs to be further understood as a research topic in terms of what causes it and why, in addition to continuing to develop the research literature on how illiquidity is caused and how illiquidity is related to mortgage derivative instruments.

Implications for Positive Social Change

There is the potential for positive social change from regulation of financial institutions that aids in stability of the financial system. This research study has shown relationships of varying strength exist between regulations and financial system results. As posed in the research question, there is interconnectedness among lenders, borrowers, intermediaries, and market participants. When these and other relationships in the financial system are upset there can be associated instability and illiquidity in the financial system, with accompanying harm to individuals, families, and society. A key objective of financial institution regulation should be the financial system remains stable and depositors and borrowers mutually benefit from banking transactions with financial institutions.

The EESA legislation had the practical result of socializing risk in the U.S. financial system, including risk that resulted from innovation and market changes. Losses incurred by financial institutions that were related to CDSs and CMOs and other high-risk, high-return financial instruments were ultimately borne by society through governmental actions. The EESA contained TARP, which raised important matters regarding liquidity as a public good and the Constitutional bounds of public policy actions. To maintain the liquidity of the U.S. financial system, bailouts benefitting financial institutions seemingly became the objective of public policy rather than a byproduct. To borrow an analogy from banking, for every debit there must be an offsetting credit, and TARP lacks the recognition of credit to the public. Liquidity was maintained because consumers placed their cash in a bank account rather than under a mattress and continued to engage in commerce rather than hoard. Yet, if the public has social obligations to maintain liquidity, then there ought to be comparable rights to the public as consumers of financial institutions' products, including rights represented by governmental regulatory powers.

A recommendation for action is for federal policymakers to determine whether there are unintended consequences emerging as a result of the EESA and to correct for imbalances of financial system competitiveness. The EESA related concerns include the equitable treatment of financial institutions in a way that does not favor the larger participants that directly benefitted from TARP. The EESA also set the direction for implementation of exchanges mandated under the DFA for derivatives transactions, including those for CDSs. A notable feature of CDSs is that these are zero-sum instruments in which one's gain is another's loss. Whether these exchanges are stimulating or merely enabling the potential for growth in derivatives is important to understand because of the potential impact to liquidity associated with settling CDS losses. Correspondingly, risk management practices for derivatives transactions need to be further developed to differentiate their use by financial institutions as a hedge against negative credit events versus a tool of market speculation. The derivatives exchanges implemented under DFA also should be evaluated as positive mechanisms for other possible uses to disseminate event related risk, such as operational risk, which could be quantified and swapped as with CDSs, foreign currency swaps, and other derivatives types.

Positive social change can also result from the clarification and demarcation of the exercise of governmental powers. Actions taken during the GFC via TARP legislation and by administrative authorities in the federal government to impact financial markets were done in a spirit of pragmatism to resolve crisis situations. Yet, pragmatic actions taken by the government to address critical financial matters do not excuse the lack of clear, Constitutionally based rationales. The persistent presence of these concerns is an indication that legal boundaries can be either better defined or better justified with basis in the law.

Conclusion

Regulation of the U.S. financial system is politically charged and affected by policymakers' responses to theories on the economy and government. While these influences should not be expected to wane, evidence based policymaking offers an opportunity to enhance the quality of governance of the U.S. financial system. In this spirit, this quantitative research study was a time series examination of the relationship between the financial system regulation of CDSs and the financial system results of CMOs. The result was empirical evidence of a relationship between the CFMA and CMOs that was statistically significant and based in a rational-comprehensive approach to policymaking. The absence of such a relationship between the EESA and CMOs inferred that the EESA was somehow different from the CFMA, of which one plausible explanation is the presence of innovation related to the capital movement associated with the CFMA. Yet, the regulatory mandated CDSs exchange was implemented in 4Q 2012 under the DFA and so relationships between regulations and CMOs continue to change. Time will tell whether these relationships between CDS regulations and CMOs are insignificant or if a new regulatory era has begun with the DFA. It is clear from this research study that regulations cannot be relaxed and then reinstated with predictable results.

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Appendix A: Data Collection Procedure

The quantitative data collection procedure was provided for the purposes of verification through replication and to potentially assist other researchers. Data sources and the associated URLs were provided for each dependent variable together with a summary of the data sources in Table A1.

Table A1

Sources of Data by Variable

Variable	Source	Years	Source of data details
COLLMO[a]	FRS	1989-2013	Z.1 Flow of Funds Accounts of the United States statistical information
LABORP[b]	DOL, BLS	1989-2013	Labor Force Statistics from the Current Population Survey

[a] Dependent variable for Collateralized Mortgage Obligations (CMOs).
[b] Control variable for Labor Participation Rate (LPR).

COLLMO

Federal Reserve System, *Z.1 Flow of Funds Accounts of the United States*

1. Open the data download page of the FRS at URL
   http://www.federalreserve.gov/datadownload/Choose.aspx?rel=Z1.
2. Go to option B "Select a preformatted data package" and select the Level series (L) account numbers for amounts outstanding at the end of quarterly (Q) periods. The data series includes "n.s.a." in the series title for "not seasonally adjusted."
3. Select financial institutions tables and sum CMO accounts for each period.
   a. L.110 U.S.-Chartered Depository Institutions, Excluding Credit Unions.
      i. 30616. Residential CMOs and other structured MBS.
      ii. 30636. Priv. residential CMOs and other structured MBS.
   b. L.111 Foreign Banking Offices in U.S.
      i. No CMO accounts in this table.
   c. L.112 Banks in U.S.-Affiliated Areas.
      i. No CMO accounts in this table.
   d. L.113 Credit Unions.
      i. No CMO accounts in this table.
   e. L.114 Property-Casualty Insurance Companies.
      i. No CMO accounts in this table.
   f. L.115 Life Insurance Companies.
      i. No CMO accounts in this table.

g. L.124 Issuers of Asset-Backed Securities (ABS).
   i. 30617. Agency- and GSE-backed securities.
   ii. 30651. Mortgage: Home.
   iii. 30654. Mortgage: Multifamily residential.
h. L.125 Finance Companies.
   i. No CMO accounts in this table.
i. L.127 Security Brokers and Dealers.
   i. No CMO accounts in this table.

4. Select “Format your package” in order to define the data file.
5. Choose a format for the data file. Click on “Observation” and select the last 100. Click on “Date” and select the year from and to date range. Select “File Type” Excel 2003, or newer, and include “Data Labels”. Select “Layout” series in columns. Click on “Go to download.”
6. Select “download file.”

LABORP

U.S. Department of Labor, Bureau of Labor Statistics, *Labor Force Statistics from the Current Population Survey*

1. Open the home page of the U.S. Department of Labor, Bureau of Labor Statistics, at URL http://www.bls.gov/home.htm.
2. Select the “Databases & Tools” tab on the top navigation bar. This page was opened directly at http://www.bls.gov/data/.

3. Select “Data Series” on the website navigation. This page was opened directly at http://data.bls.gov/cgi-bin/srgate.
4. On the “Series Report” page, locate “Series ID Formats. Enter series id(s) below:” and enter LNS11300000. Click on “Next.” This page at http://data.bls.gov/cgi-bin/srgate could not be opened directly due to the query being in progress.
5. On the “Databases, Tables & Calculators by Subject” page, select the data Output Type in the table “Text” with the dropdown “comma delimited”. Click on to “include graphs”. This page at http://data.bls.gov/cgi-bin/srgate could not be opened directly due to the query being in progress.
    a. Select view of the data, “Column Format” and click “Original Data Value.”
    b. Select the time frame for your data, clicking “Specify year range:” from 1989 to 2013 and select “All Time Periods” to retrieve monthly observations.
    c. Confirm the selection of the series: “The following series id(s) were generated from your query” with the value LNS11300000.
    d. Click “Retrieve Data.”
6. Results displayed on the “Databases, Tables & Calculators by Subject” page titled “Labor Force Statistics from the Current Population Survey,” with data specifications. This page was opened directly at http://data.bls.gov/timeseries/LNS11300000.

a. Series title: (Seas) Labor Force Participation Rate.

b. Labor force status: Civilian labor force participation rate.

7. Download Excel spreadsheet of results.

Appendix B: Data

Table B1

Collateralized Mortgage Obligations in U.S. Financial Institutions

Observation	Quarter	Month	Year	Value $millions
1	3Q	Sep.	1989	144,685
2	4Q	Dec.	1989	143,378
3	1Q	Mar.	1990	180,868
4	2Q	Jun.	1990	191,522
5	3Q	Sep.	1990	203,275
6	4Q	Dec.	1990	213,977
7	1Q	Mar.	1991	249,691
8	2Q	Jun.	1991	264,191
9	3Q	Sep.	1991	280,039
10	4Q	Dec.	1991	294,789
11	1Q	Mar.	1992	312,389
12	2Q	Jun.	1992	324,329
13	3Q	Sep.	1992	345,350
14	4Q	Dec.	1992	353,146
15	1Q	Mar.	1993	369,355
16	2Q	Jun.	1993	387,577
17	3Q	Sep.	1993	408,105
18	4Q	Dec.	1993	413,457
19	1Q	Mar.	1994	435,767
20	2Q	Jun.	1994	439,094
21	3Q	Sep.	1994	441,972
22	4Q	Dec.	1994	440,250
23	1Q	Mar.	1995	440,606
24	2Q	Jun.	1995	446,606
25	3Q	Sep.	1995	456,853
26	4Q	Dec.	1995	459,030
27	1Q	Mar.	1996	466,719
28	2Q	Jun.	1996	467,020
29	3Q	Sep.	1996	466,664

(table continues)

Observation	Quarter	Month	Year	Value $millions
30	4Q	Dec.	1996	465,180
31	1Q	Mar.	1997	470,343
32	2Q	Jun.	1997	474,174
33	3Q	Sep.	1997	484,698
34	4Q	Dec.	1997	505,522
35	1Q	Mar.	1998	529,829
36	2Q	Jun.	1998	558,288
37	3Q	Sep.	1998	606,628
38	4Q	Dec.	1998	640,396
39	1Q	Mar.	1999	682,611
40	2Q	Jun.	1999	708,248
41	3Q	Sep.	1999	726,676
42	4Q	Dec.	1999	732,821
43	1Q	Mar.	2000	739,773
44	2Q	Jun.	2000	746,726
45	3Q	Sep.	2000	753,031
46	4Q	Dec.	2000	776,275
47	1Q	Mar.	2001	808,450
48	2Q	Jun.	2001	830,830
49	3Q	Sep.	2001	872,429
50	4Q	Dec.	2001	954,909
51	1Q	Mar.	2002	991,075
52	2Q	Jun.	2002	1,001,158
53	3Q	Sep.	2002	1,070,089
54	4Q	Dec.	2002	1,114,823
55	1Q	Mar.	2003	1,204,676
56	2Q	Jun.	2003	1,252,912
57	3Q	Sep.	2003	1,293,639
58	4Q	Dec.	2003	1,386,127
59	1Q	Mar.	2004	1,525,787
60	2Q	Jun.	2004	1,603,408
61	3Q	Sep.	2004	1,705,425
62	4Q	Dec.	2004	1,814,582
63	1Q	Mar.	2005	1,984,889
64	2Q	Jun.	2005	2,121,958
65	3Q	Sep.	2005	2,291,516

(table continues)

Observation	Quarter	Month	Year	Value $Millions
66	4Q	Dec.	2005	2,434,983
67	1Q	Mar.	2006	2,600,677
68	2Q	Jun.	2006	2,744,263
69	3Q	Sep.	2006	2,891,537
70	4Q	Dec.	2006	3,010,805
71	1Q	Mar.	2007	3,122,967
72	2Q	Jun.	2007	3,215,406
73	3Q	Sep.	2007	3,195,197
74	4Q	Dec.	2007	3,188,914
75	1Q	Mar.	2008	3,134,477
76	2Q	Jun.	2008	3,034,570
77	3Q	Sep.	2008	2,939,486
78	4Q	Dec.	2008	2,815,334
79	1Q	Mar.	2009	2,653,771
80	2Q	Jun.	2009	2,493,732
81	3Q	Sep.	2009	2,365,566
82	4Q	Dec.	2009	2,248,977
83	1Q	Mar.	2010	2,139,033
84	2Q	Jun.	2010	2,046,978
85	3Q	Sep.	2010	1,979,637
86	4Q	Dec.	2010	1,928,288
87	1Q	Mar.	2011	1,892,742
88	2Q	Jun.	2011	1,864,620
89	3Q	Sep.	2011	1,831,764
90	4Q	Dec.	2011	1,781,511
91	1Q	Mar.	2012	1,718,975
92	2Q	Jun.	2012	1,643,801
93	3Q	Sep.	2012	1,593,470
94	4Q	Dec.	2012	1,538,916
95	1Q	Mar.	2013	1,538,916

(table continues)

Note. CMO value was stated in millions of U.S. dollars of residential mortgage CMOs. From FRS database *Z.1 Flow of Funds Accounts of the United States* financial tables of period-end asset balances: L.110 U.S.-Chartered Depository Institutions, Excluding Credit Unions; L.111 Foreign Banking Offices in U.S.; L.112 Banks in U.S.-Affiliated Areas; L.113 Credit Unions; L.115 Life Insurance Companies; L.124 Issuers of Asset-Backed Securities (ABS); L.125 Finance Companies; L.127 Security Brokers and Dealers; L128 Holding Companies. These financial sector tables were included based on: GLBA financial institutions that included TARP recipients and posed risk of systemic illiquidity (depository banks L.110, L.111, L.112; insurance companies L.114, L.115; security brokers and dealers [investment banks] L.127; holding companies L.128); credit unions (L.113) that included TARP recipients and were dependent on depository banks, but were not GLBA financial institutions and did not pose risk of systemic illiquidity; finance companies (L.125) that were TARP recipients and posed risk of systemic illiquidity, but were not GLBA financial institutions; and issuers of asset-backed securities (L.124) that posed risk of systemic illiquidity, but were neither GBLA financial institutions nor TARP recipients. These financial sector tables were excluded: L.107 Financial Business, the aggregation account for the summation of the financial sector; L.109 Private Depository Institutions, the aggregation account for the summation of L.110, L.111, and L.112; L.108 Monetary Authority and L.129 Funding Corporation, used for FRS financial activity; L.116 Private Pension Funds, L.117 State and Local Government Employee Retirement Funds, L.118 Federal Government Retirement Funds, L.119 Money Market Mutual Funds, L.120 Mutual Funds, and L.121 Closed-End and Exchange-Traded Funds that were not GBLA financial institutions, not TARP recipients, nor posed risk of systemic illiquidity; L.122 Government-Sponsored Enterprises (GSEs) nationalized by the U.S. government before TARP and that were not GBLA financial institutions and did not pose risk to systemic illiquidity, although GSEs did pose risk to ongoing mortgage lending activity and to the ongoing issuance of agency- and GSE-backed mortgage pools; L.123 Agency- and GSE-Backed Mortgage Pools that were existing pools of mortgage loans owned by investors and were not GBLA financial institutions, not TARP recipients, nor posed risk of systemic illiquidity, but included agency- and GSE-backed mortgage pool securities that were used as collateral for agency- and GSE-backed CMOs and privately issued CMOs identified in Table B2; and L.126 Real Estate Investment Trusts (REITs) that were existing pools of mortgage loans owned by investors and were not GBLA financial institutions, not TARP recipients, nor posed risk of systemic illiquidity. The excluded tables had no CMO as indicated by account name or footnote, other than the aggregation tables that were summations of other tables. The value of CMO in these level series data is the total of 5 accounts (#30636, #30616, #30617, #30651, and #30654) that were identified by account name or footnote as being residential mortgage CMO, and itemized by observation in Table B2.

Table B2

Account Values of CMOs in Federal Reserve Z.1 Flow of Funds Accounts

Observation	-------------------------- $Millions --------------------------				
	#30636[a]	#30616[b]	#30617[c]	#30651[d]	#30654[e]
1	-	-	110,046	33,685	954
2	-	-	99,100	43,325	953
3	-	36,570	105,141	38,165	992
4	-	41,769	105,931	42,863	959
5	-	47,723	107,378	47,260	914
6	-	54,828	103,252	55,029	868
7	27,822	60,021	101,467	59,430	951
8	28,600	67,958	94,215	72,495	923
9	28,098	78,228	87,131	84,444	2,138
10	28,241	89,405	76,631	96,732	3,780
11	26,604	97,625	76,437	106,805	4,918
12	23,884	105,592	71,788	116,694	6,371
13	23,481	119,487	64,031	132,056	6,295
14	21,624	122,709	59,971	142,265	6,577
15	21,562	129,455	65,634	145,921	6,783
16	20,842	136,421	68,924	153,845	7,545
17	21,905	137,451	76,924	164,005	7,820
18	19,814	133,808	83,563	167,899	8,373
19	20,799	132,125	94,747	179,616	8,480
20	20,644	127,363	100,988	181,026	9,073
21	21,308	123,827	105,335	182,173	9,329
22	21,491	119,396	106,541	183,002	9,820
23	21,641	116,474	106,712	185,999	9,780
24	22,573	113,937	110,928	189,046	10,122

Note. The value of CMO is totaled in Table B1.
[a] Unique identifier Z1/Z1/FL763063665.Q; U.S.-chartered depository institutions, private residential CMOs and other structured MBS, asset; millions of U.S. dollars.
[b] Unique identifier Z1/Z1/FL763061605.Q; U.S.-chartered depository institutions, agency issued residential CMOs and other structured MBS, asset; millions of U.S. dollars.
[c] Unique identifier Z1/Z1/FL673061705.Q; Issuers of asset-backed securities, agency- and GSE-backed securities, asset - Footnote (1) Agency- and GSE-backed mortgage pool securities backing privately issued CMOs; millions of U.S. dollars.
[d] Unique identifier Z1/Z1/FL673065105.Q; Issuers of asset-backed securities, home mortgages, asset - Footnote (2) Mortgages backing privately issued pool securities and privately issued CMOs; millions of U.S. dollars.
[e] Unique identifier Z1/Z1/FL673065405.Q; Issuers of asset-backed securities, multifamily residential mortgages, asset - Footnote (2) Mortgages backing privately issued pool securities and privately issued CMOs; millions of U.S. dollars.

(table continues)

Observation	------------------------- $Millions -------------------------				
	#30636[a]	#30616[b]	#30617[c]	#30651[d]	#30654[e]
25	23,611	109,349	123,955	189,468	10,470
26	24,943	101,036	127,368	193,759	11,924
27	25,875	97,320	130,274	201,074	12,176
28	25,445	90,938	129,606	208,206	12,825
28	25,445	90,938	129,606	208,206	12,825
29	22,210	89,801	127,020	213,851	13,782
30	21,801	89,495	122,806	215,357	15,721
31	21,347	92,399	116,337	224,576	15,684
32	20,587	93,173	114,530	229,072	16,812
33	21,701	96,865	104,957	243,766	17,409
34	22,460	106,997	102,079	253,804	20,182
35	28,671	108,135	100,225	268,984	23,814
36	32,370	109,989	100,383	287,717	27,829
37	35,051	121,373	112,592	307,746	29,866
38	42,769	115,869	126,816	321,869	33,073
39	44,273	123,662	144,617	334,008	36,051
40	44,784	121,275	159,170	345,311	37,708
41	46,656	124,362	167,850	348,527	39,281
42	48,801	120,858	167,816	353,744	41,602
43	46,510	120,526	175,993	354,234	42,510
44	46,993	119,352	181,449	355,282	43,650
45	51,019	108,901	178,979	369,762	44,370
46	56,493	111,033	176,374	385,465	46,910
47	57,497	114,410	186,710	402,463	47,370
48	54,289	116,413	190,907	420,262	48,959
49	53,837	133,950	192,701	442,000	49,941
50	59,260	168,209	211,407	463,247	52,786
51	60,654	166,361	216,878	494,028	53,154
52	56,982	145,570	223,553	520,601	54,452
53	66,264	156,353	249,330	542,312	55,830
54	67,387	159,057	286,527	543,566	58,286
55	79,956	179,535	316,373	569,593	59,219
56	78,842	179,334	349,025	584,542	61,169
57	84,155	158,472	372,049	615,860	63,103
58	98,333	185,834	369,063	666,496	66,401

(table continues)

Observation	#30636[a]	#30616[b]	#30617[c]	#30651[d]	#30654[e]
	------------------------- $Millions -------------------------				
59	134,779	210,832	371,127	740,935	68,114
60	131,595	200,244	367,817	834,261	69,491
61	138,900	194,826	347,532	953,840	70,327
62	148,475	180,109	355,494	1,057,624	72,880
63	165,314	208,786	359,468	1,176,736	74,585
64	179,798	200,751	341,857	1,320,663	78,889
65	192,798	193,246	335,885	1,487,991	81,596
66	204,767	183,024	310,501	1,647,242	89,448
67	218,554	189,153	308,263	1,792,191	92,516
68	225,249	191,708	295,693	1,937,174	94,439
69	217,523	206,869	304,536	2,065,768	96,841
70	224,599	179,947	333,567	2,170,178	102,514
71	232,388	185,784	333,115	2,261,846	109,834
72	251,325	178,369	337,277	2,331,058	117,377
73	267,834	174,514	330,733	2,297,838	124,278
74	328,907	174,090	351,971	2,209,952	123,994
75	338,318	178,458	344,525	2,151,735	121,441
76	325,659	184,811	342,881	2,062,650	118,569
77	315,625	181,772	342,530	1,983,310	116,249
78	285,572	193,930	325,342	1,897,249	113,241
79	256,173	204,605	264,749	1,816,510	111,734
80	213,848	219,859	226,818	1,722,101	111,106
81	213,023	239,034	165,118	1,638,989	109,402
82	202,901	263,997	100,430	1,574,256	107,393
83	170,797	312,607	66,290	1,482,884	106,455
84	157,831	333,020	30,762	1,420,583	104,782
85	144,885	364,361	7,056	1,360,672	102,663
86	132,338	393,444	5,047	1,298,735	98,724
87	123,796	417,779	9,217	1,243,914	98,036
88	116,811	450,149	7,360	1,194,875	95,425
89	113,722	472,152	2,051	1,150,347	93,492
90	110,379	473,762	747	1,105,564	91,059
91	97,370	481,967	349	1,060,081	79,208
92	93,743	460,586	339	1,012,269	76,864
93	92,796	460,032	240	965,945	74,457
94	88,368	454,555	220	923,405	72,368
95	83,690	446,665	111	885,835	68,915

Table B3

Labor Force Participation Rate

Observation	Quarter	Month	Year	Rate (%)
1	3Q	Sep.	1989	66.4
2	4Q	Dec.	1989	66.5
3	1Q	Mar.	1990	66.7
4	2Q	Jun.	1990	66.4
5	3Q	Sep.	1990	66.4
6	4Q	Dec.	1990	66.4
7	1Q	Mar.	1991	66.3
8	2Q	Jun.	1991	66.2
9	3Q	Sep.	1991	66.2
10	4Q	Dec.	1991	66.0
11	1Q	Mar.	1992	66.4
12	2Q	Jun.	1992	66.7
13	3Q	Sep.	1992	66.5
14	4Q	Dec.	1992	66.3
15	1Q	Mar.	1993	66.2
16	2Q	Jun.	1993	66.5
17	3Q	Sep.	1993	66.2
18	4Q	Dec.	1993	66.4
19	1Q	Mar.	1994	66.5
20	2Q	Jun.	1994	66.4
21	3Q	Sep.	1994	66.6
22	4Q	Dec.	1994	66.7
23	1Q	Mar.	1995	66.7
24	2Q	Jun.	1995	66.5
25	3Q	Sep.	1995	66.6
26	4Q	Dec.	1995	66.4
27	1Q	Mar.	1996	66.6
28	2Q	Jun.	1996	66.7
29	3Q	Sep.	1996	66.9
30	4Q	Dec.	1996	67.0
31	1Q	Mar.	1997	67.1
32	2Q	Jun.	1997	67.1
33	3Q	Sep.	1997	67.1

(table continues)

Observation	Quarter	Month	Year	Rate (%)
34	4Q	Dec.	1997	67.2
35	1Q	Mar.	1998	67.1
36	2Q	Jun.	1998	67.0
37	3Q	Sep.	1998	67.2
38	4Q	Dec.	1998	67.2
39	1Q	Mar.	1999	67.0
40	2Q	Jun.	1999	67.1
41	3Q	Sep.	1999	67.0
42	4Q	Dec.	1999	67.1
43	1Q	Mar.	2000	67.3
44	2Q	Jun.	2000	67.1
45	3Q	Sep.	2000	66.9
46	4Q	Dec.	2000	67.0
47	1Q	Mar.	2001	67.2
48	2Q	Jun.	2001	66.7
49	3Q	Sep.	2001	66.8
50	4Q	Dec.	2001	66.7
51	1Q	Mar.	2002	66.6
52	2Q	Jun.	2002	66.6
53	3Q	Sep.	2002	66.7
54	4Q	Dec.	2002	66.3
55	1Q	Mar.	2003	66.3
56	2Q	Jun.	2003	66.5
57	3Q	Sep.	2003	66.1
58	4Q	Dec.	2003	65.9
59	1Q	Mar.	2004	66.0
60	2Q	Jun.	2004	66.1
61	3Q	Sep.	2004	65.8
62	4Q	Dec.	2004	65.9
63	1Q	Mar.	2005	65.9
64	2Q	Jun.	2005	66.1
65	3Q	Sep.	2005	66.1
66	4Q	Dec.	2005	66.0
67	1Q	Mar.	2006	66.2
68	2Q	Jun.	2006	66.2
69	3Q	Sep.	2006	66.1

(table continues)

Observation	Quarter	Month	Year	Rate (%)
70	4Q	Dec.	2006	66.4
71	1Q	Mar.	2007	66.2
72	2Q	Jun.	2007	66.0
73	3Q	Sep.	2007	66.0
74	4Q	Dec.	2007	66.0
75	1Q	Mar.	2008	66.1
76	2Q	Jun.	2008	66.1
77	3Q	Sep.	2008	66.0
78	4Q	Dec.	2008	65.8
79	1Q	Mar.	2009	65.6
80	2Q	Jun.	2009	65.7
81	3Q	Sep.	2009	65.1
82	4Q	Dec.	2009	64.6
83	1Q	Mar.	2010	64.9
84	2Q	Jun.	2010	64.6
85	3Q	Sep.	2010	64.6
86	4Q	Dec.	2010	64.3
87	1Q	Mar.	2011	64.2
88	2Q	Jun.	2011	64.0
89	3Q	Sep.	2011	64.2
90	4Q	Dec.	2011	64.0
91	1Q	Mar.	2012	63.8
92	2Q	Jun.	2012	63.8
93	3Q	Sep.	2012	63.6
94	4Q	Dec.	2012	63.6
95	1Q	Mar.	2013	63.3

Note. Labor Force Statistics from the Current Population Survey, series title (Seas) Labor Force Participation Rate. Labor force status: Civilian labor force participation rate, age 16 years and over; Series identification LNS11300000; Seasonally Adjusted data; Stated as a percent or rate. From U.S. Department of Labor, Bureau of Labor Statistics, *Databases, tables & calculators by subject*.

Appendix C: Data Calculation and Analysis Procedure

The data analysis procedure was provided for the purposes of verification through replication and to potentially assist other researchers.

1. Transferred raw data consisting of univariate time series from Excel spreadsheet into SPSS using file name NeillCMO.sav.
    a. Descriptive statistics were calculated in Excel spreadsheet for Collateralized Mortgage Obligations (CMO) and Labor Participation Rate for minimum values, maximum values, means, medians, and modes.
2. Identified variables and manipulated data into SPSS format.
    a. Collateralized Mortgage Obligations (COLLMO) named COLLMORT and measure created as scale, with the label CMOs in Millions of Dollars. Stated in millions of U.S. dollars with zero decimal places.
    b. Labor Participation Rate (LABORP) named LABORPRT and measure created as scale, with the label Labor Participation Rate. Stated as a rate consisting of two digits and one decimal place.
    c. Regulatory period named PERIODNO and measure created as nominal, with the label Regulatory Period. Stated in 3 periods corresponding to the proposed ARIMA model parameters for regulatory periods.
    d. Calendar quarter named QUARTERS and measure created as nominal, with the label Quarter. Stated as the year and quarter, as in 2010Q3.

3. Created figures to represent over time the Collateralized Mortgage Obligations and the Labor Participation Rate.
    a. Graph > Legacy dialogs > Line > select: Simple, Values of individual cases; Line represents: COLLMORT; Category label: QUARTERS.
    b. Graph > Legacy dialogs > Line > select: Simple, Values of individual cases; Line represents: LABORPRT; Category label: QUARTERS.
    c. Graph > Legacy dialogs > Population pyramid > Counts: Get counts from variable.
        i. SPSS using file name Neill.CMO.pop_pyramid.sav.
        ii. Variable: CMO in Billions of Dollars. Noted that labels did not fit when CMOs was stated in Millions of Dollars.
        iii. Show distribution over: Quarters.
        iv. Split by: Regulatory period.
        v. Click OK.
4. Used *t* tests to evaluate whether CMOs (measured in millions of dollars) means were different between the CDS regulatory periods.
    a. Created SPSS file name Neill_CMO_t-test_r3.sav.
    b. SPSS > Analyze > Compare Means > Paired-sample t-test; where the symbol > denotes a dropdown box selection in SPSS.
        i. Pair 1: Period 1 (unregulated period) and Period 2 (favorable regulation period).

ii. Pair 2: Period 1 (unregulated period) and Period 3 (unfavorable regulation period).

iii. Pair 3: Period 2 (favorable regulation period) and Period 3 (unfavorable regulation period).

c. Calculation in Excel spreadsheet of the Effect Size *d* for each of the pairs, which was the t-test result *t* divided by the square root of *N*, where *N* is the number of paired samples.

i. The mathematical formula is: $d = t / \sqrt{N}$.

ii. Interpretation of Effect Size *d* values of .2, .5, and .8 (regardless of sign), as small, medium, and large effect sizes, respectively.

d. Pearson's r correlation coefficient was computed for the pairing of Period 2 and Period 3.

i. SPSS > Analyze > Correlate > Bivariate.

ii. Variables: Favorable regulation COLLMOP2 (Period 2) and Unfavorable regulation COLLMOP3 (Period 3).

iii. Select: Pearson correlation coefficient, One-tailed test of significance, flag significant correlations.

5. ANOVA used to evaluate whether the univariate time series was an undifferenced data set.

a. Created SPSS file name Neill_CMO_ r3.sav.

b. SPSS > Analyze > General Linear Model > Univariate.

b. Dependent variable: CMO in Millions of Dollars.

c. Fixed factors: Regulatory Period.

d. Options > Factors: Display Means for: PERIODNO.

e. Display: select: Descriptive statistics, Estimates of effect size, Homogeneity tests.

f. Significance level: alpha = .05.

g. Post Hoc > Factor: PERIODNO.

h. Post Hoc Tests for: PERIODNO.

i. Equal variances assumed: select: Tukey, R-E-G-W-Q.

j. Equal variances not assumed: select: Dunnett's *C*.

k. Click OK to generate results: display results for Univariate Analysis of Variance: Between-Subjects Factors; Descriptive Statistics; Levene's Test of Equality of Error Variances; Tests of Between-Subjects Effects; Estimated Marginal Means; Post Hoc Tests: Multiple Comparisons; Homogeneous Subsets.

l. The regulatory periods matched the proposed ARIMA model parameters for regulatory periods and was statistically significant at alpha = .05.

    i. Graph > Legacy dialogs > Boxplot > select: Simple, Summaries of groups of cases; Variable: CMO in Millions of Dollars; Category Axis: Regulatory Periods.

m. Calculation performed in Excel spreadsheet for CMO variances.

6. Descriptive statistics used to evaluate whether the univariate time series contained outlier data values.
    a. Created SPSS file name Neill_CMO_outlier.sav.
    b. SPSS > Analyze > Descriptive statistics > Descriptives.
    c. Click on CMO in Millions of Dollars (COLLMO01) and move to Variable(s).
    d. Check: Save standardized values as variables.
    e. Click OK to generate results for z-score values for the newly created variable ZCOLLMO01.
    f. Right click on variable header to Sort Ascending values.
7. Regression statistics used to evaluate whether the univariate time series contained heteroskedasticity.
    a. Created SPSS file name Neill_CMO_bp.sav.
    b. Installed plug-in statistical software R 2.14.2.
    c. Installed plug-in statistical software Essentials for R 21.0.0.
    d. SPSS > Analyze > Regression > Residual Heteroscedasticity Test.
        i. Dependent variable: CMO in Millions of Dollars (COLLMO01).
        ii. Independent variable: COLLMOP1 (Period 1).
        iii. Missing values: Omit listwise.
        iv. Repeat step (ii) using COLLMOP2 (Period 2), COLLMOP3 (Period 3).

8. Dates were defined in order to evaluate seasonal decomposition and perform spectral analysis.
    a. Created SPSS file name Neill_CMO_boxjenkins.sav.
    b. SPSS > Data > Define Dates > Cases Are: years, quarters.
    c. First case: 1989, 3Q.
    d. Click OK.
    e. Periodicity given as 4.
9. Seasonal decomposition was performed in order to generate output of seasonal factors by quarter for CMO in Millions of Dollars (COLLMO01) and Labor Participation Rate (LABORP01).
    a. Opened SPSS file name Neill_CMO_boxjenkins.sav.
    b. SPSS > Analyze > Forecasting > Seasonal Decomposition.
        i. Click on Model Type: multiplicative.
        ii. Click on Moving average weight: All points equal.
        iii. Variable(s): CMO in Millions of Dollars.
        iv. Repeat for Variable(s): Labor Participation Rate.
    c. Click OK to create 4 new variables:
        i. Seasonal adjustment factors (SAF).
        ii. Seasonally adjusted series (SAS).
        iii. Smoothed trend-cycle component (STC).
        iv. Residual, or error, value (ERR).

10. Spectral analysis was performed in order to generate output of seasonality, or periodicity.
    a. Opened SPSS file name Neill_CMO_boxjenkins.sav.
    b. SPSS > Analyze > Forecasting > Spectral Analysis.
    c. Select variables: CMO in Millions of Dollars (COLLMO01).
    d. Select Spectral window.
        i. Click on Spectral window: Tukey-Hamming.
        ii. Confirm Span is 5.
    e. Select Plot.
        i. Click to check-on Periodogram and Spectral density.
        ii. Click: By frequency.
        iii. Warning notice was produced and analysis proceeded: "The series length must be even for the fast Fourier transform. The first case has been removed from the analysis."
11. Autocorrelation function (ACF) analysis was performed in order to check the results from the Periodogram.
    a. Opened SPSS file name Neill_CMO_boxjenkins.sav.
    b. SPSS > Analyze > Forecasting > Autocorrelations.
    c. Select variables: CMO in Millions of Dollars (COLLMO01).
    d. Select Options.
        i. Maximum lag: 10.

ii. Check: Standard error: Bartlett's Approximation.

iii. Do not check: Display autocorrelations at periodic lags.

e. Transform:

i. Check: Natural log.

ii. Check: Difference and input the value of 1.

1. Note the value of 0 cannot be used and resulted in an error message.

iii. Do not check: Seasonally difference.

iv. Current periodicity: 4. The value was displayed and did not require input.

f. Select: Display Autocorrelations.

12. Sequence Charts were produced to diagnose stationarity for the CMO time series.

a. Created SPSS file name Neill_CMO_stationarity.sav.

b. SPSS > Analyze > Forecasting > Sequence Charts.

c. Sequence Charts specification were made:

i. Variables: Select SASCOLLM, labeled Seasonal adjusted series COLLMO01.

ii. Time Axis Labels: Select Date (in format QQ_YYYY).

iii. Click: One chart per variable.

iv. Time lines: Select: Lines at each change of: Regulatory period.

v. Format:

1. Click: Time on the horizontal axis.
2. Single variable chart: line chart.
3. Single variable chart: Click: Reference line at the mean of the series.

d. Transform data in Sequence Charts.

   i. Difference: Selected testing values of 1, 2, 3.

   ii. Natural log transform: Each of the Difference values were tested without the natural log selected and then with the natural log selected.

   iii. Seasonal difference: Not selected.

   iv. Current Periodicity: 4.

e. Diagnosis was the time series was not stationary and that analysis would continue with regulatory periods time series. Diagnostic data for CMOs across all CDS regulatory periods are in Table C1.

Table C1

Diagnostic Data for CMOs by CDS Regulatory Periods

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
All	1	3Q 1989	1Q 2013	0	0	0.03	3 distinct periods
All	2	3Q 1989	1Q 2013	0	0	0.00	2 or 3 periods
All	3	3Q 1989	1Q 2013	0	0	0.00	Early spikes

Note. Data transformed into natural logarithms for the aggregated CDS regulation periods (All).
[a] Difference, according to ARIMA model of first order linear trends (1), second order quadratic trends (2), and third order trends (3). The limited presence of third order trends made it unnecessary to diagnose the data for fourth order or subsequent order trends.
[b] Adjusted by adding or subtracting quarters to the start or end of the period as defined in the ARIMA modeling parameters.

13. Sequence Charts were produced to diagnose stationarity for the CMO time series corresponding to the first CDS regulatory period to identify ARIMA model *d*.
    a. Created SPSS file name Neill_CMO_stationarityCDS1.sav. The date range of the file was 3Q 1989 to 4Q 2001.
    b. SPSS > Analyze > Forecasting > Sequence Charts.
    c. Sequence Charts specification were made:
        i. Variables: Select SASCOLLM, labeled Seasonal adjusted series COLLMO01.
        ii. Time Axis Labels: Select Date (in format QQ_YYYY).
        iii. Click: One chart per variable.
        iv. Time lines: Select: Lines at each change of: Regulatory period.
        v. Format:
            1. Click: Time on the horizontal axis.
            2. Single variable chart: line chart.
            3. Single variable chart: Click: Reference line at the mean of the series.
    d. Transform data in Sequence Charts.
        i. Difference: Selected testing values of 1, 2, 3.
        ii. Natural log transform: Difference values were tested with the natural log selected.
        iii. Seasonal difference: Not selected.

iv. Current Periodicity: 4.

e. Diagnosis was the time series was stationary. Diagnostic data for CMOs in CDS regulatory period 1 are in Table C2.

Table C2

Diagnostic Data for CMOs in CDS Regulatory Period 1

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
1	1	3Q 1989	4Q 2000	0	0	0.04	2 early & 1 late spikes
1	2	3Q 1989	4Q 2000	0	0	0.00	2 early spikes
1	3	3Q 1989	4Q 2000	0	0	0.00	3 early spikes
1	1	3Q 1989	1Q 2001	0	+1	0.04	2 early & 1 late spikes
1	2	3Q 1989	2Q 2001	0	+1	0.00	2 early spikes
1	3	3Q 1989	2Q 2001	0	+1	0.00	3 early spikes
1	1	3Q 1989	2Q 2001	0	+2	0.04	2 early & 1 late spikes
1	2	3Q 1989	2Q 2001	0	+2	0.00	2 early spikes
1	3	3Q 1989	2Q 2001	0	+2	0.00	3 early spikes
1	1	3Q 1989	3Q 2001	0	+3	0.04	3 early & 1 late spikes
1	2	3Q 1989	3Q 2001	0	+3	0.00	2 early spikes
1	3	3Q 1989	3Q 2001	0	+3	0.00	3 early spikes
1	1	3Q 1989	4Q 2001	0	+4	0.04	3 early & 1 late spikes
1	2	3Q 1989	4Q 2001	0	+4	0.00	2 early spikes
1	3	3Q 1989	4Q 2001	0	+4	0.00	3 early spikes
1	1	4Q 1989	4Q 2000	-1	0	0.04	2 early & 1 late spikes
1	2	4Q 1989	4Q 2000	-1	0	0.00	2 early spikes
1	3	4Q 1989	4Q 2000	-1	0	0.00	3 early spikes
1	1	1Q 1990	4Q 2000	-2	0	0.03	1 early & 1 late spikes
1	2	1Q 1990	4Q 2000	-2	0	0.00	2 early spikes
1	3	1Q 1990	4Q 2000	-2	0	0.00	2 early spikes
1	1	2Q 1990	4Q 2000	-3	0	0.03	1 early & 1 late spikes
1	2	2Q 1990	4Q 2000	-3	0	0.00	2 early spikes
1	3	2Q 1990	4Q 2000	-3	0	0.00	1 early spike

Note. Data transformed into natural logarithms for the aggregated CDS regulation periods (All).
[a] Difference, according to ARIMA model of first order linear trends (1), second order quadratic trends (2), and third order trends (3). The limited presence of third order trends made it unnecessary to diagnose the data for fourth order or subsequent order trends.
[b] Adjusted by adding or subtracting quarters to the start or end of the period as defined in the ARIMA modeling parameters.

(table continues)

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
1	1	3Q 1990	4Q 2000	-4	0	0.03	1 early spike
1	2	3Q 1990	4Q 2000	-4	0	0.00	2 early spikes
1	3	3Q 1990	4Q 2000	-4	0	0.00	1 early spike
1	1	4Q 1990	4Q 2000	-5	0	0.03	1 early spike
1	2	4Q 1990	4Q 2000	-5	0	0.00	1 early spike
1	3	4Q 1990	4Q 2000	-5	0	0.00	1 early spike
1	1	1Q 1991	4Q 1999	-6	-4	0.03	Stationary
1	2	1Q 1991	1Q 2000	-6	-4	0.00	Stationary
1	3	1Q 1991	1Q 2000	-6	-4	0.00	Stationary
1	1	1Q 1991	1Q 2000	-6	-3	0.03	Stationary
1	2	1Q 1991	1Q 2000	-6	-3	0.00	Stationary
1	3	1Q 1991	1Q 2000	-6	-3	0.00	Stationary
1	1	1Q 1991	2Q 2000	-6	-2	0.03	Stationary
1	2	1Q 1991	2Q 2000	-6	-2	0.00	Stationary
1	3	1Q 1991	2Q 2000	-6	-2	0.00	Stationary
1	1	1Q 1991	3Q 2000	-6	-1	0.03	Stationary
1	2	1Q 1991	3Q 2000	-6	-1	0.00	Stationary
1	3	1Q 1991	3Q 2000	-6	-1	0.00	Stationary
1	1	1Q 1991	4Q 2000	-6	0	0.03	Stationary
1	2	1Q 1991	4Q 2000	-6	0	0.00	Stationary
1	3	1Q 1991	4Q 2000	-6	0	0.00	Stationary
1	1	1Q 1991	1Q 2001	-6	+1	0.03	Stationary
1	2	1Q 1991	2Q 2001	-6	+1	0.00	Stationary
1	3	1Q 1991	2Q 2001	-6	+1	0.00	Stationary
1	1	1Q 1991	2Q 2001	-6	+2	0.03	Stationary
1	2	1Q 1991	2Q 2001	-6	+2	0.00	Stationary
1	3	1Q 1991	2Q 2001	-6	+2	0.00	Stationary
1	1	1Q 1991	3Q 2001	-6	+3	0.03	Stationary
1	2	1Q 1991	3Q 2001	-6	+3	0.00	Stationary
1	3	1Q 1991	3Q 2001	-6	+3	0.00	Stationary

(table continues)

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
1	1	1Q 1991	4Q 2001	-6	+4	0.03	1 mild late spike
1	2	1Q 1991	4Q 2001	-6	+4	0.00	1 mild late spike
1	3	1Q 1991	4Q 2001	-6	+4	0.00	Stationary

14. Sequence Charts were produced to diagnose stationarity for the CMO time series corresponding to the third CDS regulatory period to identify ARIMA model *d*.
    a. Created SPSS file name Neill_CMO_stationarityCDS3.sav. The date range of the file was 2Q 2008 to 1Q 2013.
    b. SPSS > Analyze > Forecasting > Sequence Charts.
    c. Sequence Charts specification were made:
        i. Variables: Select SASCOLLM, labeled Seasonal adjusted series COLLMO01.
        ii. Time Axis Labels: Select Date (in format QQ_YYYY).
        iii. Click: One chart per variable.
        iv. Time lines: Select: Lines at each change of: Regulatory period.
        v. Format:
            1. Click: Time on the horizontal axis.
            2. Single variable chart: line chart.
            3. Single variable chart: Click: Reference line at the mean of the series.
    d. Transform data in Sequence Charts.
        i. Difference: Selected testing values of 1, 2, 3.
        ii. Natural log transform: Difference values were tested with the natural log selected.
        iii. Seasonal difference: Not selected.

iv. Current Periodicity: 4.

e. Diagnosis was the time series was stationary. Diagnostic data for CMOs in CDS regulatory period 3 are in Table C3.

Table C3

Diagnostic Data for CMOs in CDS Regulatory Period 3

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
3	1	2Q 2008	1Q 2013	+2	0	-0.04	2 peaks
3	2	2Q 2008	1Q 2013	+2	0	0.00	Uneven spikes
3	3	2Q 2008	1Q 2013	+2	0	0.00	Stationary
3	1	2Q 2008	4Q 2012	+2	-1	-0.04	2 peaks
3	2	2Q 2008	4Q 2012	+2	-1	0.00	Uneven spikes
3	3	2Q 2008	4Q 2012	+2	-1	0.00	Stationary
3	1	2Q 2008	3Q 2012	+2	-2	-0.04	2 peaks
3	2	2Q 2008	3Q 2012	+2	-2	0.00	Uneven spikes
3	3	2Q 2008	3Q 2012	+2	-2	0.00	Stationary
3	1	2Q 2008	2Q 2012	+2	-3	-0.04	2 peaks
3	2	2Q 2008	2Q 2012	+2	-3	0.00	Uneven spikes
3	3	2Q 2008	2Q 2012	+2	-3	0.00	Stationary
3	1	2Q 2008	1Q 2012	+2	-4	-0.04	2 peaks
3	2	2Q 2008	1Q 2012	+2	-4	0.00	Uneven spikes
3	3	2Q 2008	1Q 2012	+2	-4	0.00	Stationary
3	1	3Q 2008	1Q 2013	+1	0	-0.04	2 peaks
3	2	3Q 2008	1Q 2013	+1	0	0.00	Uneven spikes
3	3	3Q 2008	1Q 2013	+1	0	0.00	Stationary
3	1	3Q 2008	4Q 2012	+1	-1	-0.04	2 peaks
3	2	3Q 2008	4Q 2012	+1	-1	0.00	Uneven spikes
3	3	3Q 2008	4Q 2012	+1	-1	0.00	Stationary
3	1	3Q 2008	3Q 2012	+1	-2	-0.04	2 peaks
3	2	3Q 2008	3Q 2012	+1	-2	0.00	Uneven spikes
3	3	3Q 2008	3Q 2012	+1	-2	0.00	Stationary

Note. Data transformed into natural logarithms for the aggregated CDS regulation periods (All).
[a] Difference, according to ARIMA model of first order linear trends (1), second order quadratic trends (2), and third order trends (3). The limited presence of third order trends made it unnecessary to diagnose the data for fourth order or subsequent order trends.
[b] Adjusted by adding or subtracting quarters to the start or end of the period as defined in the ARIMA modeling parameters.

(table continues)

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
3	1	3Q 2008	2Q 2012	+1	-3	-0.04	2 peaks
3	2	3Q 2008	2Q 2012	+1	-3	0.00	Uneven spikes
3	3	3Q 2008	2Q 2012	+1	-3	0.00	Stationary
3	1	3Q 2008	1Q 2012	+1	-4	-0.04	2 peaks
3	2	3Q 2008	1Q 2012	+1	-4	0.00	Uneven spikes
3	3	3Q 2008	1Q 2012	+1	-4	0.00	Stationary
3	1	4Q 2008	1Q 2013	0	0	-0.04	2 peaks
3	2	4Q 2008	1Q 2013	0	0	0.00	Uneven spikes
3	3	4Q 2008	1Q 2013	0	0	0.00	Stationary
3	1	4Q 2008	4Q 2012	0	-1	-0.04	2 peaks
3	2	4Q 2008	4Q 2012	0	-1	0.00	Uneven spikes
3	3	4Q 2008	4Q 2012	0	-1	0.00	Stationary
3	1	4Q 2008	3Q 2012	0	-2	-0.04	2 peaks
3	2	4Q 2008	3Q 2012	0	-2	0.00	Uneven spikes
3	3	4Q 2008	3Q 2012	0	-2	0.00	Stationary
3	1	4Q 2008	2Q 2012	0	-3	-0.04	2 peaks
3	2	4Q 2008	2Q 2012	0	-3	0.00	Uneven spikes
3	3	4Q 2008	2Q 2012	0	-3	0.00	Stationary
3	1	4Q 2008	1Q 2012	0	-4	-0.04	2 peaks
3	2	4Q 2008	1Q 2012	0	-4	0.00	Uneven spikes
3	3	4Q 2008	1Q 2012	0	-4	0.00	Stationary
3	1	1Q 2009	1Q 2013	-1	0	-0.04	Stationary
3	2	1Q 2009	1Q 2013	-1	0	0.00	Multiple spikes
3	3	1Q 2009	1Q 2013	-1	0	0.00	Alternating spikes
3	1	1Q 2009	4Q 2012	-1	-1	-0.04	Stationary; Best fit
3	2	1Q 2009	4Q 2012	-1	-1	0.00	Multiple spikes
3	3	1Q 2009	4Q 2012	-1	-1	0.00	Consistent spikes
3	1	1Q 2009	3Q 2012	-1	-2	-0.04	Stationary
3	2	1Q 2009	3Q 2012	-1	-2	0.00	Multiple spikes

(table continues)

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
3	3	1Q 2009	3Q 2012	-1	-2	0.00	Consistent spikes
3	1	1Q 2009	2Q 2012	-1	-3	-0.04	Stationary
3	2	1Q 2009	2Q 2012	-1	-3	0.00	Multiple spikes
3	3	1Q 2009	2Q 2012	-1	-3	0.00	Consistent spikes
3	1	1Q 2009	1Q 2012	-1	-4	-0.04	Stationary
3	2	1Q 2009	1Q 2012	-1	-4	0.00	Multiple spikes
3	3	1Q 2009	1Q 2012	-1	-4	0.00	Consistent spikes
3	1	2Q 2009	1Q 2013	-2	0	-0.04	Stationary
3	2	2Q 2009	1Q 2013	-2	0	0.00	Multiple spikes
3	3	2Q 2009	1Q 2013	-2	0	0.00	Alternating spikes
3	1	2Q 2009	4Q 2012	-2	-1	-0.04	Stationary
3	2	2Q 2009	4Q 2012	-2	-1	0.00	Multiple spikes
3	3	2Q 2009	4Q 2012	-2	-1	0.00	Consistent spikes
3	1	2Q 2009	3Q 2012	-2	-2	-0.04	Stationary
3	2	2Q 2009	3Q 2012	-2	-2	0.00	Multiple spikes
3	3	2Q 2009	3Q 2012	-2	-2	0.00	Consistent spikes
3	1	2Q 2009	2Q 2012	-2	-3	-0.04	Stationary
3	2	2Q 2009	2Q 2012	-2	-3	0.00	Multiple spikes
3	3	2Q 2009	2Q 2012	-2	-3	0.00	Consistent spikes
3	1	2Q 2009	1Q 2012	-2	-4	-0.04	Stationary
3	2	2Q 2009	1Q 2012	-2	-4	0.00	Multiple spikes
3	3	2Q 2009	1Q 2012	-2	-4	0.00	Consistent spikes

15. Sequence Charts were produced to diagnose stationarity for the CMO time series corresponding to the second CDS regulatory period to identify ARIMA model *d*.
    a. Created SPSS file name Neill_CMO_stationarityCDS2.sav. The date range of the file was 3Q 2000 to 1Q 2009.
    b. SPSS > Analyze > Forecasting > Sequence Charts.
    c. Sequence Charts specification were made:
        i. Variables: Select SASCOLLM, labeled Seasonal adjusted series COLLMO01.
        ii. Time Axis Labels: Select Date (in format QQ_YYYY).
        iii. Click: One chart per variable.
        iv. Time lines: Select: Lines at each change of: Regulatory period.
        v. Format:
            1. Click: Time on the horizontal axis.
            2. Single variable chart: line chart.
            3. Single variable chart: Click: Reference line at the mean of the series.
    d. Transform data in Sequence Charts.
        i. Difference: Selected testing values of 1, 2, 3.
        ii. Natural log transform: Difference values were tested with the natural log selected.
        iii. Seasonal difference: Not selected.

iv. Current Periodicity: 4.

e. Diagnosis was the time series was stationary. Diagnostic data for CMOs in CDS regulatory period 2 are in Table C4.

Table C4

Diagnostic Data for CMOs in CDS Regulatory Period 2

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
2	1	3Q 2000	1Q 2009	+2	+2	0.04	Late downward trend
2	2	3Q 2000	1Q 2009	+2	+2	0.00	Early spike
2	3	3Q 2000	1Q 2009	+2	+2	0.00	Early spike
2	1	3Q 2000	4Q 2008	+2	+1	0.04	Late downward trend
2	2	3Q 2000	4Q 2008	+2	+1	0.00	Early spike
2	3	3Q 2000	4Q 2008	+2	+1	0.00	Early spike
2	1	3Q 2000	3Q 2008	+2	0	0.04	Late downward trend
2	2	3Q 2000	3Q 2008	+2	0	0.00	Early spike
2	3	3Q 2000	3Q 2008	+2	0	0.00	Early spike
2	1	3Q 2000	2Q 2008	+2	-1	0.04	Late downward trend
2	2	3Q 2000	2Q 2008	+2	-1	0.00	Early spike
2	3	3Q 2000	2Q 2008	+2	-1	0.00	Early spike
2	1	3Q 2000	1Q 2008	+2	-2	0.05	Late downward trend
2	2	3Q 2000	1Q 2008	+2	-2	0.00	Early spike
2	3	3Q 2000	1Q 2008	+2	-2	0.00	Early spike
2	1	4Q 2000	1Q 2009	+1	+2	0.04	Late downward trend
2	2	4Q 2000	1Q 2009	+1	+2	0.00	Early spike
2	3	4Q 2000	1Q 2009	+1	+2	0.00	Early spike
2	1	4Q 2000	4Q 2008	+1	+1	0.04	Late downward trend
2	2	4Q 2000	4Q 2008	+1	+1	0.00	Early spike
2	3	4Q 2000	4Q 2008	+1	+1	0.00	Early spike
2	1	4Q 2000	3Q 2008	+1	0	0.04	Late downward trend
2	2	4Q 2000	3Q 2008	+1	0	0.00	Early spike
2	3	4Q 2000	3Q 2008	+1	0	0.00	Early spike

Note. Data transformed into natural logarithms for the aggregated CDS regulation periods (All).
[a] Difference, according to ARIMA model of first order linear trends (1), second order quadratic trends (2), and third order trends (3). The limited presence of third order trends made it unnecessary to diagnose the data for fourth order or subsequent order trends.
[b] Adjusted by adding or subtracting quarters to the start or end of the period as defined in the ARIMA modeling parameters.

(table continues)

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
2	1	4Q 2000	2Q 2008	+1	-1	0.04	Late downward trend
2	2	4Q 2000	2Q 2008	+1	-1	0.00	Early spike
2	3	4Q 2000	2Q 2008	+1	-1	0.00	Early spike
2	1	4Q 2000	1Q 2008	+1	-2	0.05	Late downward trend
2	2	4Q 2000	1Q 2008	+1	-2	0.00	Early spike
2	3	4Q 2000	1Q 2008	+1	-2	0.00	Early spike
2	1	1Q 2001	1Q 2009	0	+2	0.04	Late downward trend
2	2	1Q 2001	1Q 2009	0	+2	0.00	Early spike
2	3	1Q 2001	1Q 2009	0	+2	0.00	Early spike
2	1	1Q 2001	4Q 2008	0	+1	0.04	Late downward trend
2	2	1Q 2001	4Q 2008	0	+1	0.00	Early spike
2	3	1Q 2001	4Q 2008	0	+1	0.00	Early spike
2	1	1Q 2001	3Q 2008	0	0	0.04	Late downward trend
2	2	1Q 2001	3Q 2008	0	0	0.00	Early spike
2	3	1Q 2001	3Q 2008	0	0	0.00	Early spike
2	1	1Q 2001	2Q 2008	0	-1	0.05	Late downward trend
2	2	1Q 2001	2Q 2008	0	-1	0.00	Early spike; Best fit
2	3	1Q 2001	2Q 2008	0	-1	0.00	Early spike
2	1	1Q 2001	1Q 2008	0	-2	0.05	Late downward trend
2	2	1Q 2001	1Q 2008	0	-2	0.00	Early spike
2	3	1Q 2001	1Q 2008	0	-2	0.00	Early spike
2	1	2Q 2001	1Q 2009	-1	+2	0.04	Late downward trend
2	2	2Q 2001	1Q 2009	-1	+2	0.00	Early spike
2	3	2Q 2001	1Q 2009	-1	+2	0.00	Early spike
2	1	2Q 2001	4Q 2008	-1	+1	0.04	Late downward trend
2	2	2Q 2001	4Q 2008	-1	+1	0.00	Early spike
2	3	2Q 2001	4Q 2008	-1	+1	0.00	Early spike
2	1	2Q 2001	3Q 2008	-1	0	0.04	Late downward trend
2	2	2Q 2001	3Q 2008	-1	0	0.00	Early spike
2	3	2Q 2001	3Q 2008	-1	0	0.00	Early spike
2	1	2Q 2001	2Q 2008	-1	-1	0.05	Late downward trend

(table continues)

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
2	2	2Q 2001	2Q 2008	-1	-1	0.00	Early spike
2	3	2Q 2001	2Q 2008	-1	-1	0.00	Early spike
2	1	2Q 2001	1Q 2008	-1	-2	0.05	Late downward trend
2	2	2Q 2001	1Q 2008	-1	-2	0.00	Early spike
2	3	2Q 2001	1Q 2008	-1	-2	0.00	Early spike
2	1	3Q 2001	1Q 2009	-2	+2	0.04	Late downward trend
2	2	3Q 2001	1Q 2009	-2	+2	0.00	Early spike
2	3	3Q 2001	1Q 2009	-2	+2	0.00	Early spike
2	1	3Q 2001	4Q 2008	-2	+1	0.04	Late downward trend
2	2	3Q 2001	4Q 2008	-2	+1	0.00	Early spike
2	3	3Q 2001	4Q 2008	-2	+1	0.00	Early spike
2	1	3Q 2001	3Q 2008	-2	0	0.04	Late downward trend
2	2	3Q 2001	3Q 2008	-2	0	0.00	Early spike
2	3	3Q 2001	3Q 2008	-2	0	0.00	Early spike
2	1	3Q 2001	2Q 2008	-2	-1	0.05	Late downward trend
2	2	3Q 2001	2Q 2008	-2	-1	0.00	Early spike
2	3	3Q 2001	2Q 2008	-2	-1	0.00	Early spike
2	1	3Q 2001	1Q 2008	-2	-2	0.05	Late downward trend
2	2	3Q 2001	1Q 2008	-2	-2	0.00	Early spike
2	3	3Q 2001	1Q 2008	-2	-2	0.00	Early spike

16. Sequence Charts were produced to diagnose stationarity for the Labor Participation Rate time series to identify ARIMA model *d*.
    a. Created SPSS file name Neill_CMO_stationarityLPR.sav. The date range of the file was 3Q 1989 to 1Q 2013.
    b. SPSS > Analyze > Forecasting > Sequence Charts.
    c. Sequence Charts specification were made:
        i. Variables: Select SASLABOR, labeled Seasonal adjusted series LABORP01.
        ii. Time Axis Labels: Select Date (in format QQ_YYYY).
        iii. Click: One chart per variable.
        iv. Time lines: Select: Lines at each change of: Regulatory period.
        v. Format:
            1. Click: Time on the horizontal axis.
            2. Single variable chart: line chart.
            3. Single variable chart: Click: Reference line at the mean of the series.
    d. Transform data in Sequence Charts.
        i. Difference: Selected testing values of 1, 2, 3.
        ii. Natural log transform: Difference values were tested with the natural log selected.
        iii. Seasonal difference: Not selected.

iv. Current Periodicity: 4.

e. Diagnosis was the time series was stationary at the first order differencing. Diagnostic data for Labor Participation Rate by CDS regulatory periods are in Table C5.

   i. There were no adjustments made to time periods by quarter.

   ii. Variation by CDS regulatory periods was similar.

Table C5

Diagnostic Data for Labor Participation Rate by CDS Regulatory Period

Period	Diff.[a]	Start quarter	End quarter	Adjusted at start[b]	Adjusted at end[b]	Y-axis mean	Visual inspection
All	1	3Q 1989	1Q 2013	0	0	0.00	Stationary
All	2	3Q 1989	1Q 2013	0	0	0.00	Stationary
All	3	3Q 1989	1Q 2013	0	0	0.00	Stationary
1	1	3Q 1989	4Q 2000	0	0	0.00	Stationary
1	2	3Q 1989	4Q 2000	0	0	0.00	Stationary
1	3	3Q 1989	4Q 2000	0	0	0.00	Stationary
2	1	1Q 2001	4Q 2008	0	0	0.00	Stationary
2	2	1Q 2001	4Q 2008	0	0	0.00	Stationary
2	3	1Q 2001	4Q 2008	0	0	0.00	Stationary
3	1	1Q 2009	1Q 2013	0	0	0.00	Stationary
3	2	1Q 2009	1Q 2013	0	0	0.00	Stationary
3	3	1Q 2009	1Q 2013	0	0	0.00	Stationary

Note. Data transformed into natural logarithms for the aggregated CDS regulation periods (All).
[a] Difference, according to ARIMA model of first order linear trends (1), second order quadratic trends (2), and third order trends (3). The limited presence of third order trends made it unnecessary to diagnose the data for fourth order or subsequent order trends.
[b] Adjusted by adding or subtracting quarters to the start or end of the period as defined in the ARIMA modeling parameters.

17. ARIMA models were produced to diagnose *p* and *q* values for CMOs and Labor Participation Rate by CDS regulatory periods.

    a. Created SPSS files for each stationary CDS regulatory period.

        i. File name Neill_pdq1.sav. The date range of the file was 1Q 1991 to 4Q 2000.

        ii. File name Neill_pdq2.sav. The date range of the file was 1Q 2001 to 2Q 2008.

        iii. File name Neill_pdq3.sav. The date range of the file was 1Q 2009 to 4Q 2012.

    b. SPSS > Analyze > Forecasting > Create Model > Time Series Modeler to select specifications for: Variables, Statistics, Plots, Output Filter, Save, Options.

    c. SPSS > Analyze > Forecasting > Create Model > Time Series Modeler: Variables:

        i. Dependent Variable Select labeled Seasonal adjusted series COLLMO01. Repeat for Labor Participation Rate.

        ii. Method: Select ARIMA.

            1. ARIMA Criteria: Model: ARIMA Orders with current periodicity of 4: Nonseasonal Structure of Autoregressive (p), Difference (d), Moving Average (q).

                a. Transformation: click on Natural Log.

b. Include constant in model: Do not click (i.e., a constant is excluded) unless ARIMA (0,*d*,0).

2. ARIMA Criteria: Model: Outliers: Click to detect outliers automatically and select Outliers (Additive, Level shift, Innovational, Transient, Seasonal additive, Local trend, Additive patch).

d. SPSS > Analyze > Forecasting > Create Model > Time Series Modeler: Statistics:

i. Click: Display fit measures, Lung-Box statistic, and number of outliers by model.

ii. Select Fit Measures: Stationary R square, R square, Root mean square error, Mean absolute percentage error, Mean absolute error, Maximum absolute percentage error, Maximum absolute error, Normalized BIC.

iii. Select Statistics for Comparing Models: Goodness of fit, Residual autocorrelation function (ACF), Residual partial autocorrelation function (PACF).

iv. Select Statistics for Individual Models: Parameter estimates, Residual autocorrelation function (ACF), Residual partial autocorrelation function (PACF).

v. Do not click: Display Forecasts.

e. SPSS > Analyze > Forecasting > Create Model > Time Series Modeler: Plots:
    i. Select Plots for Comparing Models: Stationary R square, R square, Root mean square error, Mean absolute percentage error, Mean absolute error, Maximum absolute percentage error, Maximum absolute error, Normalized BIC, Residual autocorrelation function (ACF), Residual partial autocorrelation function (PACF).
    ii. Select Plots for Individual Models: Series, Residual autocorrelation function (ACF), Residual partial autocorrelation function (PACF).
        1. Select Each Plot Displays: Observed values, Fit values, Confidence intervals for fit values.

f. SPSS > Analyze > Forecasting > Create Model > Time Series Modeler: Output Filter:
    i. Click: Include all models in output.

g. SPSS > Analyze > Forecasting > Create Model > Time Series Modeler: Save: no selection is necessary.

h. SPSS > Analyze > Forecasting > Create Model > Time Series Modeler: Options:
    i. Forecast Period: No selection is necessary.
    ii. User-Missing Values: Treat as invalid.
    iii. Confidence Interval Width (%): 95.

iv. Prefix for Model Identifiers in Output: Model.

v. Maximum Number of Lags Shown in ACF and PACF Output: 10.

i. Model data for CMOs and the control variable (Labor Participation Rate) by CDS regulatory periods are in tables:

i. Regulatory period 1 is in Table C6.

ii. Regulatory period 2 is in Table C7.

iii. Regulatory period 3 is in Table C8.

Table C6

Model Data for CMOs and Control Variable for Regulatory Period 1

Variable	Difference	(p, q)[a]	Parameter	Estimate	*SE*	*t*	*p*-Value	
CMO	1	(0,0)	none	0.029	0.004	7.786	0.000	***
CMO	1	(0,1)	Θ	-0.597	0.143	-4.189	0.000	***†
CMO	1	(0,2)	Θ_1	-0.654	0.162	-4.032	0.000	***†
CMO	1	(0,2)	Θ_2	-0.290	0.165	-1.756	0.088	
CMO	1	(1,0)	Φ	0.912	0.063	14.585	0.000	***
CMO	1	(1,1)	Φ	0.945	0.051	18.473	0.000	***
CMO	1	(1,1)	Θ	0.189	0.181	1.047	0.302	
CMO	1	(1,2)	Φ	0.939	0.059	15.897	0.000	***
CMO	1	(1,2)	Θ_1	0.219	0.182	1.200	0.238	
CMO	1	(1,2)	Θ_2	-0.083	0.181	-0.459	0.649	
CMO	1	(2,0)	Φ_1	0.749	0.168	4.471	0.000	***
CMO	1	(2,0)	Φ_2	0.181	0.168	1.075	0.289	
CMO	1	(2,1)	Φ_1	1.760	no value	no value	no value	
CMO	1	(2,1)	Φ_2	-0.760	no value	no value	no value	
CMO	1	(2,1)	Θ	0.990	no value	no value	no value	
CMO	1	(2,2)	Φ_1	1.487	0.203	7.335	0.000	***
CMO	1	(2,2)	Φ_2	-0.607	0.193	-3.150	0.003	**
CMO	1	(2,2)	Θ_1	1.080	77.015	0.014	0.989	
CMO	1	(2,2)	Θ_2	-1.000	142.627	-0.007	0.994	
Control	1	(0,0)	none	0.000	0.000	0.647	0.521	
Control	1	(0,1)	Θ	0.305	0.155	1.965	0.057	
Control	1	(0,2)	Θ_1	0.240	0.162	1.481	0.147	
Control	1	(0,2)	Θ_2	0.204	0.164	1.249	0.220	
Control	1	(1,0)	Φ	-0.173	0.160	-1.081	0.287	
Control	1	(1,1)	Φ	0.376	0.419	0.899	0.375	
Control	1	(1,1)	Θ	0.653	0.347	1.882	0.068	
Control	1	(1,2)	Φ	-0.034	0.816	-0.042	0.967	

Note. Difference is the ARIMA *d; SE* is the standard error of the estimate. Due to outliers at d=2, analysis was performed at d=3 to determine whether the outliers indicated a trend.
[a] ARIMA p is the autoregressive (AR) portion of the model and its estimate is represented by the mathematical symbol Φ; ARIMA q is the moving average (MA) portion of the model and its estimate is represented by the mathematical symbol Θ.
† Parameter includes ARIMA outlier.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

(table continues)

Variable	Difference	(p, q)[a]	Parameter	Estimate	*SE*	*t*	*p*-Value	
Control	1	(1,2)	Θ_1	0.207	0.799	0.260	0.797	
Control	1	(1,2)	Θ_2	0.216	0.282	0.769	0.447	
Control	1	(2,0)	Φ_1	-0.210	0.161	-1.310	0.198	
Control	1	(2,0)	Φ_2	-0.224	0.163	-1.376	0.177	
Control	1	(2,1)	Φ_1	0.261	0.503	0.520	0.606	
Control	1	(2,1)	Φ_2	-0.145	0.226	-0.641	0.525	
Control	1	(2,1)	Θ	0.506	0.499	1.015	0.317	
Control	1	(2,2)	Φ_1	0.208	1.632	0.127	0.899	
Control	1	(2,2)	Φ_2	-0.102	0.875	-0.117	0.908	
Control	1	(2,2)	Θ_1	0.453	1.637	0.277	0.784	
Control	1	(2,2)	Θ_2	0.056	1.253	0.045	0.964	
Control	2	(0,0)	none	7.903E-005	0.001	0.140	0.890	
Control	2	(0,1)	Θ	1.000	20.413	0.049	0.961	
Control	2	(0,2)	Θ_1	0.855	187.359	0.005	0.996	
Control	2	(0,2)	Θ_2	0.145	27.248	0.005	0.996	
Control	2	(1,0)	Φ	-0.456	0.155	-2.941	0.006	**†
Control	2	(1,1)	Φ	0.187	0.219	0.856	0.398	
Control	2	(1,1)	Θ	1.000	71.905	0.014	0.989	
Control	2	(1,2)	Φ	-0.888	0.206	-4.316	0.000	***
Control	2	(1,2)	Θ_1	0.005	8.442	0.001	0.999	
Control	2	(1,2)	Θ_2	0.992	8.115	0.122	0.903	
Control	2	(2,0)	Φ_1	-1.117	0.144	-7.761	0.000	***†
Control	2	(2,0)	Φ_2	-0.569	0.141	-4.039	0.000	***†
Control	2	(2,1)	Φ_1	-0.193	0.180	-1.071	0.291	
Control	2	(2,1)	Φ_2	-0.215	0.179	-1.205	0.236	
Control	2	(2,1)	Θ	0.995	2.058	0.483	0.632	
Control	2	(2,2)	Φ_1	-0.720	0.734	-0.981	0.333	
Control	2	(2,2)	Φ_2	-0.221	0.180	-1.227	0.228	
Control	2	(2,2)	Θ_1	0.444	5.154	0.086	0.932	
Control	2	(2,2)	Θ_2	0.553	3.154	0.175	0.862	
Control	3	(0,0)	none	8.025E-005	0.001	0.094	0.925	
Control	3	(0,1)	Θ	0.997	5.717	0.174	0.863	
Control	3	(0,2)	Θ_1	1.983	4.993	0.397	0.694	

† Parameter includes ARIMA outlier.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

(table continues)

Variable	Difference	(p, q)[a]	Parameter	Estimate	*SE*	*t*	*p*-Value	
Control	3	(0,2)	Θ_2	-0.997	4.978	-0.200	0.842	
Control	3	(1,0)	Φ	-0.597	0.142	-4.214	0.000	***†
Control	3	(1,1)	Φ	-0.414	0.184	-2.250	0.031	*†
Control	3	(1,1)	Θ	0.987	1.631	0.605	0.549	
Control	3	(1,2)	Φ	-0.255	0.263	-0.970	0.339	
Control	3	(1,2)	Θ_1	1.586	0.440	3.602	0.001	***
Control	3	(1,2)	Θ_2	-0.608	0.280	-2.168	0.037	
Control	3	(2,0)	Φ_1	-1.243	0.128	-9.710	0.000	***†
Control	3	(2,0)	Φ_2	-0.725	0.127	-5.693	0.000	***†
Control	3	(2,1)	Φ_1	-1.064	0.164	-6.484	0.000	***†
Control	3	(2,1)	Φ_2	-0.528	0.158	-3.349	0.002	**†
Control	3	(2,1)	Θ	0.999	19.011	0.053	0.958	
Control	3	(2,2)	Φ_1	-1.045	0.309	-3.380	0.002	**†
Control	3	(2,2)	Φ_2	-0.516	0.239	-2.153	0.039	*†
Control	3	(2,2)	Θ_1	1.089	2.104	0.517	0.608	
Control	3	(2,2)	Θ_2	-0.096	0.348	-0.275	0.785	

† Parameter includes ARIMA outlier.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Table C7

Model Data for CMOs and Control Variable for Regulatory Period 2

Variable	Difference	(p, q)[a]	Parameter	Estimate	*SE*	*t*	*p*-Value	
CMO	2	(0,0)	none	-0.002	0.004	-0.517	0.609	
CMO	2	(0,1)	Θ	0.373	0.191	1.956	0.061	
CMO	2	(0,2)	Θ_1	0.532	0.201	2.653	0.014	*†
CMO	2	(0,2)	Θ_2	-0.193	0.212	-0.909	0.372	
CMO	2	(1,0)	Φ	-0.465	0.173	-2.694	0.012	*†
CMO	2	(1,1)	Φ	-0.934	0.098	-9.492	0.000	***†
CMO	2	(1,1)	Θ	-0.550	0.247	-2.228	0.036	*†
CMO	2	(1,2)	Φ	-0.789	0.465	-1.697	0.102	
CMO	2	(1,2)	Θ_1	-0.492	99.240	-0.005	0.996	
CMO	2	(1,2)	Θ_2	0.507	50.307	0.010	0.992	
CMO	2	(2,0)	Φ_1	-0.263	0.177	-1.483	0.152	
CMO	2	(2,0)	Φ_2	0.604	0.186	3.254	0.004	**†
CMO	2	(2,1)	Φ_1	-0.724	0.407	-1.780	0.087	
CMO	2	(2,1)	Φ_2	-0.489	0.201	-2.427	0.023	*
CMO	2	(2,1)	Θ	-0.284	0.467	-0.607	0.549	
CMO	2	(2,2)	Φ_1	-0.726	0.461	-1.574	0.129	
CMO	2	(2,2)	Φ_2	-0.444	0.360	-1.234	0.229	
CMO	2	(2,2)	Θ_1	-0.282	0.507	-0.555	0.584	
CMO	2	(2,2)	Θ_2	0.062	0.513	0.121	0.904	
Control	2	(0,0)	none	0.000	0.001	0.315	0.775	
Control	2	(0,1)	Θ	0.943	0.162	5.818	0.000	***
Control	2	(0,2)	Θ_1	1.342	0.188	7.127	0.000	***
Control	2	(0,2)	Θ_2	-0.463	0.187	-2.471	0.020	*
Control	2	(1,0)	Φ	-0.483	0.167	-2.889	0.008	**
Control	2	(1,1)	Φ	-0.292	0.208	-1.402	0.173	
Control	2	(1,1)	Θ	0.900	0.134	6.707	0.000	***
Control	2	(1,2)	Φ	-0.905	0.332	-2.728	0.011	*
Control	2	(1,2)	Θ_1	-0.058	24.989	-0.002	0.998	

Note. Difference is the ARIMA *d; SE* is the standard error of the estimate.
[a] ARIMA *p* is the autoregressive (AR) portion of the model and its estimate is represented by the mathematical symbol Φ; ARIMA *q* is the moving average (MA) portion of the model and its estimate is represented by the mathematical symbol Θ.
† Parameter includes ARIMA outlier.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

(table continues)

Variable	Difference	$(p, q)^a$	Parameter	Estimate	SE	*t*	*p*-Value	
Control	2	(1,2)	Θ_2	0.941	23.508	0.040	0.968	
Control	2	(2,0)	Φ_1	-0.790	0.154	-5.138	0.000	***
Control	2	(2,0)	Φ_2	-0.665	0.140	-4.754	0.000	***
Control	2	(2,1)	Φ_1	-0.515	0.201	-2.570	0.017	*
Control	2	(2,1)	Φ_2	-0.524	0.186	-2.815	0.009	**
Control	2	(2,1)	Θ	0.731	0.174	4.196	0.000	***
Control	2	(2,2)	Φ_1	-0.494	0.372	-1.329	0.196	
Control	2	(2,2)	Φ_2	-0.520	0.201	-2.592	0.016	*
Control	2	(2,2)	Θ_1	0.757	0.433	1.748	0.093	
Control	2	(2,2)	Θ_2	-0.031	0.406	-0.077	0.939	
Control	1	(0,0)	none	-0.001	0.001	-1.052	0.302	
Control	1	(0,1)	Θ	0.320	0.183	1.747	0.092	
Control	1	(0,2)	Θ_1	0.445	0.194	2.300	0.029	*
Control	1	(0,2)	Θ_2	-0.132	0.194	-0.681	0.502	
Control	1	(1,0)	Φ	-0.260	0.182	-1.431	0.164	
Control	1	(1,1)	Φ	0.994	1.321	0.752	0.458	
Control	1	(1,1)	Θ	0.991	1.481	0.669	0.509	
Control	1	(1,2)	Φ	-0.834	0.293	-2.851	0.008	**
Control	1	(1,2)	Θ_1	-0.634	5.343	-0.119	0.906	
Control	1	(1,2)	Θ_2	0.363	1.889	0.192	0.849	
Control	1	(2,0)	Φ_1	-0.335	0.193	-1.734	0.094	
Control	1	(2,0)	Φ_2	-0.328	0.181	-1.810	0.081	
Control	1	(2,1)	Φ_1	-0.567	-0.457	-1.240	0.226	
Control	1	(2,1)	Φ_2	-0.414	0.188	-2.206	0.036	*
Control	1	(2,1)	Θ	-0.272	0.500	-0.544	0.591	
Control	1	(2,2)	Φ_1	-0.276	0.091	-3.021	0.006	**
Control	1	(2,2)	Φ_2	-0.930	0.079	-11.760	0.000	***
Control	1	(2,2)	Θ_1	-0.096	0.179	-0.535	0.597	
Control	1	(2,2)	Θ_2	-1.000	0.177	-5.652	0.000	***

† Parameter includes ARIMA outlier.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Table C8

Model Data for CMOs and Control Variable for Regulatory Period 3

Variable	Difference	(p, q) [a]	Parameter	Estimate	*SE*	*t*	*p*-Value	
CMO	1	(0,0)	none	-0.036	0.004	-9.176	0.000	***
CMO	1	(0,1)	Θ	-0.985	4.596	-0.214	0.834	
CMO	1	(0,2)	Θ_1	-1.002	1.992	-0.503	0.624	
CMO	1	(0,2)	Θ_2	-0.978	3.887	-0.252	0.806	
CMO	1	(1,0)	Φ	0.980	0.030	32.556	0.000	***†
CMO	1	(1,1)	Φ	0.977	0.038	25.881	0.000	***
CMO	1	(1,1)	Θ	0.293	0.284	1.032	0.321	
CMO	1	(1,2)	Φ	0.968	0.054	17.916	0.000	***
CMO	1	(1,2)	Θ_1	0.275	0.304	0.904	0.384	
CMO	1	(1,2)	Θ_2	-0.103	0.314	-0.329	0.748	
CMO	1	(2,0)	Φ_1	0.636	0.263	2.415	0.031	*
CMO	1	(2,0)	Φ_2	0.330	0.266	1.243	0.236	
CMO	1	(2,1)	Φ_1	-0.028	0.106	-0.267	0.794	
CMO	1	(2,1)	Φ_2	0.970	0.093	10.429	0.000	***
CMO	1	(2,1)	Θ	-0.975	1.933	-0.504	0.623	
CMO	1	(2,2)	Φ_1	-0.033	0.142	-0.231	0.821	
CMO	1	(2,2)	Φ_2	0.966	0.149	6.477	0.000	***
CMO	1	(2,2)	Θ_1	-1.081	2.903	-0.372	0.717	
CMO	1	(2,2)	Θ_2	-0.108	0.371	-0.290	0.777	
Control	1	(0,0)	none	-0.002	0.001	-2.126	0.052	
Control	1	(0,1)	Θ	0.252	0.224	1.129	0.283	
Control	1	(0,2)	Θ_1	0.180	0.256	0.701	0.499	
Control	1	(0,2)	Θ_2	0.199	0.265	0.750	0.470	
Control	1	(1,0)	Φ	-0.311	0.250	-1.242	0.240	
Control	1	(1,1)	Φ	0.947	0.180	5.276	0.000	***†
Control	1	(1,1)	Θ	0.811	0.323	2.506	0.029	*†
Control	1	(1,2)	Φ	0.968	0.052	18.492	0.000	***
Control	1	(1,2)	Θ_1	1.488	0.350	4.254	0.001	***

Note. Difference is the ARIMA *d;* SE is the standard error of the estimate.

[a] ARIMA *p* is the autoregressive (AR) portion of the model and its estimate is represented by the mathematical symbol Φ; ARIMA *q* is the moving average (MA) portion of the model and its estimate is represented by the mathematical symbol Θ.

† Parameter includes ARIMA outlier.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

(table continues)

Variable	Difference	(p, q) [a]	Parameter	Estimate	*SE*	*t*	*p*-Value	
Control	1	(1,2)	Θ_2	-0.704	0.354	-1.986	0.070	
Control	1	(2,0)	Φ_1	0.100	0.234	0.427	0.678	
Control	1	(2,0)	Φ_2	0.342	0.254	1.346	0.206	
Control	1	(2,1)	Φ_1	0.456	0.337	1.352	0.213	
Control	1	(2,1)	Φ_2	0.430	0.279	1.537	0.163	
Control	1	(2,1)	Θ	0.473	0.291	1.627	0.142	
Control	1	(2,2)	Φ_1	-0.052	0.267	-0.193	0.851	
Control	1	(2,2)	Φ_2	-0.436	0.283	-1.538	0.158	
Control	1	(2,2)	Θ_1	0.040	0.302	0.133	0.897	
Control	1	(2,2)	Θ_2	-0.964	0.299	-3.224	0.010	**†
Control	2	(0,0)	none	0.000	0.002	-0.065	0.950	
Control	2	(0,1)	Θ	1.000	734.956	0.001	0.999	
Control	2	(0,2)	Θ_1	0.988	0.232	4.261	0.002	**†
Control	2	(0,2)	Θ_2	-0.342	0.231	-1.483	0.169	
Control	2	(1,0)	Φ	-0.702	0.078	-9.019	0.000	***†
Control	2	(1,1)	Φ	-0.444	0.287	-1.550	0.156	
Control	2	(1,1)	Θ	0.512	0.220	2.323	0.045	*†
Control	2	(1,2)	Φ	0.123	0.425	0.290	0.777	
Control	2	(1,2)	Θ_1	1.703	77.620	0.022	0.983	
Control	2	(1,2)	Θ_2	-0.999	91.051	-0.011	0.991	
Control	2	(2,0)	Φ_1	-0.995	0.252	-3.951	0.002	**
Control	2	(2,0)	Φ_2	-0.578	0.225	-2.571	0.024	*
Control	2	(2,1)	Φ_1	-1.210	0.087	-13.905	0.000	***†
Control	2	(2,1)	Φ_2	-0.664	0.066	-10.005	0.000	***†
Control	2	(2,1)	Θ	-0.174	0.114	-1.524	0.171	
Control	2	(2,2)	Φ_1	0.006	0.373	0.017	0.987	
Control	2	(2,2)	Φ_2	-0.410	0.317	-1.295	0.224	
Control	2	(2,2)	Θ_1	1.601	118.357	0.014	0.989	
Control	2	(2,2)	Θ_2	-0.999	147.768	-0.007	0.995	

† Parameter includes ARIMA outlier.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

18. ARIMA models with significant parameters were tested to identify the best models for CMOs and Labor Participation Rate by CDS regulatory periods.
    a. Data from Tables C6 through C8 was selected for those models with significant parameters and shown in Tables C9 through C14.
        i. A model was tested if at least one of the parameters had a significant *p*-value.
            1. If a model with multiple parameters, such as (2,1,2), had one significant parameter, then the other parameters could be insignificant.
    b. Best models were indicated based on the criteria of the *t* score, mean absolute percentage error (*MAPE*), residual autocorrelation (ACF), and residual partial autocorrelation (PACF) values.
        i. Unambiguous results had the best *t* score (the highest absolute value) and the lowest *MAPE*.
        ii. Ambiguous results were tested with the rules-based diagnostic guidance by Nau (2014).
            1. *MAPE* indicates the best model more so than the *t* score.
                a. *MAPE* is a model-level statistic, compared to the t score and standard error of the estimate (*SE*) that are parameter-level statistics, allowing for

comparison between models with multiple parameters.

2. Plots were reviewed for indications of ACF and PACF patterns that would indicate that a parameter change was needed to improve the model.

c. Best models were chosen for the 6 periods that resulted from the 3 regulatory periods and 2 variables (dependent and control).

   i. Discussions regarding the best model fit are footnoted in each of the best model tables, including outliers and comparisons to closely related models.

      1. Best model for Regulatory Period 1 for CMOs is discussed in Table C9.
      2. Best model for Regulatory Period 1 for Control Variable is discussed in Table C10.
      3. Best model for Regulatory Period 2 for CMOs is discussed in Table C11.
      4. Best model for Regulatory Period 2 for Control Variable is discussed in Table C12.
      5. Best model for Regulatory Period 3 for CMOs is discussed in Table C13.

6. Best model for Regulatory Period 3 for Control Variable is discussed in Table C14.

Table C9

Regulatory Period 1 Best Model for CMOs (Seasonally Adjusted)

Variable	Difference	(*p, q*)[a]	Parameter	Estimate	*MAPE*	*t*	*p*-Value	
CMO	1	(0,0)	none	0.029	2.041	7.786	0.000	***
CMO	1	(0,1)	Θ	-0.597	1.643	-4.189	0.000	***[b]
CMO	1	(0,2)	Θ_1	-0.654	1.516	-4.032	0.000	***[b]
CMO	1	(0,2)	Θ_2	-0.290	1.516	-1.756	0.088	
CMO	1	(1,0)	Φ	0.912	1.420	14.585	0.000	***
CMO	1	(1,1)	Φ	0.945	1.420	18.473	0.000	***‡
CMO	1	(1,1)	Θ	0.189	1.420	1.047	0.302	‡
CMO	1	(1,2)	Φ	0.939	1.414	15.897	0.000	***
CMO	1	(1,2)	Θ_1	0.219	1.414	1.200	0.238	
CMO	1	(1,2)	Θ_2	-0.083	1.414	-0.459	0.649	
CMO	1	(2,0)	Φ_1	0.749	1.417	4.471	0.000	***
CMO	1	(2,0)	Φ_2	0.181	1.417	1.075	0.289	
CMO	1	(2,2)	Φ_1	1.487	1.115	7.335	0.000	***
CMO	1	(2,2)	Φ_2	-0.607	1.115	-3.150	0.003	**
CMO	1	(2,2)	Θ_1	1.080	1.115	0.014	0.989	
CMO	1	(2,2)	Θ_2	-1.000	1.115	-0.007	0.994	

Note. Difference is the ARIMA *d; MAPE* is the Mean Absolute Percentage Error that is shown at the model level rather than at the parameter level so that the (*p,d,q*) models may be compared.

[a] ARIMA *p* is the autoregressive (AR) portion of the model and its estimate is represented by the mathematical symbol Φ; ARIMA *q* is the moving average (MA) portion of the model and its estimate is represented by the mathematical symbol Θ.

[b] Outlier is 2Q 1991 (Local Trend).

‡ Best model. Model (1,1,1) has the highest *t* scores (18.473 and 1.047) and the *MAPE* (1.42) is better than or equal to the other models except Model (1,1,2) and Model (2,1,2). Model (1,1,0) displays a sharp cutoff of the residual ACF (autocorrelation function) after the first lag, indicating the need for the MA term in Model (1,1,1). With the addition of the second MA term in Model (1,1,2), the *MAPE* lowers from 1.42 in Model (1,1,1) to 1.414, while the *t* scores decline to 15.897, 1.2, and -0.459. With the inclusion of the second AR and MA terms in Model (2,1,2), the *t* scores for all parameters worsen compared to Model (1,1,1) while the *MAPE* improves to 1.115. The *p*-values for the MA parameters also worsen progressively as the model shifts from Model (1,1,1) to Model (1,1,2) and to Model (2,1,2). The best model is (1,1,1). See Table C15 for the Non-Seasonally Adjusted (NSA) version of the best model.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Table C10

Regulatory Period 1 Best Model for Control Variable

Variable	Difference	(p, q)[a]	Parameter	Estimate	*MAPE*	*t*	*p*-Value	
Control	2	(1,0)	Φ	-0.456	0.234	-2.941	0.006	**[b]
Control	2	(1,2)	Φ	-0.888	0.226	-4.316	0.000	*
Control	2	(1,2)	Θ_1	0.005	0.226	0.001	0.999	
Control	2	(1,2)	Θ_2	0.992	0.226	0.122	0.903	
Control	2	(2,0)	Φ_1	-1.117	0.215	-7.761	0.000	***[c]
Control	2	(2,0)	Φ_2	-0.569	0.215	-4.039	0.000	***[d]
Control	3	(1,0)	Φ	-0.597	0.327	-4.214	0.000	***[e]
Control	3	(1,1)	Φ	-0.414	0.243	-2.250	0.031	*[f]
Control	3	(1,1)	Θ	0.987	0.243	0.605	0.549	
Control	3	(1,2)	Φ	-0.255	0.281	-0.970	0.339	
Control	3	(1,2)	Θ_1	1.586	0.281	3.602	0.001	***
Control	3	(1,2)	Θ_2	-0.608	0.281	-2.168	0.037	
Control	3	(2,0)	Φ_1	-1.243	0.286	-9.710	0.000	***[g]‡
Control	3	(2,0)	Φ_2	-0.725	0.286	-5.693	0.000	***[h]‡
Control	3	(2,1)	Φ_1	-1.064	0.253	-6.484	0.000	***[i]
Control	3	(2,1)	Φ_2	-0.528	0.253	-3.349	0.002	**[i]
Control	3	(2,1)	Θ	0.999	0.253	0.053	0.958	
Control	3	(2,2)	Φ_1	-1.045	0.250	-3.380	0.002	**[j]
Control	3	(2,2)	Φ_2	-0.516	0.250	-2.153	0.039	*[j]
Control	3	(2,2)	Θ_1	1.089	0.250	0.517	0.608	
Control	3	(2,2)	Θ_2	-0.096	0.250	-0.275	0.785	

Note. Difference is the ARIMA *d; MAPE* is the Mean Absolute Percentage Error that is shown at the model level rather than at the parameter level so that the (p,d,q) models may be compared.

[a] ARIMA *p* is the autoregressive (AR) portion of the model and its estimate is represented by the mathematical symbol Φ; ARIMA *q* is the moving average (MA) portion of the model and its estimate is represented by the mathematical symbol Θ.

[b] Outliers are 4Q 1991 (Additive) and 2Q 1993 (Additive).

[c] Outlier is 2Q 1992 (Additive).

[d] Outlier is 2Q 1992 (Additive).

[e] Outliers are 1Q 1992 (Local Trend) and 2Q 1993 (Additive).

[f] Outliers are 4Q 1991 (Additive) and 2Q 1993 (Additive).

[g] Outlier is 3Q 1993 (Local Trend).

[h] Outlier is 3Q 1993 (Local Trend).

[i] Outlier is 2Q 1991 (Additive).

[j] Outlier is 2Q 1992 (Additive).

‡ Best model. Model (2,3,0) has the highest *t* scores (-9.71 and -5.693) with *MAPE* of .286. Model (2,2,0) has lower *t* scores (-7.761 and -4.039) than Model (2,3,0) but also a lower *MAPE* (.215). The best model is (2,3,0).

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Table C11

Regulatory Period 2 Best Model for CMOs (Seasonally Adjusted)

Variable	Difference	(p, q) [a]	Parameter	Estimate	*MAPE*	t	p-Value	
CMO	2	(0,2)	Θ_1	0.532	1.539	2.653	0.014	*[b]
CMO	2	(0,2)	Θ_2	-0.193	1.539	-0.909	0.372	
CMO	2	(1,0)	Φ	-0.465	1.547	-2.694	0.012	*[c]
CMO	2	(1,1)	Φ	-0.934	1.123	-9.492	0.000	***[d]‡
CMO	2	(1,1)	Θ	-0.550	1.123	-2.228	0.036	*[d]‡
CMO	2	(2,0)	Φ_1	-0.263	0.968	-1.483	0.152	
CMO	2	(2,0)	Φ_2	0.604	0.968	3.254	0.004	**[e]
CMO	2	(2,1)	Φ_1	-0.724	1.718	-1.780	0.087	
CMO	2	(2,1)	Φ_2	-0.489	1.718	-2.427	0.023	*
CMO	2	(2,1)	Θ	-0.284	1.718	-0.607	0.549	

Note. Difference is the ARIMA *d; MAPE* is the Mean Absolute Percentage Error that is shown at the model level rather than at the parameter level so that the (p,d,q) models may be compared.

[a] ARIMA p is the autoregressive (AR) portion of the model and its estimate is represented by the mathematical symbol Φ; ARIMA q is the moving average (MA) portion of the model and its estimate is represented by the mathematical symbol Θ.

[b] Outlier is 4Q 2011 (Additive).

[c] Outlier is 4Q 2011 (Additive).

[d] Outliers are 4Q 2001 (Transient) and 3Q 2003 (Additive).

[e] Outliers are 4Q 2001 (Transient) and 3Q 2003 (Transient).

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

‡ Best model. Model (1,2,1) has the highest t scores (-9.492 and -2.228), but also a higher *MAPE* (1.123) than other models and positive residual autocorrelation at lag-1, suggestive of the need for an additional AR term in the model. Model (2,2,1) has both lower t scores and higher *MAPE* than Model (1,2,1), making it a worse alternative. Model (2,2,0) has a lower *MAPE* (.968) than Model (1,2,1), but also lower t scores (3.254 and -1.483). Model (1,2,0) has only 1 outlier, compared to 2 outliers in both Model (1,2,1) and Model (2,2,0), but has a lower t score and higher *MAPE* than both those models. The best model is (1,2,1). See Table C15 for the Non-Seasonally Adjusted (NSA) version of the best model.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Table C12

Regulatory Period 2 Best Model for Control Variable

Variable	Difference	(*p, q*)[a]	Parameter	Estimate	*MAPE*	*t*	*p*-Value	
Control	1	(0,2)	Θ_1	0.445	0.226	2.300	0.029	*
Control	1	(0,2)	Θ_2	-0.132	0.226	-0.681	0.502	
Control	1	(1,2)	Φ	-0.834	0.205	-2.851	0.008	**
Control	1	(1,2)	Θ_1	-0.634	0.205	-0.119	0.906	
Control	1	(1,2)	Θ_2	0.363	0.205	0.192	0.849	
Control	1	(2,1)	Φ_1	-0.567	0.209	-1.240	0.226	
Control	1	(2,1)	Φ_2	-0.414	0.209	-2.206	0.036	*
Control	1	(2,1)	Θ	-0.272	0.209	-0.544	0.591	
Control	1	(2,2)	Φ_1	-0.276	0.167	-3.021	0.006	**‡
Control	1	(2,2)	Φ_2	-0.930	0.167	-11.760	0.000	***[b]‡
Control	1	(2,2)	Θ_1	-0.096	0.167	-0.535	0.597	‡
Control	1	(2,2)	Θ_2	-1.000	0.167	-5.652	0.000	***[b]‡
Control	2	(0,1)	Θ	0.943	0.263	5.818	0.000	***
Control	2	(0,2)	Θ_1	1.342	0.259	7.127	0.000	***
Control	2	(0,2)	Θ_2	-0.463	0.259	-2.471	0.020	*
Control	2	(1,0)	Φ	-0.483	0.333	-2.889	0.008	**
Control	2	(1,1)	Φ	-0.292	0.264	-1.402	0.173	
Control	2	(1,1)	Θ	0.900	0.264	6.707	0.000	***
Control	2	(1,2)	Φ	-0.905	0.257	-2.728	0.011	*
Control	2	(1,2)	Θ_1	-0.058	0.257	-0.002	0.998	
Control	2	(1,2)	Θ_2	0.941	0.257	0.040	0.968	
Control	2	(2,0)	Φ_1	-0.790	0.255	-5.138	0.000	***
Control	2	(2,0)	Φ_2	-0.665	0.255	-4.754	0.000	***
Control	2	(2,1)	Φ_1	-0.515	0.229	-2.570	0.017	*
Control	2	(2,1)	Φ_2	-0.524	0.229	-2.815	0.009	**
Control	2	(2,1)	Θ	0.731	0.229	4.196	0.000	***
Control	2	(2,2)	Φ_1	-0.494	0.230	-1.329	0.196	
Control	2	(2,2)	Φ_2	-0.520	0.230	-2.592	0.016	*
Control	2	(2,2)	Θ_1	0.757	0.230	1.748	0.093	
Control	2	(2,2)	Θ_2	-0.031	0.230	-0.077	0.939	

Note. Difference is the ARIMA *d; MAPE* is the Mean Absolute Percentage Error that is shown at the model level rather than at the parameter level so that the (*p,d,q*) models may be compared.
* $p \le .05$, ** $p \le .01$, *** $p \le .001$

(table continues)

[a] ARIMA *p* is the autoregressive (AR) portion of the model and its estimate is represented by the mathematical symbol Φ; ARIMA *q* is the moving average (MA) portion of the model and its estimate is represented by the mathematical symbol Θ.
[b] Outlier is 2Q 2001 (Innovational).
‡ Best model. Model (2,1,2) has the highest *t* scores (-11.76, -5.652, -3.021, and -.535) and the lowest *MAPE* (.167), with 1 outlier.

Table C13

Regulatory Period 3 Best Model for CMOs (Seasonally Adjusted)

Variable	Difference	(p, q)[a]	Parameter	Estimate	*MAPE*	*t*	*p*-Value	
CMO	1	(0,0)	none	-0.036	1.174	-9.176	0.000	***
CMO	1	(1,0)	Φ	0.980	0.998	32.556	0.000	***[b]‡
CMO	1	(1,1)	Φ	0.977	1.292	25.881	0.000	***
CMO	1	(1,1)	Θ	0.293	1.292	1.032	0.321	
CMO	1	(1,2)	Φ	0.968	1.322	17.916	0.000	***
CMO	1	(1,2)	Θ_1	0.275	1.322	0.904	0.384	
CMO	1	(1,2)	Θ_2	-0.103	1.322	-0.329	0.748	
CMO	1	(2,0)	Φ_1	0.636	1.297	2.415	0.031	*
CMO	1	(2,0)	Φ_2	0.330	1.297	1.243	0.236	
CMO	1	(2,1)	Φ_1	-0.028	1.253	-0.267	0.794	
CMO	1	(2,1)	Φ_2	0.970	1.253	10.429	0.000	***
CMO	1	(2,1)	Θ	-0.975	1.253	-0.504	0.623	
CMO	1	(2,2)	Φ_1	-0.033	1.254	-0.231	0.821	
CMO	1	(2,2)	Φ_2	0.966	1.254	6.477	0.000	***
CMO	1	(2,2)	Θ_1	-1.081	1.254	-0.372	0.717	
CMO	1	(2,2)	Θ_2	-0.108	1.254	-0.290	0.777	

Note. Difference is the ARIMA *d; MAPE* is the Mean Absolute Percentage Error that is shown at the model level rather than at the parameter level so that the (p,d,q) models may be compared.

[a] ARIMA *p* is the autoregressive (AR) portion of the model and its estimate is represented by the mathematical symbol Φ; ARIMA *q* is the moving average (MA) portion of the model and its estimate is represented by the mathematical symbol Θ.

[b] Outlier is 1Q 2010 (Seasonal Additive).

‡ Best model. Model (1,1,0) has the highest *t* score (32.556) and the lowest *MAPE* (.998), with 1 outlier. See Table C15 for the Non-Seasonally Adjusted (NSA) version of the best model.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Table C14

Regulatory Period 3 Best Model for Control Variable

Variable	Difference	(*p, q*)[a]	Parameter	Estimate	*MAPE*	*t*	*p*-Value	
Control	1	(1,1)	Φ	0.947	0.179	5.276	0.000	***[b]
Control	1	(1,1)	Θ	0.811	0.179	2.506	0.029	*[b]
Control	1	(1,2)	Φ	0.968	0.291	18.492	0.000	***‡
Control	1	(1,2)	Θ_1	1.488	0.291	4.254	0.001	***‡
Control	1	(1,2)	Θ_2	-0.704	0.291	-1.986	0.070	†
Control	1	(2,2)	Φ_1	-0.052	0.166	-0.193	0.851	
Control	1	(2,2)	Φ_2	-0.436	0.166	-1.538	0.158	
Control	1	(2,2)	Θ_1	0.040	0.166	0.133	0.897	
Control	1	(2,2)	Θ_2	-0.964	0.166	-3.224	0.010	**[b]
Control	2	(0,2)	Θ_1	0.988	0.157	4.261	0.002	**[b]
Control	2	(0,2)	Θ_2	-0.342	0.157	-1.483	0.169	
Control	2	(1,0)	Φ	-0.702	0.092	-9.019	0.000	***[c]
Control	2	(1,1)	Φ	-0.444	0.108	1.550	0.156	
Control	2	(1,1)	Θ	0.512	0.108	2.323	0.045	*[d]
Control	2	(2,0)	Φ_1	-0.995	0.358	-3.951	0.002	**
Control	2	(2,0)	Φ_2	-0.578	0.358	-2.571	0.024	*
Control	2	(2,1)	Φ_1	-1.210	0.047	-13.905	0.000	***[e]
Control	2	(2,1)	Φ_2	-0.664	0.047	-10.005	0.000	***[e]
Control	2	(2,1)	Θ	-0.174	0.047	-1.524	0.171	

Note. Difference is the ARIMA *d; MAPE* is the Mean Absolute Percentage Error that is shown at the model level rather than at the parameter level so that the (*p,d,q*) models may be compared.

[a] ARIMA *p* is the autoregressive (AR) portion of the model and its estimate is represented by the mathematical symbol Φ; ARIMA *q* is the moving average (MA) portion of the model and its estimate is represented by the mathematical symbol Θ.

[b] Outliers are 3Q 2009 (Innovational) and 4Q 2009 (Additive).

[c] Outliers are 3Q 2009 (Local Trend), 1Q 2010 (Innovational), and 3Q 2011 (Transient).

[d] Outliers are 3Q 2009 (Innovational), 4Q 2009 (Additive), and 3Q 2011 (Level Shift).

[e] Outliers are 3Q 2009 (Innovational), 4Q 2009 (Additive), 3Q 2011 (Innovational), and 1Q 2012 (Level Shift).

‡ Best model. Model (1,1,2) has the highest *t* score (18.492; also 4.254 and -1.986) and *MAPE* of .291, with no outliers. Model (2,2,1) has a lower *MAPE* (.047), but has 4 outliers with $n = 16$. The best model is (1,1,2).

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

19. The CMOs best fit models based on the seasonally adjusted (SA) data were tested for the effect of seasonality by using the original data series that was not seasonally adjusted (NSA).

    a. Repeat step 17 for best fits, by period, with original data (NSA).

    b. Results are shown in Table C15.

Table C15

Best Models for CMOs Using Non-Seasonally Adjusted Data

Period	Difference	$(p, q)^a$	Parameter	Estimate	*MAPE*	*t*	*p*-Value	
1	1	(1,1)	Φ	0.949	1.336	19.407	0.000	***‡
1	1	(1,1)	Θ	0.189	1.336	1.041	0.305	‡
2	2	(1,1)	Φ	0.002	2.091	0.005	0.996	
2	2	(1,1)	Θ	0.478	2.091	1.158	0.257	
3	1	(1,0)	Φ	0.908	0.566	18.322	0.000	***

Note. Difference is the ARIMA *d; MAPE* is the Mean Absolute Percentage Error that is shown at the model level rather than at the parameter level so that the (*p,d,q*) models may be compared.

[a] ARIMA *p* is the autoregressive (AR) portion of the model and its estimate is represented by the mathematical symbol Φ; ARIMA *q* is the moving average (MA) portion of the model and its estimate is represented by the mathematical symbol Θ.

‡ Best model. The NSA (non-seasonally adjusted) version of the model is better than the SA (seasonally adjusted) version of the model, as shown in Tables C9, C11, and C13. Period 1 Model (1,1,1) has higher *t* scores and lower *MAPE* with NSA data. Period 2 Model (1,2,1) is insignificant with NSA data. Period 3 Model (1,1,0) has a lower *t* score and proportionately lower *MAPE* with NSA data.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

20. Granger causality testing was performed on the best fit models.

    a. Opened SPSS files by CDS regulatory periods to retrieve CMOs and Labor Participation Rate data.

    b. Opened R-based calculator (Wessa, 2013) that was retrieved from http://www.wessa.net/rwasp_grangercausality.wasp.

        i. Y series data was CMOs and Labor Participation Rate.

        ii. X series data was number of quarters corresponding to the CMOs and Labor Participation Rate data.

        iii. Set the Y series parameter to 1.

        iv. Set the X series parameter to 1.

        v. Set the non-seasonal time lags to 1.

        vi. Set the seasonal period to 1. (The same results were achieved when repeated at seasonal period equal to 4.)

    c. Results are shown in Table C16.

Table C16

Granger Causality Test Statistic

Period	Variable	*F* (*df*, lag)	*F*-Statistic	Seasonality	*p*-Value
1	CMO	*F*(37, lag 1)	5.620	Non Seasonal	.03*
2	CMO	*F*(27, lag 1)	8.386	Seasonal	.01**
3	CMO	*F*(13, lag 1)	9.940	Seasonal	.01**
1	Control	*F*(37, lag 1)	7.939	Seasonal	.01**
2	Control	*F*(27, lag 1)	6.018	Seasonal	.02*
3	Control	*F*(13, lag 1)	5.596	Seasonal	.04*

Note. Seasonal indicates seasonally adjusted data. Non Seasonal indicates original data, without seasonal adjustment.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Curriculum Vitae

Jon Patraic Neill

EXECUTIVE PROFILE

Financial and risk manager successful at building high-performance businesses and leading both production and support organizations with P&L and balance sheet responsibility of $5 billion in assets. A strategic visionary with tactical planning skills able to manage through economic cycles of growth and contraction by identifying emerging risks and opportunities. Leadership skills to influence and motivate staff toward common goals. Combines entrepreneurial approach with a focus on operational controls and risk management. Skilled at implementing capital structures to benefit from regulatory structures, and at planning and executing simultaneous initiatives to improve market share, revenues, labor productivity, and margins.

Citigroup, Tampa, FL, August 2011 to Present
Senior Vice President
Global responsibilities as the Operations & Technology Program Manager for Supplier Risk Reporting. Identify and investigate supplier performance issues and coordinate executive action for remediation. Implemented strategic enhancements to enterprise-wide governance with remediation programs for supplier performance and customer complaints monitoring. Evaluate key risks involving supplier financial condition, information security, exit strategy and continuity of business plans.

- Created processes for the identification and remediation of supplier-caused technology outages and information security incidents, leading to a 60% decrease in these incidents over a 2-year period.
- Developed a comprehensive database consisting of outages, security incidents, and risk events that captured 240 variables per incident used for a risk model that prioritized residual risk for remediation.

Independent Consultant, Tampa, FL, January 2009 to August 2011
Consultant
Financial consultant and capital planning adviser for community banks. Assisted bank executives with capital raising, investment portfolio management, liquidity, loss reserves, and asset and liability risk management. Capital management expertise including Basel II capital risk-weighting of assets and compliance to capital requirements.

Contractors Financial Warehouse, Tampa, FL, June 2007 to January 2009
Chief Executive Officer
Held P&L and capital-raising responsibility for start-up commercial lending financial company serving subcontractors in the commercial construction industry. Formulated the corporate vision, led the strategic planning process, developed the product's credit underwriting and risk-based pricing, and directed capital creation efforts.

- Raised capital from venture capitalists led by an Ohio state-backed investor group.

Homegate Mortgage, West Chester, OH, & Tampa, FL, August 2004 to June 2007
Chief Executive Officer
Founding partner of licensed financial institution for the retail origination of residential mortgage loans with full P&L responsibilities. Mortgage banking correspondent of FHA, VA, Reverse Mortgage, Prime, Alt A, Jumbo, and Subprime loan production. Responsible for all areas of lending operations, product pricing and loan delivery, regulatory compliance to federal and state regulations, marketing, television advertising, sales, finance, accounting, human resources, technology, information systems and administrative matters.

- Achieved profitability in the second quarter of operations and grew the company to 30 employees in two locations producing $75 million of annual loan volume.
- Earned a perfect regulatory record with zero consumer complaints, and no loan-premium recaptures for blemished loans or loan buybacks for defaulted loans.

Provident Bank, Cincinnati, OH, & Morristown, NJ, Nov. 1995 to August 2004
Chief Financial Officer & Senior Vice President
Executive manager of a start-up mortgage business that created $100 million in annual earnings to fuel bank growth from a $5 billion regional bank into a Top 50 U.S. bank when sold nine years later. The business achieved Top 10 ranking in Non-Conforming securitization, Warehousing, and Servicing. Administrative responsibility for budgeting, forecasting, variance analysis, capital planning for assets and liabilities, product development and pricing, credit loss analysis, headcount, productivity planning, and performance metrics. Operational responsibility for the Warehousing business that generated in excess of $1 billion in monthly volume of commercial loan product. Led the negotiations for the bank's investment in Home 123, a mortgage brand with Bob Vila as celebrity spokesman, and ran the retail mortgage business with 140 employees at sites in Ohio and New Jersey.

- Led the company exit from securitization ahead of the market in 2001, based upon risk modeling of pricing, adverse selection, interest rate trends and Case-Shiller housing market model.

General Electric, Cincinnati, OH, November 1989 to November 1995
Senior Financial Analyst
Controlled cost in the Research and Development department of GE Aviation, with a $50 million annual operating budget. Conducted investigations into alleged violations of Federal Acquisition Regulation (FAR) and issued findings for adjudication.

- Saved $2 million of cost annually by outsourcing 100 union jobs of tool fabricators.

The Huntington National Bank, Cincinnati, OH, February 1987 to November 1989
Bank Manager

Wells Fargo Financial, Jacksonville, FL, October 1985 to January 1987
Credit Manager

BOARDS & PUBLICATIONS

Member, Board of Directors: **Borrow Smart Educational Foundation**, private educational foundation to educate low-income consumers that was funded by mortgage industry firms; **Home 123 Corporation**, outside director for a mortgage brand and loan originator; **Contractors Financial Warehouse**, executive director for venture-capital funded specialty loan finance company providing credit to subcontractors in the construction industry.

Publications include: Master's thesis, *Municipal Capital Budgeting Methodology and its Effect on Microcomputer Acquisition;* Capital Decision-Making: Analysis and Judgment in *Public Budgeting and Financial Management*.

Family history publications include: *Phillip Board: Bluegrass Pioneer 1760-1850*, Decorah, Iowa: Anundsen, 1992; Co-author with Ray O. Pleasant, '*Exoduster' Sally Board. An American Heritage: From Kentucky Slavery to a Kansas Homestead 1805-1892*, Cincinnati, Ohio: Privately published, 2001.

EDUCATION

Doctor of Philosophy • Walden University, Minneapolis, MN, July 2014 (expected) Ph.D. in Public Policy and Administration, GPA 4.0.

Master of Public Administration • Northern Kentucky University, Highland Heights, KY, 1996; Concentration in Finance, Honors: Outstanding Graduate Award. GPA 4.0.

Bachelor of Science of Business Administration • University of Florida, Gainesville, FL, 1984; Major in Management, Minor in Economics. GPA 3.0.