The Economic Impacts of 9/11: An Interindustry Macroeconomic Approach

Jeffrey Werling

Ronald Horst

Inforum – University of Maryland

www.inforum.umd.edu

werling@econ.umd.edu

What We Are Doing

- We identify direct impacts of 9/11, consistent with the findings of other CREATE studies.
- Shock LIFT model to calculate the "dynamic, general-equilibrium effects" on the macro economy and across industries.
- The baseline is actual U.S. economic history. Therefore, we model the counterfactual cases as positive shocks imposed in the context of the actual 2001 economy.
- For this experiment, LIFT contains some sources of (inherent) resilience:
  - price mechanism reallocates expenditures (e.g., airline to car travel).
  - dynamic, year-to-year solution allows deferred transactions to be realized later.
  - changes in economic slack and capital stocks affect subsequent expenditures.

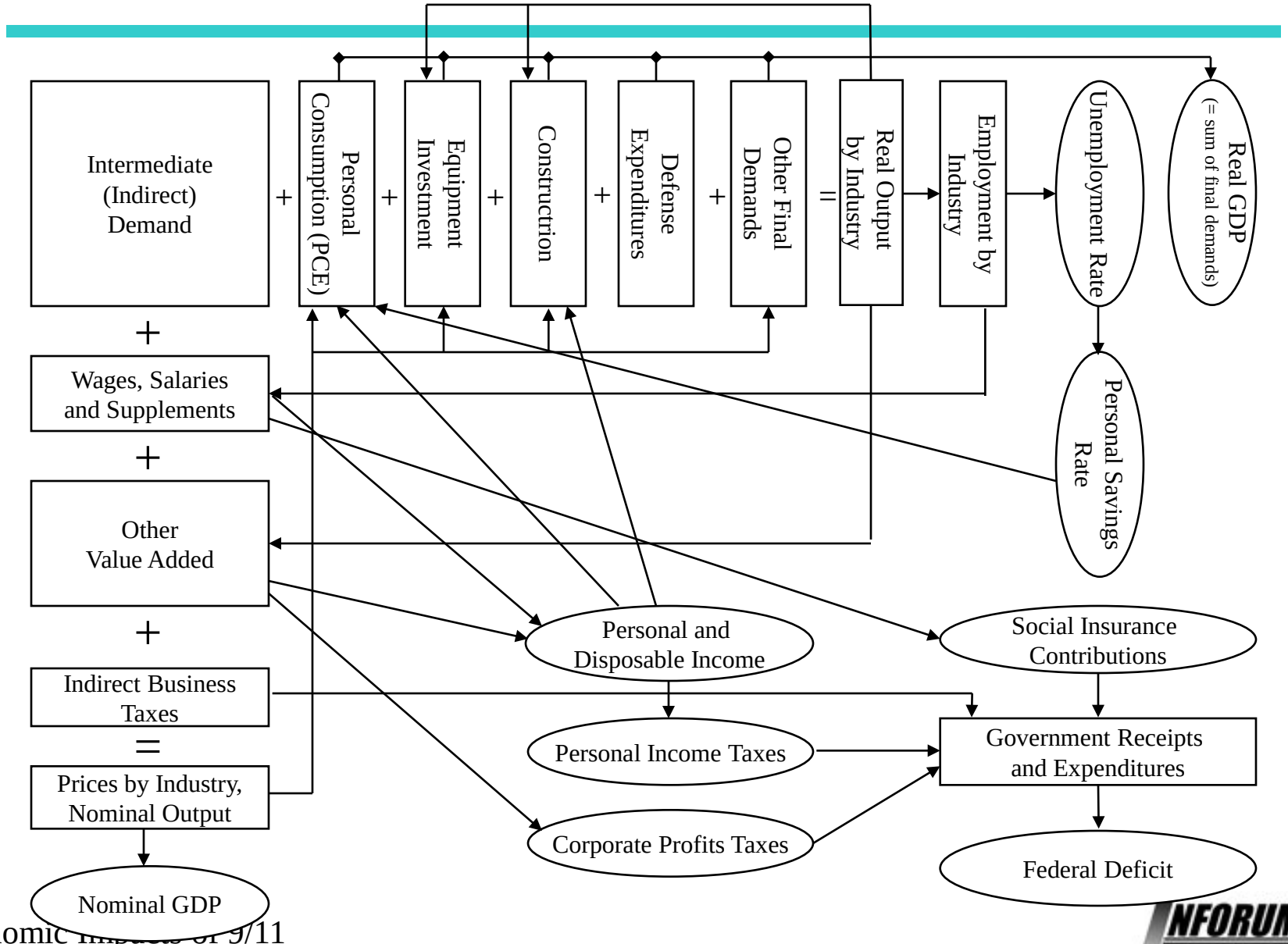
Inforum Interindustry-Macroeconomic (IM) Models

- Combine input-output structure with econometric equations in a dynamic and detailed framework. Three major components:
  - Product or Real Side: **q = Aq + f**
  - Nominal Income/Price Side: **p' = p'A + v**
  - Macroeconomic Accountant: GDP, Income, Trade, and Govt accounts, interest rates, etc.
- Like a CGE: Contains detailed industry structure and *bottom-up* accounting.
- Like an (macro) econometric or VAR model: Parameters estimated from actual data. Portray dynamic evolution of economies over actual time periods (solves year by year).
- Lift (Long-term interindustry forecasting tool) is 97 sector flagship model. Under continuous development and use for over 30 years.
- International System: BTM bilateral trade model, IM models for all major trade partners including China.

LIFT: Inforum's Model of the U.S. Economy

- LIFT, for Long-term Interindustry Forecasting Tool, is an interindustry-macro (IM) model.
  - Sectoral detail for production, prices jobs, consumer spending, foreign trade and factor income (wages, profits, depreciation, etc).
  - Macrovariables. Many, such as GDP, net exports, the unemployment rate, and the aggregate price level are aggregates of the underlying industry forecasts. Other macrovariables such as the savings rate and interest rates, complete the model.
- LIFT is dynamic, solving year by year, and incorporating investment and capital stocks.
- LIFT is particularly useful in addressing questions involving interactions between industries, as well as the interplay between industry and macroeconomic relationships.

Schematic of the Inforum Lift Model



Recent Studies Using LIFT

Economic Impact of Energy Policies – Securing America's Future Energy (SAFE)
Sustainability of Long-term Projections - Centers for Medicare and Medicaid Services
Impact of Port Closures – Applied Physics Lab, JHU
Immigration Impacts on U.S. Economy– U.S. Department of Commerce
Impact of U.S. Port Closures on U.S. and Asian Economies – Booz-Allen Hamilton
Industrial, Regional & Occupational Impacts of Defense - Department of Defense
Impact of High Oil and Natural Gas Prices – Department of Commerce (ESA)
Enhanced Medical Insurance Coverage – MITRE Corporation
Impact of Container Trade Interruptions - CBO
Impact of Currency Fluctuations – Department of Commerce (ITA)
Static & Dynamic Effects of Trade Liberalization – Manufacturers Alliance
The Digital Economy 2000/2005 - Department of Commerce (ESA)
Impact of Asian Crisis on the U.S. Industries - Manufacturers Alliance
Local Impacts of Electricity Deregulation – NRECA
China in the WTO - U.S. Government
Clean Energy and Jobs - Center for a Sustainable Economy`

Scope of this Project

- Assess the economy-wide and industrial impacts of the 9/11 Manhattan Business Interruption (BI) and the Airline related expenditure interruptions.
- We assume that the 9/11 shock might be asymmetric. Therefore, compared to actual history, our counter-factual scenarios assume that 9/11 does not occur.
- We use the direct impacts on several industries to assess the total (direct and indirect) impacts on the economy.
  - FIRE and Other Business Services, including the rail disruption.
  - Air travel and related travel services (hotels, restaurants, etc.)
  - Some policy is endogenous: Counter-cyclical monetary and automatic fiscal stabilizers.
  - Exogenous policy is not considered (excess liquidity used to stabilize financial markets)
- Longer term structural effects are not considered:
  - Productivity effects of new security, changes to inventory or other business behavior.

Economic Damage from Economic and Non-economic shocks: Important Factors

- Size matters
  - A 10.0 MBD disruption of global oil supply causes more than twice amount of economic damages than a 5.0 MBD disruption.
  - Economic models provide a framework for evaluating scale. *Data base alone provides impt information on economic, financial, and relative size of indicators for growth, stability and interdependence.*
- Duration matters
  - Impact of 6 month episode more than twice that of 3 months.
  - Dynamic models (solve yr to yr) illustrate the path of economy after the shock.
- Current economic conditions evaluated using available data and structure.
  - Economic Integration among economies (contagion and blowback).
  - Supply/demand equation across the business cycle,
  - External imbalances and distribution of financial assets.
- *Factors where models usually have less inherent ability to show:*
  - Variations by underlying cause? Military/civil strife will tend to have a negative psychological impacts.
  - Did the shock appear unexpectedly or were there warnings?
  - Perceptions: Is shock temporary or permanent?

Economic Resilience Mutes Impacts of Sudden Shocks

- Actions that mute the direct and indirect shocks by using remaining resources as efficiently as possible and by compressing the time-span of losses by speeding recovery. (Rose, 2004*)
- Some recent events highlight the importance of resilience
- Price rationing (inherent resilience) minimizes economic damage
  - In oil price shock price rationing means energy flows to highest value activities. Economies with large and efficient markets in energy are more resilient.
- Macroeconomic automatic stabilizers : Progressive income tax, unemployment insurance, inflation reduction.
- Discretionary monetary and fiscal policy.
- Non-price demand measures (adaptive resilience) such as input substitution, and changes to economic behavior (car pooling). Planning and assets to realize these conservation measures.
- Several studies on disasters and other events (Katrina, 9/11, etc.) find that resilience is often very substantial, ameliorating negative effects.

*Rose, A. 2004. "Defining and Measuring Economic Resilience to Disasters," *Disaster Prevention and Management* 13: 307-14.

Supply Side: Manhattan Business Non-Interruption

- Destruction of Capital (and Labor) is a supply shock.
- Rose, et. al. (Chapters 3 and 6) provide estimates of lost transactions net of relocations. We use these output numbers to target output increase as indicated below.
- Simulated in the model by decreasing the supply prices of the effected industries until output and demand is increased the targeted amount.
- Additional value added income taken from capital consumption.
- Price reductions are temporary and it is entirely possible that some of the increased output is reduced from subsequent periods, relative to the 9/11 baseline.

Business Non-Interruption Shocks	**Best Estimate**		**Lower Bound**		**Upper bound**	
Millions of current (2001) dollars	2001	2002	2001	2002	2001	2002
Finance, Insurance and Real Estate	7187	7187	625	625	26071	26071
Other Business Services	863	863	75	75	3129	3129

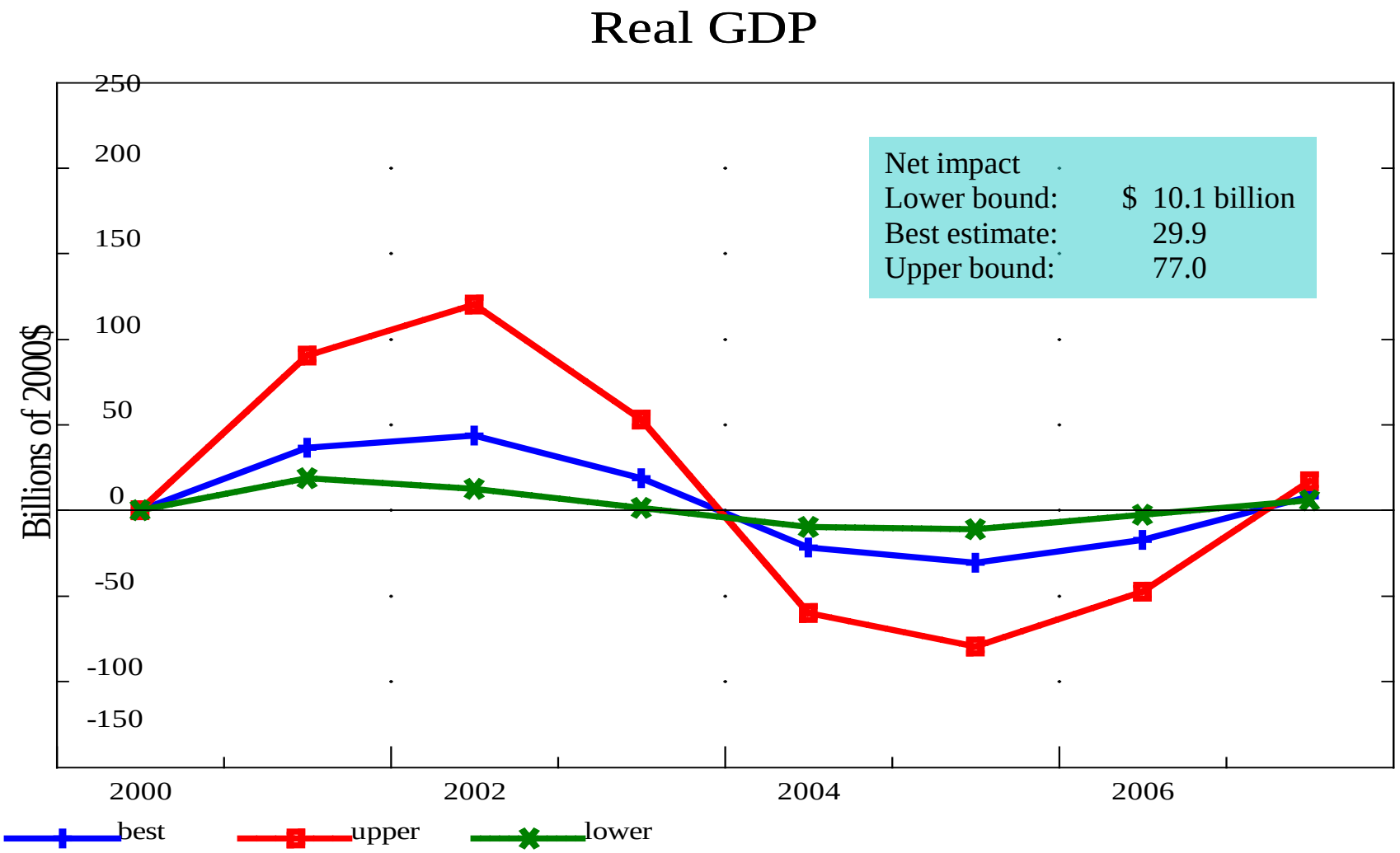
Demand Side: Travel Expenditures Not Affected

- Increased travel is a demand shock.
- We assume that most of the observed travel PCE expenditure as a result of 9/11 reduction was not redirected elsewhere, at least temporarily.
- Reduced business travel expenditures, however, were spent somewhere else in the supply chain. That is, they did not flow to productivity growth. (There is some evidence to refute this.)
- Asay, et. al. provide estimates of the reduced travel expenditures across several industries. He also estimates the timing of these reductions across quarters from 9/11 to 4Q2005.
- Used as positive final demand shocks to assess effects of no-9/11.

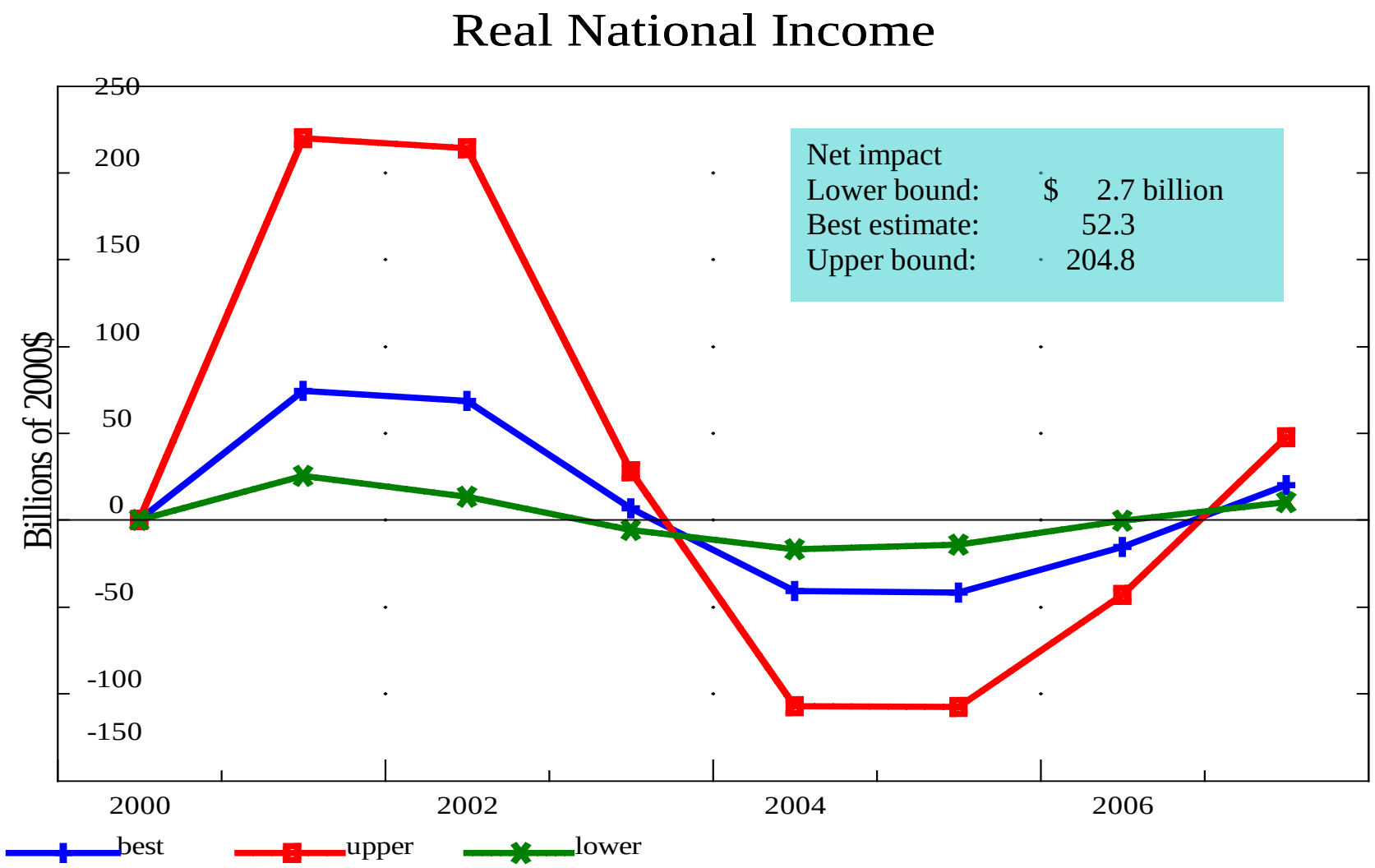
Expenditure Increases - Millions of current dollars

	Best Esimate				Lower Bound				Upper Bound			
	Total	2001	2002	2003	Total	2001	2002	2003	Total	2001	2002	2003
Air Transport	28476	9898	12701	5877	15282	8305	6344	634	42292	11547	19342	11402
Other Transport	1766	614	788	364	948	515	393	39	2623	716	1200	707
Hotels	17660	6138	7877	3645	9478	5150	3934	393	26229	7161	11996	7072
Gasoline	883	307	394	182	474	258	197	20	1312	358	600	354
Auto rentals	5520	1919	2462	1139	2963	1610	1230	123	8199	2239	3750	2210
Restaurants	10891	3785	4858	2248	5845	3176	2426	242	16174	4416	7397	4361
Retailing	4121	1432	1838	850	2211	1202	918	92	6120	1671	2799	1650
Amusements	4194	1458	1871	866	2251	1223	934	93	6229	1701	2849	1680
Railroad	500	174	223	103	500	272	208	21	500	137	229	135
Total	74011	25725	33012	15275	39951	21710	16584	1657	109678	29946	50161	29571

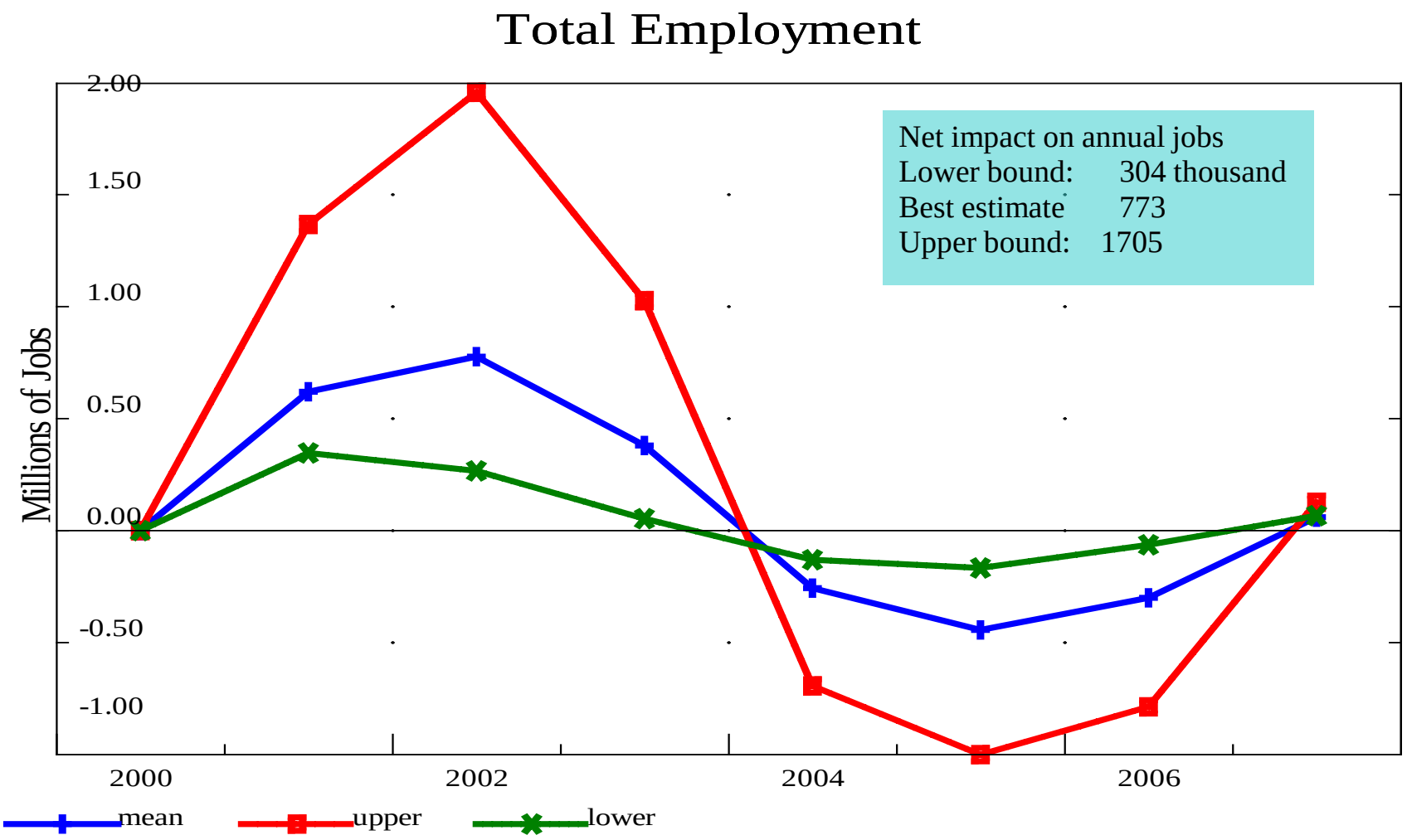
Impacts on GDP: Deviation from 9/11 Baseline



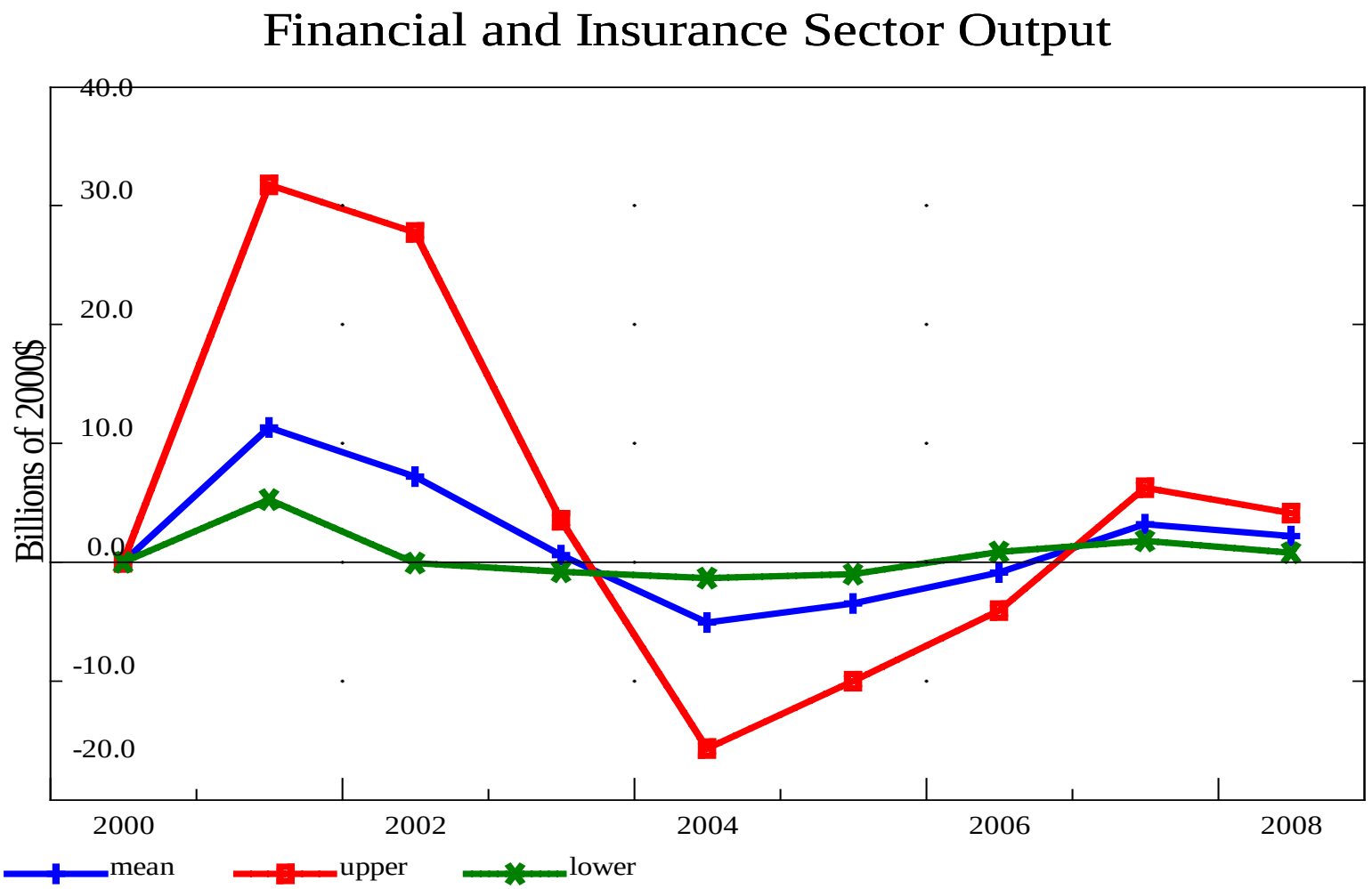
Impacts on Real Income: Deviation from 9/11 Baseline



Impacts on Employment: Deviation from 9/11 Baseline



Impacts on FIRE Output



Real Impacts on GDP and Income

	2001	2002	2003	2004	2005	2006	Net Effect
Gross Domestic Product (2000$ Chained dollars)							
9/11 Baseline Level	9890.4	10048.3	10300.6	10675.8	11003.0	11319.3	63237.4
Lower Bound Difference	18.7	12.8	1.4	-9.4	-10.8	-2.6	10.1
Best Estimate Difference	36.8	43.6	18.7	-21.5	-30.4	-17.4	29.9
Upper Bound Difference	90.5	120.5	53.2	-60.0	-79.6	-47.5	77.0
Percent difference from 9/11 baseline							**% of 2001**
Lower Bound	0.19	0.13	0.01	-0.09	-0.10	-0.02	0.10
Best Estimate	0.37	0.43	0.18	-0.20	-0.28	-0.15	0.30
Upper Bound	0.91	1.20	0.52	-0.56	-0.72	-0.42	0.78
Real National Income (2000$ Chained dollars, deflated with consumption deflator)							
9/11 Baseline Level	8769.1	8858.0	9052.1	9415.9	9634.7	9999.0	55728.8
Lower Bound Difference	25.7	13.5	-5.7	-16.8	-13.9	-0.1	2.7
Best Estimate Difference	74.6	68.8	7.0	-40.7	-41.9	-15.5	52.3
Upper Bound Difference	219.8	214.2	28.0	-106.9	-107.4	-42.8	204.8
Percent difference from 9/11 baseline							**% of 2001**
Lower Bound	0.19	0.13	0.01	-0.09	-0.10	-0.02	0.03
Best Estimate	0.37	0.43	0.18	-0.20	-0.28	-0.15	0.60
Upper Bound	0.91	1.20	0.52	-0.56	-0.72	-0.42	2.34

Interest Rates and Prices

	2001	2002	2003	2004	2005	2006
Treasury bills, 3-month (difference in rates, percent points)						
9/11 Baseline Level	3.39	1.60	1.01	1.37	3.15	4.73
Lower Bound Difference	0.18	0.19	0.03	-0.09	-0.11	-0.04
Best Estimate Difference	0.30	0.45	0.25	-0.14	-0.29	-0.18
Upper Bound Difference	0.66	1.04	0.69	-0.32	-0.74	-0.47
GDP deflator (percent difference from 9/11 baseline)						
Lower Bound	0.08	0.08	0.03	-0.01	-0.02	-0.02
Best Estimate	0.08	0.15	0.13	0.04	0.01	-0.02
Upper Bound	0.05	0.26	0.33	0.16	0.09	0.03

Selected Industry Impacts, I

	2001	2002	2003	2004	2005	2006	Net effect from 2001
7-8 Construction	**717.75**	**699.51**	**709.00**	**729.16**	**748.94**	**767.58**	**4371.95**
Lower Bound	**0.10**	**0.13**	**0.07**	**-0.25**	**-0.33**	**-0.13**	**-0.44**
Best Estimate	**0.23**	**0.37**	**0.29**	**-0.62**	**-0.93**	**-0.60**	**-1.37**
Upper Bound	**0.65**	**1.04**	**0.78**	**-1.81**	**-2.51**	**-1.63**	**-3.77**
Transport Equipment	**548.32**	**579.07**	**593.34**	**613.23**	**639.79**	**663.39**	**3637.15**
Lower Bound	**0.21**	**0.36**	**0.09**	**-0.25**	**-0.21**	**-0.05**	**0.11**
Best Estimate	**0.47**	**0.80**	**0.41**	**-0.36**	**-0.58**	**-0.28**	**0.35**
Upper Bound	**1.18**	**1.85**	**0.94**	**-0.79**	**-1.34**	**-0.70**	**0.86**
Transportation	**589.34**	**593.72**	**600.44**	**632.28**	**657.01**	**684.37**	**3757.16**
Lower Bound	**1.73**	**1.46**	**0.22**	**-0.01**	**-0.08**	**-0.01**	**3.31**
Best Estimate	**2.20**	**3.09**	**1.44**	**-0.05**	**-0.18**	**-0.13**	**6.37**
Upper Bound	**3.03**	**5.20**	**2.87**	**-0.33**	**-0.51**	**-0.36**	**9.87**
62 Air transport	153.06	161.46	171.59	186.73	191.10	194.92	1058.86
Lower Bound	5.23	4.36	0.47	0.02	-0.05	0.00	10.33
Best Estimate	6.42	8.95	3.85	-0.02	-0.08	-0.07	19.97
Upper Bound	8.01	14.16	7.53	-0.26	-0.25	-0.20	30.52

Selected Industry Impacts, II

	2001	2002	2003	2004	2005	2006	Net effect from 2001
Trade	**2301.76**	**2360.46**	**2428.84**	**2571.51**	**2706.96**	**2847.65**	**15217.18**
Lower Bound	**0.19**	**0.11**	**0.02**	**-0.09**	**-0.10**	**-0.02**	**0.09**
Best Estimate	**0.42**	**0.48**	**0.20**	**-0.20**	**-0.27**	**-0.15**	**0.40**
Upper Bound	**1.06**	**1.43**	**0.64**	**-0.55**	**-0.73**	**-0.40**	**1.23**
Finan, Insur & RE	**2905.90**	**2901.31**	**2994.73**	**3114.36**	**3230.07**	**3373.69**	**18520.05**
Lower Bound	**0.26**	**0.02**	**-0.03**	**-0.08**	**-0.07**	**0.03**	**0.11**
Best Estimate	**0.61**	**0.46**	**0.09**	**-0.27**	**-0.23**	**-0.07**	**0.54**
Upper Bound	**1.74**	**1.75**	**0.40**	**-0.80**	**-0.62**	**-0.26**	**2.04**
72 Finance & insurance	1280.37	1245.33	1288.75	1335.27	1387.55	1473.85	8011.11
Lower Bound	0.41	-0.01	-0.06	-0.10	-0.07	0.06	0.23
Best Estimate	0.89	0.58	0.04	-0.38	-0.25	-0.06	0.76
Upper Bound	2.48	2.23	0.27	-1.17	-0.72	-0.28	2.60
Services	**4009.39**	**4087.69**	**4211.87**	**4403.80**	**4573.13**	**4767.65**	**26053.52**
Lower Bound	**0.32**	**0.25**	**0.03**	**-0.09**	**-0.11**	**-0.04**	**0.33**
Best Estimate	**0.54**	**0.68**	**0.31**	**-0.16**	**-0.29**	**-0.19**	**0.83**
Upper Bound	**1.10**	**1.63**	**0.85**	**-0.41**	**-0.75**	**-0.48**	**1.78**
Total Duplicated Output	**16147**	**16216**	**16526**	**17266**	**17915**	**18712**	**102782**
Lower Bound	**0.24**	**0.18**	**0.02**	**-0.10**	**-0.11**	**-0.02**	**0.20**
Best Estimate	**0.46**	**0.56**	**0.24**	**-0.21**	**-0.30**	**-0.16**	**0.53**
Upper Bound	**1.09**	**1.47**	**0.67**	**-0.58**	**-0.78**	**-0.45**	**1.24**

Converting Model Results to 2006$

- GDP deflator in 2006$ = 116.6

9/11 Lift results		2001	2002	2003	2004	2005	2006	2001-2006	% of 2001
Real GDP, $2000		9890	10048	10301	10676	11003	11319	63237	
	lower	18.7	12.8	1.4	-9.4	-10.8	-2.6	10	0.11
	medium	36.8	43.6	18.7	-21.5	-30.4	-17.4	30	0.34
	upper	90.5	120.5	53.2	-60.0	-79.6	-47.5	77	0.88
Percent difference from	lower	0.21	0.14	0.02	-0.10	-0.11	-0.03	0.02	
actual yr by yr	medium	0.42	0.49	0.21	-0.23	-0.32	-0.17	0.07	
	upper	1.03	1.36	0.59	-0.64	-0.83	-0.48	0.17	

		2001	2002	2003	2004	2005	2006	2001-2006	% of 2001
Real GDP, $2006		8769	8858	9052	9416	9635	9999	55729	
(deflated with actual	lower	25.7	13.5	-5.7	-16.8	-13.9	-0.1	3	0.03
GDP deflator)	medium	74.6	68.8	7.0	-40.7	-41.9	-15.5	52	0.60
	upper	219.8	214.2	28.0	-106.9	-107.4	-42.8	205	2.34
Percent difference from	lower	0.29	0.15	-0.06	-0.18	-0.14	0.00	0.01	
actual yr by yr	medium	0.85	0.78	0.08	-0.43	-0.43	-0.16	0.11	
	upper	2.51	2.42	0.31	-1.14	-1.12	-0.43	0.43	

Inforum

- Founded by Clopper Almon in 1967, Inforum stands for Interindustry Forecasting at the University of Maryland. Research Center within the Department of Economics.
- Builds and uses structural economic models of U.S. and other economies. We pioneered the construction of dynamic, interindustry, macroeconomic models which portray the economy in a unique “bottom-up” fashion.
- Works with government and private sector organizations to investigate a variety of issues. Recent issues include energy, homeland security, immigration, and health care.
- Economic projections and analysis using Inforum econometric models distinguished by detail at industrial and product level.
- Inforum serves as a training crucible for University of Maryland graduate students. Students receive valuable training in empirical economics and find fertile ground for dissertation research.
- Inforum maintains active ties with a world-wide network of research associates, each of which uses Inforum modeling methods and software.