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BUILDING THE INNOVATION UNION:
LESSONS FROM THE 2008 FINANCIAL CRISIS

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1. Introduction

The Innovation Union initiative of the European Union (EU) focuses on product and process innovation for tangible goods. We argue that it is essential to extend the scope of the initiative to include innovation for financial sector products, processes, and regulatory approaches. We make this argument using examples of financial sector innovations in the United States (US) following the Great Depression and on the basis of an examination of the 2008 financial crisis.

2. The Innovation Union in Brief

The website for the Competitiveness and Innovation Framework Programme of the European Commission (2010) states that:

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> "Innovation is the only means of tackling the major societal challenges such as climate change, scarce natural resources and an aging society, while fostering jobs and growth."

The Europe 2020 strategy and its flagship Innovation Union initiative are based on this perspective. The aim is to spur growth of the EU economy and jobs via enhanced innovation activity. The ultimate goal is to harness innovation in the service of raising EU living standards now and for generations to come (European Commission, 2011a).

There are plans to offer researchers more attractive careers and to remove obstacles to the mobility of researchers across sectors and EU countries. Reforms have been agreed on too for modernizing higher education, including increasing the number of graduate students. Other measures include helping EU students and trainees study abroad and making Europe's universities more attractive destinations for talent from other nations (European Commission, 2011b).

The Europe 2020 strategy includes multiple programs as well for making the EU a more welcoming region for businesses interested in developing innovative products and processes. For example, protections of intellectual property rights are being strengthened and the costs of patenting in Europe are being reduced. Other efforts under way have the goal of improving business access to financing. Especially for young companies, finding suitable investors can be a crucial step toward business expansion and survival. Taken as a share of GDP, venture capital investment in the US is four times higher than in the EU. The Commission has appointed the Chairman of the British Business Angels Association to head an expert group tasked with formulating recommendations on how to improve the cross-border matching of innovative firms

with investors. The expert group findings will be presented in 2012 (European Commission, 2011b).

3. Setbacks Attributed to the 2008 Financial Crisis

The Europe 2020 and Innovative Union programs and plans and objectives make sense, but the lingering effects of the 2008 financial crisis represent an overarching question mark concerning feasibility. In the program documents, it is noted that the EU economy is slowly emerging from the deepest recession in decades and that the economic crisis has resulted in large losses in economic activity in the EU. Millions of jobs have been lost (European Commission, 2011e).

By the end of 2012, it is anticipated that the economies of a large share of the Member States will still be operating at output and employment levels below those preceding the crisis. The incidence of people unemployed for more than one year has increased steeply across the EU and youth unemployment exceeds 20% in more than half the EU Member States.

The impact of the financial crisis on public finances has been very negative. Government debt-to-GDP ratios have risen sharply in most Member States, reflecting both a decline in tax revenues and increased pressures on government expenditure for income support and fiscal stimulus. The crisis has further decreased potential growth via a fall in the investment rate. Business R&D investments have been hit especially hard (European Commission, 2011c).

The profitability outlook for the EU area banks is especially uncertain due to the sluggish recovery, heavy exposures to the real estate sector, and tensions in the sovereign debt market. The negative feedback from the real economy to the financial sector has been reinforced in some

Member States by high household and non-financial corporate sector indebtedness, with the prevalence of non-performing loans increasing considerably.

The EU has established new rules and agencies to try to ensure that all financial players are properly regulated in years to come (European Commission, 2011d). Efforts are under way, in particular, to ensure that EU banks have sufficient capital reserves to withstand future shocks to the financial system while continuing to function and to provide credit to households and businesses. However, stricter leverage rules mean that EU banks will be more constrained in their lending even when more favorable economic growth conditions have been restored.

One way to minimize the impact of the heightened regulatory policies is to improve the ability of financial regulators to monitor financial institutions and instruments, as well as the ability of financial intermediaries to measure and limit their own risks. Indeed, in the U.S. the Dodd-Frank Act included an Office of Financial Research to specifically accomplish these ends. Part of the charge of the Office of Financial Research is to establish data infrastructure for the study of financial instruments and institutions and to improve the monitoring capabilities of financial regulators and the financial industry. Leonard Nakamura (2011) discusses the value of such a data infrastructure and suggests one framework for it.

The Europe 2020 and the Innovation Union programs and stated goals pertain mostly to boosting R&D for products that are tangible and processes for producing tangible products. There is little mention of basic research aimed at achieving a deeper understanding of the causes of the 2008 financial crisis or that seeks to discover and develop new financial sector products, institutions, and regulatory approaches that could help address the post-crisis problems and needs. This state of affairs represents a contrast to US financial innovation activities in the wake of the

Great Depression; as explained below, those innovations included new financial products and institutions.

Some see the 2008 financial crisis as a continuation of a pattern documented by Charles Kindleberger and Robert Aliber (2005). Those authors argue that financial crises keep happening because of a recurrent pattern. Kindleberger and Aliber find that sustained increases in the price level for some asset lead investors to become increasingly optimistic and more eager to pursue speculative profit opportunities while the lenders become less risk-averse. The profit opportunities often arrive as a consequence of the "widespread adoption of an invention with pervasive effects – canals, railroads, the automobile – some political event or surprising financial success" (p.18). An increasingly large share of asset purchases is undertaken in anticipation of short-term capital gains and a large and growing share of these purchases are financed with credit. There is a pervasive sense, they argue, that it is "time to get on the train before it leaves the station" and the exceptionally profitable opportunities disappear. Asset prices increase further, fuelled by increasing speculative activity.

Eventually, Kindleberger and Aliber observe, the asset price bubble bursts, and speculators rush to unload their asset holdings, which pushes the asset prices down further. John Geanokoplos (2010) has nicely discussed how a key aspect of these repetitive price increases and declines may be differences in opinion – the optimists hold and increase their asset holdings while the price is rising, because the increase in the value of the assets increases the wealth of the optimists. When the price turns, the optimists lose wealth and must divest. Speculators who made their purchases largely using borrowed funds end up owing more on their loans than the assets can be sold for. Kindleberger and Aliber document repeated historical episodes that follow this pattern: a pattern that fits what happened in the 2008 financial crisis in multiple respects.

Nevertheless, we feel that the 2008 financial crisis also involved specific financial products and regulatory problems that require specific attention.

4. The US Financial Sector

4.1 Financial Institutions Created in the Wake of the Great Depression

Americans were bitter toward and fearful of bankers in the wake of the Great Depression, and the institutions established and rules enacted then reflect those feelings. The McFadden Act, passed in 1927, prohibited banks from having branches in more than one state. The 1933 Glass-Steagall Act prohibited depository banks from creating and selling securities. That act also created the Federal Deposit Insurance Corporation (FDIC), which insures bank deposits. In 1934, the Securities and Exchange Commission (SEC) was established to regulate the nation's stock and options exchanges and to help prevent corporate abuses in reporting and in the sale of securities.

Also in 1934, Congress created the Federal Housing Administration (FHA)[2] to help rebuild the US home construction and housing markets by providing insurance on mortgages originated by FHA-approved lenders. Soon after the FHA was established in 1934, the agency moved to create a new sort of mortgage instrument for Americans: a 30-year mortgage with the rate of interest fixed over the full mortgage term, and with the mortgage being prepayable at any time without penalty. As Susan Woodward and Robert Hall (2009) explain, this American mortgage greatly reduced homeowner risks and was instantly popular with homeowners. However, it exposes any institution that originates and holds mortgages to two sorts of serious risks. Future expected revenue from profits on mortgages already originated can suddenly vanish

[2] http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/fhahistory

if interest rates fall and homeowners refinance. Alternatively, if interest rates rise, lenders can end up facing rates on short-term funds borrowed to finance the portfolios they are carrying that are higher than the rates being paid by homeowners on their mortgages.

On the institutional front, US financial innovations following the Great Depression also included the creation in 1938 of Fannie Mae. Fannie's initial mandate was to borrow funds and then to buy up US government insured mortgages from private-sector mortgage originators (i.e., mortgage lenders). This replenished the funds of the lenders so they could then originate more mortgages. Originally, Fannie held the mortgages purchased in the corporation's portfolio and received income as borrowers repaid the interest and principal. Back then, Fannie's debt from those purchases was fully backed by the US government.

However, governments, like private businesses, often look for accounting and organizational expediencies that can legitimize operation with greater leverage. Thus, in 1954, government backing for Fannie's borrowings was rescinded,[3] and in 1968, Fannie's mortgage portfolio was taken off the federal balance sheet entirely. The original Fannie Mae was split in two. One part was renamed and became a new government corporation called Ginnie Mae. Ginnie was given the mission of selling US government insured mortgages. The other part retained the name of Fannie Mae and became a 100% stockholder-owned enterprise. Soon thereafter, in 1970, Freddie Mac was also created by the US government as a 100% shareholder-owned enterprise. However, investors clearly continued to believe there was government backing for Fannie's and Freddie's debt and were encouraged in this belief by special privileges accorded to Fannie and Freddie by the US government and special demands that were placed on Fannie and Freddie to help meet national affordable housing objectives.

[3] This happened with the passage of the Charter Act of 1954.

4.2 The Invention of Mortgage-Backed Securities (MBS) and Securitization

Mortgages have always been hard to sell to investors. Hence, the US Department of Housing and Urban Development (HUD) designed a mortgage-backed security (MBS).[4] An MBS, in its simplest form, is a bond backed by a pool of mortgages on which homeowners are contractually obligated to make regular monthly payments. Those payments are collected monthly and then passed through to the MBS holders.

Soon Ginnie Mae, Fannie Mae, and Freddie Mac were all packaging mortgages into pools and then selling MBS that were enhanced by agency guarantees against the financial risk of losses due to default. Indeed, investors were guaranteed not just full repayment but *timely* repayment, though only the guarantees of Ginnie Mae were, in fact, legally backed by the US government.

The private sector took years to develop a competing product that could match the popularity of the MBS that Ginnie, Fannie, and Freddie sold. Thus Ginnie, Fannie, and Freddie were able to dominate the MBS market through the 1990s. However, by 2001, another financial product innovation called a collateralized debt obligation (CDO) finally made it possible for private firms to compete with the Ginnie-Fannie-Freddie MBS. A CDO consists of a collection of bonds called tranches that are backed by a pool of debt assets that usually includes mortgages and often also includes other debt assets such as car loans and credit card accounts.[5] The payments from the pool flow to the different tranches in order of their seniority.

The most senior tranche, sometimes called super senior, has the highest priority claim on the mortgage pool cash flows. Once that tranche has been taken care of, cash is sequentially

[4] The first mortgage-backed securities (then called "pass-throughs") were guaranteed and issued by Fannie Mae and Freddie Mac over the years 1968-1971.

[5] CDOs backed as well by other types of debt assets besides mortgages are often referred to as a type of asset-backed security (ABS). CDOs backed only by mortgages are also a type of MBS.

allocated to fill each of the remaining tranches, in their seniority priority order. The so-called equity investors are those holding the most junior MBS tranches with the lowest cash flow priority and hence the highest risk of losses. However, the equity investors also get the highest rate of return when a CDO does well over time. Investment bank hedge funds turned out to be among the largest of the CDO equity investors.

On April 8, 2005, in his address to the Federal Reserve System's Fourth Annual Community Affairs Research Conference, then Fed Chairman Alan Greenspan declared:

> "Innovation has brought about a multitude of new products, such as subprime loans and niche credit programs for immigrants.... With these advances in technology, lenders have taken advantage of credit-scoring models and other techniques for efficiently extending credit to a broader spectrum of consumers…. The mortgage-backed security helped create a national and even an international market for mortgages, and market support for a wider variety of home mortgage loan products became commonplace. This led to securitization of a variety of other consumer loan products, such as auto and credit card loans."[6]

In this statement, Greenspan is celebrating the financial product innovations of the US, especially the development of MBS and CDO. Though some of these products were inadequately regulated and subsequently caused great losses not only in the US but also in the EU and elsewhere, many of the innovations themselves are clearly success stories.

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[6] Alan Greenspan, Consumer Finance, Remarks at the Federal Reserve System's Fourth Annual Community Affairs Research Conference, Washington, D.C., April 8, 2005, available at: www.federalreserve.gov/BoardDocs/speeches/2005/20050408/default.htm

4.3 Special Investment Vehicles (SIV)

A special investment vehicle (SIV), also referred to by a variety of other names including a special purpose vehicle and a special purpose entity, is a corporate legal entity created by a sponsoring organization to segregate specific activities (risks). By isolating high-risk projects from a parent organization and by allowing new investors to take a share of the very specific segregated risks held by the SIV, it can be easier to attract increased investor participation. An SIV often consists simply of a set of legal documents and has no offices, management, or employees. It is also usually "bankruptcy remote," meaning that if the sponsoring organization has financial problems, its creditors cannot seize the assets of the SIV.

A firm can use an SIV to finance large R&D and other sorts of risky projects so that these can be pursued without putting the entire firm at risk. This usage of an SIV can help increase investor participation in R&D, an EU objective. In addition, however, an SIV can be used by firms to avoid future taxes on the returns from R&D and many other sorts of projects that were, in fact, mostly carried out with personnel and other resources located in countries other than where the SIV are located.

Prior to the 2008 financial crisis, SIVs had come to be widely used in the creation and sale of asset-backed securities, including CDOs. In creating a CDO, usually an SIV is created first. The SIV is often established in a tax haven. The SIV issues bonds to investors in exchange for cash, which is then used to purchase the portfolio of assets that will be used for the CDO. The bonds, called tranches, are issued in layers with different risk characteristics, as noted above.

4.4 The US Nationally Recognized Statistical Rating Organizations (NRSRO)

Perhaps because of being especially reliant on capital market funding for many purposes including mortgage funding, the US has developed the world's most well known and used rating companies for assessing the riskiness of securities traded on financial markets, including debt securities such as CDOs. A small number of these rating agencies have essentially become part of the US financial sector regulatory system. These are called Nationally Recognized Statistical Rating Organizations (NRSRO).

NRSROs first came to be designated this way in 1973. Back then, the US Securities and Exchange Commission (SEC) decided to tie the capital requirements for broker-dealers to ratings for the securities they held. In designing these new regulatory capital requirements, the SEC worried that if designated as an NRSRO, some of the many agencies then producing ratings for securities might start essentially selling favorable ratings. Thus, the SEC designated just a short list of the established agencies in the securities rating business as NRSROs and decreed that only the ratings of those agencies could be used for satisfying SEC regulatory capital requirements.[7]

Soon NRSRO ratings began to be incorporated into other rules and regulatory procedures, including the leverage regulations for money market funds, pension funds, and insurance companies. In the early 1980s, there were seven NRSROs. In the 1990s, mergers reduced the number to three: Standard & Poor's (S&P), Moody's, and the Fitch Group Inc. (Fitch). Those three continue to dominate the NRSRO ratings business, though the number of NRSROs was subsequently increased again by the SEC.

Corporations (including municipalities) that issue securities want NRSRO triple A ratings for their securities because this allows those corporations to raise funds at lower cost. And

[7] http://www.sec.gov/answers/nrsro.htm

financial institutions, including banks and funds, have wanted to invest in triple A securities because the regulators for financial institutions in many countries have permitted them to operate with lower capital reserves if they were holding triple A rated securities.[8] In good times, holding less regulatory capital lets financial institutions achieve higher profit rates.

Soon international guidelines for financial institutions also began to build in NRSRO ratings. Of special importance, in 1988, the Basel Committee on Banking Supervision, an international body made up of representatives from the major central banks, produced the Basel Accord, which went into effect in 1992 in the EU and many other participating countries. The original Basel Accords were superseded in 2004 by Basel II, which was intended to create an international standard for banking regulators to control how much capital banks needed to hold in reserve to guard against financial risks.[9]

From the perspective of a lender, experience suggests that the safest direct loans are home mortgage loans to borrowers with excellent credit and loan amounts that are 80% or less of their property values. These loans to "prime" borrowers had a risk weighting of 35% under Basel II. However, when loans of that sort were packaged into a mortgage-backed security rated triple A, the risk weighting under Basel II was only 20%! In this way, Basel II reduced the amount of capital a bank had to keep in reserve to back up loans, thereby increasing bank profits so long, of course, as the bank did not end up facing solvency challenges. Thus, banks had a strong incentive to sell the mortgage and other consumer loan accounts they originated and to replace

[8] Moody's denotes its top rating by Aaa. AAA is the top rating for Standard and Poor's. We use the term "triple A" throughout to denote the top rating.

[9] For more on the Basel processes and accords, see http://en.wikipedia.org/wiki/Basel_Committee_on_Banking_Supervision .

holdings of those sorts of debt assets with triple A debt asset-backed securities. Thus, EU area banks loaded up on triple A rated MBS and CDO tranches.[10]

The NRSRO credit ratings for securities backed by consumer debt assets are arrived at using the credit rating information for the borrowers for the pooled debt assets.[11] Empirical evidence collected in recent years had shown that people with steady track records of paying all their bills on time almost never defaulted on mortgage loans, and this empirical "fact" was built into the CDO rating processes of the NRSROs. By now, however, it is recognized that there is one condition under which mortgage default becomes considerably more likely even for homeowners who, previously, had been regularly paying all their bills on time. This is the situation in which the market value of a home falls below the value of the mortgage: the underwater homeowner case. The NRSRO, along with much of the rest of the finance industry, ended up greatly underestimating the likelihood of default for subprime, and also for prime, mortgages in the underwater case.

4.5 The Use of Credit Default Swaps to Upgrade Mortgage-Backed Securities

Credit default swaps (CDS) are an insurance or a gambling product, depending on how they are used. CDS were invented by a team led by Blythe Masters of JPMorgan in 1997 as a tool for hedging default risk on loans. The cost of a freely traded credit default swap could

[10] Basel III represents an attempt to overcome some of these problems. http://www.moodysanalytics.com/Contact-Us/ERM/Contact-Form-Basel-III-Implementation/~/media/Insight/Regulatory/Basel-III/Thought-Leadership/2011/11-01-09-Implementing-Basel-III-Whitepaper.ashx

[11] Gary Witt (2010) explains several different methods that were used to rate CDOs. He was an analyst and then a managing director in the US derivatives group, at Moody's over 2000-2005.

potentially provide a better estimate of the risk on a debt instrument than the opinion, say, of a credit rating agency expressed in the form of a credit rating.[12]

With a CDS, the buyer makes a series of payments to the seller and is then entitled to a payment if a specified "credit event" happens, such as a loss of value for the "reference entity" named in the CDS purchased. CDS increasingly were used by those packaging and selling CDO tranches for the purpose of obtaining ratings upgrades for lower quality securities such as subprime debt assets. Buyers of CDOs were especially reassured by CDS sold by companies with triple A ratings from an NRSRO like the American Insurance Group (AIG), the world's largest insurance company, or a monoline insurance company like Ambac.[13]

The triple A claims paying record of AIG had been built up over years of selling types of insurance like life insurance with little potential for systemic risk. And the triple A rated monolines had built up their good credit paying records over the years by just insuring municipals bonds, for which defaults had been rare (Madigan 2008). It turned out, therefore, that the companies that sold most of the CDS had earned their triple A ratings from the NRSRO for business activities in prior years that were quite different from the business of insuring CDOs. Moreover, AIG was able to avoid holding reserves against the risk of writing the CDS because it argued that the purpose of the CDS was not insurance but simply regulatory arbitrage.

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[12] The risk-related meaning of a triple A versus, say, a double-B rating for a security is hard to quantify. In contrast, a CDS priced at, say, 1.08% on an 8% bond can be valued using standard financial methods as the equivalent of a risk-free 6.92% bond.

[13] These are the monoline insurance companies, denoted there by MI, that the internal Lehman 2007 risk analysis report of Shilpiekandula and Gorodetsky singled out as being at risk. As of December 2007, it was estimated that the monoline insurers -- eleven monoline insurers, all based in New York and regulated by that state's insurance regulator -- had given their insurance guarantee to enable the triple A rated securitization of over $2.4 trillion worth of asset-backed securities. On the official website of the monoline trade association, the Association of Financial Guaranty Insurers, it states that a security insured by an AFGI member has the "unconditional and irrevocable guarantee that interest and principal will be paid on time and in full in the event of a default": www.afgi.org/who-fact.htm . See Acharya et al. (2009) for more on how inadequacies of insurance regulation in the US contributed to the 2008 financial crisis.

The explosion in the use of CDS to shore up the ratings of CDOs backed by mortgages of increasingly dubious quality seems to have been driven by the role that triple A rated securities could play for financial institutions in meeting regulatory capital requirements. In the years prior to 2008, European banks reportedly acquired mortgage and other debt asset-backed securities that were accompanied by more than US $426 billion in AIG credit default swaps (Baily et al., 2008). When AIG's rating fell in September 2008, causing downgrades for all securities for which the rating had been enhanced via a CDS sold by AIG, this left large numbers of European banks holding less than the required levels of capital.

4.6 Synthetic CDOs: The Key to Creation of Vastly More Triple A Securities

Increasingly in the years leading up to 2008, CDS were also purchased for purely speculative purposes by buyers without any insurable interest whatsoever in the named credit events for the CDS. These CDS are referred to as naked. A speculator who bought a naked CDS was betting the reference entity written into the CDS *would* suffer a credit event. Sales of naked CDS to speculators had come to dominate the CDS market by 2008.

Though CDS had been used for decades to hedge risks, CDS sales had remained limited in earlier years. One reason for this is that, to be useful for regulatory capital purposes, a CDS had to be combined with an asset. For example, a CDS might be used to enhance the rating of a security like a CDO so that it could be held as regulatory capital by a bank. But pools of mortgages were needed to create regular CDOs, and the supply of suitable mortgages available for purchase that met the specifications needed for the creation of CDO tranches that could be highly rated if combined with a CDS was limited. However, that limitation was removed with the creation of synthetic CDOs.

A synthetic CDO combines newly created CDS with fixed income securities. The latter could be one or more already existing CDO, say. Tranches of synthetic CDOs are securities that can be rated, and the highly rated tranches could then be used to satisfy regulatory capital requirements. The term "synthetic CDO" arises because the cash flows from the premiums (via the included CDS) are analogous in some ways to the "fixed income" cash flows arising from the mortgage or other debt obligations in the pools backing up regular CDOs. However, if a credit event occurs in the fixed income portfolio part of a synthetic CDO, then investors in the synthetic CDO become responsible for the losses, starting from the lowest rated tranches of the synthetic CDO and working up. With a synthetic CDO, credit losses hurt the investors in the synthetic CDO and benefit the writers of the embedded CDS.

Buyers of a synthetic CDO are taking the "long" position, meaning they are betting that the referenced fixed income securities will perform well. Sellers of a synthetic CDO pay premiums to the buyer so long as there has not been a credit event for the referenced entity. Sellers are taking the "short" position, meaning they are betting the referenced securities will default. The seller receives a large payout from the buyer of the synthetic CDO if the referenced entities have a credit event. While the supply of synthetic CDOs was primarily driven by the intense demand for assets with the risk-return characteristics of CDOs, the sellers also stood to gain in the event of poor mortgage performance.

4.7 Innovative Changes That Resulted in Increasing Maturity Mismatch

The market for debt securities with a maturity of 13 months or less is generally referred to as the money market. Money market mutual funds have traditionally invested in short-term, low-risk instruments such as government securities, commercial paper, certificates of deposit,

repurchase agreements, and discount notes. These funds often offer immediate and full redemption of shares to members, but they fund assets that have longer terms and may be costly to liquidate. This innate fragility of money market funds can cause problems for other financial firms and the broader economy because of the size of the money fund industry and its prominence in short-term financing for other financial institutions.

The wholesale money market intermediates cash balances predominantly for institutional investors. These funds are usually raised on a short-term rollover basis (see Pozsar et al., 2010). Maturity transformation refers to the use of funding that is shorter term than the assets being financed. By definition, a financial institution engaging in maturity transformation cannot honor a sudden request for full withdrawals. As the maturity mismatch between a financial institution's debt assets and liabilities grows, the required maturity transformation and associated risks grow too.

Date and Konczal (2010) note that the traditional assets of US commercial banks were relatively illiquid commercial and consumer loans and the traditional funding source for these banks were deposits. Because deposit funding in the US enjoys some measure of protection through FDIC insurance and is provided by independent, atomized depositors, these funds are not usually withdrawn en masse in response to shocks to the economy or to a financial institution. This source of funding fits well with the inherently illiquid nature of most consumer and many commercial loans.

In contrast, the US investment banks have traditionally favored inexpensive, short-term funding in the wholesale money markets. This funding derives from relatively few institutional sources. Moreover, over time, the US investment banks increased their exposure to long-term, illiquid assets, while becoming increasingly dependent on the wholesale money market for

funding. The maturity of their liabilities declined to as short as a day. Hedge funds, which basically are unregistered investment banks that serve high net worth or institutional investors, became similarly vulnerable. In addition, over time, some of the US commercial banks began to also rely heavily on short-term, wholesale money market funding (Huang and Ratnovski, 2011).

Even though Canadian commercial banks have been allowed all along to carry out investment bank activities, Ratnovski and Huang (2009) point out that Canadian banks have consistently depended less on wholesale funding, and much more on depository funding from households, than many US depository banks. As Bordo, Redish and Rockoff (2010) explain also, when Canadian banks do use short-term wholesale funding, they are required to maintain stocks of highly liquid assets appropriate for their cash flow and funding profiles. Banks in Canada with more than 10% of funding coming from wholesale money market sources have been required to put in place internal limits on short-term funding requirements.

4.8 Off-Book Budget Items

Off-budget items are part of a broader problem of missing information that the decision makers running private financial firms and the public sector regulators need to be able to effectively do their jobs. The consequences of missing and wrong information are illustrated, for example, in a now public Lehman study completed in the fall of 2007 by company analysts Vikas Shilpiekandula and Olga Gorodetsky. Amazingly, those analysts found little cause for concern except for the monolines that had sold large volumes of CDS that had been used to

upgrade the ratings of CDOs. Beyond that, however, these analysts were mostly clueless about the developing financial market conditions that would soon destroy their company.[14]

The Commodity Futures Modernization Act (CFMA), passed on December 20, 2000, exempted derivative transactions, including CDO and CDS sales, from all requirements of exchange trading and clearing. This meant that there were no comprehensive, real-time sources of data about the volumes of CDOs and CDS that had been sold (Greenberger 2010). Also, Partnoy and Turner (2010) explain that, historically, US accounting rules required corporations to consolidate on their balance sheets any special investment vehicles they used to finance assets. During the 1970s, if a transaction was a financing, both the assets being financed and the financing had to be on the balance sheet. However, over the following decades, those rules were modified so that a corporation only had to include the assets and liabilities of another corporate entity in its financial statements if it had a "controlling interest" in that entity. Accounting standards like this that enable the growth of off-book business activities mess up the economic data used not only for regulation of financial institutions but also for economic planning.

5. Breaking the Financial Crisis of 2008 into a Chain of Four Component Crises

We see the financial crisis of 2008 as a chain reaction of component crises. Recognizing these components may make it easier to understand why extensive financial sector expertise and research are needed as a defense against follow-up financial crises of a similar nature. Poor financial sector outcomes undermine the means of paying for R&D in other sectors.

[14]See the Report of the Examiner in the bankruptcy proceedings of Lehman. http://lehmanreport.jenner.com/VOLUME%203.pdf

Crisis 1: Rising Mortgage Defaults

Mortgage defaults were the trigger for the 2008 crisis. In turn, the waves of mortgage defaults in the US were triggered by the change in average home prices from rising to falling. Though many argue now that change in the direction of the US home price trend should have been anticipated, the timing of that change clearly came as a surprise to many. It was the change in the direction of the home price trend beginning in 2006 that triggered the mortgage defaults, and those defaults contributed to further and deeper declines in home prices, leading to more defaults. It is understood by now that owners of homes for which the market values have fallen below the values of their mortgages ("underwater" homeowners) are likely to default on their mortgages even if those mortgages are classified as prime.[15]

The extent of the boom-bust cycle in housing was exacerbated during the boom phase as well, as rising house prices directly lowered the risk of home lending. Borrowers who lack the funds to make their mortgage payments could either borrow additional sums against their increased home equity or sell their homes. This reduction in risk then apparently led to additional reductions in the credit standards of lenders, allowing new borrowers to raise home demand further in a boom cycle, as described by Jan Brueckner, Paul Calem and Leonard Nakamura (2012). That is, in addition to failing to foresee when the US average home price would stop rising, the US consumer credit scoring agencies[16] failed to properly take account of the

[15] The main role played by relaxed lending seems to have been that the large volume of subprime mortgages originated with little or no money down created a pool of homeowners who quickly were underwater once the upward trend in home prices had turned. Their defaults then contributed to further home price declines. See Mian and Sufi (2008, 2009) and Calabria (2011) for more on this. And by 2007 and 2008, more than half the foreclosures in Massachusetts involved prime loans to homeowners whose homes had mortgages that were larger than the market values of their homes (Gerardi, Shapiro, and Willen, 2007).

[16] Note that these are different from the credit rating companies for securities.

likelihood of loan defaults for underwater homeowners, and this contributed to the US practice of giving mortgages without requiring significant down payments.

Crisis 2: The Ratings Downgrades and Value Slides for Mortgage-Backed Securities

The volume of mortgage-backed CDOs grew rapidly between 2000 and 2006 and then went into decline once mortgage defaults began to rise. The credit ratings for mortgage-backed securities, including CDOs, began to be downgraded by the ratings agencies once the default rate began to rise. Mortgage-backed CDOs performed far worse than other types of CDOs issued over the years 1999-2007.[17] Published in January 2007, Moody's report on structured finance ratings over the period 1983-2006[18] notes that the slowing US housing market and rising interest rates had very negative effects on the ratings of US mortgage-backed securities.

Without a triple A credit rating, a CDO was no longer useful for reducing the regulatory capital requirements for a bank or fund. Financial institutions thus began selling large volumes of their downgraded CDO securities, pushing CDO market values and ratings down further. As CDO prices fell, the trading of CDOs became increasingly difficult. This liquidity failure was aggravated by rising margin requirements, which limited the freedom of action for speculative investors and many of them also began trying to unload their CDO holdings. The regulators for financial institutions failed to foresee and guard against the chain reaction of ratings downgrades that ensued (see Benmelech and Dlugosz, 2009, and Bartlett, 2010).

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[17] This includes CDOs backed by emerging market bonds, investment-grade bonds, and high-yield bonds, all of which did significantly better. See Newman et al. (2008).

[18] http://fcic-static.law.stanford.edu/cdn_media/fcic-docs/2007-01-00%20Moody's%20Structured%20Finance%20Rating%20Transitions%20-%201983-2006%20(Moody's%20Special%20Comment).pdf

Crisis 3: Downgrades for Credit Default Swap Sellers

When homeowners began to default on their mortgages in record numbers, the owners of CDOs who had hedged their risk by CDS, and also the speculators who had placed bets that there would be widespread mortgage defaults by buying naked CDS naming downgrades of mortgage-backed CDOs as the named credit events, began to be entitled to collect payouts. However, the sellers of the CDS had not held sufficient capital reserves to deal with large numbers of claims.

In 2008, the financial press was filled with dire news about the CDS sellers. The monolines were the focus of worries back then. It was widely recognized that they had sold more CDS than they were in a position to back up. The news reports explained that if one or more of the main triple A monolines were downgraded by the rating agencies, a wide range of other financial institutions would also be in trouble.[19]

In addition to selling CDS to shore up CDS, the monolines had also collectively guaranteed about $2.4 trillion worth of municipal bonds. Those CDS guarantees had allowed municipalities to borrow more cheaply. Downgrades for the monolines meant downgrades too for the municipal bonds guaranteed by the monolines. The perceived likelihood of monoline ratings downgrades rose steadily beginning in the summer of 2007.

In January 2008, the credit rating was reduced from triple to double A for Ambac, the largest of the monolines. This caused immediate downgrades of thousands and thousands of municipal bonds, and there were resulting downgrades as well of CDOs held by financial institutions. As the major rating agencies began to downgrade other monoline insurers too during 2008, vast numbers of additional municipal bonds, CDOs, and other securities insured by those

[19] See, for example, Madigan (2008).

companies were downgraded as well. In addition, AIG had also sold far more CDS than the company was in a position to pay out claims on. Thus, the CDS crisis rapidly worsened in 2008.

The CDS sellers in the US should have been regulated under both insurance and bucket shop (i.e., gambling) laws. Unfortunately, the US explicitly exempted CDS from both those sorts of regulation (Greenberger, 2010). Europe needs to be in a position to notice a US regulatory lapse like this and to take defensive measures.

Crisis 4: The Collapse of Investment and Some Commercial Banks and Fannie and Freddie

The mortgage defaults, falling CDO values, and downgrades and payout failures of CDS sellers caused the failure of all the main US investment banks. This was the most spectacular manifestation of the 2008 financial crisis. Bear Stearns was the first to fail. On March 17, 2008, the Fed opened a line of credit that enabled JPMorgan to buy Bear for just $2 a share.[20] On September 15, Lehman Brothers declared bankruptcy. Also on September 15, Merrill Lynch was purchased by the Bank of America in an emergency deal. Back then, Merrill was the largest US brokerage firm. In addition, on September 21, the Fed agreed to let Morgan Stanley and Goldman Sachs become bank holding companies, making them eligible for federal aid.[21]

Many other financial giants failed as well that year. For example, in November, the nation's largest bank holding company, Citigroup, had to be rescued with taxpayer money. The nation's largest mortgage lender, Countrywide Financial, was acquired by Bank of America in a distressed sale, and Bank of America then had to be rescued by the Fed, due in part at least to problem assets acquired along with Merrill Lynch.

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[20] http://www.nytimes.com/2008/03/17/business/17bear.html

[21] http://www.bloomberg.com/news/2011-03-31/morgan-stanley-got-6-9-billion-from-fed-window-in-october-2008.html

Based on a study of 72 large banks and bank holding companies in the OECD, Huang and Ratnovski (2011) conclude that greater reliance on wholesale money market rather than retail depository funding was a key determinant of which banks fared badly in the 2008 financial crisis. The study revealed that many of the US investment and depository banks that got into trouble in the crisis relied heavily on wholesale (and other sorts of) funding that could be withdrawn quickly.[22]

Concerns arose as well in 2008 regarding the leverage of Fannie and Freddie and their ability to make good on their guarantees for the MBS those corporations had sold. As part of their capital reserves, they held large portfolios of private-label CDOs that had lost their original triple A ratings and much of their original market value over the summer of 2008. On September 7, 2008, the federal regulator for Fannie and Freddie put them into conservatorship.[23]

Many money market funds had purchased MBS under binding buy-back agreements that were conditional on continued triple A ratings for those assets. Hence, a sudden loss of triple A status for large volumes of MBS put those funds at imminent risk, too. Risk assessments for CDOs and MBS rose. A large portion of these securities were held in various special investment vehicles that relied on asset-backed commercial paper for financing. Doubts on the part of money market fund managers regarding the securities those SIVs held led to a market liquidity collapse for asset-backed commercial paper. Banks hoarded liquidity in order to provide sufficient funding for their SIVs and drastically reduced their lending.

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[22] In a European Union context, Poghosyan and Čihák (2009) also find that wholesale financing reliance distinguishes vulnerable banks from sound banks.

[23] Also, as a result of the financial crisis, 25 US commercial banks became insolvent and were taken over by the FDIC in 2008, including Washington Mutual. A total of 140 more failed in 2009, and 157 failed in 2010. Those bank failures seriously depleted the FDIC' funds.

Following the bankruptcy of Lehman Brothers in 2008, Mora (2010) explains that money market funds were hit by massive redemptions, as were hedge funds, which led to forced asset sales that intensified the downward spiral in asset prices. Instead of offering liquid funds to banks, money market funds began competing with banks for financing. Also, a large number of creditors, including some major hedge funds, had their assets frozen in the Lehman bankruptcy and were forced to find alternative funds, adding to the selling pressure in equity markets.

The US allowed its financial system to become very vulnerable to disruptions in the availability of wholesale money market funds. Europe needs to be in a position to notice financial market problems like this and to have ways of limiting EU area contagion.

6. Lessons for the Innovation Union from the 2008 Financial Crisis

The reality of the 2008 financial crisis is that inadequately regulated new financial sector products and practices undermined the financial support for R&D and new product and product market developments in virtually all other sectors of not just the US economy — where both the financial sector innovation and the 2008 financial crisis were rooted — but also the EU economy. A wide slowdown in R&D and in getting new innovative products to market is a perennial consequence of financial crises, regardless of their causes. Public- and private-sector R&D and the commercial development of new products all predictably diminish in the wake of a large financial crisis because the funding sources dry up. The lesson we draw from this reality is that basic research on financial markets, products, and regulation should also be a focus of the Innovation Union since financial market stability is essential for sustained innovation.

If the EU were playing more of a leadership role in financial sector innovation, this could also increase the weight of the EU in international negotiations on financial sector regulation.

The US certified NRSROs provide selective discipline for the financial activities of banks, other companies, and even nations in the EU. However, the EU does not seem to have had effective ways of modifying US financial sector activities even when those activities threatened to, or did, have bad consequences for the EU.[24] Nor did the EU take effective defensive actions to lessen the impact on the EU of the errors of the US rating agencies and regulators.

7. A Related Need for Including Tax Policy Research in the Innovation Union Agenda

R&D expenditure figures play a key role in the performance metrics built into the Innovation Union initiative and the Europe 2020 strategy. Yet the results in a 2010 article by Robert E. Lipsey raise concerns about what is being captured by the national R&D expenditure data being compiled by the EU official statistics system. A related concern is that the hoped-for benefits of the Innovation Union initiative include the projected tax revenues from resulting product sales. Lipsey's results raise concerns about those benefit projections, too.

Intangible productive assets often lack clear geographical locations. The firm that owns such assets, if it is a multinational firm, can move them from one member of the multinational group to another, changing the nominal geographical location without changing the geographical location of the use of the asset or the control of the asset. The effect of such a transaction is to shift the apparent location of the production based on that asset. In the process, the firm may change what had been recorded as production in a location into imports to that location.

[24] For example, in the Greek debt crisis, the story behind the headlines is that, in 2001, Goldman Sachs helped the Greek government borrow billions, with this showing on the government books as a currency trade rather than as debt. That deal gave Greece cash upfront in return for pledging future landing fees for the country's airports. This and subsequent other deals of a similar nature initially duped the regulators for the European Monetary Union (EMU) into agreeing that Greece met the standards for admission to the EMU (Story, Thomas and Schwartz, 2010; Mitsopoulos and Pelagidis, 2011). Most Greek voters were probably unaware of how their government services were being paid for.

The geographical assignments by the firm then determine where production based on some assets is reported to take place and, hence, the distribution of production across countries, and which sales are measured as exports or imports. As production comes to depend more and more on intangible assets such as patents, copyrights, technological and scientific knowledge, and techniques of management, the location of production by multinational firms will become more and more ambiguous. Yet this is precisely the direction in which the Innovation Union initiative is trying to move EU production and the direction in which the EU and other developed economies are believed to be moving anyway.

Lipsey provides strong empirical evidence that many firms choose the locations of production for intangible productive assets so as to minimize taxes and that they operate to reduce their measured output in countries with higher tax rates on business income. Lipsey shows that these reporting practices also exaggerate the imports of high-tax countries and understate their exports. The problem in trade data is probably worse for trade in services than for trade in goods, but it exists also for trade in goods, especially of types for which much of the value comes from intangible assets. Lipsey singles out insurance as one of the industries that takes advantage of these opportunities for tax minimization.

Moreover, many of the same problems arise with the location of production based on financial assets of a multinational firm, although the valuations of the assets are more easily defined at least. With a transfer of assets from a parent to an affiliate, or among affiliates, production appears to have shifted its location, but all the other inputs into production may have remained in the former locations.

One sign of distorted measures of output by location is the reporting of high levels of output and profits in locations where there is little labor or tangible capital. Another is the

reporting of ratios of output and profits to tangible inputs that differ to an extreme extent from worldwide norms. The inputs for which location is most reliably measured and least likely to be manipulated are of labor and of physical capital in the form of plant and equipment.

For 2004, Lipsey (2010) estimated the exaggeration of the value added, or output, and of sales of US affiliates in eight tax havens. The exaggeration of value added in 2004, estimated from its relation to fixed capital and labor compensation, was $33 billion, which is about 4% of the worldwide total of affiliate value added. The estimated exaggeration in the sales of these affiliates in that year was almost $360 billion, which was more than 10% of worldwide sales! Since the tax havens examined are relatively small countries, most of the reported sales must have been exports, suggesting an even larger impact on measured exports and imports and the balances of payments.

Hines (2005) claims that much of reported tax haven income consists of financial flows from foreign affiliates that parent companies own indirectly through their tax haven affiliates. He notes that firms in other countries that largely exempt their firms' foreign income from taxation, such as Germany and the Netherlands, have especially strong incentives to locate investment and income production in tax havens (p. 79).

The European Commission has been discussing proposals for a uniform method of allocating income among the countries in which a multinational operates. A paper by Fuest, Hemmelgarn, and Ramb (2007), based on the Deutsche Bundesbank's database on German multinationals' foreign operations and a matched database on the firms' domestic operations, calculated what firms' distributions of taxable income across countries would be under a hypothetical allocation of income based on sales, employment, and assets, including tangible and intangible assets. The paper shows large discrepancies between the hypothetical allocated

income distribution and the reported one. We see this as an important area for research and institutional and regulatory as well as product innovation. Without progress on this front, much of the hoped-for economic benefits of the Innovation Union could end up being lost as a side effect of the economic conditions that result from financial crises or could end up mostly benefiting tax havens rather than EU Member States.

8. Concluding Remarks

Charles Kindleberger studied hundreds of financial crises around the world. The discouraging conclusion Kindleberger (1993) draws is that most of the rules for sound banking were already incorporated in financial sector regulations long ago, either explicitly or implicitly in the form of financial sector traditions. He asserts that financial crises happen because whatever rules are instituted following each new financial crisis soon come to be selectively ignored by financial institutions, regulators, and politicians as the expansion phase of the next credit cycle takes hold.

There are signs of what Kindleberger describes as the seeds of the next financial-crisis-in-the-making in some aspects of how the Dodd-Frank Act is, and is not, being implemented. On July 21, 2010, President Barack Obama signed the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) into law. However, Wall Street lobbyists ensured that even under the Dodd-Frank Act, banks are permitted to exclude their full exposure to swaps from their financial statements and instead report only the "fair value" changes in those swaps over time. Such reporting, Michael Greenberger (2011) argues, is like an individual reporting only the change in his debt balances, instead of reporting the debts themselves. Yet he also feels

that "the Act has the potential to effectively regulate the derivatives markets, if regulators make the most of the tools made available to them by Dodd-Frank."

The crisis that engulfed the financial system of the US and many of the EU area economies in 2008 has had severe and widespread negative consequences. The R&D activities that the Innovation Union seeks to enhance have been especially hard hit. We argue, therefore, for including in the Innovation Union research aimed at increasing financial sector stability while protecting economic growth. In designing this program of research, it might make sense to examine the Canadian experience and regulatory methods much more carefully (Leblond 2011). Canada is a nation that has had sustained economic growth and that has a slightly higher proportion of households living in owned housing than the US, but that has not been vulnerable to banking and other financial sector instability like the US, going back at least as far as the Great Depression.

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