Ekonomi-tek Volume / Cilt: 2 No: 1 January / Ocak 2013, 41-77

The Run On Repo and the Liquidity Shortage Problems of the Current Global Financial Crisis: Europe vs. The US

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Abstract

This paper discusses several key issues regarding the current Great Crisis, which has extended over two periods. The first period covered the 2007-09 subprime crisis in the US, while the second took the form of a twin sovereign debt and banking crisis in Europe after 2010, and persists until now. At the core of the problem is the emergence over the last 30 years of a shadow banking system, which re-created the conditions for a panic. This time, the panic firstly took place in the repo market, which suffered a run when "depositors" demanded ever-increasing haircuts. Fears of insolvency reduced interbank lending, and this so-called "run on repo" caused temporary disruptions in the pricing system of short-term debt markets.

The subsequent crisis reduced the pool of assets considered acceptable as collateral, resulting in a liquidity shortage. With declining asset values and more frequent haircuts, the US banking system was effectively insolvent for the first time since the Great Depression. Via the banking system, the American "run on repo" soon infected the European financial system, becoming both a twin sovereign debt and banking debacle in many peripheral Euro area countries that raised doubts of the survival of the Euro and the regular functioning of the European Monetary System. The paper concludes that, for a successful European crisis resolution, we need to implement both a fiscal union and a banking union, ensuring that fiscal and banking policies in the Eurozone are partly centralized so as to meet the requirements necessary for the regular functioning of a monetary union.

JEL codes: E44, E52, G01, G15, G28.
Keywords: Financial crisis, shadow banking system, panic, sovereign debt crisis, banking crisis.

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I wish to thank Riccardo De Lisa, Paolo Mattana, Vincenzo Merella, Alessio Moro, and Romano Piras and two anonymous referees for their comments, which helped me greatly. The usual disclaimers apply.

1. Introduction

In the 19th century, before the advent of deposit insurance, periodic financial shocks caused depositors to be anxious about their savings, followed by their running to their banks *en masse* demanding their cash. In January 2006, in the US, there was a similar shock brought on by a fall in house prices. A year and a half later, in August 2007, a financial crisis sprang up in the subprime mortgage market, with firms withdrawing credit from other firms. Thus, a "banking panic" had arisen on the back of the dramatic decline in subprime mortgage values, itself caused by the real-estate downturn. This confirmed the impression that uninsured bank debt was vulnerable to panic. This was the origin of the Great Crisis, which first occurred in the US, while the second one began in Europe after 2010. It is essential for both Americans and Europeans to understand that it was a banking panic that underlay this two-pronged crisis if they are to learn the dynamics of financial crises in general and to design meaningful regulations of the financial system.

Currently, the new focus of turbulence is Europe, where a severe financial crisis is still under way. Its origin can be directly traced back to the American crisis of 2007-09, which spilled over into a sovereign debt crisis in several Euro area countries in early 2010. However, although this is usually described as a sovereign debt crisis, in fact it was really a sequence of interactions between sovereign debt problems and banking problems.

The sovereign debt panic, the global financial crisis (as symbolized by the dramatic collapse of the investment banking house Lehman Brothers), and the ensuing stresses in several European countries' banking sectors are all connected. With deteriorating public finances in several European countries, sovereign risk has spread and worsened many banks' balance sheets. Therefore, the European situation is best described as distinct twin sovereign debt and banking crises that mutually fuel each other, with the result of this interaction being a gradual contagion spreading to more countries and more asset classes.

Part of this scenario featured a run on the repo market in the US sparked by fears of insolvency; this, in turn, had the effect of reducing interbank lending in Europe. The subsequent crisis shrank the pool of assets accepted as collateral, giving rise to a liquidity shortage. This situation made certain observers doubt the very survival of the Euro and the European Monetary System. To put all of the above into perspective then, let us distinguish a first period of the Great Crisis—the American crisis of 2007-09—from a second one consisting of a twin European sovereign debt and banking crisis, which began in 2010 and persists to this day.

The paper is organized as follows. The next three sections identify the core of the problem, which is the emergence in the last 30 years of a shadow banking system, which re-created the conditions for a panic. Shadow banking is, in effect, unregulated banking. Thus, it is riskier than conventional banking in that it lays the groundwork for the kind of financial vulnerability that made the Great Depression possible. Section 5 deals with managerial compensation schemes and the pricing of risk. Section 6 covers fiscal stimulus and the monetary policy interventions that were employed to defuse the crisis. Section 7 illustrates the transformation of the phenomenon into a European twin sovereign debt and banking crisis, and Section 8 outlines the mispricing of risk and imbalances in the Euro area. Finally, Section 9 contains the conclusion.

2. The Essential Function of Banks and Banking

The traditional view of the world held by economists is one where functioning economies are the outcome of the "invisible hand," that is, a world where private economic decisions are unknowingly guided by prices to allocate resources efficiently. However, the current financial crisis raises a question: how is it that we got slapped in the face by the invisible hand? (Gorton, 2009, 2010). What happened? Although the answer is not straightforward, most economists would agree that the shadow banking system lies at the heart of the problem. That system was vulnerable to a banking panic, which started in the US in August 2007 and continues to this day in Europe.

The period between 1934, when the US first introduced deposit insurance, and the start of the current crisis was one of quiescence. But, from a historical perspective, banking panics are the norm. The original banking system underwent a transformation over the last several decades, and this laid the groundwork for a panic. Realizing that the shadow banking system is, in fact, real banking now and that the current market turmoil constitutes a banking panic is a prerequisite to understanding the Great Crisis of today.[1]

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[1] The classical reference on financial crises is the well known and much-cited essay by Kindleberger (1978), who notes that they characterize the history of the development of capitalism all over the world. Recent review articles on the argument are by Fratianni (2008), who shows that financial crises are far from being a rare phenomenon, and by Reinhart and Rogoff (2008, 2009), who point out the regularities of financial crises along with eight centuries of economic history. Further articles on the subject include: Shachmurove (2010), who agrees that financial crises are all similar; Vives (2010), who reviews the academic theoretical and empirical literature on the potential trade-off between competition and stability in banking; Razin and Rosefielde (2011) survey three distinct types of financial crises that took place in the 1990s and 2000s, one of which is the 2007-09 crisis; and Claessens and Kose (2013), who focus on the main theoretical and empirical explanations of four types of financial crisis: currency crises, sudden stops, debt crises, and banking crises. Further-

A banking panic means that the banking system is insolvent, i.e., it cannot honor contractual obligations: there are no private agents who can buy the amount of assets necessary to recapitalize the banking system. When this happens, many markets stop functioning, followed by deleterious effects on the real economy.

Gorton and Pennacchi (1990) argue that the essential function of banking is to create a special kind of debt that is immune to adverse selection by privately informed traders (Holmström, 2008). The leading example of this is demand deposits. More generally, this kind of debt is very liquid because its value rarely changes, so it can be traded without fear of some people having secret information about the value of it. If speculators are able to learn information that is private (only they know it), then they can take advantage of the less informed in trading. However, this is not a problem if the value of the security is not sensitive to such information. This "informationally-insensitive" debt originally was limited to demand deposits.

Demand deposits are of no use to large firms, banks, hedge funds, and corporate treasuries, which may need to deposit large amounts of money for a short period of time. Their needs are satisfied by the repurchase ("repo") market, where large amounts of money can be deposited with a bank and collateralized with bonds, which the depositor receives and may then use elsewhere. Furthermore, repo is short-term, like demand deposits, and it can be withdrawn at any time, also like demand deposits. The bank backs the deposits with bonds as collateral, and often that collateral has been in the form of securitized products, i.e., bonds issued by special-purpose vehicles to finance portfolios of loans. In the time leading up to the 2007 collapse, the demand for collateral grew to include securitized products because of the rapidly rising need for collateral in the repo banking system, for collateralizing derivatives positions, and for use for settlement purposes (Gorton, 2009).

Repo is essentially shorthand for depository banking, built around informationally-insensitive debt. In a repo transaction, one side of the transaction wants to borrow money, and the other side wants to save money by depositing it somewhere safe. Think of the borrower as a bank and the lender as a depositor that happens to be a corporation, a bank, insurance company, pension

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more, a comprehensive investigation of the real effects of banking crises is reviewed by Carpinelli (2009), while the theoretical debate on the recent Great Crisis is critiqued by Moro (2012). Finally, Brunnermeier and Oehmke (2012) survey the literature on bubbles, financial crisis, and systemic risk, while Goldstein and Razin (2013) review three branches of theoretical literature on financial crises: the first one deals with the banking crisis, the second with frictions in credit and interbank markets, and the third with currency crises.

fund, institutional investor, or hedge fund. The depositor receives a bond as collateral for his deposit.

When the depositor turns over its money to the bank, the collateral may involve a "haircut" or margin. The haircut is the percentage difference between the market value of the pledged collateral and the amount of funds lent. For example, a haircut of 5% means that a company can borrow $95 for each $100 in pledged collateral. The size of the haircut reflects the credit risk of the borrower and the riskiness of the pledged collateral. Another important feature of repo is that the collateral can be re-hypothecated. In other words, the collateral received by the depositor can be used or spent in another transaction, i.e., it can be used to collateralize a transaction with another party. Intuitively, re-hypothecation is tantamount to conducting transactions with the collateral received against the deposit.

Historically, only banks and the government could create informationally-insensitive debt, but the demand for such debt has ballooned. Now there is a range of securities with different information sensitivities. The notion of "informationally-insensitive" debt corresponds to the institutions that "surround" debt, as distinct from equity. Equity is very informationally-sensitive. It is traded on centralized exchanges, and individual stocks are followed by analysts. Because debt is senior, and because securitized debt is backed by portfolios, senior tranches of securitizations are informationally-insensitive, though not riskless like demand deposits.

Informationally-insensitive debt does not need extensive institutional infrastructure, like equity. So, for example, the job of rating agencies need not be as in-depth as that of equity analysts (Gorton and Pennacchi, 1993; Gorton and Souleles, 2006). Obviously, informationally-insensitive debt is debt that no one has to devote a lot of time and resources to investigating. In fact, it is exactly designed to avoid that. In the same way, consumers do not spend a lot of time doing due diligence on the bank that is holding the money of someone buying something from them. A "systemic shock" to the financial system is an event that causes such debt to become *informationally-sensitive*: i.e., subject to adverse selection now that the shock has created sufficient uncertainty as to make speculation profitable.

According to Gorton (2009), the current crisis has its roots in the transformation of the banking system over the last 30 years, which involved two important developments. First, derivative securities experienced exponential growth, creating an enormous demand for collateral, i.e., informationally-insensitive debt. Second, there was a massive movement of loans originated by banks into the capital markets in the form of securitization and loan sales.

Securitization is defined as the issuance of bonds ("tranches") that came to be used extensively as collateral in sale and repo transactions; this, in turn, freed other categories of assets, mostly treasuries, for use as collateral for derivatives transactions and for use in settlement systems.

Repo is a form of banking in that it involves the "deposit" of money on call (as repo is short-term, mostly overnight) backed by collateral. The ongoing financial panic centered on the repo market, which suffered a run when "depositors" required ever-greater haircuts to allay their concerns about the value and liquidity of the collateral should the counterparty bank fail. Therefore, in order to fully understand the present global financial crisis, it is important to agree that the "shadow banking system" is, in fact, banking.[2]

3. The Role of the Shadow Banking System and the Securitization Process

It is generally accepted that one of the key factors in bringing on the crisis was the lack of a regulatory framework for the shadow banking system, derivatives, or off-balance-sheet financing.[3] Financial deregulation and liberalization had amplified the scope for speculation. Elsewhere in the financial system, laws had been changed or enforcement weakened.[4] Financial institutions in the shadow banking system were not subject to the same regulations as depository banks, allowing them to assume additional debt obligations relative to their financial cushion or capital base. These entities were vulnerable because they borrowed short-term in liquid markets to purchase long-

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[2] This interpretation of the shadow banking system is extensively developed by Gorton (2009), Gorton and Metrick (2009b, 2012a), and Gorton and Ordonez (2012).

[3] The "shadow banking system" encompasses all financial institutions such as money-market funds, investment banks, hedge funds, insurance companies, mortgage companies, government-sponsored enterprises, and other financial intermediaries involved in facilitating the creation of credit across the global financial system, but whose members are not subject to regulatory oversight. The shadow banking system also refers to unregulated activities by regulated institutions, such as over-the-counter (OTC) derivatives and, particularly, credit-default swaps (CDS). The essence of this term is to differentiate between those parts of the financial system that are visible to regulators and under their direct control and those that are not.

[4] The process of banking deregulation that contributed greatly to the crisis began in October 1982, when President Ronald Reagan signed into law the Garn-St. Germain Depository Institutions Act. In November 1999, President Bill Clinton signed the Gramm-Leach-Bliley Act, which repealed part of the Glass-Steagall Act of 1933. This repeal has been criticized for eliminating the separation between commercial banks, which traditionally had a conservative culture, and investment banks, which had a more risk-taking culture. Finally, in 2004, the Securities and Exchange Commission relaxed the net-capital rule, which enabled investment banks to substantially increase the level of debt they were taking on. The role of institutions in the recent financial crisis is analyzed by Schachmurove (2012).

term, illiquid, and risky assets. This meant that disruptions in credit markets would subject them to rapid deleveraging and selling off of their long-term assets at depressed prices.

Paul Krugman has described the run on the shadow banking system as the "core of what happened" to trigger the crisis. “As the shadow banking system expanded to rival or even surpass conventional banking in importance, politicians and government officials should have realized that they were re-creating the kind of financial vulnerability that made the Great Depression possible, and they should have responded by extending regulations and the financial safety net to cover these new institutions. Influential figures should have proclaimed a simple rule: anything that does what a bank does, anything that has to be rescued in crises the way banks are, should be regulated like a bank.” He referred to this lack of controls as "malign neglect" (Krugman, 2009, pp. 162-3).

Contrary to Krugman’s prescription, regulators and accounting standard-setters allowed depository banks to move significant amounts of assets and liabilities off-balance-sheet into complex legal entities called structured investment vehicles (SIV), masking the weakness of the capital base of the institution or the degree of leverage or risk taken.[5] The whole derivatives market was never regulated.[6] How was this possible? Following Gorton and Pennacchi (1990, 1993), we can say that banks created liquidity by producing securities that were informationally-insensitive. These bonds were not subject to adverse selection when traded because it was not profitable to produce private information to speculate on them. In the extreme, these securities were

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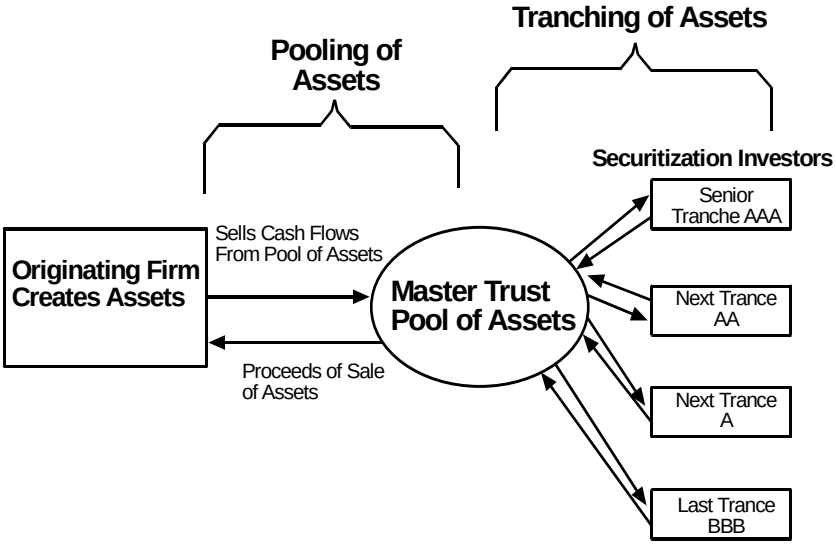
[5] According to Greenspan (2010, p. 20), inhibiting irrational behaviour when it can be identified, through regulation, as recent history has demonstrated, could be stabilizing. But, there is an inevitable cost of regulation in terms of economic growth and standards of living when it imposes restraints beyond containing unproductive behaviour. Regulation by its nature imposes restraints on competitive markets. The elusive point of balance between growth and stability has always been a point of contention, especially when it comes to financial regulation. According to Strahan (2003, p.111), deregulation was followed by better performance of the real economy. State economies grew faster and had higher rates of new business formation after this deregulation. At the same time, macroeconomic stability improved.

[6] With the advice of the President's Working Group on Financial Markets, the Commodity Futures Modernization Act of 2000 allowed the self-regulation of the over-the-counter (OTC) derivatives market. Knight (2008) highlighted the key features of the turmoil as follows: the lack of transparency in the originate-to-distribute model (see footnote 8); the role played by credit rating agencies in the evaluation of structured products; and the covert reliance on special-purpose vehicles to conduct off-balance-sheet financial transactions on a large scale. The effect of all these influences was that when the "Minsky moment" came, perceptions of risky exposures, both to credit losses and to liquidity shortages, rose sharply, as did uncertainty about where those exposures might materialize. The "Minsky moment" refers to Minsky’s (1982) prediction that a new financial crisis was going to happen. On financial innovation, see Merton (1992), Tufano (2004), and Lerner (2006).

valued riskless, like insured demand deposits (Dang et al., 2009). Shadow banking corresponds to the process of creating this type of debt. Clearly, if the debt is a claim on a diversified portfolio, like a portfolio of bank loans, this is made easier. However, this portfolio need not reside at a regulated commercial bank.

Likewise, a corporation may be financed by issuing securities that are claims on its general credit; in other words, the securities are backed by the assets of the company (bonds); alternatively, the enterprise may finance itself by segregating specified cash flows and selling claims specifically linked to those specified cash flows. The latter strategy is accomplished by setting up another company, called a Special-Purpose Vehicle (SPV) or Special-Purpose Entity (SPE), and then selling the specified cash flows to this sister company. The SPV, in turn, issues securities into the capital market to finance the purchase of the cash flows from the original corporation (called the "sponsor"). The sponsor services the cash flows, i.e., makes sure that the cash flows are arriving. The SPV is not an operating company in the usual sense. It is more of a robot company in that it is a set of rules, without employees or physical location. This process is called securitization.

Figure 1. The Tranching Mechanism



Source: Gorton (2009).

Securitization involves seniority and large portfolios. Figure 1 shows the general process of securitization, where the cash flows from assets (loans) created by an originating firm are sold to a special-purpose vehicle, which finances this by issuing securities in the capital markets. These securities are based on seniority and are called "tranches." As shown in the figure, securitization consists of two conceptual steps. First, underlying cash flows from assets are put into a pool. This means the specific assets that are generating the cash flows, usually loans of some sort, are identified and sold to the SPV (often, its legal structure is a Master Trust). Second, the pool of cash flows sold to the SPV is tranched: securities with different seniorities are designed and issued against the pool. Another way to say this is that the SPV has to have a capital structure, so its liability side must be designed. This is called tranching (Gorton and Souleles, 2006; Gorton, 2009; Brunnermeier, 2009).

According to Gorton (2009), securitized asset classes, e.g., mortgages, credit-card receivables, and auto loans, may be examples of relatively informationally-insensitive debt, created by the private sector without government insurance. Several features make securitization debt potentially immune from adverse selection. First, most of the debt is senior and investment-grade. Second, with securitization, the debt is backed by portfolios. Third, a by-product of many structured products is that they are complex, as explained by Gorton (2008). Complexity raises the cost of producing private information. Finally, securitization does not involve traded equity; this is important because there is no information leakage or externalities from the equity market, as with corporate bonds. In summary, senior tranches of securitizations are informationally-insensitive, though not riskless like demand deposits. The most senior tranches of securitization transactions have never experienced defaults.

The banking model in which loans are pooled, tranched, and then resold via securitization is defined as the "originate-to-distribute" model, as opposed to the traditional banking model, in which the issuing banks hold loans until their maturity, when they are repaid (Brunnermeier, 2009; Hull, 2009; Gorton and Metrick, 2012b).[7]

[7] Gorton (2009, 2010) strongly disagrees with the "originate-to-distribute" explanation of the crisis, which places the blame on the misaligned incentives of the underwriters, who believed they had little exposure to risk, on the rating agencies, which did not properly represent risk to investors, and on a decline in lending standards, which allowed increasingly poor loans to be made. Here Gorton becomes much less convincing, especially in light of later information, and he argues as if proponents of the originate-to-distribute explanation are directly attacking the general process of securitization itself. But there is little in Gorton's account to suggest that the originate-to-distribute explanation is excluded by the asymmetric-information hypothesis. Simply because many lenders went under after the fact does not

4. The Demand for Collateral and the Rise of the Repo Market: The Explosion of the Crisis

Collateral is like currency for businesses; they need to post collateral to mitigate the risk of their own default, but they also obtain collateral that can be reused. "Posting collateral" is a way to back up one's promise to pay, and it is acceptable as long as the collateral does not lose value while being held by the counterparty. Collateral is almost synonymous with informationally-insensitive debt, although obviously there are degrees of sensitivity. The use of collateral has expanded rapidly in the last 20 years. This is due, in large part, to the use of bilateral collateral agreements to address counterparty risk.

There is a huge demand for collateral from financial institutions, e.g., dealer banks and commercial banks, a demand that has grown to an enormous extent. First, collateral is needed in repo markets, where the transaction involves the "deposit" of cash in exchange for a bond as collateral. Second, derivatives markets use it to offset counterparty credit risk. Finally, collateral is called for in payment and settlement systems (Bank for International Settlements, 2001; Singh and Stella, 2012).

However, the greatest source of demand for collateral is the repo market. Creation of this informationally-insensitive debt is the function of the banking system. In the regulated bank sector, this corresponds to insured demand deposits. The characteristics of demand deposits are: (1) they have no fixed maturity so they can be exchanged for cash at par on demand; (2) they are senior claims; (3) they are claims on a portfolio; (4) they can be used in transactions.

This form of debt is created by depository institutions and by money-market mutual funds that offer checking accounts. Shadow banking combines repo with securitization (or other forms of informationally-insensitive debt) to accomplish the same function for firms. Senior tranches of securitized debt and commercial paper are also quite informationally-insensitive. Therefore, the participants in the shadow banking system, which is essentially the combination of repo and securitized debt, should be regarded as banks in the main, according to the following criteria: (1) repo has a short maturity, it is typically overnight, and can be withdrawn (not rolled over) on demand; (2) it is senior in that the collateral is senior, but also senior in the sense that there may be a

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mean that their incentives were necessarily aligned correctly beforehand. However, there is some anecdotal evidence to suggest that a number of the most troubled financial institutions ran into difficulties in 2007-08 precisely because they did not distribute all of the securitized debt they created, but kept a significant portion on their own balance sheets instead (Lo, 2012, p. 10).

haircut (Gorton and Metrick, 2009a) on the collateral; (3) repo collateral is backed by a portfolio if the collateral is securitization-based debt; (4) the collateral can be used in other transactions, i.e., it can be re-hypothecated (Gorton, 2009).

The players in the shadow banking system are different from depository institutions in that their activity involves the repo market, where depositors and lenders are individually matched; each depositor gets his own collateral. Securitization enters the picture via the need for collateral. If securitization debt is informationally-insensitive, it can be an input into the repo system in the role of a kind of transaction medium, i.e., collateral that can be re-hypothecated. Therefore, we can say that the shadow banking system is, in fact, an integral part of the banking system, although it is not regulated as commercial banks are. The depositors (lenders) are firms seeking a place to save cash in the short term, often in money-market funds. The borrowers are financial institutions seeking cash to finance themselves. The deposits are designed to be informationally-insensitive by being backed with informationally-insensitive collateral. Often that collateral is a securitization bond. The collateral can be spent or re-hypothecated. Depositors can withdraw their funds by not rolling over their repo agreements, and returning the bond, or they can withdraw by increasing the haircut on the collateral. This is depository banking in a different form, but banking nonetheless. However, like demand deposits at regulated commercial banks, this system is vulnerable to panic (Gorton, 2009).

The first part of the present Great Crisis began in the US with a panic in the subprime-mortgage market, where subprime mortgages were being bundled into massive mortgage-backed securities (MBSs) that were then used to create collateralized-debt obligations (CDOs).[8] A CDO is a type of bond based on portfolios of other debt instruments such as mortgages, auto loans, student loans, or credit-card receivables. These underlying assets serve as collateral for the CDOs. In the event of default, the bondholders become owners of the collateral. As explained in Section 3, because CDOs have different classes of priority known as "tranches," their risk/reward characteristics can be very different from one tranche to the next, even if the collateral assets are relatively homogeneous.

[8] The term "subprime" refers to the credit quality of the mortgage borrower as determined by various consumer credit-rating bureaus. The highest-quality borrowers are referred to as "prime"; hence, the term "prime rate" refers to the interest rate charged on loans to such low-default-risk individuals. Accordingly, "subprime" borrowers have lower credit scores and are more likely to default than prime borrowers.

The collapse gained momentum with the bursting of the housing bubble in 2006: house prices flattened, and then began to decline. Refinancing a mortgage became impossible, and mortgage delinquency rates rose. The products that were created by the securitization of mortgages lacked transparency, with the payoffs from one product depending on the performance of many others. Market participants relied on the AAA ratings assigned to financial products without evaluating the models that had been used by the rating agencies (Hull, 2009).

The opaqueness of the structures of the mortgage-backed securities delayed the unraveling of the mess. No one knew what was going to happen—or rather, many people thought they knew, but no single view dominated the market. As a device for aggregating information, the market turned out to be slow to come up with an answer in this case. When the answer did come to the market, structured investment vehicles and related conduits, which held a sixth of the highest-quality-rated CDO tranches, simply stopped rolling over their short-term debt. Interestingly, this was not due to overexposure in the subprime market. Gorton (2009) estimates that only 2% of structured investment vehicle holdings were subprime. The real cause was investors' inability to penetrate the portfolios far enough to make the determination due to their asymmetric information.

At each step in the chain, one side knew significantly more than the other about the underlying structure of the securities involved (Hull, 2009). At the top of the chain, an investor might know absolutely nothing about the hundreds of thousands of mortgages several layers below the derivative being traded, and in normal situations, this does not matter. In a crisis, however, it clearly does. The rational investor will want to avoid risk; but, as Gorton analogizes, the riskier mortgages in mortgage-backed securities had been intermingled like salmonella-tainted frosting among a very small batch of cakes that have been randomly mixed with all the other cakes in the factory and then shipped to bakeries throughout the country. To continue the analogy, the collapse of the structured investment vehicle market, and the consequent stall in the repo market, represented the market recalling the contaminated cakes (Lo, 2012, p. 9).

Here the story becomes more familiar to the historians of financial crises. Dislocation in the repo market was the first stage of a much broader liquidity crunch. Short-term lending rates between banks rose dramatically, almost overnight, in August 2007, as banks became more uncertain about which of their counterparties might be holding the cakes with tainted frosting and possibly shut down by food inspectors, i.e., which banks might be insolvent because of declines in the market value of their assets. Fears of insolvency will

naturally reduce interbank lending, and this so-called "run on repo" (Gorton and Metrick, 2009b, 2010, 2012c) caused temporary disruptions in the pricing system of short-term debt markets, an important source of funding for many financial institutions. The subsequent crisis has reduced the pool of assets considered acceptable as collateral, resulting in a liquidity shortage (Singh and Stella, 2012). Concerns about the liquidity of markets for the bonds used as collateral led to increases in repo haircuts. With declining asset values and rising haircuts, the US banking system was effectively insolvent for the first time since the Great Depression (Gorton and Metrick, 2010).

In retrospect, the events in August 2007 were just a warm-up act for the main event that occurred in September 2008, when Lehman Brothers failed, triggering a much more severe run on repo in its aftermath. Gorton believes that the regulatory insistence on mark-to-market pricing, even in a market with little to no liquidity, exacerbated the crisis.[9] Certainly there was a substantial premium between mark-to-market values and those calculated by actuarial methods. These lowered asset prices then had a feedback effect on further financing, since the assets now had much less value as collateral, creating a vicious circle.

5. Managerial Compensation Schemes and the Pricing of Risk

According to many commentators, a key role in the American crisis was also played by managerial compensation schemes and the associated leaks in corporate governance. Compensation contracts were supposedly too focused on short-term trading profits rather than long-term incentives. But, in a study of the executive compensation contracts at 95 banks, Fahlenbrach and Stulz (2011) report that CEOs' aggregate stock and option holdings were more than eight times the value of their annual compensation, and the amount of their personal wealth at risk prior to the financial crisis makes it improbable that the rational CEO knew in advance of an impending financial crash, or knowingly engaged in excessively risky behaviour (Lo, 2012).[10]

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[9] "Mark-to-market pricing" is the practice of updating the value of a financial asset to reflect the most recent market transaction price. For illiquid assets that do not trade actively, marking such assets to market can be quite challenging, particularly if the only transactions that have occurred are fire sales in which certain investors are desperate to rid themselves of such assets and must sell them at substantial losses. This has the effect of causing all others who hold similar assets to recognize similar losses when they are forced to mark such assets to market, even if they have no intention of selling those assets (Lo, 2012, p. 10).

[10] Bebchuk and Spamann (2009) and Bhagat and Bolton (2011) seek to shed some light on how banks' executive pay may have produced incentives for excessive risk-taking and how such pay should be reformed. In the case of Bear Stearns and Lehman Brothers, Bebchuk et

Furthermore, the rating agencies failed to signal the real risk associated with each financial product (Utzig, 2010; Hull, 2009). The central activity of the financial industry is creating and trading assets of uncertain value, while the liabilities in the case of banks are guaranteed by the state. They are highly leveraged businesses: leverage of 30 to one was and still remains normal in most financial institutions, including banks, but higher leverage than that is not rare. Indeed, empirical data show that the leverage of investment banks had been very high since the end of the '90s, and, in the cases of Goldman Sachs, Merrill Lynch, and Lehman Brothers, it was greater in 1998 than it was in 2007, on the eve of the financial crisis (Lo, 2012).

The pricing of risk refers to the incremental compensation required by investors for taking on additional risk, which may be measured by interest rates or fees. For a variety of reasons, market participants did not accurately measure the risk inherent in financial innovations such as mortgage-backed securities and collateralized-debt obligations, nor did they understand its impact on the overall stability of the financial system (Hull, 2009). The massive, mind-boggling losses they subsequently sustained have dramatically impacted the balance sheets of banks and insurance companies across the globe, leaving them with very little capital to continue operations.[11] Another cause of the disaster was the widespread reliance on Li's formula, known as a Gaussian copula function, in pricing any kind of asset's risk. This formula originally looked like an unambiguously positive breakthrough, a piece of financial technology that allowed hugely complex risks to be assessed with more ease and accuracy than ever before. Li made it possible for traders to sell vast quantities of new securities, expanding financial markets to unimaginable levels. This formula assumed that the price of credit-default swaps was correlated with, and could predict the correct price of, mortgage-backed securities. Because it was highly tractable, it rapidly came to be preferred by a huge percentage of CDO and CDS investors, issuers, and rating agencies.

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al. (2010) argued that their CEOs cashed out hundreds of millions of dollars of company stock from 2000 to 2008; hence, the remaining amount of equity they owned in their respective companies toward the end may not have been sufficiently large to have had an impact on their behaviour. Furthermore, in an extensive empirical study of major banks and broker-dealers before, during, and after the financial crisis, Murphy (2012) concludes that the Wall Street culture of low base salaries and outsized bonuses of cash, stock, and options actually reduces risk-taking incentives, not unlike the so-called "fulcrum fee," in which portfolio managers have to pay back a portion of their fees if they underperform (Lo, 2012, p. 2).

[11] Farmer et al. (2012) demonstrate that financial markets, by their nature, cannot be Pareto efficient, except by chance. Although individuals are rational, they show that it is sufficient to assume heterogeneity in an agent's subjective discount factor to conclude that markets are not Pareto efficient.

Li's formula was adopted by everybody, from bond investors and Wall Street banks to rating agencies and regulators, and became so deeply intertwined with day-to-day operations that warnings about its limitations were largely ignored. As innovative financial assets became more and more complex, and thus harder and harder to value, nervous investors were reassured when they saw that both the international bond-rating agencies and the bank regulators (who had allowed themselves to become dependent on those agencies) had implicitly endorsed certain complex mathematical models that theoretically showed the risks to be far smaller than they actually proved to be in practice (Hull, 2009). Similarly, the rating agencies relied on the information provided by the originators of synthetic products. It was a shocking abdication of responsibility. Li's Gaussian copula formula will go down in history as instrumental in causing the unfathomable losses that brought the world financial system to its knees. However, it should be noted that no single factor alone bears full responsibility for what happened; it was the confluence of all of them that served to spread the risk—and the fear—throughout the financial markets. Brunnermeier et al. (2011) weigh in on the peculiar nature of systemic risk: first, it cannot be detected by measuring cash instruments, e.g., balance-sheet items or ratios such as leverage and income-statement items; second, it typically builds up in the background before materializing in a crisis; and, third, it is determined by market participants' endogenous response to various shocks.

6. Fiscal Stimulus and Monetary Policy Interventions in Response to the Crisis

The first part of the crisis, the American one, hit its peak in September and October 2008. Several major institutions failed, were acquired under duress, or were subject to government takeover. The crisis rapidly escalated and spread into other economies worldwide, resulting in a number of European bank failures, plunges in various stock indexes, and large tumbles in the market value of equities and commodities. Both MBSs and CDOs had been purchased by corporate and institutional investors globally. Significant quantities of derivatives such as CDSs on the books of banks also deepened the linkage between large financial institutions. Moreover, the de-leveraging of certain financial institutions, which occurred as assets were sold to pay back obligations that could not be refinanced in frozen credit markets, further accelerated the liquidity crisis.

World political leaders, national ministers of finance, and central banks coordinated their efforts in a bid to reduce fears (Fraher and Kennedy, 2008). At the end of October 2008, a currency crisis developed, with investors trans-

ferring vast capital resources into stronger currencies such as the Euro, the yen, the dollar, and the Swiss franc, leading many emerging economies to seek aid from the IMF.[12] The US Federal Reserve and central banks around the world expanded their money supplies to head off the risk of a deflationary spiral. In addition, many governments enacted large fiscal stimulus packages, by borrowing and spending to offset the shrinkage in private-sector demand produced by the crisis. In fact, the US implemented two stimulus packages, totaling nearly $1 trillion, during 2008 and 2009. Part of their purpose was to bail out ailing corporations, as mentioned above. To date, various US government agencies have committed or spent trillions of dollars in loans, asset purchases, guarantees, and direct spending.

The credit freeze brought the global financial system to the brink of collapse. The response of the US Federal Reserve, the European Central Bank, and other central banks was immediate and dramatic. During the last quarter of 2008, these central banks purchased $2.5 trillion of government debt and the problematic assets weighing down the balance sheets of certain troubled banks. This represented the largest liquidity injection into the credit market, and the largest monetary policy action, in world history. In addition, the governments of several European nations along with that of the US boosted the capital bases of their national banking systems by $1.5 trillion, by purchasing newly issued preferred stock in their countries' major banks (Altman, 2009).

At the end of 2008, some analysts argued that the Fed was out of ammunition when overnight interest rates reached zero, but it continued to purchase assets and engaged in "quantitative easing."[13] From the beginning of 2009 until early December, the Fed, under the auspices of its Large Scale Asset Purchase (LSAP) program, had bought approximately $300 billion in Treasury securities, $150 billion in debt securities of Fannie Mae and Freddie Mac,

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[12] Financial crises are often associated with significant movements in exchange rates, which reflect both increasing risk aversion and changes in the perceived risk of investing in certain currencies. Kohler (2010) explains why exchange-rate movements during the global financial crisis of 2007-09 were unusual. Unlike in two previous episodes–the Asian crisis of 1997-98 and the crisis following the Russian debt default in 1998–in 2008, many countries that were not at the center of the crisis saw their currencies depreciate sharply. Later, such crisis-related movements reversed strongly for a number of countries. Two factors are likely to have contributed to these developments. First, during the latest crisis, safe-haven effects went against the typical pattern of crisis-related flows. Second, interest-rate differentials explain more of the crisis-related exchange-rate movements in 2008-09 than in the past. This probably reflects structural changes in the determinants of exchange-rate dynamics, such as the increased role of the so-called carry trade.

[13] "Quantitative easing" is defined as a policy strategy of seeking to reduce long-term interest rates by buying large quantities of financial assets when the overnight rate is zero (Bullard, 2010).

and $1.1 trillion of fixed- rate mortgage-backed securities (MBSs) guaranteed by Ginnie Mae, Fannie Mae, and Freddie Mac. When completed, the Fed's total assets will reach $2.6 trillion, and the Fed will own about one-fourth of the total outstanding amounts of Treasury and agency-guaranteed MBSs.

The monetary base in the US reached $2.4 trillion in 2010 and $3.1 trillion by the end of 2012. In December 2007, it was approximately $830 billion, with only $10-15 billion held by banks as deposits at the Fed (Bullard, 2010). For a comparison, the Bank of England initiated quantitative easing in March 2009 and purchased more than £175 billion in British Treasuries. In 2010, it held more than one-quarter of all such securities outstanding (Bullard, 2010).

Currently, the final effects of the quantitative easing that has been carried out are not known. Economic theory has yet to develop macroeconomic models with financial sectors adequately detailed to explore channels through which quantitative easing might boost economic activity. In fact, quantitative easing implies a risk of the enlarged monetary base fueling an undesirable overexpansion of credit, which, in turn, will set the stage for a surge in the inflation rate. Therefore, a key plank in the monetary strategy must be the stabilization of inflation expectations.

7. The Shift of the Crisis Into a European Twin Sovereign Debt and Banking Crisis

A notable aspect of the global contagion has been the extension of the crisis to European countries' sovereign debt.[14] This extension represents the second part of the current Great Crisis, what we call the European counterpart. It began with Greece, but suddenly it spread to other countries of the Eurozone like Portugal, Ireland, Italy, and Spain (the PIIGS countries for short), as well as, most recently, Cyprus. The phenomenon of sovereign borrowers possibly "getting sick" is not confined to the Euro zone but could extend to the world's biggest economies, like the UK, Japan, and the US. The problem is that the expansionary fiscal policies of deficit spending implemented by most

[14] Forbes (2012) surveys and assesses the academic literature on defining, measuring, and identifying financial contagion and the various channels by which it can occur, highlighting contagion risks in the Euro area. More generally, Das et al. (2012) discuss some salient features of the current generation of sovereign asset and liability management approaches, including objectives, definitions of relevant assets and liabilities, and methodologies used in obtaining optimal outcomes. The European public-debt problems are also analyzed by Driffill (2013) and reviewed from an empirical point of view by Tomz and Wright (2013).

countries to tackle the crisis have created huge deficits, and these will be difficult to digest in the years ahead.[15]

Indeed, the new center of market turbulence is now Europe, which is in the midst of a severe financial crisis. What is often described as a sovereign debt crisis is actually a sequence of interactions between sovereign problems and banking problems. The sovereign debt crisis is a direct outgrowth of the global financial crisis and the resulting stresses in European countries' banking sectors following the bankruptcy of Lehman Brothers. With deteriorating public finances, sovereign risk is perceived to have increased and worsened banks' balance sheets.[16] So the situation is best described as twin sovereign debt and banking crises that mutually reinforce each other, the result of which is a gradually moving cloud of contagion to more countries and more asset classes.[17]

In the European financial sector, the credit crisis was manifested as a shortage of liquidity in the same way as in the US. The fear of banking credit risk soon infected simultaneously the interbank, repo, and certificates of deposit markets. It also spread to the credit-default swaps and money-market funds markets. However, one can identify the first domino to fall in both the US and Europe as the run on repo in the interbank lending market, defined as the subset of bank-to-bank transactions that take place in the money market. So, the risk of a run on the banks and on the entire European financial system, whether traditional or shadow, became systemic.

The origins of the European crisis can be directly traced back to the global financial meltdown of 2008-09, which spilled over into a sovereign debt panic in several Euro-area countries in early 2010. To offset sharp falls in output, governments in the Euro area (like governments in the rest of the world) responded with counter-cyclical policies that expanded fiscal deficits. Moreover, fiscal positions worsened as tax revenues fell and transfer payments soared due to rising unemployment in the economic downturn. In many coun-

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[15] According to McKibbin et al. (2012), the emergence of substantial fiscal deficits and a large build-up of government debt in major advanced economies will inevitably lead to a period of fiscal consolidation in coming years.

[16] In the Euro area, the shadow banking system is less developed than in the US (Bakk-Simon et al., 2011). This explains why the European financial crisis arrived some years after it first hit the US.

[17] The potential mutation of the financial crisis into a sovereign debt one in Euro area countries is investigated by Candelon and Palm (2010), and De Grauwe (2010). More in general, Sturm and Sauter (2010) analyze the impact of the financial crisis on Mediterranean countries, while Wyplosz (2010) contrasts the United States and European situations during the crisis and examines how much of the crisis has been imported by Europe from the US. The paper argues that Europe never had a chance to avoid contagion from the US.

tries, government bailouts of banking systems also contributed to a run-up in their public debt. In effect, private debt became public debt, be it through bank bailouts or the burst of housing bubbles, leading to a full-blown sovereign crisis. So traumatic has the situation become that several member states of the Euro area have gone so far as to raise doubts about the very viability of the European Economic and Monetary Union (EMU) and the future of the Euro. Clearly, this crisis has highlighted the problems and tensions that inevitably arise within a monetary union when imbalances build up and become unsustainable (Volz, 2012).

The financial crisis mutated into a sovereign crisis within the Eurozone in early 2010. A year before, in the first months of 2009, the tense situation in several Central and Eastern European countries appeared to have stabilized, thanks to the energetic efforts of policymakers to push through economic reforms, tighten government budgets, and coordinate with international partners (in the form of the so-called Vienna Initiative) to maintain liquidity in the local banking systems (Véron, 2011). Unfortunately, that encouraging picture darkened when the government of Greece, newly elected in October 2009, revealed that its predecessor had misled its Eurozone neighbors and its own public about the true state of the country's public finances. The budget deficit for 2009 was 14.7% of GDP, more than double the previously published figure. This raised serious doubts about the country's ability to repay its debt. This was the start of the sovereign debt crisis in the Eurozone. In December 2009, the rating agencies downgraded Greek government debt below investment grade. Government bond yields rose to unsustainable levels, and, by the end of April 2010, Greece had turned to the European Union and the International Monetary Fund to activate a €45 billion bailout package. In early May 2010, the EU-IMF rescue package had to be increased to €110 billion over three years.

Soon after Greece's bailout, the EU decided to set up a European Financial Stabilization Facility (EFSF) with €440 billion financial firepower to intervene in similar situations. Simultaneously, the ECB initiated a "Securities Markets Program" under which it would buy up the sovereign debt of troubled countries in secondary markets. Subsequently, the EFSF and the IMF jointly agreed to provide conditional assistance packages to Ireland (November 2010) and Portugal (April 2011). In July 2011, further assistance to Greece was agreed to by the Eurozone governments. A relatively mild debt-restructuring scheme, euphemistically known as "private-sector involvement" (PSI), was made a condition for this additional lifeline, announced on July 21, 2011. Then, in March 2012, a new package of €130 billion for Greece was approved by the EU and IMF, Greece's creditors having accepted PSI demands for re-

structuring of Greek government bonds. This implied losses for the creditors of up to 75%. More than 85% of private bondholders agreed to the deal; had they not done so, it could have ended Greece's chances of getting any more bailout funds and pushed it into default (Kirkegaard, 2012).

The bailout, however, failed to restore market confidence in the Greek economy. Even worse, it failed to halt the contagion of panic from spreading to certain other Euro member countries that were perceived as economically weaker, with structural and competitiveness issues in addition to overly burdensome debt loads. As a consequence, the borrowing costs for these PIIGS countries jumped, as did the cost of insuring sovereign debt against default, in the face of the growing fears of eventual sovereign defaults occurring. At this point, Eurozone banks found themselves sitting on large amounts of Eurozone sovereign-debt assets, with a preponderance of bonds of the country in which a bank was headquartered. In retrospect, it is clear that this situation was due to questionable policy choices in the past, particularly the risk-weighting at zero of Eurozone sovereign bonds in regulatory capital calculations, the long-standing acceptance of such bonds with no haircut by the ECB as collateral in its liquidity policies, and possible instances of arm-twisting by home-country public authorities (Véron, 2011).

Between 2007 and 2010, the debt-to-GDP ratio of the Euro area rapidly climbed upward, from 66.3% to 85.4%. Greece is a special case: in 2007, its outstanding debt stood at an alarming 107.7% of GDP; continuously rising since 2003, the overall Greek indebtedness would go on to break all records, reaching a level of 144.9% of GDP in 2010. Like Greece, Italy had a debt level above 100% of GDP prior to the crisis, but the ratio fell back to a less worrisome level in the period between Italy's adoption of the Euro in 1999 and 2007.[18]

Among all Euro area countries, the most dramatic run-up in public debt occurred in Ireland, and this can be clearly ascribed to the country's banking crisis. Ireland did not have a fiscal or debt problem until 2008. Indeed, between 1997 and 2007, the country ran a fiscal surplus every year (except for 2002, when the government recorded a tiny deficit of 0.4% of GDP). Accordingly, the Irish debt-to-GDP ratio declined steadily over this period, from 64.3% in 1997 to 24.9% in 2007, giving Ireland one of the lowest public-debt burdens in the entire EU. The situation changed dramatically, however, in the course of the Irish banking crisis in September 2008, when the Irish government, under international pressure, guaranteed most of the liabilities of Irish-owned banks (Regling and Watson, 2010; McMahon, 2010). The government

[18] On the sustainability of Italian fiscal policy in the long run, see Bartoletto et al. (2012).

guarantee was initially for €400 billion but was later raised to €440 billion. As a consequence, the Irish deficit ballooned, and the debt-to-GDP ratio shot up from 24.9% in 2007 to 94.9% in 2010. The later disappearance of Ireland's access to capital markets in the autumn of 2010 led it in November 2010 to seek an international financial rescue package from the IMF and the EU; this amounted to over €90 billion and was needed to help it to recapitalize its banks, among other purposes.

Like Ireland, Spain had no fiscal or debt problems before 2008. In the 1999-2007 period, Spain had an average annual budget surplus of 0.3% of GDP. In fact, 2007 was a banner year, when the country recorded a fiscal surplus of 1.9%. Moreover, until the outbreak of the global financial crisis, Spain did not even once violate the EU's Stability and Growth Pact (SGP) provisions.[19] But the global financial crisis put an abrupt end to the long cycle of Spanish high growth (which had started in 1996), marked by a construction and real-estate boom (Suarez, 2010). When the economy contracted in 2008, the Spanish housing bubble burst and destabilized the banking system. The Spanish fiscal position also deteriorated, producing deficits of 4.5% in 2008, 11.2% in 2009, and 9.3% in 2010. Spain's public debt skyrocketed from 36.5% of GDP in 2007 to 61.0% of GDP in 2010.

In Portugal, too, whose track record had been less than sterling in the years leading up to the crisis, the by far greatest expansion of the public debt occurred during and following the 2008-09 turmoil: it rose from 63.8% in 2007 to 94.9% in 2010. Portugal had been the first country to breach the SGP in 2002 after having experienced a steady increase in its debt-to-GDP ratio since joining the Euro area in 1999 (when debt stood at 49.6% of GDP).

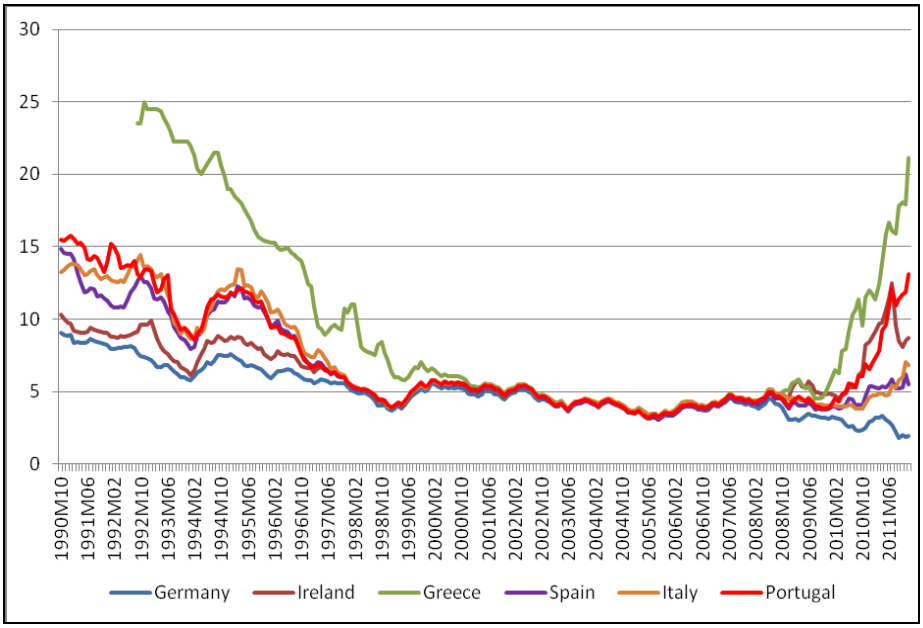
8. Mispricing of Risk and Imbalances in the Euro Area

In the decade leading up to the outbreak of the European market meltdown, a key causative factor was at work: widespread mispricing of risk by capital markets and an ensuing misallocation of capital. European monetary unification brought about a convergence of interest rates among Euro area members. Countries with weaker positions that signed up to the Euro could refinance themselves roughly at the same cost as the most solvent states. Interest-rate spreads on the sovereign bonds of the PIIGS compared to Ger-

[19] The SGP requires EU member countries to have an annual budget deficit no higher than 3% of GDP and a national debt lower than 60% of GDP or approaching that value.

many's narrowed rapidly in the run-up to EMU membership and almost disappeared once they had become members of the Euro area (Figure 2).[20]

Figure 2. 10-Year Government Bond Yields (% per annum), October 1990–December 2011



Source: Volz (2012), with data from Eurostat.

By January 2001, when Greece was welcomed into the Euro area, the yields on 10-year Greek bonds had fallen to 5% from 25% in 1992. The sovereign risk of virtually all Euro area countries, including the PIIGS, as shown in Figure 2, was priced more or less the same as German sovereign debt. This

[20] According to Blommestein (2012), the pricing of risky assets involves assessing the risk dimensions of relative asset safety. Safe assets are considered to be those that are virtually default-free. These so-called safe assets function as "informationally-insensitive" instruments, serve as "money," and have the associated basic functions of money. The return on these assets is the relatively risk-free rate. The proper pricing of sovereign risk has implications for the economy as a whole, via the impact on risk-weight rules for capital adequacy of banks, posting sovereign debt as collateral, the pricing of bonds issued by banks and other non-governmental entities. The transition from a relatively "risk-free asset" environment, as, in fact, it was for Euro area countries' sovereign debt during the first decade of the 2000s, to a relatively "risky asset" situation after 2010, has therefore had major macro- and micro-financial implications. Propounding the same argument, Panetta's (2011) *Report* outlines the impact of sovereign-risk concerns over the cost and availability of bank funding. It also describes the channels through which sovereign risk affects bank funding.

reflected financial markets' irrational optimism, which was underpinned by the zero weighting awarded in regulatory capital calculations to Euro area central government bonds. Another false assurance was derived from the ECB's policy of treating such debt as haircut-free, i.e., risk-free, when it was offered as collateral for repos and other financing trades (Véron, 2011).[21]

Mersch (2011) points to flaws in the Maastricht Treaty. At the very heart of that framework were the no-bail-out clause and the SGP. The first should have excluded free rider incentives, and the second should have aligned national fiscal policies to prevent negative spillover effects to the currency union as a whole. The SGP was a compromise: it quantified fiscal soundness without interfering with the budgetary and fiscal policies of sovereign states. Its purpose was to maintain fiscal discipline within the EMU. Member states adopting the Euro had to meet the Maastricht convergence criteria, while the SGP would make sure that they continued to observe them. The context for Maastricht was the strong belief of the time that governments would be reactive to market discipline and that the power of free markets to act as a check on government profligacy was paramount. Indeed, this was the prevailing paradigm in economics at that time. Of course, with hindsight, it is now obvious that the availability of cheap credit led to an unrestrained and unsustainable accumulation of private debt (as in Ireland, Portugal, and Spain) and public debt (as in Greece and Portugal) in today's crisis countries.

The drop in real interest rates in the periphery countries after their entry into the Euro area and the inflowing capital that followed entry fueled unsustainable development, including distorted credit dynamics and real-estate bubbles in Spain (Moro and Nũno, 2012) and excessive government spending in Greece. It also reduced the pressure for economic reform, which was sorely needed to improve the competitiveness of the weaker members of the monetary union; now they could easily finance their current-account deficits through an abundance of inflowing capital. A high level of public debt is not a problem *per se*, as long as the government is able to refinance itself and roll over its debt. However, this requires total public debt and the interest burden to grow more slowly than the economy and the tax base. This is not the case in the PIIGS anymore. Today's debt crisis in the PIIGS is therefore not merely a debt crisis; it is first and foremost a competitiveness and growth crisis that has led to structural imbalances within the Euro area (Bergsten and Kirkegaard, 2012; Mayer, 2011). In fact, below the surface of the sovereign

[21] Buiter and Siebert (2005) early highlighted this problem, maintaining that the ECB's open-market operations created moral hazard by not discriminating levels of sovereign risk within the Euro area.

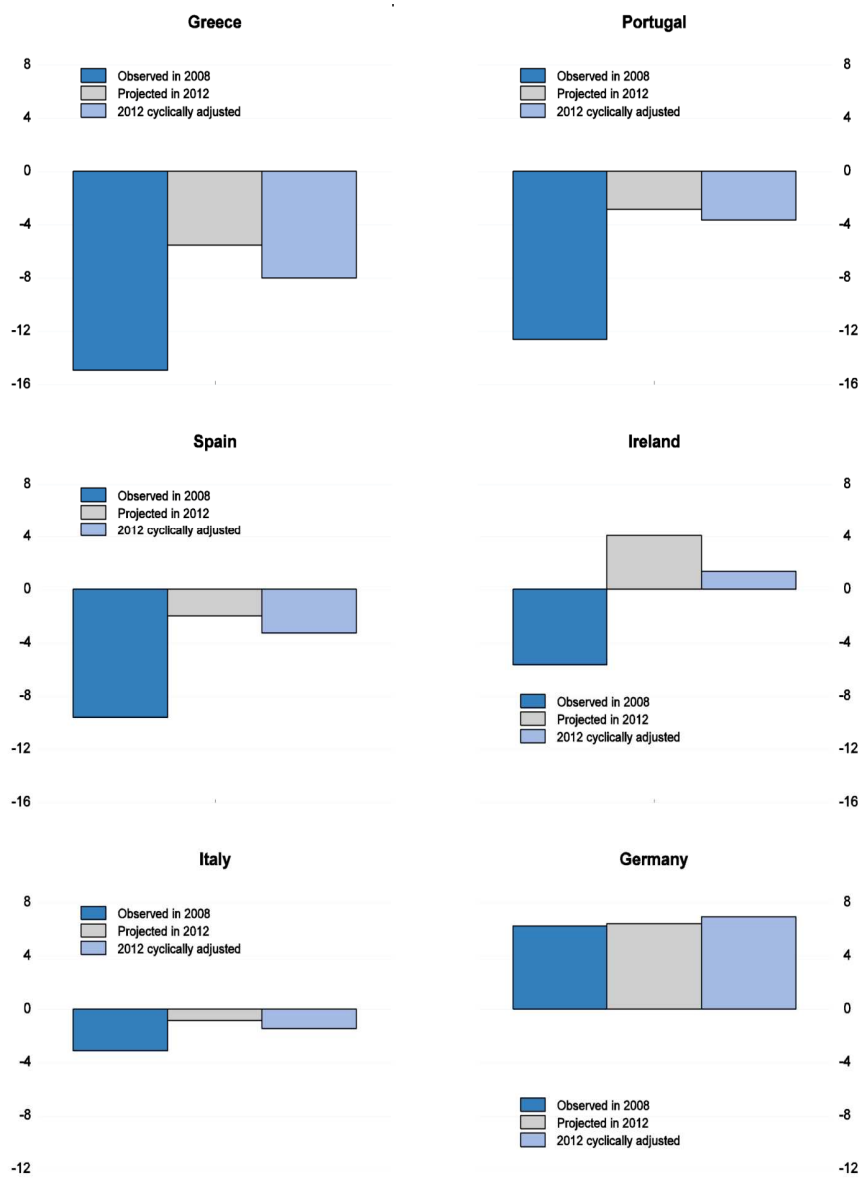
public debt and banking crises lies a balance-of-payments crisis, caused by a misalignment of internal real exchange rates.

According to Mayer (2011), before they found themselves in the midst of a Europe-wide crisis, EU officials tended to ignore the current-account imbalances in certain EMU member countries (Figure 3). Some of them, unfortunately, failed to grasp the difference between a common currency area within a political union and a currency union of politically sovereign states, leading a few to insist that these imbalances were irrelevant. As long as the financial markets remained buoyant and credit was easily available at rock-bottom cost for borrowers of differing quality, the flaw in this argument was not laid bare. This changed abruptly when the appetite for risk in credit markets suddenly dried up as panic began to roil the markets; Euro member countries with high government deficits or debt and a bleak economic outlook experienced a "sudden stop" of capital inflows, with a few suffering net capital outflows. On the surface, the "sudden stop" triggered a government funding and banking crisis. In response, EU authorities offered relief—conditioned on the imposition of budgetary austerity in the afflicted country—while the ECB stepped in to support the banks there. Below the surface, however, has lain a balance-of-payments crisis, which has so far received only scant attention. Recall that the balance of payments is defined as the sum of the current and capital accounts.[22] With floating exchange rates, the balance of payments is always zero, as the exchange rate adjusts so as to balance the current with the capital account. With fixed exchange rates, however, balance-of-payments imbalances will emerge when the exchange rate is above or below its equilibrium value.

In the first case, when the exchange rate is overvalued, a country imports more than it exports, pushing the current account into deficit. At the same time, domestic asset prices in foreign currency are higher than foreign asset prices, inducing investors to sell the former and buy the latter. This, in turn, leads to net capital outflows and hence a deficit in the capital account. The combined deficits of the current and capital accounts then produce a deficit in the balance of payments. Traditionally, balance-of-payments deficits have been funded by the sale of international reserves from the central bank. When the stock of reserves is depleted and the central bank can no longer fund the balance-of-payments deficit, the exchange rate drops so as to restore both the current and capital accounts to the black.

[22] In fact, the IMF balance-of-payments concept consists of the current account, the capital account, and the financial account. In Mayer's reasoning, however, the financial account is mixed with the capital account.

Figure 3: Current-Account Balances in Euro-area Countries: in Per cent of GDP



Note: Cyclical adjustment assumes that the economy's cyclical position is the same as that of its (trade weighted) trading partners.
Source: OECD Economic Outlook 92 database, and OECD calculations.

In the second case, when the exchange rate is undervalued, the current and capital accounts (and hence the balance of payments) are in surplus, and the central bank accumulates international reserves. This process comes to an end only when reserve accumulation has increased the money supply to the extent that domestic inflation rises to intolerable levels, at which point the authorities up-value the exchange rate in an effort to regain price stability.

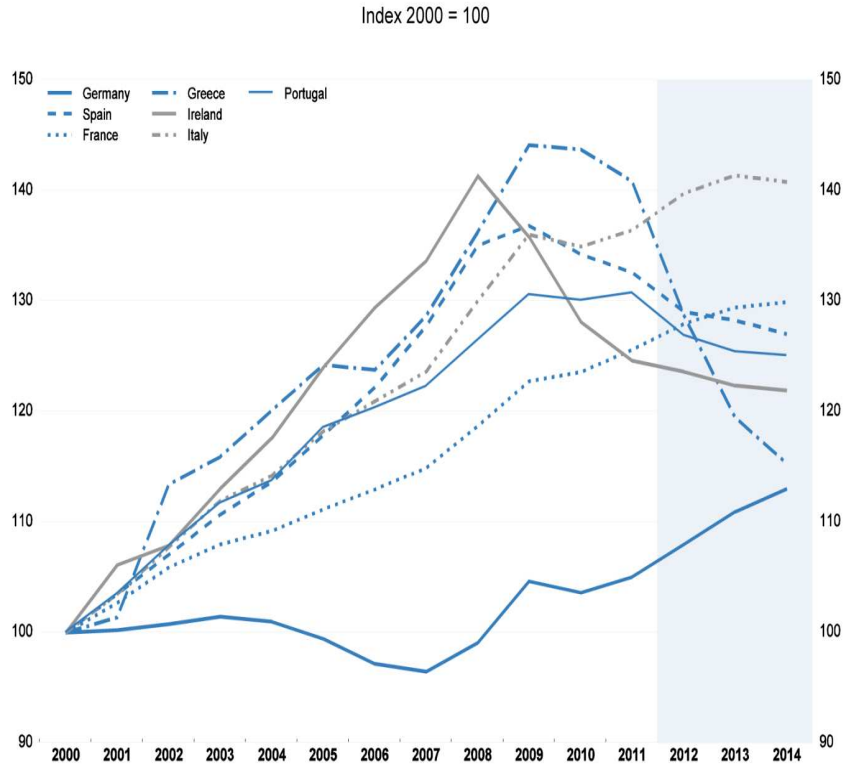
Officially being a union of sovereign states, the EMU had each member state retain its own national central bank, all of which then went on to become members of the so-called Eurosystem, with the ECB at the top. National interbank payment systems were merged into a Euro area interbank payment system (TARGET2), where national central banks assumed the role of operating the financial links between countries. A key consequence of this system was that each Euro area country had a national balance of payments in the form of the net position of its central bank within TARGET2. This net position could result in a claim (balance-of-payments surplus) or liability (balance-of-payments deficit) against the ECB, which sits in the center of the payment system. One unforeseen result of this setup was it allowed any country with a balance-of-payments deficit to automatically receive unlimited funding.

Take the example of a country that, due to an overvalued internal real exchange rate and a large government budget deficit, is running both a current-account and a capital-account deficit (Figure 3). As the banks extend credit to the overindebted government and the country's uncompetitive private sector, they are considered unsafe by international investors and lenders and are therefore cut off from private sources of funding. To ensure their continued solvency, the banks in this country receive credit from their national central bank, which acts on behalf of the ECB. Thus, reserve money flows from the ECB to fund payment outflows induced by the current- and capital-account deficits. In contrast to this scenario of local banks relying on their country's central bank and the ECB to fund their balance sheets, their counterparts in a Euro member with an undervalued real exchange rate have plenty of liquidity and therefore do not need ECB funds. Hence—according to Mayer (2011)—the ECB's funding operations become tilted towards the countries with overvalued exchange rates.[23]

[23] Mayer's idea that TARGET2 provides unlimited funding of the balance-of-payments deficits is questionable. TARGET 2 flows reflect a kind of lender-of-last-resort intervention by the ECB through the free allotment program. They just reflect the funding necessity of banks in different regions: periphery banks were the most in need, not because they lent to overindebted governments (except in Greece), but because they were the ones in dire straits due to their large positions in, for instance, real-estate markets, as in Spain.

The result of this tilt has been the lackluster growth performance in the periphery of the Euro area over the past several years, since that tilt only reinforced the erosion in those countries' competitiveness, both vis-a-vis other Euro area countries and the rest of the world. Notable features of this erosion were the domestic booms resulting from low real interest rates and strong capital inflows after accession to the EMU; hefty wage increases in excess of productivity growth, causing ever-higher unit-labor costs (Figure 4); and higher price inflation than in Germany and other "core countries" of the Euro area.

Figure 4. Unit Labor Costs



Note: The figures shown are for whole economy unit labour costs. If wage developments in the public sector diverge from those in the rest of the economy, changes in private sector costs may differ from those shown. This may mean that economy-wide labour costs are falling more sharply private sector costs in the EU/IMF programme countries.
Source: OECD Economic Outlook 92 database.

At the heart of the current difficulties in Europe are the severe structural imbalances in the distressed member countries, reflected by high current-account deficits in the periphery states and matching surpluses in the so-called core members. The prospect of the troubled countries growing economically out of their predicament is not encouraging, given their lack of competitiveness. Nor can they resort to currency devaluation as a quick fix to restore competitiveness, since they are members of a monetary union. Therefore, their necessary adjustment is going to be much more painful, involving such harsh measures as real wage cuts to push down costs. Such austerity is politically much more difficult to administer than a one-off currency devaluation. As emphasized by Véron (2011), besides budgetary belt-tightening and bank restructuring, structural reforms that enhance the crisis-hit countries' growth potential will be an indispensable part of any successful crisis resolution. Indeed, cash-strapped European governments' understandable reluctance to grapple with required economic adjustments, which demand politically unpopular policies, is what has caused markets to doubt the resolve—and therefore the future solvency—of the European periphery countries.

9. Concluding Remarks

The European experience has shown that a crisis can quickly spread among closely integrated economies, either through the trade channel, or the financial channel, or both. In an integrated world, no country can isolate itself from surrounding troubles (Rodrik, 2012). Since effective regulation, surveillance, and monitoring are the best crisis prevention, the way forward is clear: political leaders should redouble their efforts to strengthen the regional financial architecture, in tandem with bolstering domestic regulatory capacities and global financial cooperation.

In this context, it is worth stressing once more that any fixed exchange-rate arrangement (including monetary union) is prone to unsustainable stresses if the participating countries do not adjust their economies internally and their imbalances are allowed to grow well beyond the envisioned limits. If economic policies are not able to keep the domestic price level competitive vis-à-vis the rest of the integrating area, and external adjustment via the exchange rate is precluded, real exchange-rate appreciation will erode a country's competitiveness. In most cases, this will lead to current-account deficits that at some point will trigger a balance-of-payments crisis. Peripheral European countries are currently experiencing what a large number of developing and emerging countries went through over the past decades: a period of strong, yet unsustainable, output growth fueled by capital inflows comes to a halt at some

point, culminating in a "sudden stop" or reversal of capital flows (Kaminsky and Reinhart, 1999; Reinhart and Reinhart, 2009).

Since regional financial integration would require at least partial liberalization of domestic financial regulations and cross-border restrictions on financial services and financial flows, the regulatory architecture needs to keep pace with financial integration. In financially integrated areas, close cooperation between national regulators is needed. As realized possibly too late in Europe, once a certain level of regional financial integration has been reached, a regional regulatory body is needed to supervise financial institutions whose activities stretch across borders.[24]

An important lesson of both the European financial crisis and the overarching global hysteria of which it was a part is that regulatory authorities must not focus only on micro-prudential regulation and supervision of individual financial firms. Rather, they ought to identify and manage systemic risk, i.e., the risks brought on by the myriad interlinkages and interdependencies in a market, where a triggering event, such as the failure of a major investment bank, could seriously impair the functioning of financial markets and harm the broader economy (Volz, 2012).

In conclusion, the key points to focus on of both the European sovereign debt crisis and the banking panic are the following**. First**, Europe's banking system has been in a rut of systemic fragility since 2007. This is in contrast with the US, where resolution of the mess in the banking sector was swifter and essentially completed by end-2009. **Second**, had Western Europe's banks been in better shape three years ago, the policy approach to the Greek debt crisis would have been entirely different, possibly allowing for a much earlier sovereign debt restructuring. **Third**, the crisis has exposed a major deficiency in executive decision-making capability within the EU and Eurozone institutional framework, which helps to explain the insufficient policy response (Véron, 2011). In fact, the banking and sovereign debt crises are compounded by a crisis within the EU institutions themselves. Specialized European bod-

[24] Steps towards the creation of pan-European supervisory authorities for the Continent's financial sector were taken only in late 2008, when the president of the European Commission mandated a high-level expert group for that purpose. This expert group, led by Jacques de Larosière, proposed three new supervisory authorities, which were established in November 2010 and started operation in January 2011: the European Banking Authority (EBA) based in London, the European Securities and Markets Authority (ESMA) based in Paris, and the European Insurance and Occupational Pensions Authority (EIOPA) based in Frankfurt. These three supervisory authorities were complemented by the creation of the European Systemic Risk Board (ESRB), which is responsible for the macro-prudential oversight of the financial system within the EU and which has a secretariat hosted by the ECB.

ies, primarily the European Central Bank (ECB), have partly bridged this gap with policy initiatives that go beyond a narrow reading of their mandate, but they have been able to do so only to a limited extent. Thus, nothing has yet been introduced to stop the contagion in its tracks.

Therefore, a successful resolution of the current dysfunction in the markets will have to include at least the following four components: *i*) a fiscal union, i.e. a mechanism that ensures that fiscal policies in the Eurozone are partly centralized, with shared backing across countries so as to meet the requirements of a monetary union; *ii*) a banking union, i.e., a framework for banking policy and banking supervision at the European level that credibly supports the vision of a single European market for financial services; *iii*) an overhaul of EU/Eurozone institutions that would enable fiscal and banking unions to be sustainable, by allowing centralized executive decision-making to the extent necessary and by guaranteeing democratic accountability; and, finally, *iv*) short-term arrangements that chart a path towards the achievement of the above three points.

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