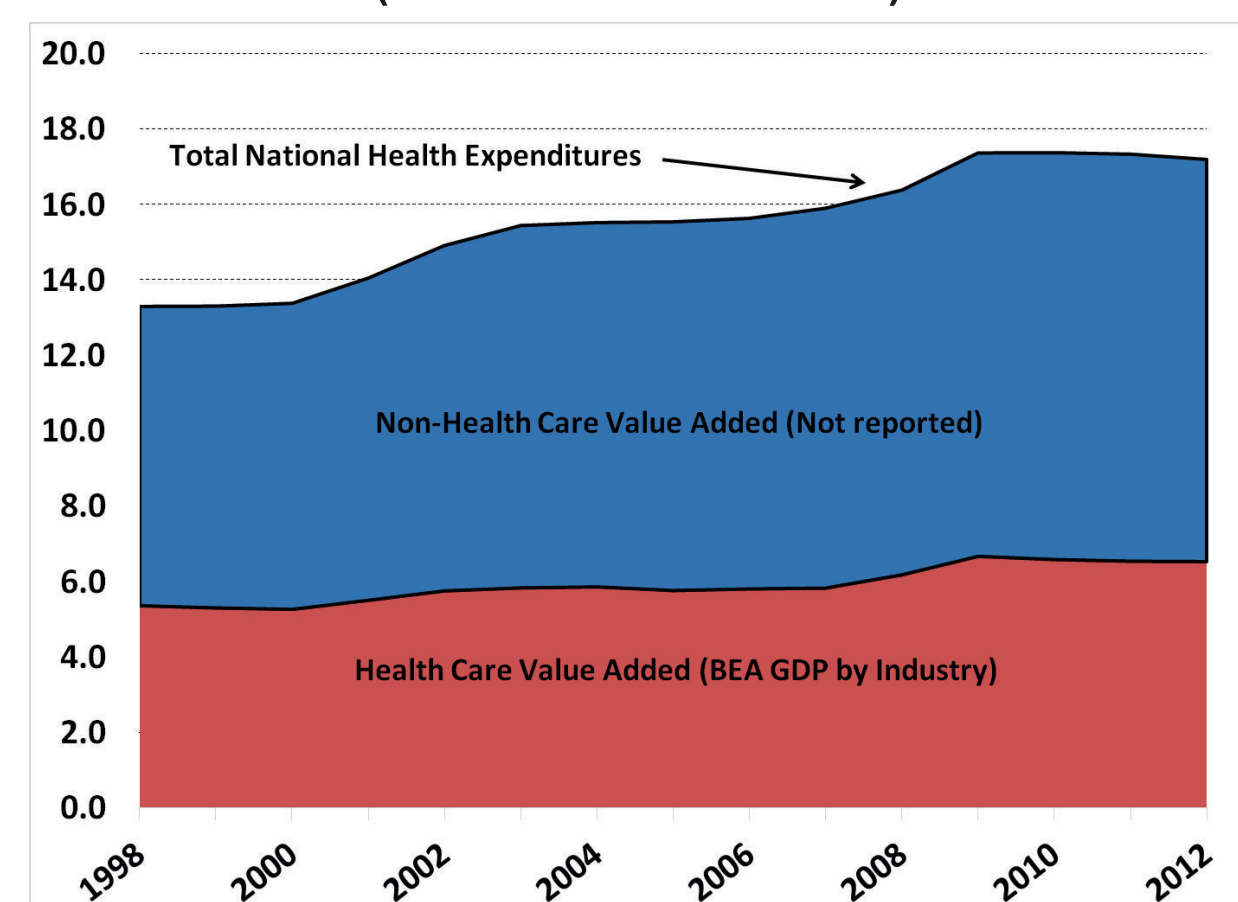


## Introduction

The macroeconomics of health care is usually analyzed through the National Health Care Expenditure Accounts (NHEA), a set of detailed historical nominal health demand published by Centers for Medicare and Medicaid Services (CMS). While the NHEA represents the demand-side of health care, surprisingly little is known about the structural detail of health care industry supply in terms of output, employment, and value added. Of the 65 industries identified in the BEA industry accounts, only two of them clearly are health care industries: (1) Ambulatory health care and (2) Hospitals and residential care. The combined value added (supply) of these two sectors was 6.6 percent of GDP in 2012, well short of health expenditures' (demand) share of 17.2 percent of GDP. To obtain a tally of value added equivalent to the demand data, we must recognize that health care is not just produced in the hospital room or the doctor's office but also by the outside accountant who balances the doctor's books and the utility that supplies the hospital's electricity.

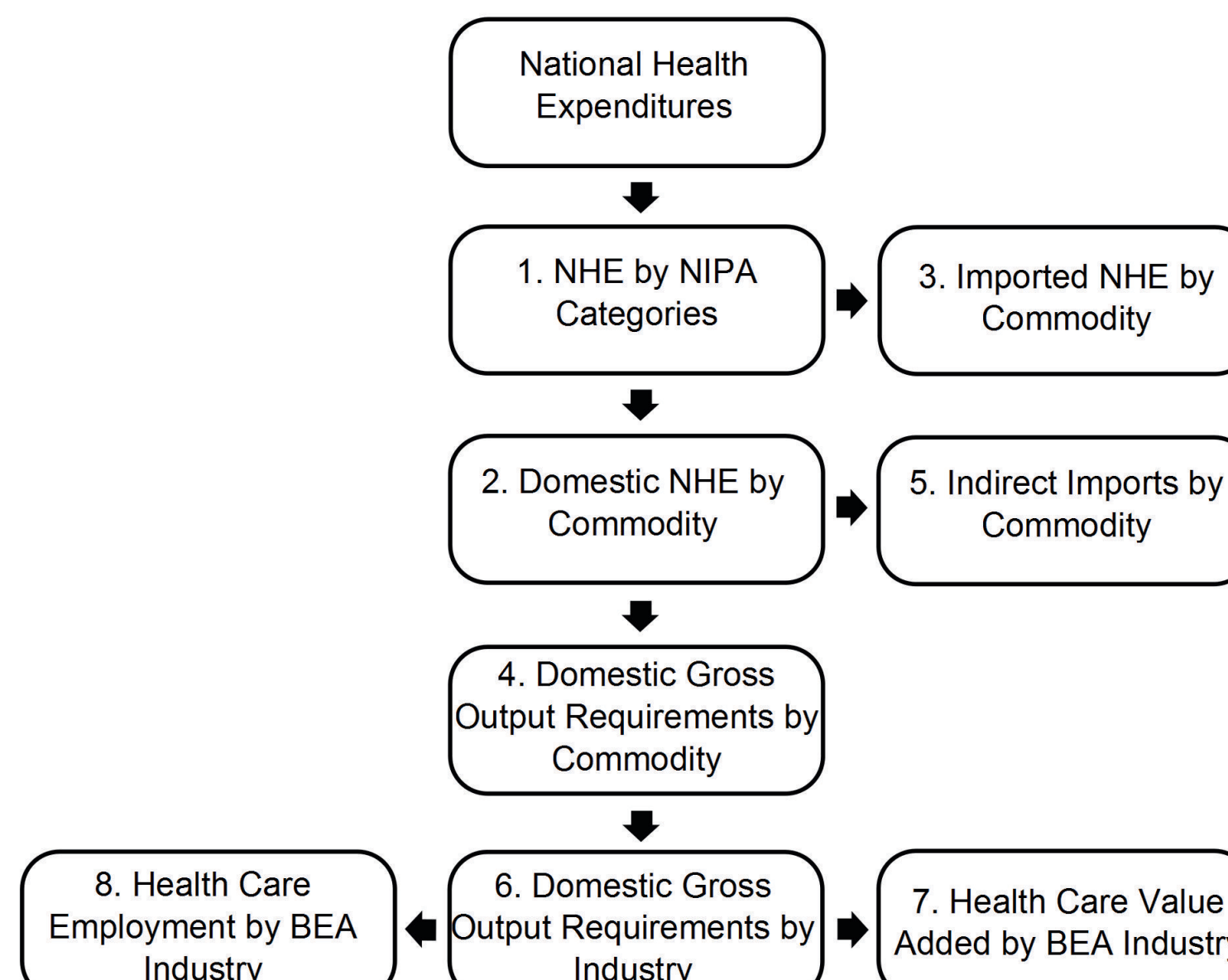
NHE and Health Care Value Added (Percent Share of GDP)



This study provides a more comprehensive accounting of health care production. We translate these expenditures to corresponding final expenditures for goods and services in the national income and product accounts (NIPAs) and then use standard input-output (IO) accounting to determine the value-added and labor requirements by industry. More specifically, we use modified versions of the Bureau of Economic Analysis (BEA) industry and I-O accounts to provide health care supply estimates including: (1) the direct and indirect gross output requirements by commodity, (2) the direct and indirect imports by commodity, (3) the value added by industry, and (4) the employment requirements by industry.

## Data & Methodology

Using the input-output (IO) framework of Inforum's LIFT model, we provide a better understanding of the supply side of health care. The core dataset is a time series of 110 commodity x 110 commodity IO tables with consumption, investment, government, export and import final demand data from 1998 through 2012. These tables have been developed from the BEA annual tables and the 2002 benchmark IO table, but the LIFT data set contains more detail for health care demand and supply compared to those provided by the BEA tables.



The first step is to define the goods and services as recorded in the NHEA as equivalent final demand items in the NIPA accounts. We then take out imports and "bridge" the demand to the commodity definitions of the I-O table. Then, the IO accounting identity computes the total domestic output requirements for furnishing this demand:

$$q^d = (I - A^d)^{-1} f^d$$

Additional I-O computations identify which industries contribute the value added for health provision, thus filling in the missing industry value added data. Similarly, the IO framework can calculate the allocation of labor among health and non-health care sectors.

## Value Added & Employment

Health care value added and employment for each industry is found by multiplying the health care gross output requirements by the corresponding historical value added-to-industry output ratios taken from the BEA industry accounts. A full accounting of health care value added is listed below. In 2012, we find that value added production for health care occupied 15.4 percent of GDP.

The aggregate number of health care associated jobs was almost 28 million in 2012, up from 21 million in 1998. In terms to total U.S. civilian jobs, health care employment grew by an annual average of 2.1 percent compared to 0.3 percent for general employment. The health care share of employment rose from 14.7 percent in 1998 to 18.7 percent in 2012.

Health Care Value Added and Employment by Industry

BEA Industry	Health Care Value Added by Industry				Health Care Employment by Industry			
	1998		2012		1998		2012	
	Bill \$	% of GDP	Bill \$	% of GDP	Thousand Jobs	% of Tot	Thousand Jobs	% of Tot
GDP	9089.1	100.0	16244.6	100.0	4.2	NA	NA	NA
National Health Expenditures	1208.9	13.3	2793.4	17.2	6.2	NA	NA	NA
Total Domestic Value Added by Industry	1132.8	12.5	2496.5	15.4	5.8	NA	NA	NA
Total U.S. Civilian Employment	NA	NA	NA	NA	140049	100.0	146991	100.0
Total Health Care Employment	NA	NA	NA	NA	20969	15.0	27941	19.0
Agriculture, forestry & fishing	4.0	0.0	9.8	0.1	6.6	93	0.1	101
Mining	3.3	0.0	13.3	0.1	10.5	20	0.0	17
Utilities	12.0	0.1	17.4	0.1	2.7	45	0.0	35
Construction	15.3	0.2	36.9	0.2	6.5	321	0.2	464
Manufacturing	100.8	1.1	172.0	1.1	3.9	1051	0.8	943
Durable manufacturing	35.9	0.4	64.0	0.4	4.2	479	0.3	437
Nondurable manufacturing	64.9	0.7	108.0	0.7	3.7	572	0.4	507
Wholesale trade	46.8	0.5	112.9	0.7	6.5	480	0.3	683
Retail trade	49.9	0.5	117.8	0.7	6.3	1243	0.9	2002
Transportation	15.7	0.2	30.7	0.2	4.9	283	0.2	346
Information	25.6	0.3	49.6	0.3	4.8	198	0.1	177
Finance, insurance, real estate, rental & leasing	133.6	1.5	318.8	2.0	6.4	874	0.6	1231
Insurance carriers & related activities	57.0	0.6	121.5	0.7	5.6	577	0.4	729
Professional & business services	104.1	1.1	286.0	1.8	7.8	2127	1.5	3352
Education, health care & social assistance	496.7	5.5	1078.3	6.6	5.7	11369	8.1	15082
Ambulatory health care services	258.6	2.8	561.4	3.5	5.7	4646	3.3	6723
Hospitals & nursing & residential care facilities	229.8	2.5	501.4	3.1	5.7	6441	4.6	8038
Arts & recreation	2.0	0.0	5.2	0.0	7.2	43	0.0	66
Accommodation & food services	8.1	0.1	19.4	0.1	6.5	340	0.2	533
Other services, except government	12.7	0.1	28.4	0.1	3.4	388	0.3	454
Government Administration & Enterprises	102.2	1.1	195.8	1.2	4.8	2094	1.5	2454

## National Health Expenditures

The Centers for Medicare & Medicaid Services (CMS) estimated that in 2012 the U.S. spent \$2.8 trillion on health care related goods and services. This total (NHE) rose from 5% of GDP in 1960 to over 17% in 2012. Total personal health care (PHC) was \$2.4 trillion, or almost 85% of total NHE. PHC itself is composed of 10 types of goods and services, such as physician and clinical services and prescription drugs. Including the share of premiums paid by their employers, consumers lay out a substantial amount (\$164 billion in 2012) for the net cost of private health insurance (premiums minus claims). The other sources of demand in the NHE come from private investment in capital equipment and structures, and from federal, state, and local government consumption and investment spending for health administration, research, and public health activities.

These health care demand figures provide no information concerning the commodity production, import penetration, and industrial income and employment composition of health care supply. While health care supply includes obvious sectors such as hospitals, demand also is satisfied indirectly by almost every sector of the economy, including wholesale, retail, and professional services.

National Health Expenditures: 1960-2012

	Billions of U.S. Dollars				Annual Percent	
	1960	1980	1998	2012	1960-2012	1998-2012
Gross Domestic Product (GDP)	543.3	2862.5	9089.1	16244.6	6.8	4.2
National Health Expenditures	27.4	255.8	1208.9	2793.4	9.3	6.2
NHE as percent of GDP	5.0	8.9	13.3	17.2	2.4	1.9
Personal Health Care	23.4	217.2	1029.2	2360.4	9.3	6.1
Hospital Care	9.0	100.5	374.9	882.3	9.2	6.3
Physician & Clinical	5.6	47.7	258.7	565.0	9.3	5.7
Dental Services	2.0	13.4	53.8	110.9	8.0	5.3
Other Professional Services	0.4	3.5	33.8	76.4	10.7	6.0
Home Health Care	0.1	2.4	34.2	77.8	14.9	6.1
Nursing Home Care	0.8	15.3	79.4	151.5	10.6	4.7
Other Health Services	0.5	8.5	56.1	138.2	11.6	6.6
Prescription Drugs	2.7	12.0	88.4	263.3	9.2	8.1
Other Non-Durables	1.6	9.8	28.6	53.7	7.0	4.6
Durable Medical Products	0.7	4.1	21.3	41.3	8.0	4.8
Net Cost of Private Insurance	1.0	9.3	49.7	164.3	10.3	8.9
Government Administration	0.1	2.8	13.2	33.6	13.2	6.9
Public Health Activities	0.4	6.4	37.5	75.0	10.7	5.1
Research	0.7	5.4	21.5	48.1	8.5	5.9
Equipment	0.4	6.1	34.2	61.6	10.2	4.3
Structures	1.5	8.6	23.7	50.3	7.0	5.5

## Total Output Requirements

In terms of total output, the largest sectors are those with the largest direct demands such as hospitals, physician offices, and insurance. Indirect requirements are the materials and services purchased for intermediate use in the production of health care such as the electricity employed to power a hospital. The chain of upstream activities are accumulated in indirect production. Indirect production requirements are especially important for insurance, professional services, real estate, administrative and support services, and management of companies and enterprises.

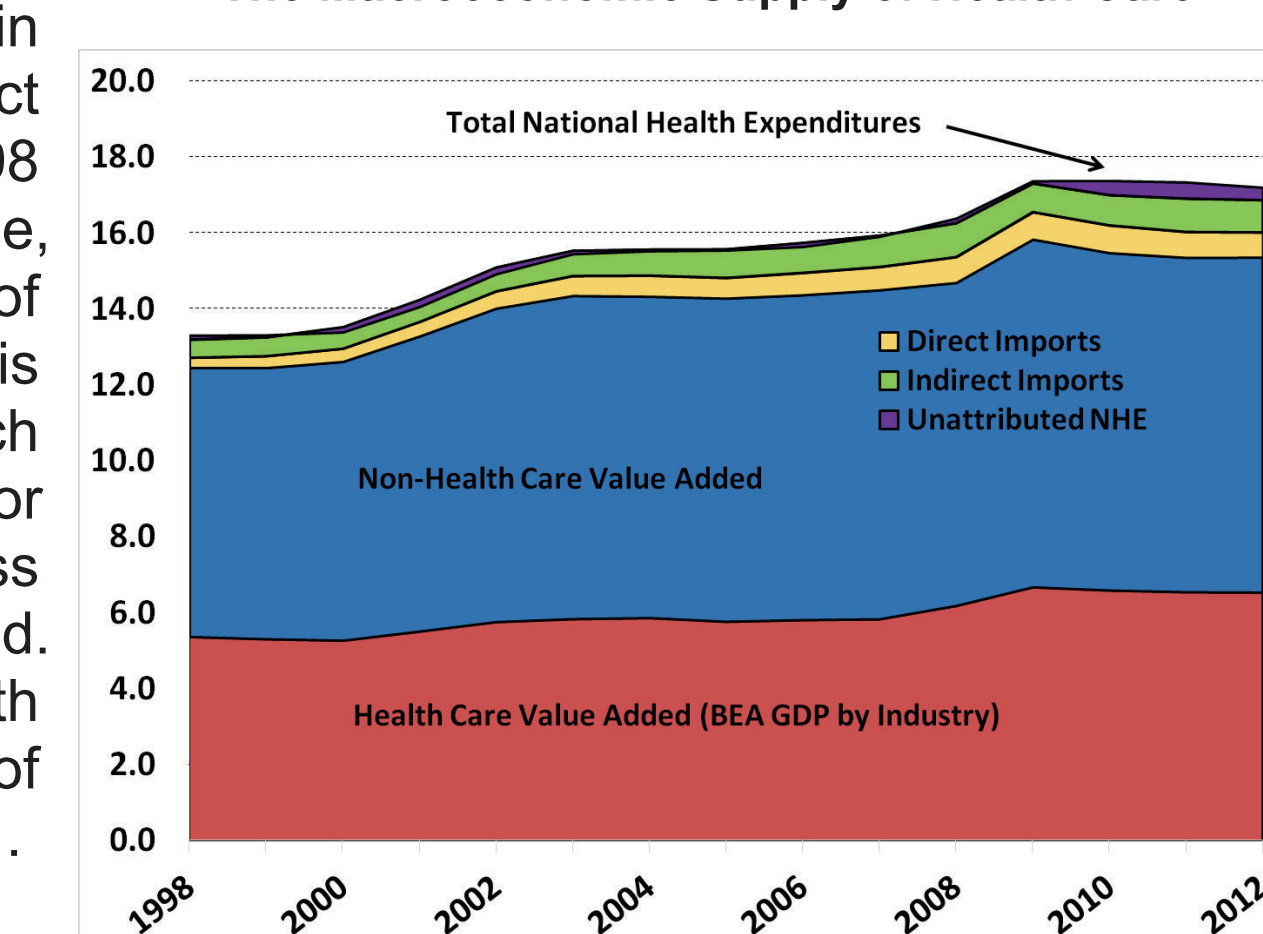
Total, Direct, and Indirect Gross Output Requirements for Supplying NHE

LIFT Commodity	Billions of Dollars						Annual Percent Growth		
	1998		2012		1998-2012		1998-2012		1998-2012
	Direct Domestic Output	Indirect Domestic Output	Health Care Total Domestic Output	Direct Domestic Output	Indirect Domestic Output	Health Care Total Domestic Output	Direct Domestic Output	Indirect Domestic Output	Health Care Total Domestic Output
Gross Commodity Output	1184.6	710.8	1895.4	2686.0	1516.8	4202.8	6.0	5.6	5.9
Multiplier			1.6			1.6			
94 Hospitals	360.2	0.5	360.7	825.8	1.1	826.9	6.1	6.6	6.1
92 Offices of physicians & other health practitioners	285.3	0.1	285.4	597.0	0.1	597.1	5.4	5.3	5.4
79 Insurance	48.4	43.8	92.3	145.9	82.7	228.6	8.2	4.6	6.7
95 Nursing and residential care facilities	104.7	0.0	104.7	214.3	0.1	214.4	5.3	5.2	5.3
93 Other ambulatory health care services	73.6	15.8	89.4	170.6	35.5	206.1	6.2	6.0	6.2
62 Retail trade	64.1	5.8	69.9	182.8	5.7	188.5	7.8	-0.1	7.3
85 Professional, scientific and technical services	15.2	67.1	82.3	33.0	151.3	184.3	5.7	6.0	5.9
61 Wholesale trade	23.0	41.0	64.0	105.0	60.7	165.7	11.5	2.8	7.0
80 Real estate	1.9	69.2	71.1	3.7	161.0	164.7	5.0	6.2	6.2
88 Administrative and support services	1.6	50.9	52.5	3.7	130.0	133.7	6.1	6.9	6.9
27 Pharmaceuticals	47.9	29.1	77.0	82.5	34.1	116.6	4.0	1.1	3.0
87 Management of companies and enterprises	0.0	25.3	25.3	0.0	116.5	116.5	-	11.5	11.5
91 Home health care services	47.5	0.0	47.5	88.1	0.0	88.1	4.5	2.2	4.5
107 General government industry	28.4	0.0	28.4	65.2	0.0	65.2	6.1	-	6.1
77 Banks, credit cards and finance	0.0	18.7	18.7	0.0	55.2	55.2	-	8.0	8.0
58 Medical equipment and supplies, dental labs	11.2	14.2	25.5	24.5	24.8	49.3	5.7	4.0	4.8
13 New construction	21.8	0.2	22.0	46.7	0.5	47.1	5.6	6.2	5.6
78 Securities, investments, funds and trusts	0.0	13.1	13.1	0.0	39.5	39.5	-	8.2	8.2
25 Petroleum and coal products	0.0	6.0	6.0	0.5	37.1	37.6	20.4	13.9	14.0
28 Other chemicals	0.1	17.4	17.5	0.3	32.7	33.1	10.3	4.6	4.6
90 Educational services	15.9	1.9	17.8	31.8	1.2	33.0	5.1	-3.5	4.5
Other Commodities	33.8	290.6	324.4	64.7	546.9	611.6	4.7	4.6	4.6

## Conclusion

Theoretically, total health care demand (NHE) is equal to the sum of direct and indirect imports plus the domestic value added generated in satisfying final demand. The table and figure below indicate that domestic value added attributable to health care production accounted was 93.7 percent of NHE in 1998 and 89.4 percent in 2012. Direct imports added 2.0 percent in 1998 and 3.8 percent in 2012, and indirect imports were 3.5 percent of NHE in 1998 and 4.9 percent in 2012. In this exercise, the unattributed value is a measure of inaccuracies of the process. Much of this error is due to simplifying assumptions, such as the assumption that the import share for goods and services are constant across categories of intermediate and final demand. The discrepancy is fairly small, with fluctuation between -2.0 and 3.0 percent of NHE, with its largest absolute value in 2011.

The Macroeconomic Supply of Health Care



NHE and Health Care Supply Reconciliation Summary

	Levels (billions)		% change	Share of NHE		
	1998	2012		1998	2012	
National Health Expenditures (NHE)	1208.9	2793.4	6.2%	100.0	100.0	
Direct Demand - Imports	24	107	11.2%	2.0	3.8	
Direct Demand - Domestic Production	1,185	2,686	6.0%	98.0	96.2	
Value Added	1,133	2,496	5.8%	93.7	89.4	
Ambulatory care, hospitals, nursing	488	1,063	5.7%	40.4	38.0	
Other industries	644	1,434	5.9%	53.3	51.3	
Indirect Demand from Imports	43	137	8.7%	3.5	4.9	
Unattributed Value Added	9	52	-	0.8	1.9	
	Levels (millions)		% change		Share of Economy-wide	
	1998	2012	1998-2012	1998	2012	
Health Care Employment by Industry	21.0	27.9	2.1%	14.7	18.7	
Ambulatory care, hospitals, nursing	11.1	14.8	2.1%	7.8	9.9	
Other industries	9.9	13.2	2.1%	6.9	8.8	