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Letter from the Editor — C. Paul Wazzan, Ph.D.

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The Role of the Economic Expert
in the Banking and Investment Disputes
Following the Subprime Crisis

by John B. Davis, Ph.D.

Economic Impact of Research Funded by
the California Institute for Regenerative Medicine

by José Alberro, Ph.D.

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The BRG Review
Berkeley Research Group, LLC
2049 Century Park East, Suite 2525
Los Angeles, CA 90067
T 310.499.4821
info@brg-expert.com

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From the Desk of the Editor

Welcome to the second issue of Berkeley Research Group Review ("the Review"), the official publication of the Berkeley Research Group, LLC ("BRG"). BRG was founded in 2010 by a group of distinguished academics and private sector professionals in the fields of economics, finance, health care, and data analytics. BRG engages primarily, but not exclusively, in litigation consulting – providing innovative solutions and analyses to the complex problems being addressed in the Courts today.

I am pleased to report that our first issue was a resounding success. More than 300,000 copies were distributed and we received almost universally positive feedback from our readers. The current issue contains two papers, the first providing a case history on the ongoing housing-related financial crisis and the second discussing the economic impact of research funded by the California Institute for Regenerative Medicine (a state funded governmental organization).

As always, we hope to use the Review to provide our audience with a "good read" and to improve our connections with clients, recruits, peers, and colleagues. We expect that the Review will stimulate discussion and debate around key issues we face today. With this in mind, we welcome any comments or feedback you have about the subjects we raise in the Review.

Kindest regards,

C. Paul Wazzan, Ph.D.
Editor

John B. Davis

John B. Davis, Ph.D. is a Managing Economist at Berkeley Research Group in Emeryville, CA. He has over a decade of experience in litigation consulting on a wide variety of matters ranging from banking and investment disputes to Title VII class-action discrimination lawsuits. He specializes in the analysis of large data sets, the design of statistical and economic studies relating to legal issues, and the analysis of expert witness testimony. He has advised clients at many stages of litigation including discovery, trial preparation, mediation, and settlement. Dr. Davis has also testified as an expert witness in an employment dispute in the California Superior Court.

Contact Information:
Email: jdavis@brg-expert.com
Phone: 510.285.3252

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The Role of the Economic Expert in the Banking and Investment Disputes Following the Subprime Crisis

Abstract:

Financial institutions sustained enormous losses when the home price bubble burst. The ensuing investor lawsuits raised the question - Who was responsible? The answer is complex given the scale and scope of financial investments and the plethora of entities involved. Fortunately, experts in economics and accounting can sort out key facts about the value of the financial instruments, the entities involved, and provide the courts with opinions addressing the "reasonableness" of alleged misrepresentations to investors. Given the rapidity of events during the subprime crisis, an expert may find that similar representations are "unreasonable" at one point in time, but "reasonable" at another point in time.

I. INTRODUCTION

We begin with a brief review of the events leading up to the subprime mortgage crisis in the first decade of the new millennium. Given the enormous losses that spread throughout the financial system when housing prices fell, it is not surprising that litigation followed wherein investors alleged financial institutions fraudulently misrepresented, and failed to properly disclose, the value of subprime-related securities. For example, on November 4, 2007, Citigroup publicly announced $55 billion in U.S. subprime-related exposures and an estimated reduction in revenues of $8 billion to $11 billion, but ultimately recorded over $18 billion in losses by year end. The SEC charged Citigroup with misleading investors about the extent of portions of this subprime exposure and Citigroup paid a penalty of $75 million to settle the

action.[1] Next, the legal framework for these matters is summarized with an emphasis on the expert's role in addressing the "reasonableness" of alleged misrepresentations. We then discuss why the investment disputes arising from the subprime crisis are unique (e.g., the complexity of the financial derivatives at issue, difficulties in valuing illiquid financial instruments in a time of financial crisis, off-balance sheet accounting arrangements, and the role of government regulators in managing the crisis). The discussion reveals that the rapidity of events during the financial crisis makes pinpointing liability and damages dependent on the timing of the alleged misrepresentations and subsequent corrective disclosures.

II. THE HOME PRICE BUBBLE

The housing price bubble that developed in the mid-2000s was, in part, due to innovations in financial derivatives and the organizational structure of the financial industry that made credit far more plentiful – especially to "subprime" borrowers whose loans were below underwriting standards for prime mortgages – while ostensibly providing "safe" instruments for savings and investment capital worldwide.[2] In the late 1990s and early 2000s, new financial derivatives were developed that transferred the returns and risks of individual home mortgages into Residential Mortgage Backed Securities ("RMBS"), Collateralized Debt Obligations ("CDO"), and Credit Default

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[1] Citigroup, Inc., *Citi's Sub-Prime Related Exposure in Securities and Banking,* Citigroup's 2007 Annual Report on Form 10-K (November 4, 2007), http://www.citigroup.com/citi/press/2007/071104b.htm.
U.S. Securities and Exchange Commission, *Litigation Release No. 21605* (July 29, 2010), http://www.sec.gov/litigation/litreleases/2010/lr21605.htm.

[2] While there is no standard definition of "subprime" loans, these loans are typically identified by FICO scores below 620, high loan to value ratios (>90%), interest-only mortgages, and other characteristics of the loan that indicate higher risk of default.

Swaps ("CDS").[3] These new derivatives were expected to provide real benefits to investors and subprime borrowers in two ways. First, by creating securities based on a pool of individual mortgages, overall risk could be reduced through diversification, thereby expanding the mortgage market to subprime borrowers. Second, by creating securities divided into "tranches" with different levels of risk, the risk preferences of a broad range of investors could be satisfied.

These new derivatives also enabled banks to expand lending capacity. Banks could sell the mortgage loans originated at their institution to other financial institutions, known as "special purpose vehicles" (SPV) or "structured investment vehicles" (SIV), that specialized in the issuance of the RMBS and CDO securities. As a result, banks were able to remove loans from bank balance sheets, free up additional capital, and make more loans. This was possible even though government regulators require bank holding companies to hold a certain amount of capital in reserve for unexpected losses to the assets on their balance sheets.[4] In particular, regulatory reserve requirements are designed to limit the "leverage" (the ratio of loans to capital) that banks can undertake.

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[3] RMBS are securities whose payments are based on the aggregate cash flows from a pool of individual home mortgages. CDOs are securities whose payments are based on aggregate cash flows from a pool of individual RMBS securities. CDS are privately negotiated bilateral contracts where a third party guarantees the buyer's loans or derivative securities against "credit events," i.e., defaults or depreciations in value.

[4] The Federal Deposit Insurance Corporation requires U.S. bank holding companies to meet leverage and risk-based capital tests. "The leverage test requires that to be well-capitalized, a bank must have tier 1 capital of at least 5 percent of its adjusted total assets (deemed to substantially exceed the regulatory minimum 4 percent). The risk-based test requires that to be well capitalized, a bank must have a risk-based capital ratio (total capital to risk-weighted assets (RWA)) of at least 10 percent, substantially exceeding the 8 percent minimum." Powell, Donald E. (November 10, 2005). *Development of the New Basel Capital Accords,* Speech presented at the Committee on Banking, Housing, and Urban Affairs, http://www.fdic.gov/news/news/speeches/archives/2005/chairman/spnov1005b.html.

Credit Default Swaps (CDS) provided another means for banks to reduce the risk profile associated with the mortgage loans, RMBS, and CDO exposures on their balance sheets. CDS enabled banks to purchase "hedges" or protection against default risks of the loans on their balance sheet.[5] Regulators allowed banks to use CDS to reduce the risk weightings of assets held on the balance sheets subject to the scrutiny of regulatory bank examiners on an institution-by-institution basis.[6]

The result of these financial innovations was an expansion of credit that changed the financial landscape of the United States. An increasing share of higher risk subprime loans entered the financial mix, jumping from a little over 5% of all mortgage originations in 2003 to nearly 20% of all mortgage originations by 2005.[7] The expansion of home financing as a result of increased subprime lending was geographically and demographically concentrated. For example, higher-priced subprime mortgages were geographically concentrated in areas such as California's Central Valley, Texas, and Florida.[8] In addition, a disproportionate share of subprime lending occurred in zip codes with residents who had lower median household income, higher poverty rates, and more minorities.[9] Along with this increase in financing, U.S. home prices nearly doubled from 2001 to the middle of 2006, and today remain about 40% above price levels in 2001 (see chart below). As with the expansion

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5 *Credit Default Swap (CDS) Primer,* Nomura Fixed Income Research (May 12, 2004).

6 *Supervisory Guidance for Credit Derivatives,* Board of Governors of the Federal Reserve System (August 12, 1996), http://www.federalreserve.gov/BOARDDOCS/SRLetters/1996/sr9617.htm.

7 Federal Reserve Bank of San Francisco, *The Subprime Mortgage Market, National and Twelfth District Developments,* Annual Report, the Subprime Mortgage Market, at 6-17 (2007).

8 Federal Reserve Bank of San Francisco, *The Subprime Mortgage Market, National and Twelfth District Developments,* Annual Report, the Subprime Mortgage Market at 9 (2007).

9 Atif Mian & Amir Sufi, *The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis,* Quarterly Journal of Economics (November 2009).

of subprime mortgages, the largest increases and subsequent decreases in home prices were concentrated. For example, home prices in Miami, Las Vegas, and California's Central Valley cities, such as Stockton, increased two to three times more than the U.S. average during the boom years and then showed the sharpest declines.[10]

The academic literature recognizes that "rapid appreciation in housing prices prior to 2006 masked the deterioration in the subprime mortgage market and thus the riskiness of subprime mortgage loans…[w]hen housing prices stopped climbing, the risk in the [subprime] market became apparent."[11] Subprime mortgage originations peaked in 2005 before declining by more than half in 2007 alone.[12] The home price bubble had burst. Home prices that had been rising since the late-1990s began falling in the last quarter of 2006 and then fell precipitously at the end of 2007, apparently reaching bottom in 2009. By 2008, foreclosure rates on both prime and subprime mortgages reached historical highs.[13]

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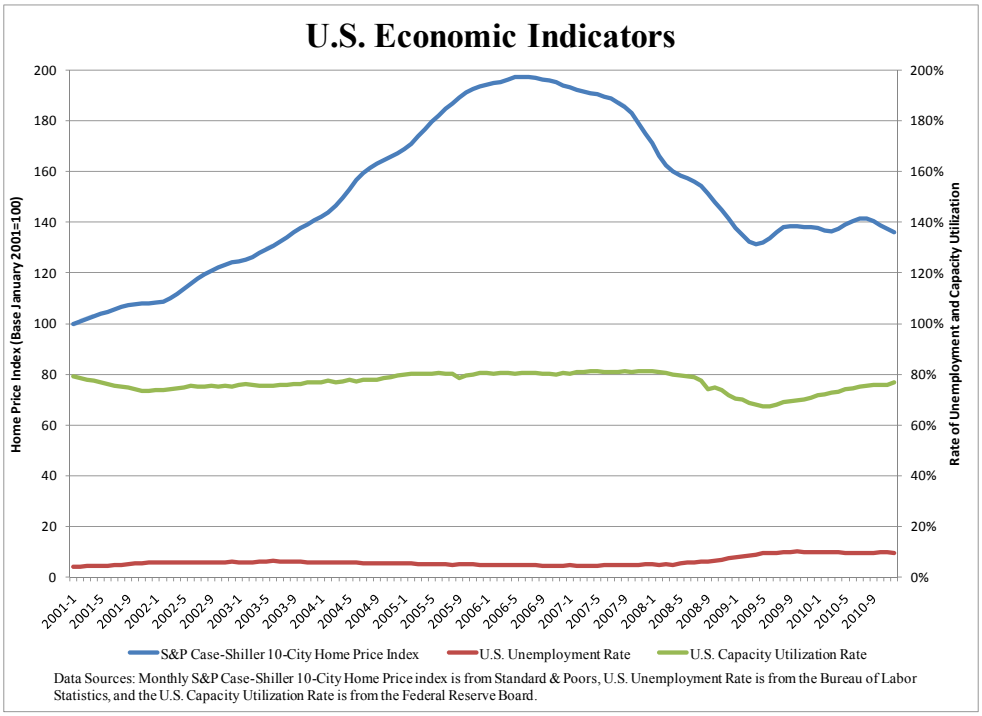
[10] Federal Reserve Bank of San Francisco, *The Subprime Mortgage Market, National and Twelfth District Developments,* Annual Report, the Subprime Mortgage Market, 2007, at 11.

[11] Yuliya Demyanyk & Otto Van Hemert, *Understanding the Subprime Mortgage Crisis,* (December 5, 2008).

[12] Federal Reserve Bank of San Francisco, *The Subprime Mortgage Market, National and Twelfth District Developments,* Annual Report, the Subprime Mortgage Market, 2007, at 6-17.

[13] Mortgage Bankers Association, *National Delinquency Survey* (2010).



Data Sources: Monthly S&P Case-Shiller 10-City Home Price index is from Standard & Poors, U.S. Unemployment Rate is from the Bureau of Labor Statistics, and the U.S. Capacity Utilization Rate is from the Federal Reserve Board.

The impact of falling home prices on securities markets was also rapid. "[O]ver the summer of 2007, unanticipated delinquency and default rates on subprime residential mortgages caused market participants to reevaluate the credit risk inherent in subprime RMBS and CDOs" that were created with subprime mortgages.[14] Two Bear Stearns hedge funds collapsed in June 2007 due to a lack of liquidity (i.e., an inability to obtain short-term financing to cover longer term debt obligations).[15] On August 9, 2007, France's BNP Paribas temporarily halted redemption from three funds that held assets backed by U.S.

[14] Jennifer E. Bethel, Allen Ferrell & Gang Hu, *Legal and Economic Issues in Litigation Arising from the 2007-2008 Credit Crisis,* The Harvard John M. Olin Discussion Paper Series at 20 (November 2008), available at http:/www.law.harvard.edu/programs/olin_Center.

[15] Matthew Goldstein & David Henry, *Bear Bets Wrong,* Bloomberg BusinessWeek, October 22, 2007, available at http://www.businessweek.com/magazine/content/07_43/b4055001.htm.

subprime mortgage debt.[16] Outstanding quantities of short-term commercial paper often used to finance mortgage-backed securities decreased by more than 16% from the beginning to the end of August 2007 alone.[17] In mid-2007, rating agencies began a thorough review of the models they used to rate the subprime securities that they had initially marked as AAA. As a result of the review process, 73% of the mortgage-backed securities Moody's had rated as AAA in 2006 were downgraded to junk.[18] Ratings downgrades for mortgage-backed securities began in the summer of 2007 and continued into the fall at an accelerated rate.[19] By late 2007, banks and other financial institutions began publicly disclosing large exposures and write-downs as a result of "marking-to-market" the values of the subprime securities held. Accounting rules require that assets held by financial institutions be valued at current market values, so when market expectations about future payment streams for an asset decline, the assets are "marked" to lower market values. At the same time, banking regulators stepped up the number and frequency of bank audits in an attempt to assess the soundness of the valuation models used to "mark" these securities to market.[20]

In contrast to the drop in home prices and the mortgage derivatives markets in 2007, U.S. unemployment rates and U.S. capacity utilization rates held steady, making it unclear at the start of the crisis whether the crisis in the

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[16] Stephen G. Cecchetti, *Monetary Policy and the Financial Crisis of 2007-2008,* CEPR Policy Insight No. 21, Centre for Economic Policy Research (March 2008).

[17] Board of Governors of the Federal Reserve System, Data Downloads, Commercial Paper, accessed January 26, 2011, http://www.federalreserve.gov/DataDownload/Choose.aspx?rel=CP.

[18] The Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* 122 (2011).

[19] Bloomberg data on monthly ratings downgrades.

[20] Comptroller of the Currency, Administrator of National Banks Memo from Michael Sullivan, RAD and Ron Frake, NBE, to John Lyons, Examiner-in-Charge, Citibank, N.A., January 17, 2008, at 2.

housing and banking sector would spread to other sectors of the economy. However, the downgrades by ratings agencies and write-downs of subprime assets by financial institutions disclosed in late 2007 led to a deeper crisis in 2008. Insurers of mortgage-backed securities who provided CDS began to be called upon to cover ever increasing losses with insurers AMBAC and MBIA suffering ratings downgrades in 2008.[21] Also by the middle of 2009, as shown in the chart, U.S. unemployment rates and U.S. capacity utilization rates worsened, indicating a broader economic crisis.

By August 2008, write-downs and credit losses at financial institutions topped $500 billion (see table). By the end of 2008, government-sponsored entities Fannie Mae (Federal National Mortgage Association) and Freddie Mac (Federal Home Loan Mortgage Corporation) had been placed into conservatorship with bailouts projected to total $221 and $363 billion respectively[22] and investment bank Lehman Brothers and insurer AMBAC Financial Group had filed for bankruptcy protection.[23] By the winter of 2009, some economists estimated the mark-to-market write downs and credit losses of U.S. banks would reach nearly $3 trillion.[24]

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[21] Wallace Witkowski, *Moody's Downgrades AAA rating of AMBAC,* Market Pulse, Wall Street Journal (June 19, 2008), http://www.marketwatch.com/story/moodys-downgrades-aaa-rating-of-ambac-mbia.

[22] Dwight M. Jaffee, *Reforming the U.S. Mortgage Market Through Private Incentives,* Paper prepared for Conference, "Past, Present, and Future of the Government Sponsored Enterprises," Federal Reserve Bank of St. Louis (November 2010).

[23] Gillian Tett, *Fool's Gold* 236, 239-40 (2009).

[24] Gillian Tett, *Fool's Gold* 243 (2009).

Losses and Capital Raised During the Financial Crisis as of August 2008

Firm	Type of Financial Institution	Country	Write Downs and Credit Losses (in billions of dollars)	Rank	Capital Raised (in billions of dollars)
Citigroup	Bank	USA	$55.1	1	$49.1
Merrill Lynch	Investment Bank	USA	$51.8	2	$29.9
UBS	Bank	Switzerland	$44.2	3	$28.3
HSBC	Bank	UK	$27.4	4	$3.9
Wachovia	Bank	USA	$22.5	5	$11.0
Bank of America	Bank	USA	$21.2	6	$20.7
IKB Deutsche Industriebank	Bank	Germany	$15.3	7	$12.6
Royal bank of Scotland	Bank	UK	$14.9	8	$24.3
Washington Mutual	Savings and Loan	USA	$14.8	9	$12.1
Morgan Stanley	Investment Bank	USA	$14.4	10	$5.6
JPMorgan Chase	Bank	USA	$14.3	11	$7.9
Deutsche Bank	Bank	Germany	$10.8	12	$3.2
Credit Suisse	Bank	Switzerland	$10.5	13	$2.7
Wells Fargo	Bank	USA	$10.0	14	$4.1
Barclays	Bank	UK	$9.1	15	$18.6
Lehman Brothers	Investment Bank	USA	$8.2	16	$13.9
Credit Agricole	Bank	France	$8.0	17	$8.8
Fortis	Bank	Belgium	$7.4	18	$7.2
HBOS	Bank	UK	$7.1	19	$7.6
Societe Generale	Bank	France	$6.8	20	$9.8
Bayerische Landesbank	Bank	Germany	$6.4	21	---
Canadian Imperial (CIBC)	Bank	Canada	$6.3	22	$2.8
Mizuho Financial Group	Bank	Japan	$5.9	23	---
ING Groep	Bank	Holland	$5.8	24	$4.8
National City	Bank	USA	$5.4	25	$8.9
Lloyds TSB	Bank	UK	$5.0	26	$4.9
IndyMac	Bank	USA	$4.9	27	---
WestLB	Bank	Germany	$4.7	28	$7.5
Dresdner	Bank	Germany	$4.1	29	---
BNP Paribas	Bank	France	$4.0	30	---
LB Baden-Wuerttemberg	Bank	Germany	$3.8	31	---
Goldman Sachs	Investment Bank	USA	$3.8	32	$0.6
E*Trade	Bank	USA	$3.6	33	$2.4
Nomura Holdings	Investment Bank	Japan	$3.3	34	$1.1
Natixis	Bank	France	$3.3	35	$6.7
Bear Stearns	Investment Bank	USA	$3.2	36	---
HSH Nordbank	Bank	Germany	$2.8	37	$1.9
Landesbank Sachsen	Bank	Germany	$2.6	38	---
UniCredit	Bank	Italy	$2.6	39	---
Commerzbank	Bank	Germany	$2.4	40	---
TOTAL ALL BANKS (not just listed banks)			**$501.1**		**$352.9**

Source: Onaran, Yalman, "Banks' Subprime Losses Top $500 Billion on Writedowns (Update1)," August 12, 2008, Bloomberg, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=a8sW0n1Cs1tY&refer=home, accessed July 2011.
For type of institution and country, see http://en.wikipedia.org/w/index.php?title=List_of_writedowns_due_to_subprime_crisis.

Central banks worldwide responded to the financial crisis using standard policy mechanisms including injections of liquidity into the banking system, which is accomplished by reducing the interest rate charged to banks for short-term loans. However, the government response also included changes in methods to limit the financial impact. Regulators encouraged mergers of stronger financial institutions with weaker institutions: Bank of America bought Countrywide and Merrill Lynch; Wells Fargo purchased Wachovia; JPMorgan bought Bear Stearns and acquired Washington Mutual branches; and the U.K.'s Lloyds TSB bought HBOS.[25] In October 2008, the Federal Reserve took the unprecedented step of injecting funds into a non-bank entity by taking an $85 billion stake in insurer AIG.[26] Also in October, the U.S. Treasury announced a much larger program, the Troubled Asset Relief Program (TARP), which could buy up to $700 billion of "toxic" assets from banks, non-bank financial institutions, and even non-financial institutions in exchange for ownership stakes.[27]

III. LITIGATION ENSUES

As losses related to subprime securities mounted, government agencies and investors filed numerous lawsuits alleging misrepresentation of the risks associated with investments in subprime-related securities. Beginning in 2007, the SEC, individual states, and private investors (including financial

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[25] Gillian Tett, *Fool's Gold,* 223-224, 239-240 (2009).
JPMorgan to buy Bear Stearns for $2 a Share, Associated Press, http://www.msnbc.msn.com/id/23662433/).
The Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* 382 (January 2011).

[26] Matthew Karnit Schnig, Deborah Solomon, Liam Pleven & Jon E. Hilsenrath, *U.S. to Take Over AIG in $85 Billion Bailout; Central Banks Inject Cash as Credit Dries Up,* WSJ.com, September 16, 2008.

[27] *Economic Rescue Swiftly Signed into Law,* AFP (October 3, 2008), http://afp.google.com/article/ALeqM5h40yrrEcqeJEeVRgcrDXB7egDo2A.

institutions who had invested in other financial institutions) filed a series of lawsuits alleging losses as a result of misrepresentation of the value of subprime-related securities due to fraud, recklessness, negligence, or other failures in the relationship between investor and financial institution. While by no means comprehensive, the examples discussed below illustrate the types of banking and investment disputes over the value of complex subprime-related securities by the institutions that held, issued, guaranteed, or insured them.[28]

The SEC has taken numerous actions on behalf of shareholders against the largest banks for their alleged failure to timely disclose the extent of subprime exposure acquired during the housing boom. For example, the SEC brought an enforcement action against Bank of America, charging the company with failing to disclose about $9.5 billion of known and expected Merrill Lynch losses before a December 5 shareholder vote to merge with Merrill Lynch; Bank of America agreed to pay $150 million to settle the action in 2010.[29] As another example, the SEC alleged that, beginning in July 2007, Citigroup failed to disclose $43 billion worth of exposure to "super senior" tranches and "liquidity puts" associated with CDOs, and Citigroup paid a penalty of $75 million to settle the action.[30] Goldman Sachs faced SEC litigation over claimed omissions and non-disclosures about how the collateral for its synthetic "Abacus" CDO was gathered, and paid $550 million to settle the action.[31] Other government enforcement agencies also pursued litigation

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[28] Other types of cases related to valuation of complex derivatives that are not disclosure related have also arisen. For example, JPMorgan Chase & Co. banker James Hertz faced an antitrust investigation for allegedly conspiring to rig bidding for Wall Street sales of derivatives and investment contracts to state and local governments, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aGdNtVsHUlZY&refer=home.

[29] The Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* 383 (January 2011).

[30] U.S. Securities and Exchange Commission, *Litigation Release No. 21605* (July 29, 2010).

[31] U.S. Securities and Exchange Commission, *Litigation Release No. 21592* (July 15, 2010).

over alleged misrepresentations to investors. For example, the Massachusetts Attorney General's Office settled charges over alleged inadequate disclosures to investors about RMBS securities in which Morgan Stanley and Goldman Sachs agreed to pay $102 million and $60 million, respectively.[32]

Private investors also filed numerous civil lawsuits. Cambridge Place Investment Management, an asset management firm, sued Morgan Stanley, Citigroup, HSBC, Goldman Sachs, Barclays, Bank of America, and others, "on the basis of the information contained in the applicable registration statement, prospectus, and prospective supplements" for derivative investments.[33] Similarly, Charles Schwab and others sued units of Bank of America, Wells Fargo, and UBS Securities over purported misrepresentations in offering documents for various mortgage-backed securities.[34] In 2007, Barclays Bank PLC alleged that Bear Stearns knew that certain assets in the Bear Stearns High-Grade Structured Credit Strategies Enhanced Leverage Master Fund were worth much less than the values represented. In 2008, Matthew Tannin and Ralph R. Cioffi, former managers of hedge funds at Bear Stearns, faced criminal charges over these same claims, but were found not guilty of misleading investors about the risks involved in the subprime market.[35] Government banks also joined the fray: the Federal Home Loan Bank of Chicago sued several banks including Bank of America, Credit Suisse

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[32] The Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* 226 (January 2011).

[33] The Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* 226 (January 2011). No. 10-2741, Mass. Sup. Ct., filed July 9, 2010, p.28.

[34] The Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* 226 (January 2011). No. cv-10-4030, N.D. Cal Sept 8, 2010. See also, Notice of Appeal to the United States Court of Appeals for the Ninth Circuit by the General Retirement System of the City of Detroit in re: Wells Fargo Mortgage Backed Certificates Litigation, No. 09-cv-01376-LHK, November 17, 2010.

[35] In another example of un-civil legal proceedings, Goldman Sachs bankers faced criminal probes from the U.S. Justice Department about municipal derivatives. http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aGdNtVsHUlZY&refer=home.

Securities, Citigroup, and Goldman Sachs over a $3.3 billion investment in mortgage-backed securities, claiming that inaccurate information was provided about these securities.[36]

Litigation over the value of subprime assets continued even after firms filed for bankruptcy. Washington Mutual, Inc.'s attorneys requested an investigation into its dealings with JPMorgan through the bankruptcy court in Delaware.[37] The Lehman bankruptcy estate also sued JPMorgan to retrieve $5 billion in cash that Lehman had posted as collateral for its line of credit with JPMorgan, which JPMorgan argued was required at the time because there was no way to value the $3.6 billion in collateral backed by illiquid securities that Lehman had previously posted to maintain its line of credit with JPMorgan.[38] Off-balance sheet financing arrangements were also the subject of litigation: for example, investors in $71 million of Citigroup bonds sued Citigroup over the extent of disclosures in 2006 about its exposure to off-balance sheet entities (SIVs).[39] Even ratings agencies, Moody's Investors Service, Standard & Poors, and Fitch, have been sued by U.S. states and small investors for the losses experienced after investing in financial instruments bought from hedge funds and others that rating agencies had allegedly overrated, although SEC investigations found no evidence that rating methodologies and models were influenced by agencies

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[36] The Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* 222.

[37] David Bario, *Quinn Emanuel Prevails in Early Test of WaMu's Billion-Dollar Case Against JP Morgan Chase,* The American Lawyer, June 26, 2009 available at http://www.law.com/jsp/article.jsp?id=1202431782829&slreturn=1&hbxlogin=1.

[38] The Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* 333 (January 2011).

[39] U.S. District Court, Southern District of NY, 08-cv-9522. http://www.blbglaw.com/cases/00121.

accepting fees from the companies whose debt they rate.[40]

What all of these cases have in common are allegations by investors of misrepresentations of the value of subprime-related securities. We now consider the general legal framework for establishing fraudulent misrepresentation and the role of the expert in this type of litigation.

IV. THE LEGAL FRAMEWORK FOR FRAUDULENT MISREPRESENTATION

The legal actions discussed above were filed in a variety of venues (including both U.S. federal and state courts), which requires the expert to assess evidence of alleged misrepresentations under a range of different legal standards. We now briefly review the key legal principles under which an expert may frame their analysis. The Securities Acts of 1933 and 1934 established the guiding federal legal principles governing disclosures to investors about the value of securities. Among other things, Rule 10b-5 of the 1934 Securities Act provides for civil liabilities arising in connection with written materials or communications related to the issuance or resale of securities and the filing of financial statements where misstatements have been made or material facts have not been disclosed to a class of investors.[41]

The Securities Act of 1995 amended these Acts in notable ways. Section 105 of the Securities Act of 1995 emphasizes that plaintiffs are only entitled to

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[40] http://www.bloggingstocks.com/2009/04/29/big-three-rating-agencies-being-sued-for-negligence-fraud-and-d/; http://www.nytimes.com/2009/11/21/business/21ratings.html?_r=1. See also, *Flawed Credit Ratings Reap Profits as Regulators Fail Investors*, April 29, 2009, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=a6NdKd8CfR2A&refer=home.

[41] Nicholas I. Crew, Patrick G. Goshtigian, Marnie A. Moore & Atulya Sarin, *Securities Act Violations: Estimation of Damages*, Litigation Services Handbook, Roman L. Weil, Michael J. Wagner & Peter B. Frank, eds., 2001, at 2-3.

recover damages that are demonstrably related to a misstatement or omission of material fact. In other words, a victorious plaintiff is only entitled to the difference between what was invested and the value of the investment at the time of purchase, but for the misrepresentation. In addition, Section 102 of the Securities Act of 1995 provides a safe harbor for forward-looking statements so that a defendant is not liable in a private action for false statements or material omissions if identified as a forward-looking statement accompanied by "meaningful cautionary" language that outlines the factors that could cause the claim to change materially.[42] Many state courts hold that forward-looking "statements of prediction or expectation about future events cannot give rise to a negligent misrepresentation or fraud claim."[43] Similarly, disclaimers and other waivers of liability found in investment contracts may also shield defendants from alleged misrepresentations.

In state courts, the plaintiff must show that a defendant is liable for fraudulent misrepresentation by demonstrating:

> *"a representation of material fact, the falsity of the representation, knowledge by the party making the representation that it was false when made, justifiable reliance by the Plaintiff and resulting injury."*[44]

The most basic element for establishing liability in a claim of fraudulent misrepresentation is the **"falsity of the representation"** made by the

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[42] Nicholas I. Crew, Patrick G. Goshtigian, Marnie A. Moore & Atulya Sarin, *Securities Act Violations: Estimation of Damages*, Litigation Services Handbook, Roman L. Weil, Michael J. Wagner & Peter B. Frank, eds., 2001, at 4-5.

[43] *Pacnet Network Ltd. v. KDDI Corp.,* 2010 NY Slip Op 8353; 78 A.D.3d 478; 912 N.Y.S.2d 178; 2010 N.Y. App. Div. LEXIS 8486; decided November 16, 2010.

[44] *Gerald S. Kaufman et al., v. Irwin B. Cohen et al.,* 307A.D.2d 113; 760 N.Y.S.2d 157; 2003. N.Y.App. Div. LEXIS 5918, decided May 27, 2003.

defendant to the plaintiff. A financial expert offers an opinion on whether the representation is "reasonable" or "unreasonable" based on the economic facts in evidence, leaving the court to make a legal finding regarding the truth or falsehood of the representation. The criteria for distinguishing between a "reasonable" and an "unreasonable" discrepancy in a representation may depend, in part, on the sophistication of the defendant. The expert's task is to estimate the discrepancy that an entity comparable to and similarly-situated to the defendant would arrive at using economic methods and data expected to be available to such an entity. While the expert may consider state-of-the-art analyses for more precisely estimating the value of securities at issue, the expert may also consider estimates based on methods that would reflect practical considerations, such as the time frame in which the defendant was required to arrive at an estimate for reporting purposes, the sophistication of an entity comparable to the defendant, and the data available to the defendant.

Plaintiffs must also establish the alleged misrepresentation as a **"material fact."** Here, the expert's task is to apply professional standards in order to assess whether the discrepancy between the actual and an economically appropriate representation is small enough (or large enough) to be a "reasonable" (or "unreasonable") communication to the plaintiff(s). For example, the expert may use standards for "statistical significance" based on statistical theory to classify the magnitude between the actual and an appropriate representation as "unreasonable" when the evidence is amenable to statistical tests. Where non-statistical analyses are performed along the lines of business valuations or market studies, the magnitude of the difference may be judged to be "unreasonable" when it is a large enough in the context of the economic investment in question to make the investment less profitable ex ante than comparable investments open to the investor.

Plaintiffs must also establish **"knowledge by the party making the representation that it was false when made."** The economic expert's role is to analyze what an entity comparable to the defendant would "reasonably"

represent to the plaintiff based on the economic evidence, with the Court determining whether such a representation should have been "known" to the defendant. Key corporate executives may be presumed by law to know all available facts and information that concern the core operations and transactions of the company in many federal and state court decisions.[45] Thus, the expert may consider all of the information available within the defendant's organization to develop an estimate of a "reasonable" disclosure for a comparable entity.

The expert may also offer opinions under different legal concepts of "knowledge" including **"reckless"** or **"negligent"** misrepresentation in which the defendant represents a statement as true when the defendant has insufficient facts to support the claim.[46] In these types of claims, plaintiffs may seek to establish that the defendant should have known the falsehood of a representation if the defendant had followed professionally accepted standards, even if the defendant was unaware of evidence confirming or disconfirming the claim. These types of misrepresentation claims are often brought under state laws, which vary from state to state, but may also be brought under federal securities laws alleging false statements as part of a public offering of a security.[47] Here, the expert will review the evidence to identify contradictory or supportive facts, or evidence of any measurable degree of error associated with the representation. Then, the expert may opine on whether it was "reasonable" or "unreasonable" to expect an entity comparable to the defendant to make such a representation based on

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[45] *Mark G. Epstein v. Itron, Inc. and Johnny M. Humphreys,* No. CS-97-214-RHW, 993 F. Supp. 1314; 1998 U.S. Dist. Court for the Eastern District of Washington, (Lexis 659); Fed. Sec. L. Rep. (CCH) P90, 157. *United States of America v. Bank of New England, N.A.,* No. 86-1334, 821 F.2d 844, 1987 U.S. App. LEXIS 7424.

[46] *Burgundy Basin Inn, Ltd. v. Watkins Glen Grand Prix Corp.*, 51 A.D.2d; 379 N.Y.S.2d 873, 2976 N.Y. App. Div., LEXIS 11065.

[47] Harvey R. Kelly and Michael R. Young, *Accountant Liability*, Litigation Services Handbook, Roman L. Weil, Michael J. Wagner & Peter B. Frank, eds., 2001, at 3-6.

that evidence. Compared to the expert's role in other misrepresentation claims, the expert may consider information (and methods) that were not demonstrably in the possession of (or used by) the defendant, but would have been "reasonably" considered given professional standards.

Another element that the plaintiff must establish is **"justifiable reliance by the plaintiff on the representation made by the defendant."** Expert testimony may be relevant on this issue as to whether the plaintiff was in a position to independently verify the representation by the defendant so that the plaintiff would not have had to "rely" on the defendant's representation. The expert may offer relevant opinions about whether a) relevant data available to the defendant was made available to the plaintiff to enable independent verification of the representation by the plaintiff using professional methods, and b) whether an investor comparable to and similarly situated to the plaintiff would have the analytical capacity and resources to evaluate the representation using such data. The expert can also offer an opinion about whether the relevant data in the possession of the defendant could be independently obtained by an entity comparable to the plaintiff to enable verification of the representation.

The last factor that must be established is loss causation or **"resulting injury"** from an alleged misrepresentation. Here, the expert's role is to demonstrate the link between the alleged misrepresentation and economic damages to the plaintiff. The 1933 and 1934 Securities Acts outline three basic approaches to damages from securities violations: 1) rescission – returning invested funds paid plus interest less any income received from the security, 2) restitution or disgorgement of excess profits earned by the defendant from the investment, or 3) consequential damages to the value of the investment due to specific

misrepresentations.[48] The latter approach is the most common approach, with the difference in the actual price paid for the security by the plaintiff and its value but for the misrepresentation equaling damages. This excludes losses due to events unrelated to the misrepresentation, such as broader market trends, and punitive damages.

A common method used by economic experts to measure consequential damages is the "event study." This approach uses econometric techniques to isolate losses in the value of a security (i.e., a stock price) when corrective disclosure to the initial misrepresentation is made.[49] While a thorough discussion of event study techniques is not presented in this paper, a number of considerations specific to cases resulting from the subprime crisis are worth noting. Event studies model the behavior of the security using a time period before or after the alleged fraud,[50] which can be problematic in periods of great economic volatility where the fundamental relationships that govern the returns on the security may be changing. In addition, since event studies are most applicable to the analysis of publicly traded stock prices, they may have less value where the dispute is about the value of an illiquid security. In such cases, a valuation that models the derivative security itself may be needed (which is discussed in a subsequent section).

We now consider features of the subprime crisis in greater detail to illustrate unique issues that arise for the expert in evaluating the "reasonableness" of

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[48] Nicholas I. Crew, Patrick G. Goshtigian, Marnie A. Moore & Atulya Sarin, *Securities Act Violations: Estimation of Damages*, Litigation Services Handbook, Roman L. Weil, Michael J. Wagner & Peter B. Frank, eds., 2001, at 8-9.

[49] Bradford Cornell and R. Gregory Morgan, *Using Finance Theory to Measure Damages in Fraud on the Market Cases*, 37 UCLA L. Rev. 883 (1990).

[50] Nicholas I. Crew, Patrick G. Goshtigian, Marnie A. Moore & Atulya Sarin, *Securities Act Violations: Estimation of Damages*, Litigation Services Handbook, Roman L. Weil, Michael J. Wagner & Peter B. Frank, eds., 2001, at 12-13.

alleged misrepresentations in banking and investment disputes.

V. THE FINANCIAL DERIVATIVES AT ISSUE IN BANKING AND INVESTMENT DISPUTES ARISING FROM THE SUBPRIME CRISIS

There are two types of securities at issue in these disputes. One is the subprime-related securities themselves that lost value as a result of the subprime crisis, such as RMBS and CDO tranches. The other is investments in financial institutions via instruments such as stocks and bonds that are impacted by the value of these securities. In either case, disclosure about the value of subprime-related securities is a central issue in the dispute.

One reason for the financial crisis was the difficulty faced by investors, and even by the purveyors of financial instruments themselves, in valuing these instruments. The securities derivatives process began with the origination and initial lending and approval of residential mortgages for 1-4 family units by banks and other lending institutions. These mortgages were then pooled into a securitization by banks or SPVs, and used to create a subprime RMBS.[51] The government-sponsored entity "Ginnie Mae" (Government National Mortgage Association) was the first to issue RMBS bonds backed by principal and interest payments from a pool of mortgages in the late 1960s, and other government sponsored entities Fannie Mae and Freddie Mac soon followed suit.[52] In the subsequent decades, the private sector further developed the concept of RMBS by issuing securities with different "tranches" of varying levels of risk, and by adding subprime (as well as other non-residential loans) to the mix. Multi-tranche securitizations were able to offer different levels

[51] Mortgage-backed securities (MBS) are often distinguished in two categories, residential mortgage-backed securities (RMBS) and commercial mortgage-backed securities (CMBS).

[52] http://en.wikipedia.org/wiki/Fannie_Mae, accessed July 27, 2007.

of risk through an explicit seniority structure whereby lower ranked tranches (e.g., with ratings of BBB) were in the first loss position, while higher ranked tranches (e.g., with ratings of AAA) were insulated from initial losses in the underlying loan pool by the lower tranches.[53]

A number of financial institutions were involved with each securitization in addition to the SPV issuing the securities. For example, the institution designated as the "collateral manager" would gather mortgages from a number of different financial institutions to obtain underlying collateral sufficient to support the tranche ratings of the RMBS securities that would ultimately be issued. Litigation has developed over alleged misrepresentations at this stage in the securitization process about the quality of the pools of mortgages purchased by the "collateral manager" and sold to a SPV. In this type of case, the expert may be called upon to determine the quality of mortgages that would "reasonably" have been represented. Due to the large number of mortgages underlying RMBS securitizations, the expert may employ sampling methodologies to determine the quality of loan pools gathered for securitization. Sampling offers a cost-effective means of assessing the average quality of the loan pool, based on statistical methods that are professionally accepted with a measurable rate of error. However, defendants may argue that such statistical methods deprive them of the right to defend the quality of each and every loan sold. Loan sampling techniques were also part of the due diligence process of purchasing loan pools,[54] so the expert may also review the actual practices to determine whether they were "reasonable" in terms of industry practices and/or professional standards.

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[53] Joel Tepner, *A Securitization Primer for First Time Issuers*, Global Securitization and Structured Finance, Greenberg Traurig (2003).

[54] Testimony of Susan Mills, Managing Director, Citigroup Global Markets Inc. before the Financial Crisis Inquiry Commission, April 7, 2010.

A second round of securitization developed in the 1990s. CDOs were structured similarly to RMBS, except the underlying collateral was not a pool of individual mortgages, but a pool of RMBS securities. This innovation enabled CDO investment tranches with AAA ratings to be built from new and existing RMBS securities that could include lower than AAA ratings. In addition, "super senior" tranches were created with first loss protection above AAA-rated tranches. Desired levels of risk could still be achieved by selecting an appropriate mix of subprime RMBS and prime RMBS, and determining the amount of first loss protection of higher tranches over lower tranches. The rating agency AAA tranche ratings for some CDO tranches were based on this expected diversification benefit from aggregating lower than AAA-level tranches from numerous independent RMBS. This gain from diversification was real to the extent that the risks from each of the underlying tranches were truly independent.[55] However, these diversification benefits rapidly disappeared when house prices dropped nationwide.

Still more complex derivatives were developed from yet another round of securitization. "CDO-Squareds" were created with underlying collateral made up of different CDO tranches, rather than underlying pools of RMBS. Unlike regular CDOs, CDO-Squareds faced "cliff" risk, in which losses mounted more quickly when defaults increased among the mortgage loans at the very bottom of the securitization structure.[56] Due to this complexity, the expert may be called upon to identify the specific risks to these securities and determine whether "meaningfully cautionary" language appears in a disclosure or prospectus that identifies these risks or the factors that drive that risk. The expert may determine whether the amount of detail in the disclosure is "reasonable" given the market conditions and expectations at the

[55] Nomura Fixed Income Research, *CDOs in Plain English* 2, (September 13, 2004).

[56] Nomura Fixed Income Research, *CDOs-Squared Demystified*, Nomura Fixed Income Research (February 4, 2005).

time that the disclosure was made. It can be argued that when the likelihood of remote macroeconomic events increases the risks associated with a security, it becomes "reasonable" to expect more detailed disclosure. Thus, the timing of the alleged misrepresentations is crucial for the expert to determine what constitutes "reasonable" disclosure of these risks. Regulations also provide guidance to the expert in assessing the sufficiency of disclosures. For example, Regulation AB issued by the SEC in 2004 requires investment prospectuses for RMBS securities to include a description of the credit-granting and underwriting criteria used to originate a pool of underlying mortgage assets, although there is no comparable guidance for CDOs.[57]

As the discussion above shows, the value of RMBS, CDO, and CDO-squared securities is built on a complicated layering of underlying collateral with complex seniority structures. As a result, many investors judged the riskiness of these investments according to the ratings provided by rating agencies and the reputation and explicit guarantees of the financial institutions offering these investments. Under federal securities laws, plaintiffs may be allowed to rely upon the integrity of the securities market to efficiently process publicly disclosed information, reducing the plaintiffs' burden for demonstrating due diligence. However, under state laws, the technical characteristics of derivative instruments may provide a basis for arguments supporting "reasonable reliance" by investors on the quality of investment securities as represented by the financial institutions that created, sold, or held them. The economic expert may judge the complexity of these instruments and determine whether an investor with resources, data access, and analytical sophistication comparable to the plaintiff would have to "reasonably rely" on the representations of the defendant. For more sophisticated investors, the expert will have to identify technical features or other information barriers that limit the ability of the investor to independently value the investment.

[57] The Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* 169.

We now consider the valuation methods used during the subprime crisis in more detail.

VI. VALUATION METHODS FOR FINANCIAL DERIVATIVES DURING THE SUBPRIME CRISIS

In recent decades, banks developed statistical methods for managing risk exposure, such as "VaR" (value-at-risk) models that measured when traders took on too much risk exposure to a given type of asset. VaR models estimated when there was a more than 5% chance that the trading portfolio could lose $X million in a single day, where the $X threshold was determined by bank policy. However, the complex new derivatives were not included in VaR models.[58] Even if they had been included, little risk would have been measured, since the VaR models rely on historical data that did not include as deep a financial crisis as occurred in the late 2000s. Traders in financial institutions also used various pricing models for the new derivatives developed internally and by vendors, such as Intex, to assist in their purchases of CDS "hedges" on these assets. However, these models were not designed to incorporate the very high default rates on home mortgages that occurred in the financial crisis. Given the fast pace of financial developments in 2007, some banks initially conducted valuations of subprime securities based on these pricing models.[59] In some cases, economic experts have designed entirely new valuation models to determine the equity value of a CDO in dispute.[60] The expert may also focus on the valuation models actually used to determine what economic evidence was available to the defendant internally compared to the disclosures made by the defendant to investors, and whether

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[58] The Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* 44 (January 2011).

[59] JPMorgan Chase & Co., *10-K Report* 112-113 (December 31, 2007).

[60] *CDO Plus Master Fund Ltd. v. Wachovia Bank*, N.A. 2009, WL 2033048.

these models employed "reasonable" assumptions and methods.

In 2007, the Financial Accounting Standards Board published Financial Accounting Standard (FAS) 157 as a guide to the measurement of the fair value of complex securities under generally accepted accounting principles (GAAP). Securities in the trading books of financial institutions are required to be marked to "fair value," which FAS 157 defines as:

> *"Fair value is the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date…[T]he measurement should consider attributes specific to the asset or liability, for example, the condition and/or location of the asset or liability and restrictions, if any, on the sale or use of the asset at the measurement date."*[61]

FAS 157 prioritizes the inputs used to measure fair value into three levels from observable market prices to unobservable measures:

(1) Level 1 valuations use quoted prices from an active market;

(2) Level 2 valuations apply quoted prices for similar assets or liabilities in active markets or inputs that are derivable principally from other observable market data;

(3) Level 3 valuations are applied when data are not available for level 1 or level 2 valuations. In this case, financial models are used based on inputs that reflect the assumptions that market participants would use in pricing the asset or liability (including assumptions about risk).[62]

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[61] Financial Accounting Standards Board, *Statement of Financial Accounting Standards No. 157 Fair Value Measurements (FAS 157)* 6.

[62] Financial Accounting Standards Board, *Statement of Financial Accounting Standards No. 157 Fair Value Measurements (FAS 157).*

Valuation techniques used to measure fair value are expected to maximize the use of observable inputs and minimize the use of unobservable inputs. As a result, the current market price of an asset based on arms' length transactions (a FAS level 1 input) is the preferred measure. However, market transactions and market prices were rarely, if ever, observed for the CDOs and RMBS at issue in disputes arising from the subprime crisis because these markets were illiquid (experiencing very limited trading) at that time. In addition, investments in these derivatives were traded in "over-the-counter" markets, rather than on centralized public exchanges such as the stock market, so that even large banks observed only a limited number of trades that could be found within their own records.

An alternative to using quoted prices in active markets to value these instruments is to derive an estimated value from the market prices for similar or related instruments, per the level 2 FAS 157 accounting designation. For example, such an approach values a CDO by valuing each of the component RMBS securities that underlie the CDO, and then adding up these values to obtain the CDO's total value. Such an approach was used by some large banks, such as Bank of America in 2007:

> *"We subsequently valued these CDO structures assuming they would terminate and looked through the structures to the underlying net asset values supported by the underlying securities. We were able to obtain security values using external pricing services for approximately 70 percent of the CDO exposure for which we used the average of all prices obtained by security. The majority of the remaining positions where no pricing quotes were available were valued using matrix pricing by aligning the value to securities that had similar vintage of underlying assets and ratings, using the lowest rating between the rating services."*[63]

[63] Bank of America, *10-K Report* 29 (February 28, 2008).

The Level 2 approach maximizes the use of economic observables, however it requires judgment by the practitioner in deciding which observables provide reasonable benchmarks and how to adjust for any systematic differences between the observable measures and the securities being benchmarked. An expert may evaluate the "reasonableness" of such a valuation by analyzing the choice of benchmarks and the adjustments that were made to match them as proxies for the value of the securities at issue.

A commonly used indicator of, and possible benchmark for, the value of many subprime securities is ABX indices. In 2006, Markit organized a CDS market that traded protection against changes in the value of a basket of selected RMBS tranches. A series of ABX indices were issued in 6-month periods beginning in 2006 that referenced recently issued subprime home equity loan RMBS of various ratings levels.[64] The expert may consider whether a FAS level 2 valuation that uses the ABX indices to value "hedges" based on CDS is "reasonable" since it is the same type of security and may share similar ratings, issuance date, and subprime collateral. Even though RMBS are a different type of security, the expert may also consider whether a FAS level 2 valuation that uses the ABX indices to benchmark the value of RMBS is "reasonable" where the ABX indices reference similar RMBS in terms of ratings, issuance date, and subprime collateral, as well as the judgments used in the benchmarking to account for differences between the two types of securities.

FAS level 3 valuation models attempt to replicate the expected cash flows of a specific derivative security, rather than benchmark against observable proxies. As noted above, prior to the financial crisis, traders in financial institutions, ratings agencies, and firms such as Intex, developed basic cash flow models for

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[64] Nomura Fixed Income Research, *Synthetic ABS 101: PAUG and ABX.HE* 6, (March 7, 2005).

valuing complex securities, but these took limited account of deal structures that became relevant under the stressed macroeconomic conditions of the subprime crisis. By 2008, most of the large U.S. banks developed more complete cash flow valuation models for valuing their subprime exposures. These models began by predicting the cash flows of the underlying collateral securities based on the pre-payment and default rates of historical loan performance data[65] and macroeconomic assumptions about the size of expected home price deflation in future years.[66] Predicted cash flows from the underlying collateral were then converted to overall cash flows for CDO tranches by incorporating detail on the rules that determined how cash flows were distributed among various tranches of the CDOs. Finally, CDO tranche cash flows were discounted to net present value using assumed discount rates that were supposed to reflect the risk premiums for investment in these securities.

Valuations generated by FAS level 3 cash flow models were extremely sensitive to the macroeconomic assumptions about future home price deflation and discount rates. FAS 157 exhorts firms to maximize the use of market observables and, in the context of FAS level 3 valuations, the assumptions adopted should be based on observable market data to the extent possible. Economic experts may opine on whether the assumptions incorporated in these models were "reasonable" in terms of the economic data and market conditions at the time of an alleged misrepresentation. The expert may also take into account whether a financial institution of comparable sophistication to the defendant would have adopted similar assumptions. However, most financial institutions released limited detail in their public filings and financial statements about the assumptions they employed in their models. The ABX indices are one of the few market observables specifically mentioned by more than one banking institution as an indicator used in the valuation of

[65] Bank of America, *10-K Report* 29 (February 28, 2008).

[66] Bank of America, *10-K Report* 29 (February 28, 2008).

subprime exposure, but how the indices were incorporated into the models is only described generally. On the other hand, the expert is likely to have a substantial amount of detail about the defendant bank's valuation methods and assumptions through discovery, including the reasons for applying or not applying some of the standard measures.

Due to the speed with which the subprime crisis unfolded, determining consensus assumptions for future macroeconomic conditions is very much dependent on the timing of an alleged misrepresentation. For example, in mid-2007, Federal Reserve Chairman Ben S. Bernanke recalled that "[a] leveling-off of sales late last year [2006] hinted at a possible stabilization of housing demand."[67] By late 2007, expectations were more pessimistic, with analysts saying that "[d]espite its ferocity, the housing downturn comes as no surprise. For months, analysts had predicted that overbuilding, speculation, lax lending practices, and natural fluctuations in interest rates would eventually trigger a rise in defaults among subprime loans that would precipitate a broad-based housing market reversal."[68] Given the rapid pace of events, the same representation based on a given economic valuation may be "reasonable" in June 2006, but "unreasonable" in March 2008. Further, this determination may depend on the day of the month that the representation is made since delinquency, home price, and other relevant data are typically released with a lag that often showed marked deterioration compared to prior data releases.

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[67] *The Housing Market and Subprime Lending*, Speech of Chairman Ben S. Bernanke, June 5, 2007 to the 2007 International Monetary Conference, Cape Town, South Africa, available at http://www.federalreserve.gov/newsevents/speech/bernanke20070605a.htm.

[68] *September 30, 2007 Market Commentary and Outlook*, September 30, 2007, Northwest Capital Management, Incorporated, available at http://www.nwcapital.com/content/commentaries/pdf/2007.q3.pdf.

VII. OFF-BALANCE SHEET BANKING

Many disputes over disclosures about the value of subprime securities stem from the indirect impact that losses in subprime derivatives have on a bank's stock. The issues that arise in these disputes differ from securities disputes in other industries due to the role that regulators play in requiring bank holding companies to hold some capital in reserve for unexpected losses. As an initial matter, banks are not producers of goods, but lending institutions that earn spread income from the difference between the yield on interest-earning assets and the cost of interest-bearing liabilities. Like firms in any industry, equity capital can be "leveraged" with additional borrowing at lower rates than investment returns. Leverage allows banks to make more loans and investments per dollar of equity capital, which is often measured by the ratio of total assets to total equity capital. The benefit (downside) of leverage is that profits (losses) are multiplied for the equity holder. The difference between banks and other industries is that banks (though not all financial institutions) are subject to government regulation that requires banks to hold a certain amount of capital in reserve, which limits leverage.

In particular, U.S. bank regulators such as the Federal Reserve Bank and the Federal Deposit Insurance Corporation (FDIC) limit leverage using a number of metrics, such as the "Tier 1 ratio." The numerator of the Tier 1 ratio is Tier 1 capital, which consists of certain types and amounts of risk capital that have equity-like components (i.e., instruments that have a greater risk of gains/losses, such as common stock), and some hybrid instruments and debt with equity-like components. The denominator of the ratio is total bank assets acquired through loans and investments that are risk-weighted following Regulatory Accounting Principles (RAP) under guidance from the international Basel II banking accords. Specific risk weights for different types of assets are set by government regulators according to the default risks of each type of asset. For example, cash has zero risk weighting since it is sure money. Loans guaranteed by government-sponsored agencies, such as

conventional mortgages guaranteed by Fannie Mae have a low weight (around 20%), while riskier investments, such as consumer loans, would have a 100% risk weight. Subprime derivatives also have varying degrees of risk. Prior to the crisis, for example, an investment in a BBB tranche of a CDO backed by subprime mortgage debt could have had a high risk weighting, while an investment in a AAA tranche of a CDO backed by subprime mortgage debt could have had a much lower risk weighting comparable to a conventional mortgage. These risk weightings change substantially when a security suffers a ratings downgrade. For example, one analyst report from late 2007 noted that "when a CDO a bank has exposure to is downgraded from AAA to BBB, the risk weighting on such assets increases by 400% under the current method…"[69] Thus, a bank's expectations of downgrades impacts the valuation of bank exposures, as well as projected capital requirements.

As noted above, off-balance sheet financing enabled banks to remove the riskiest subprime assets from their balance sheets by selling them to SPVs, which are legally separate and bankruptcy remote from banks. However, banks retained ties to SPVs by acting as sponsors, managers, placement agents, and "liquidity put" providers. Beginning in 2000, and increasing thereafter, SPVs increased the leverage of their equity capital by issuing short-term commercial paper, known as "asset-backed commercial paper" (ABCP), in addition to CDO investment tranches. By including ABCP in the structure, the SPV could profit from the small spread between the longer-term assets and shorter-term ABCP financing, and increase returns offered to CDO tranche investors due to the greater leverage.[70] However, this leverage strategy had liquidity risks, since the collateral had long-term maturities (e.g., the underlying mortgages had 20-30 year maturities) while the ABCP had

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[69] CIBC World Markets, *Ring of Fire: Capital Ratios Headed for Material Drop in Fourth Quarter* (November 11, 2007).

[70] *CDOs with short-term tranches: Moody's Approach to Rating prime - 1 CDO Notes*, Structured Finance Special Report, Moody's Investors Service (February 3, 2006).

short-term maturities (e.g., 30-90 days). In order to attract investors to the CDO tranches of SPVs, financial institutions not only played key roles in the formation of CDOs, but provided explicit guarantees to finance ABCP should an SPV face liquidity constraints. In some cases, banks simply retained the highest "super senior" tranches in the CDO structure on their balance sheets, rather than provide guarantees, since these tranches were initially considered virtually risk-free due to the amount of loss protection from lower tranches,[71] and since regulators allowed low risk weightings for these assets.

However, when CDOs began to lose value and SPVs could no longer obtain financing from ABCP markets, banks were called upon to provide support, and in some cases, take all of the SPV assets onto their balance sheets. FASB FIN46(R) governs when off-balance sheet entities must be consolidated on a bank's balance sheet.[72] In disputes over timely disclosure of exposures to assets of off-balance sheet entities, economic and accounting experts may deduce the implications of FIN46 tests that were or should "reasonably" have been conducted as the crisis deepened.

Due to regulatory capital requirements, the consolidation of off-balance sheet assets onto a bank's balance sheet has an immediate and mechanical impact on the amount of capital that a bank is required to hold. When additional assets are consolidated onto a bank's balance sheet, Tier 1 ratios necessarily fall, and banks must raise more capital in order to maintain the Tier 1 ratio at levels acceptable to regulators. This can dilute the value of the stock outstanding when the assets brought onto the balance sheet have greater risk and lower returns than assets already on the balance sheets. Thus, the

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[71] Testimony of Nestor Dominguez, Former Co-Head of Global CDOs, Citigroup, before the Financial Crisis Inquiry Commission, April 7, 2010, p.3.

[72] *FASB Interpretation No. 46, Consolidation of Variable Interest Entities*, December 2003, Financial Accounting Standards Board.

regulatory framework in which banks operate can lead the consolidation of off-balance sheet assets to have a material impact on the value of a bank's stock that injures shareholders. However, the consequential link between alleged misrepresentations and injury to shareholders may be called into question where it may be outside the defendant's control. For example, it has been suggested that when Bank of America merged with Merrill Lynch, resulting in larger subprime losses than expected, the deal was not renegotiated, as might have been in the shareholders' interests, because the Treasury Department viewed the merger as systemically important to the stability of the financial system.[73]

VIII. CONCLUSION

We have discussed that pinpointing liability when events are changing rapidly is highly dependent on the specific timing of alleged representations and corrective disclosures (among other things). Consequently, an expert may form opinions and reach contrasting conclusions about quite similar alleged misrepresentations depending on the market expectations at the time the representation was made.

[73] David Goldman, Tami Luhby & Grace Wong, *BofA: $20B Bailout, Huge Merrill Loss,* CNNMoney.com (January 16, 2009), http://money.cnn.com/2009/01/16/news/companies/bofa_new_bailout/index.htm.

Jose Alberro

Dr. Alberro's expertise focuses on economic, financial, and econometric modeling in four areas: antitrust and competition issues; network industries (e.g., telecommunications, natural gas, electricity, water distribution); economic impact analysis; and valuation of damages. In those respects, he has done extensive work in the context of international arbitration and in the analysis of the economic impact of changes in the regulatory environment, including taxes. Dr. Alberro has provided expert testimony in international arbitration cases involving treaty disputes between private investors and governments on topics related to damage valuation. Dr. Alberro has also been an arbitrator at the WorldBank's International Centre for Settlement of Investment Disputes (ICSID) and the American Arbitration Association (AAA). He was the founding CEO of a gas and gas liquids company with $16 billion in sales, 12,000 employees, and 10,000 miles of pipelines. He was Petroleos Mexicanos' chief representative during the 1990-1992 NAFTA negotiations and has consulted for the International Monetary Fund, World Bank, United Nations Development Programme, and the Economic Commission for Latin America and the Carribbean.

Dr. Alberro holds a Ph.D. in Economics from the University of Chicago. He was a tenured full professor at the age of 33 and taught economics at universities in the United States, Mexico, and the United Kingdom for 15 years. He is a member of the Mexican Academy of Science and has published in academic journals, books, and popular media – one of his papers was cited in the 1995 Nobel Prize in Economics Lecture.

Contact Information:
Email: jalberro@brg-expert.com
Phone: 510.285.3237

Economic Impacts of Stem Cell Research Funded by the California Institute for Regenerative Medicine

— José Alberro, Ph.D. —

***Abstract**:*

In November 2004, Californians voted for the establishment of the California Institute for Regenerative Medicine (CIRM) and authorized the allocation of $3 billion to support stem cell research. CIRM awarded its first grants in April 2006 and, as of July 2010, it had awarded more than $1.1 billion to over 50 institutions. In addition, grantees raised $884.3 million from donors and institutional project funds.

Funds spent in California by CIRM grantees have both one-time economic impacts while the grants are being disbursed and ongoing impacts that result from structural change and persist. We find that one-time economic impacts accrue mostly to California while ongoing economic impacts accrue to the country as a whole.

The $1.1 billion in CIRM grants and the $884.3 million in matching funds will have the following one-time effects during 2006-2014:

- *The creation of about 2,800 full time jobs, 97% of them in California; and*
- *Payment of $157 million in tax revenues to the state of California, $44 million to local governments, and $362 million to the federal government.*

As a consequence of a CIRM grant, UC San Diego and TargeGen jointly developed a JAK2 inhibitor to treat Polycythemia Vera (PV) and Primary

Myelofibrosis (PMF). This therapy could allow patients to return to work and thus, lead to a significant increase in personal income. We estimate that over a 10-year period, personal income would increase by $936.9 million in the United States and $124.2 million in California.

On the other hand, we find that annual direct health care cost savings for the United States could amount to $18.5 million and their net present value over 10 years would be $157.6 million. Since only 11.5% of the PV/PMF population is in California, annual direct health care cost savings would amount to $2.1 million and their net present value over 10 years to $18.1 million.

CIRM grants are putting California in a position of leadership in stem cell research leading to the establishment of a biological science and biotechnology infrastructure likely to attract venture capital investment in research and start-up firms. Two rapidly growing biopharmaceutical clusters can be identified in the San Francisco Bay area and around San Diego. CIRM grants have been given to institutions that concentrate in those areas, thus reinforcing those clusters.

In November 2004, Californians voted for the establishment of the California Institute for Regenerative Medicine (CIRM) and authorized the allocation of $3 billion to support stem cell research and other vital medical technologies. CIRM awarded its first grants in April 2006 and has disbursed over $570 million to date. As of July 2010, the CIRM had awarded 364 grants worth more than $1 billion to over 50 institutions in 18 rounds of funding.[1] In addition, CIRM grantees raised $884.3 million from donors and institutional project funds.

[1] http://www.cirm.ca.gov/GrantsSummary.

Funds spent in California by CIRM grantees - both the grants themselves and the matching funds - have economic benefits. Some of these benefits are immediate, while others are long-lasting. This report estimates both "one-time impacts" and "ongoing impacts" of CIRM grants. One-time impacts result from the CIRM grants (used to build new facilities, acquire equipment, fund research projects, or train researchers) as well as from the matching funds. Building facilities and acquiring equipment have construction impacts while the project is being built and end (mostly) when the project is complete.[2] Jobs associated with the construction (or renovation) of a site are not "permanent" because they exist only while the project is underway. Even if a project lasts several years, the positions have a termination date. The same argument can be applied to funding used to train individuals or to carry out research. In addition to these *direct* (one-time) economic impacts of CIRM's grants (jobs gains, tax revenue increases, etc.), there are *indirect* impacts that result from the fact that materials, equipment, and supplies need to be produced, and there are *induced* impacts given that goods and services need to be manufactured for those workers to consume.

In contradistinction, ongoing impacts accrue to Californians for two reasons:

- Directly, when CIRM-sponsored research results in cheaper and/or more effective therapies. In this case, patients no longer affected by a disease will be able to return to the labor force, bringing about increases in personal income. On the other hand, reductions in the cost of treating patients will benefit both the patients themselves and governments because expenditures are likely to decrease; and

[2] Due to lags in the diffusion of economic impacts, the effects may outlast the exact completion date of the project.

- Indirectly, due to the emergence of competitive business clusters that are beneficial for the California economy as a whole.

I. ONE-TIME IMPACTS

A. Direct, Indirect, and Induced Effects

The appropriate way to measure the one-time economic impacts of CIRM's grants is to recognize that their contributions go beyond direct disbursements. For example, the expenditure in a laboratory entails the acquisition of specialized equipment, which in turn might require purchasing steel, which would necessitate its own inputs, and so on. Only the goods and services manufactured or sold in California should be included in this estimation because those acquired in another country or another state create jobs in those locations but not in California.[3]

Regional Input-Output models quantify inter-industry linkages in a way that allows the ripple effects of the initial expenditure on the (regional) economy to be determined. Those effects (on employment, output, tax revenues, or income) are classified as "direct," "indirect," or "induced."

- **Direct effects** are directly generated by the initial expenditure.
- **Indirect effects** result from the expansion of supplier industries whose products are used by the industries producing the goods and services directly acquired (e.g., equipment, computers, and electronic equipment or the buildings needed to house the new laboratories).

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[3] Proposition 71 recognized this problem – one of its goals was that more than 50% of the goods and services used in CIRM-supported research would be purchased from California suppliers. CIRM grantees have been requested to "make good faith efforts to obtain 50% or more of their goods and services from California suppliers." Available at http://www.cirm.ca.gov/Grants_Management#California_supplier.

- **Induced effects** reflect the expansion of overall economic activity that results from the increased purchases of consumer goods and services by the workers considered in the previous paragraphs.

We have used a model developed by IMPLAN which considers 440 industrial sectors, 9 types of households differentiated by income levels, 4 types of government spending, 22 types of taxes and transfers, and 4 types of investment flows.[4] Data on CIRM expenditures for specific research projects were combined with this model to yield the measure of overall economic impact.

CIRM's grants during the period 2006-2014 (projected) can be classified into four broad categories:

- **Training:** Funds supporting skilled individuals who provide human capital to stem-cell research projects.
- **Research:** Funds contributing to supplies and other services necessary to conduct research.
- **Construction:** Funds for new construction or rehabilitation of facilities.
- **Equipment:** Funds for the purchase of equipment to sustain research.

Apportionment to those four categories is shown in Table 1.[4] Close to 70 percent of CIRM's grants have been for research and training, and the rest for facilities and equipment. Recipients of Major Facilities Grants, which amounted to $271.0 million, have obtained $561.8 million of matching funds

[4] CIRM staff assisted in identifying each grant's appropriate category.

for construction and an additional $322.5 million for faculty recruitment and other capital expenses.[5]

B. Economic Impacts: Employment

Table 1
Classification of CIRM's Grants

Year	Training	Research	Construction	Equipment	Total
2006	$ 12.1	$ -	$ -	$ -	$ 12.1
2007	$ 9.2	$ 30.5	$ 1.0	$ -	$ 40.7
2008	$ 7.7	$ 35.8	$ 189.6	$ 21.9	$ 255.0
2009	$ 10.7	$ 69.7	$ 23.3	$ 33.1	$ 136.8
2010	$ 27.6	$ 172.7	$ 3.5	$ 2.1	$ 205.9
2011	$ 22.8	$ 147.7	$ 12.9	$ 2.6	$ 186.0
2012	$ 2.8	$ 118.0	$ 10.5	$ 1.6	$ 142.9
2013	$ 2.2	$ 57.5	$ -	$ -	$ 59.7
2014	$ -	$ 11.5	$ -	$ -	$ 11.5
Total	$ 105.2	$ 643.2	$ 240.8	$ 61.3	$ 1,050.6

Information provided by the CIRM. Funds committed as of July 2010. All numbers in millions of dollars.

[5] CIRM requires that applicants pledge, at a minimum, 20% in matching funds. For our purposes, only funds from institutions outside of California or from foundations without a geographic bias should be considered, because resources reassigned to complement CIRM's grants would have had an impact in their alternative use. We assume that the $561.8 million and $322.5 million would not have otherwise been spent in California, so there is no off-set to consider.

The one-time economic impacts of CIRM's grants for the period 2006-2014 on employment are shown in Table 2. The disbursement of $1.9 billion[6] implies the creation of 24,654 Full-time Equivalents (FTE)[7] over the period 2006-2014. Of those, 10,730 are direct; 5,297 are indirect; and the remaining 8,627 are induced. The implicit employment multiplier of 2.3[8] is within the range of expected values. The Washington Research Council estimated it to be 3.9 in the case of life sciences[9] and the Selig Center for Economic Growth estimated it to be 3.5 in Georgia.[10] In the latter case, the report attributed such a high number to the "above-average salaries in many life sciences occupations as well as relatively high degree of interaction between the life sciences and the state's overall economy."[11] As both of these studies measured the impact of the life sciences industry at large, they are not strictly comparable to the case of CIRM's specific grants.[12]

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[6] $1.05 billion of grants plus $561.8 million of matching construction grants and $322.5 million of research grants.

[7] Full-time equivalent (FTE) is a way to measure a worker's involvement in a project. An FTE of 1.0 is equivalent to a worker being fully employed for a year. If the work year is defined as 2,080 hours, one worker occupying a paid full-time job all year would consume one FTE. Two employees working for 1,040 hours each would consume one FTE between the two of them.

[8] 24,654/10,730=2.3.

[9] http://www.ci.bothell.wa.us/Site/Content/Economic%20Development/Development%20Sites/IPZ/HealthLifeSciencesImpactReport.pdf.

[10] http://www.gabio.org/attachments/3/200700021200Shaping%20Infinity%202007.pdf.

[11] Beata Kochut & Jeffrey Humphreys, *Shaping Infinity* (2009).

[12] On the other hand, it is possible that the average salary of a recipient of a CIRM grant is significantly higher than average because of their extraordinary level of specialization.

Table 2
Estimated Economic Impact of CIRM's Grants & Projected Grants

Year	Grant Amount	Employment
2006	$ 12,112,251	262
2007	$ 42,896,026	558
2008	$ 684,591,470	8,069
2009	$ 191,401,717	2,292
2010	$ 317,811,811	4,292
2011	$ 365,470,684	4,776
2012	$ 205,804,322	2,816
2013	$ 96,252,751	1,329
2014	$ 18,731,039	260
Total	$ 1,935,072,072	24,654

Funds committed as of July 2010. FTEs.

Indirect employment multipliers measure the number of jobs that result from the expansion of suppliers when direct jobs are created and they vary for different types of investments, as shown in Table 3. For every job created directly by investments in training, research, facilities, or equipment, 0.19, 0.50, 0.50, and 1.63 jobs, respectively, are created indirectly. Indirect employment multipliers differ by type of grant because inter-industrial linkages are not the same: spending in equipment has a multiplier almost 9 times larger than spending in training.

Induced employment multipliers measure the number of jobs that result from the expansion of overall economic activity resulting from increased purchases of consumer goods and services by both direct and indirect jobs. Induced employment multipliers also differ by type of investment, reflecting variations in the income of the participants, and thus their consumption patterns.

Table 3
Disaggregated Employment Multipliers

	Training	Research	Construction	Equipment	Average
Indirect Effect	0.19	0.50	0.50	1.63	0.49
Induced Effect	0.30	0.62	0.46	0.65	0.52
Total Effect	1.55	2.44	2.19	4.34	2.28

The "total effect" multiplier is not the sum of the "indirect and induced effects" multipliers because indirect jobs are measured as a proportion of direct jobs, while induced jobs are a proportion of the sum of direct and indirect jobs.

Ninety-three (93%) percent of the jobs created by CIRM's grants, including the additional funds raised by CIRM grantees, derive from investment in either research or in construction. In keeping with the latest statistical information, our model assumes that in those two cases, more than 99% of the economic spillover stayed in California; in the case of training, the proportion diminishes to 77% and in the case of equipment, 62% of the goods and services come from out of state. Out of state suppliers can be either in the United States or abroad. For research, construction, and training, available evidence indicates that 99% of supplies are sourced out within the USA. In the case of equipment, the figure is only 56.5%, and the rest comes from abroad.[13]

Thus, the economic impacts of CIRM's grants on job creation for the period 2006-2014 at the federal level are a fraction of the employment created in California. Indeed, the disbursement of $1.9 billion implies the creation of 697 FTE[14] over the period 2006-2014: of those, 321 are direct, 153 are indirect, and the remaining 222 are induced.

[13] Own calculations based on the IMPLAN database and software.

[14] Full-time equivalent (FTE) is a way to measure a worker's involvement in a project.

C. Economic Impacts: Tax Revenues

The growth in economic activity results in an increase in federal, state, and local tax revenues. The growth in economic activity also results in an increase in federal revenues due to personal income taxes, social security contributions, and corporate income taxes. As shown in Table 4, $362.1 million of tax revenues would accrue to the federal government, most of it derived from personal income and social security taxes.

Table 4
Estimated Increase in Federal Tax Revenues

	Personal Income	Corporate Income	Social Security	Other	Total
2006	$ 15,648	$ 92,454	$ 641,905	$ 66,382	$ 1,316,389
2007	$ 3,504,363	$ 363,082	$ 4,011,639	$ 354,303	$ 8,233,387
2008	$ 46,208,545	$ 7,490,439	$ 51,955,207	$ 5,471,131	$ 111,125,322
2009	$ 14,275,479	$ 1,907,360	$ 16,387,023	$ 1,594,408	$ 34,164,270
2010	$ 28,520,179	$ 2,682,592	$ 32,477,813	$ 2,794,654	$ 66,475,238
2011	30,603,760	$ 3,332,882	$ 34,716,129	$ 3,131,721	$ 71,784,492
2012	$ 18,893,749	$ 1,727,376	$ 21,471,409	$ 1,832,648	$ 43,925,182
2013	$ 9,032,282	$ 810,902	$ 10,246,187	$ 870,736	$ 20,960,107
2014	$ 1,780,686	$ 158,158	$ 2,017,896	$ 171,046	$ 4,127,786
Total	$153,334,691	$ 18,565,245	$173,925,208	$16,287,029	$ 362,112,173

"Other taxes" includes: excise taxes, customs duties, fees, and fines.

In addition to the increase in federal taxes, the growth in economic activity elicits an increase in state and local tax revenues. As shown in Table 5, $201.6 million of tax revenues would accrue to California's governments: $157.2 million to the state and $44.4 to local governments.[15]

Table 5
Estimated Increase in State and Local Tax Revenues

	Sales	Personal Income	Corporate Income	Social Security	Other	Total
2006	$ 127,284	$ 101,404	$ 120,092	$ 21,078	$ 131,556	$ 501,414
2007	$ 1,069,418	$ 851,977	$ 1,284,754	$ 130,306	$ 1,100,819	$ 4,437,274
2008	$ 16,513,935	$13,156,223	$16,940,775	$2,688,248	$ 17,143,571	$ 66,442,752
2009	$ 4,812,522	$ 3,834,013	$ 5,233,614	$ 684,534	$ 4,937,575	$ 19,502,258
2010	$ 8,435,326	$ 6,720,204	$10,455,945	$ 962,757	$ 8,667,589	$ 35,241,821
2011	$ 9,452,710	$ 7,530,729	$ 11,219,817	$1,196,140	$ 9,742,890	$ 39,142,286
2012	$ 5,531,620	$ 4,406,899	$ 6,926,744	$ 619,939	$ 5,685,503	$ 23,170,705
2013	$ 2,628,204	$ 2,093,822	$ 3,311,376	$ 291,024	$ 2,700,940	$ 11,025,366
2014	$ 516,280	$ 411,307	$ 652,827	$ 56,762	$ 530,524	$ 2,167,700
Total	$49,087,299	$39,106,578	$56,145,944	$6,650,788	$50,640,967	$201,631,576

"Other state and local taxes" includes fines, fees, motor vehicle taxes, and state employment taxes (payroll). Homeowners and businesses pay property taxes. Most organizations that receive CIRM funds directly are universities or non-profit research institutes that are exempt from paying property taxes.

[15] Local government's main sources of revenue are the proceeds from the property tax and a share - estimated to be 9.5% - of the sales tax.

II. ONGOING IMPACTS

In contradistinction to one-time impacts, ongoing impacts result from structural economic changes that take place either directly, when CIRM-sponsored research results in therapies that lengthen the life expectancy of patients and allow them to rejoin the labor force or, indirectly, when CIRM's grants promote economic clusters.

Each and every discovery of a successful therapy has an enormous impact on the life of afflicted individuals. In contrast, its economic impact is a function of the prevalence of the disease, the cost of conventional treatment, decreases in morbidity and mortality, and the effect of the disease on patient productivity.

In the case of cures for orphan diseases,[16] the overall economic impact is limited precisely because the number of beneficiaries is limited. The economic impact of successful therapies for widespread diseases can entail structural adjustments in labor force participation and consumption patterns with macroeconomic impacts. A recent article estimates that "a permanent 1 percent reduction in mortality from cancer" - one of CIRM's targets - has a present value of "nearly $500 billion, whereas a cure (if one is feasible) would be worth about $50 trillion."[17] Those benefits come from extending life, raising its quality, and from the increased income derived from returning to work. It should be further noted that the distribution of such benefits is likely to differ by gender and age group.

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[16] By orphan diseases we mean ones that, according to U.S. criteria, affect fewer than 200,000 persons.

[17] Kevin M. Murphy & Robert H. Topel, *The Value of Health and Longevity*, Journal of Political Economy, vol. 114, no. 5 (2006).

Some diseases like Polycythemia Vera (PV) and Primary Myelofibrosis (PMF) can be so debilitating that the afflicted person is unable to work. Polycythemia Vera (PV) is a rare and serious blood disease in which bone marrow makes too many red blood cells. As a result, the blood becomes thicker than normal and the blood flow is slower than normal. The possibility of blood clotting is very high, and increases the probability of a heart attack, stroke, or gout. Slower blood flow also deprives the arms, legs, lungs, and eyes of the oxygen they need to perform normally. This can cause headaches, dizziness, itching, and problems with vision, such as blurred or double vision.[18] Myelofibrosis is a disorder that causes the bone marrow to be replaced by scar (fibrous) tissue, impeding its ability to produce sufficient blood cells. Anemia, bleeding problems, and a higher risk of infections may occur. As a result, the liver and spleen try to make some of these blood cells, causing these organs to swell. Among the symptoms are bone pain, bruising, easy bleeding, fatigue, increased likelihood of getting an infection, pallor, and shortness of breath.[19]

PV and PMF are chronic conditions that cannot be cured and require substantial health care expenditures once they are diagnosed. In the case of PV, treatment focuses on reducing the amount of blood cells, preventing complications, and decreasing or eliminating the disease's symptoms. Treatment may include phlebotomy to reduce the number of blood cells and decrease blood volume, medication to suppress the bone marrow's ability to produce blood cells, low doses of aspirin, and therapy to reduce itching.[20] Most patients with PMF suffer from anemia, marked enlargement of the spleen, weight loss, severe fatigue, low-grade fever, and night sweats.[21] "Corticosteroids, androgens,

[18] http://www.ncbi.nlhm.nih.gov/pubmedhealth/PMH0001558/.

[19] http://www.mayoclinic.com/health/polycythemia-vera/DS00919/DSECTION=treatments-and-drugs.

[20] http://www.polycythemiavera-pv.com.

[21] http://www.uptodate.com/contents/prognosis-and-treatment-of-primary-myelofibrosis.

erythropoiesis-stimulating agents, and immunomodulators are recommended to treat anemia of PMF, whereas hydroxyurea is the first-line treatment of PMF-associated splenomegaly."[22]

Data on the prevalence and incidence[23] of PV and PMF are difficult to come by and not very reliable. A study by the Mayo Clinic on the incidence of PMF in a Minnesota county in 1999 reported a value of 1.46 per 100,000, which translates to an estimated prevalence of 30,000 patients in the United States.[24] A recent study estimated the prevalence of PV in the United States in 2003 at 65,243 patients.[25]

The PV/PMF population is predominantly older than 65 and growing at a rate of approximately 1.2% a year. Although there are substantial variations in estimates of lifespan for people with PV and PMF, we assume a seven-year increase in the lifespan of people over age 65 and a seventeen-year increase in the life span of people under age 65. Table 6 shows the expected increase in the PV/PMF population if the JAK2 inhibitor developed by UC San Diego and TargeGen is not successful.

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[22] Tiziano Barbui, Giovanni Birgegard, et al., *Philadelphia - Negative Classical Myeloproliferative Neoplasms: Critical Concepts and Management Recommendations from European LeukemiaNet*, J. Clin. Oncol. 761-770 (2011).

[23] Prevalence and Incidence refer to the total number of patients and to the number of patients diagnosed each year, respectively.

[24] RA Mesa, MN Silverstein, et al., *Population-Based Incidence and Survival Figures in Essential Thrombocythemia and Agnogenic Myeloid Metaplasia: an Olmsted County Study 1976-1995*, Am. J. Hematol. 61(1):10-5 (May 1999).

[25] X. Ma, G. Vanasse, et. al., *Prevalence of Polycythemia Vera and Essential Thrombocythemia*, Am. J. Hematol. 83(5):359-62 (May 2008).

Table 6
PV/PMF Cases if JAK2 Inhibitors Prove Unsuccessful

Year	Projected Cases
2013	124,719
2014	126,782
2015	128,704
2016	130,483
2017	132,116
2018	133,607
2019	135,049
2020	136,439
2021	137,777
2022	139,113

As a consequence of a CIRM grant, UC San Diego and TargeGen jointly developed a JAK2 inhibitor to treat PV and PMF, which is expected to slow the disorders substantially and to cause a significant proportion of patients to enter complete remission. When they do, we assume that those patients will act as the rest of the population by returning to the labor force, thereby giving rise to an increase in personal income and taxes.[26] Direct ongoing economic impacts depend on the research funded by CIRM being successful and have two components:

[26] Our model excludes a consideration of caregivers who are not compensated monetarily because data is unavailable. On the other hand, our model assumes that paid caregivers would find alternative work.

- Increases in personal income, personal income taxes, and spending because some patients in remission can return to work;

- Decreases in governmental spending due to the reduction in the cost of attending to PV/PMF patients.

A. Direct Ongoing Impacts: Increases in Income

When estimating the additional income generated by patients no longer affected by PV or PMF, it is important to consider the proportion that is disabled and to appropriately reflect differences in labor force participation (LFP) and labor market characteristics. Attitudes towards work change significantly with age and the presence of a disability:

- The LFP of people younger than 65 is appreciably larger than that of people older than 65, because many people retire at that age.
- The LFP of people with disabilities is, on average, less than half of what it is for people without them.[27]
- The proportion of people working part-time is 10 percentage points larger for people with disabilities.
- Both unemployment rates and average wages vary by age, location (California vs. the United States as a whole) and time period.

Since the JAK2 inhibitor developed by UC San Diego and TargeGen is

[27] This general method can be parameterized differently for different diseases.

expected to substantially slow the disorder, the labor force participation of existing patients should be expected to grow. We assume that the cure will lead patients affected by PV and PMF to return to the labor force and to be employed in the same proportion as the population in general. The increase in income resulting from patients returning to the labor force can be calculated as:

$$\Delta I = \gamma.\delta.\rho.NPV_{10}\left\{\sum\sum AP_{it} \,.\, (LFP_{nd,i,t}.(1\text{-}UR_{nd,i,t}) - LFP_{d,i,t}.(1\text{-}UR_{d,i,t})).\, EAR_{it}\right\},$$

where

ΔI	=	Increase in Income.
γ	=	Percent savings attributed to the JAK2 inhibitor developed by UC San Diego and TargeGen.
δ	=	Percent of PV/PMF patients that are not in the labor force because of a disability.
ρ	=	Percent of patients that have entered complete remission. We assume that 100% of PV patients and 50% of the PMF patients have a gene mutation with the use of the JAK2 inhibitor.
NPV_{10}	=	Net Present Value over 10 years with a 3% discount rate.
i	=	1 for people younger than 65; 2 for people older than 65.
nd	=	Index for people without a disability.
d	=	Index for people with a disability.
t	=	Years into the future up to the increase in life expectancy as a result of the new therapy.
AP_{it}	=	Affected Population, whether they went to a hospital or not, at time t.
LFP_{it}	=	Labor Force Participation of group i, at time t.
UR_{it}	=	Unemployment Rate of group i, at time t.
EAR_{it}	=	Earnings of group i at time t.

While neither the labor force participation nor the unemployment rate of PV/PMF patients has been studied, the Bureau of Labor Statistics (BLS) compiles those statistics (by age group) for people with a disability.[28] There is little information on the proportion of people afflicted with PV/PMF that should be considered "disabled" in the BLS sense. An informal consultation with the MPD (Myeloproliferative Disorders) Foundation for patients with polycythemia vera, essential thrombocythemia, and myelofibrosis indicated that while each patient is unique and PMF can be much more debilitating than PV, a number like 20% could be appropriate. We have thus carried out our calculations with that proportion. We also use BLS data for the 2009 mean annual wage for California, which is equal to $49,550 and correct for age because it is, for example, 17% smaller for people older than 65 than for people between the ages of 45 and 64.

We find that, on average, 23%[29] of the PV/PMF population will return to work, bringing about a $936.9 million increase in personal income for the United States or $124.2 million for California over 10 years.[30] If we assume that the effective personal tax rate in California is 4.5%, that entails $5.6

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[28] By disability, the BLS specifically means: deafness or serious difficulty hearing; blindness or serious difficulty seeing even when wearing glasses; serious difficulty concentrating, remembering, or making decisions because of physical, mental, or emotional conditions; serious difficulty walking or climbing stairs; difficulty dressing or bathing; or difficulty doing errands alone such as visiting a doctor's office or shopping because of a physical, mental, or emotional condition.

[29] If the only PV/PMF patients not in the labor force were those with at least one hospital stay in a given year, the only people whose increase in income should be computed are those patients. If PV/PMF patients not hospitalized in a year cannot work because they are debilitated and the JAK2 inhibitor allows them to do so, they will generate income. We estimate that while currently only 6% of the people with PV/PMF older than 65 work, once they take the inhibitor that proportion will increase to 21%. In the case of people younger than 65, the corresponding percentages are 30% and 70%.

[30] If the calculation is carried out over a 30-year horizon, the corresponding numbers are significantly higher: $2.6 billion and $345.4 million.

million of additional taxes over 10 years. If 40% of people affected with PV/PMF should be considered "disabled" instead of 20%, those numbers should be doubled.

B. Direct Ongoing Impacts: Increased Spending Due to Lower Health Costs

The decrease in health costs resulting from the discovery of a successful therapy that is cheaper than current treatment implies that those monies can be spent on other goods and services. This applies to individuals as well as to governments.[31]

We estimate annual hospital costs of treating PV and PMF at $86.4 million by using the 2010 Hospital Cost and Utilization Project database from the American Hospital Association Trendwatch Chartbook.[32] In addition, we use the National Ambulatory Medical Care Survey from the Centers for Disease Control and Prevention to estimate the cost of outpatient visits at $25.4 million.

The actual annual direct health care cost savings depend on the price of the drug which, in turn, depends on the degree of competition in the market. The existence of three alternative drugs from two competitors (Incyte[33] and Exelixis[34]) suggests that there will be competition. Thus, we assume that the average price of the drug is half of the savings generated and that the

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[31] Medicare expenditures by the federal government and health-related expenditures by the states.

[32] Henry Miller, *Economic Impact of Research Funded by the California Institute for Regenerative Medicine: Polycythemia Vera/Primary Myelofibrosis: August 10, 2010,* Manuscript.

[33] http://www.incyte.com/drugs_product_pipeline.html.

[34] http://www.exelixis.com/sites/default/files/pdf/ASH-XL019-002.pdf.

TargeGen drug will have one-third of the market.[35]

As a result, annual direct health care cost savings for the United States could amount to $18.5 million;[36] and their net present value (NPV) over 10 years, with a discount rate of 3% ($NPV_{10,3\%}$), would be $157.6 million. Since only 11.5% of the PV/PMF population is in California, annual direct health care cost savings would amount to $2.1 million with a $NPV_{10,3\%}$ of $18.1 million.

C. Indirect Ongoing Impacts

Indirect ongoing economic impacts stem from the fact that CIRM grants are putting California in a position of leadership in stem cell research. This leadership position encourages the recruitment of world-class scientists and the establishment of a biological science and biotechnology infrastructure that is likely to further attract venture capital investment in research and start-up firms. These benefits would result from three phenomena:

1. Additional grants and donations that would fund research;
2. Venture capital that would invest in biotechnology start-ups; and
3. New treatment facilities that would serve patients traveling to California as research leads to successful therapies.

The importance of agglomeration economies has been recognized since the late 19th century by one of the founders of economics, Alfred Marshall, and

[35] The direct health care cost savings can be adjusted proportionately to reflect any other combination of assumptions about the price of the drug and the market share.

[36] ($86.4+$25.4)*.5*.333.

has become preeminent through the work of Paul Krugman[37] and Michael Porter, who popularized the notion of clusters as geographic concentrations of interconnected companies in a particular industrial sector. Michael Porter has shown that firms located in regions with strong clusters foster new business formation and start-up employment. Strong clusters also influence location decisions of multi-establishment firms, as they will want to locate new plants close to those clusters to take advantage of the positive externalities they create. Finally, strong clusters contribute to the survival of start-up firms.[38] In subsequent work, Porter showed that industries participating in a strong cluster "register higher employment growth, as well as higher growth of wages, number of establishments, and patenting."[39] The beneficial effects of clusters extend to related clusters in the same region and in adjacent regions and new industries. Importantly, there is evidence that "new industries emerge where there is a strong cluster environment."[40]

The Cluster Mapping Project at Harvard[41] has identified two fast growing biopharmaceutical trade clusters in the San Jose-San Francisco-Oakland and San Diego-Carlsbad-San Marcos areas which created jobs 33 and 17 times faster than expected during the period 1998-2007. As seen in the following map, CIRM grants have been given to institutions that concentrate in these areas, along with another concentration in the Los Angeles area.

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[37] Nobel Prize in Economics, 2008.

[38] Mercedes Delgado, Michael E. Porter & Scott Stern, *Clusters and Entrepreneurship,* Journal of Economic Geography (May 2010).

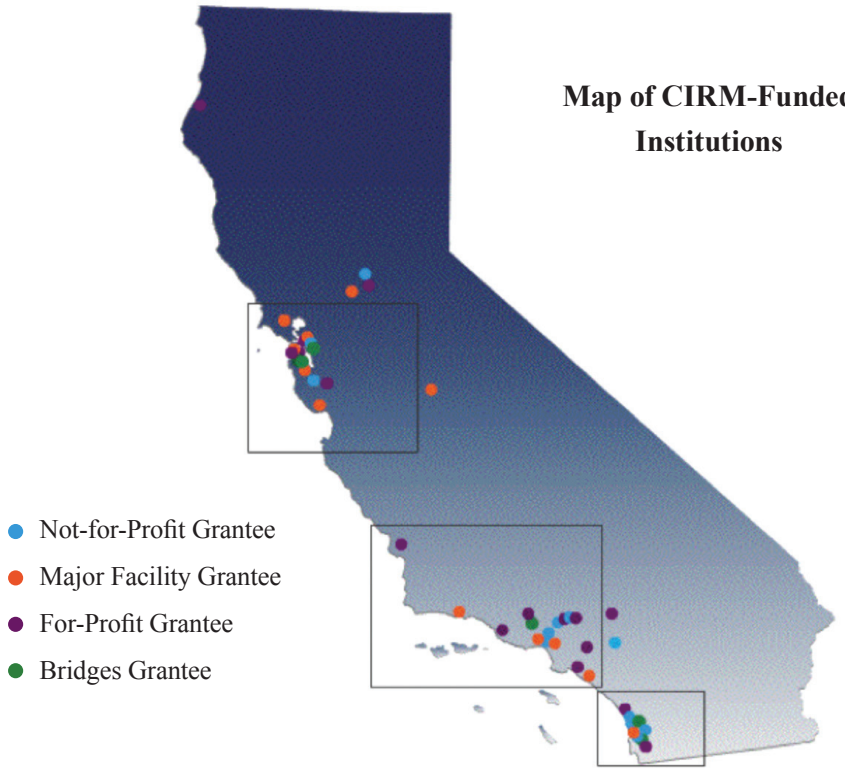
[39] Mercedes Delgado, Michael E. Porter & Scott Stern, *Clusters, Convergence, and Economic Performance*, US Census Bureau Center for Economic Studies Paper No. CES-WP-10-34 (October 1, 2010), available at SSRN: http://ssrn.com/abstract=1695011.

[40] Ibid.

[41] Traded industries sell products and services across economic areas. They pay higher wages, have far higher rates of innovation, and influence local wages. Available at http://data.isc.hbs.edu/isc/.

The recipients of Major Facilities Grants have obtained $3.25 of matching funds for every dollar received from CIRM. Of that $3.25, $2.07 is being used to construct world-class facilitiesthat are able to accommodate 2,000 scientists. The remaining $1.18 is being used primarily to recruit new researchers to these facilities. The magnitude and location of these facilities suggest that the existing clusters will be strengthened and that a third may appear in the L.A. area. The indirect, ongoing impacts of CIRM's grants are too recent to be measurable but, as time goes on, virtuous cycles are likely to develop with measureable impacts in employment, wages, number of establishments, and patents granted. The extent and health of the clusters will be measurable by using County Business Pattern data by Standard Industrial Classification (SIC) Code by County.[42]

Map of CIRM-Funded Institutions



[42] The recent purchase of TargeGen, a developer of kinase inhibitors in the San Diego area, by Sanofi-Aventis for up to $560 million is due in part to research supported by CIRM.

Finally, to the extent that research financed by CIRM leads to new therapies, it is likely that patients will travel to California to be treated. New treatment facilities are thus likely to be established as they were in Rochester, Minnesota (the Mayo clinic employs 31,500[43]), and in Houston (according to the Bureau of Labor Statistics, it has more than 178,000 life science and health care professionals). Recent evidence indicates that, over the last decade, Minnesota and Texas have been losing ground to Florida and California in these sectors, further suggesting that the biopharmaceutical sector could become a fast growing source for well paying jobs.[44]

[43] http://www.raedi.org/economic_overview.html#economy.

[44] Between 1998 and 2007, job creation in this sector in California grew ten times faster than expected while it was negative in Minnesota and Texas. Available at http://data.isc.hbs.edu/isc/.

About Berkeley Research Group

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